Right-to-Work Laws and Corporate Innovation

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Abstract

We show that state right-to-work (RTW) laws significantly encourage corporate innovations in terms of patent grant and citation count. Consistent with the conjecture that the RTW-treated firms conduct more innovations due to their decreased financial distress risk, we find that the RTW adoption also significantly decreases treated firms' financial distress risk ex post, and its treatment effect on innovation outputs is stronger for treated firms that are ex ante more likely to experience financial distress. Further analysis indicates that treated firms intensify research and development expenditures and, likely due to their improved innovations, enhance their competitiveness in product markets.

Keywords: Right-to-Work Laws; Corporate Innovations; Financial Distress Risk
JEL Code: G30; G38

1. Introduction

The Taft-Hartley Act of 1947 allows U.S. states to enact the highly controversial Right-to-Work (RTW hereafter) laws, which permit employees to enjoy the benefits defined in the collective-bargaining agreements negotiated by labor unions without having to join unions or pay union dues. Despite the controversy over the RTW laws and the strong resistance from unions,[1] 27 states have adopted the RTW so far. The RTW recognition is shown to significantly weaken labor unions' bargaining power and their activities (Chava, Denis, and Hsu, 2020; Ellwood and Fine, 1987; Hirsch, 1980; Warren and Strauss, 1979), and enhance employment, but have mixed effects on wages (Chava, Denis, and Hsu, 2020; Kalenkoski and Lacombe, 2006; Reed, 2003). The RTW laws are also shown to decrease corporate financial leverage while increase tangible investment and profitability (Chava, Denis, and Hsu, 2020). In this paper, we show that the RTW exerts a significant and positive effect on corporate innovation—the enactment of state RTW laws strongly encourages firms to generate innovation outputs with higher quantity and quality and, as a result, gain stronger competitiveness over product market rivals.

Corporate innovation activities can bring significant benefits not only to shareholders in terms of shareholder wealth creation, but also to corporate managers themselves in terms of personal reputation, social status, and private benefits of control (see, e.g., Balkin, Markman, and Gomez-Mejia, 2000; Lerner and Wulf, 2007; Makri, Lane, and Gomez-Mejia, 2006). However, when an innovating firm falls into financial distress, in addition to shareholder value loss due to the low liquidation value of intangible assets, managers will lose their personal

[1] See Devinatz (2011) for the controversy surrounding the RTW laws. Devinatz (2011; p.287) suggests that *"the presence or absence of RTW legislation is not merely a symbolic fight as some have maintained but is something that has real consequences for the trade union movement's future in the United States in the early 21st century."*

reputation and private benefits of control. Thus, we conjecture that an increase (a decrease) in financial distress risk discourages (encourages) corporate innovation activities.[2]

Unionization increases a firm's operating leverage since it is more difficult to lay off unionized workers than non-unionized ones. For example, Chen, Kacperczyk, and Ortiz-Molina (2011) show that unionization is positively related to various measures of operating leverage and the constraints on firms' operations imposed by labor unions significantly increase firms' costs of equity. The RTW weakens the bargaining power of labor unions and thus decreases treated firms' operating leverage through increasing their flexibility on wages and employment, and also leads to a drop in treated firms' financial leverage because the need to use high financial leverage as a strategic tool to bargain with unions subsides after the RTW adoption (Chava, Denis, and Hsu, 2020). Against this backdrop, we conjecture that as operating and financial leverages decrease following the state RTW adoption, financial distress risk also decreases and thus treated firms can now more freely conduct innovation activities—that is, the RTW may encourage treated firms' innovation activities.

We investigate this conjecture using a comprehensive sample of patenting firms covering a sample period of over six decades from 1950 to 2017 and a difference-in-differences (DiD) regression framework. Consistent with our expectation, the empirical evidence strongly suggests that the state adoption of the RTW results in significantly greater future patent grants and patent citations for firms headquartered in that state.[3] Three years after the state RTW adoption, an average treated firm increases its patent count by 1.66 per 10-million-dollars sales, and increases its patent citation count by 19.78 per 10-million-dollars sales, which equal 0.28

[2] For example, the literature suggests that innovation projects are not easily financed with debt (e.g., Brown, Fazzari, and Petersen, 2009; Brown, Martinsson, and Petersen, 2013), and highly levered firms with significant distress risk invest less in research and development (R&D) and innovate less (e.g., Bhagat and Welch, 1995; Hall, 1990, 1994; Hall and Lerner, 2010; Titman and Wessels, 1988). Moreover, firms financed by relationship-based bank debt innovate less than those financed by arm's length public debt and equity (e.g., Atanassov, 2016; Rajan and Zingales, 2003).

[3] Corporate headquarters are arguably close to corporate core innovation activities. Thus, following the innovation literature (e.g., Cornaggia et al., 2015), we focus on the RTW adoption events in firms' headquarter states.

and 0.21 sample standard deviation, respectively. These findings are robust to controlling for various time-varying firm characteristics and state economic conditions, as well as industry-year fixed effects (which capture the impact of potential industry-wide economic shocks) and firm fixed effects (which capture any time-invariant firm heterogeneity). We also document a robust treatment effect of the RTW on corporate innovation in different subperiods.

Results from our dynamic DiD tests further reveal that the positive effects of the RTW on both the quantity and quality of treated firms' innovation outputs only show up from the third year following the adoption of the RTW and become stronger in subsequent years. These findings suggest that the trends in innovation between the control and treatment firms are parallel before the onset of the treatment and thus the documented effects of the RTW laws on corporate innovation activities are most likely causal.

Although we control for time-varying state economic conditions in our baseline DiD regressions, unobserved local economic conditions may still confound our results. For example, some unobserved local economic conditions such as the evolution of regional innovation ecosystem can both lead to an increase in future innovation outputs of local firms and lead local governments to adopt the RTW laws. To address this potential concern, we further restrict control firms to those located in neighbouring non-RTW states, since neighbouring states have arguably similar local market dynamics as the treated firm's headquarter state. Our DiD estimation using neighbouring-state control firms shows qualitatively similar (or even stronger) results. Thus, we conclude that our findings are most likely driven by the state RTW adoption rather than by unobservable local economic conditions. Moreover, consistent with the notion that the RTW encourages corporate innovations through weakening labor unions' bargaining power, we find that the economic impact of the RTW on innovation activities shows up mainly among highly unionized firms.

As we conjecture that the RTW encourages corporate innovations through reducing financial distress risk, we next investigate the impact of the RTW on treated firms' ex-post changes in distress risk. Following the literature (e.g., Bharath and Shumway, 2008; Brogaard, Li, and Xia, 2017; Farre-Mensa and Ljungqvist, 2016), we use Merton's (1974) Distance-to-Default metric, which measures the firm's default probability, to capture distress risk. We find that following the state RTW adoption, treated firms on average experience a significant reduction in distress risk by about 2 percentage points relative to control firms. Moreover, consistent with the RTW encouraging corporate innovations through weakening labor unions and thus reducing financial distress risk for treated firms, we find that the treatment effect of the RTW on innovation outcomes is significantly stronger for those treated firms that have higher default probability ex ante.

In addition, we further document that the positive treatment effect of the RTW on patent grants and patent citation count is significantly stronger for treated firms that are ex ante more likely to experience financial distress due to the frictions in three distinct markets: (i) firms facing more intense competition in product market (Valta, 2012; Zhdanov, 2007), (ii) firms depending more heavily on skilled workers in labor market (Belo, Li, Lin, and Zhao, 2007; Ghaly, Dang, and Stathopoulos, 2007), and (iii) firms having greater financial constraints in financial market (Livdan, Sapriza, and Zhang, 2009; He and Ren, 2017). Thus, our evidence is consistent with greater employer's bargaining power over labor unions significantly decreasing firm distress risk and hence encouraging innovation activities.

Consistent with the findings on innovation outputs, we also find that following the headquarter-state RTW adoption, treated firms invest significantly more in R&D expenditures as an input to their improved innovation activities. Relative to control firms located in non-RTW states, treated firms on average increase their R&D expenses as a share of sales by 25.8% following the RTW adoption. Finally, likely due to the increased innovation activities of treated firms, we also document a significantly positive treatment effect of the RTW on these firms' competitiveness as evidenced by their gains in sales growth and market share growth from product market rivals. Our empirical evidence suggests that following the RTW adoption, treated firms on average seize 3.8% sales growth rate from industry rivals located in the non-RTW states.

Our paper is related to the broad labor laws and finance literature (e.g., Agrawal and Matsa, 2013; Klasa, Ortiz-Molina, Serfling, and Srinivasan, 2018; Matsa, 2010; Qiu and Wang, 2018; Serfling, 2016; Simintzi, Vig, and Volpin, 2015) and, in particular, to the literature on the economic impacts of the RTW laws (e.g., Chava, Denis, and Hsu, 2020; Ellwood and Fine, 1987; Makridis, 2019). Chava, Denis, and Hsu (2020) find that the RTW leads to lower wage growth at the state level and leads treated firms to decrease leverage and increase employment, capital expenditure and profitability. Ellwood and Fine (1987) document a significant and permanent post-RTW reduction in unionization. Makridis (2019) shows that the RTW leads to more competition among unions, resulting in an improvement in life satisfaction and economic sentiment of union workers. We contribute to this literature by providing novel evidence that the enactment of the RTW laws strongly motivate corporate managers to engage in innovation activities and enhance their firms' competitiveness.

Our study also contributes to the literature on labor and innovation (e.g., Acemoglu, 2010; Acharya, Baghai, and Subramanian, 2013, 2014; Bradley, Kim, and Tian, 2017). Acemoglu (2010) shows that labor scarcity encourages technology innovations if technology is strongly labor saving. Exploiting country-level changes in dismissal laws, Acharya, Baghai, and Subramanian (2013) find that more stringent dismissal laws foster innovation particularly in innovation-intensive industries, while Acharya, Baghai, and Subramanian (2014) show that the staggered adoption of wrongful discharge laws across U.S. states spurs innovation and new firm creation by limiting employers' ability to hold up innovating employees after the innovation is successful. Our paper is closely related to Bradley, Kim, and Tian (2017), who examine the effect of unionization on firm innovation. Using a regression discontinuity design that relies on "locally" exogenous variation in unionization generated by elections that pass or fail by a small margin of votes, the authors show that passing a union election results in an 8.7% (12.5%) decline in patent quantity (quality) three years after the election. Our findings on the impact of RTW laws on innovation are consistent with their findings, albeit we use a longer sample period and examine the impact of state-level legal changes that affect the negotiation and formation power of labor unions. Besides documenting a significant effect of the RTW laws on corporate innovations, we further document significant treatment effects on firm distress risk and product market outcomes. In sum, our evidence points toward the bright side of the RTW recognition and contributes to the debate around the real effects of these controversial laws on corporate behavior.

