Board gender-balancing, network information, and insider trading

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Summary of what we do

(1) We propose and test the following basic network hypothesis:

Increased access to an informal network of peer-firm insiders
$\Rightarrow$ enhanced value of insider information

(2) We use two quasi-experimental settings relevant for insider trades

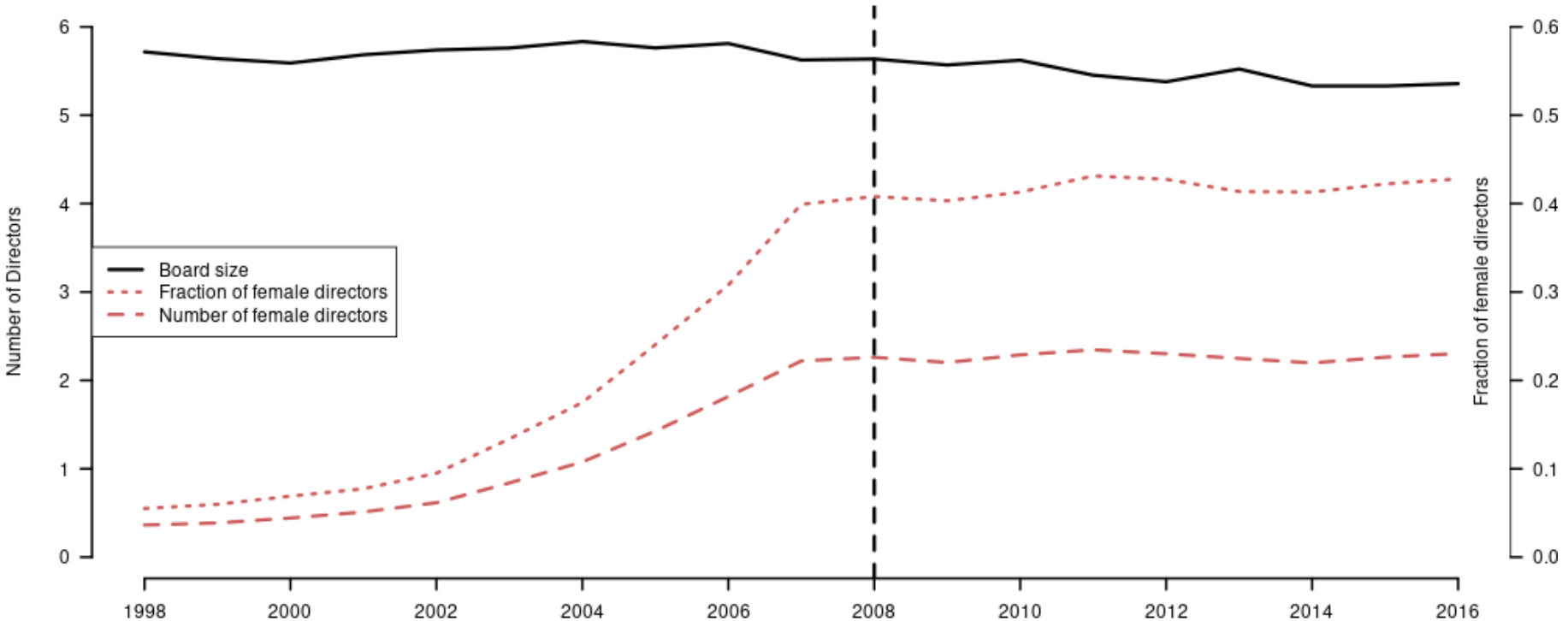
(i) Female director network shock: Norway's pioneering quota law
(ii) Exogenous price shock caused by the financial crisis

(3) We use population data on primary insider trades and holdings

(4) Three empirical inquiries:

