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Does Mandatory Board Gender-Balancing Reduce Firm Value?

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February 2022

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Abstract

Mandated board gender-balancing is a social-policy instrument, which in principle is unrelated to concerns about firms' economic performance. Nonetheless, imposing such a policy may have unintended consequences (positive or negative) for firm value, which is important for all of the firm's constituencies - not only shareholders. In this paper, we highlight and extend our recent research on the economic effects of Norway's pioneering gender-quota law, which forced board gender balancing of all domestic public limited corporations by early 2008. This research subsumes and econometrically corrects controversial conclusions of extant studies. Most important, our research shows that quota-induced changes in market valuations and operating performance were both economically and statistically negligible. Furthermore, we show that corporate conversions to a legal form that prevents the firm from raising public equity capital---but does not require gender-balancing - were unrelated to the company's pre-quota female director shortfall. We also present new evidence that boards managed to preserve directors' large-firm CEO experience, without increasing director busyness. We conclude that the supply of qualified female director candidates was sufficiently large to avoid board concentration and negative economic effects of the quota restriction.

Keywords: Gender quota; board diversity; valuation effect; return correlation; long-run performance, operating performance, legal conversion

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February 20, 2022

Abstract

Mandated board gender-balancing is a social-policy instrument, which in principle is unrelated to concerns about firms' economic performance. Nonetheless, imposing such a policy may have unintended consequences (positive or negative) for firm value, which is important for all of the firm's constituencies—not only shareholders. In this paper, we highlight and extend our recent research on the economic effects of Norway's pioneering gender-quota law, which forced board gender balancing of all domestic public limited corporations by early 2008. This research subsumes and econometrically corrects controversial conclusions of extant studies. Most important, our research shows that quota-induced changes in market valuations and operating performance were both economically and statistically negligible. Furthermore, we show that corporate conversions to a legal form that prevents the firm from raising public equity capital—but does not require gender-balancing—were unrelated to the company's pre-quota female director shortfall. We also present new evidence that boards managed to preserve directors' large-firm CEO experience, without increasing director busyness. We conclude that the supply of qualified female director candidates was sufficiently large to avoid board concentration and negative economic effects of the quota restriction.

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Introduction

Restricting shareholders' free choice of directors by mandating gender-balancing may—in theory—have the unintended consequence of either reducing or increasing board effectiveness. On the one hand, firms may be forced to appoint new female directors with less relevant experience than the departing male directors, reducing the quality of the board's advice and oversight. It has also been suggested that female directors may be overly focused on monitoring[1] and exhibit different preferences for risk-taking than male directors.[2] On the other hand, board effectiveness may also increase after the imposition of a gender quota. For example, this may happen if the quota requirement increases the efficiency of board elections by reducing the influence of an existing male director "old boys" network.[3] This may result in the appointment of female directors that are more independent[4] and have a broader skill set that is beneficial to the board.[5] Thus, the answer to the question posed in the title of this paper can only be answered empirically.

We empirically discriminate between the two opposing theoretical effects of forced gender balancing by explaining and augmenting our own prior research on Norway's pioneering gender-quota law.[6] Norway's quota law is both interesting and instructive because it generated a clear and exogenous shock to board composition, or what we in econometrics refer to as a "quasi-experiment".[7] This experiment helps identify the *causal* effect (if any) of board gender balancing

[1]Renee B. Adams & Daniel Ferreira, *Women in the boardroom and their impact on governance and performance*, Journal of Financial Economics 94 (2009).

[2]Rachel Croson & Uri Gneezy, *Gender Differences in Preferences*, Journal of Economic Literature 47 (2009), Renee B. Adams & Patricia Funk, *Beyond the Glass Ceiling: Does Gender Matter?*, Management Science 58 (2012), and Vathunyoo Sila, Angelica Gonzales & Jens Hagendorff, *Women on Board: Does Boardroom Gender Diversity Affect Firm Risk?*, Journal of Corporate Finance 36 (2016).

[3]Sumit Agarwal, Wenlan Qian, David M. Reeb & Tien Foo Sing, *Playing the Boys Game: Golf Buddies and Board Diversity*, American Economic Review 106 (2016).

[4]See, e.g., Michael C. Jensen, *The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems*, Journal of Finance 48 (1993), James S. Linck, Jeffry M. Netter & Tina Yang, *The Determinants of Board Structure*, Journal of Financial Economics 87 (2008), Ran Duchin, John Matsusaka & Oguzhan Ozbas, *When are Outside Directors Effective?*, Journal of Financial Economics 96 (2010), and Ronald W. Masulis & Shawn Mobbs, *Are All Inside Directors the Same? Evidence from the External Directorship Market*, Journal of Finance 66 (2011) for discussions of the role of director independence.

[5]Daehyun Kim & Laura T. Starks, *Gender Diversity on Corporate Boards: Do Women Contribute Unique Skills?*, American Economic Review 106 (2016).

[6]B. Espen Eckbo, Knut Nygaard & Karin S. Thorburn, *Valuation Effects of Norway's Board Gender-Quota Law Revisited*, Management Science (2021), available (open access) at https://doi.org/10.1287/mnsc.2021.4031.

[7]The 2021 Nobel prize in economics was awarded to three scholars who helped develop the use of quasi-

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on firm performance as opposed to a mere association between the two economic variables. To illustrate the difference between correlation and causation, suppose that, in the absence of a quota law, the data shows a positive cross-sectional correlation between firm performance and the fraction of (freely elected) directors that are female. This correlation may arise because female directors are particularly productive or, alternatively, because particularly productive firms tend to appoint female directors. However, if this positive correlation also emerges in response to the *forced* appointment of female directors, one can be much more confident that a higher fraction of female directors in fact causes the higher performance.

Norway's quota law is a particularly powerful econometric quasi-experiment for several reasons. First, it was the result of gender politics unrelated to corporate performance, which is necessary to draw inferences about the quota's causal impact on firm performance.[8] Second, it regulates board gender-balancing *only*, which greatly simplifies identification of the causal impact. Third, the quota applies to a significant portion of Norway's economy in terms of aggregate firm value. Fourth, as the first of its kind, Norway's quota law was highly unanticipated, which is a requirement for the impact of the law to be registered in stock prices (our measure of its valuation impact).[9]

As a final motivation, the Securities and Exchange Commission (SEC) refers to research on the Norwegian gender quota when the agency in August of 2021 approved Nasdaq stock exchange's listing standard requiring firms to disclose diversity information about their boards (gender, race and LGBTQ+).[10] This paper helps clarify SEC's own discussion in terms of the likely economic effects of forced board gender-balancing on firm value and board effectiveness. Most important, as explained below, our evidence rejects the hypothesis that forced board gender-balancing lowers

experiments (which include legislative shocks) as the perhaps most important econometric tool available to the social sciences. (Sveriges Riksbank Prize in Economic Sciences in memory of Alfred Nobel, October 11, 2021, https://www.nobelprize.org/prizes/economic-sciences/2021/press-release/).

[8]The Norwegian government white paper, Odelstingsproposisjon 97, 2002-2003, lays out the political process leading to the quota law.

[9]Since Norway's quota law was mandated in December of 2005, several other European countries have adopted board gender quotas of their own, including Belgium, France, Germany, Iceland, Italy, the Netherlands, Portugal and Spain. The quotas vary across countries, some with Norway's 40% requirement and other with less, and none with Norway's ultimate penalty of forced liquidation for non-compliance.

[10]SEC release No. 34-92590, order approving SR-NASDAQ-2020-081 and SR-NASDAQ-2020-082. p.28.

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firm value and performance.[11] In light of this evidence, we also add a brief comment on the likely valuation effect of California's Senate Bill 826 (SB 826), which was signed into law in September of 2018. SB 826 requires listed companies with their principal executive offices in California to have some female directors. We argue that any estimate of the valuation effect of California's gender quota must be evaluated in light of the generally low opportunity cost of reporting the location of firm's executive offices in a different state.

I Norway's quota law and firm performance

Norway's legislative efforts started in early 2002, when the idea of a board gender-quota received unexpected support by the newly elected conservative government, which had previously argued against such a policy. Then, in June of 2003, the government proposed a quota law, which contained a sunset provision: the quota requirement would be cancelled if firms complied voluntarily by the end of 2005. Although many firms—in particular companies with large government share-ownership—immediately began to increase female board representation, the observed degree of compliance was ultimately deemed insufficient by the government. Hence, in December of 2005, the government mandated the quota and gave firms two years to comply.[12]

The quota law applies to Norwegian public limited companies (*Allmennaksjeselskap*, henceforth ASA), with private limited companies (*Aksjselskap*, henceforth AS) being exempted.[13] Of the total population of ASA, less than half are at any time traded on the Oslo Stock exchange (OSE). Under Norwegian gender-balancing, the required fraction of each gender ranges from 33% to 50%. For example, an ASA board with five directors must have a minimum of 40% female directors (two women), while the female requirement is 50% for boards with four and six members (two and three women, respectively).

[11] ECKBO, supra n. 6.

[12] Most directors are appointed for a term of two years. Hence, the two-year compliance period covered a typical election cycle. There are no inside directors on corporate boards in Norway, with the possible exception of the CEO up to 2010.

[13] The corporate forms ASA and AS correspond to the United Kingdom's Public Limited Company (PLC) and Private Limited Company (Ltd), respectively. In Norway, shareholders elect one set of the directors and employees another (up to one third of the board). Norway's gender quota applies to the shareholder-elected directors only.

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Figure I shows that, for 1,150 ASA, the fraction of female directors rose from 5% in 2002 to about 40% by the end of 2007, with most of this rise occurring in the formal compliance period starting in December of 2005 (depicted between the two vertical bars). Figure I also shows that the average size of ASA boards remained at five shareholder-elected directors throughout the sample period. Hence, for the average five-member board in 2003, quota compliance implied replacing 1.5 male directors with females, bringing the number of female directors to two.

Throughout the empirical analysis, we use the variable $Shortfall_i$ to measure the severity of the quota-constraint for firm i. $Shortfall_i$ is defined as the fraction of additional female directors firm i needs to appoint in order to comply with the quota. Hence, $Shortfall$ is at its maximum for all-male boards and zero for boards who met the quota requirement prior to the imposition of the quota.

