**Supplementary Material for “Political Activism and Firm Innovation“**

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This Online Appendix presents additional empirical results:

- ***Section 1*** presents the sample descriptive statistics.

- ***Section 2*** presents the summary statistics for the measures of firm political activism used in the paper.

- ***Section 3*** presents additional robustness tests for the relation between firm political activism and innovation.

- ***Section 4*** presents the results of tests of alternative hypotheses for the relation between firm political activism and innovation.

## *Section 1: Sample Descriptive Statistics*

Table 1.1 reports summary statistics for various firm characteristics of politically active and inactive firms used in our study. All variables are defined in the paper in Appendix A. In panel A, politically active firms are much larger, older and more profitable than inactive firms. Politically active firms also have more tangible assets, higher leverage, lower Q, and invest significantly less in R&D relative to their assets. In terms of sheer raw innovation, politically active firms receive more patents and patent citations, although this result likely reflects the firm size effect. To address this issue, panel B reports the characteristics of politically active and inactive firms within size-ranked deciles. We sort all firms in the patent citations file by NYSE annually ranked size decile breakpoints and within each decile report the characteristics of politically active and inactive firms.

The results in panel B show that politically active firms receive more patents compared to inactive firms, but this result holds only for very large firms. For other firms, there is no discernible pattern in patent activity between the two subsamples. Similarly, there appears no consistent differences in patent citations between politically active and inactive firms once we control for firm size. As regards other variables, the relation between firm size and political activism is particularly evident from the distribution of politically active firms across size deciles. The percentage of politically active firms is 1.1% in the smallest decile but increases significantly to 14.7% for firms in decile five and 71.5% for the largest decile. Controlling for firm size, politically active firms tend to be older and less profitable, with more tangible assets and higher leverage but lower Q and R&D expenditures. Politically active firms also operate in more competitive industries.

## Table SM.1.1
## Characteristics of Politically Active and Inactive Firms, 1979 – 2004

This table presents formation period summary statistics for various firm characteristics of politically active and politically inactive firms. The subsample of politically active firms consists of 1,805 unique firms with an established political action committee (PAC) and political contributions data from the Federal Election Commission (FEC) for the period January 1, 1979 – December 31, 2004. The subsample of politically inactive firms consists of all other firms in the CRSP/Compustat merged database with nonmissing values of the firm characteristics in this table. The numbers in each cell are time-series averages of yearly cross-sectional median statistics. N is the average annual number of firms in each subsample. *t*-test is the t-statistic computed under the null hypothesis that the difference between politically active and inactive firms is zero. Panel A reports characteristics of politically active and inactive firms. Panel B reports characteristics of politically active and inactive firms based on NYSE annually ranked size decile breakpoints. All numbers, except SIZE, AGE, PATENTS, and PATENT CITATIONS are in decimal form, i.e. 0.01 is 1%. All variables are fully defined in Appendix A in the paper.

## Table 1.1

| Firms | SIZE | AGE | ROA | PPE _ASSETS | LEV | Q | HI | R&D _ASSETS | CAPX _ASSETS | PATENTS | PATENT CITATION | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Panel A: Comparison of Politically Active and Inactive Firms* | | | | | | | | | | | | |
| Politically active | 1.289 | 22.346 | 0.118 | 0.338 | 0.261 | 1.119 | 0.154 | 0.012 | 0.052 | 6.106 | 0.309 | 740 |
| Inactive | 0.068 | 7.000 | 0.085 | 0.200 | 0.190 | 1.268 | 0.193 | 0.038 | 0.041 | 0.752 | 0.171 | 5405 |
| *t*-test (difference) | 8.14 | 21.38 | 6.99 | 8.13 | 8.75 | -4.47 | -4.96 | -11.04 | 2.90 | 19.07 | 9.79 | |
| *Panel B:Comparison of Politically Active and Inactive Firms by Size Deciles* | | | | | | | | | | | | |
| Small Active | 0.030 | 10.404 | 0.074 | 0.232 | 0.289 | 1.018 | 0.203 | 0.007 | 0.033 | 0.320 | 0.111 | 29 |
| Inactive | 0.018 | 6.240 | 0.049 | 0.188 | 0.202 | 1.149 | 0.204 | 0.041 | 0.034 | 0.193 | 0.094 | 2665 |
| *t*-test | 4.95 | 6.36 | 2.99 | 1.65 | 5.07 | -5.42 | -0.03 | -11.63 | -0.14 | 1.29 | 0.94 | |
| Decile 2 | 0.080 | 14.115 | 0.084 | 0.235 | 0.258 | 1.031 | 0.195 | 0.008 | 0.032 | 0.560 | 0.167 | 30 |
| | 0.076 | 6.780 | 0.089 | 0.191 | 0.171 | 1.269 | 0.191 | 0.043 | 0.042 | 0.335 | 0.197 | 688 |
| | 0.50 | 9.30 | -0.60 | 2.18 | 5.39 | -6.77 | 0.29 | -10.48 | -2.75 | 1.66 | -1.42 | |
| Decile 3 | 0.136 | 13.077 | 0.091 | 0.249 | 0.265 | 1.050 | 0.172 | 0.007 | 0.036 | 0.525 | 0.176 | 35 |
| | 0.134 | 7.080 | 0.104 | 0.191 | 0.164 | 1.326 | 0.190 | 0.038 | 0.044 | 0.714 | 0.217 | 490 |
| | 0.15 | 7.67 | -1.94 | 3.17 | 8.04 | -7.27 | -1.97 | -9.97 | -2.08 | -1.36 | -1.31 | |
| Decile 4 | 0.216 | 14.442 | 0.098 | 0.291 | 0.246 | 1.061 | 0.144 | 0.008 | 0.043 | 0.594 | 0.192 | 46 |
| | 0.217 | 7.560 | 0.113 | 0.194 | 0.169 | 1.355 | 0.177 | 0.034 | 0.045 | 0.960 | 0.223 | 401 |
| | -0.02 | 7.29 | -2.50 | 6.36 | 7.10 | -8.78 | -3.42 | -9.17 | -0.69 | -2.68 | -1.60 | |
| Decile 5 | 0.337 | 17.423 | 0.105 | 0.317 | 0.255 | 1.067 | 0.149 | 0.008 | 0.047 | 1.218 | 0.179 | 57 |
| | 0.34 | 8.380 | 0.124 | 0.209 | 0.176 | 1.432 | 0.178 | 0.029 | 0.048 | 1.079 | 0.265 | 333 |
| | 0.038 | 9.12 | -3.38 | 6.36 | 7.98 | -9.92 | -3.30 | -8.37 | -0.24 | 0.42 | -4.21 | |
| Decile 6 | 0.526 | 18.904 | 0.112 | 0.344 | 0.270 | 1.093 | 0.130 | 0.008 | 0.049 | 0.928 | 0.190 | 70 |
| | 0.52 | 9.760 | 0.130 | 0.241 | 0.179 | 1.458 | 0.173 | 0.026 | 0.052 | 1.198 | 0.266 | 264 |
| | 0.030 | 8.84 | -3.20 | 5.04 | 10.17 | -8.97 | -5.79 | -7.20 | -0.69 | -1.48 | -3.27 | |
| Decile 7 | 0.832 | 21.481 | 0.118 | 0.397 | 0.276 | 1.098 | 0.145 | 0.008 | 0.053 | 2.011 | 0.248 | 84 |
| | 0.84 | 11.260 | 0.140 | 0.268 | 0.201 | 1.503 | 0.173 | 0.024 | 0.057 | 1.562 | 0.310 | 213 |
| | -0.043 | 9.92 | -4.74 | 5.92 | 8.86 | -10.28 | -3.38 | -9.62 | -0.83 | 1.67 | -2.71 | |
| Decile 8 | 1.411 | 24.577 | 0.119 | 0.387 | 0.270 | 1.122 | 0.149 | 0.011 | 0.054 | 2.968 | 0.281 | 104 |
| | 1.40 | 13.460 | 0.145 | 0.273 | 0.195 | 1.542 | 0.171 | 0.023 | 0.058 | 2.594 | 0.333 | 166 |
| | 0.067 | 10.82 | -5.17 | 4.41 | 9.26 | -7.80 | -2.54 | -8.15 | -0.69 | 0.98 | -2.22 | |
| Decile 9 | 2.850 | 29.519 | 0.122 | 0.379 | 0.273 | 1.137 | 0.145 | 0.012 | 0.058 | 5.192 | 0.356 | 125 |
| | 2.73 | 17.000 | 0.154 | 0.267 | 0.191 | 1.697 | 0.171 | 0.023 | 0.059 | 3.158 | 0.378 | 121 |
| | 0.335 | 12.28 | -6.28 | 4.71 | 14.10 | -8.11 | -3.40 | -6.59 | -0.09 | 4.84 | -0.78 | |
| Big | 9.433 | 36.769 | 0.146 | 0.345 | 0.245 | 1.300 | 0.166 | 0.022 | 0.064 | 20.947 | 0.559 | 160 |
| | 7.326 | 22.100 | 0.162 | 0.289 | 0.184 | 1.861 | 0.189 | 0.028 | 0.065 | 14.835 | 0.507 | 64 |
| | 1.46 | 10.66 | -2.50 | 2.07 | 8.33 | -4.82 | -2.47 | -3.17 | -0.16 | 4.21 | 1.38 | |

