DOES MANDATORY BOARD GENDER-BALANCING REDUCE FIRM VALUE?*

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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 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 per-

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[1] Renee B. Adams & Daniel Ferreira, *Women in the Boardroom and Their Impact on Governance and Performance*, 94 J. Fin. Econ. 291, 301 (2009).

[2] *See, e.g.*, Rachel Croson & Uri Gneezy, *Gender Differences in Preferences*, 47 J. Econ. Literature 448, 448 (2009); Renée B. Adams & Patricia Funk, *Beyond the Glass Ceiling: Does Gender Matter?*, 58 Mgmt. Sci. 219, 220 (2012); Vathunyoo Sila et al., *Women on Board: Does Boardroom Gender Diversity Affect Firm Risk?*, 36 J. Corp. Fin. 26, 29 (2016).

[3] *See* Sumit Agarwal et al., *Playing the Boys Game: Golf Buddies and Board Diversity*, 106 Am. Econ. Rev. 272, 275 (2016).

[4] See, for example, Michael C. Jensen, *The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems*, 48 J. Fin. 831, 866 (1993); James S. Linck, Jeffry M. Netter & Tina Yang, *The Determinants of Board Structure*, 87 J. Fin. Econ. 308, 326 (2008); Ran Duchin et al., *When Are Outside Directors Effective?*, 96 J. Fin. Econ. 195, 197 (2010); and Ronald W. Masulis & Shawn Mobbs, *Are All Inside Directors the Same? Evidence from the External Directorship Market*, 66 J. Fin. 823, 824–25 (2011), for discussions of the role of director independence.

[5] *See* Daehyun Kim & Laura T. Starks, *Gender Diversity on Corporate Boards: Do Women Contribute Unique Skills?*, 106 Am. Econ. Rev. 267, 270 (2016).

[6] *See* B. Espen Eckbo et al., *Valuation Effects of Norway's Board Gender-Quota Law Revisited*, Mgmt. Sci., Aug. 2021, at 1, 1–2.

[7] The 2021 Nobel Prize in Economics was awarded to three scholars who helped develop the use of quasi-experiments (which include legislative shocks) as perhaps the most important econometric tool available to the social sciences. *See* Press Release, The Prize in Economic Sciences 2021, The Royal Swedish Acad. of Scis. (Oct. 11, 2021).

formance 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 the Nasdaq Stock Market's listing standard requiring firms to disclose diversity information about their boards (gender, race, and LGBTQ+).[10] This paper helps clarify the 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 firm value

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[8] The Norwegian government white paper lays out the political process leading to the quota law. *See* Ot.prp. nr. 97 (2002–2003) (Nor.); Om lov om endringer i lov 13. juni 1997 nr. 44 om aksjeselskaper, lov 13. juni 1997 nr. 45 om allmennaksjeselskaper og i enkelte andre lover (likestilling i styrer i statsaksjeselskaper, statsforetak, allmennaksjeselskaper mv.) [On the Act Amending Act no. 44 of 13 June 1997 on Public Limited Companies, Act no. 45 of 13 June 1997 on Public Limited Companies and in Certain Other Acts (Equality in Boards of Directors of Public Limited Companies, State-Owned Enterprises, Public Limited Companies, etc.)].

[9] Since Norway's quota 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 others with lower requirements, and none with Norway's ultimate penalty of forced liquidation for non-compliance. For further details on the European board gender quotas, see, for example, Moez Bennouri, Chiara De Amicis & Sonia Falconieri, Women on Board: Gender Balance Initiatives and Their Impact on Board Structure and Firm Performance (unpublished manuscript) (Mar. 4, 2022), https://ssrn.com/abstract=4009820. Recently, the European Commission has revived earlier attempts to impose an EU-wide directive requiring board gender balancing. Rosamund Shreeves et al., *Gender balance on boards*, LEGIS. TRAIN SCHEDULE (May 20, 2022), https://www.europarl.europa.eu/legislative-train/theme-area-of-justice-and-fundamental-rights/file-gender-balance-on-boards.

[10] *See* Order Approving Proposed Rule Changes, as Modified by Amendments No. 1, to Adopt Listing Rules Related to Board Diversity and to Offer Certain Listed Companies Access to a Complimentary Board Recruiting Service, 86 Fed. Reg. 44,424 (Aug. 12, 2021).

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. While the Superior Court of California for Los Angeles County has recently ruled the law unconstitutional,[12] we point to econometric issues when it comes to attributing firm performance to SB 826.

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.[13]

The quota law applies to Norwegian public limited companies (*Allmennaksjeselskap*, hereinafter ASA), with private limited companies (*Aksjselskap*, hereinafter AS) being exempted.[14] 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).

Figure 1 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 1 also shows that the aver-

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[11] *See* Eckbo et al., *supra* note 6, at 20-21.

[12] *California's Gender Diversity Board Mandate Struck Down in Court,* Fin. Times (May 17, 2022), https://on.ft.com/3lz6K8t.

[13] Directors are appointed for a term of two years. Lov om allmennaksjeselskaper [Public Limited Liabilities Companies Act] § 6.6(1) (Act No. 45 of 13 June 1997) (Nor.). Hence, the two-year compliance period covered a typical election cycle. Prior to 2010, the CEO could be a director of a Norwegian public limited company. *Id.* § 6.1(3) (2007).

[14] 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). Lov om allmennaksjeselskaper [Public Limited Liabilities Companies Act] § 6.4(2) (Act No. 45 of 13 June 1997) (Nor.). Norway's gender quota applies to the shareholder-elected directors only. *Id.* § 6.11a(2).

age 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.