The remainder of the paper is organized as follows. Section 2 develops the hypothesis that helps guide our empirical analysis. Section 3 describes the data and variable constructions. Section 4 presents the empirical results. Section 5 concludes. The Appendix provides the definitions of all variables used in the study and their data sources as well as additional empirical results.

2. Hypothesis Development

We develop a simple theoretical framework to guide our hypothesis development and subsequent empirical analysis. The framework follows Coles, Lemmon, and Meschke (2012) and Gormley and Matsa (2016). Consider a firm with normally distributed equity value $V \sim N(\mu, \sigma^2)$. The manager's ownership in the firm is $\alpha < 1$. The manager exerts personal costly effort e in running the firm, with the pecuniary effort cost to the manager being $c(e)$. She further derives private benefits b (e.g., in terms of social status and personal reputation) if the firm avoids distress. Denote π as the probability of distress. The manager has constant absolute risk aversion and her utility function (with ρ being the coefficient of absolute risk aversion) is

$$U = -e^{-\rho[\alpha V + (1-\pi)b - c(e)]}. \tag{1}$$

The manager is considering whether to invest in an innovation project. This innovation project, if invested, will increase μ by $\Delta\mu$, σ by $\Delta\sigma$, and π by $\Delta\pi$. It will also increase the private benefits of running the firm to the manager by Δb due to the enhanced personal reputation (if the firm avoids distress) but will require the manager to exert additional costly effort Δe. Maximizing Equation (1) is known to be equivalent to maximizing

$$\widehat{U} = \left[\alpha\mu - \frac{1}{2}\rho\alpha^2\sigma^2 + (1-\pi)b - c(e)\right]. \tag{2}$$

After investing in the innovation project, $\widehat{U}$ will become

$$\widehat{U}^{Inno} = \left[\alpha(\mu + \Delta\mu) - \frac{1}{2}\rho\alpha^2(\sigma + \Delta\sigma)^2 + \big(1 - (\pi + \Delta\pi)\big)(b + \Delta b) - c(e + \Delta e)\right]. \tag{3}$$

Therefore, if the manager is willing to invest in innovation, we must have $\widehat{U}^{Inno} \geq \widehat{U}$, which is equivalent to

$$\Delta\mu \geq \frac{1}{2}\rho\alpha\Delta\sigma^2 + \rho\alpha\sigma\Delta\sigma + \frac{\big(c(e+\Delta e) - c(e)\big)}{\alpha} + \frac{\Delta\pi(b+\Delta b)}{\alpha} - \frac{(1-\pi)\Delta b}{\alpha}. \tag{4}$$

Note that although well-diversified shareholders of the firm want the manager to invest in innovation as long as the NPV of the project is positive (i.e., $\Delta\mu > 0$), the manager will skip a positive NPV innovation project as long as it is too risky, requires too much additional effort and/or increases distress risk by too much such that $\frac{1}{2}\rho\alpha\Delta\sigma^2 + \rho\alpha\sigma\Delta\sigma + \frac{(c(e+\Delta e)-c(e))}{\alpha} + \frac{\Delta\pi(b+\Delta b)}{\alpha} - \frac{(1-\pi)\Delta b}{\alpha} > \Delta\mu > 0$.

Now, let us consider the case that the firm's headquarter state adopts the RTW. We assume that due to the weakened labor union, the distress likelihood without the innovation project decreases to $\pi^* < \pi$ after the RTW adoption. The other assumptions remain the same as before. If so, the manager will invest in the innovation project if

$$\Delta\mu|_{RTW} \geq \frac{1}{2}\rho\alpha\Delta\sigma^2 + \rho\alpha\sigma\Delta\sigma + \frac{(c(e+\Delta e)-c(e))}{\alpha} + \frac{\Delta\pi(b+\Delta b)}{\alpha} - \frac{(1-\pi^*)\Delta b}{\alpha}. \quad (5)$$

We can immediately see that the investment NPV threshold under the RTW has decreased by

$$\frac{(1-\pi^*)\Delta b}{\alpha} - \frac{(1-\pi)\Delta b}{\alpha} = \frac{\Delta b}{\alpha}(\pi - \pi^*) > 0. \quad (6)$$

That is, the firm can now invest in more (positive NPV) innovation projects. The NPV threshold is lowered even further if the innovation project leads to a smaller increase in distress likelihood ($\Delta\pi$) with the RTW than without the RTW. Therefore, we hypothesize that *other things being equal, the adoption of the RTW will result in more innovations in firms headquartered in the adopting state due to the decreased firm distress risk.*

However, a weakened labor union (and the associated decrease in operating and financial leverages and the level of distress risk) may result in more entrenched firm management. The manager under the RTW may prefer a quiet life with minimum personal effort (Bertrand and Mullainathan, 2003). Investing in innovation may hence lead to a greater increase in costly personal effort to the manager with the RTW than without the RTW. That is $\left.\frac{(c(e+\Delta e)-c(e))}{\alpha}\right|_{RTW} > \frac{(c(e+\Delta e)-c(e))}{\alpha}$. Such a greater increase in managerial effort cost will result in an increase in the NPV threshold with the RTW (relative to without the RTW) and can potentially outweigh the effect of the reduction in firm distress risk on the NPV threshold, leading to lower levels of corporate innovation.

Moreover, greater leverage may encourage the firm to take risky actions such as substituting risky projects for safe ones (Jensen and Meckling, 1976), since the benefits of undertaking risky projects (e.g., innovation projects) are enjoyed by shareholders (who benefit from the upside) but the costs of innovation are suffered by creditors (who bear the downside risk). If leverage usage leads to innovation due to asset substitution, we should also expect the enactment of the RTW legislation to decrease corporate innovation.[4]

Therefore, the relation between the RTW adoption and firm innovation is unclear ex ante and warrants rigorous empirical investigation.

3. Data and Variable Construction

3.1. Sample Construction

In 1947, the U.S. Congress, in a move to redress what was considered an imbalance of power in favor of unions, passed the Labor Management Relations (Taft-Hartley) Act, which authorizes states to pass "right-to-work" (RTW) laws (see Garcia (2019) for a detailed survey on the history and objectives of this legislation). Accordingly, RTW-adopting states are allowed to prohibit "union security" clauses in the employment contracts, which means workers in unionized workplaces have the rights to receive the same benefits as union members, but without being required to join and pay dues to the unions as an employment condition (Makridis, 2019).[5] This legislation was considered to have significantly weakened the bargaining power of unions and provide individuals with more freedom to work (Garcia, 2019). The RTW laws have gained increasing popularity in the U.S. as evidenced by more and more states adopting the RTW over time. For example, around 20% of all states adopted the RTW by 1960 while over 50% of the states did so by 2018 (Makridis, 2019).

Despite the inconclusive evidence on the positive effect of the RTW laws on employment and wages, there is a common observation that the adoption of these laws is

[4] However, Myers (1977) suggests that firms with high levels of debt may underinvest in risky, positive-NPV projects due to the debt-overhang problem. Moreover, the widely used covenants in debt contracts limit firms' ability to engage in asset substitution (e.g., Gârleanu and Zwiebel, 2008; Smith and Warner, 1979).

[5] The 1947 Taft Hartley Act made the closed shop, which requires the worker to be a member of the union before he can obtain employment, illegal and incorporated the following famous statement in Section 14 (b): "Nothing in this subchapter shall be construed as authorizing the execution or application of agreements requiring membership in a labor organization as a condition of employment in any State or Territory in which such execution or application is prohibited by State or Territorial law." (Novit, 1969).

associated with a significant reduction in both the levels and flows of unionization (Ellwood and Fine, 1987; Farber, 1984; Lumsden and Petersen, 1975; Warren and Strauss, 1979). Further, the RTW laws are also shown to trigger more severe competition among unions, which forces them to provide higher-quality services and eventually leads to improved well-being and economic optimism among union workers (Makridis, 2019).

Our construction of the *RTW* indicator variable is consistent with Chava, Danis, and Hsu (2020). As shown in Table 1, over the 1943-2017 period, the authors identify in total 27 states that passed the RTW laws with Florida (FL) being the first adopter in 1943 and Kentucky (KY) being the latest adopter in 2017.

[Insert Table 1 about here]

We start our sample construction with all Compustat firms headquartered in the U.S. over the 1950-2017 period. Our sample period starts in 1950 because this is the first year in which firm financial data become available in Compustat. Thus, our sample period begins seven years after Florida (FL) passed the RTW in 1943, and three years after Arizona (AZ), Arkansas (AR), Georgia (GA), Iowa (IA), Nebraska (NE), North Carolina (NC), South Dakota (SD), Tennessee (TN), Texas (TX) and Virginia (VA) passed the RTW in 1947, and one year after North Dakota (ND) passed the RTW in 1948. Our sample period ends in 2017 because this is the latest year by which firm innovation data (patents and citations) are available to us when we conduct the analysis. Hence, our sample period ends two years after Wisconsin (WI) passed the RTW in 2015, one year after West Virginia (WV) passed the RTW in 2016, and in the same year when Kentucky (KY) passed the RTW in 2017. In other words, 12 states recognized the RTW prior to, and 15 states recognized the RTW during our sample period.

Consistent with Chava, Danis, and Hsu (2020), we exclude financial firms and utility firms (SIC codes: 6000–6999 and 4900–4999) from the sample. We further require all firm-years to have non-negative sales revenue and non-negative total assets. Finally, after requiring available data to construct firm innovation outcome measures (discussed in the next subsection), the *RTW* indicator and all control variables in our baseline regression model, we have a baseline sample of 41,626 firm-year observations of 3,552 unique firms over the 1950-2017 period.

3.2. Main Dependent Variables

Our main dependent variables of interest are firm innovation outcomes. We adopt two alternative measures of firm innovation outputs. The first measure captures the quantity of a firm's innovation activities, *PATENT*, which is computed as the number of successful patents scaled by sales in a year. The second measure captures the quality of firm innovation activities, *CITATION*, which is given as the number of patent citations scaled by sales in a year. We focus on the innovation outputs three years after the RTW adoption (t+3) because these laws might affect innovation only with a lag. For example, the average time between patent application and patent grant is two years on average (see, e.g., Bena and Li, 2014; Chemmanur, Loutskina, and Tian, 2014). Our construction of patents and citations counts are consistent with Kogan, Papanikolaou, Seru, and Stoffman (2017).[6] Scaling the innovation outputs by sales helps capture the importance of innovation activities in the firm's revenue-generation process.[7] The mean values of $PATENT_{t+3}$ and $CITATION_{t+3}$ of 0.144 and 2.045 in Table 2 indicate that an average firm in the sample generates 1.44 patents and 20.45 citations for every 10 million dollars of sales, respectively.