## *Section 2: Measures of Firm Political Activism*

Table 2.1 reports summary statistics for the political activism measures used in our study. On average, politically active firms support 84 political candidates over any given 5-year period. This support is divided between 13.5 candidates who serve on influential Congressional committees and 70.6 candidates who serve on outside committees. The minimum number of supported candidates is one (315 firms in our sample support a single candidate) and the maximum is 844 (AT&T in 1984). In terms of contribution amounts, firms in our sample contribute on average a total of $226,050 over a 5-year period. These contributions are divided between $44,082 contributed to members of influential Congressional committees and $181,968 contributed to other politicians. These results show that members of influential committees receive more in political contributions ($44,082/13.483 = $3,270 on average) compared to other politicians ($181,968/70.619 = $2,577), which is consistent with Romer and Snyder (1994) and Kroszner and Stratmann (2000). The minimum amount of political contributions is zero and the maximum is $6,293,663 (AT&T in 1990).[1]

In panel B, we present a detailed account of political contributions made by each politically active firm in each election cycle to members of each Congressional committee in our sample. Ranked by the average contribution amount, members of the House Energy and Commerce committee collectively receive the most in political contributions from a typical firm ($13,578 on average), while members of the House Merchant Marine and Fisheries committee receive the least ($7,335). Similarly in the Senate, members of the Commerce committee receive the most in political contributions ($9,479), while members of the Environment and Public Works receive the least ($7,409). Other committees receive between $7,000 and $10,000 on average from firms, with the Armed Services, Financial Services, and the House Transportation committee receiving amounts at the top end of the distribution and the Agriculture and Natural Resource committees at the bottom.

In addition to contribution totals, two other results stand out. First, firm contributions to Congressional committees are significantly related to the rankings of powerful committees developed in Edwards and Stewart (2006). Three out of seven House committees in our sample (Energy and Commerce, Transportation and Infrastructure, and Armed Services/National

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[1] Zero contributions arise when a firm's original contribution is refunded by a politician's campaign, usually after an election loss. We view them as valid contributions in the sense that the firm attempted to establish a relationship with a politician based on considerations deemed important by the firm. However, the money was refunded for reasons most likely outside of the firm's control.

Security), and two out of six Senate committees (Commerce, Science, and Transportation and Armed Services) are on the Edwards and Stewart (2006) list of the ten most powerful committees. Moreover, the correlation between contribution totals in panel B and committee power rankings is 0.782 for the House committees and 0.538 for the Senate committees. These correlations are significantly higher than those reported in Ovtchinnikov and Pantaleoni (2012) who study individual political contributions and show that firms target powerful committees to a much greater extent than individuals. The results are consistent with prior evidence that committees with significant power over firms receive more money (see, e.g., Grier and Munger (1991), Romer and Snyder (1994), and Ansolabehere and Snyder (1999)).

Second, the differences in committee contribution totals reflect differences in the number of committee members that firms choose to support rather than differences in the total amount of political contributions made to each committee member. In fact, the latter is roughly constant, with approximately $1,700 contributed to members of the House committees and $2,800 contributed to members of the Senate committees. These results are in line with Cooper, et al. (2010) and show that the level of firms' political activism is determined by the number of political candidates firms choose to support rather than by the amount of money contributed to each candidate. Therefore, in our analysis in the paper, we focus on political activism measures based on the number of supported political candidates. We use political activism measures based on the amount of contributions to political candidates as a robustness check.

**Table 2.1**
**Measures of Firm Political Activism, 1984 – 2004**

This table presents data from the FEC detailed contribution files on political contributions to House, Senate, and Presidential elections. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. Individual contributions are combined into ten firm-year level measures of political activism as described in equations (1) – (6) in section III.B. Panel A presents the descriptive statistics for each political activism measure. Total in row 1 equals *PCAND* (equation (1)) in columns 1 – 6 and *CAMOUNT* (equation (2)) in columns 7 – 12. Committee in row 2 equals $PCAND^{Committee}$ (equation (3)) in columns 1 – 6 and $CAMOUNT^{Committee}$ (equation (4)) in columns 7 – 12. Non-committee in row 3 equals $PCAND^{Non\text{-}Committee}$ (defined in section III.B) in columns 1 – 6 and $CAMOUNT^{Non\text{-}Committee}$ (defined in section III.B) in column 7 – 12. $\Delta Y^+$ in row 4 equals $\Delta PCAND^+$ (equation (5)) in columns 1 – 6 and $\Delta CAMOUNT^+$ (equation (6)) in columns 7 – 12. $\Delta Y^-$ in row 5 equals $\Delta PCAND^-$ (defined in section III.B) in columns 1 – 6 and $\Delta CAMOUNT^-$ (defined in section III.B) in columns 7 – 12. Panel B presents election cycle firm political contribution totals for each Congressional committee in our sample. The FEC data on political contributions is for the period January 1, 1979 – December 31, 2004. Since we require five years of data to compute each measure of political activism, the variables are computed at the end of October of each year, from 1984 to 2004, resulting in 16,065 firm-year observations for each variable.

| | *PCAND* | | | | | | *CAMOUNT* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Min | 25th Per | Median | 75th Per | Max | Mean | Min | 25th Per | Median | 75th Per | Max |
| *Panel A: Measures of Political Activism* | | | | | | | | | | | | |
| Total | 84.102 | 1 | 14 | 39 | 117 | 844 | $226,050 | 0 | $20,948 | $73,135 | $238,656 | $6,293,663 |
| Committee | 13.483 | 0 | 0 | 3 | 18 | 172 | 44,082 | 0 | 0 | 5,339 | 35,911 | 1,574,725 |
| Non-Committee | 70.619 | 0 | 11 | 32 | 97 | 791 | 181,968 | 0 | 16,142 | 58,342 | 192,408 | 5,354,005 |
| $\Delta Y^+$ | 0.422 | 0 | 0 | 0 | 0 | 15 | 1,126 | 0 | 0 | 0 | 0 | 88,615 |
| $\Delta Y^-$ | 0.367 | 0 | 0 | 0 | 0 | 15 | 1,306 | 0 | 0 | 0 | 0 | 123,913 |
| *Panel B: Political Contributions to Members of Congressional Committees* | | | | | | | | | | | | |
| House Congressional Committees | | | | | | | | | | | | |
| Energy & Commerce | 7.623 | 1 | 2 | 4 | 11 | 51 | $13,578 | 0 | $1,593 | $4,787 | $14,908 | $518,973 |
| Financial Services | 5.640 | 1 | 1 | 3 | 6 | 62 | 10,637 | 0 | 1,284 | 3,346 | 9,436 | 380,510 |
| Transportation | 5.942 | 1 | 1 | 3 | 7 | 66 | 10,511 | 0 | 1,399 | 3,910 | 10,751 | 393,013 |
| Armed Services | 5.462 | 1 | 1 | 3 | 6 | 57 | 10,216 | 0 | 1,292 | 3,305 | 9,031 | 327,122 |
| Agriculture | 4.930 | 1 | 1 | 3 | 6 | 48 | 8,423 | 0 | 1,292 | 3,264 | 8,942 | 325,162 |
| Natural Resources | 4.622 | 1 | 1 | 3 | 6 | 40 | 7,886 | 0 | 1,272 | 3,381 | 9,019 | 196,176 |
| Merchant Marine | 4.915 | 1 | 1 | 3 | 6 | 42 | 7,335 | 0 | 1,295 | 3,328 | 8,267 | 173,512 |
| Senate Congressional Committees | | | | | | | | | | | | |
| Commerce | 3.241 | 1 | 1 | 2 | 4 | 17 | $9,479 | 0 | $1,753 | $4,726 | $12,044 | $133,323 |
| Banking | 3.165 | 1 | 1 | 2 | 4 | 17 | 9,008 | 0 | 1,673 | 4,457 | 10,950 | 109,078 |
| Agriculture | 3.138 | 1 | 1 | 2 | 4 | 16 | 8,945 | 0 | 1,747 | 4,501 | 11,581 | 108,511 |
| Armed Services | 3.042 | 1 | 1 | 2 | 4 | 20 | 8,872 | 0 | 1,673 | 4,185 | 10,742 | 139,483 |
| Energy | 3.211 | 1 | 1 | 2 | 4 | 17 | 8,639 | 0 | 1,587 | 4,333 | 10,987 | 126,395 |
| Environment | 2.717 | 1 | 1 | 2 | 4 | 15 | 7,409 | 0 | 1,523 | 3,875 | 9,597 | 97,661 |

## *Section 3: Additional Robustness Tests of the Relation Between Firm Political Activism and Innovation*

*3.1. Baseline Regressions with Additional Controls*

In our baseline tests in section IV in the paper, we follow the standard methodology in the innovation literature and estimate equation (7) with industry and year fixed effects. The inclusion of these variables ensures that none of our results are identified from differences across industries or differences through time. However, we cannot dismiss a possibility that our identification comes from industry-time variation in firm innovation that is also related to political activism. For example, it is possible that fluctuations in the business cycle simultaneously affect firm innovation and the demand for political activism and this relation varies systematically across industries. To control for this possibility, our first robustness test augments equation (7) with industry-time interaction fixed effects. In this test, the identification of the effect of political activism on firm innovation comes from firm-by-firm variation within each industry each year.

