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Cracks in the Boards: The Opportunity Cost of Governance Homogeneity

Abstract

Does the composition of governance affect firm outcomes? We exploit the timings and thresholds of a gender quota in boards of directors and supervisory boards to causally determine the impact of a change in leadership on performance. Using a novel design and data on boards, we find that firms forced to comply with the 2011 gender quota in France increased their profit margin by 5.4 percent relative to firms with unchanged boards thereby limiting diminishing profitability. We identify a shift in their cost structure away from purchasing of services such as out-sourcing and sub-contracting. In particular, we find evidence that firms change the type and the amount of external short-contract workers they hire. The decision to employ a lower amount of more qualified temporary workers is optimal as the firms' revenue grows. This in part reflects the importance of using domestic labour outsourcing to flexibly adjust to demand changes. We show that our effects are nearly entirely explained by the first newcomer in the board. The persistence of our estimates provide evidence for its role in updating knowledge. We find that the law is associated with the diversification of boards in terms of gender but also of nationality, age and links with other firms. The added value of within-board and network diversity suggest a sizable opportunity cost of governance homogeneity for performance.

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Group composition and group performance are closely related variables. Theory and empirical research finds that diversity in characteristics matters for productivity as individuals bring unique skills that can affect the output of a group. In the setting of a firm, heterogeneity can matter within a team that produces a good or a service or one that supervises that production. Employees' and employers' set of characteristics have the potential to affect firm performance as well as aggregate market outcomes. At the level of employees the productivity of an individual is directly related to the output of its team while at the level of employers differences in decision-making can affect the structure of the firm and the market. In particular, the composition of governance bodies can have macro implications as they have the authority to take high-level decisions on the firms' production and costs.

The relevance of employees' characteristics for team and firm performance is the focus of many papers (see Hamilton et al. (2003); Iranzo et al. (2008) and Parrotta et al. (2012)). The importance of employers' characteristics, on the other hand, are so far largely omitted although research on management practices (see Bloom and Van Reenen (2007) and Bloom et al. (2012)) and managers' skills touch upon it (see Bertrand and Schoar (2003) and more recently Braguinsky et al. (2015)).[2] The absence of such studies is in part related to the endogeneity of the decision to hire individuals. This is particularly true for high-level employees or employers for which there exists no random shifts to determine the causal effect of certain skills or characteristics on performance (see Erhardt et al. (2003); Güner et al. (2008); Flabbi et al. (2016) and Kim and Starks (2016)). The lack of turnover in those positions no doubt further limits such studies.[3] Individuals with governance mandates usually keep their job for many years alongside colleagues that rarely change. The set of skills and characteristics do not vary enough to identify their relevance for firm performance. [4]

This paper seeks to overcome those limitations and causally determine the impact of changes in the composition of leadership on firm performance. We use the implementation of a gender quota in France in boards of directors and supervisory boards as a quasi-natural experiment. The choice of this setting is not random. First of all, France chose to impose a strict compliance to the law. In 2017, it was the highest performing country in Europe in terms of female representation in boards up from one of the worst performances at the beginning of the century. This progression creates a sizable turnover of individuals and potentially reshuffles characteristics of interest. Second of all, the law uses a size cutoff

[2] Caliendo et al. (2015) highlights the importance of managers by finding a positive correlation between value added and upper occupational layers within firms.

[3] Mas and Moretti (2009) use data on a supermarket chain where workers overlap in an unsystematic way and find that diversity in individual productivity is optimal. This type of setting is however specific not only to the industry but also to the occupation level of employees.

[4] A few papers use the unexpected hospitalization or death of CEOs to assess their importance for firm performance (see Bennedsen et al. (2020)). Yet those events are not only rare but also limit the analysis to leaders' fixed effects as a whole.

to define compliance and a time schedule to achieve a certain share of women. We extend the difference-in-discontinuities design developed by Grembi et al. (2016) which exploits the timings and thresholds of the law to additionally account for partial compliance. One main advantage of this fuzzy design is the absence of demand-side variables that could otherwise wrongly be attributed to the change in the composition of the governance body. Papers that study the implementation of gender quotas in boards focus on publicly traded firms either due to the specifications of the law (Matsa and Miller (2013); Ahern and Dittmar (2012) and Bertrand et al. (2019) for Norway; Ferrari et al. (2018) for Italy) or the relative ease to obtain the composition of boards for those large companies (Dalvit et al. (2020) for France). They either use a difference-in-differences strategy with a matched sample[5] or an instrumental variables strategy where the share of women in boards is instrumented with its past share interacted with a year fixed effect.[6] In both cases there is a risk that firm outcomes react to the composition of boards through the market's approval or disapproval of a new governance rather than through that board's change (see Giannetti and Wang (2021) for evidence on the relationship between high abnormal returns and high public attention to gender equality and Ferrari et al. (2018) for the positive response of the market to the election of a female board member).[7] There is additional concern that the size of firms might be correlated with both the evolution of performance and the compliance to the quota. Since our strategy follows the cutoff of the law, we focus on medium-sized firms for which such market-side response and confounding factors are arguably reduced.

A unique feature of our design is the construction of a dataset that covers firms for which the composition of governance is not readily available nor easily collectable. We identify board members as well as other high-level positions (CEOs, vice-presidents and members of other governance bodies) for medium-sized firms across a ten year period with information on their gender as well as the start and end of their mandate. This data allows us to measure the evolution of the share of women in governance accounting for their actual presence each year. We have additional information on individuals such as age, nationality and education which give us insights into the types of diversity that operate in boards beyond gender. Our design has the advantage of reducing the extent

[5] Matsa and Miller (2011) gather information on boards for some large unlisted firms that are used as a control group in their design.

[6] Ferrari et al. (2018) arguably comes closest to our design as they instrument the share of women in boards with the time period of the law. However for reasons that will be mentioned below, this strategy fails to account for market-related confounding factors.

[7] The exclusion restriction could additionally be invalidated in the IV strategy if the instrument is related to the outcome through another channel. A higher share of female board members prior to the law could be related to a more progressive working environment. Such a firm could be open to hiring more women in high positions with managerial tasks in line with societal changes. This in turn could affect the way the firm is managed and is performing. As for the DiD strategy, the design relies on the assumption that large unlisted firms can be used as a control group. There is a risk, however, that listing is related to inherent differences in the way firms are run.

to which the change in those characteristics is endogenous to the firm. The local average treatment estimate limits the potential for a different access to pools of candidates that would depend on firm size to be an issue. Our results reflect the common response of firms to the law.

Finally, our access to detailed balance sheet, employee data and sectoral survey allows us to identify the specific production components responsible for changes in performance. A main limitation is our inability to disentangle quantities from prices. The implications from input and output responses are somehow restricted as we cannot distinguish productivity from cost. Our setting is however able to find the causal response of performance to changes in governance. Unlike papers which study the relationship between ownership changes and performance (see Lichtenberg and Siegel (1987) and Schoar (2002)), we have a shock on decision-takers that is purely exogenous to firms.

This article starts by describing the law as well as the data and design used to find a causal estimate for performance. We then analyze the results of our regression of interest. Our findings indicate a gain in performance from changes in governance. We find that a one percentage point increase in the share of women in boards leads to a 0.3 percentage point increase in profit margin. The overall effect of the law on our performance outcome is 2.1 percentage points or 5.4 percent. Since profitability is diminishing, we find that this relative gain limits the loss that firms with unchanged boards experience. Those results are robust to the inclusion of a set of fixed effects such as an interaction term of sector and time, the gender of the CEO and of the president of the board, the age of the firm, the exposure to external finance and the size of the board.

After we establish this main result, we decompose performance into its various production components. We identify a significant shift in firms' cost structure away from external costs.[8] In particular, the revenue share of external costs decreases by 2.1 percentage points or 6.2 percent. Since purchases of services are increasing, we find that this relative reduction corresponds to a marginal increase. The deviation away from external costs is consistent with it being an easily adjustable factor of production. In particular, the effect comes from changes in the type and quantity of temporary workers which are, by definition, easily hired and fired. We do not find any effect on the remaining inputs. This is in line with the inability of a new board member to suddenly lower the price of purchases and/or improving the technology to produce goods. It is unlikely that the reshuffle of governance can induce market power or technological change. Similarly, neither labour nor capital change significantly as they are heavily regulated or require time.

Our findings point to the added value of using domestic labour outsourcing as a tool to manage demand better. We additionally show that such differences in cost strategies

[8]Those costs are purchases of services from other firms. They include outsourcing costs, lease payments, rental charges for equipment and furniture, maintenance expenses, insurance premiums and costs for external market search, advertising, transportation and external consultants.

have further repercussions. Our estimates on revenue growth indicate that the decision to switch from many low-qualified to fewer high-qualified external workers is an optimal expansion strategy. We find that the quota leads to a 5.1 percentage point or 5 percent increase in revenue and that this relative gain corresponds to an actual improvement of around 3 percent.

We explore the mechanism behind board decision-taking by first testing for non-linearities. We find that over 90 percent of our effects on performance and cost are borne by the first woman entering governance due to the quota. Our results indicate that the individual responsible for reducing homogeneity plays a central role in swaying decisions taken by the boards. The strongly diminishing returns to an additional newcomer and the persistence of our effects suggest that the individual plays a pivot role. We then separately test for the relevance of individual characteristics. We show that the law led to an increase of within-board diversity. The newcomers increase the share of foreigners and young people. We additionally test for changes in network diversity since it members can sit on at most 5 different boards. We find that the newcomers tend to sit on unique boards with which the firm did not have prior connections. While within-board diversity touches upon individual knowledge, network diversity reflects the value added of sharing and transmission of information across firms.

Finally we discuss the wider implications of the policy. In particular, our results lead to questioning the profit-maximising motive of firms and the presence of a principal-agent problem. Board members' role is to increase the profitability of firms. The policy however highlights the boards' inability or unwillingness to hire colleagues that would achieve that. We believe that the habit of hiring candidates from the same pool as well as a lack of precedents on the benefits of heterogeneity play a significant role. The potential incentive for a well-performing firm not to share a board member with a worse-performing one within the same industry might additionally explain the static network of boards.

