The Effect of Board Quotas on Female Director Turnover[1]

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Abstract

The annual rate of turnover of female directors falls by about a third following the introduction of a board gender quota in France in 2011. This decline in turnover is more pronounced for quota-induced new appointments, especially in boards that regularly hire directors who are members of the French business elite. By contrast, the quota has no effect on male director turnover. The evidence suggests that, by changing the director search technology used by firms, the French quota has improved the stability of director-firm matches.

1 Introduction

The market for corporate directors is a matching market: Both firms and directors care about the quality of the match. Poor matches may occur and persist for some time, perhaps because of search and matching frictions. However, a poor match is likely to be eventually terminated, either because unhappy directors voluntarily step down, or because problematic directors are not reappointed. In contrast, high-quality matches are stable. Although empiricists cannot observe the quality of a match, the *stability* of a match can be empirically measured by the director turnover rate. Turnover rates allow us to measure how the parties jointly value the match, thus offering us insights into the functioning of director labor markets.

In this paper, we study the introduction of a mandatory gender balance law in France in 2011, and its immediate effect on female director turnover. Beginning with Norway, many European countries have recently passed similar gender quota laws, including Italy, Belgium, The Netherlands, Spain, and Germany. Such laws typically require firms to have a minimum proportion of each gender on their boards. We see the French case as a laboratory for studying the effects of minority quota policies on firms' recruitment policies. What is unique about France is that we can plausibly identify one particular network – *Grand Ecole* graduates – through which some firms recruit their directors.

The introduction of a gender quota is an exogenous shock to the demand for female directors. Such a demand shock has opposing effects on the stability of director-firm matches. On the one hand, the total surplus generated by a director-firm pair may fall after the quota, because firms may hire less-qualified female directors. In addition, female directors may choose to leave their firms more frequently, because of improved outside opportunities. Both of these effects lead to an increase in female director turnover. On the other hand, the quota may increase firms' incentives to retain female directors. In addition, match quality may improve if the introduction of a quota forces firms to abandon search technologies (i.e., selection and hiring practices) that under-recruit qualified women.[2] Both of these effects lead to a decrease in female director turnover.

[2] This argument has been used in the literature on affirmative action policies: "*Whereas the policy is costly when it distorts the selection of the best qualified individual, this need not be the case when the initial selection is*

The overall effect of quotas on female director turnover is thus an empirical question. In our empirical work, we look for answers to a number of questions: Do quotas affect turnover? Are such effects different for male and female directors? Are such effects different for pre-quota and post-quota directors? How do such effects vary across firms? How do quotas affect hiring practices? How do they affect director labor markets?

Our target quantity is the average difference in annual turnover rates between male and female directors. We call this quantity the *(gender) turnover gap*. The turnover gap in France for the 2003-2014 period is 4.6%: On average, the male turnover rate is 12.2% and the female turnover rate is 7.6%. Our goal is to explain this turnover gap.

To estimate the effect of the quota on the turnover gap, we need to isolate such an effect from other confounding effects. A key concern is that the endogenous matching of firms and directors may explain most or all of the gap, that is, women may select or be selected by firms in which turnover is low. To complicate things, this selection effect could be time-varying: Firms may go through cycles of low and high turnover, and such cycles may match with cycles of more or fewer women on boards. We are able to perfectly control for any fixed or time-varying firm characteristic by using only *within firm-year* variation in turnover rates across directors. This approach is possible because we focus on *individual* director outcomes, and thus our study has some methodological advantages over studies that focus on firm-level consequences of quotas.[3]

We show that the turnover gap is fully explained by the years after the quota (2011-2014): The gap increases from virtually zero before the introduction of the quota to 3%-5% after the quota. Because average male director turnover is unchanged after the quota, we can attribute virtually all of this gap to a decrease in female director turnover. The pre-quota female turnover rate was 11%; the quota has then reduced this rate by about 27%-45%.

For comparison, we also estimate the turnover gap for US firms during the same period. The US is a useful control group because, in the US, there has been no real discussion of mandatory quotas, unlike in most European countries. We find that the US has a much lower gender turnover gap: 1.85%. Unlike the turnover gap in France, the US turnover gap is fully

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suboptimal. If the best qualified candidates fail to be selected or fail to apply, then the introduction of affirmative action may reduce if not eliminate these costs" (Nierdele, Segal, and Vesterlund, 2013, p. 1).

[3] Our approach is similar to that of Jiang, Wan, and Zhao (2016), who use within-board variation to study the voting behavior of corporate directors in China.

explained by firm-year fixed effects and director characteristics (in particular age and tenure), leaving nothing to be attributed to gender. There is also no clear time trend in the US turnover gap. We also find that the empirical determinants of director turnover in the US are very similar to those in France, which validates the use of US directors as a control group. Difference-in-differences estimates, using US directors as the control group, confirm that the quota fully explains the residual turnover gap in France.

We then investigate the mechanisms behind this decrease in female turnover. First, we find that post-quota appointments explain most of the decrease in turnover: Relative to new male appointments, newly-appointed female directors have lower turnover probabilities. The quota thus appears to have improved the stability of *new* matches.

Second, we find that the decrease in female turnover is more pronounced in firms that regularly employ directors who are members of the French business elite. We measure the degree of board elitism by the proportion of elite *Grande Ecole* graduates on the board. This is in line with Nguyen (2012) and Kramarz and Thesmar (2013), who argue that a *Grande Ecole* degree is a good proxy for membership in elite business networks in France. Firms that rely mostly on social networks as a means to select directors are likely to consider only a small pool of candidates. Our data show that, even before the quota, male directors were more likely to come from elite schools than female directors. We find that lower turnover of women recently appointed to elitist boards explains virtually all of the effect of the quota.

To interpret the results, we use a simple theoretical framework in which the turnover rate is decreasing in the *net surplus* from the director-firm match. It is natural to consider the net surplus as a measure of *match quality*. Because high-quality matches are less likely to be dissolved, the turnover rate is an empirical proxy for the (unobservable) net surplus. The net surplus is then defined as the *gross surplus* from the match minus the firm's and the director's outside options. That is, an increase in gross surplus decreases turnover, while improvements in outside options (for either party) increase turnover.

We expect the quota to improve female directors' outside options and to worsen firms' outside options, while the effect of the quota on the gross surplus is ambiguous. If firms employ efficient search technologies when selecting and hiring directors, quotas will reduce the gross surplus. That is, if firms always identify the best possible candidate for a directorship, quotas will force firms to recruit lower-quality candidates. However, if the search technology is imperfect,

quotas may actually increase the gross surplus, and thus match quality. This could happen, for example, if firms arbitrarily focus on a small pool of candidates, and thus ignore potentially qualified candidates from outside this pool. Policy advocates often use such arguments as a possible justification for board gender quotas.[4] From a theoretical perspective, search frictions alone can generate equilibria in which firms only search for one type of worker, even if worker type is irrelevant for performance (Mailath, Samuelson, and Shaked, 2000).

We argue that the worsening of firms' outside options cannot fully explain the fall in turnover, because most of this fall in turnover is observed for new (post-quota) appointments, and the cost of replacing long-serving directors should be no lower than the cost of replacing recently-appointed directors.

It is possible that the quota increases the supply of female director candidates, and that these new candidates have worse outside opportunities than pre-quota female directors, who are more experienced and connected. This possibility is, however, insufficient for explaining the low turnover rate among post-quota appointments, because we find no differences in turnover between new appointments of experienced directors and new appointments of "rookie" directors. In addition, female turnover falls relative to *newly-appointed male directors*, which is a group whose outside opportunities have sharply deteriorated.

Because the quota effect is (much) stronger for firms that regularly hire directors who are members of the French business elite, the evidence suggests that, compared to non-elitist firms, elitist firms experience either greater deterioration of their outside options (i.e., higher replacement costs) or greater improvements in match quality after the quota. In either case, the evidence suggests that forced changes in hiring practices among elitist firms explains the bulk of the quota effect on turnover. We discuss some additional anecdotal evidence which is in line with this interpretation.

We show a number of additional results. Based on observables – including age, executive experience, and education – post-quota female directors seem no less qualified than pre-quota female directors. We also find that post-quota female directors are more independent and less likely to have family connections to owners than pre-quota female directors. Female director "entrenchment" is thus unlikely to explain the fall in turnover rates after the quota. In addition, we find that – after the quota – experienced female directors are *more* likely to leave poorly-

[4] For examples, see the Higgs (2003) and Tyson (2003) reports in the UK.

performing firms and firms with more volatile performances, suggesting that improved labor market opportunities allow experienced female directors to cherry pick the boards on which they sit.

The evidence in this paper makes a number of contributions to the academic literature and policy debates on the topic. First, in line with the theoretical arguments in Mailath, Samuelson, and Shaked (2000), our evidence suggests that search technologies that disproportionately target candidates from certain groups may constitute a significant matching friction. The largest improvements in female job stability occur precisely in those firms that relied more on the "old boy network" for selecting directors. These are the firms more likely to have – perhaps inadvertently – discriminated against female directors.

Second, a natural concern about board quotas is that they may lead to lower standards for selecting female directors. In the case of Norway, Bertrand, Black, Jensen, and Lleras-Muney (2014) show that this concern has little empirical support; they find that the introduction of the quota improved the observable characteristics of female appointees. We reach a similar conclusion through a different route: The greater stability of post-quota female appointments suggests that the quality of the director selection process has not been compromised by the quota.

Finally, our results show that female directors may benefit in multiple ways from the introduction of quotas. Not only quotas make more board seats available to women, they may also increase female director job stability – especially in "elitist" boards – and allow female directors to be more selective about the boards on which they sit. Although the gain in the number of board seats for women comes largely at the expense of men, the additional gain in job stability does not: We find that male director turnover rates are largely unchanged after the quota.

This paper also contributes to a recent literature on board diversity (Adams and Ferreira, 2009; Adams and Funk, 2012; Adams and Kirchmaier, 2015; Schwartz-Ziv, 2015; Carter, Franco and Gine, 2015; Schmid and Urban, 2015; Giannetti and Zhao, 2016), in particular to the literature on the consequence of quotas (Nygaard, 2011; Ahern and Dittmar, 2012; Matsa and Miller, 2013; Bøhren and Staubo, 2014, 2015; Bertrand, Black, Jensen, and Lleras-Muney, 2014; Eckbo, Nygaard and Thorburn, 2016; Reberioux and Roudaut, 2016). More broadly, this paper is related to the literature on male-female differences in behavior and labor market outcomes for executives and other high-skill workers (e.g., Huang and Kisgen, 2013; Bertrand, Goldin, and

Katz, 2010). Our paper is also related to vast literature on CEO and director turnover, although our focus is quite different from the focus in that literature.[5]

2 Institutional Background

2.1 Board gender quotas

In France, the Zimmermann-Copé law, adopted on the 27th of January 2011, requires a minimum of 20% of women on company boards from January 2014 on, rising to 40% on January 1st, 2017. When a firm has a dual board (a supervisory board and a management board), the law applies only to the supervisory board. Within boards, the quota applies to all members—insiders and outsiders—with one exception: Directors representing employees, who are usually union representatives.

The law applies to all listed and non-listed companies employing at least 500 employees[6] or with revenues of at least EUR 50 million. The legal forms that are subject to this law are limited liability corporations (*Sociétés Anonymes*), limited partnerships that include at least one general partner and a number of limited partners who buy shares in the entity (known as "*commandite par actions*" corporations), and Societas Europaea (the European company statutes). All listed companies have to adopt one of these three legal forms. Non-listed companies can opt for other legal forms, which are not subject to quotas (SARL, *sociétés à responsabilité limitée*, which have no boards, or SAS, *sociétés anonymes simplifiées*, in which boards are optional).

The quota law was submitted to the French National Assembly on December 3, 2009, and adopted in first reading on January 20, 2010. The parliamentary debates continued throughout 2010 to January 2011, when the law was formally approved. As many companies have anticipated the adoption of the law in 2010, we exclude the 2010 year when comparing the pre-quota period with the post quota period.

[5] See e.g., Warner, Watts, and Wruck (1988), Weisbach (1988), Denis and Denis (1995), Parrino (1997), Huson, Parrino, and Starks (2001), Fee and Hadlock (2004), Bushman, Dai, and Wang (2010), Kaplan and Minton (2012), Peters and Wagner (2014), Jenter and Kanaan (2015), and Bates, Becher, and Wilson (2015).

[6] A new law passed on August 5, 2014, lowering the threshold from 500 to 250 employees from January 1, 2020.

For several years now, European countries have had a number of high-profile policy debates on the question of quotas on company boards. Norway was the first country to adopt such a law in 2003, implemented in 2008, requiring a minimum of 40% of board directors from each gender. On November 14, 2012, the European Commission adopted a proposal for a directive setting a minimum objective of having 40% of the under-represented gender in non-executive board-member positions in listed companies in Europe by 2020. This directive is still under debate. Meanwhile, several countries adopted regulations on women on boards. The two countries closest to France are Italy and Belgium. Both countries adopted a one-third quota law, which are effective from 2015 (Italy) and 2017 (Belgium).[7] Even Germany, initially reluctant to consider quotas, adopted in December 2014 a law establishing a gender quota of 30%, effective in 2016 for the largest listed companies.