To measure innovation inputs, we construct the variable, *R&D*, which is computed as research and development expenditure scaled by sales. Specifically, we measure average R&D

[6] Patents and citations data at the firm-year level are sourced from https://iu.app.box.com/v/patents. We thank Noah Stoffman for sharing the data.

[7] It is well known that large firms tend to file more patents (e.g., Kogen et al., 2017). We also scale the innovation output measures by total assets following Kogen et al. (2017) and document qualitatively very similar results.

investment over three years following the RTW law adoption (from t to t+2). The mean value of $R\&D_{t,t+2}$ of 0.475 in Table 2 indicates that a sample firm on average invests 4.75 million dollars in R&D activities for every 10 million dollars of sales. This relatively high level of R&D expenditure may reflect the fact that only innovation-intensive firms (those with successful patents/citations) are included in our sample. Note that for the *R&D* variable presented in Table 2, we follow extant studies (e.g., Lewis and Tan, 2016) to replace missing R&D expenditure (*xrd* in Compustat) with zero. However, we use the *R&D* variables with missing *xrd* both set to zero and not set to zero in our analysis in recognition of Koh and Reeb's (2015) observation that some missing R&D firms may still engage in innovation activities.

To estimate financial distress risk, we follow the recent literature (e.g., Bharath and Shumway, 2008; Brogaard, Li, and Xia, 2017; Farre-Mensa and Ljungqvist, 2016) to compute Merton's (1974) distance-to-default (DD) for a given firm-year. The firm's distress probability (*DPROB*) in the year is then calculated as N(–DD), where N is the cumulative standard normal distribution function. To understand the impact of the RTW laws on the probability of financial distress which may eventually lead to a change in innovation outcomes in year $t+3$, we calculate the average *DPROB* over three years following the passage of such a law (from t to $t+2$). The mean value of $DROB_{t,t+2}$ of 0.03 in Table 2 reveals that our sample of patenting firms on average have a default probability of 3%, suggesting that the distress risk of such innovation-intensive firms in our sample is relatively low.

To capture the change in a firm's competitiveness, we follow Fresard (2010) and Billett, Garfinkel, and Yu (2017) to analyze its product market outcomes. In particular, we compute the annual growth rate in sales (*SG*) for each firm-year. Consistent with other analyses, we focus on the average sales growth over three-year period following the RTW recognition (from t to t+2). Table 2 reports that the mean of $SG_{t,t+2}$ is 0.197, that is, the average annual sales growth rate of a sample firm is 19.7%. This is slightly higher than the average annual sales growth rate (15.6%) reported in Billett, Garfinkel, and Yu (2017) and may reflect the fact that investment in innovation helps firms enhance competitiveness in product markets and achieve faster growth rate. In addition to sales growth, we also follow Billett, Garfinkel, and Yu (2017) to calculate market share growth, *MSG_SIC* and *MSG_FF*, which is defined as *SG* of the focal firm minus the growth rate of industry median sales using 4-digit SIC and Fame-French 49 industry classification, respectively. These latter two metrics help capture the focal firm's growth in sales at the expense of its direct rivals in product markets.

[Insert Table 2 about here]

3.3. Control Variables

We control for a list of time-varying firm-level and state-level characteristics that may affect innovation outcomes. In particular, we include the following firm-level control variables: *LNASSET* which is the natural logarithm of total assets; *CAPEX* which is computed as capital expenditure scaled by total assets; *LEV* which is the ratio of total debt (short-term plus long-term debt) over total assets; *ROA* which is calculated as operating income before depreciation scaled by total assets; *CASH* which equals cash plus short-term investments over total assets. Controlling for *CAPEX* and *LEV* is particularly important in our setting given the findings in Chava, Danis, and Hsu (2020) that the RTW laws result in significant changes in treated firms' capital expenditure and financial leverage. The data to construct firm-level control variables are sourced from Compustat. Summary statistics in Table 2 suggest a sample firm on average invests 6.4% of total assets in capital expenditure, uses a financial leverage of 19.7%, generates a return on assets of 7.8%, and holds 22.7% of total assets in the form of cash and cash equivalents.

With regard to the state-level control variables, we follow Qiu and Wang (2018) and incorporate the following three measures to capture state economic conditions: *SI* which is the natural logarithm of state income; *SI_GR* which is the growth rate in state income; *SI_CAPITA* which is the natural logarithm of per capita state income. The data to construct these variables are sourced from Bureau of Economic Analysis. Firms headquartered in states with more favorable economic environments (i.e., higher state income level and income growth rate) may be more innovative than rivals located in states with poor economic conditions.

We lag all control variables by one year and measure these variables in year *t-1*. Detailed definitions of all variables can be found in Table A1 in the Appendix. To mitigate the impact of outliers, we winsorize all continuous variables at their 1st and 99th percentiles.

4. Empirical Results

4.1. The Impact of RTW on Firm Innovation Outcomes

We use a difference-in-differences (DiD) regression framework to examine how the enactment of RTW laws impacts the innovation outcomes of firms in treated states. Following Bertrand and Mullainathan (2003), we estimate the following model:

$$INNO_{i,s,t+3} = \alpha + \beta\, RTW_{s,t} + \gamma\, X_{i,s,t-1} + \omega_i + \tau_{jt} + \varepsilon_{i,s,t}, \quad (7)$$

Where:

i = firm i,

j = industry j defined using two-digit SIC codes,

s = the firm's headquarter state, and

t = the current year.

The dependent variable *INNO* is one of the two proxies for firm innovation outputs: *PATENT* or *CITATION*, with higher values indicating better innovation outcomes. In a robustness check, we replace sales with total assets as the alternative scaling factor following Kogen et al. (2017) and observe qualitatively unchanged evidence, as shown in Table A2 in the Appendix. *RTW* is a dichotomous variable indicating whether the RTW has been adopted by the firm's headquarter state by year *t*, *X* is a vector of firm and state-level control variables defined in Section 3 and measured in year *t-1*, ω_i is the firm fixed effects, and τ_{jt} is the industry-by-year fixed effects. Including firm fixed effects controls for time-invariant firm characteristics that may affect *INNO* and thus estimates the treatment effect (i.e., RTW enactment) within firm over time. Including industry-by-year fixed effects helps control for time-varying industry shocks (e.g., demand shocks or technological breakthroughs) that may drive *INNO* (e.g., see Klasa et al., 2018). Moreover, including industry-by-year fixed effects is equivalent to subtracting the corresponding industry means from each variable in each year. Hence, we can interpret the coefficient on the *RTW* indicator, β, as the effect of the recognition of RTW laws on the innovation outcomes of a firm in a recognizing state (i.e., the treatment state) relative to that of its industry rivals in non-recognizing ones (i.e., the control states).[8]

An important advantage of the DiD setting is that different states adopted the RTW at different points in time, which allows a given adopting state to be both a treatment and a control state. In addition, the specification is not affected by the fact that some states did not adopt the RTW during our sample period and some states adopted the RTW before the start of our sample period. To address concerns about autocorrelation, we cluster standard errors at the state level given that the key independent variable of interest, *RTW*, is a state-specific variable.

[Insert Table 3 about here]

Table 3 presents the estimation results of Equation (7). To alleviate the concern on endogenous controls (e.g., see Angrist and Pischke, 2009), we run regressions both without and with the full list of control variables. Columns (1) through (3) report the results for *PATENT*, and Columns (4) through (6) report the results for *CITATION*. Across all models, the coefficients on the main variable of interest, *RTW*, are positive and statistically significant at

[8] The results are similar if we include firm and year fixed effects instead, as shown in Table A3 in the Appendix.

less than 1% level. These results indicate a strong positive impact of the RTW adoptions on the innovation outcomes of the treated firms relative to control rivals.

The magnitude of the treatment effect is also economically meaningful. For example, the estimated coefficient of *RTW* in Column (3) is 0.166 meaning that an average treated firm increases its patent count by 1.66 per 10-million-dollars of sales from before to after the RTW adoption, which translates to 0.28 (= 0.166/0.596) sample standard deviation of *PATENT*. Likewise, the estimated coefficient of *RTW* in Column (6) is 1.978 indicating that an average treated firm increases its citations count by 19.78 per 10-million-dollars of sales subsequent to the RTW recognition, which equals 0.21 (= 1.978/9.220) sample standard deviation of *CITATION*.[9]

To summarize, the baseline results in Table 3 lend strong support for our main hypothesis that higher bargaining power granted to the firm over the labor union encourages the firm to take risk and invest more in innovative activities.

4.2. Identification Validation

In this section, we address three main concerns about the causal interpretation of our baseline results: (i) reverse causality or a violation of parallel-trends assumption; (ii) omitted unobservable local economic conditions; and (iii) the RTW may inadvertently exert side effects other than being a valid exogenous shock to labor unions. In particular, we validate the parallel-trends assumption for the efficacy of the DiD approach by implementing a dynamic DiD regression framework. In addition, we better control for unobservable local economic conditions by relying on control firms in neighboring states contiguous to the treatment states. Finally, we estimate the economic impact of the RTW on firms' innovation outputs separately

[9] By way of comparison, Makridis (2019) documents an impact of 2.9% and 4.1% standard deviation improvements in the individual workers' life satisfaction and economic sentiment after the passage of RTW laws.

on subsamples of firms with high versus low labor union coverage and expect more pronounced impact on the high labor-unionization subsample.

4.2.1. Parallel-trends assumption: Dynamic DiD

A causal interpretation of the effect of the RTW enactment on firm innovation outcomes in our DiD regressions requires that the innovation outputs of the treatment and control firms follow parallel trends absent the changes in the status of the RTW laws. To test the validity of our empirical strategy, we introduce lead-lag terms in the DiD regressions. We first create a new set of adoption indicator variables: RTW^{-3}, RTW^{-2}, RTW^{-1}, RTW^{0}, RTW^{+1}, RTW^{+2}, RTW^{3+}, which are equal to one if the firm is headquartered in a state that will adopt the RTW in three years, will adopt the RTW in two years, will adopt the RTW in one year, adopts the RTW in the current year, adopted the RTW one year ago, adopted the RTW two years ago, adopted the RTW three or more years ago, respectively, and zero otherwise.

