Director informativeness following board gender-balancing: Evidence from insider trading
Internet Appendix

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A Section 2: Institutional setting and data

Figure IA.1: Number of board seats held by male and female directors in 2002 and 2008—across all ASA

The distribution of the number of directorships in all (not just listed) ASA held by individual male and female directors in years 2002 and 2008, respectively. Board data are from the national *Brønnøysund Registry Centre*, 1998-2016.

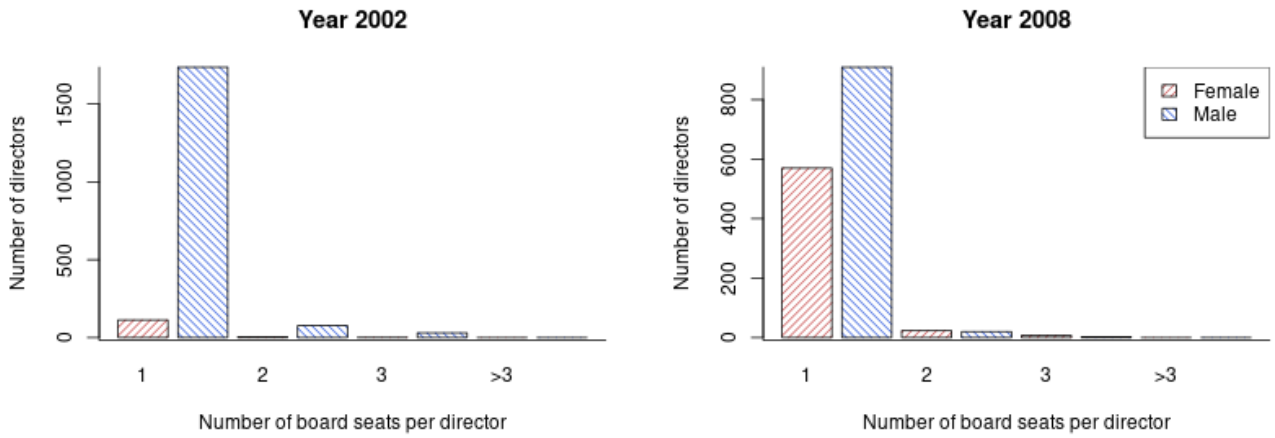

Table IA.1: Annual primary insider trades by gender and value, OSE 1997-2016

This table shows the annual distribution of the primary insider trades. Primary insiders are directors and executives. 100K means NOK 100.000. Data on insider trades and holdings are from OSE electronic records (`https://newsweb.oslobors.no/`).

	Primary Insider Purchases					**Primary Insider Sales**				
	Number of Transactions				% Female	Number of Transactions				% Female
Year	<100K	>100K	Female	Male	by value	<100K	>100K	Female	Male	by value
1997	353	488	60	781	0.43	281	111	20	372	0.20
1998	187	230	21	398	0.05	87	28	7	108	0.10
1999	477	554	60	977	0.78	270	105	18	357	0.28
2000	277	270	20	529	0.15	218	34	13	239	14.24
2001	227	221	18	431	3.25	154	54	6	202	2.22
2002	261	286	24	523	0.12	69	43	3	109	0.01
2003	159	196	18	338	1.38	120	63	6	177	0.05
2004	149	168	25	294	0.26	123	38	15	146	0.59
2005	163	143	32	278	2.49	156	32	16	174	0.10
2006	306	156	41	424	0.32	223	26	15	235	0.69
2007	429	213	104	539	0.37	145	13	13	146	2.49
2008	345	275	84	538	7.31	61	15	3	73	0.04
2009	520	643	205	971	6.49	104	33	17	120	0.35
2010	487	531	162	866	14.50	98	31	14	115	3.00
2011	508	425	139	797	4.76	65	26	10	81	21.79
2012	314	191	66	440	1.45	80	24	17	87	14.17
2013	349	198	68	479	1.46	97	32	19	110	14.79
2014	402	247	91	559	2.77	96	35	20	111	25.61
2015	338	284	102	521	10.35	53	26	13	66	4.23
2016	295	302	106	494	10.37	69	38	13	94	2.39
All	6546	6021	1446	11177	1.47	2569	807	258	3122	2.09

Table IA.2: Annual primary insider trades by gender and position, OSE 1997-2016

This table shows the annual distribution of the primary insider trades. Primary insiders are directors and executives. 100K means NOK 100.000. Data on insider trades and holdings are from OSE electronic records (`https://newsweb.oslobors.no/`).