I.A Quota-induced average abnormal stock returns

In this section, we report on our estimates of the stock-market reaction to what is arguably the single most important quota-related news event, which occurred on Friday, February 22, 2002.[14] As is the convention in event studies, to maximize test power, we estimate abnormal stock returns over the two-day event window (-1,0), which ends with the public announcement date (event day 0).[15] Moreover, since all OSE-listed ASA are affected by the event on the same calendar date, we form a portfolio of the listed companies. This portfolio formation is important as it effectively controls for the normal contemporaneous cross-correlation of stock returns. That is, since much of the news are relevant for several corporations simultaneously, stock prices of different firms typically

[14]The abnormal stock return estimates reported in this section originate in ECKBO, supra n 6. In that paper, we also examine four additional quota-related news announcements that occurred between March 8, 2002, and December 9, 2005 (when the Norwegian Cabinet mandated the final quota law). These additional news events do not, however, alter the main conclusion based on the February 22, 2002, event and are therefore not discussed here.

[15]Studies attempting to capture the true market reaction to the arrival of new information seek to get as close to the news announcement as possible in calendar time. This is to avoid unrelated firm-specific information to also influence the abnormal return estimates. In the large literature employing event studies to infer economic impact of news announcements, the two-day event window (-1,0) has emerged as the econometric standard. Day -1 is included because the news may be available to the market on the day before the standard news outlets report the event on day 0). Moreover, including days following day 0 would also add firm-specific noise since, in a reasonably efficient stock market (which has been shown to also characterize OSE), the market reaction is swift and certain to be reflected in stock prices within one day.

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tend to move together on any given day (hence the term contemporaneous cross-correlation of returns).

We estimate the two-day abnormal stock return to portfolio p as $CAR(-1,0) \equiv 2AR_p$ using the following return-generating process:

$$r^e_{pt} = \alpha_p + \beta_p r^e_{wt} + AR_p d_t + \varepsilon_{pt}. \tag{1}$$

Here, r^e_{pt} is the daily equal-weighted return (converted to USD using the daily exchange rate) in excess of the daily 3-month U.S. Treasury bill, d_t is a dummy for the event window (-1,0), and r_{wt} is the daily excess return on the Morgan Stanley Capital International (MSCI) stock market world index.[16]

In Column (2) of Table I, High $Shortfall$ firms have a female director $Shortfall$ at or above the median in the preceding year-end, while Low $Shortfall$ firms in Column (3) are below the median. Columns (1)–(5) use OSE-listed Norwegian ASA only, while columns (6) and (7) also use OSE-listed foreign-domiciled companies that are not regulated by the quota. In columns (4) and (7), the abnormal return is estimated for long-short portfolios: long in High- and short in Low-$Shortfall$ firms in Column (4), and long- in domestic and short in foreign firms in Column (7), respectively. A long-short portfolio informs about the difference in average returns between firms in the long vs. the short portfolio.

In Table I, the p-values in brackets measure the probability that the reported average $CAR(-1,0)$ are significantly different from zero. At the 1% level of statistical confidence, one can reject the null hypothesis of $CAR(-1,0) = 0$ if and only if the reported p-value is less than 0.01. Hence, the large p-values shown in all of the columns in Table I uniformly fail to reject this null hypothesis. In sum, the average abnormal return estimates in Table I, which account for the contemporaneous cross-correlation of stock returns, all fail to reject the null hypothesis of a zero two-day market

[16]The regression starts 252 trading days prior to and ends on event day 0. To be included in portfolio p, a firm must have a minimum of 100 one-day return observations from *Oslo Børsinformasjon* and a one-day return observation on both days in the two-day event window. See ECKBO, supra n. 6, for further data details.

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reaction to the gender-quota news announcement on February 22, 2002.[17]

I.B Correcting a prior event study

In contrast to our conclusion above, a prior event study (henceforth referred to as AD) concludes that the market reaction to the quota-related announcement on February 22, 2002, is negative and statistically significant.[18] However, we show that AD's test statistic is greatly overstated because it assumes that stock returns are cross-sectionally uncorrelated. Correcting for the actual cross-sectional correlation in the data, which is necessary because the quota-news hits all firms on the same day, brings AD's conclusion back in line with our own.[19]

To see why, note first that, for each sample firm i, AD computes the following five-day abnormal

[17]As reported by ECKBO, supra n. 6, this conclusion holds also with an alternative three-day event window (-1,1), and irrespective of alternative risk adjustment. Moreover, in that paper, we also report the results of cross-sectional (OLS) regressions at the firm level, where we test whether $CAR(-1,0)$ depends on $Shortfall$ as well as other firm-specific characteristics. These characteristics include the percent ownership of the largest shareholder, a dummy variable indicating government ownership of at least 30% of the outstanding shares, a dummy indicating that quota-induced females and employee directors together have a majority of the board seats, the firm's daily stock return volatility in the year prior to the event, the log of book value of total assets, and industry fixed effects allocating each OSE-listed ASA to one of ten industry sectors. This regression also fails to identify a statistically significant effect of $Shortfall$ on $CAR(-1,0)$.

[18]Kenneth R. Ahern & Amy Dittmar, *The Changing of the Boards: The Impact on Firm Valuation of Mandated Female Board Representation*, Quarterly Journal of Economics 127 (2012). AD concludes that Norway's gender quota "caused a significant drop in the stock price at the announcement of the law." (abstract). This conclusion received substantial attention in the financial press at the time. For example, *The Financial Times* wrote "[Norway's quota caused] a large decline in [market value]...over the following years" (August 20, 2011), while *The Economist* printed that "[Norway's gender quota] led to large numbers of inexperienced women being appointed to boards, and...has seriously damaged those firms' performance" (July 21, 2011). Also, *The Wall Street Journal* wrote that "[the quota law] damaged shareholder value in the companies affected" (June 11, 2012). These newspaper quotes also reflect AD's estimate of a large (20%!) drop in Tobin's Q. However, we show in ECKBO supra n. 10 that their instrumentation of the cross-sectional variation in the impact of the quota law on firm value is invalid.

[19]To illustrate the downward bias in the standard error when ignoring the actual cross-correlation in the data, suppose for simplicity that all firms have the same standard deviation of daily returns ($\sigma > 0$) and pairwise daily return correlation ($\rho > 0$). The standard deviation of the average return across N firms is $\sigma_{N|\rho>0} = \sqrt{\frac{1}{N}\sigma^2 + \frac{N-1}{N}\sigma^2\rho}$. Moreover, the bias from assuming that $\rho = 0$ is $\frac{\sigma_{N|\rho>0}}{\sigma_{N|\rho=0}} = \frac{\sigma_{N|\rho>0}}{\sqrt{\sigma^2/N}} = \sqrt{1+(N-1)\rho}$. For example, with $\rho = 0.10$, which is a typical average pairwise return correlation on the OSE, AD's sample size of $N = 94$ means that $\sigma_{N|\rho>0} = 3.2\sigma_{N|\rho=0}$. In other words, the true standard deviation would in this case be 3.2 times greater than a standard deviation computed under AD's counterfactual assumption of zero contemporaneous cross-correlation of stock returns.

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stock return, where day 0 is February 22, 2002:

$$CAR_i(-2,2) \equiv \sum_{\tau=-2}^{2} \left(r_i - r_{i,match}\right)_\tau . \tag{2}$$

Here, r_i is firm i's realized stock return on event day τ and $r_{i,match}$ is the equal-weighted average realised stock return to U.S.-listed companies in firm i's Global Industry Classification Standard (GICS) industry. In Table II, we use AD's definition of abnormal return in Eq. (2) and apply it to their sample of firms.[20] We form a portfolio of AD's sample and estimate the following time-series regression to obtain the correct standard error of the daily abnormal return AR_p within the five-day window:

$$r_{pt}^{-I} = \alpha_p + AR_p d_t + \epsilon_{pt}, \tag{3}$$

where the dependent variable, $r_{pt}^{-I} \equiv \frac{1}{N}\sum_{i=1}^{N}(r_i - r_{i,match})_t$, is the equal-weighted portfolio of the daily abnormal returns using AD's definition in Eq. (2). The dummy variable d_t takes a value of one during AD's five-day event window (-2,2) and zero otherwise.[21] Panel A of Table II reports the average value of AD's $CAR(-2,2)$ and the p-values. As shown, none of the p-values can reject the hypothesis that the average market reaction to the quota announcement is different from zero. This conclusion holds even for the subsample of firms with all-male boards in 2001, defined as $Zero_{2001}$ in Column 2.

In Panel B of Table II, we also report the day-by-day portfolio estimates of abnormal returns within AD's five-day window (requiring a one-day return being available for each day). Again, none of the four individual trading days are associated with a statistically significant average abnormal return. Notice also that Monday, February 25, shows the largest abnormal return estimate with AR(1) = -1.86%. If we were to follow AD and wrongly assume cross-sectional independence, then this negative one-day market reaction becomes statistically significant at the

[20] Table II is Table 5 in ECKBO, supra n. 6. We thank Kenneth Ahern for supplying us with the identity of the 94 OSE-listed companies used by AD. Otherwise, all data used in Table II are collected by us. We also requiring at least one return observation within the five-day (-2,2) window, which reduces AD's original sample from 94 to 79 firms. In ECKBO, supra n. 6, we show that this sample reduction does not affect our main conclusion.

[21] Since AR_p is the daily average abnormal stock return over the five-day event window, the five-day average abnormal return reported by AD is simply $5AR_p$.

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1% level, while the other three days in AD's five-day event window—AR(-2), AR(-1) and AR(2)—all remain insignificant.[22] The importance of this observation is that, while the quota-related news announcement on Friday substantially increased the probability of a quota law, a news announcement on Saturday reversed this probability.[23] Since the market reacts to this Saturday reversal announcement during Monday's trading, the negative AR(1)—which drives AD's negative $CAR(-2,2)$ estimate—can only be interpreted as a negative market reaction to an event that *lowers* the likelihood of the quota law—a reversal of AD's conclusion even on their own econometric terms.

In sum, when correcting for the contemporaneous cross-correlation of stock returns, the evidence implies a statistically insignificant valuation effect of the quota—also when using AD's definition of abnormal returns.