We replace the *RTW* indicator variable in the previous tests with this new list of adoption indicator variables in the baseline model. Given that this is a dynamic DiD model, we measure the innovation outcomes in year t (instead of year $t+3$ as in the baseline analysis). Across all six columns in Table 4, we find that the coefficients of RTW^{-3}, RTW^{-2}, RTW^{-1}, RTW^{0}, RTW^{+1}, RTW^{+2} are relatively small and statistically insignificant, while the coefficients of RTW^{3+} are positive and significant throughout. These results indicate that firms in the RTW-adopting states improve their innovation outcomes relative to that of the control firms only after the actual adoption of the RTW, but not before. More importantly, the positive treatment effect of the RTW on firm innovation mainly shows up from three years after the law enactment, validating our focus on innovation outcomes in year $t+3$ in the main analysis. Hence, reverse causality or a violation of the parallel-trends assumption is unlikely to explain our key finding that an increase in the firm's bargaining power over the labor union encourages firm innovation activities.

[Insert Table 4 about here]

We further visualize the parallel trends and treatment effect around the RTW adoptions in Figure 1. Graph A compares patent grants (*PATENT*) of firms headquartered in states that adopted the RTW with patent grants of firms headquartered in states where the RTW was not adopted. It is clear that the treatment and control firms have parallel trends in patent grants before the RTW adoption, and the treatment firms' patent grants significantly increase relative to those of the control firms starting from the third year after their headquarter states adopted the RTW. Similarly, Graph B shows that the treatment and control firms have parallel trends in citation count (*CITATION*) before the RTW adoption, and only the treatment firms' citation count significantly increases starting from the third year after their headquarter states adopted the RTW.

[Insert Figure 1 about here]

Moreover, we adopt the same dynamic DiD regression procedure as in Table 4 with more RTW indicators being included to better test the parallel trends and estimate the longer-term effect of the RTW laws. We then plot the estimated regression coefficients on RTW indicators over an event window from *five years before to five years after* the RTW adoptions in Figure 2. For example, the first RTW indicator, RTW^{-5}, indicates the firm is headquartered in a state that will adopt the RTW in five years; and the last RTW indicator, RTW^{5+}, indicates the firm is headquartered in a state that adopted the RTW five or more years ago. Graphs A and B of Figure 2 depict the dynamic treatment effects of the RTW on *PATENT* and *CITATION*, respectively, with the solid line representing the estimated coefficients and the dashed lines representing their corresponding 95% confidence intervals.

It is clear from Figure 2 that the treatment and control firms follow parallel trends in innovation outcomes before the RTW adoption, as evidenced by the solid line being relatively flat and close to zero line. Importantly, the treated firms start to show more successful innovation outputs from three years subsequent to the RTW adoption, as manifested in the upward sloping lines from year *t+3* onwards. This pattern is consistent across both graphs on *PATENT* and *CITATION* respectively, which again confirms the validity of the parallel-trends assumption underlying the causal interpretation of the main findings.

[Insert Figure 2 about here]

4.2.2. Unobservable local economic conditions: Neighboring states

Although we have controlled for observable local economic conditions in the baseline regressions, our results could be driven by unobserved local economic conditions, which can be associated with both the adoption of the RTW and corporate innovation outcomes. In this subsection, we address this concern by better selecting control firms located nearby (i.e., in contiguous neighboring states) the treated firms. We then investigate whether our results continue to hold. If our results are indeed driven by unobserved local economic conditions, we expect our DiD results will become weaker or cease to exist, because both types of firms are very likely subject to very similar local economic conditions.

To perform this robustness check, we construct a new sample which consists of treated firms (the same with baseline models in Table 3) and nearby control firms (those headquartered in non-adopting states which are contiguous to at least one adopting state by year *t*). We then reestimate all the baseline regressions as per Table 3 on the new sample and present the results in Table 5. Again, the coefficients of *RTW* indicator variable continue to load positively and significantly, which suggest that the positive impact of RTW adoption on firm innovation outcomes is unlikely to be driven by local economic conditions. Importantly, the coefficient of the *RTW* indicator appears to be larger in size compared to that in the baseline model. For example, the estimated coefficient of *RTW* is 0.536 in Column (3) of Table 5 compared to 0.166 in Column (3) of Table 3 for *PATENT*, and 8.698 in Column (6) of Table 5 compared to 1.978 in Column (6) of Table 3 for *CITATION*. These differences suggest that the RTW effects on firm innovation outputs have even larger magnitudes when state-level heterogeneities in economic conditions (between the treatment and control firms) are better controlled for.

[Insert Table 5 about here]

4.2.3. The impact of RTW on firm innovation outcomes conditional on union coverage

If the RTW indeed encourages corporate innovations through weakening labor unions' bargaining power, then it is intuitive that the economic impact of the RTW mainly shows up among highly unionized firms. Thus, we further split our full sample into subsamples of high- and low-union-coverage firms. The union coverage is measured at the 4-digit SIC industry level and sourced from the Union Membership and Coverage Database.[10] To account for the possibility that the union coverage may be influenced by the RTW adoption, we focus on the three lag years from *t-3* to *t-1* relative to the *RTW* indicator measurement year *t*, and calculate the average union coverage rate over this time window.[11] We classify firms into the high (low)-union-coverage subsample if the firm's industry union coverage rate is above (below) the cross-sectional sample median. We then reestimate the baseline DiD regressions in each subsample and present the results in Table 6.

We find that the estimated coefficients of *RTW* are 0.402 in Column (1) for *PATENT* and 5.162 in Column (3) for *CITATION* of the high-union-coverage firms, which are statistically significant at the 5% and 1% levels, respectively. By contrast, the *RTW* coefficients

[10] See http://www.unionstats.com/.

[11] The subsample analysis results are very similar if we use the union coverage measured in year *t* instead.

are -0.008 in Column (2) for *PATENT* and 0.031 in Column (4) for *CITATION* of the low-union-coverage firms, both of which are statistically insignificant. These findings clearly suggest that the impact of the RTW mainly concentrates in the high-union-coverage subsample, corroborating the validity of RTW laws as an exogenous and negative shock to labor unions.

[Insert Table 6 about here]

4.3. Reduction in Financial Distress Risk as an Underlying Mechanism

Next, we investigate empirically our theoretical argument that the RTW recognition results in lower financial distress risk for treated firms, which motivates managers to invest in risky innovation projects. As discussed earlier, Chava, Danis, and Hsu (2020) suggest that both operating and financial leverages decrease for the treated firms after the enactment of the RTW laws, which, we conjecture, will lead to lower financial distress risk for these firms. Given that distress risk is among the main hindrances for corporate managers to invest in risky innovation projects, a RTW-induced reduction in financial distress risk will likely encourage managers to engage in risky innovations. To examine this conjecture empirically, we conduct two separate sets of empirical tests: (i) we examine the direct impact of the RTW laws on ex-post financial distress risk, and (ii) we evaluate the RTW-innovation relation conditional on the ex-ante financial distress risk level.

First, we compute ex-post firm default probability (*DPROB*) based on Merton's (1974) distance-to-default metric. We create three measures, $DPROB_t$, $DPROB_{t,t+1}$ and $DPROB_{t,t+2}$, to comprehensively capture the firm distress risk in year t, the average distress risk in years t and $t+1$, and the average distress risk in years t, $t+1$ and $t+2$, respectively. Panel A of Table 7 presents the results of regressing each of these three ex-post default probability measures on the *RTW* indicator, with and without the full list of control variables.[12]

Consistent with our conjecture, across all the six regressions, the coefficients of *RTW* are negative and statistically significant at less than 1% level, confirming that the treated firms indeed experience a significant reduction in financial distress risk subsequent to the RTW recognition. For example, the estimated *RTW* coefficient of -0.020 in Column (6) indicates that the default probability decreases by about 2 percentage points for firms in the RTW-adopting states relative to industry rivals in the RTW-non-adopting states. This shift is economically meaningful, representing about 0.2 (= 0.020/0.094) sample standard deviation of $DPROB_{t,t+2}$. This evidence is consistent with greater RTW-induced bargaining power of the firm over the labor union significantly lowering financial distress risk and thus encouraging corporate innovations.

Second, if the RTW promotes corporate innovations through weakening labor unions and reducing financial distress risk for treated firms, we expect the treatment effect on innovation outcomes to be stronger for those treated firms that have higher distress risk level ex ante. Thus, we define *High DPROB* as an indicator of ex-ante above-median default probability measured as the average default probability over the three lag years from *t-3* to *t-1*, relative to the *RTW* indicator measurement year *t*. We then estimate the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on the interaction term of *RTW* and *High DPROB*. In addition to the regressions with firm and industry-year fixed effects, we employ another regression specification with a further inclusion of state-year fixed effects. These latter fixed effects are included to control for any unobservable, time-varying state-level variables that can be correlated with both the RTW law changes and corporate

[12] Note that the *DPROB* data is available for more firms than the *INNO* data, but we opt to use the baseline sample (as in Table 3) to ensure that we look at the same set of firms throughout. Nevertheless, Table A4 in the Appendix shows that the results based on a broader sample of firms with available *DPROB* data are qualitatively similar to the results based on the baseline sample as reported in Panel A of Table 7.

innovation outcomes (the *RTW* indicator is absorbed by the state-year fixed effects). We expect the positive treatment effect of the RTW enactment on firm innovation outcomes to be more pronounced for those treated firms having higher distress risk level ex ante. The results are reported in Panel B of Table 7.

Consistent with our expectation, we find that the estimated regression coefficients of *RTW*High DPROB* are positive across all, and statistically significant at least at the 5% level in five out of six, regressions, strongly suggesting that the treatment effect of the RTW on innovation outcomes is indeed more pronounced for treated firms that have higher distress risk level ex ante.

[Insert Table 7 about here]

4.4. Heterogeneities in the Impact of the RTW on Firm Innovation Outcomes

We next augment our main DiD specification by interacting the *RTW* indicator with factors that likely affect a firm's financial distress risk ex ante. These heterogeneity tests serve to shed further light on the economic mechanism underlying our main results. We expect the positive treatment effect of the RTW enactment on firm innovation outcomes to be more pronounced for those treated firms that are ex ante more likely to experience financial distress due to the frictions in three distinct markets: (i) treated firms facing intense competition in product market, (ii) treated firms heavily relying on skilled workers in labor market, and (iii) treated firms facing binding financial constraints in financial market.