	Primary Insider Purchases				**Primary Insider Sales**			
	Female		Male		Female		Male	
Year	Mgmt	Board	Mgmt	Board	Mgmt	Board	Mgmt	Board
1997	42	18	523	258	13	7	228	144
1998	20	1	244	154	7	0	70	38
1999	40	20	618	359	14	4	241	116
2000	16	4	329	200	7	6	159	80
2001	13	5	261	170	4	2	123	79
2002	14	10	307	216	1	2	61	48
2003	7	11	195	143	5	1	111	66
2004	10	15	213	81	8	7	87	59
2005	16	16	171	107	8	8	113	61
2006	23	18	226	198	11	4	145	90
2007	45	59	348	191	8	5	99	47
2008	40	44	382	156	2	1	54	19
2009	136	69	662	309	10	7	79	41
2010	102	60	607	259	12	2	78	37
2011	84	55	557	240	6	4	63	18
2012	33	33	289	151	8	9	67	20
2013	39	29	253	226	5	14	61	49
2014	44	47	331	228	11	9	56	55
2015	49	53	310	211	7	6	41	25
2016	55	51	306	188	9	4	57	37
All	828	618	7132	4045	156	102	1993	1129

B Section 3: Market-reaction to non-routine insider purchases

B.1 Gender differences in CAR

In the paper we show estimates for two subperiods, 1997-2007 and 2008-2016. Appendix Table IA.3 shows corresponding estimates for the whole period 1997-2008.

Table IA.3: Market reaction to insider purchases, 1997–2016

The table reports the cumulative abnormal abnormal stock return $CAR \equiv \tau\gamma$, where γ is the average daily abnormal return over τ days in event time centered on the day of insider purchases (day 0) and estimated using the following one-factor return-generating process for firm i:

$$r^e_{it} = a_i + b_i r^e_{mt} + \gamma D_{it} + \varepsilon_{it},$$

where r^e_{mt} is the return on the market portfolio in excess of the risk-free rate on day t, and D_{it} is a dummy variable that takes a value of one inside the event window and zero otherwise. There are four alternative event windows around day 0: days $(-1, 1)$, $(-1, 5)$, $(-1, 25)$, and $(-1, 50)$. The estimation in Panel A (Panel B) uses trades of primary female (male) insiders only. We remove routine trades as in Cohen, Malloy, and Pomorski (2012). Standard errors in brackets. Statistical significance is indicated by: *=p<0.1, **=p<0.05, ***=p<0.01. Data on insider trades and holdings are from OSE electronic records (`https://newsweb.oslobors.no/`).

	Event windows for the cumulative abnormal return			
	$CAR(-1,1)$	$CAR(-1,5)$	$CAR(-1,25)$	$CAR(-1,50)$
A: Female Insiders				
CAR	0.012***	0.012***	0.007	0.003
	(0.001)	(0.0008)	(0.0004)	(0.0003)
Observations	643,261	643,261	643,261	643,261
$\overline{R}^2$	0.030	0.030	0.030	0.030
B: Male Insiders				
CAR	0.014***	0.014***	0.003	−0.009
	(0.001)	(0.001)	(0.001)	(0.0004)
Observations	1,013,513	1,013,513	1,013,513	1,013,513
$\overline{R}^2$	0.005	0.005	0.005	0.005

B.2 The potential effect on CAR of other director characteristics

As discussed in the paper, we consider whether the main result in paper Table 3 depends on a number of director characteristics using cross-sectional regressions with CAR as dependent variable of the general form:

$$CAR_i(\tau_1, \tau_2) = a_i + b_1 \mathbf{Controls} + b_2 DirectorCharacteristic_i + \varepsilon_i.$$

Here $CAR_i(\tau_1, \tau_2)$ is the estimated cumulative abnormal return starting τ_1 days before and ending τ_2 days after the announcement. The vector of control variables (**Controls**) consists of the (log) market capitalization of the firm (*MktCap*) and the (log) size of the insider trade (*TradeValue*).