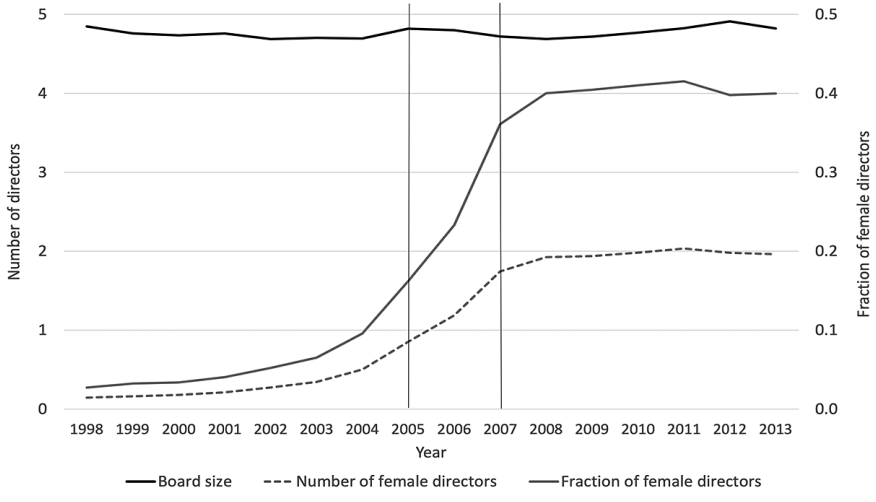

Figure 1. Norwegian ASA board size and proportion of female directors, 1998–2013. The figure shows the average board size (left axis), defined as the number of shareholder-elected directors, and the number (left axis) and fraction (right axis) of female directors. The two vertical lines bracket the two-year quota compliance period (December 2005–December 2007). The sample is 1,150 Norwegian ASA, 1998–2013.[15]

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 that 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 that satisfied the quota requirement prior to the imposition of the quota.

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.[16] As is the convention in event studies, to maximize test power, we estimate abnormal stock returns over the

[15] Eckbo et al., *supra* note 6, at 6 fig.1 (citing BRØNNØYSUND REG. CTR. (April 2016), https://www.brreg.no/en/).

[16] *See generally id.* at 1 for abnormal stock-return estimates reported in this section. 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). *Id.* These additional news events do not, however, alter the main conclusion based on the February 22, 2002, event and are therefore not discussed here.

two-day event window (-1,0), which ends with the public announcement date (event day 0).[17] 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 is relevant for several corporations simultaneously, stock prices of different firms typically 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:

$$r_{pt}^{e} = \alpha_p + \beta_p r_{wt}^{e} + AR_p d_t + \varepsilon_{pt} \quad (1)$$

Here, r_{pt}^{e} 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 variable for the event window (-1,0), and r_{wt}^{e} is the daily excess return on the Morgan Stanley Capital International (MSCI) stock market world index.[18]

In Column (2) of Table 1, 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 versus the short portfolio.

In Table 1, the p-values in brackets measure the probability that the reported averages $CAR(-1,0)$ 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

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[17] 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. See, e.g., S.P. Kothari and Jerold B. Warner, *Econometrics of Event Studies*, in B. Espen Eckbo (ed.), HANDBOOK OF CORPORATE FINANCE: EMPIRICAL CORPORATE FINANCE VOLUME 1, Elsevier/North-Holland Handbook of Finance Series, Ch. 1, 3-36 (2007).

[18] 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 et al., *supra* note 6, at 11–12 for further data details.

p-values shown in all of the columns in Table 1 uniformly fail to reject this null hypothesis. In sum, the average abnormal return estimates in Table 1, which account for the contemporaneous cross-correlation of stock returns, all fail to reject the null hypothesis of a zero two-day market reaction to the gender-quota news announcement on February 22, 2002.[19]

TABLE 1. ABNORMAL RETURNS TO PORTFOLIOS OF OSE-LISTED FIRMS ON THE KEY QUOTA EVENT DATE.

Event date February 22, 2022	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	

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

$$r_{pt}^{e} = \alpha_p + \beta_p r_{wt}^{e} + AR_p d_t + \varepsilon_{pt}$$

where r_{pt}^{e} is the daily equal-weighted return (converted to USD using the daily exchange rate) in excess of the daily three-month U.S. Treasury bill, d_t is a dummy variable for the event window (-1,0), and r_{wt}^{e} 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 and 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*.[20] Significance levels are *** 1%, ** 5%, * 10%.

B. Correcting a Prior Event Study

In contrast to our conclusion above, a prior event study (hereinafter referred to as AD) concludes that the market reaction to the quota-related announcement on February 22, 2002, is negative and statistically significant.[21] 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 nec-

[19] As reported by *id.* at 12, this conclusion also holds with an alternative three-day event window (-1,1) and irrespective of alternative risk adjustment. Moreover, in that paper, we 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 variable indicating that quota-induced female directors 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).

[20] https://www.brreg.no/en/ (last visited May 31, 2022).

