

Online Appendix to “Equity Vesting and Investment”

Definition of variables used in the Online Appendix

This table describes the calculation of variables used only in this online appendix. The variables used also in the core analysis are described in Appendix A of the paper. t indexes the year to which quarter q belongs.

Variable	Definition
CEO incentives from equity vesting	
$VESTING_IN_q$ ($UNVESTED_IN_{q-1}$ $UNVESTED_IN_{q-1}$ $VESTED_IN_{q-1}$)	Similar to $VESTING_q$, except that options' deltas are replaced with their intrinsic values, i.e., delta is set to one for all in-the-money options and is set to zero for all out-of-the-money options (calculations are analogous for all measures with a postfix of IN);
$VESTING_1Y_q$ ($UNVESTED_1Y_{q-1}$ $UNVESTED_1Y_{q-1}$ $VESTED_1Y_{q-1}$)	Similar to $VESTING_q$, except that time-to-maturity is assumed to be one year for all options (calculations are analogous for all measures with a postfix of $1YR$);
$VESTING_0.7_q$ ($UNVESTED_0.7_{q-1}$ $UNVESTED_0.7_{q-1}$ $VESTED_0.7_{q-1}$)	Similar to $VESTING_q$, except that delta is assumed to be 0.7, the mean delta of all options in our sample, for all options (calculations are analogous for all measures with a postfix of 0.7);
$VESTING_AM_q$ ($UNVESTED_AM_{q-1}$ $UNVESTED_AM_{q-1}$ $VESTED_AM_{q-1}$)	Similar to $VESTING_q$, except that all options are assumed to be at the money (calculations are analogous for all measures with a postfix of AM);
$VESTING_2_q$	Similar to $VESTING_q$, except that we use only post-2006 time-based awards (as opposed to all post-2006 awards) to identify vesting shares in the first step of the algorithm discussed in Section 2.1;
$VESTING_3_q$	Similar to $VESTING_q$, except that we use only post-2006 time-based awards to identify vesting shares in the first step of the algorithm, and only performance-based post-2006 awards to identify vesting shares in the second step of the algorithm;
$VEGA_{q-1}$	The dollar change in the CEO's wealth for a 100% change in stock return volatility for his entire equity holdings at the end of year $t-1$;
RD_q	The level of R&D expenditure in quarter q ;
$CAPEX_q$	The level of capital expenditure in quarter q ;
$NETINV_q$	The level of net capital expenditure in quarter q ;
$RDCAPEX_q$	The level of R&D plus capital expenditure in quarter q ;
$RDNETINV_q$	The level of R&D plus net capital expenditure in quarter q .

Table OA1: Vesting equity and change in investment: Interactions

Panel A: $\Delta RDCAPEX$ regressions interacting $VESTING$ with the raw variables

Dependent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta RDCAPEX_q$					
$VESTING_q$	-0.200*** (0.043)	-0.152*** (0.039)	-0.186*** (0.041)	-0.154*** (0.040)	-0.022 (0.069)	-0.076* (0.042)
$VESTING_q \times IO_{q-1}$	0.481** (0.195)					
IO_{q-1}	-0.002** (0.001)					
$VESTING_q \times BLOCKO_{q-1}$		0.495** (0.194)				
$BLOCKO_{q-1}$		-0.001 (0.001)				
$VESTING_q \times NBLOCK_{q-1}$			0.020*** (0.006)			
$NBLOCK_{q-1}$			-0.000** (0.000)			
$VESTING_q \times CEOAGE_{q-1}$				-0.519 (0.537)		
$CEOAGE_{q-1}$				0.004 (0.005)		
$VESTING_q \times MV_{q-1}$					-0.067** (0.027)	
MV_{q-1}					-0.000 (0.000)	
$VESTING_q \times FIRMAGE_{q-1}$						-1.132*** (0.207)
$FIRMAGE_{q-1}$						0.669** (0.299)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.100	0.099	0.100	0.099	0.099	0.100

OLS regression results on the relationship between the CEO's vesting equity and the change in investment measured using $RDCAPEX$, interacting CEO's vesting equity with firm and CEO characteristics. We subtract a cross-sectional variable's sample mean from the variable when interacting it with $VESTING$. Variable definitions are in Appendix A. $VESTING$ is in billions. Robust standard errors are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively.