To perform these analysis it has been necessary to refine the insider sample to include only directors which can be matched with the company board lists. The total number of trades by identified board members in the period 1998–2016 is 2263.

The director characteristics we consider are

1. Director properties directly related to the regulation on gender balanced boards.
   (a) New female directors coming on board in 2006 or 2007 (incoming directors). We investigate their trades in the period after the board reform (2006–2016).
   (b) The directors *not* let go when the board needed space for the new female directors (retained directors). We investigate their trades in the period 2006–2016
   (c) The board members let go when the company needed space for the new female directors. For these we need to look at the performance of their trades in the period while they were still directors (1998–2005).
2. General properties of board members that may affect how the market view their trades
   (a) Experience – is the reaction to a director trade related to director tenure on the board?

In the paper we showed results for 1(a) entering female directors in the period 2006 to 2007, and for 2(a) director board tenure. The paper table reported results for $CAR(-1, 1)$ and $CAR(-1, 5)$. For completeness Table IA.4 reports corresponding estimates for $CAR(-1, 25)$ and $CAR(-1, 50)$).

Table IA.4: CAR regressions investigating director characteristics. Female directors entering 2006 and 2007, and Director tenure. $CAR(-1,25)$ and $CAR(-1,50)$.

This table supplements paper Table 4 which reported the same regressions with $CAR(-1,1)$ and $CAR(-1,5)$ as dependent variables. This table reports results using $CAR(-1,25)$ (columns 1-3) and $CAR(-1,50)$ (columns 4-6). The tables report cross-sectional regressions of the following form:

$$CAR_i(\tau_1,\tau_2) = a + b_1 MktCap_i + b_2 TradeValue_i + b_3 DirectorCharacteristic_i + \varepsilon_i,$$

Here $MktCap$ is the log of the market capitalization of the firm and $TradeValue$ is the log of the kroner amount of the trade. In Panel A $DirectorCharacteristic_i$ is an indicator variable equal to one if the director is female and (1) enter the board in 2006 *(Female director entering 2006)*, (2) enter the board in 2007: *Female director entering 2007)*, or (3) enter either of 2006 or 2007: *Female director entering 2006 or 2007)* The sample is all trades by identified directors in the period 2006-2016. In Panel B $DirectorCharacteristic_i$ is an indicator variable equal to one if the director entered the board (1) the same year *(First year on board)*, (2) One year earlier *(Second year on board)*, or (3) Two or more years earlier *(Three or more years on board)*. The sample is all trades by identified directors in the period 2000-2016.

	Event windows for the cumulative abnormal return					
	$CAR(-1,25)$			$CAR(-1,50)$		
A. Entering female directors						
(Intercept)	0.1903***	0.1905***	0.1903***	0.4576***	0.4604***	0.4573***
	(0.0569)	(0.0569)	(0.0569)	(0.1053)	(0.1052)	(0.1052)
MktCap	−0.0103***	−0.0103***	−0.0103***	−0.0216***	−0.0214***	−0.0213***
	(0.0027)	(0.0027)	(0.0027)	(0.0050)	(0.0050)	(0.0050)
TradeValue	0.0017	0.0017	0.0017	0.0002	−0.0002	−0.0002
	(0.0024)	(0.0024)	(0.0024)	(0.0045)	(0.0045)	(0.0045)
Female director entering 2006	−0.0028			−0.0258		
	(0.0345)			(0.0639)		
Female director entering 2007		−0.0040			−0.0704	
		(0.0249)			(0.0460)	
Female director entering 2006 or 2007			−0.0037			−0.0566
			(0.0205)			(0.0379)
Adj. R^2	0.0081	0.0081	0.0081	0.0118	0.0133	0.0132
Num. obs.	1457	1457	1457	1457	1457	1457
B. Board Tenure						
(Intercept)	0.2661***	0.2466***	0.2562***	0.5746***	0.5630***	0.5659***
	(0.0509)	(0.0512)	(0.0508)	(0.0886)	(0.0891)	(0.0883)
MktCap	−0.0143***	−0.0138***	−0.0144***	−0.0282***	−0.0279***	−0.0285***
	(0.0024)	(0.0024)	(0.0024)	(0.0042)	(0.0042)	(0.0042)
TradeValue	0.0025	0.0026	0.0026	0.0014	0.0015	0.0015
	(0.0022)	(0.0022)	(0.0022)	(0.0038)	(0.0038)	(0.0038)
First year on board	−0.0247***			−0.0250		
	(0.0095)			(0.0165)		
Second year on board		0.0121			0.0007	
		(0.0094)			(0.0164)	
Three or more years on board			0.0090			0.0177
			(0.0081)			(0.0141)
Adj. R^2	0.0187	0.0162	0.0160	0.0223	0.0212	0.0220
Num. obs.	1978	1978	1978	1978	1978	1978