[21] *Id.* at 12.

essary because the quota news hits all firms on the same day, brings AD's conclusion back in line with our own.[22]

To see why, note first that, for each sample firm i, AD computes the following five-day abnormal stock return, where day 0 is February 22, 2002:

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

Here, r_i is firm i's realized stock return on event day τ and $r_{i,match}$ is the equal-weighted average realized stock return to U.S.-listed companies in firm i's Global Industry Classification Standard (GICS) industry. In Table 2, we use AD's definition of abnormal return in Equation (2) and apply it to their sample of firms.[23] We form a portfolio of AD's sample and estimate the following timeseries regression to obtain the correct standard error of the daily abnormal return AR_p within the five-day window:

$$r_{pt}^{-I} = \alpha_p + AR_p d_t + \epsilon_{pt} \quad (3)$$

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[22] Kenneth R. Ahern & Amy K. Dittmar, *The Changing of the Boards: The Impact on Firm Valuation of Mandated Female Board Representation*, 127 Q. J. Econ. 137, 137 (2012). AD concludes that Norway's gender quota "caused a significant drop in the stock price at the announcement of the law." *Id.* This conclusion received substantial attention in the financial press at the time. For example, *The Financial Times* published that "[Norway's quota caused] a large decline in [market value] . . . over the following years," Valeria Criscione, *Norway Eyes Female Boardroom Quota*, Fin. Times (Aug. 19, 2011), https://www.ft.com/content/250a33d8-c982-11e0-9eb8-00144feabdc0 [https://perma.cc/ZW25-NQDK], 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," Editorial, *The Wrong Way to Promote Women*, The Economist (July 21, 2011), https://www.economist.com/leaders/2011/07/21/the-wrong-way-to-promote-women [https://perma.cc/FCA6-SQ3D]. Also, *The Wall Street Journal* published that "[the quota law] damaged shareholder value in the companies affected," Yasmine Chinwala, *Women in Finance Are Cold on Quotas*, Wall St. J. (June 11, 2012), https://www.wsj.com/articles/SB10001424052702303768104577458210879222988 [https://perma.cc/NJ9U-ZBDU]. These newspaper quotes also reflect AD's estimate of a large (20%!) drop in Tobin's Q. However, we show in Eckbo et al., *supra* note 6, at 15–17, that their instrumentation of the cross-sectional variation in the impact of the quota law on firm value is invalid.

[23] 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.

where the dependent variable, $r_{pt}^{-I} \equiv \frac{1}{N}\sum_{i=1}^{N}\left(r_i - r_{i,match}\right)_t$ is the equal-weighted portfolio of the daily abnormal returns using AD's definition in Equation (2). The dummy variable d_t takes a value of one during AD's five-day event window (-2,2) and zero otherwise.[24] Panel A of Table 2 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.

TABLE 2. ADJUSTING AD'S EVENT STUDY FOR CONTEMPORANEOUS CROSS-CORRELATION OF RETURNS.

		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	-.0231	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. OCE 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	

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 1 above). We estimate a time-series regression of the model:

[24] Table 2 is Table 5 in Eckbo et al., *supra* note 6, at 11. 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 2 are collected by us. We also required at least one return observation within the five-day (-2,2) window, which reduces AD's original sample from 94 to 79 firms. In *id.* at 10, we show that this sample reduction does not affect our main conclusion.

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

The dependent variable $r_{pt}^{-I} \equiv \frac{1}{N}\sum_{i=1}^{N}\left(r_i - r_{i,match}\right)_t$ 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 variable 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 brackets) 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 has a one-day return in Compustat Global on a given day in the event window. The board data is from *Brønnøysund Register Centre*.[25] 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%.[26]

In Panel B of Table 2, 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 1% level, while the other three days in AD's five-day event window—AR(-2), AR(-1), and AR(2)—all remain insignificant.[27] 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.[28] 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 based on the market reaction to the quota announcement in February, 2002, implies a statistically insignificant valuation effect of the quota—also when using AD's definition of abnormal returns.

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

[25] 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 $5AR_p$.

[26] *Supra* note 20

[27] *Id.* at 11.

[28] *Id.* at 10–11.

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:

$$r_{pt}^{e} = \alpha_p + \beta_{p1} r_{wt}^{e} + \beta_{p2} HML_t + \beta_{p3} SMB_t + \varepsilon_{pt} \quad (4)$$

where the regression period is from February 2002 through April 2008 and r_{pt}^{e} 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 three-month U.S. Treasury bill. r_{wt}^{e} is the monthly return on the MSCI world stock market index in excess of the current month's three-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.[29]

Table 3 shows α_p estimates for three alternative equal-weighted portfolios. In Columns (1)–(3), the return-generating process is from Equation (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 Norway's forced board gender balancing.

[29] See *id.* at 9, for further details of this reversal announcement event, which AD does not mention in their analysis.

TABLE 3. LONG-RUN ABNORMAL PERFORMANCE OF PORTFOLIOS CLASSIFIED BY FEMALE REPRESENTATION.

	$Zero_{2001}$ 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)
We	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

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:

$$r_{pt}^{e} = \alpha_p + \beta_{p1} r_{wt}^{e} + \beta_{p2} HML_t + \beta_{p3} SMB_t + \varepsilon_{pt}$$

where the regression period is from February 2002 through April 2008, r_{pt}^{e} 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 three-month U.S. Treasury bill. r_{wt}^{e} is the monthly return on the MSCI world stock market index in excess of the current month's three-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 parentheses and significance levels are indicated by *** 1%, ** 5%, * 10%.[30]

D. Long-Run Operating Profitability

In this section, we switch the performance analysis from abnormal stock returns to potential quota-induced changes in firms' cash flow. Since abnormal stock returns measure the present value of expected cash flow changes to shareholders, the above evidence of statistically insignificant short- and long-run abnormal performance suggests that one should also find insignificant post-quota cash flow changes in the data. However, the connection between the abnormal stock return and cash flow changes is not one-to-

[30] *See generally* Eugene F. Fama & Kenneth R. French, *Common Risk Factors in the Returns on Stocks and Bonds*, 33 J. FIN. ECON. 3 (1993) for the definitions of the two risk factors *HML* and *SMB*.

one. Moreover, a prior study concludes that the Norwegian quota caused a decline in operating performance.[31] Hence, we show in this section our results from a cash-flow analysis.