1 The Gender Quota in French Boards of Directors and Supervisory Boards: Background Facts

The issue of gender inequality has gained traction in recent years. Since the early 2000's, policy-makers specifically started pointing out the low share of women in high-level positions and the striking near-absence of women in governance bodies. It became additionally clear that societal changes towards women were not reflected in those positions. The share of women in boards, for instance, was hovering around 10% across Europe for the first decade of the twenty-first century. The slow evolution of women in governance became a major issue for governments seeking greater gender equality. Since then, individual countries started introducing policies to break that apparent glass ceiling. In 2003, Norway led this effort by imposing a gender quota for corporate boards in publicly traded companies

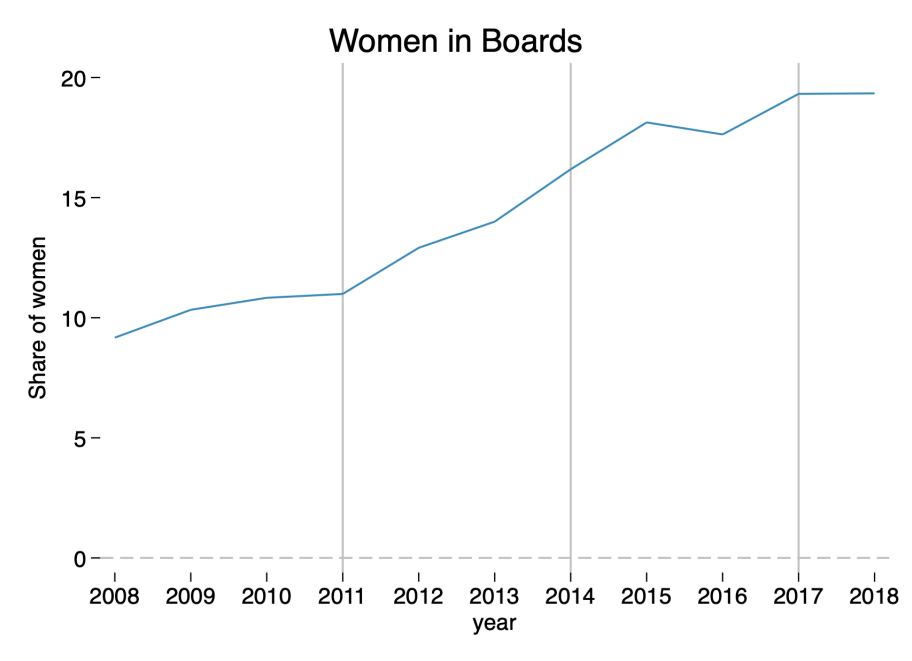
with a clear target and timeline. Those firms had two years to achieve a 40% share of women and non-compliance would be met with severe sanctions. Several European countries followed with quotas of their own. Most of them heavily based themselves on the Norwegian model. France, however, departed from it by setting unique firm-size requirements and staggered targets. Those differences will be key to our identification strategy and will allow us to estimate the pure causal effect of the policy on firm performance.

The introduction of a gender quota in boards of directors (*Conseil d'administration*) and supervisory boards (*Conseil de surveillance*) in France resulted from a fast process. After barely one year of preliminary works and discussions, the president promulgated the law on the 27th January 2011. One of its unique features is the types of firms it targets. The French law does not limit itself to publicly traded firms as does Norway or Italy. It reaches far deeper into the economy down to medium-sized companies by using a size cutoff to determine compliance. In practice, firms with a revenue of at least 50 million euros and 500 employees for the past three years need to abide by the law. The second specificity of the French quota relates to its staggered timeline. The government established several compliance periods over six years. Above the size cutoff, firms would need to have 20% of women in their boards in the first general assembly following 2014[9], i.e. three years after the announcement of the law, and 40% in the first general assembly following 2017, i.e. six years after the announcement of the law. Any firm crossing the size-cutoff after 2017 would have to immediately comply with the 40% target. Since the size of a board can legally vary between a minimum of 3 and a maximum of 18 members, the law specified a different share to be respected for firms with at most 8 board members. For those firms, the gap between the number of individuals of each gender cannot be bigger than two as of 2017.

Figure 1 shows the evolution of the share of women in boards of directors and supervisory boards for firms just above the size cutoff of the law. We can draw a set of observations from that picture. First of all, the mandatory share of women was not achieved by 2018. In our case where the size of boards averages six members the target to respect should be around 33%. The absence of full compliance could be due to several reasons. Auditing by public officials could be too low to enforce the sanctions intended by the law. In theory, non-complying firms should see their board nominations nullified as well as the remuneration of their board members suspended. Another reason for partial compliance could be the lack of public scrutiny. Medium-sized firms are not known and as a result do not have to face the same reputation costs as larger firms do. The media coverage of public traded firms' behaviour could have shed smaller more unknown firms from the spotlight.

[9]This intermediate condition applies only to publicly traded firms. For those firms as well, if no woman is present in the board at the time of the announcement of the law in 2011 at least one has to be nominated at the next general assembly.

Figure 1: The evolution of the share of women in boards, 2008-2018



Notes: This figure shows the share of women in boards of directors and supervisory boards from 2008 to 2018 for medium-sized firms above the size cutoff of the law, i.e. with 500 to 4,999 employees for the past three years and revenues of 50 to 1.5 M. euros. It is computed from the flows and stocks of board members collected by the French chambers of commerce and the national institute of intellectual property (INPI). The three grey vertical lines refer to the timeline of the quota: the announcement in 2011, the first threshold in 2014 and the second threshold in 2017.

Nonetheless, even in the absence of auditing and public scrutiny, the sudden increase of the share of women due to the law in medium-sized firms is striking. Before the announcement of the quota, that number was stagnating. It was hovering around 10% from 2008 to 2011. The law has clearly provided an exogenous push on the representation of women in governance. Between 2011 and 2014, the share of women on boards increased by around 5 percentage points. By 2018, it reached nearly 20%

2 Data

Our main data source is firm-level board data taken from the French chambers of commerce (BODACC) and the national institute of intellectual property (INPI). For this paper, we have collected all the announcements of flows and stocks of members in medium-sized firms from 2008 to 2018.[10] The decision to focus on this category of firm is justified by our cutoff approach which will be detailed below. Since we have the stocks for those firms in 2017 and 2018, we can use the combination of flows and stocks from 2008 to

[10]We focus only on this category of firms to avoid capturing other policy changes that might occur upon entering another size group.

2016 to back out the yearly board composition of each firm. The resulting panel data has information on the first and last names, the specific role[11] as well as the starting and ending months of the mandate of a given member. We match the first names to a repertory of gender-name associations provided by the French government to retrieve the gender of each member. Since this dataset does not cover all names, we search manually the gender usually associated to a given first name. For members with a gender-neutral name, we look for the specific person and find its gender thanks to companies' websites or platforms such as linkedin. We use the information on the starting and ending months of a given member to calculate the actual presence of members on boards instead of deciding which year we consider as the starting or ending one. For instance, if a person is nominated in January, she will count as a full member that year. However, if she is nominated in November, she would have been a member for only two months. We construct the share of women in boards for each firm in any given year based on the total count of this monthly mandate. Our estimate of the share of each gender therefore reflects directly their presence in the boards. We use the same strategy for the other governance changes that are recorded by BODACC and INPI such as CEOs and vice-presidents. We complement the personal information such as age and nationality that we get from those datasets with BoardEx. For this sub-sample (around 17% of members) we additionally record the education level and school. Our resulting dataset is a firm-year panel dataset on the gender and characteristics composition of governance. It is unique as we can track medium-sized firms instead of publicly traded companies giving us novel insights into the individuals running private firms.

This dataset is matched to the fiscal balance sheet panel data (FICUS-FARE) provided by the French statistical office (INSEE) thanks to a common firm identification number. We have information on firm characteristics such as its sector and its age as well as production-related variables from 2008 to 2018. We know the firms' revenues, amount of employees and expenditure. We can further separate costs into labour, capital, intermediary products as well as external services. We can track the investments, types and level of indebtedness of firms as well. We multiply capital with the 9.3 percent average cost of debt for French firms from Carluccio et al. (2018) to retrieve capital cost. We complement this with the annual sectoral survey (ESA) which decomposes firm costs further. This allows us, for instance, to disentangle out-sourcing from advertising, temporary workers and insurance costs. The composite dataset on governance and balance sheet is further merged to a matched employer-employee data (DADS) from the INSEE. We can track the average salary, number of hours worked and number of employees by both gender and occupation. Unfortunately this panel is available only from 2008 to 2015. It is, therefore, mainly used for additional results and heterogeneity analysis.

Table 1 displays the mean and standard deviation of variables of interest for the full

[11] One can be either a simple or presiding member of a board of directors or supervisory board

and restricted samples from 2008 to 2018. The table excludes firms in the agricultural and public sectors, without boards of directors or supervisory boards and which are outside the official medium-sized category ranging from 250 to 4,999 employees and a revenue of up to 1.5 billion euros or a balance sheet of up to 2 billion euros. Firms are relatively old, have profit margins averaging between 10 to 13 percent and returns on asset of 19 percent. Their biggest expenditure is external purchases of services from other firms and they are financially healthy as their ratio of equity over assets is around 30 percent. Boards of directors and supervisory boards have around 5 to 6 members with 15 percent of women. Presidents and directors are predominantly men. Less than 10 percent of firms are run by women. For the purpose of this paper, we want to keep firms who have values for all those characteristics. Although we will use the restricted sample of 1,510 firms for our main analysis the remaining firms will be used in a set of robustness checks.

Table 1: Characteristics of firms

	Mean	*Sd*	*Count*	*Mean*	*Sd*	*Count*
	Full sample			Restricted sample		
	Firm characteristics					
Profit margin	0.10	0.33	3,125	0.13	0.23	1,650
Return on assets	0.19	0.28	3,125	0.19	0.32	1,650
Input share	0.25	0.26	3,125	0.25	0.25	1,650
External costs share	0.35	0.24	3,125	0.35	0.22	1,650
Labour share	0.25	0.15	3,125	0.25	0.13	1,650
Capital share	0.05	0.18	3,125	0.03	0.11	1,650
Equity share	0.31	0.31	3,125	0.32	0.34	1,650
Age	40	21	3,125	39	20	1,650
	Governance characteristics					
Size of board	5.54	4.13	3,125	5.53	4.11	1,650
Share of women	14.47	17.81	3,125	14.53	18.28	1,650
Women ≥ 1	0.47	0.50	3,125	0.46	0.50	1,650
Share of women president	0.91	6.77	2,846	0.64	5.53	1,510
Women president ≥ 1	0.06	0.25	2,846	0.06	0.24	1,510
Share of women director	1.84	9.32	2,967	1.89	9.31	1,561
Women director ≥ 1	0.08	0.27	2,967	0.08	0.28	1,561

Notes: The restricted sample includes firms within the optimal bands of employment from 355 to 800 employees. Profit margin is calculated as $\frac{Revenue - total\ costs}{Revenue}$. All the production variables are expressed as shares of revenue.

The combination of governance, balance sheet and employee-level information for

medium-sized firms provides unique insights into the relationship between the composition of decision-takers, production and costs. The exogenous reorganization of governance used in this paper can be related to changes in the structure and performance of the firm.

3 Empirical Specification

In a simple world, we would relate changes in governance to performance by running the following regression:

$$Y_{i,t} = \beta_0 + \beta_1 Share_{i,t} + \beta_k \Omega_{k(i,t)} + v_{s,t} + \epsilon_{i,t}$$

where $\Omega_{k(i,t)}$ is a vector of time-varying individual controls, $v_{s,t}$ sector and $\epsilon_{i,t}$ individual fixed effects. β_1 would identify the effect of a percentage increase in the share of women in boards on $Y_{i,t}$. However, this estimate is likely to be biased because of a non-random evolution of $Share_{i,t}$. Higher performing firms, for instance, might be inclined to hire more women in their boards as they have the time and financial resources necessary to do so. Since boards are mostly composed of men, it might be costly to hire members outside the usual pool of candidates. Performance could allow this financial effort to occur.