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

1 (b) Directors in place before 2006 (Retained directors) It is of interest to compare the market reactions to trades by the new directors with those of directors that were *not* let go to make room for the new female directors (retained directors). To that end we add indicator variables equal to one if this is a trade by a retained director. Since we want to compare these directors with those brought on board as a result of the board regulation (incoming directors), we restrict the sample to the period after the regulation, 2006–2016. We do this for two cases. One for all directors, the other for just female directors. Table IA.5 reports the results. We find no significant coefficients on the indicator variables related this being a retained director.

Table IA.5: CAR regressions investigating retained directors

The tables report cross-sectional regressions of the following form:

$$CAR_i(\tau_1, \tau_2) = a + b_1 MktCap_i + b_2 TradeValue_i + b_3 DirectorCharacteristic_i + \varepsilon_i,$$

where $MktCap$ is the log of the market capitalization of the firm and $TradeValue$ is the log of the kroner amount of the trade. In Panel A the $DirectorCharacteristic_i$ is an indicator variable equal to one if the director was on the board before 2006 *(Retained Director)*. In Panel B the $DirectorCharacteristic_i$ is an indicator variable equal to one if the director is female and was on the board before 2006 *(Retained female director)*. The sample is all trades by identified directors in the period 2006-2016.

	Event windows for the cumulative abnormal return			
	$CAR1(-1,1)$	$CAR(-1,-5)$	$CAR(-1,25)$	$CAR(-1,50)$
A: Retained directors				
(Intercept)	0.0831***	0.1138***	0.1907***	0.4509***
	(0.0191)	(0.0313)	(0.0572)	(0.1059)
MktCap	−0.0038***	−0.0067***	−0.0103***	−0.0214***
	(0.0009)	(0.0015)	(0.0027)	(0.0050)
TradeValue	0.0001	0.0025*	0.0017	0.0006
	(0.0008)	(0.0013)	(0.0024)	(0.0045)
Retained director	−0.0024	−0.0044	0.0005	−0.0127
	(0.0034)	(0.0055)	(0.0101)	(0.0186)
Adj. R^2	0.0118	0.0132	0.0080	0.0120
Num. obs.	1457	1457	1457	1457
B: Retained female directors				
(Intercept)	0.0843***	0.1169***	0.1902***	0.4563***
	(0.0190)	(0.0311)	(0.0569)	(0.1052)
MktCap	−0.0038***	−0.0069***	−0.0103***	−0.0212***
	(0.0009)	(0.0015)	(0.0027)	(0.0050)
TradeValue	0.0000	0.0025*	0.0016	−0.0003
	(0.0008)	(0.0013)	(0.0024)	(0.0045)
Retained female director	−0.0064	0.0109	−0.0063	−0.0743
	(0.0103)	(0.0168)	(0.0307)	(0.0569)
Adj. R^2	0.0117	0.0131	0.0081	0.0129
Num. obs.	1457	1457	1457	1457

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

1 (c) Directors leaving in 2006 or 2007 period (exiting directors). We next investigate the informedness of the directors that were let go during the period when boards needed to be filled with a sufficient number of female directors. Is it the case that the directors let go were the least experienced/valuable (low informativeness)? If so, does the market signal that the trades of these directors were less informed while they were directors? That is, we look at the trades of these directors in the 1998–2005 period. We implement this with indicator variables equal to one if this is a trade by a director that exited in 2006 or 2007. We distinguish three cases:

- Director exited the board in 2006
- Director exited the board in 2007
- Director exited the board in 2006 or 2007.