2.2 Boards in France

Under French law, the size of the board may range from three to 18 members. French firms can adopt either a unitary board or a dual board, with a supervisory board and a management board. The maximum term for a director is six years. The company bylaws determine the duration of directors' terms. The Association of French Companies' (AFEP-MEDEF) code, adhered to by many French firms, calls for a maximum of four years. Renewal is permitted.

According to the AFEP-MEDEF code, independent directors should account for at least half the members of the board in widely-held companies. In closely-held companies, independent directors should account for at least a third of the board. After twelve years on the board, independent directors lose their independent status. The governance code recommends that the non-executive directors meet periodically without the executive directors. A non-executive director should not hold more than five directorships in listed corporations, including foreign corporations. An executive director should not hold more than three directorships in listed corporations, including foreign corporations. This limit does not apply to directorships held in subsidiaries and holdings.

[7] All our results are robust when taking into account a broader sample including Belgium, France and Italy instead of France alone, but including these countries requires considering different years of implementation of the quotas and different institutional settings.

French law does not cover the number or composition of board committees, which are determined by each board. However, French firms typically have three committees: audit, nomination, and compensation.

2.3 French business elites

The higher education system in France is divided into two separate blocks: universities and elite establishments called "*Grandes Ecoles*". In contrast with universities, where entrance after high school is guaranteed by law, *Grandes Ecoles* are highly selective, and their students represent only 5% of the total of those who enroll in higher education each year. In addition to excellent high school records, the selection entrance at *Grandes Ecoles* is based upon an examination that requires two years of intensive preparation (*Classes Préparatoires aux Grandes Ecoles*).

In France, the majority of business and governmental elites (administrative, scientific, and executive) are former students of the *Grandes Ecoles*. For instance, around two-thirds of the chief executives in France's largest firms graduated from the *Grandes Ecoles* (for more details, see Dudouet and Joly, 2010, and Conférence des grandes écoles, 2016).

Due to historical reasons, those business elites not only benefit from a highly selective education, but also from pervasive political and social connections. After World War II, numerous former civil servants (from the Ministry of Finance or the Ministry of Industry) who graduated from the *Grandes Ecoles* began to be hired at top-level management positions by big companies (especially state-owned and privatized companies) (for more details, see Bertrand, Kramarz, Schoar, and Thesmar, 2007).

A second distinctive feature of *Grandes Ecoles* is that they appear to be biased against women and students from low-income families. According to Albouy and Wanecq (2003), among graduates from *Grandes Ecoles* who were born during the 1949-1958 period, 2432 are male and 546 are female (respectively 1829 and 732 among graduates who were born during the 1959-1968 period). Ecole Polytechnique (the top engineering *Grande Ecole*) did not accept female candidates until 1972, and had in 2015 less than 20% female students. Moreover, between 1989 and 2009, the proportion of female graduates from the Ecole Nationale d'Administration was only around 25-30% (Larat, 2015).

3 Data

We analyze an unbalanced panel of French and US boards over the period 2003 to 2014 using data from Management Diagnostic's BoardEx database. The sample consists of 3,369 firm-year observations for 414 unique French firms, and of 68,170 firm-year observations for 10,490 unique US firms. Accounting data are taken from Datastream. If we exclude firm-year observations with missing values for firm size (firm operating performance), the sample consists of 3,126 (3,086) firm-year observations for France and of 45,222 (42,926) firm-year observations for the US.

3.1 Firm and board characteristics

Panel A of Table 1 presents summary statistics of firm characteristics. Firm size is measured as total assets in millions of Euros, and return on assets is the ratio of operating income before interest, taxes, depreciation, and amortization to total assets. Both variables are winsorised at the 1% and 99% levels. The average firm size in France is 13,873 million Euros (the median is 1,105 million Euros), while the average firm size in the US is 3,588 million Euros (the median is 474 million Euros). French firms have better operating performance: On average, return on assets over the period 2003-2014 is equal to 9.1% for French firms (median 9.4%), and to 4.7% for US firms (median 8.1%)

Panel B of Table 1 shows board characteristics. Boards are larger in the French sample: The average number of board members (including executives) is 10.5 in France and 7.7 in the US. The proportion of independent directors (i.e., non-executive directors who are classified as independent by BoardEx) is also much lower in France: On average, over 2003-2014, French boards have 34% of their members classified as independent, while in US boards this number is 60%. At the same time, the proportion of female directors is much higher in France: The average proportion of female directors on boards is 14% in France and 8.5% in the US. This difference in gender representation between France and the US is explained by the quota introduced in France in 2011.

3.2 Director characteristics

The sample includes 35,233 director-firm-year observations for France and 521,948 director-firm-year observations for the US. Table 2 compares director characteristics between France and the U.S. separated by gender. Female directors are younger than their male counterparts in the U.S. and France. However, the age gap between female and male directors is much bigger in France (almost 5 years compared to almost 3 years for the US).

Female directors are more likely to be independent in both the US and France. However, female directors on French boards are more likely than their male counterparts to be family members, defined (following Ahern and Dittmar, 2012) as directors who share the same last name as another board member. Note also that, in our sample, the proportion of family directors is higher in France than in the US (10% in France versus 3.4% in the US).

Overall, there is a gender gap in terms of expertise and board experience, which is slightly more pronounced in France than in the US. Among French boards, female directors hold a lower number of seats in boards of publicly-listed companies (1.69 seats for female directors versus 2.04 seats for male directors, on average), while among US boards the reverse is true (2.78 seats for female directors versus 2.02 seats for male directors, on average). Moreover, in France, female directors are less likely to be member of a major committee (e.g., audit, compensation, nomination, or governance committees) than in the US. The gender gap in terms of industry expertise is larger in France than in the US (8% in France versus 1.9% in the US). In France, female directors are also less likely to be a graduate from an elite *Grande Ecole*. This is not surprising, given that *Grandes Ecoles* (especially, Ecole Nationale d'Administration, and most engineering schools, among them, Ecole Polytechnique) include (even until recently) only a small proportion of female graduate students. In the US, female directors are not less likely than their male counterparts to be a graduate from an Ivy League school, but they are nonetheless less likely to hold an MBA degree.

3.3 Turnover rates and final sample

To construct turnover rates, we follow the same procedure as in Bates, Becher, and Wilson (2015). We follow a director from one firm-year board report date on BoardEx to the next, where a report date corresponds to the fiscal year end. Directors that are no longer listed at a subsequent

report date are classified as turnover directors, while those who remain listed are classified as non-turnover directors. Director turnover cannot be identified when the firm is no longer available in the database the next year. As a result, the sample excludes 4,037 firm-director-year observations for France, and 76,742 firm-director-year observations for the US, where we cannot identify director turnover.

The unconditional director turnover rates are on average higher in France than in the US and, accordingly, the average director tenure is lower in France (see Table 2). In both the US and France, female directors spend less time on boards than their male counterparts: The board tenure of female directors is on average 1.8 (1.4) year lower than that of male directors in France (US). Female board members are much less likely than male directors to quit boards in any given year: Female directors have lower turnover rates than male directors. These differences in turnover rates are also much larger in France than in the US (3.6% in France and 1.4% in the US).

In our regressions we use only outside (i.e., non-executive) directors, thus we also exclude 6,913 director-firm-year observations for France, and 92,357 director-firm-year observations for the US, where the director is an executive of the firm. Finally, we exclude 2,916 director-firm-year observations for France and 8,297 for the U.S. with missing values for age and tenure. The final sample used in the regression models consists of 21,367 director-firm-year observations for France and 344,552 for the US over the period 2003 to 2014.

4 Descriptive Evidence

Figure 1 shows the speed of adjustment to the new law. While the average proportion of women on French boards is 13% in 2010, it rises continuously to 25% in 2014.

Firms may adjust to the new requirements in two ways: They may increase the number of female directors and/or reduce the number of male directors. By reducing the size of the board through the dismissal of some male directors, firms may be able to comply with the law without needing to employ many female directors. Figure 2 shows that firms did not choose such a strategy. Although for the unbalanced sample average board size appears to decline both before and after the quota, this is mostly a composition effect. In balanced samples, we can see that the average board sizes do not change much: For the same set of firms, board sizes in 2014 are very

similar to their 2007 levels. This figure does suggest, however, that new entrants to the sample have smaller boards on average.

Figure 3 confirms that most of the adjustment occurs through the selection of new directors: The proportion of newly-appointed directors who are women jumps from about 13% in 2009 to 32% in 2010, and continues to rise afterwards, reaching 50% in 2014. This figure clearly shows that the quota changed the director selection process of firms very quickly. Since the law only passed in January 2011, the significant increase in the proportion of women among new directors in 2010 suggests that some firms clearly anticipated the passing of the law (see the discussion in Section 2). Interestingly, we see no evidence of anticipation in 2009 or earlier.

Since firms chose to appoint so many female directors so quickly, a natural question is whether firms have lowered the standards for selecting new female directors. Table 3 shows a comparison of female director characteristics before and after the quota. Unlike Table 2, here we focus on outside (i.e., non-executive) directors only, as this is the sample we use in later tests.[8] Perhaps the most striking conclusion from this table is that, along a number of relevant dimensions, post-quota female directors appear to have better attributes on average. Post-quota female directors are older, have more CEO and C-suite experience, hold more directorships, and are more likely to be assigned to major committees, to be industry experts, and to hold an MBA degree. They have spent significantly less time on their boards, which is to be expected, because many of these directors have only been appointed because of the quota. Post-quota women are also more independent and less likely to be related to the families that control their firms.[9] Interestingly, despite having better qualifications in most dimensions, post-quota female directors are less likely to be graduates from an elite *Grand Ecole*. Finally, we note that the average female turnover rate falls from 11% to 6.7%.

Table B shows a comparison between newly-appointed women before the quota and newly-appointed women after the quota. Panel B confirms that post-quota new appointments are slightly older and more independent. Post-quota female directors are again less likely to be *Grand Ecole* graduates; the difference is exactly the same as in Panel A, but now it is not statistically significant (Panel B has a much smaller sample size). All other observable

[8] In the Internet Appendix, we replicate this table using all directors. The conclusions are essentially the same.

[9] This is in contrast with the case of Norway, where post-quota women are more likely to be related to the controlling family (see Ahern and Dittmar (2012)).

characteristics are, however, very similar. Again, we find significant differences in turnover rates: Post-quota new female directors have a 3.5% turnover rate, which is substantially lower than the 8.8% rate for new appointments before the quota.

This simple comparison allows us to draw some preliminary conclusions. On the basis of observable characteristics, there is no evidence that firms select post-quota women who are less qualified than pre-quota women. There is clear evidence that post-quota female directors are more independent, measured either by family ties or by formal director independence. This latter finding mirrors the evidence from Norway (see Bøhren and Staubo, 2014). Whether independence is good or bad however depends on the context (see e.g., Adams and Ferreira, 2007 and 2009).

We focus on turnover rates because such rates allow us to measure how the parties jointly value the match. Before the quota, new female directors leave their boards at a rate of 8.8% per year. By contrast, new female directors after the quota leave their boards very rarely – at a rate of 3.5% per year. This finding suggests that the net surplus from matching is higher after the quota (see Section 7 for a more careful interpretation of the results).

Figures 4 and 5 show the average turnover rate for both men and women over our sample period. The turnover rate for men looks fairly stable over the years, and does not seem to be much affected by the introduction of the quota. The female turnover rate is much more variable, as is to be expected from a much smaller sample, but does not appear to differ much from the male rate until 2010. After 2010, we observe a persistent gap between these two rates.

It is instructive to note that the turnover gap is only observed in 2011. Although there are many quota-induced female appointments in 2010, turnover for such appointments obviously can only be observed in 2011. The fact that we do not see a turnover gap in the years just before the quota – 2009 and 2010 – strengthens the hypothesis that such a gap is a consequence of the quota.