I.C Long-run abnormal performance

Under market efficiency, the average market reaction to the quota news announcement—estimated in Section I.A—represents an unbiased estimate of the true valuation effect of the quota constraint. Therefore, if the valuation effect is truly close to zero—as suggested by our evidence of a statistically insignificant market reaction—there should be no subsequent (long-run) quota-induced abnormal performance of the OSE-listed firms. To test this proposition, we measure long-run abnormal portfolio performance using the parameter α_p in the following three-factor model:

$$r^e_{pt} = \alpha_p + \beta_{p1} r^e_{wt} + \beta_{p2} HML_t + \beta_{p3} SMB_t + \varepsilon_{pt}, \quad t = 2/2002, ..., 4/2008. \tag{4}$$

where r^e_{pt} is now the monthly USD-denominated stock return to portfolio p of domestic OSE-listed ASA, which is converted to USD using the monthly exchange rate, in excess of the current month's 3-month U.S. Treasury bill. r^e_{Wt} is the monthly return on the MSCI world stock market index in

[22] ECKBO, supra, n. 6.

[23] See ECKBO, supra n. 6, for further details of this reversal announcement event, which AD does not mention in their analysis.

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excess of the current month's 3-month U.S. Treasury bill. HML_t and SMB_t are monthly returns to the widely used Fama-French global value- and size-based stock-market risk factors.[24]

Table III shows α_p estimates for three alternative equal-weighted portfolios. In columns (1)–(3), the return-generating process is from Eq. (4), while columns (4)–(6) add a global momentum risk factor (MOM). The first portfolio, $Zero_{2001}$, contains an average of 98 OSE-listed ASA with all-male boards in 2001. The second portfolio, Pos_{2001}, contains an average of 32 firms with at least one female director in 2001, while the third portfolio, $Zero–Pos$, is long in $Zero_{2001}$ and short in Pos_{2001}, capturing the difference in the return of the two portfolios. The abnormal performance parameter α_p is insignificantly different from zero for all three portfolios. That is, even for a portfolio that goes long in firms that are the most affected by the quota ($Zero_{2001}$) and short in the least affected firms (Pos_{2001}), there is no long-run abnormal stock performance. This evidence supports our conclusion from the short-run event study of a value-neutral market reaction to forced board gender balancing.

I.D Long-run operating profitability

If the quota reduces board effectiveness, ASA may experience a post-compliance decline in operating profitability. To formally examine this possibility, we estimate the difference-in-difference (DID) regression shown in Eq. (5) below. The difference is between the performance of ASA (treated firms, since regulated by the gender quota) and Large AS (control firms, since not regulated by the gender quota). Large AS are the largest 1% AS by revenue in each year. The dependent variable, ROA_{it}, is the ratio of firm i's earnings before interest and tax (EBIT) to total assets in year t:

$$ROA_{it} = \gamma_0 + \gamma_1 ASA_i * Comply_t + \gamma_2 \mathbf{X_{i,t}} + \theta_i + \tau_t + \epsilon_{it}, \tag{5}$$

In this regression, θ_i and τ_t are firm and year fixed effects, respectively. Moreover, $Comply_t$ is an indicator variable that takes a value of 1 for all years $t \geq 2008$, as compliance was required by

[24]Eugene F. Fama & Kenneth R. French, *Common Risk Factors in the Returns on Stocks and Bonds*, Journal of Financial Economics 33 (1993).

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year-end 2007, and zero otherwise. The vector X_{it} contains control variables, including firm i's age, size, and leverage, the % ownership by the largest owner, board size, CEO experience, and busyness. All variables are defined in Table IV. The sample comprises a panel of 409 unique ASA and 1,687 unique Large AS , for a total of 11,228 firm-years in 2003-2013.[25]

The results are shown in Table V. In columns (3) and (4), which use the full sample period 2001-2013, $ASA * Comply$ is statistically insignificant. That is, there is no discernible effect of quota compliance on the operating profitability of ASA relative to the non-regulated Large AS. Columns (5) and (6) decompose $Comply_{it}$ into year-by-year effects ($ASA_i * \tau_t$), indicating a negative effect on the ROA of ASA in the year 2008 and a positive effect in the year 2013 after the inclusion of firm characteristics.

To address a prior study, which concludes that the Norwegian quota had a negative effect on firms' operating performance,[26] columns (1) and (2) follow this study and restrict the sample to the period 2003–2009. By restricting the post-quota period to the years 2008 and 2009, we confirm the negative effect of the quota on ROA documented in the prior study. However, since we show that this negative effect is limited to year 2008, it may well be the result of a heterogeneous impact of the financial crisis on ASA and Large AS as opposed to tracing back to the quota constraint. Overall, there is no evidence suggesting that Norway's board gender quota has affected firm profitability, corroborating our conclusion of a value-neutral effect.[27]

II Norway's quota law and board effectiveness

The evidence on valuation discussed above suggests that the quota-induced board changes had no statistically significant effect on firm value. While the female directors appointed to these boards

[25] For details on the sample selection, see ECKBO supra n. 6.

[26] David A. Matsa & Amalia Miller, *A Female Style in Corporate Leadership? Evidence from Quotas*, American Economic Journal: Applied Economics 5 (2013).

[27] Commenting on our evidence of a negative ROA in year 2008 (columns 5 and 6 of Table V), Amalia R. Miller, Women and leadership, Ch. 22 in Susan L. Averett, Laura M. Argys & Saul D. Hoffman (eds.), *The Oxford Handbook of Women and the Economy*, Oxford University Press (2018), New York (Oxford University Press), suggests a labor cost channel (p. 549): "[the short-term negative effect on ROA documented by Eckbo et al.] is consistent with profits at affected firms being lower during the recession years when they bore additional labor costs from retaining workers, but then rebounding relative to other firms during the recovery."

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post-quota were slightly younger than the male directors,[28] they were more qualified than their predecessors in terms of their labor market income, and the gender gap in earnings within boards fell substantially.[29] In this section, we present new evidence on the actual changes of the boards. We first examine whether the quota constraint led to a loss of Chief Executive Officer (CEO) experience on the boards or a concentration of board seats among a small group of busy female directors. We then study whether the quota drove ASA to switch legal form to AS, which is not subject to the quota.

II.A Board CEO experience

Director CEO experience is generally viewed as central for board effectiveness and, therefore, valuable to investors.[30] There are, however, relatively few women with CEO experience from large firms. In Norway, the fraction of female CEOs of ASA was 2% in 1998 increasing to 5% of listed ASA and 10% of unlisted ASA by 2013. Hence, only a limited number of female board candidates had CEO experience. Whereas this scarcity may raise concerns that the forced appointment of women reduced boards' qualifications, what matters is the board's overall CEO experience.

Evidence from the US shows that the stock market reacts positively when the first outside CEO is appointed to the board (compared to other outside directors), while there is no similar reaction when the second or third outside CEO is appointed to the board.[31] Thus, it is difficult to argue that a board should be stacked with CEOs. Moreover, to retain valuable experience, shareholders may choose to replace male directors without CEO experience or expand board size to make room for new female directors while keeping the experienced male directors. Hence, the low percentage of female CEOs does not in itself imply that the overall board-level CEO experience will decline

[28] Id AHERN supra n. 14.

[29] Marianne Bertrand, Sandra E. Black, Sissel Jensen & Adriana Lleras-Muney, *Breaking the Glass Ceiling? The Effect of Board Quotas on Female Labor Market Outcomes in Norway*, Review of Economic Studies 86 (2019).

[30] For evidence on the value of CEO experience to directors, see, e.g., Eliezer M. Fich, E., *Are Some Outside Directors Better than Others? Evidence from Director Appointments by Fortune 1,000 Firms*, Journal of Business 78 (2005), Rudiger Fahlenbrach, Angie Low & Rene M. Stulz, *Why do Firms Appoint CEOs as Outside Directors?*, Journal of Financial Economics 97 (2010), and Shinwoo Kang, E. Han Kim & Yao Lu, *Does Independent Directors CEO Experience Matter?*, Review of Finance 22 (2018).

[31] Id. FAHLENBRACH supra n. 30.

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when complying with the gender quota.

To examine the effect of the quota on the board's overall CEO experience, we use two different measures of an individual director's CEO experience over the last three years. The first is *Large-firm CEO experience*, which restricts the director's CEO experience to ASA and Large AS (the 1% largest AS by revenue). The second measure is *Small-firm CEO experience*, which records the CEO experience in ASA and any AS, i.e., it includes the remaining 99% of the annual population of roughly 100,000 AS. We explicitly distinguish CEO experience in large and small firms because the population of AS is overwhelmingly dominated by tiny firms: 46% of all AS have at most one employee, 58% have at most two, and 90% have at most ten. In comparison, the annual number of employees averages 657 for listed ASA, 209 for unlisted ASA, and 45 for Large AS, all of which are included in our measure *Large-firm CEO experience*.[32] Hence, a director's *Large-firm CEO experience* is undoubtedly of greater value to the board of a publicly listed firm than her *Small-firm CEO experience*.

The board large-firm CEO experience, defined as the fraction of director's with *Large-firm CEO experience*, averages 17% in listed ASA, 15% in unlisted ASA, and 14% in Large AS.[33] This implies that, in a typical board of five, only one director has CEO experience from a large Norwegian firm. The board small-firm CEO experience is substantially higher, averaging 53% in listed ASA, 48% in unlisted ASA, and 44% in Large AS. The large difference in the two experience measures suggests that many directors have CEO experience from quite small firms.

Figure II plots the time series of large-firm CEO experience pooled across listed and unlisted ASA, both at the board level and split by male and female directors. Notice first that a substantially higher fraction of male directors have large-firm CEO experience than female directors. Importantly, the fraction of male directors with large-firm CEO experience increases somewhat around quota compliance, suggesting that shareholders made an effort to retain male directors with such experience. This retention attenuates the impact of the increasing number of female

[32]The frequency distribution of ASA is skewed towards firms with at most 50 employees.

[33]In comparison, Id, FAHLENBRACH, n. 30, report that 10% of outside directors in listed US firms are current outside CEOs.

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directors on the board-level large-firm CEO experience.

In Table VI, we use Eq. 5 to test whether the quota constraint caused changes in the board-level large-firm CEO experience of ASA relative to the control group of Large AS. The dependent variable is now $Board\ CEO\ Experience_{it}$, which is the fraction of directors of firm i in year t with CEO experience. The vector X_{it} controls for firm age and size, leverage, and the percent ownership of the firm's largest shareholder. The sample comprises a panel of 436 unique ASA (treated firms) and 1,786 unique Large AS (control firms), for a total of 13,333 firm-years in 2001-2013.