In our second robustness test, we also add location and location-time fixed effects. This inclusion further guarantees that our results are not identified from systematic differences across firm locations or location-time interactions. Finally, our third robustness test represents a much higher hurdle to identify the political activism effect. In this test, we keep the time and industry-time fixed effects but replace the industry fixed effect with a firm fixed effect. Thus, the coefficient $\beta_1$ associated with political activism in equation (7) is identified from the time-series within-firm variation in political activism that is unrelated to the average industry political activism time dynamics. In other words, the identification comes from firms changing their political contribution strategies over time in ways that are orthogonal to changes in political contributions for the entire industry. This test is especially important for the sample of politically active firms, because, in addition to controlling for all known determinants of firm political involvement above, it also controls for the possibility that some unobserved time invariant firm characteristics drive firm self-selection into the politically active group thereby explaining the relation between political activism and innovation.

The results of all three tests are presented in table 3.1. For brevity, we report the results for *PCAND* only and note the results for *CAMOUNT* are qualitatively similar. The $\beta_1$ coefficient is always positive and significant in the industry-time and state-time level fixed effects regressions and is similar in magnitude to those reported in table 3. In firm level fixed effects regressions, the $\beta_1$ coefficient is smaller in magnitude but still mostly significant at conventional levels. It is positive but insignificant in the patent citation regressions at the one-year horizon. These results suggest that the effect of political activism on firm innovation is orthogonal to industry and location time dynamics and to unobserved time invariant firm effects.

## Table 3.1
## Robustness Tests: Additional Controls, 1984 – 2004

The political contributions data are from the FEC detailed contribution files. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. This table presents the robustness results of estimating equation (7) on the sample of politically active and inactive firms for the period November 1984 – October 2004. All firms are all firms with available data on CRSP/Compustat and include 123,531 firm-year observations. Active firms are politically active firms only and include 16,065 firm-year observations. Panel A presents the results for the total number of patent applications. Panel B presents the results for the total number of patent citations. All variables are defined in section III.B and Appendix A. Standard errors are in parentheses and are adjusted for heteroskedasticity and correlated within firms. $R^2$ is the adjusted R-squared in the regression. *N* is the total number of firm-year observations. [a], [b], [c], indicates significance at the 1%, 5%, and 10% level, respectively.

*Panel A: Number of Patents*

| | $EFFPATENT_{t+1}$ | | | | | | $EFFPATENT_{t+3}$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms |
| *PCAND/10²* | 0.272[a] | 0.156[a] | 0.299[a] | 0.168[a] | 0.067[a] | 0.038[a] | 0.336[a] | 0.194[a] | 0.369[a] | 0.211[a] | 0.090[a] | 0.056[a] |
| | (0.037) | (0.038) | (0.010) | (0.012) | (0.013) | (0.014) | (0.045) | (0.047) | (0.045) | (0.049) | (0.016) | (0.017) |
| *Table 3 controls* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Firm FE* | No | No | No | No | Yes | Yes | No | No | No | No | Yes | Yes |
| *Ind FE* | Yes | Yes | Yes | Yes | No | No | Yes | Yes | Yes | Yes | No | No |
| *State FE* | No | No | Yes | Yes | No | No | No | No | Yes | Yes | No | No |
| *Year FE* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Ind × Year FE* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *State ×Year FE* | No | No | Yes | Yes | No | No | No | No | Yes | Yes | No | No |
| $R^2$ | 0.305 | 0.555 | 0.310 | 0.546 | 0.831 | 0.887 | 0.335 | 0.581 | 0.339 | 0.572 | 0.869 | 0.908 |
| *N* | 123,531 | 16,065 | 115,812 | 15,459 | 123,531 | 16,065 | 118,122 | 15,271 | 111,006 | 14,734 | 118,122 | 15,271 |

*Panel B: Patent Citations*

| | $CPATENT_{t+1}$ | | | | | | $CPATENT_{t+3}$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms | All Firms | Active Firms |
| *PCAND/10²* | 0.033[a] | 0.024[a] | 0.035[a] | 0.028[a] | 0.004 | 0.001 | 0.070[a] | 0.053[a] | 0.074[a] | 0.059[a] | 0.025[a] | 0.024[a] |
| | (0.006) | (0.008) | (0.002) | (0.003) | (0.005) | (0.006) | (0.012) | (0.015) | (0.012) | (0.016) | (0.008) | (0.009) |
| *Table 3 controls* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Firm FE* | No | No | No | No | Yes | Yes | No | No | No | No | Yes | Yes |
| *Ind FE* | Yes | Yes | Yes | Yes | No | No | Yes | Yes | Yes | Yes | No | No |
| *State FE* | No | No | Yes | Yes | No | No | No | No | Yes | Yes | No | No |
| *Year FE* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Ind × Year FE* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *State ×Year FE* | No | No | Yes | Yes | No | No | No | No | Yes | Yes | No | No |
| $R^2$ | 0.187 | 0.367 | 0.190 | 0.361 | 0.465 | 0.591 | 0.256 | 0.445 | 0.261 | 0.438 | 0.676 | 0.759 |
| *N* | 123,531 | 16,065 | 115,812 | 15,459 | 123,531 | 16,065 | 118,122 | 15,271 | 111,006 | 14,734 | 118,122 | 15,271 |

### *3.2. Baseline Regressions with Alternative Measures of Innovation*

In addition to measuring firm innovation with the number of patents and patent citations (innovation output), we also measure firm innovation with the R&D expenditures (innovation input). The results from estimating equation (7) with R&D expenditures as the dependent variable are presented in table 3.2.

We also use patent originality and patent relevancy to measure firm innovation. Patent originality is calculated as in Hall, Jaffee, and Trajtenberg (2001):

$$ORIGINALITY_i = 1 - \sum_{j}^{ni} s_{ij}^2$$

where $s_{ij}$ is the percentage of citations made by patent $i$ that belong to patent class $j$, out of $ni$ patent classes. Patent relevancy is calculated as follows. In the first step, we follow Silverman (1999) and use the absolute level of a firm's patent portfolio that is likely to be applicable to a particular industry, $ABSTECH_j$, as a measure of relevant patents. First, we calculate the number of patents, $N_{ic}$, that are assigned to International Patent Classification $c$ ($IPC_c$) for firm $i$ in year $t$. Second, we use the frequency with which patents in each class are assigned to each SIC code to create a probability distribution that relates patent classes to SIC codes. For example, suppose that the US Patent Office grants 376 patents that are assigned to $IPC_c$, and assigns 138 of these patents to $SIC_j$ as the "SIC of Use". Then any single patent assigned to $IPC_c$ during this period has a 36.7% probability of being assigned to $SIC_j$. We aggregate these probability-weighted SIC assignments over firm $i$'s entire patent portfolio to determine the total strength of the firm's technological resources, as measured by its patents, in each SIC. Formally, $ABSTECH_j$ is a measure of application-specific technological strength:

$$ABSTECH_j = \sum_i \sum_c Prob(industry = j \mid patent = c) * N_{ic}$$

Our patent relevancy measure is the sum of application-specific technological strength, $ABSTECH_j$ in each SIC industry.

The results from estimating equation (7) with these measures of firm innovation are presented in table 3.3 (for patent originality) and table 3.4 (for patent relevancy). In all regressions, we find a significant positive relation between firm political activism and innovation.