5 Empirical Strategy

Before we present our main results, we first describe our empirical strategy. Let y_{dft} be an indicator variable that equals 1 if director d leaves firm f at the end of fiscal year t, and zero for all $t' < t$, and let w_d take the value of 1 if director d is female and zero otherwise. We use y and

w to denote the random variables associated with these indicators. We define the *gender turnover gap* as

$$g \equiv E(y|w = 0) - E(y|w = 1). \quad (1)$$

In words, the turnover gap is the difference between the average turnover rates of male and female directors. We can estimate g by a simple regression of y_{dft} on w_d and a constant. Column 1 from Table 4 shows that our estimate of g for France using the whole period (2003-2014) is 4.57% and our estimate of $E(y|w = 0)$ is 12.19%.[10]

The turnover gap may be a consequence of endogenous matching of firms and directors. For example, large, mature, and stable firms may provide more job stability, which could be a characteristic favored by female directors. Provided that such characteristics don't change over time, we can account for them through firm fixed effects. However, it's likely that characteristics that are relevant for matching, such as e.g., firm performance, change over time. An option is to use a long list of time-varying covariates in an attempt to address this issue, but such an approach is always subject to the criticism that something could be left out. We thus use *firm-year fixed effects* α_{ft} to account for any variation at the firm-year level in a flexible way. Such an approach means that our estimates of the *residual* turnover gap (i.e., after accounting for firm-year fixed effects) are free from any time-varying endogenous matching at the firm level.

Since we only use within firm-year variation, the turnover gap can only be explained by differences between male and female directors, who work for the same firm at the same time. Personal characteristics, such as age, tenure, and others, could explain part or all of this gap, leaving nothing to gender. To account for such possibilities, we thus include a vector of observable director characteristics, $\boldsymbol{x}_{dt}$. The residual turnover gap thus reflects characteristics that are not included in $\boldsymbol{x}_{dt}$.

Finally, we consider the effect of the board quota by introducing an indicator variable p_t, which takes the value of 1 for $t > 2010$, and zero for $t < 2010$,[11] and interacting it with w_d. We thus have the following regression:

[10] These estimates are for the subsample for which we have full data on age and tenure.

[11] 2010 is omitted because it is a difficult year to classify.

$$y_{dft} = \alpha_{ft} + a_1 w_d + a_2 w_d p_t + a_3 p_t + \boldsymbol{\beta} \boldsymbol{x}_{dt} + u_{dft}. \quad (2)$$

Note that p_t is absorbed by the fixed effects and, therefore, a_3 is not directly recoverable. The effect of the quota on the (residual) turnover gap is thus given by:

$$g^{BA} \equiv E(g|p = 1, \alpha, \boldsymbol{x}) - E(g|p = 0, \alpha, \boldsymbol{x}) = -a_2, \quad (3)$$

which can be directly estimated from regression (2). An estimator for g^{BA} is a *before-after* estimator of the average effect of the quota on the turnover gap.[12]

A before-after estimator is all we need if we assume that the gender gap was not trending over time. Although Figure 4 shows no clear trend for the difference between male and female turnover rates, we cannot rule out the possibility that the turnover gap changes over time independently of the introduction of the quota. We thus consider US firms as a control group. The advantage of using US firms is that there has been no realistic threat of legal action against those US firms that do not promote gender balance on boards. This is unlike the case of most leading European economies, where such legal actions have been taken or are being seriously discussed. The obvious drawback is that US firms may operate in a very different environment. Differences in turnover rates between France and the US may exist because of differences in competition, regulation, governance practices, and business cultures, among other reasons.

To address this latter concern, we estimate turnover regressions as in (2), but without p_t, for both France and the US. We find that the empirical determinants of turnover are remarkably similar in both countries (Table 4 shows the results). This finding suggests that institutional and environmental differences between US and France have little impact on the turnover behavior of corporate directors. This validation exercise increases our confidence that the US is a reasonable control group.

[12] Because our goal is to estimate partial effects, as in (3), we use linear probability models. An alternative is to use binary dependent variable models that allow for fixed effects, such as Logit models. We present estimates using Logit models in the Internet Appendix. The estimates for Logit models with fixed effects are statistically stronger than those for linear models, and they confirm all the results obtained with linear models. A problem with Logit models is that we cannot recover the partial effect in (3) without making assumptions about the distribution of the firm-year fixed effects. This explains our preference for linear models.

We then run the following regression with data from both France and the US:

$$y_{dft} = \alpha_{ft} + a_1 w_d + a_2 w_d p_t + a_3 p_t + a_4 w_d q_f + a_5 w_d q_f p_t + a_6 p_t q_f + a_7 q_f + \boldsymbol{\beta} \boldsymbol{x}_{dt} + u_{dft}, \quad (4)$$

where q_f is an indicator variable that takes the value of 1 if the firm is in France (i.e., the firm is "treated") and zero otherwise. Notice that a_3, a_6 and a_7 are absorbed by the fixed effects. [13] The *difference-in-differences* effect of the quota on the (residual) turnover gap is thus given by

$$g^{DD} \equiv g^{BA}(q = 1) - g^{BA}(q = 0) = -a_5. \quad (5)$$

If the turnover gap has no trends that are unrelated to the quota, then $g^{BA} = g^{DD}$. Otherwise, g^{DD} is preferred.

Our methodology allows us – under the maintained assumptions – to identify the effect of the quota on the turnover gap, which is the difference between the turnover rates of men and women. But what can we say about the effect of the quota on female turnover *levels*? If we are willing to assume that the quota had no effect on the turnover behavior of men, then $a_3 = 0$, and g^{BA} is now a difference-in-differences estimator of the average effect of the quota on female turnover rates, and g^{DD} is a triple-difference estimator of this effect. Although we do not make the assumption that $a_3 = 0$, we note that, empirically, a_3 indeed appears to be very close to zero. Therefore, in practice it does not make much difference which interpretation we follow: Changes in the gender gap are almost identical to changes in female turnover rates.

6 Main Empirical Results

In this section we present our main empirical results.

6.1 The effect of the quota on female director turnover

[13] According to our notation, any variable that doesn't have a *d* subscript is absorbed by the firm-year fixed effects.

Table 4 shows the outputs of regressions of the turnover variable on the female indicator and other controls, for France (Columns 1 to 4) and the US (Columns 5 to 8). Column 1 shows the estimate of the gender turnover gap in a simple regression without any controls or fixed effects. We find that the "raw" turnover gap in France is 4.6%. Then, in Column 2, we add firm-year fixed effects. The gap falls by roughly 21%, and is now 3.6%. Endogenous matching of firms and directors explain only a small fraction of the gap. In Column 3, we add a measure of director tenure (number of years on the board) and a fourth-order polynomial of age.[14] The measured gap is now 2.9%. In Column 4 we add five additional director-level covariates: the number of additional directorships, and indicators for (possible) family connections, independence, membership in major committees, and industry expertise. The number of observations now falls because of some missing data. We see that all director-specific variables appear to affect turnover in a statistically precise way, with the exception of industry expertise, which is only borderline significant. There is an economically and statistically significant gender turnover gap of 3.5%. Adding even more director characteristics reduces sample size but has little impact on the gender gap (we consider educational variables in Table 6).

Columns 4 to 8 replicate the same exercise for US firms. From Column 5 we see that a gender gap also exists in the US, although it is much lower: 1.85%. Note that male turnover is also lower in the US than in France, which is compatible with the hypothesis that the US market for corporate directors is more developed, and thus more stable.[15] Column 6 reveals that, as in France, firm-year effects explain only a small portion of the gender gap, which is now 1.56%. The most important difference arises in Column 7: After controlling for tenure and age, the gender turnover gap all but disappears. The estimated gap of 0.29% is economically irrelevant and borderline statistically significant, despite the very large sample. Once the additional controls are added, the turnover gap is obliterated: It is now 0.03% with a *t*-statistic of 0.16. With a sample size of more than 300,000 observations, we can safely conclude that there is no residual gender tenure gap in the US.

Table 4 allows us to draw two important conclusions. First, firm-year effects and director characteristics cannot fully explain the gender turnover gap in France. By contrast, firm-year

[14] Fourth-order polynomials – or quartics – of age are typically used in labor economics when studying gender effects (see e.g., Goldin, 2014). Alternative specifications for tenure and age yield very similar results.

[15] See Section 7 for interpretation.

effects and director characteristics – in particular age and tenure – explain all of the turnover gap in the US, leaving no room for pure gender effects. In the US, male and female turnover rates are essentially identical to one another, once other characteristics are controlled for. We conclude that there is something specific to French directors, which is not yet captured by the covariates included in our empirical model.

Second, comparing Columns 4 and 8, we find that, with the above noted exception of the gender gap, the empirical determinants of turnover are strikingly similar in both countries. Note that not only all coefficients share the same signs, but their magnitudes are very similar too. The effects of tenure and age are, in particular, very similar. The shape of the age polynomial is remarkably similar, differing only by a level effect. Because constant level effects are differenced out in difference-in-differences estimations, the comparison between Columns 4 and 8 suggests that, at least for the purpose of estimating director turnover, the US is indeed a good control group for France.

Table 5 displays our main results. In Columns 1 to 4 we run increasingly more saturated versions of the model in (2), from no controls to a full set of controls. In Column 1 we see that, even without any control variable or firm-year effect, the turnover gap is fully explained by the years after the quota. Our before-after estimate of the effect of the quota on the turnover gap is 5.14%. Note that the coefficient of the post-2010 dummy is economically negligible and statistically insignificant. This indicates that the turnover gap is fully explained by a reduction in female turnover after the quota. Male director turnover does not seem to be affected by the quota. Thus, we reach the same conclusions independently of whether we interpret the results as a reduction in the gap or as a reduction in female director turnover. Columns 1 to 4 show estimates of the gender gap that range between 3% and 5%. In sum, the post 2010 period explains virtually all of the residual gender gap reported earlier in Table 4.

Columns 5 to 8 show the difference-in-differences estimates as in model (4), using the US as a control. We find estimates of the gender turnover gap that are remarkably similar to those obtained through before-after estimators, suggesting that there are no trends in the differences between female and male turnover rates that confounded the before-after estimates.

We have not used educational variables as covariates in the regressions in Tables 4 and 5, because missing data reduce the sample size significantly. For robustness, in Table 6 we present the results of the full-model regressions when we include an MBA dummy, a *Grande Ecole*

dummy (for France), and an Ivy League dummy (for the US) among the set of director characteristics. We find that the quota effects appear stronger when educational variables are included, with estimated effects in the 4.2%-4.7% range for the full model, in contrast with an effect of about 3% in Table 5. The differences could, however, be explained by the different sample sizes, and not by the educational variables.[16]

We conclude that the French quota has reduced female director turnover. This effect is quite robust and about 3 to 5 percentage points, depending on the specification and the sample.

6.2 Why does female director turnover go down?

In this section we consider additional cuts of the data to investigate some of the reasons why female director turnover goes down.

One possibility is that, after quota, turnover falls because firms become more reluctant to let incumbent female directors go. This would happen if the cost of replacing female directors increases after the quota (that is, if the quota worsens the firm's outside options; see Section 7). This hypothesis predicts that the gender gap should increase both for existing appointments and for new appointments.

Table 7 shows before-after and difference-in-differences estimates of the effect of the quota on the gender turnover gap, after we restrict the sample to appointments (male and female) made before 2010. We see that, in this sample, the effect of the quota is weaker than that in the unrestricted sample. The quota effect now ranges between 2.3%-3.2% and fails to be statistically significant when all controls are included. These estimates suggest that the quota effect is stronger for post-2010 appointments. Table 8 confirms this suggestion. There we see that the quota effect for new appointments after 2010 ranges from 3.7% to 5.5%, and this effect appears stronger when more controls are included.

What can we conclude? One may think that the stronger effect for new appointments is a somewhat mechanical effect, because new appointments are less likely to be terminated in the near future than old appointments. But note that this cannot be the case, because the turnover gap compares new female appointments with *new* male appointments; any mechanical effect should

[16] In the Internet Appendix, we present additional results after controlling for whether directors are foreigners, CEO experience, and C-Suite experience. The estimates of the effect of the quota are very similar.

also affect new male appointments. It must thus be the case that female director-firm matches formed after the quota are more stable than pre-quota matches.

It is possible that, when recruiting directors, some boards rely more on some observable director characteristics than others. There is evidence that networks based on common educational backgrounds affect the selection of executives and directors in France (Nguyen (2012); Kramarz and Thesmar (2013)). Thus, here we investigate the effect of board elitism, measured by the proportion of *Grande Ecole* and Ivy League graduates on the board (we include Ivy League graduates to construct a similar variable for US firms).

With one more interaction, interpreting the coefficients becomes more difficult, so it's important that we define formally which effects we want to estimate. Let e be a dummy variable that equals 1 if the board has a proportion of elite school graduates that is below the sample median. We are interested in three quantities (we omit the conditioning variables α and $\boldsymbol{x}$ to simplify notation):

$$\begin{aligned} g(e=0) &\equiv E(g|p=1,e=0) - E(g|p=0,e=0) \\ g(e=1) &\equiv E(g|p=1,e=1) - E(g|p=0,e=1) \\ \Delta g(e) &\equiv g(e=1) - g(e=0). \end{aligned} \tag{6}$$

In words, $g(e=0)$ is the effect of the quota on the turnover gap for low-elitism boards, $g(e=1)$ is the effect of the quota on the turnover gap for high-elitism boards, and $\Delta g(e)$ is the effect of the quota on the difference in turnover gaps between high-elitism boards and low-elitism boards.