To circumvent this issue, we use the timings and size cutoffs of the law in a novel empirical design to estimate the pure causal effect of a change in governance on firm organization and performance. We extend the difference-in-discontinuities (diff-in-disc) design developed by Grembi et al. (2016) to account for incomplete compliance to the law. The resulting fuzzy diff-in-disc allows us to compare firms that differ only in their requirement to respect or not the gender quota.

3.1 A Fuzzy Difference-in-Discontinuities Design

The fuzzy diff-in-disc combines a fuzzy regression discontinuity with a difference-in-difference. We develop this strategy rather than use either one of the methods as they would not allow to estimate accurately the effect of the governance change on performance. With a difference-in-difference, we risk wrongly attributing changes in performance to the law. Even if we were to limit ourselves to medium-sized firms, we would inevitably capture legal or market developments that are unrelated to the quota. Larger firms, for instance, have been increasing their market power over the years. This in turn might affect our performance estimates (see De Loecker and Eeckhout (2018) and De Loecker et al. (2020)).[12] The government has also enacted laws on corporate social responsibility

[12]This would also be a reason not to instrument the share of women in boards with the timeline of the law as done by Ferrari et al. (2018) as the exclusion restriction might be violated.

and corruption for bigger firms during that time period.[13] Similarly, a fuzzy regression discontinuity might capture inherent differences related to pre-sample laws as in Grembi et al. (2016). The labour code which dates back to the 1980s stipulates that firms with at least 500 employees need to follow an additional set of rules regarding trade unions. An additional union representative can be elected and the time a representative can spend on her union work increases by 5 hours. This is just an example of the entrenched legal differences firms face as they cross the 500 employee cutoff.[14] The regression discontinuity estimator could be biased because the effects of several treatments would not be disentangled. We show the presence of such a pre-sample discontinuity in figure A1. The fuzzy difference-in-discontinuities allows to control for those pre-existing differences and accurately estimate the effect of the quota on performance.

3.2 Identification Assumptions

The fuzzy difference-in-discontinuities is similar to an instrumental variables strategy. In our case, the size and time cutoffs are instruments for the share of women in boards. We face an additional econometric challenge from having two instead of one forcing variable. We use Papay et al. (2011) and Grembi et al. (2016) to define treatment probabilities for two thresholds for the post-treatment period :

$$W_{1,i,t} = 1\{X_{1,i,t} \geq c_1,\ t \geq t_0\}$$
$$W_{2,i,t} = 1\{X_{2,i,t} \geq c_2,\ t \geq t_0\}$$

and for the pre-treatment period:

$$\widetilde{W}_{1,i,t} = 1\{X_{1,i,t} \geq c_1,\ t < t_0\}$$
$$\widetilde{W}_{2,i,t} = 1\{X_{2,i,t} \geq c_2,\ t < t_0\}$$

where $\widetilde{W}_{k,i,t}$ and $W_{k,i,t}$ are binary dummies for being above one of the two k cutoffs respectively before and after t_0 equal to 2014, c_1 is our 500 employee cutoff and c_2 is our 50 M. euros revenue cutoff.[15] Firms can fall into a total of eight treatment conditions

[13] Both laws target firms with 500 employees and 100 M. euros revenue. The 2010 law on corporate social responsibility or more commonly known as *Loi Grenelle* requires firms to include qualitative information on steps taken to account for social, societal and environmental issues. The 2016 law on corruption or more commonly known as *Loi Sapin 2* requires firms to put in place systems to prevent corruption and influence peddling.

[14] It is more difficult to identify the 50 M. euro cutoff in legal documents as France introduced the euro in 2003. However, the presence of a discontinuity at the employee cutoff could on its own induce pre-quota differences across the thresholds.

[15] In practice, we use three time periods. The first one corresponds to the pre-quota years from 2008 to 2010, the second one to the introduction of the quota from its announcement in 2011 up to the year

which are a combination of the employee and revenue forcing variables for each time period. For example, the effect of the c_1 cutoff conditional on being at the c_2 cutoff in the post-treatment period is:

$$\underbrace{\lim_{x \to c_1^+} E[Share_{i,t} / X_{1,i,t} = x_1,\ X_{2,i,t} = c_2,\ t \geq t_0]}_{Share^+_{c1/c2=1}} -$$

$$\underbrace{\lim_{x \to c_1^-} E[Share_{i,t} / X_{1,i,t} = x_1,\ X_{2,i,t} = c_2,\ t \geq t_0]}_{Share^-_{c1/c2=1}}$$

As mentioned above, we introduce the difference-in-difference approach to remove the selection bias due to pre-sample laws. The identification of the causal effect of the gender quota on the treatment discontinuity is the difference between the conditional mean outcomes of post-treatment and pre-treatment for firms above versus below the cutoffs. The causal effect of the gender quota for a particular space of treatment such as the one mentioned above is:

$$\tau_{ci/cj} = (Share^+_{ci/cj} - Share^-_{ci/cj}) - (\widetilde{Share^+_{ci/cj}} - \widetilde{Share^-_{ci/cj}})$$

where the subscript ci/cj denotes the space of treatment and $\widetilde{Share_{ci/cj}}$ is the conditional mean outcome for the pre-treatment period.

As in an instrumental variables strategy, our performance result will be the ratio between the outcome and treatment discontinuities :

$$\theta_{ci/cj} = \frac{\psi_{ci/cj}}{\tau_{ci/cj}}$$

where $\psi_{ci/cj}$ is the outcome discontinuity:

$$\psi_{ci/cj} = (Y^+_{ci/cj} - Y^-_{ci/cj}) - (\widetilde{Y^+_{ci/cj}} - \widetilde{Y^-_{ci/cj}})$$

with $Y_{ci/cj}$ denoting the effect of the cutoff on our performance outcome.

This estimator is valid under a set of identification assumptions. A first condition requires that observable and unobservable characteristics do not jump at the cutoffs (the local continuity assumption). In practice, firms close to the 500 employee and 50 M. euro revenue thresholds should differ only in their requirement to comply with the gender

before the first legal target, the third one starts in 2014. Since our instrument is based only on the 2014 cutoff and the distinction between the two first time periods is only used in our estimation, we do not introduce this here.

quota. This guarantees that the difference between average observed outcomes above and below the cutoff is equal to the average treatment effect at that cutoff. The effect of the c_1 cutoff conditional on being at the c_2 takes the following form:

$$Share^{+}_{c1/c2=1} - Share^{-}_{c1/c2=1} =$$
$$E[Share_{i,t}/W_{1,i,t} = 1,\ W_{2,i,t} = 1] - E[Share_{i,t}/W_{1,i,t} = 0,\ W_{2,i,t} = 1]$$

As it is not possible to test directly for the local continuity assumption, we follow Cattaneo et al. (2020) in providing empirical evidence for its validity. We show that covariates are balanced before 2011 in A1. In practice, we conduct a pooled regression discontinuity on a set of characteristics such as the age or the size of a firm's board excluding treatment years. We find no effect for any of our pre-determined covariates. This test has the additional advantage of proving the exogeneity of the law. If the quota had been imposed for firms at the 500 employee and 50M. euro revenues cutoff for a reason, this would show up in our covariates. Second, we show in figures A2 and A3 that there is no manipulation of the running variables at the cutoffs. In particular, we find that there is no change in the density around the thresholds from pre- to post-treatment years (McCrary (2008)). We conduct a third falsification test in A4 where placebo cutoff values define treatment. We find no effect at any of the revenue and employee thresholds combinations on the left and on the right of the real cutoffs. We additionally test for pre-treatment changes in A2 by using placebo timelines. We exclude the years after 2011 and use fake events to define the time dummy of our instrument. We find no effect for any of the years preceding the announcement of the law. Finally, we show that our results are robust to changes to the bandwidth. In figures A5, we plot the treatment effects with bands incrementally larger and smaller than the optimal ones.

The validity of our estimator requires also that the probability of compliance jumps at the cutoffs (the monotonicity assumption). This appears in the strength of our first stage which clearly indicates a significant increase in the share of women in boards due to the quota. Additionally, our cutoffs need to impact performance only through a change in governance (exclusion restriction). This condition is guaranteed by the non-manipulation of the running variable.

As in Grembi et al. (2016), the combination of a fuzzy regression discontinuity with a difference-in-difference requires use to make and test additional assumptions. First of all, the effect of pre-treatment confounding policies such as the representation of trade unions mentioned above need to be stable over time. In practice, this is equivalent to having parallel trends around the cutoffs prior to 2014. We test this assumption in A2 and A1 and show that this condition is met. We additionally need to prove that the effect of our treatment does not depend on confounding policies. Although we cannot test for this directly, we have an indication that pre-treatment differences around the cutoffs does

not lead to different reactions to the law. In august 2014, the law was amended to be extended to smaller firms with a revenue of at least 50 M. euros and 250 employees. If we disentangle yearly treatment effects, we have clear results up to 2016. In 2017 and 2018 the effects start dissipating as our control group becomes itself treated. When the gender quota was announced for firms with at least 500 employees and 50M. euros in revenue, it took around three years for the boards to start changing. This is exactly what we observe for the extension of the law in 2014 to firms with 250 employees. Three years after that, the effects on our cutoffs start fading as the control group starts hiring women in its boards. This confirms the relationship between the quota and the share of women at any point in the distribution and validates our strategy as our results do not depend on pre-existing confounding policies at the 500 employee cutoff.

Under the above assumptions, the fuzzy diff-in-disc estimator identifies the local causal average treatment effect of increasing the share of women in governance for firms around the thresholds.