4.4.1. Product market competition

Firms operate in an intensely competitive environment face higher risk of financial distress because competitive threats may erode the firm's market power, profits, pledgeable income and hence increase its cash flow risk (e.g., Valta, 2012). Both theories and empirical evidence suggest that idiosyncratic risk and cash flow volatility increase with the intensity of product market competition (e.g., Gaspar and Massa, 2006; Irvine and Pontiff, 2009; Raith, 2003). Higher cash flow risk and lower cash flows due to intense product market competition pose greater distress risk to the firm.

If treated firms improve their innovation outcomes due to the RTW adoptions lowering distress risk, we expect the effect should be stronger for those treated firms facing more intense product market competition and thus greater distress risk ex ante. We employ the well-known measure of product market competition intensity based on textual analysis of the firm's 10-K disclosures, that is, total product similarity (*TSIM*) (Hoberg and Phillips, 2010; 2016). The *TSIM* data is available over 1996-2017 period. Differing from the traditional industry-level competition measures such as the Herfindahl index and industry concentration ratios, this measure is firm specific and can better capture firm-level effects.[13] In particular, the *TSIM* metric captures how similar the firm's products are to those of all other firms based on their product descriptions in 10-Ks, with higher values indicating more product rivals and hence higher product market competition. We interact *TSIM* with the *RTW* indicator in the baseline model. Consistent with our expectation, Panel A of Table 8 show that the coefficients on the interaction term of interest, *RTW***TSIM*, are positive and statistically significant across different models with *PATENT* and *CITATION* as the dependent variables. These results suggest that treated firms facing greater competitive threats (and thus having higher distress risk ex ante) benefit more in their innovation outcomes from the RTW enactment.[14]

[Insert Table 8 about here]

[13] We thank Gerard Hoberg and Gordon Phillips for making the total product similarity data available at their research website: https://hobergphillips.tuck.dartmouth.edu/tnic_poweruser.htm.

[14] As a robustness check, we further use the number of peer firms in the same industry (defined at two-digit SIC codes) as an alternative measure of product market competition (e.g., Chen, Gao, and Ma, 2020) and find qualitatively similar results, as shown in Panel A of Table A5 in the Appendix.

4.4.2. Reliance on skilled labor

Firms heavily relying on skilled labor incur substantial amounts of labor adjustment costs (LACs) (Belo et al., 2017; Ghaly, Dang, and Stathopoulos, 2017). This is because high-skill workers who perform technical and sophisticated jobs are relatively harder and more costly to search for, recruit, retain and replace than lower-skill employees who perform basic and general tasks. Thus, skilled-labor-reliant firms have higher levels of LACs, which subject their future cash flows to more sources of fluctuations such as macro-economic shocks or consumer demand changes (Oi, 1962; Shapiro, 1986), leading to greater financial distress risk. Consistent with this notion, Belo et al. (2017) show that shareholders of skilled-labor-reliant firms in general require higher risk premium in stock returns, while Ghaly, Dang, and Stathopoulos (2017) document that managers of these high-skill firms in general are more conservative and accumulate more precautionary cash, both due to the higher risks associated with high LACs.

Therefore, we measure the extent to which a firm is reliant on skilled employees as a proxy for ex-ante distress risk. Our measure of skilled labor dependence is consistent with Belo et al. (2017), who develop a labor skill index (*LSI*). The *LSI* data is available at the industry level over the 1988-2013 period.[15] Specifically, *LSI* is defined as the percentage of employees whose occupations require a high degree of training and preparation (i.e., high-skill occupations with more than two years of lapsed time needed to acquire information, learn techniques, and develop facility for the average performance). According to Belo et al. (2017), industry is defined at three-digit SIC codes until 2002, and four-digit NAICS codes after 2002. Higher *LSI* values indicate higher levels of labor skilled requirements for a particular industry and hence higher LACs for an average firm in that industry.

[15] We thank Frederico Belo for making the labor skill intensity data available at his website: https://sites.google.com/a/umn.edu/frederico-belo/.

Similar to the previous cross-sectional analysis, we include the interaction term, *RTW*LSI*, in the baseline regression model and present the regression results in Panel B of Table 8. As expected, the coefficients on the interaction term *RTW*LSI* are positive and statistically significant across all the six regressions. The evidence suggests that treated firms facing greater labor adjustment costs (and thus facing higher distress risk ex ante) benefit more in their innovation outputs from the RTW adoption.[16]

4.4.3. Financial constraints

Firms with tight financial constraints may have high levels of financial distress risk ex ante for the following reasons. First, constrained firms may underinvest in both tangible (Rajan and Zingales, 1998) and intangible assets (Li, 2011) and as a result, risk losing market shares and growth to deep-pocket rivals (Bolton and Scharfstein, 1990). Second, constrained firms may be forced to implement suboptimal labor policy such as being unable to replace low-quality workers (Garmaise, 2007) and/or having to fire short-tenured employees with potentially high productivity in the future (Caggese, Cunat, and Metzger, 2019). As such, it is not surprising that financially constrained firms are riskier and have higher expected stock returns than less financially constrained firms (Livdan, Sapriza, and Zhang, 2009) and are more likely to experience stock price crashes (He and Ren, 2017).

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[16] As a robustness check, we follow Ghaly, Dang, and Stathopoulos (2017) and adopt an alternative index of skilled labor reliance (*LSI_GHALY*) and find qualitatively similar results, as shown in Panel B of Table A5 in the Appendix. To construct this alternative index, we source data from the Occupational Employment Statistics database of Bureau of Labor Statistics and the O*NET program classification of occupations according to skill levels. The *LSI_GHALY* index, which is also measured at the industry level, is computed as follows: $LSI\_GHALY_j = \sum_{m=1}^{O} \left(\frac{E_{mj}}{E_j} * S_m\right)$, where E_{mj} is the number of employees in industry j working in occupation m, E_j is the total number of employees in industry j, O is the total number of occupations in industry j, and S_m ranges from 1 to 5 corresponding with the occupation's skill level based on the O*NET program classification (1 represents the least skilled occupations while 5 represents the most skilled occupations). In classifying occupations, the Department of Labor considers the level of education, the extent of relevant work experience, and amount of training that is required for an employee to work in that occupation and perform competently.

Therefore, we predict that the RTW laws exert disproportionately stronger impact on innovation outcomes of financially constrained firms than those of their unconstrained counterparts. To test this conjecture, we interact an indicator of financially constrained firms *FC* with the *RTW* indicator in the baseline regression model. We expect the estimated coefficient of the interaction term *RTW**FC* to be significantly positive. We follow Hadlock and Pierce (2010) and use the size-age index (*SA* index) to capture firm-level financial constraints.[17] The index is calculated as: *SA* index = (−0.737**SIZE*) + (0.043*$SIZE^2$) − (0.040**AGE*), where *SIZE* is the log of book assets, and *AGE* is the number of years the firm has been on Compustat with a non-missing stock price. Higher values of the index indicate greater financial constraints. The *FC* indicator equals 1 for those firms in the top quartile of *SA* index distribution each year and equals 0 otherwise.

The regression results, as reported in Panel C of Table 8, are consistent with our conjecture. The significantly positive coefficients of *RTW*FC* across all the six regressions suggest that, relative to unconstrained firms, financially constrained firms are exposed to higher ex-ante distress risk and hence benefit more from the RTW adoption, leading to more successful innovation outcomes.

4.5. The Impact of RTW on R&D Expenditures

As discussed earlier, the post-RTW reduction in distress risk encourages the firm to invest in more innovation projects. Thus, we further examine whether treated firms increase their R&D expenditures after the RTW enactment.

We reestimate the baseline regression model with the dependent variable being *R&D*, which is calculated as R&D expenditures scaled by sales. Table 9 reports the regression results

[17] We further use the financial-constraint index developed in Whited and Wu (2006). The regression results based on this alternative index, as shown in Panel C of Table A5 in the Appendix, are consistent with those based on the size-age index.

with missing R&D being treated as zero in Columns (1) through (3), or being dropped from the sample in Columns (4) through (6). Note that even though the data on *R&D* is generally more available than the data on the innovation outputs (*PATENT* and *CITATION*), we opt for using the innovation sample (i.e., the baseline sample in Table 3) to ensure that we use the same set of firms throughout. This is to verify empirically whether those treated firms that have better innovation outcomes indeed intensify their innovation inputs. The significantly positive coefficients of *RTW* across all the six regressions confirm that this is indeed the case, and the results are not sensitive to how we treat the sample firms that report missing R&D in the Compustat database. The size of the estimated coefficients of *RTW* reveals a substantial impact of the passage of the RTW laws on the R&D intensity of the treated firms. For example, the coefficient of 0.258 in Column (3) suggests that firms in the RTW-adopting states enhance their R&D expenditures as a share of sales by 25.8% more than their industry rivals in the non-RTW-adopting states, which is equivalent to about 0.10 (= 0.258/2.462) sample standard deviation. This sizable surge in R&D expenditures is consistent with our conjecture that treated firms gain success in their innovation outcomes mainly due to their significantly intensified R&D expenditures.[18]

[Insert Table 9 about here]

4.6. Additional Robustness Checks

4.6.1. Alternative measure of innovation success: product market outcomes

In this set of analysis, we aim to establish the effect of RTW-induced innovation intensity on treated firms' competitiveness in product markets. The baseline results presented in Table 3

[18] Similar to the tests on default probability, in a robustness check, we replicate the regression results of *R&D* on *RTW* using a broad sample of Compustat firms and find qualitatively similar evidence, as shown in Table A6 in the Appendix. In terms of economic magnitude, as expected the impact of the RTW laws on R&D expenditures is much weaker for the broad sample than for the innovative-firm baseline sample. For example, the economic impact of the RTW is an increase of 4.3% in R&D expenditures as a proportion of sales as manifested in the coefficient of 0.043 of the *RTW* indicator in Column (3) of Table A6.

already indicate that firms headquartered in the RTW-adopting states indeed generate more successful innovation outputs than industry rivals in the non-adopting states. Since treated firms boost their corporate innovations after the RTW enactment, we expect these firms should also enhance their product market competitiveness over industry rivals. That is, treated firms will surpass their competitors in terms of sales growth, and eventually win over market shares.

For this analysis, our measures of sales growth (*SG*) and market share growth (*MSG_SIC* or *MSG_FF*) are constructed following Fresard (2010) and Billett, Garfinkel, and Yu (2017). We then run DiD regressions of each of these measures of product market outcomes on *RTW* without and with the full list of time-varying controls, and report the results in Table A7 using either our baseline regression sample (Panel A), or a broader sample of Compustat firms (Panel B).