Table 9 presents both before-after and difference-in-differences estimates for the effects in (6). We find that the quota has an economically strong and statistically precise effect on the turnover gap for high-elitism boards: Our estimates all lie in a narrow range between 5.4% and 6.6%. By contrast, the quota has virtually no effect on the turnover gap for low-elitism boards. Finally, the difference between the two effects is about 5 percentage points.

As before, we also split the sample into pre 2010 appointments and post 2010 appointments. Table 10, Panel A, shows that, for pre 2010 positions only, the effect of the quota for high-elitism board is a bit weakened: It ranges from 3.4% to 4.4%, and its significance is sometimes marginal. As before, the quota effect on low-elitist boards is small and statistically

insignificant. Panel B considers post 2010 appointments and shows an even stronger effect of the quota on the turnover gap for high-elitism boards: Our estimates now lie between 5.5% and 7.4%. Again, we see virtually no effect on low-elitism boards. The difference between the two is large – between 4.7 and 6.8 percentage points – but fails statistical significance tests, probably because of the reduction in sample size (there are only 1,882 new appointments in France after 2010).

There are a number of firm characteristics that could be related to board elitism. Is board elitism just a proxy for other important characteristics that affect turnover? We have investigated some of the main candidate variables: We considered sample splits on firm size, industries with high versus low number of female employees, the fraction of women on boards pre-2010, (partial) government ownership, and firm location (Paris versus the rest of the country). The effect of the quota on turnover does not seem to vary across these characteristics (results are omitted for brevity, but available in the Internet Appendix).

In sum, French boards that rely more on educational networks are the ones most affected by the quota. Female directors hired by those boards after the quota experience much lower turnover rates (relative to men) than before. Again, this effect is particularly strong for new appointments.

6.3 Has the quota improved female director job market opportunities?

An additional effect of gender quotas on female director turnover operates through the labor market for directors. Board quotas increase the demand for female directors and thus improve their job market opportunities. With more opportunities, experienced female directors may choose to work only for some of the best companies. Such directors may then voluntarily depart from boards that they no longer find attractive. This *labor market effect* increases voluntary turnover.

Figure 6 shows the number of directorships held by directors appointed before 2010, for three cohorts of incumbent directors: 2007, 2008, and 2009. While the number of directorships held by incumbent men appears fairly stable from 2007 to 2014, the number of directorships held by incumbent female directors increases significantly from 2010. For example, female directors who are incumbents in 2007 experience an increase in their average number of directorships

from 1.7 seats in 2007 to 2.6 seats in 2014. While in 2007 this cohort holds significantly fewer board seats than its equivalent male cohort, in 2014 the same cohort holds more seats than its male counterpart. Finally, notice that earlier cohorts tend to hold more seats throughout the sample period than later cohorts, suggesting that experience is a valuable attribute in the market for corporate directors.

Figure 6 shows clear evidence that the quota has improved the job market opportunities of experienced female directors. If the quota significantly improves the market for incumbent female directors, such directors may "cherry pick" the boards on which sit: They can now afford to leave poor-performing firms because there are additional seats available to them. We then have an apparent puzzle: When faced with more opportunities for board appointments, shouldn't female directors display higher turnover rates? Directors cannot hold too many seats, either because of regulations[17] or simply because they may not have sufficient time available. Directors may also choose to depart from boards of poor performing or volatile firms to avoid negative reputational effects (see e.g., Fahlenbrach, Low, and Stulz, 2015).

Our evidence shows that turnover rates decrease for both new and existing appointments (see Tables 7 and 8). This effect is, however, weaker for existing appointments, which is consistent with the hypothesis that female directors become more likely to engage in cherry-picking behavior after the quota. To investigate the cherry-picking hypothesis more directly, we estimate of the effect of the quota on the turnover gaps for low and median/high performing firms. We define a low-performance indicator as a dummy variable that takes the value of 1 if the ROA (return on assets) of firm *f* in year *t* is in the lowest quintile relative to other firms in the benchmark. We use a set of European firms as the benchmark for France and US firms as the benchmark for the US. The use of percentiles of performance is standard in the most recent literature on CEO and director turnover (see, e.g., Jenter and Lewellen, 2014; Jenter and Kanaan, 2015; Bates, Becher, and Wilson, 2015) and helps substantially when interpreting the results. The choice of the lowest quintile as a measure of poor performance is made for convenience; different thresholds lead to similar results.

Table 11 reports the results in which we interact the poor-performance dummy with the quota and the female dummy. In the sample of pre 2010 appointments, we find that the quota

[17] French regulations recommend that a non-executive director should not hold more than five directorships in listed corporations, including foreign corporations, not affiliated with his or her group.

reduces the turnover gap for low-ROA firms: This effect ranges from 16% to 22%. The difference in the turnover gaps between low-performing and high/median-performing firms ranges between 21 to 25 percentage points and is statistically significant. By contrast, in the sample of post 2010 appointments, the quota increases the turnover gap for both low and high/median performing firms and the difference between the two groups is never statistically significant.

In the internet appendix, we replicate the analysis in Table 11, now using the absolute value of the change in ROA as a measure of recent volatility. In the sample of pre 2010 appointments, the gender gap increases for volatile firms and decreases for firms with stable profitability. The difference in the turnover gap between volatile and stable firms ranges between 18.9 to 20.8 percentage points and is statistically significant. Similar to previous results for profitability, in the sample of post 2010 appointments, the difference in impact on turnover gap between volatile and stable firms is not statistically significant.

We conclude that, after the quota, experienced female directors are more likely to depart from poor-performing and volatile firms than experienced male directors. This evidence and the evidence of a disproportionate increase in board appointments for experienced female directors jointly suggest that the quota has allowed these directors to cherry pick the boards on which they sit.

7 Interpretation

7.1 The effect of the quota on female turnover rates: Possible explanations

In the Appendix, we provide a simple theoretical framework that is helpful for interpreting the evidence. Here we present an informal version of this framework.

Define the *net surplus* from a firm-director pair (f, d) as

$$Q_{fd} \equiv S_{fd} - V_f - U_d, \tag{7}$$

where S_{fd} is the gross surplus from the match (or the *internal match quality*), and V_f and U_d are the parties' outside options, for the firm and the director, respectively. We may interpret these

outside options as what each party expects to receive under an alternative match, minus searching and matching costs. Because a match should be continued only when the net surplus is sufficiently high, it is natural to interpret Q_{fd} as a measure of *(net) match quality*. This implies that the probability of turnover is decreasing in match quality (the Appendix formalizes this claim).

It's important not to confuse match quality with shareholder value; increases in match quality can actually reduce firm value, for two reasons. First, note that the unit of analysis is a firm-director pair (f, d), and thus Q_{fd} measures the *joint* net surplus from this match, without any reference to how this surplus is shared between the parties. An increase in net surplus that is accompanied by an increase in directors' bargaining power can thus reduce shareholder value. Second, an important aspect of (7) is that the firm is represented by its *controlling agent* (i.e., the party who effectively controls board appointments), such as the CEO or a controlling shareholder. The controlling agent maximizes her objective function, which may include private benefits. To give a concrete example, suppose that the quota is used as an excuse to appoint some of the controlling agent's female relatives to the board. This may increase match quality from the joint perspective of the controlling agent and the director, but it is certainly bad news for the non-controlling shareholders.

What is the effect of a board gender quota on match quality? The effect of the quota on outside options is unambiguous: Because the quota increases the demand for female directors, if director d is female, V_f decreases and U_d increases. By contrast, the effect of the quota on the gross surplus from the match, S_{fd}, is ambiguous. Note the quota can only affect S_{fd} by influencing the formation of new matches. If the quota induces firms to hire less-qualified female directors, S_{fd} falls after the quota. On the other hand, if the quota induces firms to hire more-qualified female directors, S_{fd} increases after the quota.

How can we apply this framework to make sense of the evidence? First, notice that the evidence that female director turnover decreases after the quota suggests an increase in match quality. But what is the mechanism through which the quota affects match quality? When trying to answer this question, we use the decomposition of match quality into three components, as in (7), as a way of organizing the different explanations:

(i) Changes in V_f

We expect V_f to fall after the quota, because firms may find it more difficult to replace female directors because of more competition. This effect alone could explain the increase in match quality.[18] We call this explanation the *replacement cost hypothesis*.

If an increase in replacement costs was the only reason for the decrease in female turnover, we would expect to see similar reductions in turnover for both new and existing appointments. If anything, we would expect firms to find harder to replace experienced incumbent female directors than newly-appointed female directors. However, we find that the effect of the quota on turnover is much stronger for post-quota appointments. This evidence cannot be explained by an increase in firm's replacement costs.

We conclude that an increase in replacement costs may explain part of the fall in female turnover, but it cannot explain why such a decrease is concentrated among newly-appointed directors.

(ii) Changes in U_d

Since the quota is likely to *increase* U_d, which then decreases match quality, one may think that we can quickly rule out changes in U_d as a possible explanation for the decrease in female turnover. But there is a subtle way through which changes in U_d could still help explain the evidence: If the quota induces firms to hire new female directors with worse outside opportunities, the *average* U_d may actually fall. But we find no evidence that such "rookie" directors have lower turnover than experienced directors, casting doubt on explanations based on U_d only (these results are presented in the Internet Appendix).

(iii) Changes in S_{fd}

For this mechanism to explain the evidence, we need the quota to increase the (gross) surplus generated by the match, S_{fd}. That is, *internal* match quality needs to increase. How is this possible?

Internal match quality may increase if the quota eliminates frictions in the matching process. This could happen if, before the quota, some firms only considered a restricted set of

[18] Alternatively, it is possible that the quota increases V_f, perhaps because a large number of women now enter the director labor market. This is, however, unlikely to happen in the short run.

qualified women as potential candidates. If the quota forces firms to change their hiring practices, firms may now find even better female candidates, thus improving internal match quality.

The data offer some support for this explanation. First, this explanation is compatible with the evidence that the quota effects operate mainly through new appointments. Second, we find that, based on observable characteristics, post-quota female appointments are clearly no less qualified than pre-quota female directors. If anything, new appointments are older (and thus perhaps more experienced) and more independent.

Third, the quota effects are much stronger for firms that regularly hire directors who are members of the French business elite. Firms may find it difficult to identify qualified female candidates in a network in which women are underrepresented. This interpretation is in line with Mailath, Samuelson, and Shaked (2000), who develop a model in which firms search for workers, who are either "red" or "green." Although reds and greens are equally qualified for the job, there is an equilibrium in which firms search only for green workers. The authors "*interpret a strategy of searching only for greens as the cultivation of a contact network that involves primarily greens*" (p.48).

7.2 Some anecdotal evidence

The business media has reported many instances of changes in hiring practices as a consequence of the quota. Here are a couple of examples:

*"The transformation induced by the Copé-Zimmermann Law had several consequences, amongst which more professional recruitment methods. Careful selection of candidates replaced old friendly cooptation." (*Le Nouvel Economiste, January 2016).

"*From 2011, when Hubert Sagnières (CEO of Essilor) received a large amount of unsolicited applications and recommendations for joining the board (particularly women), he wished to ensure the independence of the hiring decision by using a headhunter*." (Source: Les Echos Business, March 2016).

Although the use of headhunting firms is just one aspect of the recruitment process, it is a good indicator of the professionalization of this process. After 2010, some executive headhunting firms have created separate departments for female directors. For example, Leyders Associates introduced "*Femmes au Cœur des Conseils*," which has a database of more than one thousand women as potential candidates for board positions.

The quota may also have affected the supply side of the director labor market. Before the quota, most women knew that opportunities to be on boards were very rare (except for family and some very well connected women). After the quota, many more women chose to train to become a director. For example, since 2010, the *Institut Français des Administrateurs*, a non-profit organization of directors, offers a degree "*Le Certificat Administrateur de Sociétés*" (executive education over 6 months) aimed at people who would like to become a director. Over the period 2010-2016, 54% of the participants have been women.

7.3 Related evidence

Our results relate to the literature on the effect of affirmative action policies on gender differences. For example, Nierdele, Segal, and Vesterlund (2013) shows experimental evidence that the introduction of female "quotas" for winners in a competitive tournament increases the supply of qualified female participants. They show that this supply effect fully offsets the potential negative effect of the quota on the average performance of winners. This happens because, without the quota policy, many high-performing women choose not to participate in the tournament.

Another study that shows evidence of possible frictions in the selection of men versus women is Kaplan and Sorensen (2016), who study the characteristics of candidates for top executive positions, using a private database of executive assessments. They identify four clusters of characteristics that predict the likelihood of becoming CEO. In their sample, there are no significant differences between men and women with respect to these observable characteristics. Nonetheless, after holding these four clusters of characteristics constant, women are still less likely to be hired as CEO than men.

8 Conclusion

We conclude with a discussion of some possible interpretations and consequences of our findings.