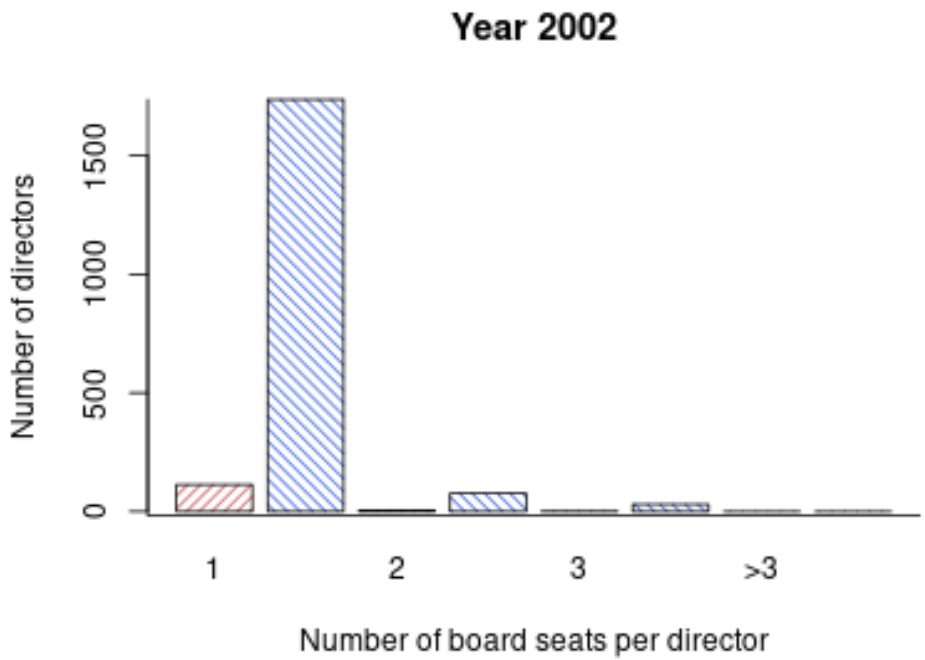
(i) The network shock $\Rightarrow$ increased information content of trades?
(ii) The network shock $\Rightarrow$ increased insider performance?
(iii) Trading during crisis period $\Rightarrow$ relative female risk aversion?

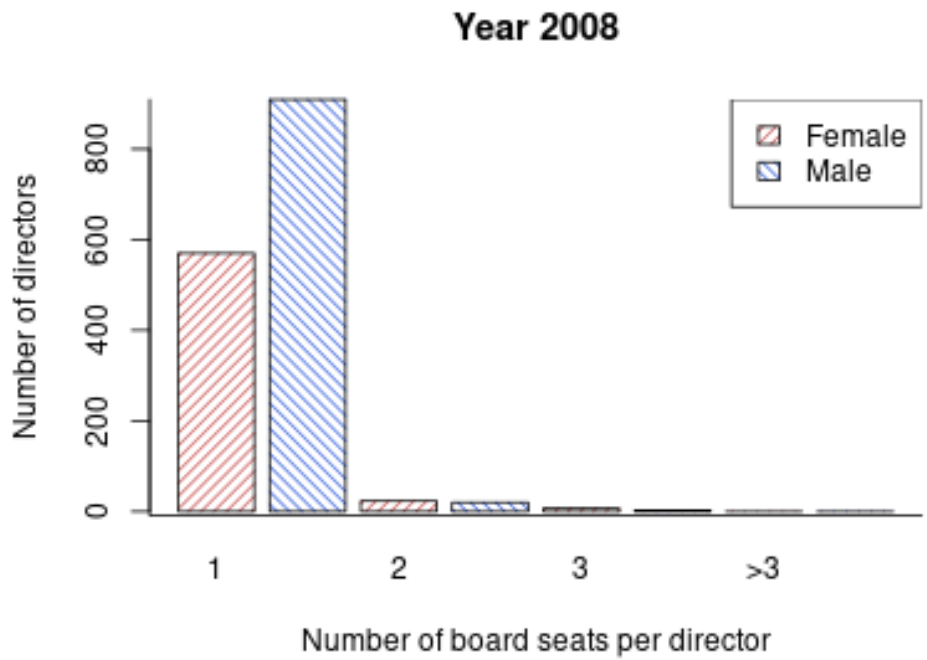
Board size and fraction female directors