For this analysis we consider all exiting directors. The majority of exiting directors ' were male, but there are a few female cases. The hypothesis about low informativeness is not gender specific, it is therefore natural to do this estimation for all exiting directors. Table IA.6 shows the results where the indicator is one if this is a trade by a director that exited the board in 2006 or 2007. We see that none of these variables show a significant effect.

Table IA.6: CAR regressions investigating exiting directors

The tables report cross-sectional regressions of the following form:

$$CAR_i(\tau_1, \tau_2) = a + b_1 MktCap_i + b_2 TradeValue_i + b_3 DirectorCharacteristic_i + \varepsilon_i,$$

where $MktCap$ is the log of the market capitalization of the firm and $TradeValue$ is the log of the kroner amount of the trade, and $DirectorCharacteristic_i$ is an indicator variable equal to one the if (1) *Director exited in 2006*, (2) *Director exited in 2007*, or (3) *Director exited in 2006 or 2007*. The sample is all trades by identified directors in the period 1998–2005.

	Event windows for the cumulative abnormal return					
	$CAR(-1,1)$			$CAR(-1,5)$		
A. Dependent variable: $CAR(-1,1)$ **and** $CAR(-1,5)$						
(Intercept)	0.0509**	0.0508**	0.0509**	0.1749***	0.1766***	0.1769***
	(0.0238)	(0.0238)	(0.0238)	(0.0507)	(0.0505)	(0.0506)
MktCap	−0.0027**	−0.0027**	−0.0027**	−0.0079***	−0.0079***	−0.0079***
	(0.0011)	(0.0011)	(0.0011)	(0.0024)	(0.0024)	(0.0024)
TradeValue	0.0007	0.0007	0.0007	−0.0005	−0.0006	−0.0005
	(0.0009)	(0.0009)	(0.0009)	(0.0019)	(0.0019)	(0.0019)
Director exited in 2006	−0.0001			0.0097		
	(0.0085)			(0.0181)		
Director exited in 2007		−0.0004			−0.0115	
		(0.0106)			(0.0225)	
Director exited in 2006 or 2007			−0.0003			0.0015
			(0.0068)			(0.0144)
Adj. R^2	0.0035	0.0035	0.0035	0.0112	0.0112	0.0108
Num. obs.	806	806	806	806	806	806
B: Dependent variables: $CAR(-1,25)$ **and** $CAR(-1,50)$						
(Intercept)	0.5185***	0.5197***	0.5184***	0.9581***	0.9533***	0.9570***
	(0.0836)	(0.0834)	(0.0835)	(0.1318)	(0.1314)	(0.1315)
MktCap	−0.0270***	−0.0270***	−0.0270***	−0.0477***	−0.0475***	−0.0476***
	(0.0040)	(0.0040)	(0.0040)	(0.0063)	(0.0063)	(0.0063)
TradeValue	0.0029	0.0029	0.0029	0.0023	0.0023	0.0022
	(0.0032)	(0.0032)	(0.0032)	(0.0050)	(0.0050)	(0.0050)
Director exited in 2006	0.0037			−0.0187		
	(0.0298)			(0.0470)		
Director exited in 2007		0.0072			−0.0131	
		(0.0371)			(0.0585)	
Director exited in 2006 or 2007			0.0053			−0.0172
			(0.0237)			(0.0374)
Adj. R^2	0.0508	0.0508	0.0508	0.0650	0.0648	0.0650
Num. obs.	806	806	806	806	806	806

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

C Section 5: Insider performance

The paper shows estimates for the two subperiods 1997–2006 and 2007-2008. In IA Tables IA.7 and IA.8 we show corresponding estimates for the whole period 1997–2016.