3.3 Estimation

We apply a local linear regression with parameters accounting for all the possible interactions between the variables (see Papay et al. (2011)). We use a uniform kernel and polynomial of order 1 as suggested by Lee and Lemieux (2010) and Imbens and Lemieux (2008). In the first stage of the two-stage least squares regression, τ_0 indicates the effect of the gender quota on the share of women in boards as it corresponds to the combination of time, revenue and employment dummies:

$$
\begin{aligned}
Share_{i,t} = \delta_0 + \alpha_1 T_t + W_{1,i,t}(\delta_1 + \alpha_2 T_t) + W_{2,i,t}(\delta_2 + \alpha_3 T_t) \\
+ \overbrace{D_{i,t}}^{W_{1,i,t} \times W_{2,i,t}} (\delta_3 + \tau_0 T_t) + X^*_{1,i,t}(\delta_4 + \alpha_4 T_t) + X^*_{2,i,t}(\delta_5 + \alpha_5 T_t) + \overbrace{S_{i,t}}^{X^*_{1,i,t} \times X^*_{2,i,t}} (\delta_6 + \alpha_6 T_t) \\
+ (X^*_{1,i,t} \times W_{1,i,t})(\delta_7 + \alpha_7 T_t) + (X^*_{2,i,t} \times W_{2,i,t})(\delta_8 + \alpha_8 T_t) + (X^*_{1,i,t} \times W_{2,i,t})(\delta_9 + \alpha_9 T_t) + \\
(X^*_{2,i,t} \times W_{1,i,t})(\delta_{10} + \alpha_{10} T_t) + (S_{i,t} \times W_{1,i,t})(\delta_{11} + \alpha_{11} T_t) + (S_{i,t} \times W_{2,i,t})(\delta_{12} + \alpha_{12} T_t) \\
+ (X^*_{1,i,t} \times D_{i,t})(\delta_{13} + \alpha_{13} T_t) + (X^*_{2,i,t} \times D_{i,t})(\delta_{14} + \alpha_{14} T_t) + (S_{i,t} \times D_{i,t})(\delta_{15} + \alpha_{15} T_t) \\
+ \beta_k \Omega_{k(i,t)} + v_{s,t} + \epsilon_{i,t}
\end{aligned}
$$

where $Share_{i,t}$ is the share of women in boards and ranges from 0 to 100 in firm i at time t, T_t is a dummy equal to 2 after 2014 and 1 between 2011 and 2013, $W_{1,i}$ is a binary dummy equal to one if $X_{1,i,t} \geq c_1 = 500$ for t as well as $t-1$ and $t-2$, $W_{2,i}$ is a binary dummy equal to one if $X_{2,i,t} \geq c_2 = 50000$, $X^*_{1,i,t} = X_{1,i,t} - c_1$ is the normalized number of employees, $X^*_{2,i,t} = X_{2,i,t} - c_2$ is the normalized amount of revenue in thousand euros, $v_{s,t}$ is a sector-time fixed effect and $\epsilon_{i,t}$ is an individual fixed effect. $\Omega_{k(i,t)}$ are controls for the logarithm of the firm's age, the size of the board, the share of female presidents and

vice-presidents[16] as well as the equity share of revenue to account for differential exposure of firms to external finance. In our specification, the instrument uses only 2014 as the year that switches the quota but the parameter interactions accounts for potential differences between years prior to the 2011 announcement and the period from 2011 to 2013. By separating our sample into three different periods and using only years after 2014 in our instrument, we control for the marginal response of a few firms to the introduction of the law in 2011 in our pre-treatment years.

In the second stage, we regress performance, $\hat{Y_{i,t}}$, on our instrumented share of women in boards, $\hat{Share}_{i,t}$, controlling for the variables and their interactions as specified in the first stage. This allows us to consistently estimate the effect of the quota at the cutoffs :

$$\begin{aligned}
Y_{i,t} = \delta_0' + \alpha_1' T_t + W_{1,i,t}(\delta_1' + \alpha_2' T_t) + W_{2,i,t}(\delta_2' + \alpha_3' T_t) + \delta_3' D_{i,t} + \theta_0 \hat{Share}_{i,t} \\
+ X^*_{1,i,t}(\delta_4' + \alpha_4' T_t) + X^*_{2,i,t}(\delta_5' + \alpha_5' T_t) + S_{i,t}(\delta_6' + \alpha_6' T_t) + (X^*_{1,i,t} \times W_{1,i,t})(\delta_7' + \alpha_7' T_t) \\
+ (X^*_{2,i,t} \times W_{2,i,t})(\delta_8' + \alpha_8' T_t) + (X^*_{1,i,t} \times W_{2,i,t})(\delta_9' + \alpha_9' T_t) + (X^*_{2,i,t} \times W_{1,i,t})(\delta_{10}' + \alpha_{10}' T_t) \\
+ (S_{i,t} \times W_{1,i,t})(\delta_{11}' + \alpha_{11}' T_t) + (S_{i,t} \times W_{2,i,t})(\delta_{12}' + \alpha_{12}' T_t) + (X^*_{1,i,t} \times D_{i,t})(\delta_{13}' + \alpha_{13}' T_t) \\
+ (X^*_{2,i,t} \times D_{i,t})(\delta_{14}' + \alpha_{14}' T_t) + (S_{i,t} \times D_{i,t})(\delta_{15}' + \alpha_{15}' T_t) + \beta_k \Omega_{k(i,t)} + v_{s,t} + \epsilon_{i,t}
\end{aligned}$$

where θ_0 identifies the causal effect of an increase in the share of women in boards on performance. Standard errors are robust clustered at the firm level in both stages.

We follow Papay et al. (2011) to compute the optimal bandwidths that determine the window of observations on which we run the analysis. We use the cross-validation procedure of Imbens and Lemieux (2008) extended to two running variables for medium-sized firms. We limit ourselves straightaway to this category as they are subject to different tax rates which we do not want to pick up in our estimates. We use our local linear regression on varying ranges of employees and revenues in each space of treatment for this sample of firms. We estimate the fitted values of the effect for that interval combination and compare all of the possible estimates with the observed values across the entire sample. The optimal bandwidth is the one that minimizes this difference. Since we obtain estimates at the cutoff, we can limit ourselves to using the bandwidths of one of the running variables. Our regressions will use observations within the optimal range of employees. The window on the left and right of the cutoffs will not be symmetric due to the skewness of firm size distribution. In a series of robustness checks, we modify the bands due to the introduction of two laws (The *Loi Grenelle* in 2010 and the *Loi Sapin 2* in 2016) targeting firms with at least 500 employee and a revenue of 100 M. euros. We show in tables B1, B2 and B3 that deleting observations beyond that revenue cutoff alters none of our results. Although we lose power due to the exclusion of a set of firms, we find

[16] Recall that the share of a gender is calculated as the number of months per year a person has been in a certain role. Controlling for the share of female presidents and vice-presidents is therefore equivalent to controlling for the monthly presence of women in those positions.

the same sign and size for each of our estimates. [17]

4 Empirical Analysis

Boards of directors and supervisory boards are responsible for the profitability of firms. They meet at least once a year to draw up the accounts for the shareholders as well as to discuss the firms' strategy and its implementation. During those meetings, resolutions are passed by the majority of members present unless specified otherwise by the company.

We relate the exogenous reorganization of boards to changes in performance and identify the production component responsible for this. We find that the new governance limits its diminishing profitability by targeting expenditure on easily adjustable costs. It only marginally increases external services instead of following the general trend of large out-sourcing and sub-contracting. In particular, firms change the type and quality of temporary workers they hire. The decision to deviate away from many lower-qualified towards fewer higher-qualified external workers is beneficial as revenue growth significantly increases.

Our effects are nearly entirely explained by the first newcomer in the board. Since resolutions are usually passed by the majority of members, that person is pivotal in swaying the decision away from excessive external production and diminishing profitability. While the second newcomer explains only a fraction of the effect, it still adds positively to it. The non-linearity and persistence of our estimates indicate that knowledge updating is the main channel at work. We find that two types of diversity are relevant for this. While within-board diversification extends the knowledge of the board, network diversification allows for transmission across firms. The added value of both components provide evidence for an opportunity cost of governance homogeneity.

4.1 Changes in Governance and Profitability

Table 2 shows the results from the local linear regression for a set of accounting variables for which boards are responsible: profit margin and return on assets. We start with the easiest operating performance measure where the only expenditure is intermediary and final inputs. We then show results gradually adding all the costs such as external services, capital and labour to display the effect of the law on any possible calculation of operating performance.

The first column of the table corresponds to our first stage and indicates the effect of the gender quota on the share of women in boards. The law induced a significant 26 percentage points increase in the proportion of women in governance. Since the size of a board averages six members, this effect is equivalent to adding on average between 1 and

[17] Other laws have been enacted during that time period but they specifically target very large and/or publicly traded companies that are not present in our medium-sized firms sample.

2 women. The remaining columns correspond to our second stage and indicate the effect of an increasing share of women on profit margin and return on assets.

Table 2: Diff-in-disc estimates of performance

	Share	$\frac{Revenues-Input\ costs}{Revenue}$	... − $\frac{External\ costs}{Revenue}$	... − $\frac{Capital\ costs}{Revenue}$	... − $\frac{Labour\ costs}{Revenue}$	$\frac{Net\ income}{Assets}$
Diff-in-Disc	26.33***					
	(5.98)					
Share		0.00	0.36***	0.31***	0.34**	0.81**
		(0.06)	(0.12)	(0.12)	(0.15)	(0.35)
AR confidence set			[0.20 ; 0.52]	[0.15 ; 0.47]	[0.14 ; 0.54]	[0.34 ; 1.22]
Regression	OLS	IV	IV	IV	IV	IV
Observations	1,212	1,212	1,212	1,212	1,212	1,212
Controls	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	-	19.38	19.38	19.38	19.38	19.38
Bandwidths			355 to 780-800 employees			

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

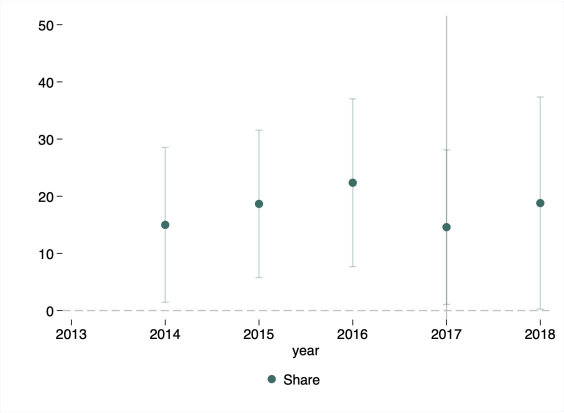
We find that the exogenous change in governance is associated with gains in performance. If we take the third column as an example, we find that a one percentage point increase in the share of women in boards leads to a 0.36 percentage points increase in profit margin. Since the proportion of women in governance over the whole sample went up by around 5.8 percentage points relative to pre-treatment years, the quota is responsible for a 2.1 percentage point (5.8×0.36) increase in performance relative to firms who do not have to comply with it. This corresponds to a 5.4 percent increase as profit margin averages 39 prior to the law ($\frac{2.1}{39} \times 100$). Although this number might seem high, it is important to recall that this variable accounts for neither capital nor labour costs. In the fifth column where all production components are accounted for it averages 14 percent. In order to calculate the actual evolution of profit margin for firms that changed their governance, we need to retrieve the overall evolution of profit margin over the years. Since it decreases by 3.4 percentage points or 8.7 percent ($\frac{3.4}{39} \times 100$), we find that firms with a new governance actually experience a drop in profitability of around 3.3 percent ($8.7 - 5.4$). All the other columns indicate the same qualitative results although their size varies depending on the variable we look at. In the fifth column where all cost components are accounted for, we find that profit margin increases relatively by 14 percent and drops

overall by 13 percent. Finally, return on assets in the last column increases relatively by 22 percent and drops overall only marginally.