If the quota were to significantly reduce board effectiveness, ASA would be expected to experience a post-compliance decline in operating profitability. To examine this hypothesis, we estimate the difference-in-difference regression shown in Equation (5) below. The difference is between the performance of ASA (treated firms, as they were regulated by the gender quota) and Large AS (control firms, as they were 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:

$$ROA_{it} = \gamma_o + \gamma_1 ASA_i * Comply_t + \gamma_2 \boldsymbol{X_{it}} + \theta_i + \tau_t + \varepsilon_{it} \quad (5)$$

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 year-end 2007, and zero otherwise. The vector X_{it} contains control variables, including firm i's age, size, and leverage, the percent ownership by the largest owner, board size, CEO experience, and busyness. All variables are defined in Table 7 available in the Appendix. 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.[32]

The results are shown in Table 4. 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.

Columns (1) and (2) address the prior study's claim that the Norwegian quota caused a negative effect on firms' operating performance.[33] As in the prior study, Columns (1) and (2) 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. Hence, one cannot confidently conclude that Norway's board gender

[31] Eckbo et al., *supra* note 6, at 15.

[32] David A. Matsa & Amalia R. Miller, *A Female Style in Corporate Leadership? Evidence from Quotas*, 5 Am. Econ. J.: Applied Econ. 136, 165–66 (2013).

[33] For details on the sample selection, see Eckbo et al., *supra* note 6, at 19.

quota affected firm profitability, corroborating our conclusion above of a value-neutral effect.[34]

TABLE 4. QUOTA-INDUCED CHANGES IN OPERATING PERFORMANCE.

	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
$R2$	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

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

$$ROA_{it} = \gamma_o + \gamma_1 ASA_i \times Comply_t + \gamma_2 \boldsymbol{X_{it}} + \theta_i + \tau_t + \varepsilon_{it}$$

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 $t = 2008$ 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 7. In Columns (5) and (6), the model is:

$$ROA_{it} = \gamma_0 + ASA \sum_{2008}^{2013} \gamma_t \tau_t + \gamma_2 \mathbf{X}_{it} + \theta_i + \tau_t + \epsilon_{it}$$

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 in both the treatment group and control group). The estimation period is 2003–2009 in Columns

[34] Matsa & Miller, *supra* note 31.

(1)–(2) and 2003–2013 in Columns (3)–(6). Standard errors clustered by firm are reported in parentheses. Stars indicate significance levels: *** 1%, ** 5%, and * 10%.[35]

II. Norway's quota law and board effectiveness

The evidence above suggests that the quota-induced board changes had no statistically significant effect on firm value or operating profitability. In this section, we examine whether measures of changes in board effectiveness corroborate this conclusion. This examination is of interest because any valuation effect of a board quota must be predicated on an assumption that board effectiveness affects firm value. Hence, we document changes in board characteristics that may be relevant to board effectiveness.

Extant studies have shown that the female directors appointed to these boards post-quota were slightly younger than the male directors[36] and observably more qualified than their predecessors along several dimensions (including labor market income), and that the gender gap in earnings within boards fell substantially.[37] Below, 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.

A. Board CEO Experience

Director CEO experience is generally viewed as central for board effectiveness and, therefore, valuable to investors.[38] 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 U.S. shows that the stock market reacts positively when the first outside CEO is appointed to the board (compared to other

[35] Commenting on our evidence of a negative ROA in year 2008 (Columns (5) and (6) of Table V), Amalia R. Miller, *Women and Leadership*, *in* The Oxford Handbook of Women and the Economy 539, 547 (Susan L. Averett, Laura M. Argys & Saul D. Hoffman eds. 2018), suggests a possible labor cost channel: "[the short-term negative effect on ROA documented by Eckbo et al., *supra* note 6, at 18–19] 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."

[36] Eckbo et al., *supra* note 6, at 18.

[37] Ahern & Dittmar, *supra* note 21.

[38] *See* 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*, 86 Rev. Econ. Stud. 191, 228 (2019).

outside directors), while there is no similar reaction when the second or third outside CEO is appointed to the board.[39] 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 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; 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*.[40] 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 directors with *Large-firm CEO experience*, averages 17% in listed ASA, 15% in unlisted ASA, and 14% in Large AS.[41] 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 2 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 has 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

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[39] For evidence on the value of CEO experience to directors, see, e.g., Eliezer M. Fich, *Are Some Outside Directors Better than Others? Evidence from Director Appointments by Fortune 1,000 Firms*, 78 J. Bus. 1943, 1943–46 (2005); Rudiger Fahlenbrach, Angie Low & Rene M. Stulz, *Why do Firms Appoint CEOs as Outside Directors?*, 97 J. Fin. Econ. 12–14 (2010); and Shinwoo Kang, E. Han Kim & Yao Lu, *Does Independent Directors' CEO Experience Matter?*, 22 Rev. Fin. 905, 905 (2018).

[40] Fahlenbrach, Low & Stulz, *supra* note 38, at 23.

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

effort to retain male directors with such experience. This retention attenuates the impact of the increasing number of female directors on the board-level large-firm CEO experience.

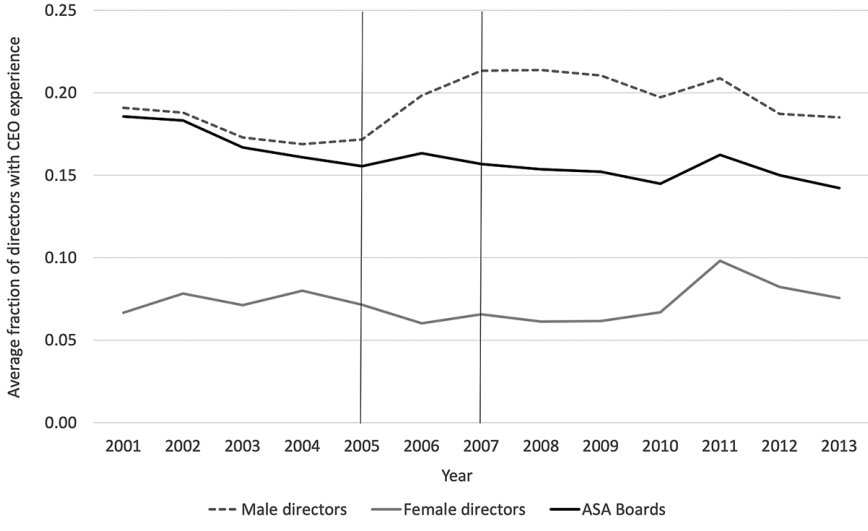

Figure 2. Large-firm CEO experience of ASA directors and boards, 2001–2013.

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 or she is an outside CEO in an $ASA_{j \neq i}$ or Large AS (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 4,604 male and 1,395 female directors of 997 ASA, 2001–2013.[42]

In Table 5, we use Equation 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 board-level 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

[42] *But see Id.* at 24 (reporting that 10% of outside directors in listed U.S. firms are current outside CEOs).

were able to maintain the overall level of director large-firm CEO experience while gender balancing their boards.

Turning to board-level small-firm CEO experience, the regressions in Columns (3) and (4) of Table 5 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.[43]

Since directors' CEO experience from large firms is almost 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. Hence, this evidence further corroborates our conclusion of a value-neutral effect of Norway's board gender quota.

TABLE 5: QUOTA-INDUCED CHANGES IN BOARD CHARACTERISTICS.

	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
R2	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

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

$$Y_{i,t} = \gamma_o + \gamma_1 ASA_i \times \gamma_2 \mathbf{X}_{it} + \theta_i + \tau_t + \varepsilon_{it}$$

where θ_i and τ_i 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 $ASA_{j\neq i}$ or Large $AS_{j\neq i}$ (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

[43] BRØNNØYSUND REG. CTR., *supra* note 20.

directors with at least three board seats in ASA and Large AS. $Comply_t = 1$ for years $t \geq 2008$, reflecting mandatory compliance by December 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 7. A constant is included but not reported. The sample is 436 ASA (treated firms) and 1,786 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 parentheses. Stars indicate significance levels: *** 1%, ** 5%, and * 10%.

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 directors—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 1 above.

Columns (5) and (6) of Table 5 formally test whether the quota caused a change in the average board size of listed and unlisted ASA relative to Large AS, using the difference-in-difference framework in Equation (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 directors is lower than the cost of adding additional directors to the board.

To gain a deeper understanding of the board-size dynamics, Panel C of Figure 3 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 board members.[44] In 2001, 37% of the sample firms had boards with four or six directors, which dropped to 19% in 2008. Over the same period, the sample proportion of five-member boards increased

[44] Ahern & Dittmar, *supra* note 21, at 153. AD's definition is based on director biographies in company annual reports and includes "work experience as CEO or owner. *Id.* at 190. In their sample, 66% of male directors and 40% of female directors have CEO experience. *Id.* Online app. tbl.II. These figures are close to the small-firm CEO experience in our sample.

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 the 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. 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.[45] 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.[46] If qualified women are in short supply, many firms may recruit the same women, and the female director seat concentration should increase. Panels A and B of Figure 3 plot 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 or she holds three or more board seats[47] on ASA and Large AS boards. The last three bars in Panels A and B of Figure 3 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.

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[45] A non-parametric Kolmogorov-Smirnov test shows that the distributions from 2001 and 2008 are significantly different at the 5%-level. Frank J. Massey Jr., *The Kolmogorov-Smirnov Test for Goodness of Fit*, 46 J. Am. Statistical Assoc. 68, 68–78 (1951).

[46] Eugene F. Fama & Michael C. Jensen, *Separation of Ownership and Control*, 26 J.L. & Econ. 301, 321–23 (1983); Stephen P. Ferris, Murali Jagannathan & A.C. Pritchard, *Too Busy to Mind the Business? Monitoring by Directors with Multiple Board Appointments*, 58 J. Fin. 1087, 1109–10 (2003); Ronald W. Masulis & Shawn Mobbs, *Are All Inside Directors the Same? Evidence from the External Directorship Market*, 66 J. Fin. 823, 865–66 (2011); Laura Field, Michelle Lowry & Anahit Mkrtchyan, *Are Busy Boards Detrimental?*, 109 J. Fin. Econ. 63, 81 (2013).