Columns (1) and (2) examine the impact of the quota on boards' large-firm CEO experience. As shown, the coefficient estimate for $ASA * Comply$ is statistically insignificant, whether or not the firm and board controls are included. Thus, the regressions provide no support for the hypothesis that ASA-board large-firm CEO experience falls relative to that of Large AS after quota compliance. Said differently, the evidence suggests that firms were able to maintain the overall level of director large-firm CEO experience while gender-balancing their boards.

Turning to boards' small-firm CEO experience, the regressions in columns (3) and (4) of Table VI generate a negative and significant coefficient estimate for $ASA * Comply$. Since board large-firm CEO experience does not decline (shown in columns 1 and 2), this decline is overwhelmingly dominated by CEO experience in tiny AS. So, whereas many of the departing male directors had CEO experience from small firms, the incoming female directors did not. While it is questionable if the decline in small-firm CEO experience had much relevance to board effectiveness, it helps clarify the decline in CEO experience documented by AD.[34] AD's definition is based on director bios in company annual reports and includes "work experience as CEO or owner". In their sample, 66% of male directors and 40% of female directors have CEO experience (their online Appendix Table II), which is close to the small-firm CEO experience in our sample.

Since directors' CEO experience from large firms is most certainly more relevant for the value of listed firms than experience from small firms, we conclude that ASA boards succeeded in maintaining the relevant board-level CEO experience through quota compliance, corroborating

[34]Id. AHERN supra n. 18.

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our finding of a value-neutral effect of the quota.

II.B Board size and director busyness

We next examine whether maintaining the board's large-firm CEO experience necessitated changes in other board characteristics, such as size and director busyness. If qualified females are in short supply, an efficient response to the quota constraint may require an increase in board size to maintain male director CEO experience while adding female directors, or a concentration of board seats to a small group of female directors.

The cost of expanding board size—making room for female directors while retaining male—places an upper bound on the expected costs of the quota. That is, in complying with the quota, shareholders will choose the alternative that imposes the lowest costs on the firm. Hence, observing the actual changes in board size allows us to make inferences about the least costly path. It is therefore interesting in itself that the average ASA board size remained largely unchanged at five shareholder-elected directors after the quota, as illustrated in Figure I above.

Columns (5) and (6) of Table VI formally test whether the quota caused a change in the average board size of listed and unlisted ASA relative to Large AS, using the DID framework in Eq. 5 above. In Column (5), the coefficient on the interaction variable $ASA * Comply$ is negative and marginally significant (at the 10% level). However, when adding firm characteristics in Column (6), the coefficient estimate becomes insignificant. Thus, there is little evidence of a change in average ASA board size. The fact that the average board size remained at five members after the quota implies that the cost of replacing male directors with female is lower than the cost of adding additional directors to the board.

To gain a deeper understanding of the board-size dynamics, Panel A of Figure III plots the board-size frequency distribution for 555 ASA in 2001 and 395 ASA in 2008. While the average board size is unchanged, there is a narrowing of the distribution, reflecting a shift from four to five board members and from six to five.[35] In 2001, 37% of the sample firms had boards with four

[35] A non-parametric Kolmogorov-Smrinov test shows that the distributions from 2001 and 2008 are significantly

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or six directors, which drops to 19% in 2008. Over the same period, the sample proportion of five-member boards increased from 26% to 43%. These changes may be motivated by a desire to minimize the quota constraint. Increasing the board from four to five members allows a firm to appoint two new female directors while terminating only one male director. Moreover, reducing board size from six to five directors allows the firm to appoint two new females rather than three, which is the requirement for a six-member board. So in sum, while the quota did not cause a change in the average board size, the increase in the proportion of five-member boards may well reflect a desire to minimize quota-induced costs at the margin.

We next turn to changes in director seat concentration and board busyness. Having multiple directorships can be a sign of director quality, improving the board's ability to give good advice.[36] On the other hand, directors serving on multiple boards may be overcommitted, lacking time and attention to devote to the firm, and, therefore, fail to provide meaningful monitoring of the managers.[37] If qualified women are in short supply, many firms may recruit the same women, and the female director seat concentration should increase. Panel B of Figure III plots the frequency distribution of the number of board seats in ASA and Large AS held by male and female ASA directors in 2001 and 2008. ASA directorships are highly dispersed in both years: Almost three-quarters of individual directors hold only one board seat. Moreover, the distribution is largely similar for male and female directors, both pre- and post-quota.

We follow the literature and define a director as busy if he/she holds three or more board

different at the 5%-level).

[36]Eugene F. Fama & Michael C. Jensen, *Separation of Ownership and Control*, Journal of Law and Economics 26 (1983), Stephen P. Ferris, Murali Jagannathan & A. C. Pritchard, *Too Busy to Mind the Business? Monitoring by Directors with Multiple Board Appointments*, Journal of Finance 58 (2003), Ronald W. Masulis and Shawn Mobbs, *Are All Inside Directors the Same? Evidence from the External Directorship Market*, Journal of Finance 66 (2011), and Laura C. Field, Michelle Lowry & Anahit Mkrtchyan, *Are Busy Boards Detrimental?*, Journal of Financial Economics 109 (2013).

[37]John E. Core, Robert W. Holthausen & David F. Larcker, *Corporate governance, chief exectuvie officer compensation, and firm performance*, Journal of Financial Economics 51 (1999), Anil Shivdasani & David Yermack, *CEO Involvement in the selection of new board members: An empirical analysis*, Journal of Finance 54 (1999), Eliezer M. Fich & Anil Shivdasani, *Are busy boards effective monitors?*, Journal of Finance 61 (2006), Antonio Falato, Dalida Kadyrzhanova & Ugur Lel, *Distracted directors: Does board busyness hurt shareholder value?*, Journal of Financial Economics 113 (2014) & Roie Hauser, *Busy directors and firm performance: Evidence from mergers*, Journal of Financial Economics 128 (2018).

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seats[38] on ASA and Large AS boards. The last three bars in Panel B of Figure III show the proportion of busy directors. In 2001 and 2008, 12% and 13%, respectively, of the male directors were busy and 9% and 11%, respectively of the female directors were busy. Hence, the distribution of individual board seats does not indicate that the quota created a small group of busy female directors. On the contrary, if anything, the quota lowered the fraction of male directors with five or more seats, indicating a shift towards a more uniform distribution of board seats across male and female ASA directors after quota compliance.

Columns (7) and (8) of Table VI show the results of formal tests for changes in board busyness using our DID regression setup. The dependent variable is the fraction of a board's directors that are classified as busy. As reported, the coefficient estimate for the interaction variable $ASA * Comply$ is negative and significant in both columns. That is, the ASA board busyness decreased post-quota relative to that of unregulated Large AS. A consistent interpretation is that the pool of qualified female directors was sufficiently deep to avoid the appointment of a few high-profile females to a large number of boards.

II.C ASA–to–AS legal conversions

The above analysis explores ways in which firms adjusted their boards in response to the quota. In this section, we examine whether some ASA chose to avoid the quota altogether by converting their legal status to AS. In particular, we ask whether conversion is more likely for firms with a high female director shortfall relative to the quota requirement. In doing this, it is important to keep in mind that a firm converting from ASA to AS typically does not disclose the reason for the conversion. Therefore, inferences as to why conversions happen in general—and whether they are driven by the quota-constraint in particular—are indirect.

Notice first that the legal differences between ASA and AS pertain primarily to the dispersion of share ownership and ability to raise public equity, where ASA is designed for firms with a widely dispersed shareholder base. Only ASA can do a public equity offering and list its shares on the

[38]Id. supra FICH n. 29 and FIELD n. 36

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OSE. Also, a public listing imposes additional restrictions on the firm, such as reporting of the financial accounts according to International Financial Reporting Standards (IFRS), disclosure of executives' and directors' compensation, and complying with or explaining any deviation from the OSE corporate governance code. Moreover, investors must flag when they cross certain share ownership thresholds, and reaching a 33% ownership fraction triggers a mandatory bid for the remaining shares.

Beyond the ability to go public, there are few differences between ASA and AS of a certain size.[39] For example, the protection of creditors is largely identical, and a substantial fraction of the bonds traded on OSE are issued by AS. Moreover, AS can issue equity in private placements and let their shares trade over the counter (OTC). However, the fraction of non-voting shares is limited to 50% for ASA, with no limitation for AS. Moreover, ASA are required to report trades in their shares to the Norwegian Securities Register (VPS) and insiders must report their trades to the board, while there are no such requirements for AS.

Unlisted firms can easily switch between ASA and AS through a change in their bylaws. However, for a listed ASA, switching to AS also requires delisting, which can be difficult (it requires 90% shareholder approval)[40] and potentially very costly to shareholders (the loss of stock-market liquidity). Panel A of Figure IV plots the total number of listed ASA over time, and the number of exits and entries in each year.[41] As shown, the number of listed ASA reaches a peak of 195 in 2007, but is otherwise relative stable. While about one-tenth of the listed firms leave the stock-market every year due to acquisitions or bankruptcy, there is a steady inflow of new listings, in particular in the period 2004-2007, as the quota was phased in. This evidence is inconsistent with a negative impact of the gender quota on firms' propensity to be publicly listed.

Panel B plots the same statistics for unlisted ASA. As shown, there is a steady decline in

[39] AS with a share capital below 3 million NOK (approx. 400 thousand USD) and less than 20 shareholders have fewer requirements related to the board of directors and the general meeting.

[40] In 2015, OSE denied IT-company Evry's application to delist after the British company AXA had acquired 88% of the firm's stock and wanted to take the company private.

[41] The information on domestic M&A and bankruptcy is based on *Brønnøysund Register Center*, while we hand-collect information on cross-border acquisitions of listed ASA through news articles and press releases. The sample excludes financial firms, which were required to be ASA until 2007.

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the number of unlisted ASA over time, in part because firms go public (transferring to Panel A) and are acquired or file for bankruptcy. Since acquisitions and bankruptcy are very costly transactions, we rule out that they are undertaken with a purpose to avoid the board quota. Of more interest to the quota discussion, there are a total of 156 firms that exit the ASA legal form for other, unexplained reasons. To test whether the gender quota drove these other delistings, we propose two competing conversion hypotheses. The first is that conversion is driven by the quota constraint and predicts that the conversion likelihood is increasing in the female director shortfall. The second hypothesis is that the unlisted ASA has abandoned plans to go public and list on the OSE. This alternative hypothesis exploits the fact that there are few benefits of remaining unlisted ASA, while there are some costs. Since, depending on the unlisted ASA's investment and financing opportunities, this alternative hypotheses may play out in the data at any time during our sample period, we estimate the likelihood of conversion next year as a function of firm characteristics. Under this alternative hypothesis, the conversion likelihood is unrelated to board gender composition.

Table VII report the results of estimating the following logit model:

$$Convert_{it} = \alpha + \gamma_1 Shortfall_{it} + \gamma_2 \mathbf{X}_{it} + \kappa_i + \tau_t + \epsilon_{it}, \tag{6}$$

where κ_i and τ_i are, respectively, industry and year fixed effects, and the vector $\mathbf{X}_{it}$ contains six firm characteristics, including operating profitability. The dependent variable, $Convert_{it}$, equals one if the firm converts to AS next year $(t+1)$ and zero otherwise. Firms that convert necessarily drop out of the sample in the year of conversion (they no longer have a choice to convert). We include year fixed effects because, as shown in Figure I, there is a strong downward time trend in $Shortfall$ as ASA comply with the quota regulation. This specification controls for this time trend in the gender-balancing of boards, allowing for a comparison of firms in a given year. Our unbalanced panel contains 880 firm-years for 264 unlisted non-financial ASA, of which 150 convert sometime in the period 2002-2009.

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In columns (1) and (2) of Table VII, the coefficient for the female director shortfall ($Shortfall$) is statistically insignificant. In columns (3) and (4), $Shortfall$ is replaced with the shortfall number of female directors ($Shortfall_{Number}$), which also receives statistically insignificant coefficient estimates. This evidence fails to support the hypothesis that conversions are quota-driven. It does not reject, however, our alternative hypothesis that unlisted ASA convert to the lower-cost AS legal form after aborting plans to raise public equity. While not tabulated, this inference is robust to replacing the variable *Shortfall* with the dummy *High shortfall* (shortfall above median).

In sum, when we test the likelihood of conversion using a sample of firms with the lowest conversion costs (unlisted firms and conversions unrelated to acquisitions and bankruptcy), there is no evidence that the gender quota *per se* caused firms to convert from ASA to AS.[42]

III Impact of California's SB 826: A brief comment

On September 30, 2018, California Governor Jerry Brown signed SB 826 into law, thereby mandating the first board gender quota in the US. SB 826 requires public companies with their principal offices in California to have at least one female director by year-end 2019 and at least two or three female directors, depending on board size, by year-end 2021. The quota covered 12% of all public US firms, with a combined market capitalization over $5 trillion. To comply, 28% of the 602 firms headquartered in California must add one female director by 2019 and 88% must add one or more female directors by 2021.

During the 2018 legislative process, the likelihood of the quota increased on several distinct dates. This includes when the quota was introduced in the Senate on January 3, passed by the Senate on May 31, and passed by the Assembly on August 29. Importantly, there was no significant stock-market reaction on any of these days. However, when Governor Brown finally signed SB 826 into law, the average stock price of California firms dropped by –1.2%, corresponding to a

[42]The results in Table VII contradict the main conclusion of Øyvind Bøhren & Siv Staubo, *Does Mandatory Gender Balance Work? Changing Organizational Form to Avoid Board Upheaval*, Journal of Corporate Finance 28 (2010). As discussed in ECKBO supra n. 10, their tests fail to control for the time trend in boards' gender composition.

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$60 billion value loss.[43] The stock price fell less for firms that must add one female director by 2021 (–1.1%) than firms in need of three new females (–1.6%). The stock market reaction was also more negative for firms in industries with no female CEOs and few (below median) female directors.[44]

The key question is, of course, whether the stock price decline on October 1, 2018 (the first trading day after the announcement) can be attributed to the quota law. Since Governor Brown decided on 183 bills over the same weekend, and there was no stock-price reaction to the earlier legislative events, it is possible that other news made the market move on October 1. For the quota to have reasonably caused the stock-price drop, the magnitude of the market reaction must be proportional to the potential quota costs. However, there are several reasons pointing to marginal quota costs in California—beyond the value neutrality of the Norwegian quota.

First, the penalty for non-compliance is relatively low. The statute is non-criminal with a maximum fine of $100,000 in 2019 and $900,000 per year of non-compliance after 2021. Second, the quota law may be unconstitutional, as it applies a California law to firms incorporated in other states or countries.[45] Only 72 companies are incorporated and headquartered in California, potentially limiting the reach of the law. Also, at least two lawsuits have challenged the law on claims that it violates the equal protection clause of the US constitution.[46] Third, like in Norway, California firms could simply add female directors to the incumbent male-dominated boards, preserving valuable board experience. Hence, the quota costs are limited by the costs of expanding board size by up to three members. Fourth, the principal office has no legal definition and is self-reported by the firm in its 10K filing. Hence, an easy way to escape a costly quota

[43]Daniel Greene, Vincent J. Intintoli & Kathleen M. Kahle, 2020, *Do Board Gender Quotas Affect Firm Value? Evidence from California Senate Bill no. 826*, Journal of Corporate Finance 60 (2020).

[44]Id GREENE p. 6

[45]Joseph Grundfest, *Mandating Gender Diversity in the Corporate Boardroom: The Inevitable Failure of California's SB826*, Rock Center for Corporate Governance at Stanford University Working Paper No. 232 (2018) and Jill E. Fisch & Steven Davidoff Solomon, *Centros, California's 'Women on Boards' Statute and the Scope of Regulatory Competition*, European Corporate Governance Institute (ECGI) - Law Working Paper No. 454/2019 (2019).

[46]Andrew Sheeler, *California man sues to overturn 'woman quota' in state gender equity law*, Sacramento Bee, Nov. 13, 2019. For a brief update of the status of lawsuits, see Cydney Posner, *First Legal Challenge to California's Board Gender Diversity Statute Heads to Trial*, Harvard Law School Forum on Corporate Governance (2021).

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constraint is to report a different location for the principal office. Overall, it is highly unlikely that the California quota would have much of a valuation effect, given its low penalties, potential unconstitutionality, and the existence of low-cost strategies to comply or entirely avoid the quota constraint. This suggests that the October 1, 2018, stock price decline of California firms instead was caused by some other news.

IV Concluding remarks

In this paper, we review and extend the empirical evidence on the economic effects of Norway's pioneering board gender-quota law. Our evidence addresses the potential for economic effects ranging from changes in market valuations and firm profitability, in board characteristics such as board size and CEO experience, in director busyness, and in legal conversions. Also important, our evidence subsumes and econometrically corrects prior published research on Norway's gender quota. With our corrections and expansions, the scientific evidence leads to one unified conclusion: access to a deep pool of qualified female director candidates has allowed shareholders of ASA to rebalance their boards without a statistically significant loss of market value.

In the US, there is growing support for greater board diversity, reflected in a convergence of Federal securities law standards, the California, Washington and Nasdaq standards, and institutional investor actions.[47] Hence, our finding that Norway's forced board gender-balancing has left firm values largely unaffected is important also for US policymakers. A policy that has little potential for distorting firm performance is unlikely to conflict with directors' all-important fiduciary responsibility of protecting firm value. Just as rising water lifts all boats, the objective of maximizing firm value protects all of the firm's contractual partners—all its stakeholders—not just shareholders (who are the residual claimants to the firm's cash flow).[48]

[47] Joel Seligman, *Framing the issues: Board Diversity and Corporate Purpose*, Harvard Business Law Review (20220.

[48] For the same reason, Noble Laureate Milton Friedman famously wrote "The Social responsibility of Business is to Increase its Profits", New York Times (September 13, 1970, p. 17). For elaborations of the view of the firm as a nexus of contracts, see Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure*, Journal of Financial Economics 3 (1976). See also Eugene F. Fama &

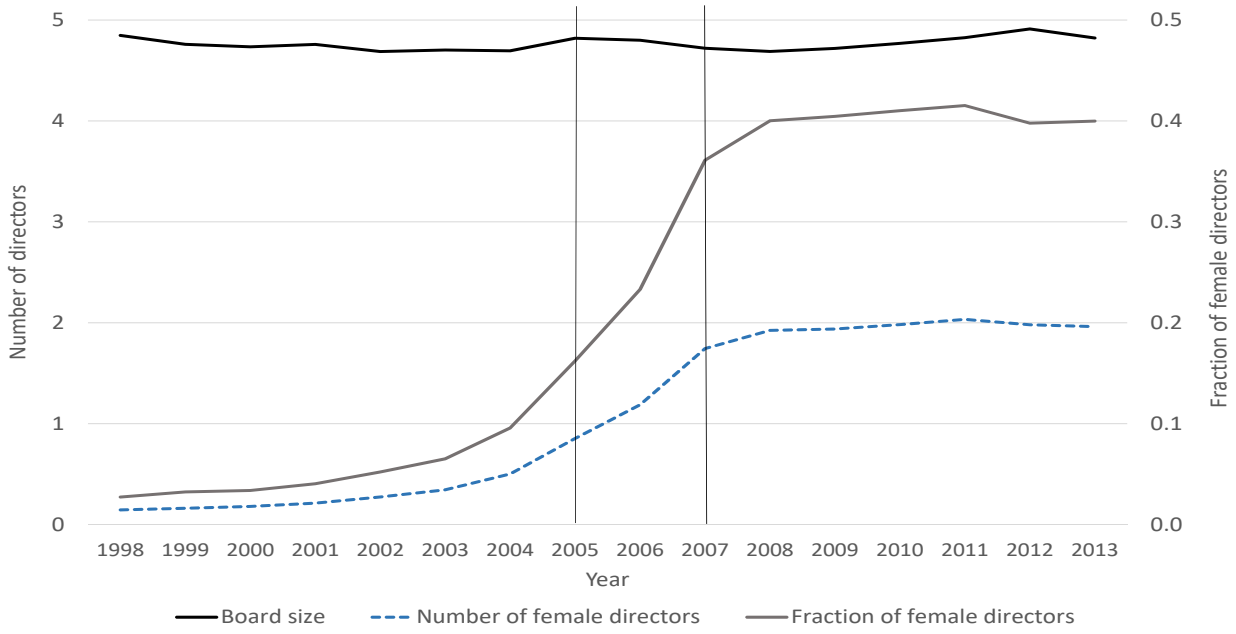
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Finally, our central finding of statistically and economically insignificant economic effects of Norway's gender quota highlights the need for healthy scepticism towards research presenting firm-value estimates that themselves are highly disproportionate relative to firms' often low costs of adjusting to the quota constraint.

Michael C. Jensen, *Separation of Ownership and Control*, Journal of Law and Economics 26 (1983), and Eugene F. Fama & Michael C. Jensen, *Agency Problems and Residual Claims*, Journal of Law and Economics 26 (1983).

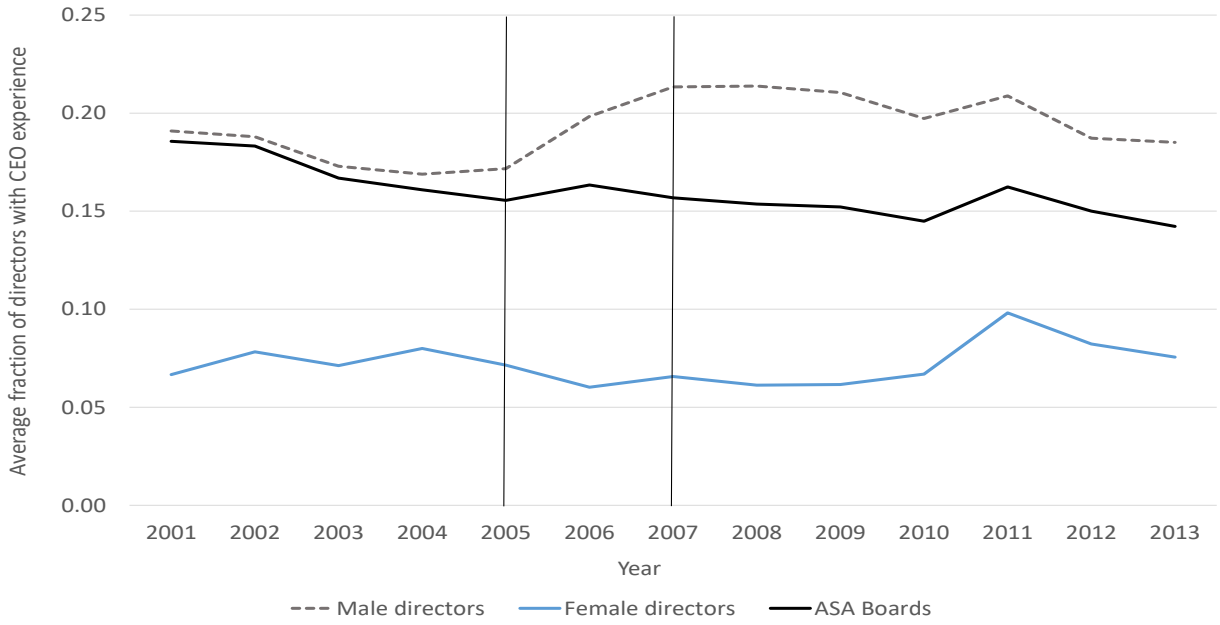
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Figure I: Norwegian ASA board size and proportion of female directors, 1998-2013
The figure shows the average board size (left axis), defined as the number of shareholder-elected directors, and the number (left axis) and fraction (right axis) of female directors. The two vertical lines bracket the two-year quota compliance period (12/2005–12/2007). The sample is 1150 Norwegian ASA, 1998-2013. Board data are from *Brønnøysund Register Centre*. Source: ECKBO, supra n. 6.



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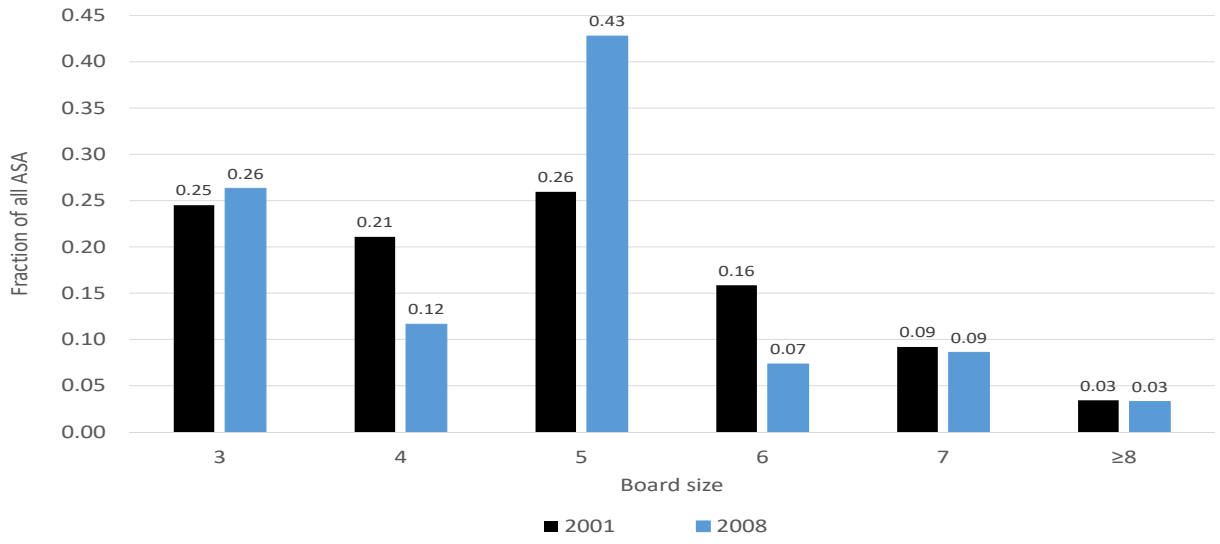
Figure II: Large-firm CEO experience of ASA directors and boards, 2001-2013
The figure shows the annual fraction of male and female ASA board seats with large-firm CEO experience, as well as the fraction of directors with large-firm CEO experience of the average ASA board. A director of firm i has large-firm CEO experience if he/she is an outside CEO in an $\text{ASA}_{j\neq i}$ or Large $\text{AS}_{j\neq i}$ (top 1% AS by revenue) in year t, or was CEO in any ASA or Large AS in at least one of the past three years. The sample is 4604 male and 1395 female directors of 997 ASA, 2001-2013. Board data are from *Brønnøysund Register Centre*.



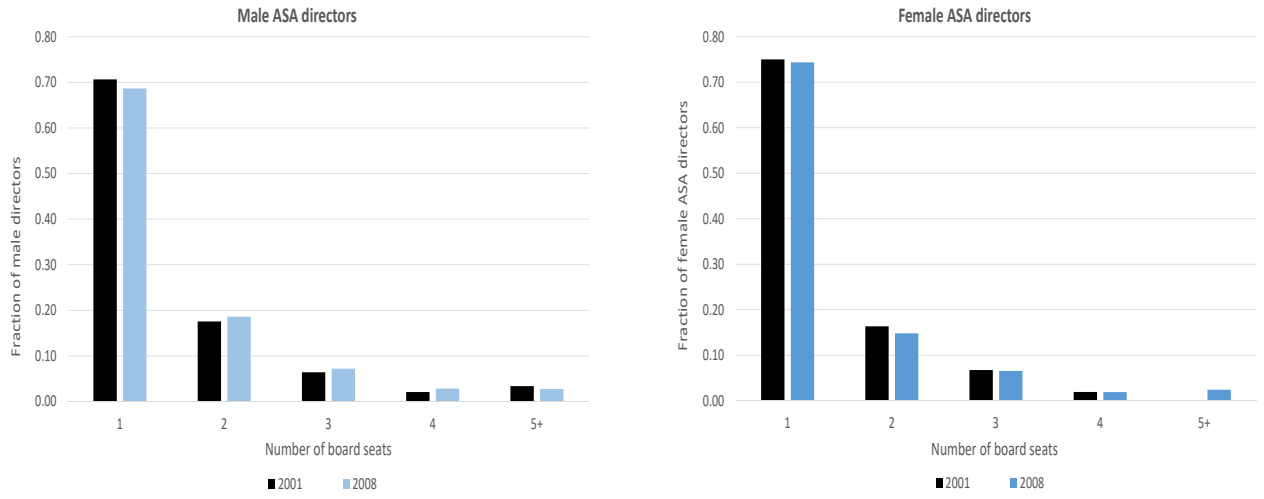
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Figure III: Frequency distribution of ASA board size and director board seats, 2001 and 2008
Panel A shows the frequency distribution of board size. Panel B plots the frequency distribution of the total number of board seats in ASA and Large AS (the top 1% AS by revenue) held by male and female directors. Five and more board seats are reported under 5+. The sample is 555 ASA (1938 male and 104 female directors) in 2001 and 395 ASA (919 male and 581 female directors) in 2008. Board data are from *Brønnøysund Register Centre*. Source: ECKBO, supra n. 6.