## Table 3.2
## Robustness Tests: Political Contributions and Corporate R&D Expenses, 1984 – 2004

The political contributions data are from the FEC detailed contribution files. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. This table presents Tobit regressions of R&D_ASSETS on political activism during 1984 - 2004. Models 1 and 2 present results for all firms with available data on CRSP/Compustat and include 111, 670 firm-year observations. Models 3 and 4 present results of politically active firms only and include 15,247 firm-year observations. We control for firm self-selection in models 3 and 4 by including the inverse Mills ratio (IMR) from the first-stage probit model of whether a firm has an established PAC on determinants of PAC participation. The first stage probit results are presented in Appendix B. All regressions include industry and year fixed effects. All variables are defined in section III.B and Appendix A. Standard errors are in parentheses and are adjusted for heteroskedasticity and correlated within firms. [a], [b], [c], indicates significance at the 1%, 5%, and 10% level, respectively.

| | $R\&D\_ASSETS_{t+1}$ | | | |
|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 |
| *$PCAND/10^2$* | 0.018[a] | | 0.003[b] | |
| | (0.002) | | (0.001) | |
| *CAMOUNT* | | 0.039[a] | | 0.006[b] |
| | | (0.005) | | (0.003) |
| *dy/dx* | 0.004[a] | 0.009[a] | 0.001[a] | 0.001[a] |
| | (0.001) | (0.001) | 0.000 | 0.000 |
| *ROA* | -0.200[a] | -0.199[a] | -0.046[c] | -0.047[c] |
| | (0.005) | (0.005) | (0.026) | (0.026) |
| *PPE_ ASSETS* | -0.052[a] | -0.051[a] | -0.010 | -0.009 |
| | (0.007) | (0.007) | (0.011) | (0.011) |
| *LEVERAGE* | -0.105[a] | -0.105[a] | -0.039[a] | -0.039[a] |
| | (0.005) | (0.005) | (0.009) | (0.009) |
| *CAPEX_ ASSETS* | 0.079[a] | 0.078[a] | 0.052[c] | 0.051[c] |
| | (0.014) | (0.014) | (0.027) | (0.027) |
| *HI* | -0.088[a] | -0.090[a] | -0.005 | -0.006 |
| | (0.020) | (0.020) | (0.026) | (0.027) |
| *$HI^2$* | 0.078[a] | 0.081[a] | -0.007 | -0.006 |
| | (0.022) | (0.022) | (0.026) | (0.026) |
| *Q* | 0.010[a] | 0.010[a] | 0.009[a] | 0.009[a] |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| *LnAGE* | -0.001 | 0.001 | -0.002 | -0.001 |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| *IMR* | | | -0.009[a] | -0.011[a] |
| | | | (0.003) | (0.003) |
| *Observations* | 111,670 | 111,670 | 15,247 | 15,247 |
| *Log likelihood* | 15,252 | 15,188 | 7,339 | 7,334 |

## Table 3.3

## Robustness Tests: Political Contributions and Patent Originality, 1984-2004

The political contributions data are from the FEC detailed contribution files. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. This table presents regressions of patent originality on political activism variables on the sample of politically active and inactive firms for the period November 1984 – October 2004. Patent originality is calculated as 1 minus sum of squared percentage of citation made by patent *i* in industry *j* and then averaged over each firm year (Trajtenberg, Jaffe and Henderson, 1997). Models 1, 2, 5, and 6 present results for all firms with available data on CRSP/Compustat and include 123,531 (118,122 for model 5 and 6) firm-year observations. Models 3, 4, 7, and 8 present results for politically active firms only and include 16,065 (15,271 for model 7 and 8) firm-year observations. We control for firm self-selection in models 3, 4, 7, and 8 by including the inverse Mills ratio (IMR) from the first-stage probit model of whether a firm has an established PAC on determinants of PAC participation. The first stage probit results are presented in Appendix B. All regressions include industry and year fixed effects. All other variables are defined in section III.B and Appendix A. Standard errors are in parentheses and are adjusted for heteroskedasticity and correlated within firms. $R^2$ *controls only* is the adjusted R-squared from the model that includes only the control variables but does not include measures of political activism. *N* is the total number of firm-year observations. [a], [b], [c], indicates significance at the 1%, 5%, and 10% level, respectively.

| | $ORIGINALITY_{t+1}$ | | | | $ORIGINALITY_{t+3}$ | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *PCAND/10²* | 0.019[a] | | 0.013[a] | | 0.061[a] | | 0.041[a] | |
| | (0.003) | | (0.004) | | (0.010) | | (0.012) | |
| *CAMOUNT/10⁶* | | 0.045[a] | | 0.028[a] | | 0.146[a] | | 0.093[a] |
| | | (0.009) | | (0.009) | | (0.028) | | (0.028) |
| *R&D_ASSETS* | 0.305[a] | 0.305[a] | 0.963[a] | 0.964[a] | 0.846[a] | 0.847[a] | 2.806[a] | 2.805[a] |
| | (0.016) | (0.016) | (0.189) | (0.189) | (0.046) | (0.046) | (0.535) | (0.534) |
| *ROA* | 0.049[a] | 0.047[a] | 0.037 | 0.036 | 0.159[a] | 0.156[a] | 0.137[a] | 0.134[a] |
| | (0.005) | (0.005) | (0.045) | (0.045) | (0.014) | (0.014) | (0.123) | (0.123) |
| *PPE_ ASSETS* | -0.010[b] | -0.010[c] | -0.016[b] | -0.013 | -0.023 | -0.020 | -0.052[b] | -0.043[c] |
| | (0.005) | (0.005) | (0.020) | (0.020) | (0.015) | (0.015) | (0.060) | (0.060) |
| *LEVERAGE* | -0.045[a] | -0.045[a] | -0.039[c] | -0.040[a] | -0.137[a] | -0.138[a] | -0.145[b] | -0.146[b] |
| | (0.004) | (0.004) | (0.015) | (0.015) | (0.011) | (0.011) | (0.044) | (0.044) |
| *CAPEX_ ASSETS* | 0.059[a] | 0.058[a] | -0.025[c] | -0.028 | 0.175[a] | 0.172[a] | -0.010[c] | -0.019 |
| | (0.010) | (0.010) | (0.053) | (0.053) | (0.028) | (0.028) | (0.145) | (0.145) |
| *HI* | 0.093[a] | 0.094[a] | 0.198[a] | 0.205[a] | 0.282[a] | 0.286[a] | 0.615 | 0.638 |
| | (0.017) | (0.017) | (0.053) | (0.053) | (0.050) | (0.050) | (0.164) | (0.162) |
| *HI²* | -0.086[a] | -0.087[b] | -0.160[a] | -0.168[a] | -0.256[a] | -0.260[a] | -0.493 | -0.520 |
| | (0.021) | (0.021) | (0.064) | (0.064) | (0.061) | (0.061) | (0.195) | (0.194) |
| *Q* | 0.008[a] | 0.008[a] | 0.010[a] | 0.011 | 0.025[a] | 0.025[a] | 0.032 | 0.033 |
| | (0.001) | (0.001) | (0.004) | (0.004) | (0.002) | (0.002) | (0.010) | (0.010) |
| *SIZE* | 0.019[a] | 0.020[a] | 0.011[a] | 0.012[a] | 0.055[a] | 0.057[a] | 0.031[a] | 0.034[a] |
| | (0.001) | (0.001) | (0.004) | (0.004) | (0.002) | (0.002) | (0.012) | (0.012) |
| *LnAGE* | 0.008[a] | 0.008[a] | 0.009[b] | 0.010[b] | 0.024[a] | 0.026[a] | 0.026[a] | 0.126[a] |
| | (0.001) | (0.001) | (0.004) | (0.004) | (0.004) | (0.004) | (0.012) | (0.030) |
| *IMR* | | | -0.127[b] | -0.027[b] | | | -0.082[a] | -0.252[a] |
| | | | (0.065) | (0.011) | | | (0.032) | (0.084) |
| $R^2$ | 0.226 | 0.226 | 0.387 | 0.387 | 0.295 | 0.294 | 0.479 | 0.478 |
| $R^2$ *controls only* | 0.224 | 0.224 | 0.385 | 0.385 | 0.292 | 0.292 | 0.475 | 0.475 |
| *N* | 123,531 | 123,531 | 16,065 | 16,065 | 118,122 | 118,122 | 15,271 | 15,271 |

## Table 3.4
## Robustness Tests: Political Contributions and Patent Relevancy, 1984-2004

The political contributions data are from the FEC detailed contribution files. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. This table presents regressions of patent relevancy on political activism on the sample of politically active and inactive firms during November 1984 – October 2004. For each firm *i* in year *t*, $RELEVANT_t$ is calculated as the sum of application-specific technological strength (Silverman, 1999) considering Fama-French 48 industry classifications. Models 1, 2, 5, and 6 present the results for all firms with available data on CRSP/Compustat and include 123,531 (118,122 for model 5 and 6) firm-year observations. Models 3, 4, 7, and 8 present the results for politically active firms only and include 16,065 (15,271 for model 7 and 8) firm-year observations. We control for firm self-selection in models 3, 4, 7, and 8 by including the inverse Mills ratio (IMR) from the first-stage probit model of whether a firm has an established PAC on determinants of PAC participation. The first stage probit results are presented in Appendix B. All regressions include industry and year fixed effects. All other variables are defined in section III.B and Appendix A. Standard errors are in parentheses and are adjusted for heteroskedasticity and correlated within firms. *$R^2$ controls only* is the adjusted R-squared from the model that includes only the control variables but does not include measures of political activism. [a], [b], [c], indicates significance at the 1%, 5%, and 10% level, respectively.