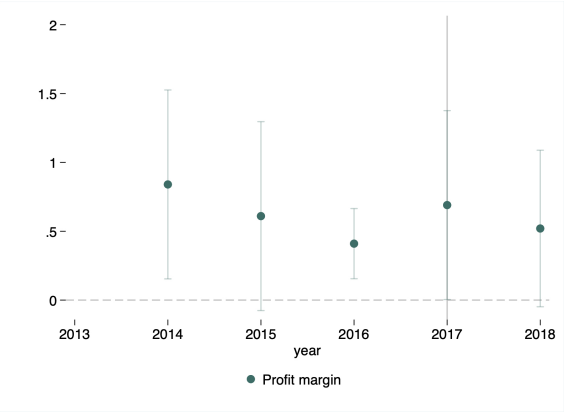
All our profitability estimates indicate gains due to the change in board composition. The new governance is able to limit the general drop that we observe in the rest of the sample. This result indicates boards' ability to take decisions that are more optimal for the firm. We further show the association between the gender quota, the governance change and profitability by plotting the yearly diff-in-disc estimates in figures 2a and 2b. Each year on the plot corresponds to the local linear regression where any other time is discarded. For instance, in order to retrieve the estimate for 2014 we use only that year as our post-treatment time dummy and neither 2015, 2016, 2017 nor 2018 is used. Due to a smaller sample for each regression, the standard errors are much larger than for our pooled estimates. However, the yearly estimates confirm our results. There is an overall clear association between a higher share of women and marginal profitability gains.

Figure 2: Diff-in-disc estimates by year

(a) Share of women by year



(b) Profitability by year



Notes: The figures display yearly estimates which we retrieve by excluding any other year in our instrument.

In both figures the 2016 diff-in-disc is the most significant one as this is the last year when firms can finalize their new boards. In 2017, most of them should be compliant with the law. In 2017 and 2018 there is a slight reduction in the precision of the estimates. This could be explained by the expansion of the law in 2014 to firms with 250 employees. Alike firms around the 500 cutoff, those companies start re-shuffling their boards as they approach their first legal threshold three years after the announcement in 2017. If anything, this confirms the positive relationship between the quota, the share of women and profitability at any point in the distribution and validates our strategy as our results do not depend on pre-existing confounding policies at the 500 employee cutoff.

4.2 Changes in adjustable costs and optimal expansion strategy

Boards of directors and supervisory boards can influence profitability by changing the firms' strategy. Since they draw up the accounts for the shareholders they know the cost and revenue decomposition of their output. In the case of overall diminishing profitability, new boards can identify which profit margin component they can quickly change to avoid those losses.

Table 3 shows the results from the local linear regression for all the variables used in the profit margin calculation in table 2. All components are expressed as revenue shares.

Table 3: Diff-in-disc estimates of revenue shares

	Share	$\frac{\text{Goods Costs}}{\text{Revenue}}$	$\frac{\text{Inventory Costs}}{\text{Revenue}}$	$\frac{\text{External Costs}}{\text{Revenue}}$	$\frac{\text{Labour Costs}}{\text{Revenue}}$	$\frac{\text{Capital Costs}}{\text{Revenue}}$
Diff-in-Disc	26.33***					
	(5.98)					
Share		-0.00	-0.01	-0.36***	-0.03	0.06
		(0.07)	(0.04)	(0.11)	(0.05)	(0.04)
AR confidence set				[-0.51 ; -0.21]		
Regression	OLS	IV	IV	IV	IV	IV
Observations	1,212	1,212	1,212	1,212	1,212	1,212
Controls	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	-	19.38	19.38	19.38	19.38	19.38
Bandwidths				355 to 780-800 employees		

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

First of all, we do not find any effect on capital costs (column 6). This is consistent with the fact that it takes time for the potential benefits of such investments to appear. Similarly, we do not find any effect on labour costs (column 5). Since France has strict labour regulations, changes in the employment stock come with significant hurdles. Instead of showing results for the overall costs of intermediate and final inputs, we distinguish between their purchases (column 2) and their stocks (column 3). We find that none of the variable changes significantly with the new governance. This is in line with the inability of the board to lower the price of purchases and/or improving the technology to produce goods. It is unlikely that the arrival of a board member can induce market

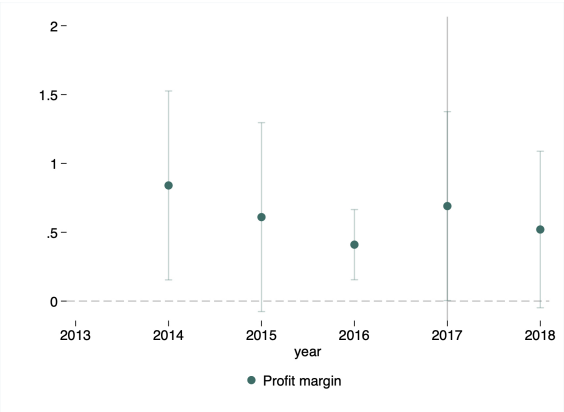
power or technological change. The absence of effects for inventory costs shows that the new governance does not influence the management of storage facilities. The costs associated with unsold goods can affect performance in some sectors but their improvement is associated with the hiring of more skilled employees who directly oversee it (see Braguinsky et al. (2015)). The new governance is probably too distant to that everyday type of management.

The only component that varies are purchases of services from other firms (column 4). They include costs such as outsourcing, lease payments, rental charges, insurance, external market search, advertising and consultants. We find that a one percentage point increase in the share of women in boards leads to a 0.36 percentage point decrease in those costs. Since the proportion of women in governance over the whole sample goes up by around 5.8 percentage points relative to pre-treatment years, the quota is responsible for a 2.1 percentage point (5.8×0.36) decrease in external costs relative to firms who do not have to comply with it. This corresponds to a 6.2 percent decrease as purchases of services average 34 percent as a share of revenue before the law ($\frac{2.1}{34} \times 100$). This number is largely consistent with reports by the French statistical office. Since this expenditure increases by around 2.2 percentage points or 6.5 percent ($\frac{2.2}{34} \times 100$), we find that firms with a new governance actually marginally increase external purchases by around 0.3 percent ($6.2 - 6.5$).

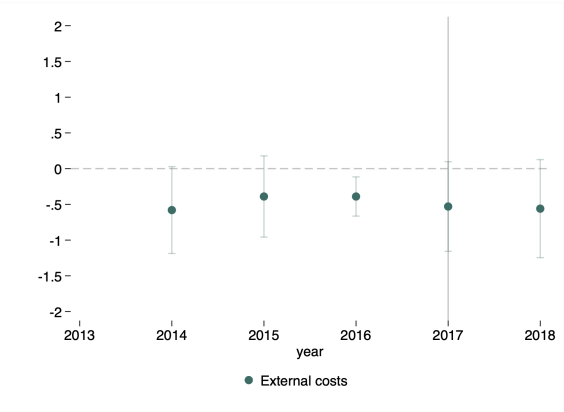
We show the association between external costs and profit margin by plotting their yearly diff-in-disc in figures 3a and 3b.

Figure 3: Diff-in-disc estimates by year

(a) Profitability by year



(b) External purchases by year



Notes: The figures display yearly estimates which we retrieve by excluding any other year in our instrument.

The estimates show a mirror correspondence between the two variables. A higher share of women in boards leads to performance gains through a reduction of excessive purchases from other firms. The persistence of our estimates confirm that this process

results from active decision-making. The arrival of new members could have led boards to be less able to discuss the strategy of the firm as the newcomers need to settle in and adjust to their role. In that case, we would have observed a quick reversion to the usual cost strategy and profit margin.

Our findings suggest that firms with unchanged boards spend non-optimally on a flexibly adjustable type of input while firms with a new governance limit this decision. It is important to add at this point that external costs are also extremely relevant. Their revenue share averaged 33% in 2018 and has been on an upward trend since the early 2000s (see Figure C1). Changes to the amount of external expenditure can thus be an important source of gains or losses for firms.

Thanks to the annual sectoral survey of the INSEE, we can further disentangle external costs into all of its components for a sub-sample of firms. Table 4 displays the diff-in-disc estimates of those expenditures as a share of revenue or employment. Again, only the most flexibly adjustable and relevant factor of production changes significantly. Neither production outsourcing, publicity nor miscellaneous costs (including insurance and rental) are affected by the new board. The decision to outsource more or less requires profound changes in the production strategy of the company. This might explain why we do not see a significant effect on that variable. Both publicity and miscellaneous costs do not represent big shares of firm expenditures. They are also not as variable as the other costs as they mainly are comprised of SG&A types of costs which are essential to run a business. As a result they might not be as relevant points of negotiation during board meetings. On the other hand, and especially in the context of France with its stringent firing rules, labour outsourcing can appear as a modern way to adapt to the state of the economy. Braguinsky et al. (2015) identified the ability of better qualified managers to manage demand better by lowering inventory costs in the cotton-spinning industry at the end of the 19th century. Whether this might be specific to the time period or not, it is clear that inventory costs are quite specific to the manufacturing or wholesale/retail sectors. A similar observation could be made of production outsourcing for which we find no effect. However, outsourced labour could be a relevant margin of adjustment across industries to shocks to the economy. In France, temporary contracts can last for a maximum of 18 months and are linked to specific missions such as seasonal work or the temporary growth of the firm. They are regular points of discussion in firms' financial reports for their ability to make firms more responsive to variations in demand (see for instance the financial reports of Accor).

Since we only have information on the quantity of interim (external temporary) workers used we can deduce changes in their wages and hence their quality. We find that the number of interim workers decreases by around 33 percent for firms with new boards. Compared to the observed increase in external purchases of 0.3 percent, this would suggest a change in the wages of interim workers. Although the wages of in-house labour is sticky,

the one of outsourced labour is not and could be a way to adjust both quantities and prices of the workforce. This difference also holds with the other factors of production. While outsourced labour can be more easily increased and decreased in terms of both quantities and prices, it is unlikely that a price renegotiation takes place for intermediary goods for instance.

Table 4: Diff-in-disc estimates of revenue/employment shares

	Share	$\frac{\text{Outsourcing Costs}}{\text{Revenue}}$	$\frac{\text{Publicity Costs}}{\text{Revenue}}$	$\frac{\text{Miscellaneous Costs}}{\text{Revenue}}$	$\frac{\text{Interim}}{\text{Employment}}$
Diff-in-Disc	29.14***				
	(6.18)				
Share		-0.05	0.00	-0.06	-0.48***
		(0.17)	(0.01)	(0.04)	(0.13)
AR confidence set					[-0.65 ; -0.31]
Regression	OLS	IV	IV	IV	IV
Observations	876	876	876	876	876
Controls	Yes	Yes	Yes	Yes	Yes
F-stat	-	22.19	22.19	22.19	22.19
Bandwidths	355 to 780-800 employees				

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

Without further information on the qualifications of those temporary workers, we cannot deduce anything about their quality. However, one way to test for the hiring of a fewer amount of more qualified workers is to look at the progression of revenue growth for those firms. Indeed, higher paid workers who are raising firm performance should be more qualified.