A: ASA board size



Panel B: Male and female ASA directors' board seats in ASA and Large AS

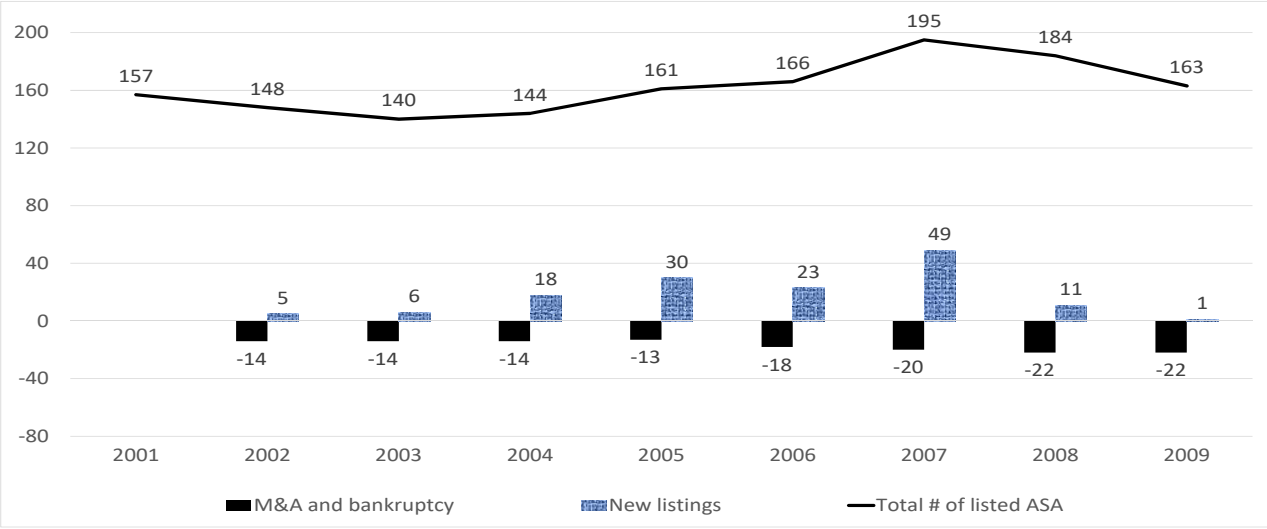


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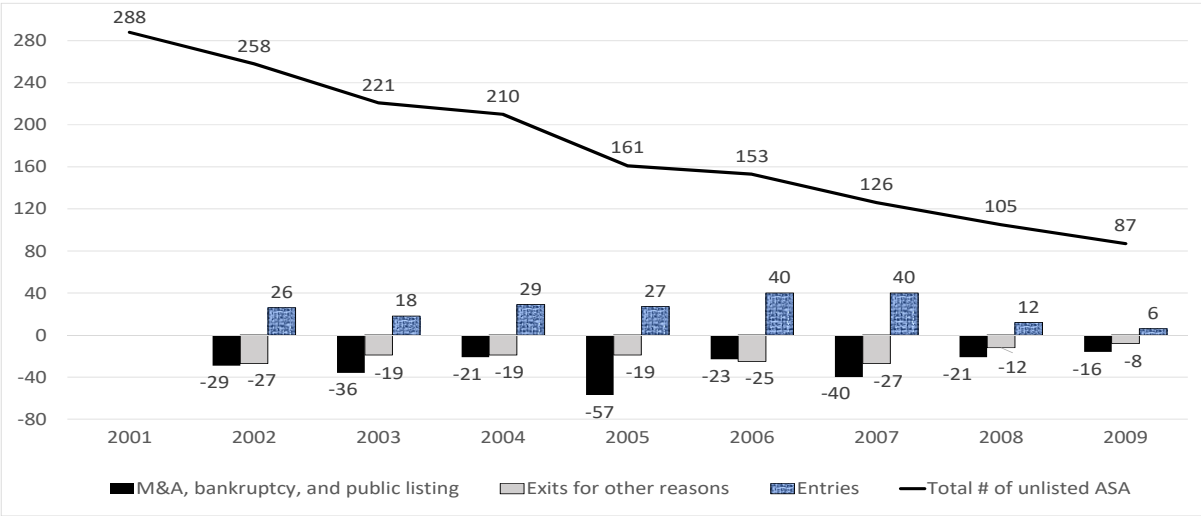
Figure IV: Total number and exits and entries of listed and unlisted ASA by year

The figure shows the total number of listed ASA (Panel A) and unlisted ASA (Panel B) at year-end, 2001-2009, and the number of exits and entries during the period 2002–2009. Firms enter and exit the legal form ASA by changing their bylaws, but typically give no reason for the change. No listed firm delist for reasons other than M&A or bankruptcy. Unlisted ASA exit because they are acquired or file for bankruptcy (192 firms), go public (51 firms), or for other reasons (156 firms). The sample is 288 listed and 467 unlisted non-financial ASA, 2002-2009. The data is from *Brønnøysund Register Centre*, complemented with manual searches of press releases and news for acquisitions by foreign firms. Source: ECKBO, supra n. 6.

Panel A: Listed ASA (no firm delists for reasons other than M&A and bankruptcy)



Panel B: Unlisted ASA (156 firms convert to AS for other reasons)



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Table I: Abnormal returns to portfolios of OSE-listed firms on key quota event dates

The table reports cumulative abnormal stock returns, $CAR(-1,0) = 2AR_p$, for portfolios of OSE-listed firms, estimated using the return-generating process:

$$r^e_{pt} = \alpha_p + \beta_p r^e_{wt} + AR_p d_t + \varepsilon_{pt},$$

where r^e_{pt} is the daily equal-weighted return (converted to USD using the daily exchange rate) in excess of the daily 3-month U.S. Treasury bill, d_t is a dummy for the event window (-1,0), and r^e_{wt} is the daily excess return on the MSCI stock market world index. Columns (1)–(4) use samples of Norwegian firms subject to the quota. Columns (5)–(7) use samples of OSE-listed Norwegian (treated) and foreign (control) firms in the oil/offshore sector. $Shortfall$ is the fraction of additional female directors a firm needs to appoint to comply with the quota. N denotes the number of firms in each portfolio. Daily stock returns are from *Oslo Børsinformasjon*. Information on board composition is from *Brønnøysund Register Centre*. Significance levels are *** 1%, ** 5%, * 10%. Source: ECKBO, supra n. 6.

Event date February 22, 2002	All firms (1)	High $Shortfall$ (2)	Low $Shortfall$ (3)	High –Low (4)	Domestic oil/offshore (5)	Foreign oil/offshore (6)	Domestic – Foreign (7)
$CAR(-1,0)$	-0.009	-0.012	0.001	-0.013	-0.000	-0.019	0.018
p-value	[0.557]	[0.493]	[0.953]	[0.419]	[0.986]	[0.476]	[0.477]
N	143	93	41		32	11	

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Table II: Adjusting AD's event study for contemporaneous cross-correlation of returns.

The table revisits AD's event study by using their sample and data sources but adjusting for the cross-correlation of returns through a portfolio estimation of CAR(-2,2) around February 22, 2002 (the event date also used in Table I above). We estimate a time-series regression of the model:

$$r_{pt}^{-I} = \alpha_p + AR_p d_t + \epsilon_{pt}.$$

The dependent variable $r_{pt}^{-I} \equiv \frac{1}{N}\sum_{i=1}^{N}(r_i - r_{i,match})_t$ is the equal-weighted portfolio of industry-matched returns, where r_i is the return of ASA i (from Compustat Global) and $r_{i,match}$ is the average return to U.S.-listed companies in firm i's GICS industry (from CRSP) on day t, and d_t is a dummy that takes the value of one for all days in the five-day event window (-2,2). Panel A shows the coefficient estimates $CAR(-2,2) = 5AR_p$ from the time-series regression. The p-values (in square bracket) use the standard error from the regression, $\sigma_{5AR_p}(\rho) = 5\sigma_{AR_p}(\rho)$, which accounts for the cross-correlation in returns. Panel B reports the daily AR in the five-day event window, using the same portfolio estimation but with five different dummies d_t (one for each day). We require a firm to have at least a single one-day return in the event window. This reduces the sample size to 79 firms in Panel A (from AD's 94). The number of observations is lower in Panel B because only a subset of firms have a one-day return in Compustat Global on a given day in the event window. The board data is from *Brønnøysund Register Centre*. The sample is split by firms' 2001 board gender composition into zero female directors ($Zero_{2001}$, Column 2) and at least one female director (Pos_{2001}, Column 3). Significance levels: *** 1%, ** 5% and * 10%. Source: ECKBO, supra n. 6..

		All firms (1)	Firms with $Zero_{2001}$ (2)	Firms with Pos_{2001} (3)	Diff. in mean $Zero - Pos$ (4)
A: Time-series portfolio estimation of the five-day CAR (one-day returns)					
	$CAR(-2,2)$	-2.203	-3.364	0.924	-4.288
	p-value	[0.521]	[0.356]	[0.796]	[0.116]
	N	79	57	22	
B: Time-series portfolio estimation of the daily AR (one-day returns)					
Feb 20 (Wed)	$AR(-2)$	-0.806	-1.014	-0.231	-0.784
	p-value	[0.598]	[0.532]	[0.885]	[0.518]
	N	64	47	17	
Feb 21 (Thu)	$AR(-1)$	0.549	0.176	1.740	-1.563
	p-value	[0.720]	[0.913]	[0.276]	[0.197]
	N	67	51	16	
Feb 22 (Fri)	$AR(0)$	-0.620	-0.555	-0.773	0.218
	p-value	[0.685]	[0.732]	[0.628]	[0.857]
	N	66	46	20	
Feb 23 (Sat): Reversal announcement. OSE closed, no trading.					
Feb 25 (Mon)	$AR(1)$	-1.862	-2.397	-0.597	-1.800
	p-value	[0.224]	[0.140]	[0.708]	[0.138]
	N	64	45	19	
Feb 26 (Tue)	$AR(2)$	0.538	0.426	0.785	-0.359
	p-value	[0.725]	[0.793]	[0.622]	[0.767]
	N	65	45	20	

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Table III: Long-run abnormal performance of portfolios classified by female representation

The table reports monthly abnormal stock returns for portfolios of listed ASA with zero or positive female representation in 2001, over the period February 2002 (start of quota legislative process) to April 2008 (full quota compliance). A $Zero_{2001}$ firm has zero female directors in 2001, while a Pos_{2001} firm has at least one female director in 2001. The monthly average number of firms in the $Zero_{2001}$ and Pos_{2001} portfolios are 98 and 32, respectively. In columns (1) - (3), the abnormal stock return is estimated using the following three-factor return-generating process:

$$r^e_{pt} = \alpha_p + \beta_{p1} r^e_{wt} + \beta_{p2} HML_t + \beta_{p3} SMB_t + \varepsilon_{pt}, \quad t = 2/2002, ..., 4/2008,$$

where r^e_{pt} is the monthly USD-denominated stock return to portfolio p of domestic OSE-listed ASA, converted to USD using the monthly exchange rate, in excess of the current month's 3-month U.S. Treasury bill. r^e_{Wt} is the monthly return on the MSCI world stock market index in excess of the current month's 3-month U.S. Treasury bill. SMB (size) and HML (value) are global risk factors. Columns (4)–(6) include an additional global momentum risk factor (MOM). Standard errors in parenthesis and significance levels are indicated by *** 1%, ** 5%, * 10%. Source: ECKBO, supra n. 6.