There is clear evidence that the introduction of board gender quotas in France has decreased the rate of turnover of female directors. One possible explanation for this evidence is that firms uniformly became keener to reappoint most female directors at the end of their terms. But this story cannot explain why most of the effect of the quota was on newly-appointed female directors: Quota-induced matches are much more stable than pre-quota matches. Thus, any explanation must account for the differences between pre-quota and post-quota appointments.

Female directors appointed after the quota do not appear to be less qualified than pre-quota female directors. Post-quota female appointees are slightly older and more independent than pre-quota female directors, which also means that post-quota female directors are less connected to shareholders and executives.

The effect of the quota on turnover is more pronounced for firms that typically hire from the French business elite. This evidence suggests that the quota forced "elitist" firms to look beyond their normal pool of candidates. Because women are underrepresented among *Grand Ecole* graduates, we expect these firms to find it difficult to select female directors without changing their selection practices. It is thus perhaps not surprising that such firms prefer to hold on to their female directors. But note again that difficulties in selecting women cannot explain the differential turnover rates among incumbent and newly-appointed female directors.

One story that can rationalize the results is as follows. It is possible that some firms used a search technology that excluded a number of potentially qualified individuals from the pool of candidates. This does not mean that firms discriminated against women per se; discrimination may happen indirectly and incidentally as a consequence of existing hiring norms. Slow-changing hiring practices may thus represent a real matching friction. Large, mature, and profitable firms, such as those in our sample, may survive or even thrive despite such practices. It may also be that hiring through social connections is ultimately beneficial to firms because of the connections themselves, even if firms pass up opportunities to hire better qualified candidates.

Once the quota forces firms to change their hiring practices, they start tapping into a different pool of talent. The new recruits form more stable matches, perhaps because they are of high quality but were previously ignored, or because these new directors value their board positions more than those who have been hired through connections. In either case, match quality – as measured by the probability of termination – is improved.

A1 Variable Definition

Firm characteristics	(Source : Datastream)
Firm Size	Total assets in Millions of Euros.
Return on Assets (ROA)	Earnings before interest, taxes, depreciation, and amortization scaled by total assets.
Board characteristics	(Source : Boardex)
Board Size	The number of board members.
Proportion of independent directors	The ratio of independent directors on the board.
Proportion of women on board	The ratio of female directors on the board.
Director Characteristics	(Source : Boardex)
Age	Director age in years.
Time on board	Director tenure in years.
Female	Indicator equal to one if the director is female, zero otherwise.
Family	Indicator equal to one if the director shares his last name with at least one other director, zero otherwise.
Independent	Indicator equal to one if the director is independent, zero otherwise.
Number of directorships	Number of current board seats held by the director in quoted firms.
Major Committee Member	Indicator equal to one if the director is member of the audit, compensation, nomination, strategy, executive or governance committee, zero otherwise.
Industry Expert	Indicator equal to one if the sector of the firm where the director is a board member is the same of at least one firm in his/her employment history.
Turnover Dummy	Indicator equal to one if a director turns over in the year following the fiscal year end for each firm-year observation, zero otherwise.
Post 2010	Indicator equal to zero if the year of turnover is ≤ 2009, one if the year of turnover is ≥ 2011.
MBA Dummy	Indicator equal to one if a director has a MBA degree, zero otherwise.
Grande Ecole Dummy	Indicator equal to one if a director has a degree from Ecole Polytechnique Paris, Corps des Mines, Mines Paritech, Centrale Paris, Ecole des Ponts Paristech, Telecom Paristech, Supelec, HEC Paris or ENA.
Ivy League Dummy	Indicator equal to one if a director has a degree from an Ivy League University.
CEO Experience	Indicator equal to one if the director has or had at least one CEO position in his/her employment history.
C-Suit Experience	Indicator equal to one if the director has or had at least one c-suit position in his/her employment history.

A2 Theoretical Framework

This is not a full-fledged theory, but simply a formalization of the argument.

At the beginning of each period *t*, firms select directors to join boards of a fixed size *s* (a strictly positive integer). To simplify the exposition, we consider a single representative firm. This firm has a number of vacancies $a_t \leq s$ it needs to fill. Vacancies are created because some of the incumbent directors leave the firm at the end of each period. The number of new matches, m_t (i.e., the number of vacancies that are filled), is determined by the matching function $m_t = min\{a_t, n_t\}$, where n_t is the number of director candidates available for the firm to choose. This function implies that, provided that $a_t \leq n_t$, all vacancies are filled.

Candidates come from the set $N_t \subset \mathcal{N}_t$; n_t is the number of elements in N_t, and $\mathcal{N}_t$ denotes the population of director candidates. We assume that the set $\mathcal{N}_t$ is sufficiently large, so that all vacancies can be filled, provided that we choose a sufficiently large subset of the population as the set of candidates. We also assume (for simplicity only) that all directors in set N_t are observationally equivalent from the firm's perspective, and thus all directors in N_t have the same probability of being matched with the firm. In this formulation, matching frictions can only occur because the set of candidates N_t excludes some potential candidates in $\mathcal{N}_t$.

There are many interpretations of the set N_t: It can denote the set of all potential candidate in the firm's network of contacts, the set of candidates suggested by head-hunters, etc. For simplicity, we take N_t as exogenously given. In reality, we expect the firm to choose N_t through its choice of hiring practices.

To avoid complications, we assume that directors can work for two consecutive periods, and then retire. That is, a director "born" in year *t–1* can work in years *t* and *t+1*; firms live forever. Directors can only be appointed at the beginning of each period, and director terms last for one period. Young directors are either retained from year *t* to *t+1* or terminated at the end of year *t*. Old directors are always terminated at the end of the year, thus there is no retention decision in those cases. Because our focus is on endogenous turnover, here we confine our analysis to young directors.

If the firm hires a new director $d \in N_t$, the match between the firm and the director produces a joint gross surplus denoted by a random variable S_{dt}, with cumulative distribution function F_{dt} defined over $(0,\infty)$. The realization of this variable, s_{dt}, becomes known to both

parties as soon as the director is appointed and, for simplicity only, the joint surplus remains constant at t+1: $s_{dt} = s_{dt+1}$. For simplicity only, we assume that S_{dt} and $S_{d't}$, $d \neq d'$, are independent random variables. This assumption implies that the surplus produced by a board member is independent of the composition of the board.

All potential directors in $\mathcal{N}_t$ have a binary observable characteristic $w \in \{0,1\}$, which denotes gender, with $w = 0$ for men and $w = 1$ for women. For simplicity only, we assume that gender is not a productive characteristic: $F_{dt}(s \mid w = 1) = F_{dt}(s \mid w = 0)$.

A match formed in time t can only be dissolved at time t+1. If the match is dissolved, the parties receive their (expected) outside options v_{t+1} and u_{dt+1}, for the firm and the director, respectively. These outside options may be interpreted as what each party expects to receive under an alternative match, minus the (possibly deadweight) searching and matching costs.

We define the net surplus from a match at time t as a random variable:

$$Q_{dt} = S_{dt} - v_t - u_{dt}.$$

At each t, the surplus is split between the firm and the director according to the sharing rule $\alpha \in [0,1]$, where the firm receives $v_t + \alpha q_{dt}$ and the director receives $u_{dt} + (1-\alpha)q_{dt}$.

The retention decision. Consider a young director d who is hired at time t. Immediately after being hired, both parties learn $s_{dt} = s_{dt+1}$. Assuming efficient bilateral bargaining,[19] the match is dissolved at the end of t if and only if $q_{dt+1} < 0$, i.e. the net surplus is negative.

The probability of turnover. Since Q_{dt+1} is a random variable as of t, we can define the probability that a match formed at t is terminated at the end of year as $\delta_{dt} = \Pr_t(Q_{dt+1} < 0)$. Let H_t^w denote the set of directors of gender $w \in \{0,1\}$ hired at time t, and $H_t \equiv H_t^0 \cup H_t^1$. The cross-sectional average probabilities of turnover for all young directors and for young directors of each gender are

$$\delta_t \equiv \sum_{d \in H_t} \frac{\delta_{dt}}{a_t} \text{ and } \delta_t^w \equiv \sum_{d \in H_t^w} \frac{\delta_{dt}}{a_t^w},$$

where a_t^w is the number of vacancies allocated to directors of gender w.

The quota. Suppose that at date t', an unexpected shock occurs, such as the introduction of the quota. We are interested in the effect of the introduction of a quota on δ_t^w. In what follows, we consider only the expected effect of the quota on female directors, i.e. we make w =

[19] Bargaining costs don't change the conclusions, as long as the quota does not affect such costs. The quota is likely to affect bargaining power, but not the deadweight costs of bargaining.

1. There is a number of combination of effects that could explain why male director turnover does not change with the quota; empirically, we are unable to separate between these possibilities.

The quota can affect average female turnover in two ways: It may affect the set of female directors who are hired, H_t^1, and/or the individual probabilities of turnover δ_{dt}.

Consider first the effect on δ_{dt}. After the shock (i.e., for periods $t \geq t'$), the net surplus is given by

$$Q'_{dt} = S'_{dt} - v'_t - u'_{dt},$$

and the probability of turnover is δ'_{dt}. For a given female director d, we expect $u'_{dt} > u_{dt}$, that is, the quota should improve their outside opportunities. As this effect increases δ_t^1, we conclude changes in outside opportunities for a given female director cannot explain the evidence.

Next, for a given firm, we expect $v'_t < v_t$, that is, the quota should restrict their outside opportunities. This effect decreases δ_t^1 and thus can, in principle, explain the observed reduction in female turnover rates. But, empirically, we also find that δ_t^1 falls significantly more for newly appointed directors. Changes in firms' outside opportunities alone cannot explain why turnover falls more for newly appointed directors; if anything, replacing experienced incumbent female directors should become even more difficult after the quota.

Finally, we consider the effect of the quota on the gross surplus for a given match, S_{dt}. Conditional on the firm complying with the quota, there is no reason to expect any immediate change in the gross surplus generated by a given director. This conclusion might not hold in the long run; perhaps, given time, female directors can invest more in their human capital in response to the quota, and firms may also change their "board technology" to adapt to a more gender diverse board. But, given the speed and the magnitude of the quota effect on female turnover, it seems unlikely that director training and management technology changes explain any substantial fraction of the fall in turnover rates.

We now consider the effect of the quota on H_t^1. Clearly, the quota must have a direct effect on the size of this set, which must now increase. Such an increase creates the possibility that the directors appointed after the quota are different from those appointed before the quota. Our model allows for two such differences:

(1) Differences in u_{dt}. It could be that some of the new female directors have lower u_{dt}, which could then explain the fall in turnover. But this is hard to reconcile with the evidence that

rookie female directors (i.e., directors who enter our sample only after the quota) have similar turnover rates as seasoned directors (who are defined as directors are present in our sample before the introduction of the quota).

(**2) Differences in F_{dt}.** To explain this case, we first need to introduce a criterion for ranking distribution functions. We assume that all F_{dt} 's can be unambiguously ranked by first-order stochastic dominance (even when the firm cannot differentiate between them): F_{dt} is (weakly) better than $F_{d't}$ if and only if $F_{dt}(s) \leq F_{d't}(s)$ for all s.

Now, differences in F can arise because firms may need to choose from a new set N_t', perhaps because the original set N_t is too small. Suppose first that the original set has all the best possible female candidates. Thus, if $d' \in N_t'$ but $d' \notin N_t$, then for any $d \in N_t$, F_{dt} is better than $F_{d't}$. This implies that turnover should increase after the quota, which is not what we observe.

This leaves us with the possibility that the new set N_t' has the best possible female candidates. Why would that be the case? Perhaps the quota forces firms to change their hiring practices, such as relying less on personal connections, and more on professional recruitment firms. An expanded, improve set of female director candidates can simultaneously explain the three main pieces of the evidence: (i) a decrease in female turnover, (ii) the larger effect of the quota on newly-appointed directors, and (iii) the larger effect of the quota on those firms that hire mostly through informal networks (in which women are underrepresented).

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Table 1 – Firm and Board Characteristics

This table details firm and board characteristics across French and U.S. companies with available board data in Boardex over the period 2003-2014. All variable definitions are described in the Table ''Variable Definition''.