OSE-listed ASA, 1998–2016

Number of board seats held by male and female directors

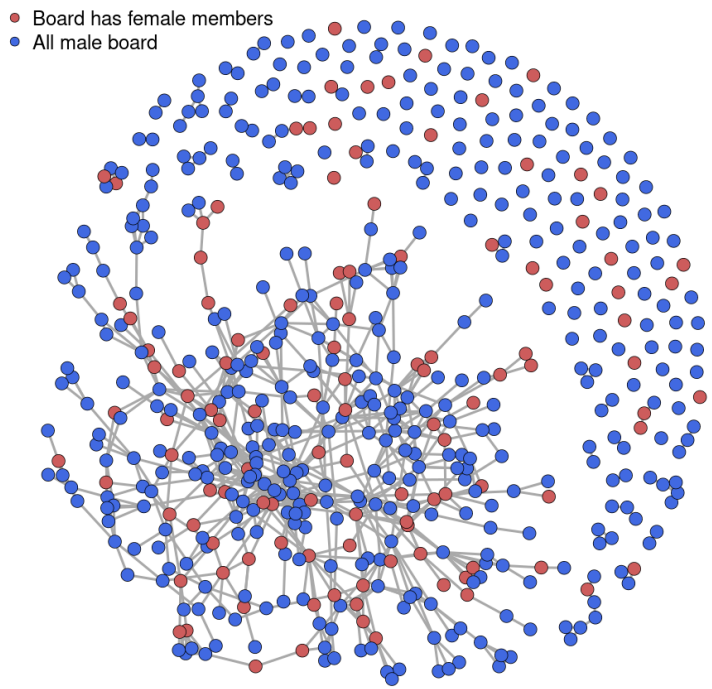




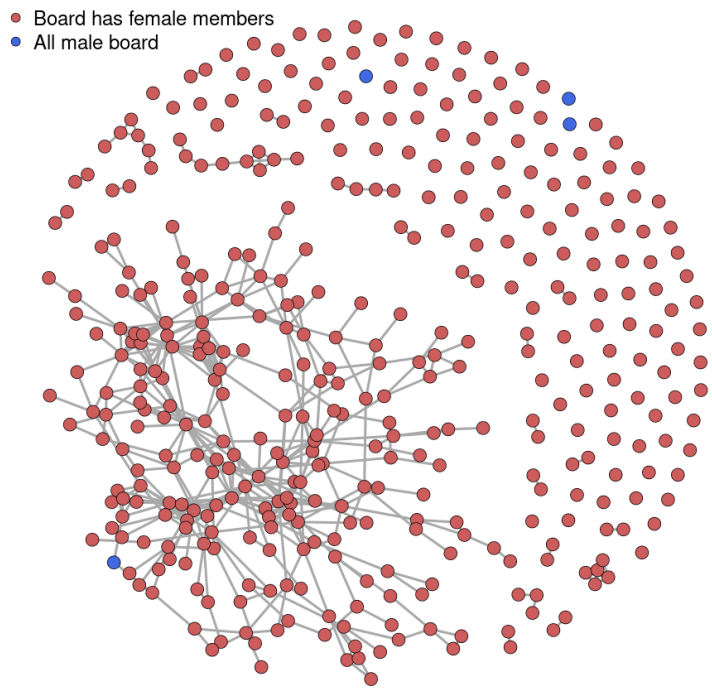
(all ASA)