[47] John E. Core, Robert W. Holthausen & David F. Larcker, *Corporate Governance, Chief Executive Officer Compensation, and Firm Performance*, 51 J. Fin. Econ. 371, 383 (1999); Anil Shivdasani & David Yermack, *CEO Involvement in the Selection of New Board Members: An Empirical Analysis*, 54 J. Fin. 1829, 1846–47 (1999); Eliezer M. Fich & Anil Shivdasani, *Are Busy Boards Effective Monitors?*, 61 J. Fin. 689, 721–22 (2006); Antonio Falato, Dalida Kadyrzhanova & Ugur Lel, *Distracted Directors: Does Board Busyness Hurt Shareholder Value?*, 113 J. Fin. Econ. 404, 423 (2014); Roie Hauser, *Busy Directors and Firm Performance: Evidence from Mergers*, 128 J. Fin. Econ. 16, 34–35 (2018).

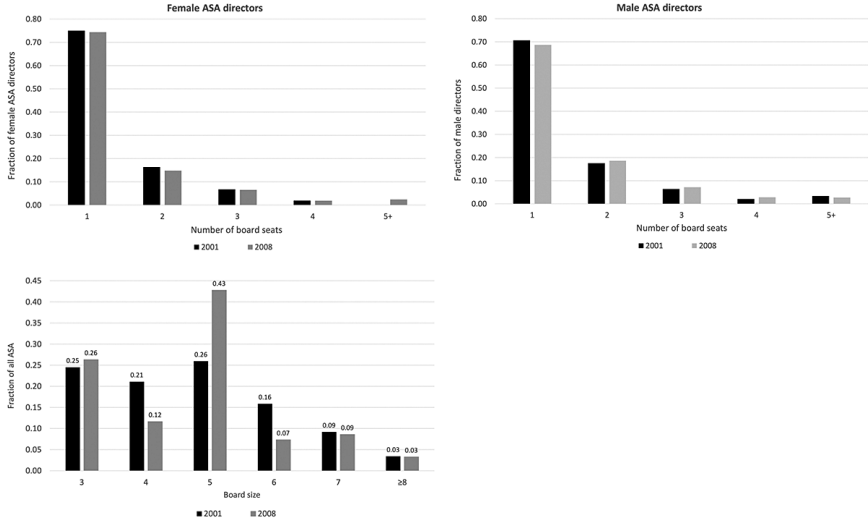

Figure 3. Frequency distribution of female (Panel A, top-left) and male (Panel B, top-right) directors on ASA boards and the frequency distribution of ASA board size (Panel C, bottom-left), 2001 and 2008.

Panel C shows the frequency distribution of board size. Panels A and B plot 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 (1,938 male directors and 104 female directors) in 2001 and 395 ASA (919 male directors and 581 female directors) in 2008.[48]

Columns (7) and (8) of Table 5 show the results of formal tests for changes in board busyness using our difference-in-difference 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.

C. ASA-to-AS Legal Conversions

The above analysis explores ways in which firms adjusted their boards in response to the quota and whether these changes affected firm market values. In this section, we simply 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 this analysis, it is important to keep in mind that a firm converting from ASA to AS rarely dis-

[48] Fich & Shivdasani, *supra* note 46, at 695; Field et al., *supra* note 45, at 66.

closes 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 shares on the 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.[49]

Beyond the ability to go public, there are few differences between ASA and AS of a certain size.[50] For example, the protection of creditors is largely identical, and a substantial fraction of the bonds traded on the OSE are issued by AS. Moreover, AS can issue equity in private placements and let their shares trade over the counter. 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)[51] and potentially very costly to shareholders (the loss of stock-market liquidity). Panel A of Figure 4 plots the total number of listed ASA over time and the number of exits and entries in each year.[52] As shown, the number of listed ASA reaches a peak of 195 in 2007 but is otherwise relatively

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[49] Eckbo et al., *supra* note 6, at 7 fig.2 (citing BRØNNØYSUND REG. CTR., *supra* note 20).

[50] For reviews of Norwegian corporate and securities laws, see, for example, GEIR WOXHOLTH, SELSKAPSRETT: OPPGAVESAMLING [COMPANY LAW: COLLECTION OF TOPICS] (2014), ASLE AARBAKKE ET AL., AKSJELOVEN OG ALLMENNAKSJELOVEN: LOVKOMMENTAR [THE NORWEGIAN COMPANIES ACT AND THE PUBLIC LIMITED LIABILITY COMPANIES ACT: LEGISLATIVE COMMENTARY] (4th ed. 2017), and MADS HENRY ANDENAES ET AL., AKSJESELSKAPER OG ALLMENNAKSJESELSKAPER [LIMITED COMPANIES AND PUBLIC LIMITED COMPANIES] (2017).

[51] AS with a share capital below 3,000,000 NOK (approximately 400,000 USD) and fewer than twenty shareholders have fewer requirements related to the board of directors and the general meeting. *See generally* Lov om aksjeselskaper [The Private Limited Companies Act] (Act. No. 45 of June 13, 1997).

[52] In 2015, OSE denied IT company Evry ASA's application to delist after a private equity fund had acquired 88% of the firm's stock and wanted to take the company private. OSLO BØRS ASA, EVRY ASA – DECISION TO REFUSE EVRY'S APPLICATION FOR DELISTING FROM OSLO BØRS (2015), https://www.euronext.com/sites/default/files/2020-09/2015-06-15%20EVRY%20ASA%20–%20decision%20to%20refuse%20EVRY's%20application%20for%20delisting%20from%20Oslo%20Børs.pdf.

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 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 hypothesis 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.