Table OA1 (Cont'd)

Panel B: $\Delta RDNETINV$ regressions interacting $VESTING$ with the raw variables

Dependent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta RDNETINV_q$					
$VESTING_q$	-0.289*** (0.088)	-0.212*** (0.079)	-0.258*** (0.082)	-0.204*** (0.079)	0.016 (0.136)	-0.105 (0.088)
$VESTING_q \times IO_{q-1}$	0.748* (0.387)					
IO_{q-1}	-0.000 (0.002)					
$VESTING_q \times BLOCKO_{q-1}$		0.817** (0.388)				
$BLOCKO_{q-1}$		0.000 (0.002)				
$VESTING_q \times NBLOCK_{q-1}$			0.025** (0.012)			
$NBLOCK_{q-1}$			-0.000 (0.000)			
$VESTING_q \times CEOAGE_{q-1}$				-1.952* (1.184)		
$CEOAGE_{q-1}$				0.012 (0.010)		
$VESTING_q \times MV_{q-1}$					-0.117** (0.053)	
MV_{q-1}					-0.005*** (0.001)	
$VESTING_q \times FIRMAGE_{q-1}$						-1.627*** (0.366)
$FIRMAGE_{q-1}$						-0.005 (0.788)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.058	0.058	0.058	0.058	0.058	0.058

OLS regression results on the relationship between the CEO's vesting equity and the change in investment measured using $RDNETINV$, interacting CEO's vesting equity with firm and CEO characteristics. We subtract a cross-sectional variable's sample mean from the variable when interacting it with $VESTING$. Variable definitions are in Appendix A. $VESTING$ is in billions. Robust standard errors are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively.

Table OA2: Vesting equity and changes in investment: Excluding controls

Dependent Variables	(1)	(2)	(3)	(4)	(5)
	ΔRD_q	$\Delta CAPEX_q$	$\Delta NETINV_q$	$\Delta RDCAPEX_q$	$\Delta RDNETINV_q$
$VESTING_q$	-0.050** (0.021)	-0.052** (0.026)	-0.152** (0.068)	-0.108*** (0.039)	-0.210*** (0.080)
Intercept	-0.002*** (0.000)	-0.002*** (0.000)	0.000 (0.001)	-0.004*** (0.000)	-0.002*** (0.001)
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.084	0.051	0.028	0.081	0.035

OLS regression results on the relationship between the CEO's vesting equity and the change in investment. Variable definitions are in Appendix A. $VESTING$ is in billions. Robust standard errors are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively.

Table OA3: Vesting equity and change in investment: Robustness checks on delta

Panel A: Replacing delta with intrinsic value

	(1)	(2)	(3)	(4)	(5)
Dependent Variables	ΔRD_q	$\Delta CAPEX_q$	$\Delta NETINV_q$	$\Delta RDCAPEX_q$	$\Delta RDNETINV_q$
<i>VESTING_IN_q</i>	-0.061^{***} (0.021)	-0.076^{***} (0.025)	-0.183^{***} (0.067)	-0.147^{***} (0.038)	-0.256^{***} (0.079)
<i>UNVESTED_IN_{q-1}</i>	-0.003 (0.008)	0.002 (0.011)	0.049 (0.031)	-0.001 (0.015)	0.052 (0.035)
<i>VESTED_IN_{q-1}</i>	-0.001 [*] (0.001)	0.002 (0.002)	-0.006 (0.004)	0.001 (0.002)	-0.008 [*] (0.005)
Other Controls	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.093	0.066	0.053	0.099	0.058

Panel B: Assuming that all options expire in one year

	(1)	(2)	(3)	(4)	(5)
Dependent Variables	ΔRD_q	$\Delta CAPEX_q$	$\Delta NETINV_q$	$\Delta RDCAPEX_q$	$\Delta RDNETINV_q$
<i>VESTING_IY_q</i>	-0.060^{***} (0.019)	-0.081^{***} (0.022)	-0.136^{**} (0.059)	-0.151^{***} (0.034)	-0.208^{***} (0.069)
<i>UNVESTED_IY_{q-1}</i>	-0.003 (0.009)	0.004 (0.013)	0.051 (0.036)	0.002 (0.018)	0.054 (0.040)
<i>VESTED_IY_{q-1}</i>	-0.001 [*] (0.001)	0.002 (0.001)	-0.006 (0.004)	0.001 (0.002)	-0.008 [*] (0.004)
Other Controls	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.093	0.066	0.053	0.099	0.058