| *Politically Relevant Patents* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $RELEVANT_{t+1}$ | | | | $RELEVANT_{t+3}$ | | | |
| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *PCAND/$10^2$* | 0.162[a] | | 0.071[a] | | 0.199[a] | | 0.081[b] | |
| | (0.029) | | (0.027) | | (0.034) | | (0.032) | |
| *CAMOUNT/$10^6$* | | 0.306[a] | | 0.077 | | 0.395[a] | | 0.100 |
| | | (0.080) | | (0.060) | | (0.100) | | (0.073) |
| *R&D_ASSETS* | 0.459[a] | 0.461[a] | 6.856[a] | 6.887[a] | 0.670[a] | 0.673[a] | 8.949[a] | 8.978[a] |
| | (0.040) | (0.041) | (1.117) | (1.128) | (0.054) | (0.054) | (1.418) | (1.430) |
| *ROA* | 0.066[a] | 0.052[a] | 0.540[a] | 0.552[a] | 0.098[a] | 0.082[a] | 0.799[a] | 0.816[a] |
| | (0.014) | (0.014) | (0.181) | (0.184) | (0.018) | (0.018) | (0.241) | (0.244) |
| *PPE_ ASSETS* | -0.013 | -0.005 | -0.145 | -0.122 | -0.016 | -0.007 | -0.208 | -0.182 |
| | (0.019) | (0.018) | (0.101) | (0.099) | (0.024) | (0.024) | (0.126) | (0.124) |
| *LEVERAGE* | -0.062[a] | -0.068[a] | -0.045 | -0.050 | -0.096[a] | -0.103[a] | -0.088 | -0.095 |
| | (0.011) | (0.011) | (0.071) | (0.071) | (0.015) | (0.015) | (0.088) | (0.089) |
| *CAPEX_ ASSETS* | 0.162[a] | 0.155[a] | 0.368 | 0.351 | 0.218[a] | 0.210[a] | 0.412 | 0.391 |
| | (0.030) | (0.030) | (0.236) | (0.235) | (0.038) | (0.038) | (0.281) | (0.280) |
| *HI* | 0.150[b] | 0.166[b] | -0.075 | 0.001 | 0.227[a] | 0.246[a] | -0.007 | 0.077 |
| | (0.067) | (0.068) | (0.313) | (0.312) | (0.086) | (0.087) | (0.386) | (0.384) |
| *$HI^2$* | -0.112 | -0.123[a] | 0.203 | 0.131 | -0.174 | -0.188[c] | 0.165 | 0.086 |
| | (0.085) | (0.086) | (0.391) | (0.389) | (0.109) | (0.110) | (0.478) | (0.476) |
| *Q* | 0.013[a] | 0.014[a] | 0.026 | 0.027 | 0.018[a] | 0.019[a] | 0.028 | 0.029 |
| | (0.002) | (0.002) | (0.017) | (0.017) | (0.002) | (0.002) | (0.021) | (0.021) |
| *SIZE* | 0.051[a] | 0.058[a] | 0.108[a] | 0.121[a] | 0.070[a] | 0.078[a] | 0.133[a] | 0.147[a] |
| | (0.003) | (0.003) | (0.020) | (0.021) | (0.004) | (0.004) | (0.025) | (0.026) |
| *LnAGE* | 0.025[a] | 0.032[a] | 0.053[a] | 0.061[a] | 0.033[a] | 0.042[a] | 0.061[b] | 0.070[a] |
| | (0.004) | (0.005) | (0.019) | (0.019) | (0.006) | (0.006) | (0.024) | (0.024) |
| *IMR* | | | -0.012 | -0.025 | | | -0.038 | -0.051 |
| | | | (0.048) | (0.048) | | | (0.062) | (0.061) |
| *$R^2$* | 0.254 | 0.243 | 0.492 | 0.488 | 0.282 | 0.272 | 0.530 | 0.528 |
| *$R^2$ Controls Only* | 0.232 | 0.232 | 0.487 | 0.487 | 0.261 | 0.261 | 0.527 | 0.527 |
| *N* | 123,531 | 123,531 | 16,065 | 16,065 | 118,122 | 118,122 | 15,271 | 15,271 |

## *Section 4: Alternative Hypotheses*

In this section, we consider two alternative hypotheses for the positive relation between political activism and firm innovation. We first describe the two hypotheses and then present evidence that allows us to distinguish our information acquisition hypothesis from the two alternative hypotheses.

### *4.1. Hypotheses Development*

It is possible that the positive relation between political activism and firm innovation arises because firms engage in "buffering" strategies (Meznar and Nigh (1995) and Blummentritt (2003)) and actively lobby the government for favorable legislation. Similar to information acquisition, "buffering" may also lower political uncertainty for politically active firms, thereby stimulating investment in innovation. We refer to this as the "lobbying" hypothesis.

The second hypothesis, which we term the "procurement" hypothesis, is rooted in the Murphy, Shleifer, and Vishny (1993) public rent-seeking argument. In their view, political activism (specifically, lobbying) is a form of public rent extraction by government officials, so firm political activism is nothing other than redistribution from the private sector to the government bureaucrats. Politically active firms bribe government officials to obtain government-supplied goods, such as permits, licenses, and construction approvals. Firms also bribe government officials to obtain government procurement contracts (Tahoun (2014), Goldman, Rocholl and So (2013), and Brogaard, Denes, and Duchin (2016)). A defining characteristic of procurement, especially in industries such as high tech and defense, is the constant pursuit of improved performance and capabilities through technological innovation (Rogerson (1995)). Because the government cannot directly purchase all innovative efforts of firms, the incentive problem is solved by allowing firms to earn positive economic profit on production contracts awarded in return for innovation. The hypothesis implies that politically active firms innovate more and are allowed to earn positive profit as compensation for innovation efforts. Similar to the information acquisition hypothesis, the procurement hypothesis implies that political activism stimulates investment in innovation.[2]

[2] In a related paper, Brogaard, et al (2016) also examine the impact of political connections on the allocation and characteristics of government procurement contracts and subsequent innovation activity. They show that firms that make political contributions are more likely to obtain procurement contracts. Those firms also experience better operating performance and innovate more, although the effect is partially offset by the agency costs that arise due to lax government monitoring in the execution of government contracts. Our paper differs from Brogaard, et al. (2016)

*4.2. Do politically Active Firms Innovate More Because They Face Lower Political Uncertainty?*

Under the information acquisition hypothesis, firms engage in political activism to purchase access to politicians who, in return for contributions, supply legislative information relevant for firm innovation. A unique prediction of this argument is that politically active firms are better able to predict future legislative changes (because they know the lawmakers' political cost) and, therefore, set their innovation strategies in expectation of upcoming legislative changes. Empirically, this implies that changes in innovation by politically active firms predict future legislative changes. We test this prediction in table 4.1 in this appendix.

In predicting legislative changes, we focus on major deregulatory initiatives affecting the petroleum and natural gas, telecommunications, utilities and transportation industries as defined by the Fama-French 49-industry definitions. Those deregulatory initiatives are from Ovtchinnikov (2010, 2013) and are listed in table 4.1, panel A. We focus on economic deregulation, defined as deregulation of entry, exit, price, and quantity, because it represents a major shock to the operating environment of U.S. industries during our sample period (Winston (1993)) and, therefore, is expected to significantly affect firm innovation strategies. Prior research shows that deregulation significantly affected firms' decision making including their financing and investment choices are results in significant changes in firm operating performance.

Given the impact of deregulation on the industry's operating environment, we expect that firms would invest heavily in information about the precise timing of successive deregulatory initiatives. Importantly, the incentive to invest in information will arise not only among incumbent firms in soon-to-be-deregulated industries but also among potential new entrants. If successful, access to deregulation timing information gives politically active firms valuable competitive advantage in adjusting their innovation strategies to upcoming regulatory changes.