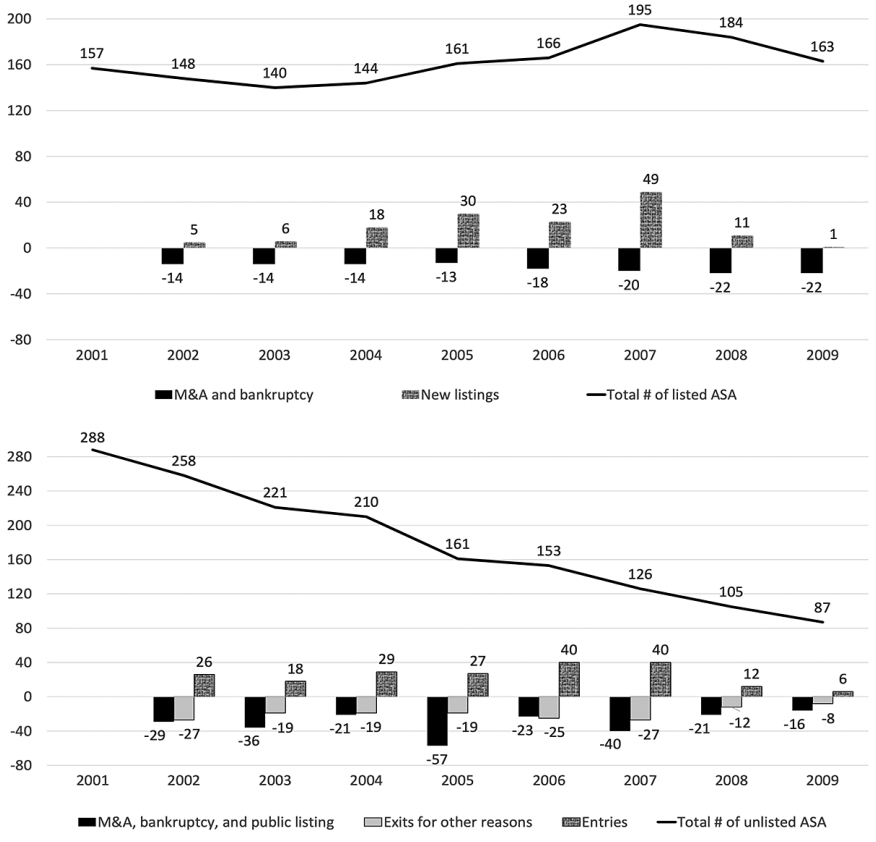

Figure 4. Total number and exits and entries of listed (Panel A, top) and unlisted (Panel B, bottom) ASA by year.

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 firms 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.[53]

Table 6 reports the results of estimating the following logit model

$$Convert_{it} = \alpha + \gamma_1 Shortfall_{it} + \gamma_2 \mathbf{X}_{it} + k_i + \tau_t + \varepsilon_{it} \quad (6)$$

where k_i and τ_t are, respectively, industry and year fixed effects, and the vector $\mathbf{X}_{it}$ contains six firm characteristics, including operating profitability.

[53] The information on domestic M&A and bankruptcy is obtained from BRØNNØYSUND REG. CTR., *supra* note 20, while we hand-collected information on cross-border acquisitions of listed ASA through news articles and press releases from *Editorial Suite*, RETRIEVER, https://www.retrievergroup.com/editorial-suite (last visited May 30, 2022), and *Oslo Børs*, EURONEXT: LIVE MKTS., https://live.euronext.com/en/markets/oslo (last visited May 30, 2022). The sample excludes financial firms, which were required to be ASA until 2007.

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 1, 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.

In Columns (1) and (2) of Table 6, 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.[54]

[54] Eckbo et al., *supra* note 6, at 20 fig.3 (citing BRØNNØYSUND REG. CTR., *supra* note 20). Data further complemented with manual searches of press releases and news for acquisitions by foreign firms.

TABLE 6: DETERMINANTS OF THE CONVERSION LIKELIHOOD FOR UNLISTED ASA.

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

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

$$Convert_{it} = \alpha + \gamma_1 Shortfall_{it} + \gamma_2 \mathbf{X}_{it} + k_i + \tau_t + \varepsilon_{it}$$

where k_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 7. 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 (Column (3)). Standard errors clustered by firm are reported in parentheses. Significance levels: *** 1%, ** 5%, and * 10%.

III. Valuation 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 U.S. 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.[55] The quota covered 12% of all public U.S. firms, with a combined market capitalization over five trillion USD.[56] 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.[57] While the Superior Court of California for Los Angeles County has recently ruled SB 826 unconstitutional,[58] we comment in this section on several econometric issues raised by the recent claim of a significant negative valuation impact of this law.[59]

An estimate of the valuation effect of the announcement of a regulatory event, such as our CAR estimates above, is a function of two factors: the announcement-induced change in the probability of the event occurring, Δp, and the valuation effect conditional on the event, E[V], where $CAR = f(\Delta p \times E[V])$. Hence, the announcement must clearly identify Δp.[60] Moreover, the regulatory event itself must have a clear expected impact on firm value, E[V], which is limited by firms' costs of avoiding the regulation. As discussed below, these factors affect our interpretation of the recent claim that SB 826 have a significant negative valuation impact.[61]

During the 2018 legislative process, the likelihood of the quota increased on several distinct dates, of which the prior study concludes based solely on the very last date—the signing of SB 826 into law on Sunday, September 30. The next day (the first trading day after the announcement), the average stock price of California firms dropped by CAR $= -1.2\%$, corresponding to a sixty billion USD value loss.[62] 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%).[63] The stock market reaction was also more

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[55] Oyvind Bøhren & Siv Staubo, *Does Mandatory Gender Balance Work? Changing Organizational Form to Avoid Board Upheaval*, 28 J. Corp. Fin. 152, 159–65 (2014) conclude that the quota induced conversions from ASA to AS. However, this conclusion is based on a set of tests that fails to control for the time trend in boards' gender composition (which our tests account for). *See* Eckbo et al., *supra* note 6, at 3.