	Mean	Median	Min	Max	SD	N
Panel A. Firm Characteristics						
All Sample						
Firm Size (€ millions)	4252.7	501.6	0.0069	1803679.5	28398.3	48348
Return on assets	0.05	0.08	-6	0.61	0.19	46012
France						
Firm Size (€ millions)	13873.1	1105.5	3.60	819768	57593.9	3126
Return on assets	0.09	0.09	-1.03	0.61	0.10	3086
US						
Firm Size (€ millions)	3587.6	473.9	0.0069	1803679.5	25022.9	45222
Return on assets	0.05	0.08	-6	0.56	0.19	42926
Panel B. Board Characteristics						
All Sample						
Board Size	7.79	8	1	65	3.44	71539
Proportion of independent directors	0.60	0.71	0	1	0.30	71539
Proportion of women on board	0.09	0	0	1	0.12	71539
France						
Board Size	10.5	10	2	36	4.39	3369
Proportion of independent directors	0.34	0.33	0	1	0.23	3369
Proportion of women on board	0.14	0.12	0	0.75	0.13	3369
US						
Board Size	7.66	7	1	65	3.33	68170
Proportion of independent directors	0.61	0.71	0	1	0.30	68170
Proportion of women on board	0.08	0	0	1	0.12	68170

Table 2 –Director Characteristics

This table details director characteristics in France and the U.S. separated by gender. The sample period is 2003-2014. All variable definitions are described in the Table "Variable Definition''. Diff. denotes the difference between coefficients associated with Men and Women directors (Men – Women).

	Mean	Median	Min	Max	SD	N	Women	Men	Diff.	t stat.
Panel A. France										
Age	57.6	58	23	92	10.3	30467	53.2	58.2	4.97	(28.275)
Time on board	6.42	4.60	0	57.8	6.31	35228	4.88	6.66	1.78	(18.055)
Family	0.10	0	0	1	0.30	35233	0.14	0.097	-0.041	(-8.576)
Independent	0.36	0	0	1	0.48	35233	0.42	0.35	-0.071	(-9.523)
Number of directorships	2.00	1	1	17	1.60	34457	1.69	2.04	0.35	(13.901)
Major Committee Member	0.57	1	0	1	0.50	30643	0.53	0.58	0.042	(5.053)
Industry Expert	0.17	0	0	1	0.38	35233	0.10	0.18	0.080	(13.582)
Turnover dummy	0.11	0	0	1	0.32	31196	0.081	0.12	0.036	(6.511)
MBA	0.15	0	0	1	0.36	24593	0.14	0.15	0.013	(1.896)
Grande Ecole	0.36	0	0	1	0.48	24593	0.23	0.38	0.15	(16.503)
Ivy League	0.074	0	0	1	0.26	24593	0.047	0.078	0.031	(6.199)
CEO Experience	0.46	0	0	1	0.50	35233	0.29	0.49	0.20	(25.247)
C-Suit Experience	0.047	0	0	1	0.21	35233	0.041	0.048	0.0067	(2.026)
Panel B. US										
Age	59.7	60	19	103	9.81	499048	57.1	59.9	2.80	(58.983)
Time on board	7.63	5.50	0	68.8	7.42	499048	6.39	7.75	1.37	(37.936)
Family	0.034	0	0	1	0.18	499048	0.029	0.034	0.0052	(5.957)
Independent	0.69	1	0	1	0.46	499048	0.82	0.67	-0.15	(-65.722)
Number of directorships	2.10	1	1	50	4.24	450117	2.79	2.03	-0.76	(-35.670)
Major Committee Member	0.76	1	0	1	0.43	464189	0.85	0.75	-0.10	(-47.862)
Industry Expert	0.21	0	0	1	0.41	499048	0.20	0.21	0.018	(8.956)
Turnover dummy	0.085	0	0	1	0.28	428853	0.072	0.086	0.014	(9.536)
MBA	0.34	0	0	1	0.47	429354	0.31	0.34	0.034	(13.756)
Grande Ecole	0.0016	0	0	1	0.040	429354	0.00036	0.0017	0.0014	(6.676)
Ivy League	0.27	0	0	1	0.44	429354	0.27	0.27	-0.0046	(-2.013)
CEO Experience	0.43	0	0	1	0.49	499048	0.27	0.44	0.17	(72.501)
C-Suit Experience	0.079	0	0	1	0.27	499048	0.095	0.078	-0.017	(-12.957)

Table 3 – Female Director Characteristics in France

This table details female director characteristics among French Boards before and after the quota (introduced in 2010). Panel A includes all non-executive female board members between 2003 and 2014. Panel B includes all non-executive female board members that were appointed to a board after 2010. The sample period is 2003-2014. All variable definitions are described in the Table "Variable Definition''. Diff. denotes the difference between coefficients associated with the period After 2010 and the period Before 2010 (Before 2010 – After 2010).

	Before 2010	After 2010	Diff.	t stat.
Panel A - All Female Directors				
Age	53.9	54.6	-0.78	(-1.977)
Time on board	7.06	5.01	1.94	(9.134)
Family	0.19	0.098	0.090	(7.680)
Independent	0.32	0.57	-0.24	(-12.814)
Number of directorships	1.85	1.95	-0.076	(-1.541)
Major Committee Member	0.56	0.64	-0.054	(-2.773)
Industry Expert	0.078	0.14	-0.042	(-3.378)
Turnover dummy	0.11	0.067	0.049	(4.609)
MBA	0.13	0.15	-0.027	(-1.675)
Grande Ecole	0.27	0.21	0.063	(3.250)
CEO Experience	0.24	0.31	-0.074	(-4.245)
C-Suit Experience	0.014	0.038	-0.024	(-3.644)
Panel B - New Female Directors				
Age	49.2	51.5	-2.28	(-2.854)
Time on board	0.54	0.55	-0.011	(-0.590)
Family	0.053	0.031	0.021	(1.306)
Independent	0.45	0.60	-0.15	(-3.601)
Number of directorships	1.84	1.77	0.063	(0.592)
Major Committee Member	0.51	0.49	0.012	(0.262)
Industry Expert	0.13	0.12	0.011	(0.373)
Turnover dummy	0.088	0.035	0.053	(2.760)
MBA	0.11	0.15	-0.041	(-1.194)
Grande Ecole	0.27	0.21	0.057	(1.382)
CEO Experience	0.28	0.33	-0.050	(-1.238)
C-Suit Experience	0.018	0.044	-0.026	(-1.570)

Table 4 – Director Turnover in France and in the US, 2003-2014

This table reports OLS estimates of the coefficient associated with dummy variables set equal to one if the director is a woman (“Female’’), if the director shares the same name of at least one director within the same board (“Family’’), if the director is an independent director (“Independent’’), if the director is a member of at least one major committee such as governance, management, compensation, nomination, or audit committees (“Major Committee Member’’), the total number of directorships held by the director (“Number of directorships’’), the number of years since the director first joined the board (“Tenure’’), and fourth degree polynomials of director age. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES								
Female	-0.0457	-0.0362	-0.0289	-0.0350	-0.0185	-0.0156	-0.0029	-0.0003
	[-8.571]	[-6.050]	[-4.579]	[-5.124]	[-13.179]	[-10.538]	[-1.891]	[-0.159]
Family				-0.0896				-0.0434
				[-7.146]				[-9.551]
Independent				-0.0424				-0.0653
				[-5.675]				[-18.790]
Number of directorships				-0.0059				-0.0017
				[-3.828]				[-3.630]
Major Committee Member				-0.0537				-0.0405
				[-8.637]				[-14.764]
Industry Expert				-0.0114				-0.0013
				[-1.752]				[-0.756]
Time on Board			0.0018	0.0024			0.0025	0.0019
			[3.289]	[4.188]			[21.213]	[15.445]
Age			0.1698	0.1663			0.1654	0.1798
			[4.009]	[3.592]			[11.581]	[11.454]
Age^2			-0.4602	-0.4486			-0.4652	-0.5026
			[-3.916]	[-3.501]			[-12.499]	[-12.361]
Age^3			0.0523	0.0508			0.0540	0.0583
			[3.721]	[3.322]			[12.786]	[12.707]
Age^4			-0.0021	-0.0020			-0.0022	-0.0024
			[-3.423]	[-3.047]			[-12.445]	[-12.463]
Constant	0.1219	0.1207	-2.1079	-2.0132	0.0866	0.0863	-1.9618	-2.0770
	[30.670]	[157.204]	[-3.804]	[-3.303]	[124.182]	[556.185]	[-9.732]	[-9.303]
Observations	21,367	21,367	21,367	19,561	344,552	344,552	344,552	314,131
R-squared	0,0023	0,2199	0,2271	0,2336	0,0004	0,2466	0,2618	0,2484
Firm-Year FE	NO	YES	YES	YES	NO	YES	YES	YES
Country	France	France	France	France	US	US	US	US

Table 5 – The Effect of the Quota on Turnover

This table reports OLS estimates of the treatment effects of the quota ("Post 2010'') on the gender turnover coefficient ("Female''). Treatment effects ("Female X Post 2010'' and ``Female X Post 2010 X Treated'') are highlighted in boxes. "Additional director controls'' include dummy variables set equal to one if the director shares the same name of at least one director within the same board, if the director is an independent director, if the director is a member of at least one major committee (e.g., compensation, nomination, or audit committees), and the total number of directorships held by the director. "Tenure'' is the number of years since the director first joined the board. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES								
Female	-0.0137	-0.0114	-0.0099	-0.0186	-0.0169	-0.0163	-0.0061	-0.0029
	[-1.217]	[-0.934]	[-0.787]	[-1.416]	[-8.277]	[-7.375]	[-2.710]	[-1.298]
Post 2010	0.0036				-0.0066			
	[0.510]				[-4.829]			
Female X Post 2010	-0.0514	-0.0421	-0.0335	-0.0306	-0.0036	0.0002	0.0053	0.0046
	[-3.877]	[-2.942]	[-2.302]	[-2.109]	[-1.204]	[0.047]	[1.634]	[1.410]
Treated					0.0312			
					[5.473]			
Female X Treated					0.0032	0.0049	-0.0073	-0.0220
					[0.282]	[0.393]	[-0.567]	[-1.656]
Treated X Post 2010					0.0102			
					[1.417]			
Female X Post 2010 X Treated					-0.0479	-0.0423	-0.0353	-0.0303
					[-3.525]	[-2.843]	[-2.354]	[-2.007]
Constant	0.1208	0.1213	-1.9973	-1.9387	0.0896	0.0887	-1.9691	-2.1065
	[21.467]	[143.997]	[-3.370]	[-3.019]	[97.556]	[546.958]	[-10.099]	[-9.689]
Observations	19,360	19,360	19,360	17,680	333,052	333,052	333,052	304,257
R-squared	0,0033	0,2229	0,2307	0,2367	0,0014	0,2431	0,258	0,248
Tenure + 4th order poly of age	NO	NO	YES	YES	NO	NO	YES	YES
Firm-Year FE	NO	YES	YES	YES	NO	YES	YES	YES
Additional director controls	NO	NO	NO	YES	NO	NO	NO	YES
Treated Group	France	France	France	France	France	France	France	France
Control Group					US	US	US	US

Table 6 – Turnover Regressions with Education Controls

This table reports OLS estimates of the treatment effects of the quota (“Post 2010’’) on the gender turnover coefficient (“Female’’) and additional education control variables which include dummy variables set equal to one if the director holds a MBA (“MBA’’), if the director graduated from a Grande Ecole in France (“Grande Ecole’’), and if the director graduated from the Ivy League in the U.S. (“Ivy League’’). Treatment effects (“Female X Post 2010’’ and “Female X Post 2010 X Treated’’) are highlighted in boxes. “Additional director controls’’ include dummy variables set equal to one if the director shares the same name of at least one director within the same board, if the director is independent director, if the director is a member of at least one major committee (e.g., compensation, nomination, or audit committees), and the total number of directorships held by the director. “Tenure’’ is the number of years since the director first joined the board. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Female	-0.0366	0.0005	-0.0057	-0.0014	-0.0015
	[-4.252]	[0.321]	[-0.320]	[-0.594]	[-0.636]
Female X Post 2010			-0.0466	0.0035	0.0036
			[-2.338]	[0.986]	[1.029]
Female X Treated					-0.0113
					[-0.643]
Female X Post 2010 X Treated					-0.0421
					[-2.098]
MBA	0.0149	0.0027	0.0060	0.0023	0.0025
	[1.990]	[2.063]	[0.741]	[1.702]	[1.834]
Grande Ecole	-0.0006		0.0002		0.0010
	[-0.088]		[0.033]		[0.174]
Ivy League		0.0029		0.0033	0.0036
		[2.118]		[2.270]	[2.487]
Observations	15,351	272,039	13,860	247,940	261,800
R-squared	0,254	0,2656	0,258	0,2658	0,2655
Tenure + 4th order poly of age	YES	YES	YES	YES	YES
Additional director controls	YES	YES	YES	YES	YES
Firm-Year FE	YES	YES	YES	YES	YES
Treated Group	France	US	France	US	France
Control Group					US