Table IA.7: Holdings-based primary insider performance, 1997–2016

This table shows performance estimates using holdings-based performance evaluation. The two sets of portfolio weights are defined in Eq. (7) in the text. The Insider-ownership-weight of firm i (columns 1-3) is the insiders' percentage ownership of firm i divided by the sum of the percentage insider holdings across all OSE firms. The Insider-value-weight (columns 4-6) of firm i is the value of insider holdings in i divided by the value of all insider holdings in all OSE firms. The holdings-based estimates are based on covariances between monthly changes in insider holdings (weights) and subsequent returns, as follows:

$$HCM = \frac{1}{T-2}\sum_{t=2}^{T}\frac{1}{N_t}\left(\sum_{i=1}^{N_t} cov\left(\Delta w_{it},\ r_{i,t+\tau} - E[r_{i,t+\tau}]\right)\right)$$

where Δw_{it} is the change in the weight of stock i in the insider portfolio from month $t-1$ to t, and $r_{i,t+\tau} - E[r_{i,t+\tau}]$ is the abnormal returns over the subsequent τ months ($\tau = 1, 3, 6$). Δw_{it} is the monthly change in insider holdings, $w_{it}^{ins} - w_{i,t-1}^{ins}$. $E[r_{i,t+\tau}]$ is the predicted return using the Fama-French-Carhart risk factors estimated using five years of monthly data prior to time t. The estimation is done for the entire sample period, 1/1997–12/2016. The columns labeled p(diff) report the p-value for the test of difference between the male and female portfolio performance metrics. The p-values are calculated using standard errors robust to autocorrelation. Statistical significance is indicated as: *=p<0.1, **=p<0.05, ***= p<0.01. Data on insider trades and holdings are from OSE electronic records (`https://newsweb.oslobors.no/`).

	Insider-ownership portfolio weights			**Insider-value portfolio weights**		
	Female (1)	Male (2)	p(diff) (3)	Female (4)	Male (5)	p(diff) (6)
A: Short-lived insider information: one-month future return horizon ($T = 1$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+1} - E[r_{i,t+1}])$	0.0010	0.0000	0.46	0.0007	0.0008	0.93
Δ_{it}: *market portfolio weights*						
$Cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+1} - E[r_{i,t+1}])$	0.0018	−0.0028	0.34	−0.0015	−0.0029	0.72
B; Intermediate-lived inside information: three-month future return horizon ($T = 3$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+3} - E[r_{i,t+3}])$	0.0025	0.0003	0.31	0.0018	−0.0002	0.40
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+3} - E[r_{i,t+3}])$	0.0030	−0.0058	0.48	−0.0079	−0.0092	0.92
C: Long-lived insider information: six-month future return horizon ($T = 6$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+6} - E[r_{i,t+6}])$	0.0009	0.0002	0.70	0.0000	0.0003	0.95
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+6} - E[r_{i,t+6}])$	−0.0009	−0.0048	0.84	−0.0215	−0.0139	0.73

Table IA.8: Returns-based primary insider portfolio performance, 1997–2016.

The performance estimates reported in this table are based on monthly portfolio returns and re-balancing. The three sets of portfolio weights are defined in Eq. (6) in the text. The Insider-ownership-weight of firm i (columns 1-3) is the insiders' percentage ownership of firm i divided by the sum of the percentage insider holdings across all OSE firms. The Insider-value-weight (columns 4-6) of firm i is the value of insider holdings in i divided by the value of all insider holdings in all OSE firms. The Male–female portfolio is long in male and short in female insider weights, respectively. The estimation is done for entire sample period 1/1997–12/2016. The two performance metrics, α_p^{4f} and α_p^{rb} are defined in Eq. (9) in the text. The first is the constant term in a four-factor Fama-French-Carhart regression, while the second is the average constant term in a rolling-beta CAPM regression. Standard errors in brackets. Statistical significance indicated as *=p<0.1, **=p<0.05, ***= p<0.01. Data on insider trades and holdings are from OSE electronic records (`https://newsweb.oslobors.no/`).