Panel C: Assuming a flat delta of 0.7

	(1)	(2)	(3)	(4)	(5)
Dependent Variables	ΔRD_q	$\Delta CAPEX_q$	$\Delta NETINV_q$	$\Delta RDCAPEX_q$	$\Delta RDNETINV_q$
<i>VESTING_0.7_q</i>	-0.079^{***} (0.023)	-0.106^{***} (0.027)	-0.196^{***} (0.073)	-0.196^{***} (0.042)	-0.289^{***} (0.085)
<i>UNVESTED_0.7_{q-1}</i>	-0.002 (0.009)	0.002 (0.014)	0.051 (0.041)	0.003 (0.019)	0.058 (0.045)
<i>VESTED_0.7_{q-1}</i>	-0.001 [*] (0.001)	0.002 (0.001)	-0.007 (0.004)	0.001 (0.002)	-0.008 [*] (0.005)
Other Controls	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.093	0.066	0.053	0.099	0.058

Panel D: Assuming that all options are at the money

	(1)	(2)	(3)	(4)	(5)
Dependent Variables	ΔRD_q	$\Delta CAPEX_q$	$\Delta NETINV_q$	$\Delta RDCAPEX_q$	$\Delta RDNETINV_q$
<i>VESTING_AM_q</i>	-0.065^{***} (0.023)	-0.100^{***} (0.027)	-0.184^{**} (0.072)	-0.175^{***} (0.042)	-0.263^{***} (0.085)
<i>UNVESTED_AM_{q-1}</i>	-0.003 (0.009)	0.003 (0.014)	0.051 (0.040)	0.001 (0.019)	0.056 (0.045)
<i>VESTED_AM_{q-1}</i>	-0.001 [*] (0.001)	0.002 (0.001)	-0.007 (0.004)	0.001 (0.002)	-0.008 [*] (0.005)
Other Controls	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.093	0.066	0.053	0.099	0.058

OLS regression results on the relationship between the CEO's vesting equity and the change in investment. Variable definitions are in the table at the start of this Online Appendix. In Panel A, the option delta is replaced with its intrinsic value. In Panel B, all options are assumed to expire in one year. In Panel C, the delta is set to 0.7, the mean delta of all options in our sample. In Panel D, all options are assumed to be at the money. All displayed independent variables are in billions. Robust standard errors are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively.

Table OA4: Vesting equity and change in investment: Alternative assumptions on stock vesting**Panel A: Including only post-2006 time-based stock awards in the first step calculation**

Dependent Variables	(1)	(2)	(3)	(4)	(5)
	ΔRD_q	$\Delta CAPEX_q$	$\Delta NETINV_q$	$\Delta RDCAPEX_q$	$\Delta RDNETINV_q$
<i>VESTING_2_q</i>	-0.059^{***} (0.021)	-0.088^{***} (0.025)	-0.154^{**} (0.067)	-0.158^{***} (0.039)	-0.229^{***} (0.079)
Controls	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.093	0.066	0.053	0.099	0.058

Panel B: Including only post-2006 time-based stock awards in the first step calculation and only performance-based post-2006 stock awards in the second step calculation

Dependent Variables	(1)	(2)	(3)	(4)	(5)
	ΔRD_q	$\Delta CAPEX_q$	$\Delta NETINV_q$	$\Delta RDCAPEX_q$	$\Delta RDNETINV_q$
<i>VESTING_3_q</i>	-0.075^{***} (0.024)	-0.092^{***} (0.028)	-0.157^{**} (0.076)	-0.182^{***} (0.043)	-0.255^{***} (0.089)
Controls	Yes	Yes	Yes	Yes	Yes
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.093	0.066	0.053	0.099	0.058

OLS regression results on the relationship between the CEO's vesting equity and the change in investment. Variable definitions are in the table at the start of this Online Appendix. In Panel A, we use only post-2006 time-based awards (as opposed to all post-2006 awards) to identify vesting shares in the first step of the algorithm discussed in Section 2.1. In Panel B, we use only post-2006 time-based awards to identify vesting shares in the first step of the algorithm, and only performance-based post-2006 awards to identify vesting shares in the second step of the algorithm. *VESTING_2* and *VESTING_3* are in billions. Robust standard errors are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively.