[56] Daniel Greene et al., *Do Board Gender Quotas Affect Firm Value? Evidence from California Senate Bill No. 826*, 60 J. Corp. Fin. 1, 1 (2020).

[57] *Id.* at 2.

[58] *Id.*

[59] Fin. Times, *supra* note 12.

[60] Greene et al. *supra* note 55, at 2.

[61] In this discussion, we ignore the fact that Δp is attenuated by market expectations that SB 826 might be struck down by the California Superior Court. This attenuation implies that the estimated $60 billion market-value loss, if true, is even larger.

[62] *Id.*

[63] *Supra* note 60.

negative for firms in industries with no female CEOs and few (below median) female directors.[64]

However, to clearly attribute this CAR to the quota, one must assume that the signing into law came as a surprise to investors (causing a significant Δp). Moreover, it must be assumed that no other important events occurred on Sunday or Monday that might confound the causal effect of SB 826. There are two problems with the attribution. First, the prospect of SB 826 had already been publicly debated for several months. For example, the quota was introduced in the California State Senate on January 3, passed by the California State Senate on May 31, and passed by the California State Assembly on August 29.[65] All of these events substantially increased the likelihood of a quota in the minds of investors. Second, over the same weekend, Governor Brown decided on as many as 183 bills,[66] some of which may have induced a negative market reaction. Importantly, the prior study finds no significant stock-market reaction on any of the quota-related event days prior to September 30.[67] This is surprising if the quota truly were expected to be costly for investors. Moreover, the Δp caused by the signing of SB 826 into law is almost certainly small (given all the earlier events) and it is reasonable to expect some of the other 182 bills to have caused a decline in firm value. For example, California's net neutrality law, SB 822, which caps the payment internet providers can charge for consumer access to the internet and which was opposed by many telecommunication companies.[68]

Furthermore, as to E[V], for the sixty billion USD loss in market value on Monday, October 1, to be reasonably attributed to SB 826, it must be lower than both a) the present value of the penalty for non-compliance and b) the cost of avoiding the quota altogether. As to a), the penalty for non-compliance is relatively low: The maximum fine is $100,000 in 2019 and $900,000 per year of non-compliance after 2021,[69] which has a present value far below $60 billion for the affected companies. Moreover, to comply, rather than replacing valuable male board members, shareholders have the option of adding female directors to the incumbent male-dominated boards. Hence, the quota costs are necessarily limited by the total costs of expanding board size (by up to three members). Finally, the principal office has no legal definition and is self-reported by the firm in its 10K filing. Hence, one way to escape a perceived costly quota constraint is to relocate the principal office out of California. In sum, we view it is highly unlikely that the California quota can cause much of a negative valuation effect. In any event, it is

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[64] *Id.* at 3.
[65] *Id.*
[66] *Id.*
[67] Felix von Meyerinck et al., *As California Goes, so Goes the Nation? Board Gender Quotas and Shareholders' Distaste of Government Interventions* (Eur. Corp. Governance Inst., Working Paper Series in Finance No. 785/2021, 2021).
[68] *Id.* at 7–8.
[69] *Id.* at 8.

not possible to single out SB 826 as the main cause of the negative market reaction that occurred on Monday, October 1, 2018.

Conclusion

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 U.S., 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.[70] Hence, our finding that Norway's forced board gender balancing has left firm values unaffected is important also for U.S. 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 the rising tide 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).[71]

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

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[70] *Id.* at 2.

[71] *See* Joel Seligman, *Framing the Issues: Board Diversity and Corporate Purpose*, 12 Harv. Bus. L. Rev. (forthcoming 2022).

Appendix

Table 7. Variable definitions.

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 ("*Allmennaksjeselskap*"), regulated by the quota.
AS	Private limited company ("*Aksjeselskap*"), not regulated by the quota.
Industry	Firms are allocated to ten different industry sectors: oil and offshore, telecom and technology, manufacturing, construction, wholesale and 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 variable indicating a *Shortfall* at or exceeding the median. In 2007, the median *Shortfall* is zero and we require *Shortfall* > 0.
Low shortfall	Dummy variable indicating a below-median *Shortfall*.
$Zero_{2001}$	Dummy variable equal to one if the firm has zero female directors in 2001.
Pos_{2001}	Dummy variable equal to one if the firm has at least one female director in 2001.
Comply	Dummy variable equal to one in years $t \geq 2008$ (reflecting quota compliance by December 2007).

The main data source is *Brønnøysund Register Centre*[72] and *Oslo Børsinformasjon*.[73] Ownership is complemented with data from the Norwegian tax authorities (2004–2013). Log refers to the natural logarithm.[74]

[72] *See* Milton Friedman, *The Social Responsibility of Business Is to Increase Its Profits*, N.Y. TIMES, Sept. 13, 1970, at 17 (underlining the differences between social responsibilities of individuals and of businesses); Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure*, 3 J. FIN. ECON. 305, 310–11 (1976); Eugene F. Fama & Michael C. Jensen, *Separation of Ownership and Control*, 26 J.L. & ECON. 301, 301–02 (1983); Eugene F. Fama & Michael C. Jensen, *Agency Problems and Residual Claims*, 26 J.L. & ECON. 327, 327–28 (1983) (elaborating on the view of the firm as a nexus of contracts).

[73] *Supra* note 20.

[74] (on file with the author).