As expected, the coefficients of *RTW* show up positively in all, and statistically significantly in eleven out of the twelve, regressions. This finding confirms that treated firms indeed achieve better product market outcomes than their control rival firms post the RTW enactment. The effect is economically non-trivial. For example, the estimated coefficient of *RTW* in Column (2) in Panel A of 0.038 reveals that treated firms seize on average 3.8% sales growth from their industry rivals in the non-RTW states. To put the number into perspective, Chava, Danis, and Hsu (2020) document that employment growth is merely 1.7% higher subsequent to the RTW recognition. The seemingly stronger impact of the RTW laws on sales growth implies that treated firms obtain better product market outcomes not simply by expanding the operation scale (i.e., recruiting more workers). Our results further point to innovation investments as another potential contributing factor to such improved competitiveness in product markets. The evidence reiterates the significant role of innovation in firms' survival and growth.

4.6.2. Subperiod analysis

Although our sample period starts in 1950, there is a concentration of RTW passages in more recent years starting from the Oklahoma (OK) adoption in 2001. Hence, a subperiod analysis of the DiD test will be helpful to see if the main findings remain robust in different subperiods. For example, the RTW adoptions in the later subperiod may be more likely to be expected than the adoptions in the earlier subperiod.

For the purpose of the subperiod analysis, we adopt two distinct splitting criteria: (i) splitting the full sample period into two equal halves with 34 years each 1950-1983 vs. 1984-2017, and (ii) dividing into two unequal subperiods 1950-1995 vs. 1996-2017 to allow up to five years prior to the RTW recognition in OK (1996 is year *t-5* relative to the adoption year 2001 in OK). We then rerun the baseline DiD regressions on each subsample, and report the regression results in Panels A and B of Table A8, respectively. The results show positive and statistically significant coefficients of the *RTW* indicator across all four subperiods of interest for both dependent variables *PATENT* and *CITATION*, indicating a robust treatment effect of the RTW on corporate innovation.

5. Conclusion

The U.S. Congress passed the Taft-Hartley Act in 1947, which authorizes states to recognize "right-to-work" (RTW) legislations. The RTW laws prohibit "union security" clauses in the employment contracts, which means workers in unionized workplaces have the rights to receive the same benefits with union members, but without being required to join unions and pay union dues. Despite the controversy surrounding the RTW laws, 27 states have adopted the RTW so far.

Because the state RTW laws weaken the bargaining power of labor unions and decrease firm leverages (Chava, Denis, and Hsu, 2020) which lowers financial distress risk, we conjecture that RTW-treated firms are motivated to conduct more innovation activities. Employing a difference-in-differences estimation framework, we find that the RTW adoption strongly encourages treated firms' successes in their innovation activities in terms of patent grant and citation count three years after the adoption, and the treatment effects of the RTW on innovation outcomes mainly concentrate in highly unionized firms. Consistent with our expectation, we also find that the RTW adoption significantly decreases treated firms' financial distress risk ex post, and its treatment effect on innovation outcomes is stronger for firms that are ex ante more likely to experience financial distress. Results from further analyses show that treated firms increase research and development expenditures and, likely due to their improved innovations, enhance their competitiveness in product markets. Collectively, our findings highlight the bright side of the RTW laws in encouraging corporate innovations. Given the ongoing controversy on the RTW laws, the findings may be of interests to practitioners, academics and regulators.

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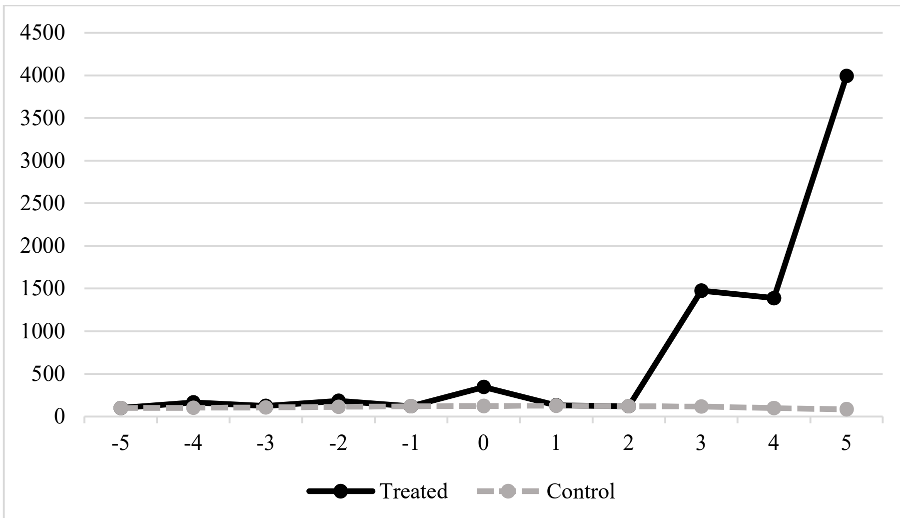
Figure 1
Firm Innovation Outputs around the RTW Adoptions

These graphs plot firm innovation outputs (*PATENT* in Panel A; *CITATION* in Panel B) each year from five years before (year -5) to five years after (year 5) the RTW adoption year (year 0), for the treated group (black solid line) and the control group (grey dotted line). Year -5 serves as the base year, and the level of innovation outputs in year -5 is rescaled to 100 for both groups. The levels of innovation outputs in the remaining years are then calculated relative to the base year. A detailed description of the variable construction is provided in the Appendix A1.

Panel A: Patent Grants



Panel B: Citation Count

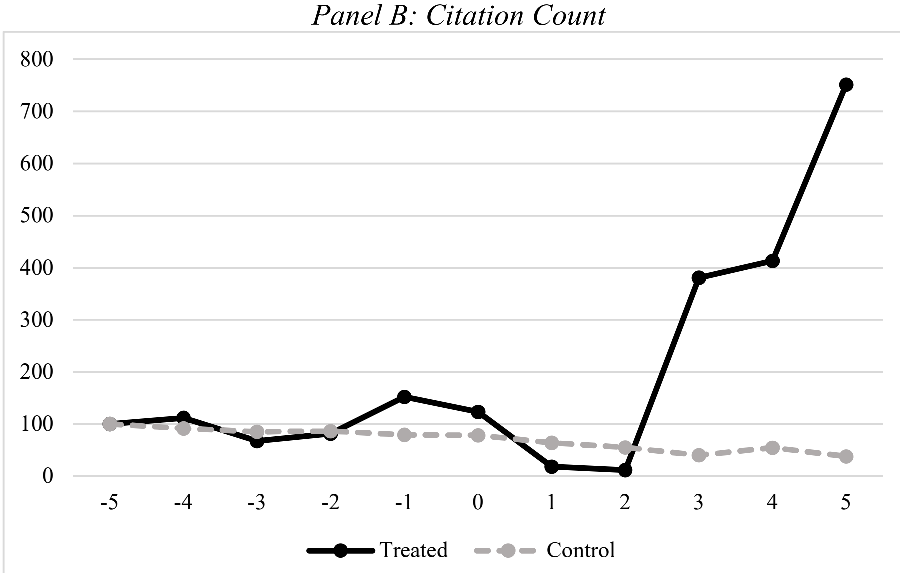
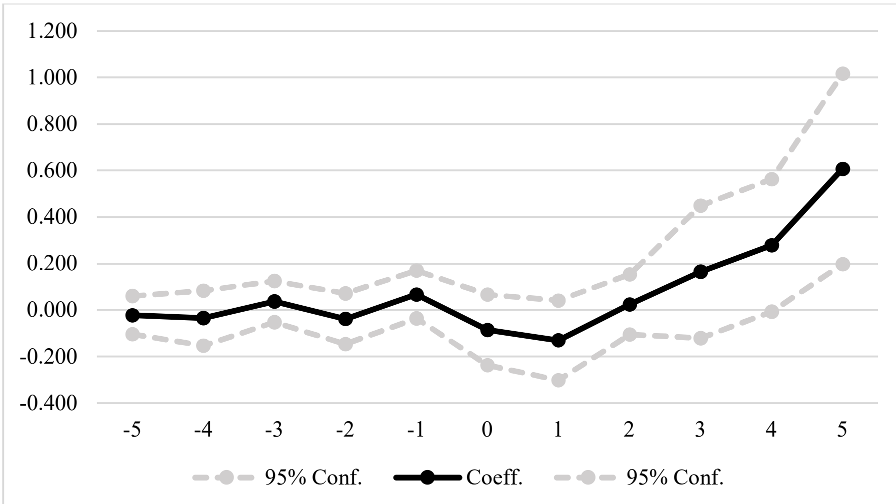


Figure 2

Dynamics of RTW Effect on Firm Innovation Outputs

These graphs plot coefficient estimates and corresponding 95% confidence intervals in the dynamic DiD regressions of firm innovation outputs (*PATENT* in Panel A; *CITATION* in Panel B) on time dummies indicating from five years before to five years or more after the RTW adoption year. All regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects. A detailed description of the variable construction is provided in the Appendix A1.

Panel A: Patent Grants



Panel B: Citation Count

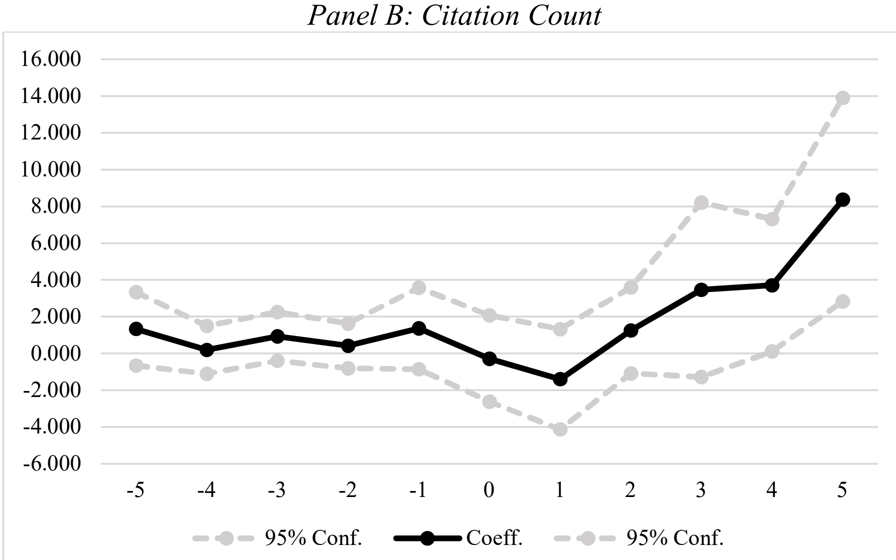


Table 1
Timelines of State Adoptions of Right-to-Work Laws in the US

State	State Name	Year RTW	State	State Name	Year RTW
AL	Alabama	1953	MT	Montana	
AK	Alaska		NE	Nebraska	1947
AZ	Arizona	1947	NV	Nevada	1952
AR	Arkansas	1947	NH	New Hampshire	
CA	California		NJ	New Jersey	
CO	Colorado		NM	New Mexico	
CT	Connecticut		NY	New York	
DE	Delaware		NC	North Carolina	1947
DC	D.C.		ND	North Dakota	1948
FL	Florida	1943	OH	Ohio	
GA	Georgia	1947	OK	Oklahoma	2001
HI	Hawaii		OR	Oregon	
ID	Idaho	1986	PA	Pennsylvania	
IL	Illinois		RI	Rhode Island	
IN	Indiana	2012	SC	South Carolina	1954
IA	Iowa	1947	SD	South Dakota	1947
KS	Kansas	1958	TN	Tennessee	1947
KY	Kentucky	2017	TX	Texas	1947
LA	Louisiana	1976	UT	Utah	1955
ME	Maine		VT	Vermont	
MD	Maryland		VA	Virginia	1947
MA	Massachusetts		WA	Washington	
MI	Michigan	2013	WV	West Virginia	2016
MN	Minnesota		WI	Wisconsin	2015
MS	Mississippi	1960	WY	Wyoming	1963
MO	Missouri				