	Insider-ownership portfolio weights			**Insider-value portfolio weights**		
	Female (1)	Male (2)	Male−Female (3)	Female (4)	Male (5)	Male−Female (6)
A: Average raw returns and Sharpe Ratio						
$(1/N)\sum r_{pt}$	0.0116	0.0094	−0.0023	0.0099	0.0119	0.0020
$(1/N)\sum r_{pt}^e$	0.0085	0.0063		0.0068	0.0088	
Sharpe Ratio	0.0991	0.0930	−0.0259	0.0912	0.1133	0.0313
B: Four-factor alpha estimate						
α_p^{4f}	−0.001	−0.006**	−0.008	−0.005	−0.004	−0.002
	(0.005)	(0.003)	(0.006)	(0.004)	(0.003)	(0.004)
β_p^m	0.774***	1.142***	0.378***	1.063***	1.258***	0.204**
	(0.113)	(0.055)	(0.119)	(0.076)	(0.060)	(0.087)
b_p^{SMB}	0.217	0.088	−0.126	−0.014	−0.219***	−0.203*
	(0.135)	(0.066)	(0.142)	(0.091)	(0.072)	(0.104)
b_p^{HML}	0.304***	−0.042	−0.346***	−0.134*	−0.163***	−0.029
	(0.110)	(0.053)	(0.116)	(0.074)	(0.059)	(0.085)
b_p^{UMD}	0.081	−0.072	−0.148	0.025	0.002	−0.017
	(0.091)	(0.044)	(0.095)	(0.061)	(0.049)	(0.070)
Observations	240	240	240	240	240	240
$\overline{R}^2$	0.158	0.674	0.098	0.493	0.703	0.039
C: Average rolling-beta CAPM estimate of alpha						
α_p^{rb}	0.0008	−0.0038	−0.0076	−0.0036	−0.0096***	−0.0091
	(0.0052)	(0.0026)	(0.0055)	(0.0054)	(0.0031)	(0.0056)
$\overline{\beta}_p^{rb}$	0.6179	0.9916	0.3737	1.1551	1.4559	0.3009

D Section 6. Insider trading during the financial crisis

D.1 Alternative measures of insider trading

Alternative measures of insider trading For purposes of robustness, we also estimate the effect of the financial crisis on the following two alternative measures of monthly aggregate insider trades, used previously by Lakonishok and Lee (2001) and Anginer, Donmez, Seyhun, and Zhang (2020):

$$Insider\ Direction_{it} = \frac{\sum_j Buy_{ijt} - \sum_j Sell_{ijt}}{\sum_j Buy_{ijt} + \sum_j Sell_{ijt}}, \tag{1}$$

where a Buy (Sell) is an indicator variable that takes a value of one if insider j in firm i has made a purchase (sale) in month t, and

$$Insider\ Shares_{it} = \frac{Shares\ Purchased_{it} - Shares\ Sold_{it}}{Shares\ Purchased_{it} + Shares\ Sold_{it}}, \tag{2}$$

where $Shares\ Purchased\ (Sold)_{it}$ is the total number of shares of company i purchased (sold) by insiders in month t. *Insider Direction* treats each insider trade equally, independent of the trade size, while *Insider Shares* gives more weight to larger trades in terms of the number of shares purchases or sold. Figure IA.2 plots the fraction of companies at the OSE with positive *Insider Direction*, calculated separately for the trades of female and male insiders. The number of firms with a positive aggregate direction of inside trading clearly increases at the beginning of the crisis. This effect of the crisis is confirmed in Table IA.9, which reports coefficient estimates from panel regressions with either $Insider\ Direction_{it}$ or $Insider\ Shares_{it}$ as dependent variable. Again, the coefficient estimate for *Crisis* is positive and significant for both female and male insiders. Also as before, independent of gender, the coefficients indicate more insider trading in larger, more volatile, more liquid, and less risky firms.

Figure IA.2: Fraction of positive *Insider direction*, 1997–2016

The figure plots the quarterly fractions of OSE-listed firms with positive aggregate *Insider Direction*, where

$$Insider\ Direction_{i,t} = \frac{\sum_j Buy_{ijt} - \sum_j Sell_{ijt}}{\sum_j Buy_{ijt} + \sum_j Sell_{ijt}}.$$

Buy (Sell) is an indicator variable that takes a value of one if insider j in firm i has made a purchase (sale) in quarter t. Population data on insider trades and holdings are from OSE electronic records (`https://newsweb.oslobors.no/`).

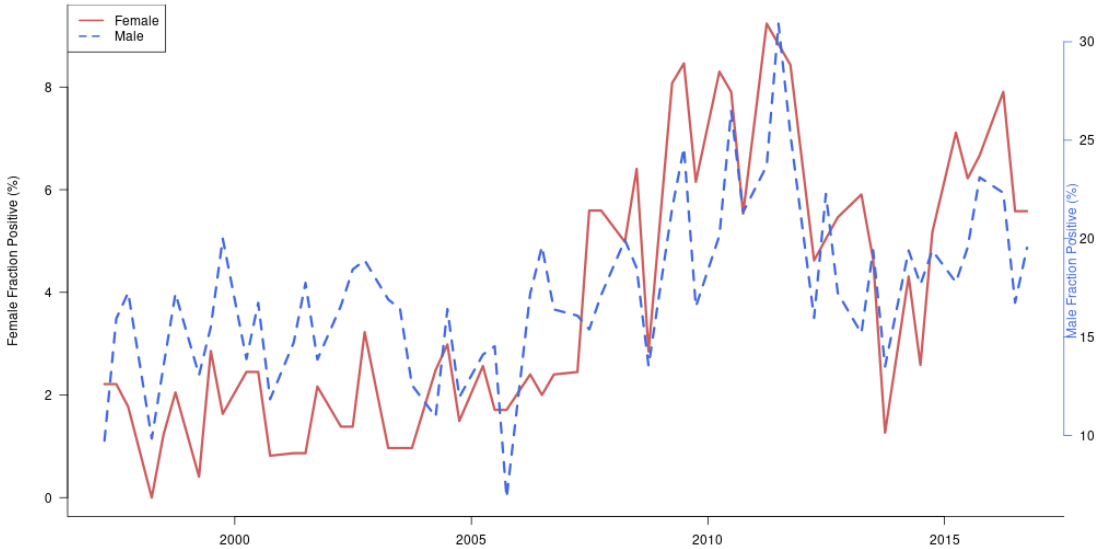

Table IA.9: Effect of financial crisis on two alternative measures of insider trades

The table reports coefficient in cross-sectional regressions with the following two alternative measures of monthly aggregate insider trade as dependent variable:

$$Insider\ Direction_{it} = \frac{\sum_j Buy_{ijt} - \sum_j Sell_{ijt}}{\sum_j Buy_{ijt} + \sum_j Sell_{ijt}}$$

where Buy (Sell) is an indicator variable that takes a value of one if insider j in firm i has made a purchase (sale) in month t, and

$$Insider\ Shares_{it} = \frac{Shares\ Purchased_{it} - Shares\ Sold_{it}}{Shares\ Purchased_{it} + Shares\ Sold_{it}}$$

where *Shares Purchased* (*Sold*)$_{it}$ is the total number of shares of company i purchased (sold) by insiders in month t. The explanatory variables include the indicator variable *Crisis*, which takes a value of one during the financial crisis period 2008:10–2010:12. The firm-level explanatory variables include the log of the *market capitalization* of the firm, stock *volatility* (the quarterly volatility of the firm's stock return), stock *liquidity* (last quarter's average daily quoted stock bid/ask spread), and stock *beta* (estimated over the past 36 months). The estimation period is 1998-2016. Standard errors in brackets. Statistical significance is indicated by p-values as follows: *=p<0.1, **=p<0.05, ***=p<0.01. Data on insider trades and holdings are from OSE electronic records (`https://newsweb.oslobors.no/`).

	Alternative measures of insider trades			
	Insider Direction		*Insider Shares*	
	Female	Male	Female	Male
	(1)	(2)	(3)	(4)
Constant	−0.059***	0.026	−0.058***	0.032
	(0.016)	(0.031)	(0.016)	(0.031)
Crisis	0.011***	0.012**	0.011***	0.010**
	(0.002)	(0.005)	(0.002)	(0.005)
Market Capitalization	0.004***	0.002	0.003***	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Volatility	0.067**	0.120**	0.067**	0.120**
	(0.029)	(0.055)	(0.029)	(0.056)
Liquidity	−0.088**	−0.273***	−0.092**	−0.264***
	(0.039)	(0.074)	(0.039)	(0.075)
Beta	−0.002	−0.003	−0.002	−0.003
	(0.002)	(0.003)	(0.002)	(0.003)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	24,143	24,143	24,143	24,143
$\overline{R}^2$	0.005	0.004	0.005	0.004

References

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