	$Zero_{2001}$ Portfolio (1)	Pos_{2001} Portfolio (2)	*Zero-Pos* Portfolio (3)	$Zero_{2001}$ Portfolio (4)	Pos_{2001} Portfolio (5)	*Zero-Pos* Portfolio (6)
α_p	-0.002	0.003	-0.005	-0.001	0.004	-0.005
	(0.006)	(0.005)	(0.004)	(0.006)	(0.005)	(0.004)
W^e	1.422***	1.419***	0.003	1.410***	1.373***	0.037
	(0.154)	(0.122)	(0.108)	(0.164)	(0.129)	(0.115)
HML	-0.143	0.320	-0.463	-0.128	0.376	-0.504
	(0.428)	(0.338)	(0.300)	(0.435)	(0.341)	(0.304)
SMB	1.120***	0.727***	0.393*	1.141***	0.804***	0.337
	(0.310)	(0.245)	(0.218)	(0.325)	(0.255)	(0.227)
MOM				-0.042	-0.160	0.118
				(0.189)	(0.148)	(0.132)
R^2	0.601	0.682	0.061	0.601	0.687	0.071
Observations (months)	75	75	75	75	75	75

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Table IV: Variable definitions

The main data source is *Brønnøysund Register Centre* and *Oslo Børsinformasjon*. Ownership is complemented with data from the Norwegian tax authorities (2004–2013). Log refers to the natural logarithm. Source: ECKBO, supra n. 6.

Variable name	Definition
A: Firm characteristics	
Firm age	Log of firm age since incorporation.
ROA	Return on assets (earnings before interest and taxes (EBIT) / total assets).
Total assets	Log of book value of total assets.
Size	Log of revenue.
Leverage	Ratio of book value of total debt to total assets.
Largest owner	Percent ownership by the firm's largest shareholder.
ASA	Public limited company ("*Allmenaksjeselskap*"), regulated by the quota.
AS	Private limited company ("*Aksjeselskap*"), not regulated by the quota.
Industry	Firms are allocated to ten different industry sectors: oil/offshore, telecom/technology, manufacturing, construction, wholesale/retail, finance, agriculture, transportation, electricity, and other services.
B: Board characteristics	
Board size	Number of shareholder-appointed directors on the board.
Board CEO experience	The fraction of the board's directors with CEO experience from an ASA or one of the 1% largest AS by revenue in the past three years.
Board busyness	The fraction of the board's directors that hold at least three board seats in an ASA or one of the 1% largest AS by revenue.
$Shortfall$	The difference between the fraction of female directors required by the quota and that of the current board.
High shortfall	Dummy indicating a $Shortfall$ at or exceeding the median. In 2007, the median $Shortfall$ is zero and we require $Shortfall > 0$.
Low shortfall	Dummy indicating a below-median $Shortfall$.
$Zero_{2001}$	Dummy equal to one if the firm has zero female directors in 2001.
Pos_{2001}	Dummy equal to one if the firm has at least one female director in 2001.
Comply	Dummy equal to one in years $t \geq 2008$ (reflecting quota compliance by 12/2007).

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Table V: Quota-induced changes in operating performance

Columns (1)–(4) report coefficient estimates from the following OLS regression for firm i in year t:

$$ROA_{it} = \gamma_0 + \gamma_1 ASA_i \times Comply_t + \gamma_2 \mathbf{X_{it}} + \theta_i + \tau_t + \epsilon_{it},$$

where θ_i and τ_t are firm and year fixed effects, respectively. The dependent variable is firm i's operating profitability (ROA) in year t, defined as earnings before interest and tax (EBIT)/total assets. $Comply_t = 1$ for year $t \geq 2008$ and zero otherwise. The vector $\mathbf{X}_{it}$ contains the following firm characteristics: *Firm age*, *Size*, *Leverage*, *Largest owner*, *Board size*, *Board CEO experience*, *Board busyness*, and a constant (all suppressed). The variables are defined in Table IV. In columns (5) and (6), the model is:

$$ROA_{it} = \gamma_0 + ASA_i \sum_{2008}^{2013} \gamma_t \tau_t + \gamma_2 \mathbf{X_{it}} + \theta_i + \tau_t + \epsilon_{it},$$

The sample comprises 409 ASA (treated firms) and the 1,687 1% largest AS by revenue and year (control firms), 2003-2013. We exclude financial firms and firm-year observations with missing dependent or control variable values. For each estimation period, we exclude firms with only one observation (they would be nulled out by the firm fixed effect), and firms that switch between ASA and Large AS over the estimation period (a firm cannot appear both in the treatment and control group). The estimation period is 2003–2009 in columns (1)–(2) and 2003–2013 in columns (3)–(6). Standard errors clustered by firm are reported in parenthesis. Stars indicate significance levels: *** 1%, ** 5%, and * 10%. Source: ECKBO, supra n. 6.

	2003-2009		2003-2013			
	(1)	(2)	(3)	(4)	(5)	(6)
$ASA \times Comply$	-0.024**	-0.022**	-0.012	-0.000		
	(0.012)	(0.011)	(0.011)	(0.010)		
$ASA \times \tau_{2008}$					-0.049***	-0.042***
					(0.016)	(0.015)
$ASA \times \tau_{2009}$					-0.015	-0.011
					(0.015)	(0.014)
$ASA \times \tau_{2010}$					0.002	0.018
					(0.017)	(0.016)
$ASA \times \tau_{2011}$					-0.009	0.008
					(0.021)	(0.019)
$ASA \times \tau_{2012}$					0.004	0.023
					(0.020)	(0.017)
$ASA \times \tau_{2013}$					0.025	0.039**
					(0.017)	(0.017)
Firm characteristics	No	Yes	No	Yes	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.024	0.135	0.018	0.122	0.022	0.127
N (firm-years)	6,968	6,968	11,228	11,228	11,228	11,228

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Table VI: Quota-induced changes in board characteristics

The table reports coefficient estimates from the following panel OLS regression for firm i in year t:

$$Y_{i,t} = \gamma_0 + \gamma_1 ASA_i * Comply_t + \gamma_2 \mathbf{X_{it}} + \theta_i + \tau_t + \epsilon_{it},$$

where θ_i and τ_t are firm and year fixed effects, respectively. The dependent variable Y_{it} is firm i's board CEO experience (columns 1-4), board size (columns 5-6), and board busyness (columns 7-8) in year t. Board large-firm CEO experience is the fraction of firm i's directors that are outside CEOs in $\text{ASA}_{j\neq i}$ or Large $\text{AS}_{j\neq i}$ (the top 1% by revenue) in year t, or were CEO in any ASA or Large AS at some point in the past three years. Board small-firm CEO experience includes directors' CEO experience in *any* AS, regardless of size. Board size is the number of shareholder-elected directors of firm i. Board busyness is the fraction of directors with at least three board seats in ASA and Large AS. $Comply_t = 1$ for years $t \geq 2008$, reflecting mandatory compliance by 12/2007, and zero otherwise. The vector $\mathbf{X}_{it}$ contains the following firm characteristics: *Firm age*, *Size*, *Leverage*, and *Largest owner*. All variables are defined in Table IV. A constant is included but not reported. The sample is 436 ASA (treated firms) and 1786 Large AS (control firms), 2001-2013. We exclude financial firms and Large AS registered as ASA at some point during the sample period, and require firms to have at least two observations. Standard errors clustered by firm are reported in parenthesis. Stars indicate significance levels: *** 1%, ** 5%, and * 10%.

	Board large-firm CEO experience		Board small-firm CEO experience		Board size		Board busyness	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
*ASA * Comply*	-0.009	-0.008	-0.051***	-0.051***	-0.150*	-0.101	-0.036***	-0.037***
	(0.011)	(0.011)	(0.016)	(0.016)	(0.082)	(0.082)	(0.014)	(0.014)
Firm age		-0.020**		-0.012		-0.013		-0.014
		(0.008)		(0.010)		(0.052)		(0.009)
Size		0.002		-0.001		0.065***		0.011***
		(0.003)		(0.004)		(0.017)		(0.004)
Leverage		-0.020		0.039**		-0.341***		-0.030
		(0.013)		(0.019)		(0.095)		(0.018)
Largest owner		0.003		-0.062***		-0.743***		0.038*
		(0.017)		(0.020)		(0.099)		(0.021)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.004	0.006	0.008	0.012	0.003	0.022	0.006	0.010
N (firm-years)	13,333	13,333	13,333	13,333	13,333	13,333	13,333	13,333

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Table VII: Determinants of the conversion likelihood for unlisted ASA

The table reports the coefficient estimates from the following logit regression for firm i in year t:

$$Convert_{it} = \alpha + \gamma_1 Shortfall_{it} + \gamma_2 \mathbf{X}_{it} + \kappa_i + \tau_t + \epsilon_{it},$$

where κ_i and τ_t are, respectively, industry and year fixed effects. The dependent variable, $Convert_{it}$, takes the value of one if the firm converts to AS in the next year, and zero otherwise. Firms drop out of the sample when they convert. The explanatory variables are *Shortfall* (columns 1-2) or $Shortfall_{Number}$ (columns 3-4), the control variables in $\mathbf{X}_{it}$ (*Board size*, *Board CEO experience*, *Firm age*, *ROA*, *Total assets*, *Leverage*, and *Largest owner*), industry fixed effects, and a constant (unreported). Year-fixed effects are included in odd-numbered columns only. All variables are defined in Table IV. The sample is 264 non-financial unlisted ASA, 2001-2008, of which 150 convert and 114 do not convert to AS in the period 2002-2009. We exclude firms that exit the ASA legal form due to M&A and bankruptcy (listed in column (3) of Table **??**). Standard errors clustered by firm are reported in parenthesis. Significance levels: *** 1%, ** 5%, and * 10%.

	Dependent variable: $Convert_{it}$			
Regressors	(1)	(2)	(3)	(4)
Shortfall	0.905	0.716		
	(0.759)	(0.551)		
$Shortfall_{Number}$			0.114	0.088
			(0.160)	(0.120)
Board size	0.063	0.043	0.034	0.024
	(0.082)	(0.078)	(0.101)	(0.094)
Board CEO experience	0.511	0.492	0.525	0.522
	(0.654)	(0.602)	(0.655)	(0.602)
Firm age	0.078	0.089	0.079	0.093
	(0.104)	(0.099)	(0.103)	(0.099)
ROA	–0.544*	–0.397	–0.545*	–0.395
	(0.282)	(0.276)	(0.283)	(0.277)
Total assets	–0.146**	–0.134**	–0.145**	–0.137**
	(0.062)	(0.057)	(0.061)	(0.057)
Leverage	0.490	0.379	0.505*	0.391
	(0.304)	(0.282)	(0.302)	(0.281)
Largest owner	1.605***	1.536***	1.542***	1.491***
	(0.377)	(0.350)	(0.369)	(0.347)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Pseudo R^2	0.088	0.058	0.087	0.057
Firm-years	880	880	880	880

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