In table 5 we show that the decision to hire fewer external workers at a higher price is an optimal strategy. We run our usual local linear regression with a set of growth variables as outcomes. We find that a one percentage point increase in the share of women in boards leads to a 0.9 percentage point increase in revenue growth (column 3).[18] The quota is responsible for a 5.1 percentage point (5.8×0.9) and a 5 percent increase

[18] Our growth variables are expressed relative to a baseline of 100. For instance a revenue growth of 3 percent would show up as 103.

in revenue ($\frac{5.1}{103} \times 100$). Since revenue growth decreases by around 1.4 percentage points or 1.2 percent ($\frac{1.2}{103} \times 100$), we find that the decision not to excessively increase external purchases is beneficial to firms' growth. They grow by around 3.6 percent ($5 - 1.2$). We plot the yearly diff-in-disc estimates in figure C1 to show its association with the gender quota. Employment and its growth (columns 4 and 5) do not change significantly with the new governance.

Table 5: Diff-in-disc estimates of size

	Share	$Revenue_{t+1}$	$\Delta Revenue$	$Employment_{t+1}$	$\Delta Employment$	$\frac{Revenue}{Employment}_{t+1}$	$\Delta \frac{Revenue}{Employment}$
Diff-in-Disc	26.60***						
	(5.16)						
Share		365*	0.88***	0.92	0.19	0.77*	0.68**
		(202)	(0.32)	(0.89)	(0.17)	(0.44)	(0.30)
AR confidence set		[115 ; 615]	[0.49 ; 1.27]			[0.22 ; 1.32]	[0.32 ; 1.05]
Regression	OLS	IV	IV	IV	IV	IV	IV
Observations	1,039	1,039	1,039	1,039	1,039	1,039	1,039
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	-	26.59	26.59	26.59	26.59	26.59	26.59
Bandwidths	355-360 and 365 to 780-800 employees						

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

Firms with unchanged boards seem to be hiring too many lower-paid external workers. Our revenue estimates suggest that although their output grows, it does so at a lower rate. The increase in costs are not matched by proportionally higher sales. Instead, a switch to fewer higher-paid external workers leads to both increases in revenue and growth as well as labour productivity and growth by around 3 percent (columns 6 and 7) that surpasses that of firms with unchanged boards. Those gains in future growth seem to suggest a relationship between the price of external workers and their quality. Unfortunately, we cannot dig deeper into the level of quality or expertise of this new workforce nor identify the specific purpose for which they have been hired.

4.3 The role of the first newcomer as a pivot

The arrival of board members leads to changes in the cost structure and performance of firms. This effect can be due to several reasons. First of all, particular skills and/or

characteristics could be associated with the women entering governance. If those are unique as suggested by Kim and Starks (2016), they can add necessary knowledge to take an informed decision for the firm. Second of all, the new board members could incentivize incumbents who do not want to be fired to exert effort or replace them as in Besley et al. (2017). Finally, our effect might come from the act of re-shuffling itself. Boards of directors and supervisory boards are not only homogeneous in terms of their characteristics and skills but also vary little over time. The current boards could be taking wrong decisions by habit of being in a meeting with the same individuals. They are not necessarily unskilled or do not want to exert effort. They lack sufficiently updated knowledge to take accurate decisions. This is particularly true if they need to respond to unusual changes in the market. Obviously all mechanisms could be relevant in explaining our effects. In all cases, however, we can identify the central issue of board homogeneity. This could not be better summarized than by quoting the CEO of a company arguing in an interview that "The more similar a board is, with directors of the same age, gender, background, education, the more likely they are not to see the iceberg they are driving into" (Bouquet (2020)).

We run the local linear regression to test the role of heterogeneity in explaining our results. Since the size of our boards averages six and we find that the law leads to between one to two women entering it, we cannot plot the effects for a multitude of governance changes. However, we can test for potentially different effects between the first and subsequent newcomer. The first column of table 6 displays the first stage where the instrumented variable is a dummy equal to 1 if the board has exactly one woman. It indicates that the law increases the probability for firms above the size cutoffs to add exactly that individual by 70 percent. A one percentage point increase in that number leads to a 14 percentage point gain in performance. Since the share of firms with one woman goes up by 0.14 percentage points, the quota is responsible for a 1.96 percentage point (0.14×14) increase in performance. We recall from table 2 that the overall effect of an increasing share of women in boards led to a 2.1 percentage points increase in performance. We find that over 90 percent of our effect is borne by the first newcomer ($\frac{1.96}{2.1}$). The third and fourth columns display respectively the first and second stage where the instrumented variable is a dummy equal to one when the board has at least one woman. Our results indicate that the subsequent individual adds further value to the firm at a lower rate. The second woman explains 9 percent of the overall effect ($\frac{(15.3\times0.14)-1.96}{2.1}$). Since we find that boards add between one to two women on average in response to the law, it is unsurprising that the first and second women explain nearly the full effect of the quota.

Table 6: Diff-in-disc estimates of performance

	$Woman = 1$	$Profit\ margin$	$Woman \geq 1$	$Profit\ margin$
Diff-in-Disc	0.70***		0.70***	
	(0.17)		(0.17)	
Dummy woman		14.09***		15.31***
		(4.65)		(5.25)
AR confidence set		[7.57 ; 20.61]		[7.96 ; 22.66]
Regression	OLS	IV	OLS	IV
Observations	1,188	1,188	1,130	1,130
Controls	Yes	Yes	Yes	Yes
F-stat	-	16.62	-	16.21
Bandwidths	355-360 and 365 to 780-800 employees			

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

Those results are confirmed by table 7 where we test the non-linearity for the revenue share of external costs. Our estimates indicate that the first newcomer accounts for 87 percent of the overall effect ($\frac{13.6 \times 0.14}{2.2}$) while the second one explains 10 percent ($\frac{(15.1 \times 0.14) - (13.6 \times 0.14)}{2.2}$). The estimates for revenue growth in table C1 confirm the overt importance of the outsider shock on the board.

Our findings indicate that the individual responsible for reducing homogeneity plays a central role in swaying decisions taken by the boards. The fact that most decisions are passed by the majority of members points to the added value of an outsider updating knowledge. The strongly diminishing returns to an additional arrival confirms this hypothesis. If skills or characteristics were the only relevant channel, we would have expected added value to be more linear or even to exhibit increasing returns as a sufficient amount of new individuals would be needed to tip off the vote in boards. In our case, it seems that the arrival of the first woman is a wake-up call not to hire ever more low-qualified temporary workers. The yearly persistence of our estimates prove that this results from an active change in decision-making.

Table 7: Diff-in-disc estimates of external costs

	$Woman = 1$	$\frac{External\ Costs}{Revenue}$	$Woman \geq 1$	$\frac{External\ Costs}{Revenue}$
Diff-in-Disc	0.70***		0.70***	
	(0.17)		(0.17)	
Dummy woman		-13.57***		-15.08***
		(4.37)		(4.60)
AR confidence set		[-19.69 ; -7.45]		[-21.52 ; -8.64]
Regression	OLS	IV	OLS	IV
Observations	1,188	1,188	1,130	1,130
Controls	Yes	Yes	Yes	Yes
F-stat	-	16.62	-	16.21
Bandwidths	355-360 and 365 to 780-800 employees			

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

We want to specifically disentangle the source of knowledge updating that seem to occur with the arrival of new board members. To do so, we classify the aforementioned mechanisms into two categories: within-board and network diversity. The former relates to skills and characteristics while the latter relates to the act of reshuffling. All else equal, the arrival of an outsider could be beneficial to the quality of decisions taken. The way we define being an outsider with valuable knowledge is specific to the way boards operate. It is common for individuals to sit on several boards. They are allowed by law to be in up to 5 different ones. We posit that members, whatever their skills or characteristics, that are sitting in a board with which the firm used not to be linked could add board-relevant knowledge that the current firm does not yet have access to. In order to test those two hypothesis, we run our usual regression on the share of foreign members defined as individuals who are not French, the share of young members defined as individuals who are younger than the median age of boards prior to the law and finally the amount of new links that women and men bring to the board. The latter variable counts the amount of boards on which individuals sit and on which no other member of the same board was sitting. Those new relationships are then summed up at the board level by gender. Table

8 displays the diff-in-disc estimates of those diversity measures.

Table 8: Diff-in-disc estimates of diversity measures

	Within-Board diversity			Network diversity		
	Share	$\frac{young}{directors}$	$\frac{foreigners}{directors}$	*Share*	$\frac{New\ links\ from\ women}{Women}$	$\frac{New\ links\ from\ men}{Men}$
Diff-in-Disc	27.86***			24.90***		
	(6.18)			(5.71)		
Share		1.75***	0.17**		2.67***	0.19
		(0.54)	(0.08)		(0.98)	(0.29)
AR confidence set		[1.03 ; 2.47]	[0.06 ; 0.28]		[1.37 ; 3.97]	
Regression	OLS	IV	IV	OLS	IV	IV
Observations	893	893	893	1,226	1,226	1,226
Controls	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	-	20.28	20.28	-	19.08	19.08
Bandwidths	355 to 780-800 employees					

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

The gender quota did not only lead to an increasing share of women in boards but also to a higher share of young and international directors. This would point towards the importance of within-board diversity and individual-specific knowledge in updating the information boards have when they take their decisions. We find an even stronger effect when looking at network diversity. In particular, women account for two new relationships which the boards did not have prior to their arrival. At the same time, we see no opposite effect for men. The quota did not lead to separation of links that might have been optimally formed prior to the law. The overall diversification of the boards' network points towards the importance of board-relevant outsider knowledge. Beyond skills or characteristics, there seems to be value in reshuffling board members who can share new information across firms. There might be distributional consequences from this as the benefits of lower performing firms being connected with higher performing ones might be stronger. However, the overall average effect suggests benefits across firm types.

5 Discussion and conclusions

We have used novel data to investigate how an exogenous change in governance affects decisions on costs and performance of firms. These effects have been studied in a limited way on large companies where estimates can be contaminated by the response of the market to board announcements and the size of firms. Our data allows us to gain further insights by circumventing these issues.

We find that a gender quota in boards of directors and supervisory boards leads to the sudden arrival of one to two women. This leads to gains in performance that reduce greatly the rate at which profit margin decreases. The new boards improve profitability by deviating from expenditure on external purchases of services. They only marginally increase it and seem to change the nature of those costs. Instead of increasing the amount of low-qualified external workers they hire, they move to a fewer and higher-qualified outsourced labour. This is a more optimal cost strategy as firms' revenue grows. The arrival of the first woman explains around 90 percent of our effects. The non-linearity as well as persistence of deviations in cost and performance points to an active role of the newcomer as a pivot. We find significant evidence of an opportunity cost of homogeneity and the importance of the newcomer in swaying board decisions away from non-optimal decisions. In particular, we identify both within-board and network diversity to be important sources of knowledge updating with the latter being more prominent than the former.