Table OA5: Vesting equity and change in investment: Controlling for vega

Dependent Variables	(1) ΔRD_q	(2) $\Delta CAPEX_q$	(3) $\Delta NETINV_q$	(4) $\Delta RDCAPEX_q$	(5) $\Delta RDNETINV_q$
<i>VESTING_q</i>	-0.060*** (0.021)	-0.084*** (0.026)	-0.150** (0.067)	-0.154*** (0.039)	-0.223*** (0.079)
<i>VEGA_{q-1}</i>	-0.003 (0.006)	-0.021*** (0.007)	0.002 (0.025)	-0.025** (0.010)	-0.004 (0.028)
<i>UNVESTED_{q-1}</i>	-0.003 (0.009)	0.005 (0.013)	0.051 (0.036)	0.003 (0.018)	0.054 (0.040)
<i>VESTED_{q-1}</i>	-0.001* (0.001)	0.002 (0.001)	-0.006 (0.004)	0.001 (0.002)	-0.008* (0.004)
<i>SALARY_{q-1}</i>	-0.305 (0.620)	-0.001 (1.004)	4.170 (2.741)	-0.336 (1.391)	4.010 (3.007)
<i>BONUS_{q-1}</i>	-0.047 (0.142)	-0.186 (0.240)	-0.334 (0.628)	-0.279 (0.338)	-0.433 (0.688)
<i>CEOAGE_{q-1}</i>	0.001 (0.003)	0.001 (0.003)	0.005 (0.009)	0.003 (0.005)	0.011 (0.010)
<i>CEOTENURE_{q-1}</i>	-0.000 (0.003)	-0.000 (0.004)	-0.000 (0.011)	-0.000 (0.006)	-0.005 (0.012)
<i>NEWCEO_q</i>	0.000 (0.001)	-0.000 (0.001)	-0.002 (0.003)	0.001 (0.002)	-0.002 (0.004)
<i>FIRMAGE_{q-1}</i>	0.020 (0.079)	0.589*** (0.226)	0.012 (0.740)	0.670** (0.299)	-0.005 (0.787)
<i>Q_q</i>	0.000* (0.000)	0.000 (0.000)	0.004*** (0.001)	0.001** (0.000)	0.005*** (0.001)
<i>Q_{q-1}</i>	0.000 (0.000)	-0.000 (0.000)	-0.002*** (0.000)	0.000 (0.000)	-0.002*** (0.001)
<i>MV_{q-1}</i>	-0.001*** (0.000)	0.001** (0.000)	-0.004*** (0.001)	-0.000 (0.000)	-0.005*** (0.001)
<i>MOM_{q-1}</i>	0.000 (0.000)	0.002*** (0.000)	0.001 (0.001)	0.002*** (0.001)	0.001 (0.001)
<i>CASH_{q-1}</i>	0.004*** (0.001)	0.011*** (0.001)	0.041*** (0.003)	0.016*** (0.002)	0.048*** (0.003)
<i>BOOKLEV_{q-1}</i>	-0.001 (0.001)	-0.006*** (0.001)	-0.021*** (0.004)	-0.008*** (0.002)	-0.023*** (0.004)
<i>RETEARN_{q-1}</i>	0.000 (0.000)	-0.000** (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.001)
<i>ROA_{q-1}</i>	0.014*** (0.002)	0.010*** (0.002)	-0.056*** (0.008)	0.027*** (0.004)	-0.036*** (0.010)
Intercept	-0.004 (0.015)	-0.122*** (0.044)	0.013 (0.144)	-0.137** (0.058)	0.017 (0.153)
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.093	0.066	0.053	0.099	0.058

OLS regression results on the relationship between the CEO's vesting equity and the change in investment. Variable definitions are in Appendix A and the table at the start of this Online Appendix. *VESTING*, *VEGA*, *UNVESTED*, *VESTED*, *SALARY*, and *BONUS* are in billions. *CEOAGE*, *CEOTENURE*, and *FIRMAGE* are in hundreds. Robust standard errors are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively.