Panels B and C of table 4.1 present formal tests of this hypothesis. We first focus on new entrant firms and test whether innovation of these firms predicts future deregulation. We expect

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in that we study the innovation activity of all politically active firms, not just those that receive government procurement contracts. In our empirical tests, we show that politically active firms innovate more irrespective of whether they receive procurement contracts, which indicates that the procurement explanation is unlikely to completely account for the innovation activity of politically active firms.

this relation to hold but only for politically active firms. New entrant firms are new innovators in soon-to-be-deregulated industries and are defined as follows. Every year and for every firm in our sample, we record all technology classes for which the firm submits new patent applications. For every new technology class in a particular year, we track the firm's patent activity in that class over the remaining sample period. If the duration to the subsequent patent application is no longer than that of the average firm in the same technology class, we classify the firm in question as a new innovator in that technology class in the first year of new patent activity. The explanatory variable in our tests below, $NEW\_INNOVATOR_t$, is the sum of new innovator firms in each technology class in year *t* scaled by the total number of firms with patent activity in that technology class in year *t*-1. The technology classes are then mapped into 4-digit SIC codes using the Silverman (1996, 1999) concordance procedure.[3]

In table 4.1, panel B, we build on the above example and analyze whether firm innovation, especially that of politically active firms, systematically predicts future legislative changes. We estimate industry-year probit models that relate the year of industry deregulation to the inflow of new innovator firms into each industry during the prior year. The baseline results in model 1 show no relation between the inflow of new innovators into an industry and the likelihood of its subsequent deregulation. However, when we split the sample of new innovator firms into those that are politically active and inactive, the results in model 2 show that the inflow of new innovator politically active firms strongly predicts future deregulation.[4] In terms of economic magnitudes, an interquartile increase in the inflow of politically active new innovators increases the probability of deregulation by 6.84%. In contrast, the inflow of new innovators that are not politically active does not predict future deregulation. These results are

[3] An example may be useful to fix ideas and outline the intuition for our tests. Northrop Grumman Corp., a politically active firm, which itself operates in the Search, Detection, Navigation, Guidance, Aeronautical, and Nautical Systems and Instruments industry (SIC 3812), unexpectedly began innovating in the Railroads, Line-Haul Operating industry (SIC 4011) in 1994. Two years later, the firm continued its innovation activity in the new industry. Because the Northrop Grumman's two-year duration between successive patent applications was shorter than the industry average of 3.43 years, we define Northrop Grumman as a new innovator in the railroad industry in 1994. The Northrop Grumman's timing of innovation in the railroad industry is particularly noteworthy given that the following year Congress passed the ICC Termination Act that abolished the Interstate Commerce Commission and fully deregulated the railroad industry. In our view, the Northrop Grumman's strategy to start innovating in the railroad industry just prior to its full deregulation is quite suggestive and consistent on the anecdotal level with the hypothesis that political contributions are valuable because they allow firms to set their innovation strategies in anticipation of future legislative changes.

[4] The results are not sensitive to our definition of a politically active firm. We find very similar results if politically active firms are defined as firms that contribute to a single or multiple members of relevant Congressional committees. Moreover, the effects are stronger for firms that support more political candidates. The results are available upon request.

consistent with our hypothesis and show that changes in innovation of politically active firms predicts future legislative changes.

In models 3 – 6, we split the sample of deregulatory initiatives into those passed by Congress and those adopted by the Executive Order. We hypothesize that politically active firms have significant advantage predicting legislative changes adopted by Congress (because of a direct connection to members of Congress) compared to those adopted by the Executive Branch. Consistent with this, we find that changes in innovation of politically active firms strongly predict deregulatory Congressional Acts (models 3 and 4) but have little ability to predict deregulatory Executive Orders (models 5 and 6). In economic terms, an interquartile increase in the inflow of politically active new innovators increases the probability of a deregulatory Congressional Act by 10.21%. Compared to the unconditional probability of deregulation of 21%, these results are economically significant. In a series of robustness tests, we repeat the analysis with different lags between firm innovation and subsequent deregulation. We find that changes in innovation of politically active firms predict industry deregulation, especially deregulation adopted by Congress, two and three years in the future.

We next turn to incumbent industry firms and test whether changes in innovation of these firms predicts future deregulation. Because incumbent firms are expected to lose regulatory protection from competition after deregulation, they should rationally speed up their innovation efforts in expectation of deregulation. Hence, as with new entrant firms, we expect a positive relation between patent growth of incumbent firms and subsequent deregulation. We also expect this relation to hold only for politically active firms. We estimate the same industry-year probit models as in panel B but replace the inflow of new innovator firms into soon-to-be-deregulated industries with the growth rate in relevant patents for incumbent industry firms. Patent relevancy is defined in section 3.2 of the Online Appendix.

The results are presented in table 4.1, panel C. Model 1 shows a positive relation between the patent growth rate of incumbent industry firms and the likelihood of subsequent industry deregulation. Consistent with our predictions, this relation is fully concentrated among politically active firms in model 2. An interquartile increase in the patent growth rate of politically active firms leads to a 0.26% greater deregulation probability. Compared to the unconditional deregulation probability of 21% in our sample, the results appear economically significant. In models 3 – 6, we find that the patent growth rate predicts deregulatory initiatives enacted through Congressional Acts as well as through Executive Orders. Because regulated incumbent firms have a naturally intimate relationship with the regulator, it is not surprising that their innovation dynamics help predict deregulation as enacted not only by Congress but also by the Executive Branch. In sum, the results in panels B and C of table 4.1 show that firm innovation, especially by politically active firms, strongly predicts future legislative changes.

### *4.3. Do Politically Active Firms Innovate More Because They Lobby for Favorable Legislation?*

To address the possibility that the positive relation between political activism and firm innovation arises because of lobbying efforts by politically active firms, we perform case studies of two industries, trucking and telecommunications, affected by deregulation during our sample. These industries deserve a closer look because they took diametrically opposing positions on deregulation. Viscusi, et al. (2005) show that trucking companies earned significant abnormal profits during the regulated period and, as a result, lobbied heavily *against* deregulation.[5] Abnormal profits for trucking companies resulted from the Interstate Commerce Commission's (ICC) practice of setting regulated transportation rates well above cost and the contemporaneous regulation of entry to the point where it was virtually impossible for potential new entrants to enter the trucking business (Viscusi, et al. (2005)).

Given this unique situation in trucking, the lobbying argument would predict a negative relation between innovation of politically active trucking companies and subsequent deregulation. Politically active trucking companies would incorrectly think that their lobbying efforts would succeed in neutralizing lobbying pressure from railroads and block deregulation. If so, politically active trucking companies should innovate less despite the upcoming deregulation. In contrast, the passive information acquisition argument would predict a positive relation between innovation of politically active trucking companies and subsequent deregulation as politically active firms learn about upcoming deregulation and increase their innovation efforts to combat upcoming increase in competition.

To test these predictions, we repeat the analysis in panel C of table 4.1 on the subsample of trucking companies and present the results in panel D. Consistent with the passive information acquisition argument but inconsistent with the lobbying argument, we find a positive and significant relation between the patent growth rate and the likelihood of subsequent

[5] In fact, it was railroads that lobbied heavily for deregulation of trucking because railroads found it increasingly difficult to compete with trucking companies with the development of the interstate highway system.

deregulation in the trucking industry, but only for the politically active firms. Models 3 – 6 show that this effect is present for Congressional Acts but absent for Executive Orders, which is also more consistent with the information rather than the lobbying explanation.

In contrast to trucking companies, telecommunications companies (other than AT&T) historically took a decisively *pro*-deregulation position (Viscusi, et al. (2005)). The industry was eventually deregulated with the passage of the Telecommunications Act of 1996; however, years prior to 1996 may be viewed as years of deregulation failure since the lobbying pressure to deregulate proved unsuccessful. We use this setting to distinguish between the passive information acquisition from the lobbying hypotheses. Specifically, we test whether politically active telecommunications companies other than AT&T reduce their innovation activities during the period of deregulation failure compared to politically inactive firms. If so, this evidence would be consistent with the information acquisition argument. In contrast, under the lobbying hypothesis, we would expect higher innovation efforts of politically active firms during the period of deregulation failure as firms lobby for deregulation and increase innovation in expectation of their lobbying success.

The results of this test are presented in panel E of table 4.1. The dependent variable identifies the period of deregulation failure taking a value of one during the 1988 – 1994 period and zero during the post-deregulation period 1997 – 2003. The results show that, on average, telecommunications companies increase their innovation efforts during the 1988 – 1994 time period. However, this result is entirely concentrated among politically inactive companies. In contrast, politically active companies significantly reduce their innovation efforts during the period of deregulation failure. This evidence is consistent with the passive information acquisition argument but inconsistent with the lobbying argument. Under the latter, we would have expected that lobbying telecommunications companies would have increased their innovation efforts in expectation of successfully influencing legislators to deregulate the industry.

### *4.4. Do Politically Active Firms Innovate More Because They Receive More Government Contracts?*

It is possible that firms engage in political activism to obtain government procurement contracts that require new innovation. Thus, more political contributions lead to more procurement, and more procurement leads to more investment in innovation. The clear empirical prediction of this hypothesis is that the relation between political activism and firm innovation is concentrated in those industries that conduct significant business activities with the government.

To analyze this prediction, we return to the analysis in table 1 in the paper. We augment the vector of explanatory variables in equation (7) to include an interaction term between our political activism measures and an indicator variable for industries that sell at least some of their output to the government (we refer to these as government connected industries). The results are reported in table 4.2 in this Appendix. For brevity, we report the coefficients on the political activism measures, the interactions terms and the indicator for government connected industries. The coefficients on other control variables are little changed from those reported in table 1 in the paper.

If the positive relation between political activism and firm innovation comes from politically active firms receiving more procurement contracts, we expect an insignificant relation between political activism proxies and firm innovation and a significant positive relation between the interaction terms and innovation in table 4.2. The evidence is inconsistent with this prediction. The coefficients on political activism proxies in table 4.2 are always positive, highly statistically significant and almost identical to those reported in table 1 in the paper. In contrast, the coefficients on the interaction terms are indistinguishable from zero. So, the effects of political activism on firm innovation are similar across government connected and non-connected industries. This evidence contradicts the procurement hypothesis. We also repeated the analysis replacing the indicator for government connected industries with an indicator for regulated industries with virtually identical results.

In the final test in table 4.3 in this Appendix, we compare the innovation activity of politically active and inactive firms across the government connected and non-connected industries. Under the procurement hypothesis, we expect higher levels of innovation for politically active firms, but only in the government connected industries. For every politically active firm, we first select all other inactive firms in the same industry and then identify a propensity-score-matched firm based on a nearest neighbor matching. Propensity scores are calculated from firm level logit regressions of a binary variable indicating whether or not a particular firm is politically active on the set of firm level characteristics in appendix B. The results in panels A and B of table 4.3 show that the samples of politically active and propensity-score-matched inactive firms are statistically indistinguishable on all dimensions that are important for firm political participation decisions.

In panel C, we analyze whether the patent activity of politically active firms is higher than that of inactive firms and, more importantly, whether this relation is stronger for the sample of government connected firms. The first two rows show that, compared to inactive firms, politically active firms obtain more patents on average, but the difference is only significant for firms in the non-connected industries. This evidence is inconsistent with the procurement hypothesis. Also inconsistent with the procurement hypothesis, we find that firms in government connected industries innovate less irrespective of their political activism status, although the results are not statistically significant.[6]

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[6] We also calculate the predicted revenues from procurement by regressing firm procurement on our political activism measures. We then test whether predicted procurement explains future innovation. In unreported results, we find that our political activism measures are positively but insignificantly related to revenues from procurement contracts. Moreover, we find that predicted procurement does not explain future innovation. Both results are inconsistent with the procurement hypothesis.

## Table 4.1
## Political Contributions and Subsequent Legislative Dynamics, 1984 – 2004

The political contributions data are from the FEC detailed contribution files. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. This table presents the results of the probit regression that relates the year of industry deregulation to changes in innovation for firms in deregulated industries in the prior year and to the inflow of new innovator firms into each deregulated industry during the prior year. Panel A lists the deregulatory legislation and the year of the passage of each legislation. Panel B presents the results of the probit regression that relates the year of industry deregulation to the inflow of new innovator firms into each deregulated industry during the prior year. The sample includes 647 politically active firms and 3,343 politically inactive firms. New innovators are defined as firms that begin innovating in an industry and innovate more often that the average industry firm. Panel C presents the results of the probit regression that relates the year of industry deregulation to changes in innovation for firms in deregulated industries in the prior year. The sample includes 82 incumbent politically active firms and 100 incumbent politically inactive firms. Panel D is similar to Panel C, but considers the set of trucking industry and the relevant deregulation initiatives. The sample includes 9 politically active firms and 11 politically inactive firms. Panel E presents results of the probit regression that relates deregulation failure in the Telecommunications industry to changes in innovation for firms in that industry in the prior year. The sample includes 10 politically active firms and 8 politically inactive firms. Politically active are firms with an established political action committee (PAC). Standard errors are in parentheses and are adjusted for heteroskedasticity. [a], [b], [c], indicates significance at the 1%, 5%, and 10% level, respectively.

*Panel A: Major Deregulatory Initiatives*

| Year | Deregulatory Initiative |
|---|---|
| Petroleum and Natural Gas | |
| 1989 | Natural Gas Wellhead Decontrol Act |
| 1992 | FERC Order 636 |
| Telecommunications | |
| 1988 | Proposed rules on price caps (FCC) |
| 1996 | Telecommunications Act |
| Utilities | |
| 1988 | Proposed rules on natural gas and electricity (FERC) |
| 1992 | Energy Policy Act |
| 1996 | FERC order 888 |
| 1999 | FERC order 2000 |
| Transportation | |
| 1986 | Trading of airport landing rights |
| 1987 | Sale of Conrail |
| 1993 | Negotiated Rates Act |
| 1994 | Trucking Industry and Regulatory Reform Act |
| 1995 | ICC Termination Act |

## Table 4.1 – continued

*Panel B: Regression Results for New Innovator Firms*

| | All Deregulation | | Congressional Acts | | Executive Orders | |
|---|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 | 6 |
| *NEW_INNOVATOR* | 0.002 | | 0.004[b] | | -0.001 | |
| | (0.002) | | (0.002) | | (0.005) | |
| | [6.80%] | | [14.27%] | | [-3.30%] | |
| *NEW_INNOVATOR× POLITICALLY_ACTIVE* | | 0.006[b] | | 0.008[a] | | 0.001 |
| | | (0.002) | | (0.002) | | (0.007) |
| | | [6.84%] | | [10.21%] | | [1.62%] |
| *NEW_INNOVATOR× POLITICALLY_INACTIVE* | | -0.004 | | -0.004 | | -0.004 |
| | | (0.007) | | (0.007) | | (0.008) |
| | | [-8.29%] | | [-8.14%] | | [-8.03%] |
| *Log likelihood* | -233.78 | -232.95 | -122.82 | -122.01 | -135.61 | -135.51 |
| *Pseudo $R^2$* | 0.001 | 0.004 | 0.004 | 0.010 | 0.000 | 0.001 |
| *N* | 8,812 | 8,812 | 8,812 | 8,812 | 8,812 | 8,812 |

*Panel C: Regression Results for All Deregulated Firms*

| | All Deregulation | | Congressional Acts | | Executive Orders | |
|---|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 | 6 |
| *Δ Ln(ABSTECH)* | 1.008[a] | | 0.658[a] | | 1.021[a] | |
| | (0.334) | | (0.209) | | (0.426) | |
| | [0.51%] | | [0.40%] | | [0.67%] | |
| *Δ Ln(ABSTECH)× POLITICALLY_ACTIVE* | | 1.235[a] | | 0.907[a] | | 1.173[a] |
| | | (0.247) | | (0.210) | | (0.311) |
| | | [0.26%] | | [0.20%] | | [0.28%] |
| *Δ Ln(ABSTECH)× POLITICALLY_INACTIVE* | | 0.078 | | 0.020 | | 0.124 |
| | | (0.090) | | (0.054) | | (0.114) |
| | | [0.01%] | | [0.00%] | | [0.02%] |
| *Log likelihood* | -588.13 | -587.69 | -415.38 | -415.00 | -334.41 | -334.42 |
| *Pseudo $R^2$* | 0.004 | 0.005 | 0.002 | 0.003 | 0.017 | 0.005 |
| *N* | 1,281 | 1,281 | 1,281 | 1,281 | 1,281 | 1,281 |

*Panel D: Regression Results for Trucking Firms*

| | All Deregulation | | Congressional Acts | | Executive Orders | |
|---|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 | 6 |
| *Δ Ln(ABSTECH)* | 2.023[a] | | 2.935[a] | | -0.144 | |
| | (0.637) | | (0.950) | | (0.093) | |
| | [0.91%] | | [1.61%] | | [-0.09%] | |
| *Δ Ln(ABSTECH)× POLITICALLY_ACTIVE* | | 3.513[a] | | 4.605[a] | | 0.364 |
| | | (1.153) | | (1.378) | | (0.378) |
| | | [1.58%] | | [2.53%] | | [0.22%] |
| *Δ Ln(ABSTECH)× POLITICALLY_INACTIVE* | | -6.809[a] | | -7.095[a] | | -3.053 |
| | | (1.700) | | (0.713) | | (2.509) |
| | | [-0.61%] | | [-0.77%] | | [-0.37%] |
| *Log likelihood* | -57.59 | -57.57 | -43.00 | -42.98 | -33.02 | -33.02 |
| *Pseudo $R^2$* | 0.001 | 0.001 | 0.002 | 0.002 | 0.00 | 0.00 |
| *N* | 105 | 105 | 105 | 105 | 105 | 105 |

## Table 4.1 - continued

| | All Deregulation | | Congressional Acts | | Executive Orders | |
|---|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 | 6 |
| *Panel E: Regression Results for Telecommunications Firms* | | | | | | |
| | | | | | DEREGULATION _FAILURE | |
| Variable | | | | | 1 | 2 |
| *Δ Ln(ABSTECH)* | | | | | 2.666[a]<br>(0.164)<br>[26.44%] | |
| *Δ Ln(ABSTECH)× POLITICALLY_ACTIVE* | | | | | | -101.302[a]<br>(21.839)<br>[-70.99%] |
| *Δ Ln(ABSTECH)× POLITICALLY_INACTIVE* | | | | | | 124.724[a]<br>(22.512)<br>[34.15%] |
| *Log likelihood* | | | | | -70.34 | -58.83 |
| *Pseudo $R^2$* | | | | | 0.005 | 0.167 |
| *N* | | | | | 105 | 105 |

## Table 4.2
## Political Contributions and Corporate Innovation, 1984 – 2004: Regressions With Additional Controls

The political contributions data are from the FEC detailed contribution files. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. This table presents the results of estimating the regression in table 3 that also includes the government purchases indicator, *GIND*, and its interaction with our political activism measures. We include all control variables from table 3 in the regressions in this table. Models 1, 2, 5, and 6 present the results for all firms with available data on CRSP/Compustat and include 123,531 firm-year observations. Models 3, 4, 7, and 8 present the results for politically active firms only and include 16,065 firm-year observations. We control for firm self-selection in models 3, 4, 7, and 8 by including the inverse Mills ratio (IMR) from the first-stage probit model of whether a firm has an established PAC on determinants of PAC participation. The first stage probit results are presented in Appendix B. Panel A presents the results for the total number of patent applications. Panel B presents the results for the total number of patent citations. All regressions include industry and year fixed effects. All variables are defined in section III.B and Appendix A. Standard errors are in parentheses and are adjusted for heteroskedasticity and correlated within firms. $R^2$ is the adjusted R-squared in the regression. *N* is the total number of firm-year observations. [a], [b], [c], indicates significance at the 1%, 5%, and 10% level, respectively.

*Panel A: Number of Patents*

| | EFFPATENT$_{t+1}$ | | | | EFFPATENT$_{t+3}$ | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | All firms | All firms | Active firms | Active firms | All firms | All firms | Active firms | Active firms |
| *PCAND/10$^2$* | 0.284[a] | | 0.157[a] | | 0.348[a] | | 0.201[a] | |
| | (0.037) | | (0.038) | | (0.045) | | (0.047) | |
| *CAMOUNT/10$^6$* | | 0.617[a] | | 0.261[a] | | 0.806[a] | | 0.376[a] |
| | | (0.108) | | (0.095) | | (0.131) | | (0.120) |
| *(PCAND/10$^2$) x GIND* | 0.000 | | 0.012 | | -0.000 | | 0.009 | |
| | (0.024) | | (0.023) | | (0.030) | | (0.030) | |
| *(CAMOUNT/10$^6$) x GIND* | | 0.022 | | 0.067 | | -0.003 | | 0.047 |
| | | (0.074) | | (0.063) | | (0.090) | | (0.082) |
| *GIND* | -0.003 | -0.003 | -0.026 | -0.033 | | | | |
| | (0.005) | (0.005) | (0.024) | (0.022) | | | | |
| | | | | | -0.006 | -0.006 | -0.020 | -0.024 |
| *Table 3 controls* | Yes | Yes | Yes | Yes | (0.007) | (0.007) | (0.032) | (0.029) |
| *$R^2$* | 0.315 | 0.305 | 0.567 | 0.563 | Yes | Yes | Yes | Yes |
| *N* | 123,531 | 123,531 | 16,065 | 16,065 | 0.344 | 0.337 | 0.586 | 0.583 |

*Panel B: Patent Citations*

| | CPATENT$_{t+1}$ | | | | CPATENT$_{t+3}$ | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | All firms | All firms | Active firms | Active firms | All firms | All firms | Active firms | Active firms |
| *PCAND/10$^2$* | 0.033[a] | | 0.025[a] | | 0.068[a] | | 0.055[a] | |
| | (0.006) | | (0.008) | | (0.012) | | (0.015) | |
| *CAMOUNT/10$^6$* | | 0.069[a] | | 0.042[b] | | 0.147[a] | | 0.094[b] |
| | | (0.017) | | (0.019) | | (0.035) | | (0.037) |
| *(PCAND/10$^2$) x GIND* | 0.003 | | 0.004 | | 0.006 | | 0.006 | |
| | (0.005) | | (0.006) | | (0.009) | | (0.011) | |
| *(CAMOUNT/10$^6$) x GIND* | | 0.014 | | 0.016 | | 0.029 | | 0.034 |
| | | (0.014) | | (0.015) | | (0.025) | | (0.026) |
| *GIND* | -0.003 | -0.003 | -0.002 | -0.003 | | | | |
| | (0.002) | (0.002) | (0.007) | (0.006) | | | | |
| | | | | | -0.006 | -0.006 | 0.000 | -0.003 |
| *Table 3 controls* | Yes | Yes | Yes | Yes | (0.004) | (0.004) | (0.013) | (0.012) |
| *$R^2$* | 0.192 | 0.192 | 0.382 | 0.381 | Yes | Yes | Yes | Yes |
| *N* | 123,531 | 123,531 | 16,065 | 16,065 | 0.262 | 0.261 | 0.450 | 0.449 |

## Table 4.3
## Comparison of Patent Activity Between Politically Active and Inactive Firms in Government Connected and Non-connected Industries, 1984 – 2004

The political contributions data are from the FEC detailed contribution files. We exclude all noncorporate contributions, contributions from private firms and subsidiaries of foreign firms, as well as contributions from firms with insufficient data on CRSP/Compustat. The final sample consists of 813,692 political contributions to 5,584 unique political candidates made by 1,805 unique firms. This table presents the comparison of patent activity between politically active and inactive firms in government connected and non-connected industries. Government connected industries are industries that sell some of their output to the government. Non-connected industries are industries that sell none of their output to the government. For every politically active firm, we select an inactive firms that is matched on industry and the propensity score. The propensity score is calculated from industry-specific logit regressions with explanatory variables from appendix B. Panel A presents comparisons of firm characteristics between politically active and propensity score matched inactive firms that operate in government connected industries. Panel B presents comparisons of firm characteristics between politically active and propensity matched inactive firms that operate in non-connected industries. Panel C presents the difference-in-difference results comparing differences in patent activity of politically active and inactive firms across government connected and non-connected industries. All variables are defined in Appendix B. T-statistics for the differences between politically active and propensity score matched inactive firms are in parentheses.

## Table 4.3

| Variable | Politically Active Firms | Politically Inactive Firms | Difference |
|---|---|---|---|
| *Panel A: Propensity Score Matching Diagnostics for Government Connected Industries* | | | |
| NUMBER_OF_PATENTS | 1.126 | 0.867 | 0.259 |
| | | | (0.944) |
| Ln(MARKET_CAP) | 12.750 | 12.766 | -0.016 |
| | | | (-0.206) |
| Ln(SALES) | 6.204 | 6.176 | 0.028 |
| | | | (0.388) |
| Ln(EMPLOYEES) | 1.165 | 1.159 | 0.007 |
| | | | (0.089) |
| NUM_BUSINESS_SEGMENTS | 1.680 | 1.643 | 0.036 |
| | | | (0.592) |
| NUM_GEOGRAPHIC_SEGMENTS | 1.875 | 1.850 | 0.025 |
| | | | (0.614) |
| BM | 1.139 | 0.999 | 0.140 |
| | | | (0.692) |
| LEVERAGE | 0.248 | 0.248 | -0.000 |
| | | | (-0.032) |
| CF | 0.050 | 0.052 | -0.002 |
| | | | (-0.675) |
| N | 759 | 759 | |
| *Panel B: Propensity Score Matching Diagnostics for Non-connected Industries* | | | |
| NUMBER_OF_PATENTS | 2.533 | 2.101 | 0.432 |
| | | | (2.003) |
| Ln(MARKET_CAP) | 13.154 | 13.152 | 0.001 |
| | | | (0.053) |
| Ln(SALES) | 6.605 | 6.598 | 0.006 |
| | | | (0.270) |
| Ln(EMPLOYEES) | 1.450 | 1.451 | -0.001 |
| | | | (-0.030) |
| NUM_BUSINESS_SEGMENTS | 2.148 | 2.148 | 0.000 |
| | | | (0.014) |
| NUM_GEOGRAPHIC_SEGMENTS | 2.099 | 2.090 | 0.009 |
| | | | (0.464) |
| BM | 1.647 | 1.875 | -0.229 |
| | | | (-1.108) |
| LEVERAGE | 0.249 | 0.250 | -0.001 |
| | | | (-0.463) |
| CF | 0.055 | 0.054 | 0.001 |
| | | | (0.840) |
| N | 8,650 | 8,650 | |
| *Panel C: DiD results* | | | |
| Government Connected Industries | 1.126 | 0.867 | 0.259 |
| | | | (0.944) |
| Non-connected Industries | 2.533 | 2.101 | 0.432 |
| | | | (2.003) |
| Difference | -1.408 | -1.234 | 0.173 |
| | | | (0.785) |

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