While our findings do not necessarily apply in a setting where profit margins are increasing, they call into question the relationship between boards and shareholders. In theory, governance should maximise profitability. If heterogeneity in skills, characteristics and habits can improve performance, boards should hire specific individuals and re-shuffle them to guarantee knowledge updating. It is unclear why firms are foregoing profits by not changing their governance. We identify two main reasons for this occurrence. First of all, firms might find it difficult to hire individuals who are different. At the announcement of the gender quota, firms have expressed concern about the lack of women for this job. Although gender is a particular characteristic, boards tend to be composed of individuals of the same age and education. The habit of hiring from this pool of candidates might lead to discarding a lot of potential members who have different practices. Another reason why governance is not more reshuffled could be related to the lack of knowledge on its benefits. Without precedents, there is no proof that taking the risk to hire an outsider will add value to the firm. We expect this to be particularly true for medium-sized firms who might not have as much room for manoeuvre as large ones. Finally, there might be some risk associated with diversifying a board's network. This will be the case if higher performing firms do not benefit from relationships with lower performing ones and especially if they suffer from it. Information sharing could in practice be a source of business stealing by imitation of practices. In that case, the incentives to reshuffle is low as firms might be afraid of a new board member sharing valuable information with a competitor.

While we cannot dig deeper into the reasons for foregone profits, we provide a link between upper management and profitability. Our data and setting offer a unique exogenous shock to assess the relevance of group composition in firms. Like with blue collar employees, the characteristics of higher hierarchical levels play an important role for performance.

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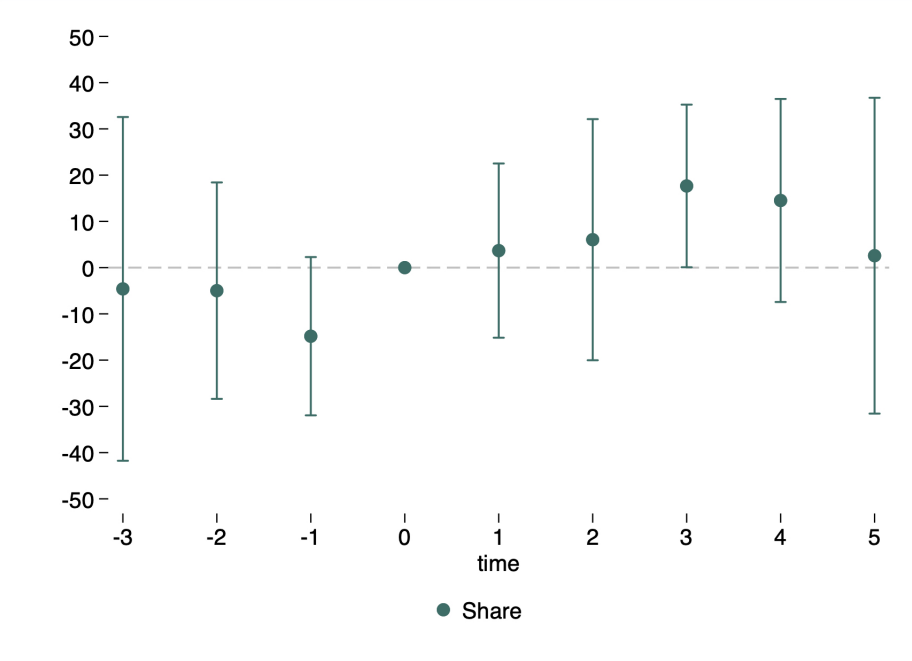
A Identification assumptions

Figure A1: Test of pre-trends



Notes: This figure shows the diff-in-disc estimates of the share of women relative to time $t = 0$ (from 2011 to 2013). Each coefficient is calculated exclusively on a given year by excluding the rest of the sample.

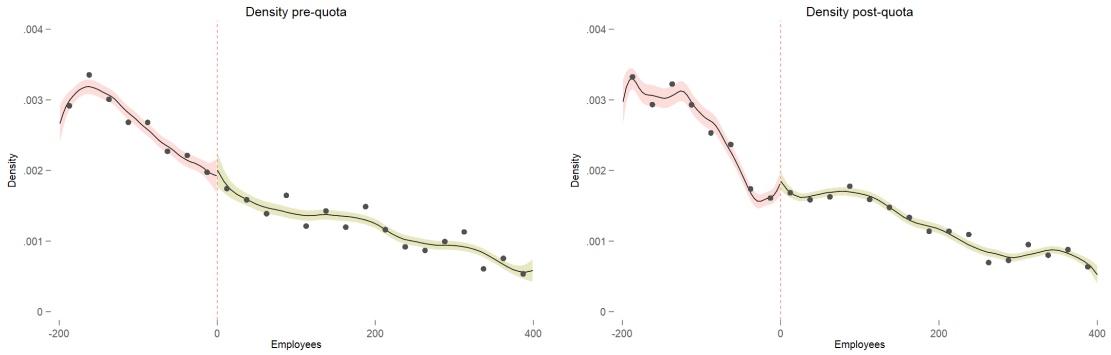
Table A1: RD ESTIMATES FOR COVARIATES

	Board size	*Age*	*Share woman president*	*Share woman director*	*Equity share*
RD	-0.96	-0.01	-0.32	0.90	0.07
	(1.24)	(0.03)	(0.34)	(1.40)	(0.05)
Observations	418	418	365	377	418
Bandwidths			355 to 780-800 employees		

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All have individual fixed effects and have standard errors that are robust clustered at the firm level. The RD estimate is an interaction between sales, which is a dummy equal to 1 if the firms has more than 50 M. in revenue at t, and employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2. All regressions exclude years after 2010.

Figure A2: Test of employee manipulation

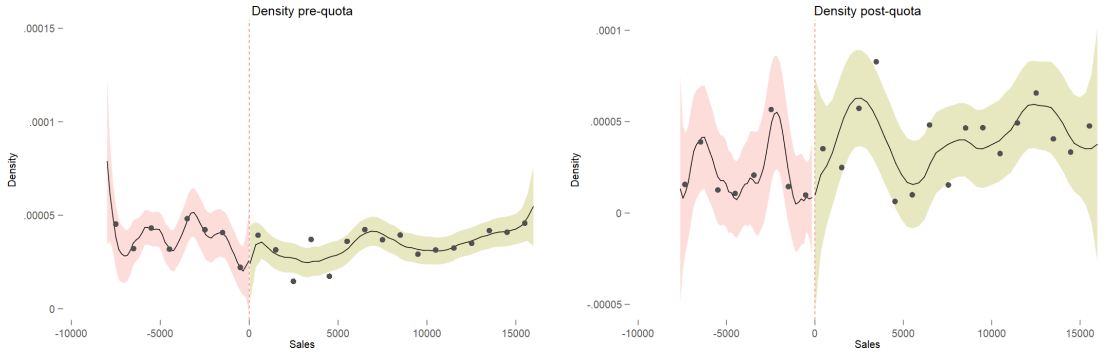
(a) Distribution before 2011 (b) Distribution after 2011



Notes: The figures show the distribution of firms prior and after the announcement of the quota in 2011 for the employment cutoff.

Figure A3: Test of sales manipulation

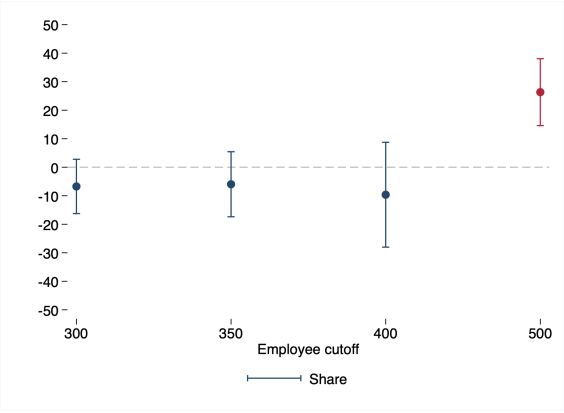
(a) Distribution before 2011 (b) Distribution after 2011



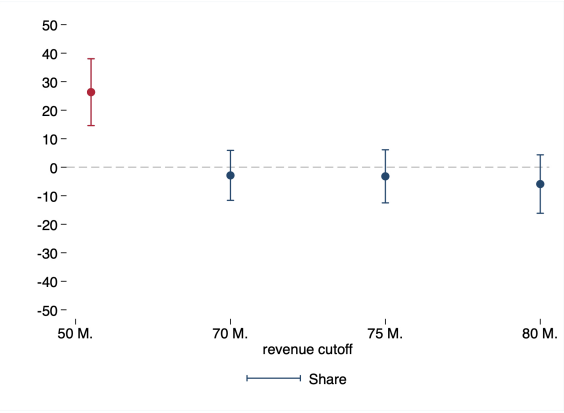
Notes: The figures show the distribution of firms prior and after the announcement of the quota in 2011 for the sales cutoff.

Figure A4: Diff-in-disc estimates for different cutoffs

(a) Employment changes



(b) Revenue changes



Notes: Each coefficient is estimated with our standard regression with optimal bands where we vary the cutoff for employees (figure a) or revenue (figure b). In order not to capture the actual effects of the law, all the regressions using placebo running variables exclude firms with more than 500 employees (figure a) or more than 50 M. euros in revenue (figure b). The red coefficient is our actual effect where we use the optimal bandwidth on our unrestricted sample.

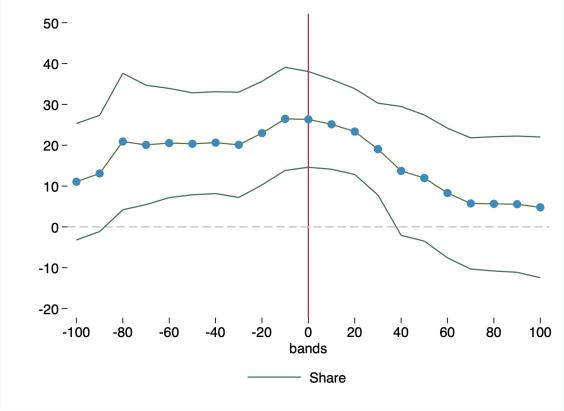
Table A2: Diff-in-disc estimates for different events

Event	Placebo		Actual
	$Share_{T=2009}$	$Share_{T=2010}$	$Share_{T\geq 2014}$
Diff-in-Disc	3.73	-5.26	26.33***
	(3.52)	(8.79)	(5.98)
Observations	323	451	1,212

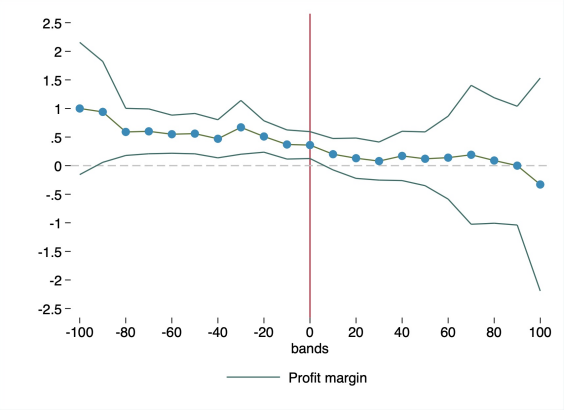
Notes: The regressions follow the same structure as table 2. They have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t and employees, which is a dummy equal to 1 if the firm has more than 500 employees at t. Our time dummy varies depending on the definition of the event. In column 1, it is equal to 1 if the year is 2009 and 0 if it is 2008. In column 2, it is equal to 2 if the year is 2010, 1 if it is 2009 and 0 if it is 2008. The third column follows our main strategy where time is equal to 2 if the year is at least 2014, 1 if it is between 2011 and 2013 and 0 otherwise.