Table OA6: Vesting equity and level of investment

Dependent Variables	(1) <i>RD_q</i>	(2) <i>CAPEX_q</i>	(3) <i>NETINV_q</i>	(4) <i>RDCAPEX_q</i>	(5) <i>RDNETINV_q</i>
<i>VESTING_q</i>	-0.003 (0.022)	-0.038 (0.026)	-0.103** (0.047)	-0.035 (0.041)	-0.116* (0.063)
<i>UNVESTED_{q-1}</i>	0.004 (0.009)	-0.004 (0.013)	0.019 (0.024)	-0.009 (0.019)	0.014 (0.034)
<i>VESTED_{q-1}</i>	-0.001* (0.001)	0.006*** (0.001)	0.005* (0.003)	0.005*** (0.002)	0.003 (0.003)
<i>SALARY_{q-1}</i>	-0.352 (0.798)	-0.777 (1.203)	-0.682 (1.890)	-2.126 (1.692)	-1.586 (2.447)
<i>BONUS_{q-1}</i>	-0.019 (0.145)	-0.113 (0.257)	-0.161 (0.459)	-0.202 (0.370)	-0.181 (0.578)
<i>CEOAGE_{q-1}</i>	0.006* (0.003)	0.008** (0.004)	0.017*** (0.006)	0.013** (0.005)	0.023*** (0.008)
<i>CEOTENURE_{q-1}</i>	-0.013** (0.005)	-0.003 (0.005)	-0.016** (0.007)	-0.013* (0.007)	-0.025** (0.010)
<i>NEWCEO_q</i>	0.001 (0.001)	0.001 (0.001)	-0.003 (0.002)	0.002 (0.002)	-0.002 (0.003)
<i>FIRMAGE_{q-1}</i>	0.138 (0.140)	1.015*** (0.262)	1.282*** (0.469)	1.616*** (0.482)	2.007*** (0.773)
<i>Q_q</i>	0.003*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.004*** (0.000)	0.005*** (0.001)
<i>Q_{q-1}</i>	-0.001*** (0.000)	0.000*** (0.000)	0.001*** (0.000)	-0.001 (0.000)	-0.001 (0.001)
<i>MV_{q-1}</i>	-0.001*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.001** (0.000)	0.001* (0.001)
<i>MOM_{q-1}</i>	-0.001** (0.000)	-0.001*** (0.000)	0.001* (0.001)	-0.002*** (0.001)	-0.000 (0.001)
<i>CASH_{q-1}</i>	-0.004*** (0.001)	0.003** (0.001)	0.023*** (0.002)	-0.001 (0.002)	0.021*** (0.003)
<i>BOOKLEV_{q-1}</i>	-0.012*** (0.002)	-0.011*** (0.001)	-0.019*** (0.002)	-0.025*** (0.003)	-0.036*** (0.004)
<i>RETEARN_{q-1}</i>	-0.007*** (0.001)	-0.001*** (0.000)	-0.000 (0.000)	-0.008*** (0.001)	-0.009*** (0.001)
<i>ROA_{q-1}</i>	-0.026*** (0.003)	0.001 (0.002)	0.012*** (0.004)	-0.027*** (0.004)	-0.022*** (0.006)
Intercept	-0.007 (0.027)	-0.203*** (0.051)	-0.273*** (0.091)	-0.300*** (0.094)	-0.393*** (0.150)
Year, Quarter, and Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	26,724	26,724	26,724	26,724	26,724
Adjusted R ²	0.909	0.707	0.320	0.800	0.630

OLS regression results on the relationship between the CEO's vesting equity and the level of investment. Variable definitions are in Appendix A and the table at the start of this Online Appendix. *VESTING*, *UNVESTED*, *VESTED*, *SALARY*, and *BONUS* are in billions. *CEOAGE*, *CEOTENURE*, and *FIRMAGE* are in hundreds. Robust standard errors are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively.