**Web Appendix A**

**Measures of Control Variables**

Firm size. We use log of Total Assets to measure firm size.

Profitability. We include return on assets (ROA) as a control variable when using Tobin’s q as the dependent variable. This is in line with Feng, Morgan, and Rego’s (2015) study, which argues that including ROA as a control addresses firm-level endogeneity potentially induced by ROA.

SGA intensity. We measure SGA intensity as SGA expenditure divided by Total Assets.

CEO tenure.We measure CEO tenure by the number of years a CEO is employed at the firm in the CEO role.

CEO equity compensation. CEO equity compensation may influence firm performance. We measure CEO equity compensation as the percentage of compensation that is accounted for by equity (e.g., stocks, options) divided by the CEO’s total compensation.

*Sales growth*. We measure sales growth as the change in sales divided by the prior year sales.

*Market concentration*. We measure market concentration using the Herfindahl–Hirschman index (HHI), a commonly accepted measure of market concentration. We calculated HHI as the sum of the square of the market shares at the two-digit Standard Industrial Classification level.

Board size. Board size has an inverse relationship to the market value of the firm, making small boards of directors more effective (Yermack 1996). We measure board size as the number of directors serving on the board.

Board ownership. Agency theory predicts that directors who have more ownership in the firm monitor management actions more effectively. We measure board ownership as the cumulative percentage of shares held by the board of directors. We obtain these data from ISS.

Board gender diversity. Board demographic diversity positively affects firm performance (Carter, Simkins, and Simpson 2003). For example, gender-diverse boards are more effective at monitoring management (Adams and Ferreira 2009). We measure board diversity as the percentage of women directors on the board.

Board workload. The effective functioning of directors requires a commitment of time and resources. Therefore, directors serving on multiple boards might be less capable of devoting time to coach and monitor the management (Boivie, Bednar, and Andrus 2016). We measure board workload by the average number of directorships the focal firm board members hold.

CEO duality. In some cases, the CEO also serves as the chairman of the board of directors, a phenomenon known as CEO duality (Krause, Semadeni, and Cannella 2014). However, because of a weaker governance structure, agency problems may be more prevalent in such firms, leading to suboptimal decisions (Bebchuk and Fried 2004). We use a dummy variable that takes the value of 1 if a firm’s CEO is also the chairman of the board and 0 otherwise. We obtain these data from ExecuComp.

Board Age. We measure board age as the average age of the directors.

*Director CEOs.* We include director CEOs, or the percentage of directors who are currently CEOs at their firms, as a control variable because these CEOs exert a positive influence on firm performance ([Fahlenbrach](https://www.sciencedirect.com/science/article/pii/S0304405X10000139%22%20%5Cl%20%22%21), Low, and Stulz 2010).

**References**

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**Web Appendix B**

**Sample Size by Industry**

|  |  |
| --- | --- |
| **Industry** | **Firms in Sample** |
| Business Services | 47 |
| Industrial and Commercial Machinery and Computer Equipment | 36 |
| Electronic & Other Electrical Equipment & Components | 33 |
| Measuring, Photographic, Medical, & Optical Goods, & Clocks | 28 |
| Oil and Gas Extraction | 25 |
| Chemicals and Allied Products | 23 |
| Transportation Equipment | 17 |
| Electric, Gas and Sanitary Services | 16 |
| Communications | 10 |
| Primary Metal Industries | 9 |
| Wholesale Trade - Durable Goods | 9 |
| Paper and Allied Products | 8 |
| Furniture and Fixtures | 6 |
| Motor Freight Transportation | 6 |
| Security & Commodity Brokers, Dealers, Exchanges & Services | 5 |
| Petroleum Refining and Related Industries | 5 |
| Engineering, Accounting, Research, and Management Services | 5 |
| Fabricated Metal Products | 5 |
| Heavy Construction, Except Building Construction, Contractor | 5 |
| Miscellaneous | 31 |
| **Total** | **329** |

**Web Appendix C**

 **Effect of COB on R&D Intensity**

|  |  |  |
| --- | --- | --- |
|  | **DV: R&D intensity** | **DV: Tobin’s q** |
| COB | .007\*\* | .207\*\* |
|  | (.002) | (.045) |
|  |  |  |
| R&D intensity |  | 5.289\*\* |
|  |  | (1.021) |
|  |  |  |
| Demand uncertainty | -.093\* | -1.945\* |
|  | (.039) | (.975) |
|  |  |  |
| MKTG in TMT | .004\* | .448\*\* |
|  | (.002) | (.114) |
|  |  |  |
| Diversification | .017\*\* | -.048 |
|  | (.005) | (.124) |
|  |  |  |
| Firm size | -.003 | -.006 |
|  | (.004) | (.097) |
|  |  |  |
| Profitability | -.024 | 3.737\*\* |
|  | (.030) | (.824) |
|  |  |  |
| SGA intensity | .245\*\* | .980 |
|  | (.046) | (1.185) |
|  |  |  |
| CEO tenure | .001\*\* | .003 |
|  | (.000) | (.007) |
|  |  |  |
| CEO equity compensation | .003 | -.290 |
|  | (.017) | (.382) |
|  |  |  |
| Sales growth | -.024\*\* | -.034 |
|  | (.009) | (.255) |
|  |  |  |
| Market concentration | .000 | -.440 |
|  | (.021) | (.428) |
|  |  |  |
| Board size | -.001 | -.007 |
|  | (.002) | (.043) |
|  |  |  |
| Board ownership | -.001 | -.023 |
|  | (.000) | (.012) |
|  |  |  |
| Board gender diversity | .078 | -.011 |
|  | (.049) | (.826) |
|  |  |  |
| Board workload | -.003 | -.670\*\* |
|  | (.008) | (.187) |
|  |  |  |
| CEO duality | -.005 | -.081 |
|  | (.007) | (.158) |
|  |  |  |
| Board age | .002 | .096\*\* |
|  | (.001) | (.023) |
|  |  |  |
| Director CEOs | -.084\* | .969 |
|  | (.035) | (.871) |
|  |  |  |
| Lag. Tobin’s q |  | .394\*\* |
|  |  | (.040) |
|  |  |  |
| Lag. R&D intensity | .611\*\* |  |
|  | (.044) |  |
|  |  |  |
| Intercept | .000 | -5.080\*\* |
|  | (.001) | (1.347) |
|  |  |  |
| Firm fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Number of observations | 1514 | 1514 |

Notes: Standard errors are in parentheses. \* *p* < .05, \*\* *p* < .01.