Figure A5: Results with different bands

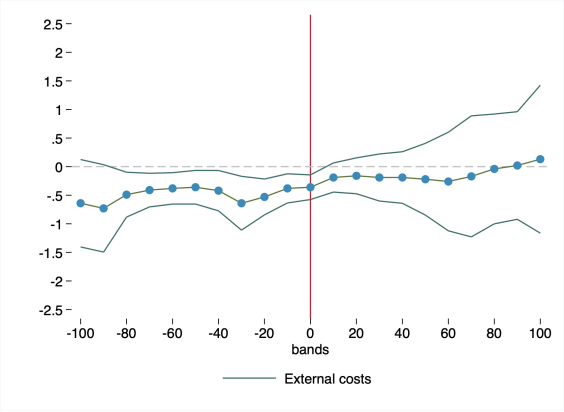
(a) Diff-in-Disc estimates for the share of women



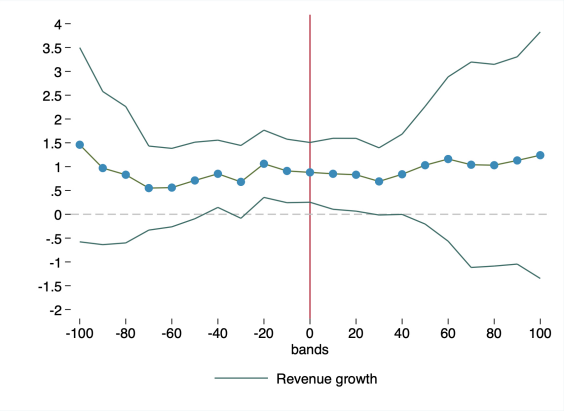
(b) Diff-in-Disc estimates for profit margin



(c) Diff-in-Disc estimates for external costs



(d) Diff-in-Disc estimates for revenue growth



Notes: Each coefficient is estimated with bands that are larger or lower than the optimal ones by the indicated amount on the x axis.

B Robustness checks

Table B1: Diff-in-disc estimates excluding revenue $\geq$ 100 M.

	$Share$	$Profit\ margin$	$\frac{External\ Costs}{Revenue}$	$Share$	$\Delta Revenue$
Diff-in-Disc	26.37***			25.79***	
	(7.12)			(6.34)	
$Share$		0.33*	-0.28*		1.23**
		(0.19)	(0.16)		(0.47)
Regression	OLS	IV	IV	OLS	IV
Observations	637	637	637	555	555
Controls	Yes	Yes	Yes	Yes	Yes
F-stat	-	13.72	13.72	-	16.55
Bandwidths	355 to 880 employees				

Notes: The regressions follow the same structure as tables 2, 3 and 5. They have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. All regressions exclude firms with revenues higher or equal to 100 M. euros to account for the introduction of two laws using that threshold in 2010 and 2016.

Table B2: Diff-in-disc estimates excluding revenue $\geq$ 100 M.

	$Woman = 1$	$Profit\ margin$	$\frac{External\ Costs}{Revenue}$	$Woman = 1$	$\Delta Revenue$
Diff-in-Disc	0.60***			0.59***	
	(0.21)			(0.19)	
Dummy woman		12.92*	-10.77		52.89**
		(7.65)	(6.84)		(21.28)
Regression	OLS	IV	IV	OLS	IV
Observations	622	622	622	540	540
Controls	Yes	Yes	Yes	Yes	Yes
F-stat	-	8.37	8.37	-	9.47
Bandwidths	355 and 360 to 870 employees				

Notes: The regressions follow the same structure as tables 6, 7 and C1. They have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. All regressions exclude firms with revenues higher or equal to 100 M. euros to account for the introduction of two laws using that threshold in 2010 and 2016.

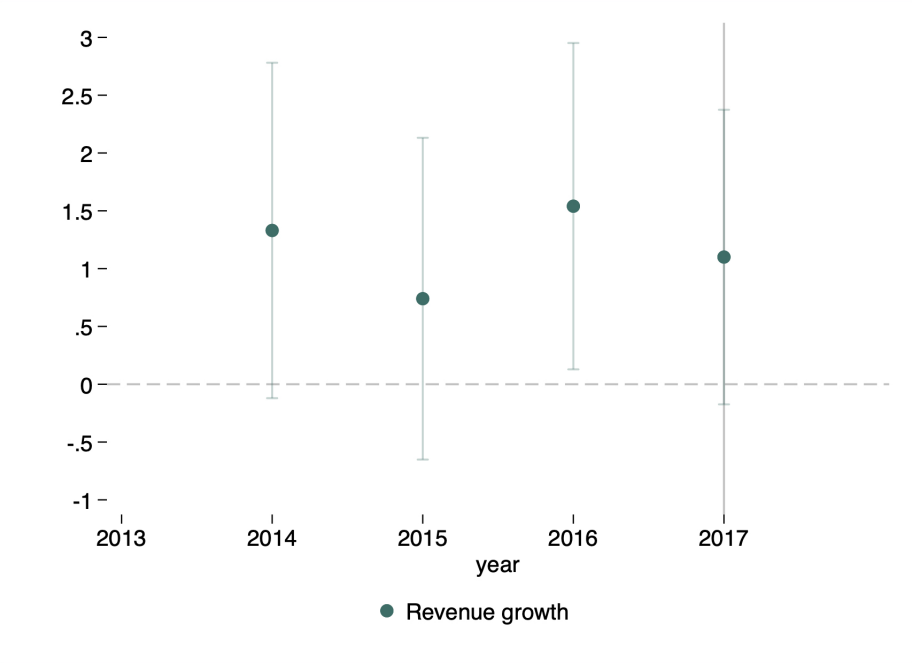
Table B3: Diff-in-disc estimates excluding revenue $\geq$ 100 M.

	$Woman \geq 1$	$Profit\ margin$	$\frac{External\ Costs}{Revenue}$	$Woman \geq 1$	$\Delta Revenue$
Diff-in-Disc	0.66***			0.57***	
	(0.18)			(0.17)	
Dummy woman		13.11*	-11.29*		59.07**
		(6.99)	(6.59)		(23.14)
Regression	OLS	IV	IV	OLS	IV
Observations	637	637	637	555	555
Controls	Yes	Yes	Yes	Yes	Yes
F-stat	-	13.32	13.32	-	11.76
Bandwidths	355 to 880 employees				

Notes: The regressions follow the same structure as tables 6, 7 and C1. They have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. All regressions exclude firms with revenues higher or equal to 100 M. euros to account for the introduction of two laws using that threshold in 2010 and 2016.

C Additional results

Figure C1: Revenue growth estimates by year



Notes: The figure displays yearly estimates which we retrieve by excluding any other year in our instrument.

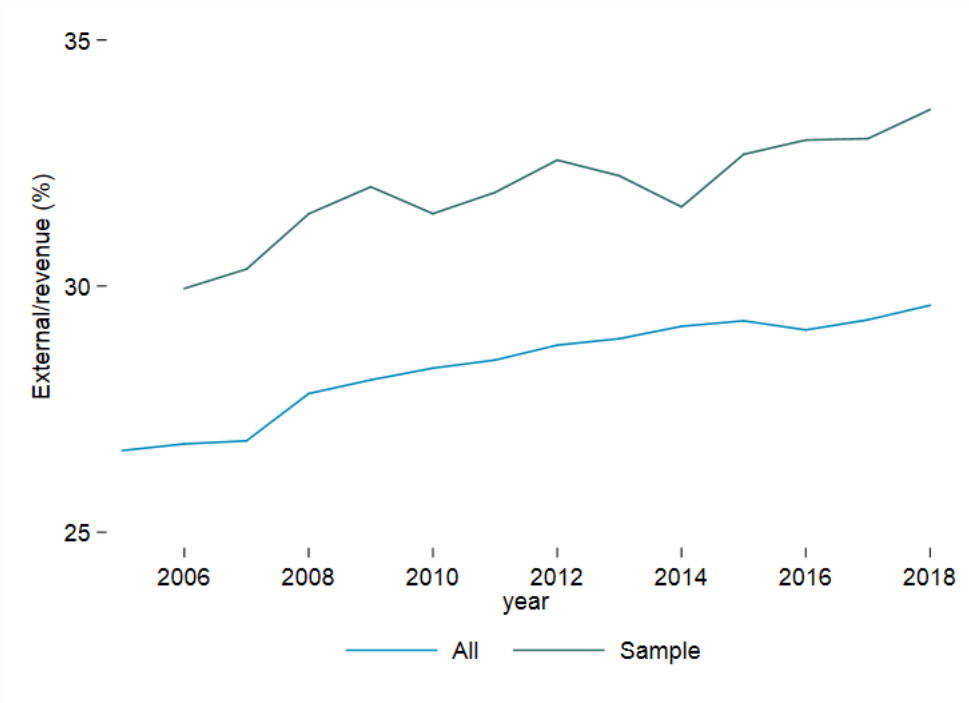
Table C1: Diff-in-disc estimates of revenue growth

	$Woman = 1$	$\Delta Revenue$	$Woman \geq 1$	$\Delta Revenue$
Diff-in-Disc	0.75***		0.68***	
	(0.17)		(0.17)	
Dummy woman		30.87**		34.88**
		(12.31)		(14.60)
AR confidence set		[-2 ; 63.74]		[-4.1 ; 73.86]
Regression	OLS	IV	OLS	IV
Observations	1,020	1,020	968	968
Controls	Yes	Yes	Yes	Yes
F-stat	-	18.50	-	15.72
Bandwidths	355-360 and 365 to 780-800 employees			

Notes: The regressions have a polynomial of order 1, Papay et al. (2011) bandwidth and a uniform kernel. All regressions have individual and sector-time fixed effects and control for the log of age, board size as well as the share of women who are directors and CEOs. We also control for the equity share of revenue to account for differential exposures of firms to external finance. The standard errors are robust clustered at the firm level. The diff-in-disc estimate is an interaction between sales, which is a dummy equal to 1 if the firm has more than 50 M. in revenue at t, employees, which is a dummy equal to 1 if the firm has more than 500 employees at t, t-1 and t-2 and time, which is a dummy equal to 2 if the year is at least 2014 and 1 if it is between 2011 and 2013. The Anderson Rubin confidence sets are calculated following the tf procedure of Lee et al. (2020)

D Additional information

Figure C1: External costs as a share of revenue



Notes: The green line displays the average share of external costs as a share of revenue for firms within our sample while the blue line shows the corresponding value for the universe of French firms