Table 7 – The Effect of the Quota on Turnover: Pre 2010 Appointments

This table reports OLS estimates of the treatment effects of the quota ("Post 2010'') on the gender turnover coefficient ("Female''). The sample includes all directors that were appointed before 2010. Only treatment effects on the turnover gap are shown. "Additional director controls'' include dummy variables set equal to one if the director shares the same name of at least one director within the same board, if the director is an independent director, if the director is a member of at least one major committee (e.g., compensation, nomination, or audit committees), and the total number of directorships held by the director. "Tenure'' is the number of years since the director first joined the board. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES						
Female X Post 2010	-0.0323	-0.0264	-0.0234			
	[-2.157]	[-1.720]	[-1.523]			
Female X Post 2010 X Treated				-0.0315	-0.0276	-0.0254
				[-2.028]	[-1.761]	[-1.598]
Observations	17,538	17,538	16,096	306,061	306,061	284,549
R-squared	0,2326	0,2405	0,2467	0,2466	0,2619	0,253
Tenure + 4th order poly of age	NO	YES	YES	NO	YES	YES
Additional director controls	NO	NO	YES	NO	NO	YES
Firm-Year FE	YES	YES	YES	YES	YES	YES
Treated Group	France	France	France	France	France	France
Control Group				US	US	US

Table 8 – The Effect of the Quota on Turnover: Post 2010 Appointments

This table reports OLS estimates of the treatment effects of the quota ("Post 2010'') on the gender turnover coefficient ("Female''). The sample includes all directors that were appointed after 2010. Only treatment effects on the turnover gap are shown. "Additional director controls'' include dummy variables set equal to one if the director shares the same name of at least one director within the same board, if the director is an independent director, if the director is a member of at least one major committee (e.g., compensation, nomination, or audit committees), and the total number of directorships held by the director. "Tenure'' is the number of years since the director first joined the board. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES						
Female	-0.0460	-0.0481	-0.0551			
	[-2.523]	[-2.502]	[-2.536]			
Female X Treated				-0.0373	-0.0405	-0.0440
				[-1.853]	[-1.975]	[-2.053]
Observations	1,822	1,822	1,584	26,991	26,991	19,708
R-squared	0,4954	0,496	0,529	0,5348	0,537	0,5281
Tenure + 4th order poly of age	NO	YES	YES	NO	YES	YES
Additional director controls	NO	NO	YES	NO	NO	YES
Firm-Year FE	YES	YES	YES	YES	YES	YES
Treated Group	France	France	France	France	France	France
Control Group				US	US	US

Table 9 – Turnover in High-Elitism Boards vs Low-Elitism Boards

This table reports OLS estimates of the treatment effects of the quota ("Post 2010'') on the gender turnover coefficient ("Female'') for two separate groups of boards. Boards in the first group ("high-elitism'') include a proportion of directors who graduated either from a Grande Ecole or from the Ivy League which is above the median. Boards in the second group ("low-elitism'') include a proportion of directors who graduated either from a Grande Ecole or from the Ivy League which is below the median. Only treatment effects on the turnover gap are shown. "Additional director controls'' include dummy variables set equal to one if the director is a graduate either from a Grande Ecole or from the Ivy League, if the director shares the same name of at least one director within the same board, if the director is an independent director, if the director is a member of at least one major committee (e.g., compensation, nomination, or audit committees), and the total number of directorships held by the director. "Tenure'' is the number of years since the director first joined the board. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
Quota effect on high-elitism boards ($g(e=1)$)	-0.0629	-0.0538	-0.0535	-0.0664	-0.0584	-0.0555
	[-3.171]	[-2.669]	[-2.729]	[-3.221]	[-2.799]	[-2.714]
Quota effect on low-elitism boards ($g(e=0)$)	-0.0123	-0.0042	0.0042	-0.0083	-0.0027	0.0067
	[-0.615]	[-0.208]	[0.205]	[-0.398]	[-0.128]	[0.313]
Difference ($g(e=1)-g(e=0)$)	-0.0506	-0.0496	-0.0577	-0.0581	-0.0558	-0.0621
	[-1.801]	[-1.760]	[-2.027]	[-1.985]	[-1.905]	[-2.101]
Observations	19,360	19,360	17,680	333,052	333,052	304,257
R-squared	0,2308	0,2309	0,2369	0,258	0,258	0,248
Tenure + 4th order poly of age	NO	YES	YES	NO	YES	YES
Additional director controls	NO	NO	YES	NO	NO	YES
Firm-Year FE	YES	YES	YES	YES	YES	YES
Treated Group	France	France	France	France	France	France
Control Group				US	US	US

Table 10 – Turnover in High-Elitism Boards vs Low-Elitism Boards: Pre 2010 Appointments and Post 2010 Appointments

This table reports OLS estimates of the treatment effects of the quota ("Post 2010'') on the gender turnover coefficient ("Female'') for "high-elitism'' Boards and "low-elitism'' boards as described in Table 9. Panel A includes all directors that were appointed before 2010, and Panel B includes all directors that were appointed after 2010. Only treatment effects on the turnover gap are shown. "Additional director controls'' include dummy variables set equal to one if the director is a graduate either from a Grande Ecole or from the Ivy League, if the director shares the same name of at least one director within the same board, if the director is an independent director, if the director is a member of at least one major committee (e.g., compensation, nomination, or audit committees), and the total number of directorships held by the director. "Tenure'' is the number of years since the director first joined the board. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pre 2010 appointments						
Quota effect on high-elitism boards ($g(e=1)$)	-0.0414	-0.0342	-0.0347	-0.0441	-0.0396	-0.0399
	[-1.999]	[-1.616]	[-1.651]	[-2.052]	[-1.819]	[-1.843]
Quota effect on low-elitism boards ($g(e=0)$)	-0.0213	-0.0169	-0.0079	-0.0161	-0.0134	-0.0064
	[-0.987]	[-0.780]	[-0.357]	[-0.719]	[-0.601]	[-0.280]
Difference ($g(e=1)-g(e=0)$)	-0.0201	-0.0173	-0.0269	-0.0280	-0.0262	-0.0335
	[-0.666]	[-0.572]	[-0.873]	[-0.894]	[-0.839]	[-1.058]
Observations	17,538	17,538	16,096	306,061	306,061	284,549
R-squared	0,2405	0,2406	0,2468	0,2619	0,2619	0,253
Panel B: Post 2010 appointments						
Quota effect on high-elitism boards ($g(e=1)$)	-0.0663	-0.0695	-0.0738	-0.0550	-0.0604	-0.0678
	[-2.776]	[-2.810]	[-2.829]	[-2.085]	[-2.257]	[-2.490]
Quota effect on low-elitism boards ($g(e=0)$)	-0.0125	-0.0131	-0.0105	-0.0073	-0.0072	-0.0001
	[-0.451]	[-0.453]	[-0.321]	[-0.237]	[-0.231]	[-0.004]
Difference ($g(e=1)-g(e=0)$)	-0.0539	-0.0565	-0.0633	-0.0477	-0.0532	-0.0677
	[-1.463]	[-1.500]	[-1.615]	[-1.170]	[-1.287]	[-1.583]
Observations	1,822	1,822	1,584	26,991	26,991	19,708
R-squared	0,4976	0,4983	0,5323	0,5371	0,5371	0,5283
Tenure + 4th order poly of age	NO	YES	YES	NO	YES	YES
Additional director controls	NO	NO	YES	NO	NO	YES
Firm-Year FE	YES	YES	YES	YES	YES	YES
Treated Group	France	France	France	France	France	France
Control Group				US	US	US

Table 11 – Turnover and Firm Performance

This table reports OLS estimates of the treatment effects of the quota (“Post 2010’’) on the gender turnover coefficient (“Female’’) for two separate groups of firms. Firms in the first group (“low-ROA firms’’) belong to the bottom quintile of operating performances observed on a given year in a given region (Europe for French firms, and the U.S. for U.S. firms). Firms in the second group (“high-ROA firms’’) belong to the second to fifth quintiles of operating performances observed on a given year in a given region. Operating performances is the ratio of operating income before interest, taxes, and depreciation to the firm total assets. Panel A includes all directors appointed before 2010, and Panel B includes all directors appointed after 2010. Only treatment effects on the turnover gap are shown. “Additional director controls’’ include dummy variables set equal to one if the director shares the same name of at least one director within the same board, if the director is an independent director, if the director is a member of at least one major committee (e.g., compensation, nomination, or audit committees), and the total number of directorships held by the director. “Tenure’’ is the number of years since the director first joined the board. Observations are defined at the firm-year-director level. The sample includes only outsiders (non-executive directors), and all observations with missing information for director age and tenure are excluded. The dependent variable is a dummy set to equal to one if the director leaves the board at the end of the fiscal year. The sample period is from 2003 to 2014. Standard errors are clustered at the firm level and t-stat are reported in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pre 2010 appointments						
Quota effect on low-ROA firms	0.1527	0.1556	0.1733	0.1743	0.1643	0.1839
	[2.251]	[2.378]	[2.982]	[2.509]	[2.457]	[3.077]
Quota effect on high/median-ROA firms	-0.0372	-0.0307	-0.0309	-0.0343	-0.0290	-0.0319
	[-2.213]	[-1.807]	[-1.813]	[-1.967]	[-1.652]	[-1.805]
Difference (low minus high)	0.1899	0.1863	0.2042	0.2086	0.1932	0.2158
	[2.673]	[2.708]	[3.307]	[2.867]	[2.752]	[3.398]
Observations	14,353	14,353	13,213	218,438	218,438	216,374
R-squared	0,007	0,239	0,2427	0,0174	0,2331	0,2412
Panel B: Post 2010 appointments						
Quota effect on low-ROA firms	-0.0767	-0.0827	-0.0994	-0.0443	-0.0506	-0.0518
	[-1.344]	[-1.423]	[-2.075]	[-0.721]	[-0.789]	[-1.002]
Quota effect on high/median-ROA firms	-0.0430	-0.0467	-0.0453	-0.0370	-0.0422	-0.0392
	[-1.952]	[-1.998]	[-1.818]	[-1.549]	[-1.734]	[-1.583]
Difference (low minus high)	-0.0338	-0.0361	-0.0541	-0.0073	-0.0083	-0.0126
	[-0.543]	[-0.580]	[-1.018]	[-0.110]	[-0.121]	[-0.216]
Observations	1,377	1,377	1,303	15,982	15,982	15,422
R-squared	0,0196	0,5237	0,5328	0,0163	0,4961	0,5092
Tenure + 4th order poly of age	NO	YES	YES	NO	YES	YES
Additional director controls	NO	NO	YES	NO	NO	YES
Firm-Year FE	YES	YES	YES	YES	YES	YES
Treated Group	France	France	France	France	France	France
Control Group				US	US	US

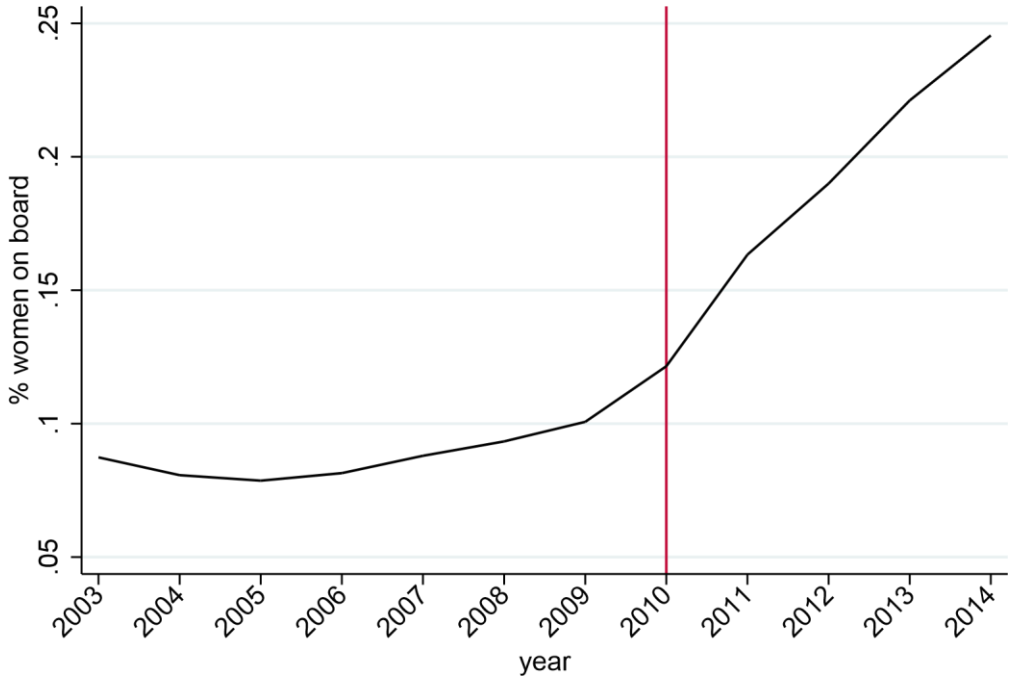

Figure 1 – Percentage of female directors on French boards. This figure reports the average proportion of women on boards each year over the 2003-2014 period. The sample consists of 377 French firms from BoardEx. The vertical line marks the year of the implementation of the law.

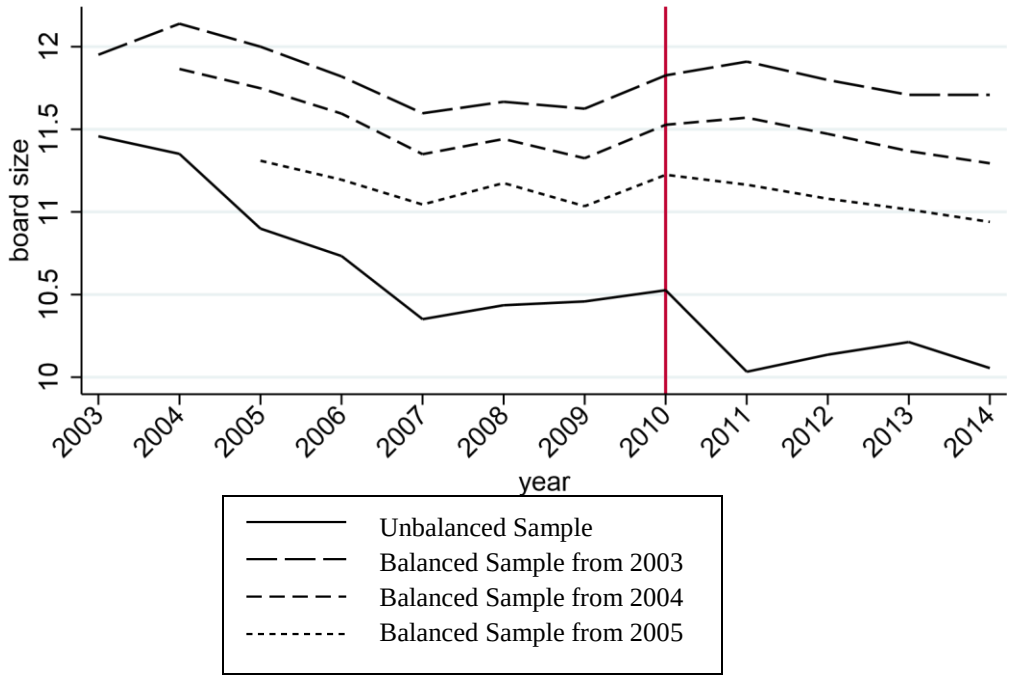

Figure 2 – Average board size in France. This figure reports the average number of directors (outsiders and executives) on boards each year over the 2003-2014 period. The solid line represents the unbalanced sample, while the dashed lines represent balanced samples from 2003, 2004 and 2005. The vertical line marks the year of the implementation of the law.

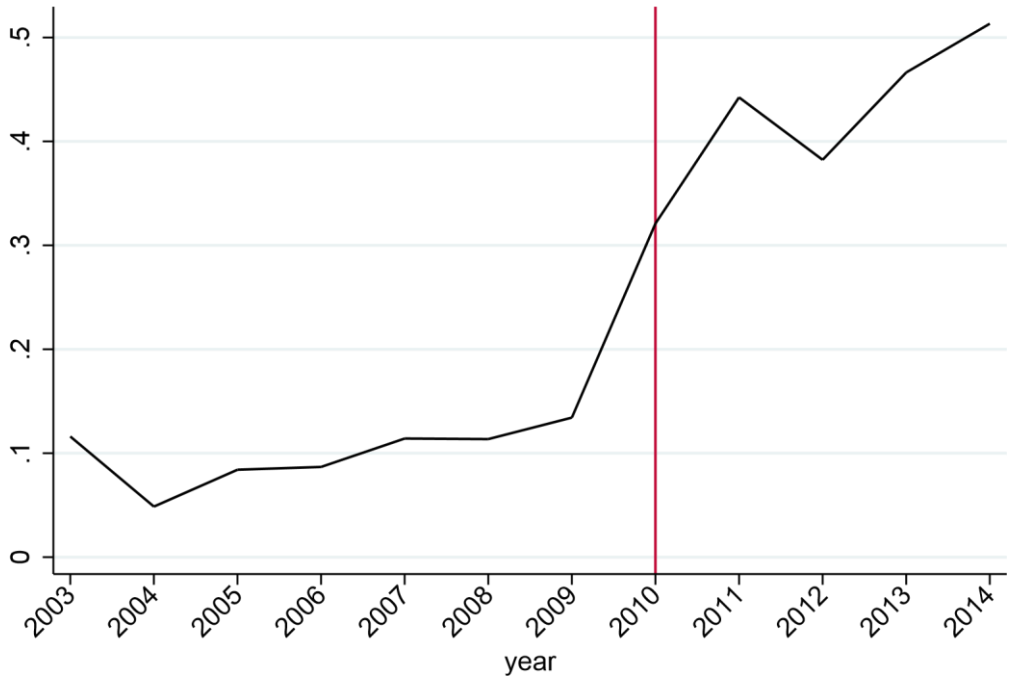

Figure 3 – Percentage of new female positions over total new positions in France. This figure reports the proportion of newly-appointed female directors over all newly-appointed directors. We estimate this proportion as the ratio of the average probability to get a new positions for a female director times the number of new female positions, over the average probability to get a new positions for a male or female directors times the number of new positions for male or female. The sample includes only non-executive directors over the 2003-2014 period. The vertical line marks the year of the implementation of the law.

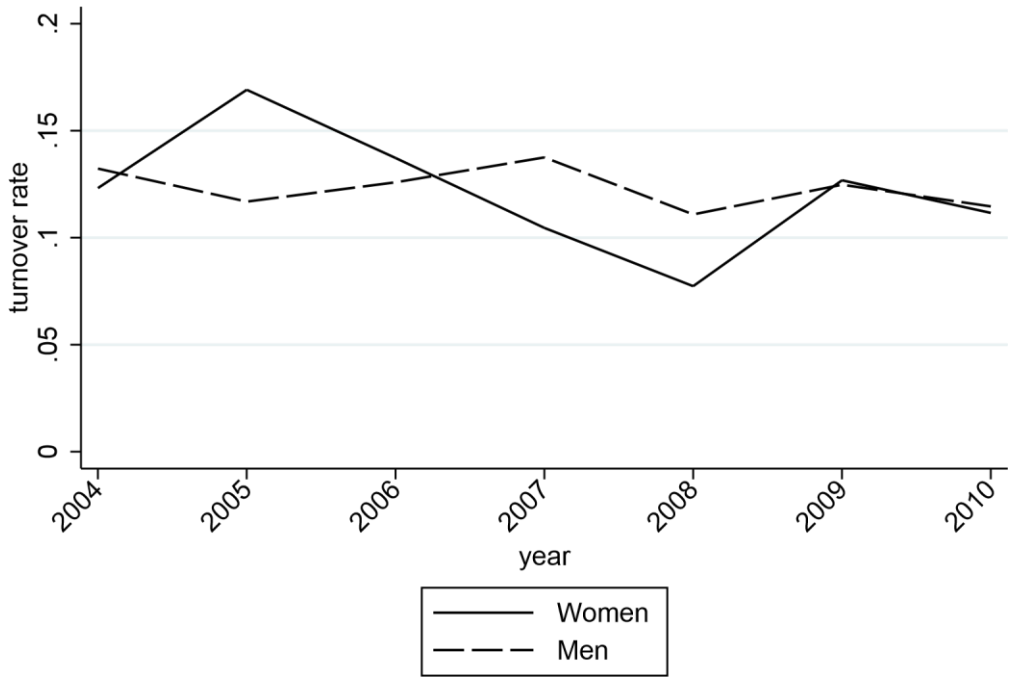

Figure 4 – Average turnover rate by gender in France before 2010. This figure represents the annual turnover rate in France each year, separated by gender. The solid line represents the turnover rate for female directors, while the dashed line represents the turnover rate for male directors. Turnover is defined as an indicator equal to one if a director leaves the board at the end of the fiscal year. The sample includes only non-executive directors over the 2003-2010 period.

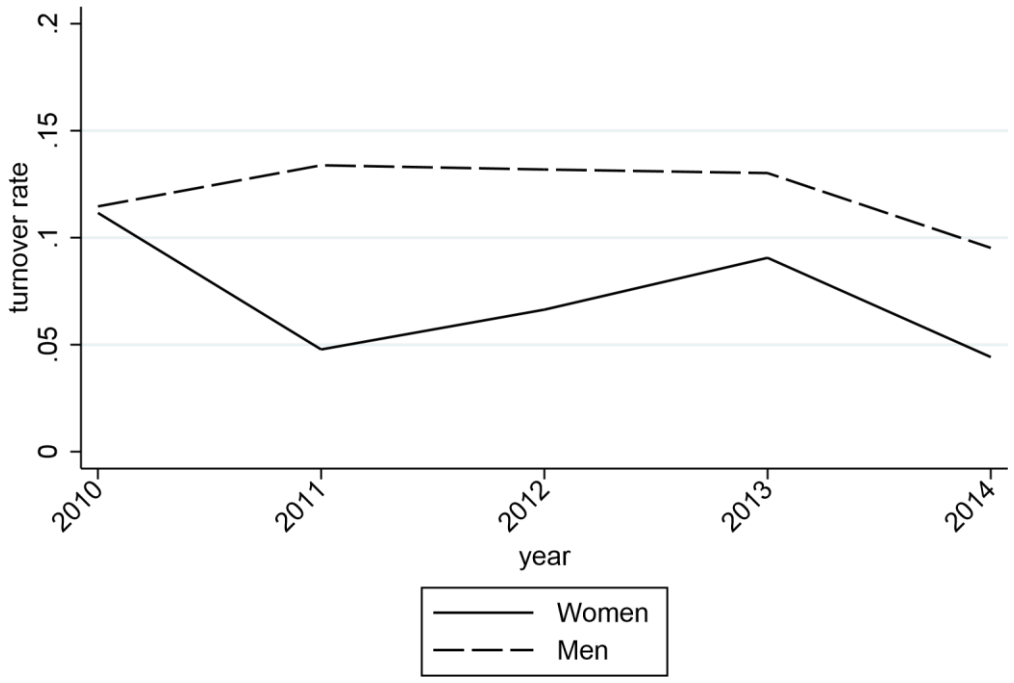

Figure 5 – Average turnover rate by gender in France after 2010. This figure represents the annual turnover rate in France each year, separated by gender. The solid line represents the turnover rate for female directors, while the dashed line represents the turnover rate for male directors. Turnover is defined as an indicator equal to one if a director leaves the board at the end of the fiscal year. The sample includes only non-executive directors over the 2010-2014 period.

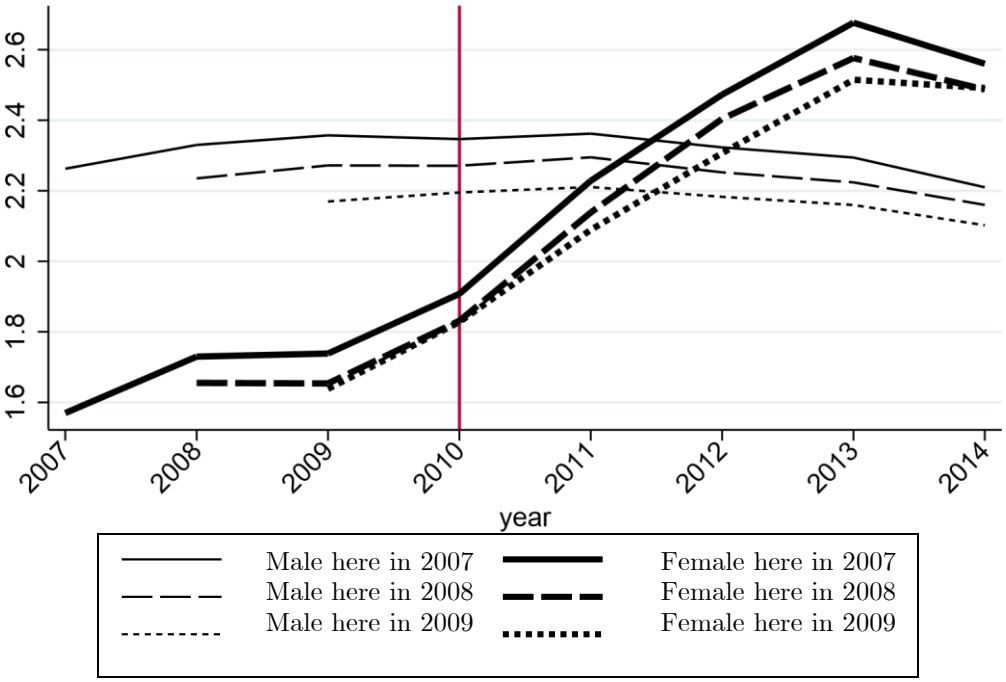

Figure 6 – Number of directorships in France by Gender. This figure shows the number of directorships held by both female and male directors for three cohorts of incumbent directors: 2007 (solid lines), 2008 (long-dashed lines), and 2009 (short-dashed lines). The sample includes only non-executive directors over the 2003-2014 period. The vertical line marks the year of the implementation of the law.