Evolution of board network gender composition

Year 2002

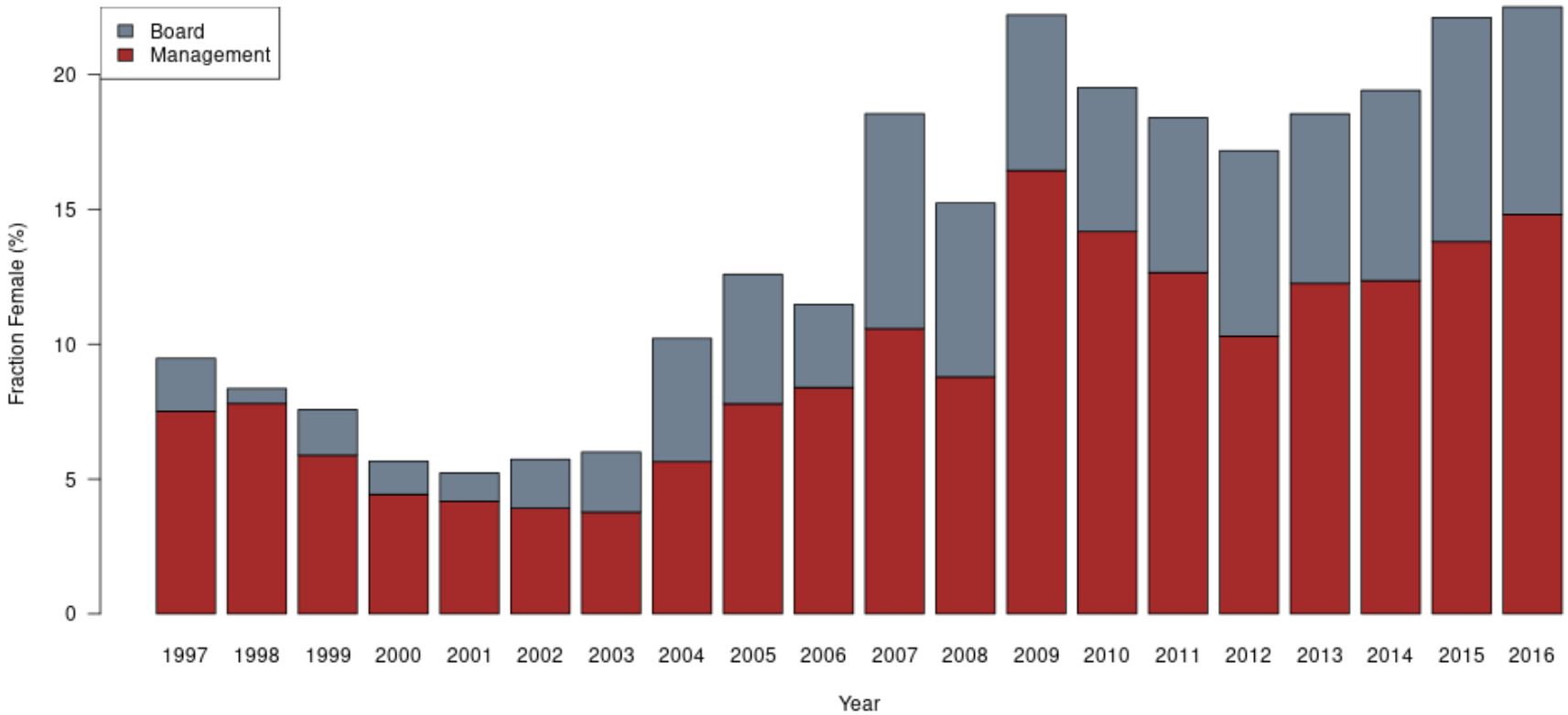


Year 2008



(all ASA)

Fraction primary insider trades by females



Numbers in percent

Market reaction to non-routine primary insider purchases

Event windows (τ_1, τ_2)

$$r^e_{it} = a_i + b_i r^e_{mt} + \gamma_i(\tau_1, \tau_2) D_{it} + \varepsilon_{it}$$

	A: Pre-quota years			**B: Post-quota years**		
Event window:	(-1,1)	(-1,5)	...	(-1,1)	(-1,5)	...
Female Insiders						
$\gamma(\tau_1, \tau_2)$	0.0026	0.0069	...	0.0155***	0.0147***	...
	(0.002)	(0.001)	...	(0.001)	(0.001)	
Obs.	209,427	209,427	...	309,470	309,470	
Male Insiders						
$\gamma(\tau_1, \tau_2)$	0.014***	0.014***	...	0.014**	0.013 ...	
	(0.001)	(0.001)	...	(0.002)	(0.002)	...
Obs.	507,385	507,385	...	470,032	470,032	...

Effect of network centrality (pagerank) on market reaction

$$\gamma_i(\tau_1, \tau_2) = \alpha_i + \beta_1 \mathit{MktCap}_i + \beta_2 \mathit{TradeSize}_i + \beta_3 \mathit{Centrality}_i + \varepsilon_i$$

	Cumulative abnormal return $\gamma(\tau_1, \tau_2)$			
	$\gamma(-1,1)$	$\gamma(-1,5)$	$\gamma(-1,20)$	$\gamma(-1,50)$
	(1)	(2)	(3)	(4)
Constant	0.072***	0.157***	0.257***	0.516***
	(0.014)	(0.026)	(0.042)	(0.074)
MktCap	-0.004***	-0.007***	-0.012***	-0.023***
	(0.001)	(0.001)	(0.002)	(0.003)
TradeSize	-0.0002	-0.001	-0.0004	-0.002
	(0.001)	(0.001)	(0.002)	(0.003)
Centrality	2.147***	1.614*	3.144**	0.276
	(0.482)	(0.886)	(1.462)	(2.565)
Observations	2,679	2,679	2,679	2,679

Insider portfolio weights

Using the population of insider holdings at all times

- ω_{it} = weight of insider holdings in firm i at time t
- S_{it} = firm i's total number of shares outstanding at time t
- s_{it} = number of shares held by insider
- $s_{it}p_{it}$= market value of insiders' holding in period t

$$\omega_{it} \equiv \begin{cases} \omega_{it}^{ow} = s_{it}/S_{it} & \text{insider ownership weight} \\ \omega_{it}^{vw} = p_{it}s_{it}/\sum_{i=1}^{N_t} p_{it}s_{it} & \text{insider value weight} \end{cases}$$

Two alternative measures of the weight change $\Delta\omega_{it}$:

$$\Delta\omega_{it} \equiv \begin{cases} \omega_{it} - \omega_{i,t-1} & \text{insider weight change} \\ \omega_{it} - \omega_{i,t-1}^{m} & \text{market-adjusted insider weight change} \end{cases}$$

$\omega_{i,t-1}^{m}$ = firm i's value-weight in the OSE market portfolio at $t-1$.

Cross-sectional holdings-based performance measure: "Buy low and sell high?"

$r_{i,t+1} - E[r_{i,t+1}]$ = the one-month abnormal stock return

$$\begin{aligned} cov(\omega_{it}; r_{i,t+1}) &= E(\omega_{it}(r_{i,t+1} - E[r_{i,t+1}])) \\ &= E[(\omega_{it} - E[\omega_{it}])r_{i,t+1}] \end{aligned}$$

Our cross-sectional, holdings-based performance measure combines both unexpected weight changes ($\omega_{it} - E[\omega_{i,t-1}]$ and abnormal stock returns:

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

τ = number of months until the inside information becomes public (We use $\tau = 1, 3, 6$)

Zero pre-quota cross-sectional holdings-based performance

(HCM, 1997–2007)

	Insider-ownership portfolio weights			Insider-value portfolio weights		
	Female (1)	Male (2)	p(diff) (3)	Female (4)	Male (5)	p(diff) (6)
A.1: HCM with Short-lived insider information: one-month future return horizon ($\tau = 1$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+1} - E[r_{i,t+1}])$	0.0007	-0.0003	0.46	0.0006	0.0020	0.54
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+1} - E[r_{i,t+1}])$	0.0006	-0.0018	0.66	-0.0034	-0.0064**	0.61
A.2; HCM with intermediate-lived inside information: three-month future return horizon ($\tau = 3$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+3} - E[r_{i,t+3}])$	0.0031	-0.0000	0.31	0.0025	0.0017	0.84
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+3} - E[r_{i,t+3}])$	-0.0001	-0.0066	0.69	-0.0147	-0.0226**	0.72
A.3: HCM with long-lived insider information: six-month future return horizon ($\tau = 6$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+6} - E[r_{i,t+6}])$	0.0007	-0.0005	0.63	-0.0012	0.0039	0.43
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+6} - E[r_{i,t+6}])$	-0.0154	-0.0082	0.79	-0.0438	-0.0423**	0.97

Zero post-quota holdings-based performance

(HCM, 2008–2016)

	Insider-ownership portfolio weights			Insider-value portfolio weights		
	Female (1)	Male (2)	p(diff) (3)	Female (4)	Male (5)	p(diff) (6)
B.1: HCM with short-lived insider information: one-month future return horizon ($\tau = 1$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+1} - E[r_{i,t+1}])$	0.0014	0.0004	0.70	0.0008	-0.0006	0.28
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+1} - E[r_{i,t+1}])$	0.0033	-0.0041	0.39	0.0008	0.0014	0.88
B.2; HCM with intermediate-lived inside information: three-month future return horizon (*tau* $= 3$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+3} - E[r_{i,t+3}])$	0.0018	0.0007	0.72	0.0009	-0.0024Zero p	0.06
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+3} - E[r_{i,t+3}])$	0.0069	-0.0048	0.53	0.0004	0.0070	0.41
B.3: HCM with long-lived insider information: six-month future return horizon ($\tau = 6$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+6} - E[r_{i,t+6}])$	0.0011	0.0012	1.00	0.0016	-0.0041	0.09
Δ_{it}: *market portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{m}\ ;\quad r_{i,t+6} - E[r_{i,t+6}])$	0.0168	-0.0006	0.51	0.0058	0.0208	0.24

Alternative: Returns-based portfolio performance

Jensen's alpha:

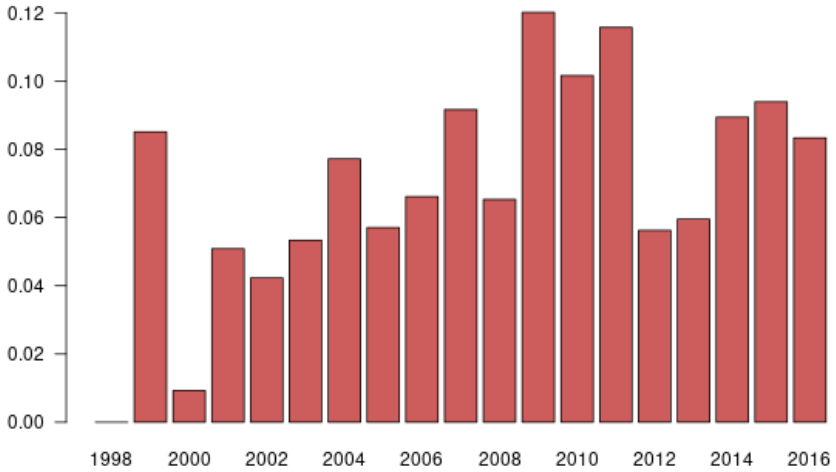
$$\alpha_{pt} \equiv \begin{cases} \alpha_{pt}^{4f} = r_{pt}^{e} - [\widehat{\beta}_{p}^{m}(r_{mt} - r_{ft}) + \widehat{b}_{p1} SMB_t + \widehat{b}_{p2} HML_t + \widehat{b}_{p3} MOM \\ \alpha_{pt}^{rb} = r_{pt}^{e} - [\widehat{\beta}_{p,t-1}^{rb}(r_{mt} - r_{ft})] \end{cases}$$

- α_{pt}^{rb}, is the constant term in the rolling-beta estimation of the one-factor Capital Asset Pricing Model (CAPM), which allows for time variation in the portfolio's (lagged) market risk factor exposure $\beta_{p,t-1}^{rb}$.

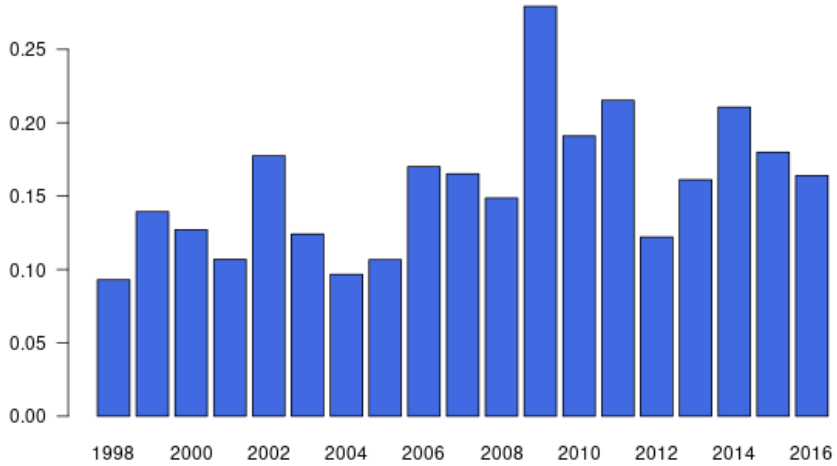
- Main result: Zero abnormal portfolio performance both before and after the quota law

Likelihood of director purchases during the financial crisis

Female purchases



Male purchases



Likelihood of director trading during financial crisis

$$Y_{jt} = \alpha + \beta_1 Crisis_t + \beta_2' \mathbf{Controls}_{jt} + \epsilon_{jt}$$

$Y_{jt} = 1$ if one or more directors trades in quarter t, 1998–2016

	Female Directors		**Male Directors**	
	Purchases	Sales	Purchases	Sales
	(1)	(2)	(3)	(4)
Constant	-2.544***	-3.591***	-2.080***	-2.516***
	(0.366)	(0.849)	(0.178)	(0.270)
Crisis	0.227***	-0.628**	0.229***	-0.144**
	(0.055)	(0.274)	(0.033)	(0.064)
Market Cap	0.019	0.026	0.013*	0.014
	(0.016)	(0.036)	(0.008)	(0.012)
Volatility	1.537**	1.716*	1.040***	0.966***
	(0.603)	(0.920)	(0.217)	(0.282)
Liquidity	-2.908***	-6.533*	-2.967***	-3.264***
	(1.064)	(3.560)	(0.459)	(0.748)
Beta	-0.022	0.007	0.011	0.035
	(0.043)	(0.095)	(0.020)	(0.029)
Industry FE	Yes	Yes	Yes	Yes

Our proposition

- At the time of the financial crisis, male and female insiders had access to similar-sized director networks
- With equal access, insiders tend to agree on the interpretation of exogenous price shocks

Proposition (crisis-induced insider trading): *Insiders who respond by purchasing additional shares do so for two reasons:*

(1) *They believe that the market is (temporarily) undervaluing the firm.*

(2) *They restore an optimal portfolio allocation between risky and risk-free assets.*

Reason (1) predicts positive abnormal trading performance.
Reason (2) predicts a greater asset purchase the lower the insider's risk aversion.

HCM-performance: insider purchases during financial crisis

	Insider-ownership portfolio weights			Insider-value portfolio weights		
	Female	Male	p(diff)	Female	Male	p(diff)
	(1)	(2)	(3)	(4)	(5)	(6)
A: HCM with short-lived insider information: one-month future return horizon ($\tau = 1$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+1} - E[r_{i,t+1}])$	-0.0070	-0.0013	0.36	-0.0046	-0.0013	0.61
B; HCM with intermediate-lived inside information: three-month future return horizon ($\tau = 3$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+3} - E[r_{i,t+3}])$	-0.0031	-0.0018	0.82	-0.0004	-0.0025	0.78
C: HCM with long-lived insider information: six-month future return horizon ($\tau = 6$)						
Δ_{it}: *lagged insider portfolio weights*						
$cov(w_{it}^{ins} - w_{i,t-1}^{ins}\ ;\quad r_{i,t+6} - E[r_{i,t+6}])$	-0.0047	-0.0015	0.56	0.0014	-0.0061	0.42

$\Rightarrow$ Zero abnormal performance

$\Rightarrow$ Purchase intensity reflects individual risk aversion

$\Rightarrow$ Female directors no more risk averse than male directors

Main conclusions:

(1) Following the dramatic female director network expansion, the market for the first time assigns valuable information to reported purchases by female primary insiders

(2) However, tracking insiders' actual holding periods reveals that female insiders do not realize abnormal holdings-based abnormal performance either before or after the forced expansion of the female director network.

(3) Both male and female primary insiders increase purchases during the financial crisis period—with similar increases in trading likelihood.

(4) With about equal-sized male and female director networks at the time of the crisis, and since we find no evidence of abnormal performance resulting from the insider trades during the crisis period, the increased purchase intensity suggests that female directors are no more risk averse than their male counterparts.