Table 2
Summary Statistics

The sample consists of 41,626 firm-year observations over the period 1950-2017. A detailed description of the variable construction is provided in the Appendix A1. All continuous variables are winsorized at the 1st and 99th percentiles.

	Obs.	Mean	Std. Dev.	P25	Median	P75
Panel A: Main dependent variables						
$PATENT_{t+3}$	41,626	0.144	0.596	0.006	0.019	0.060
$CITATION_{t+3}$	41,626	2.045	9.220	0.036	0.175	0.656
$R\&D_{t,t+2}$	41,626	0.475	2.462	0.006	0.028	0.105
$DPROB_{t,t+2}$	27,729	0.030	0.094	0.000	0.000	0.003
$SG_{t,t+2}$	41,537	0.197	0.457	0.031	0.102	0.207
Panel B: Main independent variable						
RTW_{t}	41,626	0.197	0.397	0.000	0.000	0.000
Panel C: Control variables						
$LNASSET_{t-1}$	41,626	5.501	2.142	3.974	5.369	6.940
$CAPX_{t-1}$	41,626	0.064	0.054	0.029	0.051	0.083
LEV_{t-1}	41,626	0.197	0.208	0.041	0.170	0.290
ROA_{t-1}	41,626	0.078	0.312	0.071	0.138	0.195
$CASH_{t-1}$	41,626	0.197	0.227	0.037	0.101	0.270
SI_{t-1}	41,626	11.917	1.377	10.943	12.018	12.888
SI_GR_{t-1}	41,626	0.066	0.032	0.047	0.066	0.087
SI_CAPITA_{t-1}	41,626	9.659	0.914	9.007	9.953	10.402

Table 3
The Effect of RTW Laws on Firm Innovation Outputs

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) *PATENT* $_{t+3}$	(2) *PATENT* $_{t+3}$	(3) *PATENT* $_{t+3}$	(4) *CITATION* $_{t+3}$	(5) *CITATION* $_{t+3}$	(6) *CITATION* $_{t+3}$
RTW $_t$	**0.168*** **	**0.170*** **	**0.166** **	**2.048*** **	**2.049*** **	**1.978*** **
	[2.89]	[2.71]	[2.53]	[8.98]	[8.17]	[7.74]
LNASSET $_{t-1}$		-0.003	-0.003		-0.353***	-0.351***
		[-0.68]	[-0.71]		[-3.47]	[-3.49]
CAPX $_{t-1}$		0.111***	0.111***		0.850	0.861
		[3.40]	[3.42]		[1.20]	[1.23]
LEV $_{t-1}$		-0.102***	-0.102***		-0.681	-0.686
		[-5.82]	[-5.84]		[-1.66]	[-1.68]
ROA $_{t-1}$		-0.075**	-0.075**		-1.494***	-1.496***
		[-2.61]	[-2.62]		[-3.19]	[-3.20]
CASH $_{t-1}$		0.056***	0.056***		0.739*	0.738
		[3.10]	[3.09]		[1.68]	[1.67]
SI $_{t-1}$			0.019*			-0.109
			[1.76]			[-0.48]
SI_GR $_{t-1}$			0.012			-0.734
			[0.13]			[-0.45]
SI_CAPITA $_{t-1}$			-0.098*			-1.184
			[-1.90]			[-1.40]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	41,626	41,626	41,626	41,626	41,626	41,626
Adjusted R-squared	0.590	0.592	0.592	0.543	0.545	0.545

Table 4
Parallel Trends Assumption Check: Dynamics of RTW Effect

The table reports results of the falsification test that counterfactually assumes that the RTW took place a few years before the actual event. The dependent variable is firm innovation outputs (*PATENT* or *CITATION*). RTW^{-3}, RTW^{-2}, RTW^{-1}, RTW^{0}, RTW^{+1}, RTW^{+2}, and RTW^{3+} are indicator variables that indicate three years before, two years before, one year before, the current year of, one year after, two years after, and three or more years after the RTW, respectively. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $PATENT_t$	(2) $PATENT_t$	(3) $PATENT_t$	(4) $CITATION_t$	(5) $CITATION_t$	(6) $CITATION_t$
RTW^{-3}	**0.042**	**0.031**	**0.032**	**0.774**	**0.623**	**0.555**
	[1.16]	[0.86]	[0.95]	[1.24]	[1.01]	[0.90]
RTW^{-2}	**-0.038**	**-0.051**	**-0.050**	**0.234**	**0.027**	**-0.048**
	[-0.75]	[-1.09]	[-1.13]	[0.40]	[0.05]	[-0.09]
RTW^{-1}	**0.072**	**0.051**	**0.052**	**1.262**	**0.942**	**0.863**
	[1.62]	[1.34]	[1.46]	[1.19]	[1.07]	[0.98]
RTW^{0}	**-0.074**	**-0.084**	**-0.083**	**-0.324**	**-0.422**	**-0.513**
	[-0.95]	[-1.01]	[-0.98]	[-0.27]	[-0.32]	[-0.39]
RTW^{+1}	**-0.117**	**-0.116**	**-0.114**	**-1.403**	**-1.274**	**-1.360**
	[-1.29]	[-1.28]	[-1.25]	[-1.02]	[-0.96]	[-1.03]
RTW^{+2}	**0.030**	**0.025**	**0.027**	**1.211**	**1.197**	**1.101**
	[0.50]	[0.47]	[0.52]	[1.10]	[1.14]	[1.06]
RTW^{3+}	**0.334****	**0.332*****	**0.333*****	**4.903*****	**4.917*****	**4.837*****
	[2.68]	[2.74]	[2.82]	[2.70]	[2.86]	[2.84]
$LNASSET_{t-1}$		-0.028**	-0.029**		-0.797***	-0.795***
		[-2.64]	[-2.65]		[-4.17]	[-4.17]
$CAPX_{t-1}$		-0.227	-0.225		-2.261	-2.239
		[-1.42]	[-1.41]		[-1.11]	[-1.09]
LEV_{t-1}		-0.029	-0.028		0.923	0.917
		[-0.71]	[-0.71]		[1.18]	[1.17]
ROA_{t-1}		-0.355***	-0.355***		-4.653***	-4.655***
		[-6.16]	[-6.16]		[-3.92]	[-3.93]
$CASH_{t-1}$		0.404***	0.405***		7.636***	7.637***
		[9.03]	[9.07]		[7.95]	[7.95]
SI_{t-1}			0.067			-0.467
			[1.21]			[-0.88]
SI_GR_{t-1}			-0.061			-2.463
			[-0.24]			[-0.78]
SI_CAPITA_{t-1}			-0.118			-0.769
			[-1.27]			[-0.50]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	41,626	41,626	41,626	41,626	41,626	41,626
Adjusted R-squared	0.531	0.545	0.545	0.506	0.520	0.520

Table 5
Robustness Check: Analysis involving Firms in Neighboring States

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator, using control firms headquartered in neighboring states contiguous to the treated ones. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $PATENT_{t+3}$	(2) $PATENT_{t+3}$	(3) $PATENT_{t+3}$	(4) $CITATION_{t+3}$	(5) $CITATION_{t+3}$	(6) $CITATION_{t+3}$
RTW_t	**0.539*** **	**0.538*** **	**0.536*** **	**8.780*** **	**8.820*** **	**8.698*** **
	[10.40]	[10.42]	[9.74]	[9.42]	[9.45]	[9.17]
$LNASSET_{t-1}$		0.002	0.002		-0.266	-0.248
		[0.09]	[0.13]		[-0.89]	[-0.83]
$CAPX_{t-1}$		-0.008	-0.007		0.108	0.085
		[-0.15]	[-0.14]		[0.06]	[0.05]
LEV_{t-1}		-0.038	-0.038		0.225	0.211
		[-1.18]	[-1.20]		[0.54]	[0.53]
ROA_{t-1}		-0.064	-0.065		-0.595	-0.603
		[-1.38]	[-1.38]		[-1.08]	[-1.09]
$CASH_{t-1}$		0.093	0.095*		0.698	0.729
		[1.78]	[1.82]		[0.90]	[0.94]
SI_{t-1}			-0.010			0.123
			[-0.29]			[0.22]
SI_GR_{t-1}			-0.293			-5.020*
			[-1.55]			[-1.94]
SI_CAPITA_{t-1}			-0.116			-3.228**
			[-0.72]			[-2.66]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	16,086	16,086	16,086	16,086	16,086	16,086
Adjusted R-squared	0.586	0.587	0.587	0.557	0.557	0.557

Table 6

The Effect of RTW Laws on Firm Innovation Outputs: Split by Union Coverage

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator, using the subsamples of high/low (above/below cross-sectional median values) union coverage. The union coverage is measured at the 4-digit SIC industry level in each year and sourced from the Union Membership and Coverage Database. For the sample splitting purpose, we measure the average union coverage over the three lag years from *t-3* to *t-1* relative to the *RTW* indicator measurement year *t*. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) *PATENT* $_{t+3}$	(2) *PATENT* $_{t+3}$	(3) *CITATION* $_{t+3}$	(4) *CITATION* $_{t+3}$
	High Unionization	Low Unionization	High Unionization	Low Unionization
RTW $_t$	**0.402****	**-0.008**	**5.162*****	**0.031**
	[2.43]	[-1.21]	[6.22]	[0.12]
LNASSET $_{t-1}$	0.017**	-0.004	0.074	0.070
	[2.28]	[-1.54]	[0.78]	[0.54]
CAPX $_{t-1}$	0.130	0.108*	-1.570	2.913*
	[0.85]	[2.00]	[-0.54]	[1.81]
LEV $_{t-1}$	-0.132***	-0.005	-2.468***	-0.998*
	[-6.78]	[-0.76]	[-4.61]	[-1.72]
ROA $_{t-1}$	-0.016	-0.070***	-0.973	-3.101**
	[-0.35]	[-2.93]	[-1.13]	[-2.30]
CASH $_{t-1}$	0.138***	0.071**	0.050	1.815***
	[2.82]	[2.12]	[0.07]	[2.94]
SI $_{t-1}$	-0.414***	0.029	-8.337***	-0.331
	[-5.13]	[1.31]	[-4.98]	[-0.92]
SI_GR $_{t-1}$	-0.881**	0.325***	-13.346**	3.654*
	[-2.31]	[3.80]	[-2.09]	[2.01]
SI_CAPITA $_{t-1}$	0.616**	-0.207**	11.835*	-3.390**
	[2.16]	[-2.46]	[1.92]	[-2.27]
Ind-Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y
Observations	9,987	10,902	9,987	10,902
Adjusted R-squared	0.555	0.716	0.525	0.581

Table 7
Channel Analysis: Firm Default Probability

This table reports the results of the difference-in-differences regressions of firm ex-post default probability (*DPROB*) on *RTW* indicator (Panel A), and the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator, conditional on firm's ex-ante default probability (Panel B). The ex-post *DPROB* is measured within the three lead years from *t* to *t+2*, while ex-ante *High DPROB* is an indicator of above median of default probability measured as the average default probability over the three lag years from *t-3* to *t-1* relative to the *RTW* indicator measurement year *t*. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: The impact of the RTW on ex-post financial distress risk

VARIABLES	(1) *DPROB* $_{t}$	(2) *DPROB* $_{t}$	(3) *DPROB* $_{t,t+1}$	(4) *DPROB* $_{t,t+1}$	(5) *DPROB* $_{t,t+2}$	(6) *DPROB* $_{t,t+2}$
RTW $_{t}$	**-0.025*** **	**-0.027*** **	**-0.022*** **	**-0.023*** **	**-0.021*** **	**-0.020*** **
	[-3.05]	[-2.90]	[-4.28]	[-4.24]	[-4.63]	[-4.06]
LNASSET $_{t-1}$		0.015***		0.014***		0.012***
		[11.96]		[18.21]		[16.72]
CAPX $_{t-1}$		0.005		0.007		0.025*
		[0.42]		[0.68]		[1.96]
LEV $_{t-1}$		0.093***		0.059***		0.041***
		[19.61]		[18.15]		[15.16]
ROA $_{t-1}$		-0.017***		-0.007***		-0.004
		[-4.28]		[-3.26]		[-1.68]
CASH $_{t-1}$		-0.012***		-0.011***		-0.009***
		[-3.22]		[-3.84]		[-3.76]
SI $_{t-1}$		-0.047**		-0.036*		-0.019
		[-2.28]		[-1.74]		[-1.54]
SI_GR $_{t-1}$		-0.093		-0.075*		-0.070***
		[-1.49]		[-1.87]		[-2.86]
SI_CAPITA $_{t-1}$		0.007		0.011		0.008
		[0.20]		[0.28]		[0.30]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	24,067	24,067	26,213	26,213	27,729	27,729
Adjusted R-squared	0.228	0.247	0.335	0.351	0.415	0.426

Table 7 (continued)

Panel B: The RTW-innovation relation conditional on the ex-ante financial distress risk

VARIABLES	(1) *PATENT* $_{t+3}$	(2) *PATENT* $_{t+3}$	(3) *PATENT* $_{t+3}$	(4) *CITATION* $_{t+3}$	(5) *CITATION* $_{t+3}$	(6) *CITATION* $_{t+3}$
RTW $_{t}$ **** High DRPOB*** $_{t-3,t-1}$	**0.021****	**0.014*****	**0.014*****	**0.313**	**0.355*****	**0.351*****
	[2.36]	[2.83]	[2.88]	[1.56]	[3.72]	[3.65]
High DRPOB $_{t-3,t-1}$	0.002	0.003	-0.004	-0.178*	-0.196**	-0.233***
	[1.33]	[1.44]	[-0.73]	[-1.77]	[-2.48]	[-2.75]
RTW $_{t}$	0.011			-0.413		
	[0.80]			[-0.58]		
LNASSET $_{t-1}$			0.003			-0.152
			[0.82]			[-1.36]
CAPX $_{t-1}$			0.307***			2.531**
			[8.70]			[2.56]
LEV $_{t-1}$			-0.077**			-0.388
			[-2.44]			[-0.65]
ROA $_{t-1}$			-0.073***			-1.990***
			[-8.17]			[-5.28]
CASH $_{t-1}$			0.006			-0.201
			[0.30]			[-0.27]
State-Year FE	N	Y	Y	N	Y	Y
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	23,895	23,689	23,689	23,895	23,689	23,689
Adjusted R-squared	0.593	0.582	0.583	0.550	0.540	0.542

Table 8
Heterogeneity of the RTW Effect

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator, conditional on the ex-ante default risk as proxied by product market competition (Panel A), reliance on skilled labor (Panel B), and financial constraints (Panel C). Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) all lagged by one period. Some regressions also control for state-times-year, industry-times-year, and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $PATENT_{t+3}$	(2) $PATENT_{t+3}$	(3) $PATENT_{t+3}$	(4) $CITATION_{t+3}$	(5) $CITATION_{t+3}$	(6) $CITATION_{t+3}$
Panel A: Heterogeneous impact of total similarity (Hoberg and Phillips, 2016)						
$RTW_t * TSIM_t$	**0.009****	**0.010****	**0.010****	**0.114*****	**0.112*****	**0.110*****
	[2.69]	[2.20]	[2.05]	[4.16]	[3.12]	[2.82]
$TSIM_t$	0.004*	0.005***	0.005**	0.070**	0.076***	0.077***
	[1.75]	[2.76]	[2.65]	[2.64]	[3.89]	[3.74]
RTW_t	0.105**			1.093***		
	[2.12]			[6.92]		
$LNASSET_{t-1}$			-0.002			0.045
			[-0.48]			[0.65]
$CAPX_{t-1}$			0.120***			1.971*
			[3.03]			[2.02]
LEV_{t-1}			-0.167***			-0.790**
			[-6.34]			[-2.46]
ROA_{t-1}			-0.109***			-2.649***
			[-4.82]			[-5.44]
$CASH_{t-1}$			0.005			-0.505
			[0.14]			[-1.23]
State-Year FE	N	Y	Y	N	Y	Y
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	16,160	16,039	16,039	16,160	16,039	16,039
Adjusted R-squared	0.583	0.575	0.577	0.531	0.521	0.525

Table 8 (continued)

Panel B: Heterogeneous impact of skilled labor (Belo et al., 2017)						
RTW_t * LSI_t	**0.496****	**0.549*****	**0.545*****	**4.255***	**4.471*****	**4.278*****
	[2.15]	[4.54]	[4.75]	[1.75]	[3.79]	[3.97]
LSI_t	-0.120*	-0.142*	-0.142*	-0.732	-0.847	-0.755
	[-1.97]	[-1.87]	[-1.92]	[-0.52]	[-0.51]	[-0.49]
RTW_t	0.137			1.972		
	[0.78]			[1.36]		
$LNASSET_{t-1}$			-0.000			-0.282***
			[-0.02]			[-4.72]
$CAPX_{t-1}$			0.093			1.255
			[1.46]			[0.86]
LEV_{t-1}			-0.133***			-0.954**
			[-7.27]			[-2.22]
ROA_{t-1}			-0.063**			-1.396***
			[-2.35]			[-3.41]
$CASH_{t-1}$			0.017			0.142
			[0.52]			[0.24]
State-Year FE	N	Y	Y	N	Y	Y
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	22,245	22,081	22,081	22,245	22,081	22,081
Adjusted R-squared	0.579	0.570	0.571	0.536	0.529	0.531

Table 8 (continued)

Panel C: Heterogeneous impact of financial constraints (Hadlock and Pierce, 2010)						
RTW_t * FC_t	**0.104****	**0.114****	**0.128*****	**2.787****	**3.490*****	**3.528*****
	[2.32]	[2.66]	[3.00]	[2.25]	[3.07]	[2.90]
FC_t	0.059**	0.048**	0.035	3.840***	3.509***	3.057***
	[2.14]	[2.10]	[1.50]	[6.59]	[6.03]	[5.86]
RTW_t	0.126**			1.498***		
	[2.59]			[10.02]		
$LNASSET_{t-1}$			-0.000			-0.109
			[-0.00]			[-1.66]
$CAPX_{t-1}$			0.237***			2.255
			[4.45]			[1.68]
LEV_{t-1}			-0.134***			-0.985*
			[-6.32]			[-2.02]
ROA_{t-1}			-0.096**			-1.901***
			[-2.67]			[-3.72]
$CASH_{t-1}$			0.076***			0.841*
			[2.80]			[1.75]
State-Year FE	N	Y	Y	N	Y	Y
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	26,019	25,846	25,846	26,019	25,846	25,846
Adjusted R-squared	0.583	0.577	0.579	0.528	0.522	0.524

Table 9
The Effect of RTW Laws on Firm R&D Expenditure

This table reports the results of the difference-in-differences regressions of firm R&D expenditure (*R&D*) on *RTW* indicator. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $R\&D_{t,t+2}$	(2) $R\&D_{t,t+2}$	(3) $R\&D_{t,t+2}$	(4) $R\&D_{t,t+2}$	(5) $R\&D_{t,t+2}$	(6) $R\&D_{t,t+2}$
	Replacing missing R&D with 0			Excluding missing R&D		
$\boldsymbol{RTW_t}$	**0.247*** **	**0.257*** **	**0.258*** **	**0.395*** **	**0.374*** **	**0.374** **
	[3.90]	[3.13]	[2.75]	[3.14]	[2.83]	[2.52]
$LNASSET_{t-1}$		-0.023	-0.023		-0.029	-0.029
		[-1.32]	[-1.30]		[-1.31]	[-1.28]
$CAPX_{t-1}$		0.101	0.102		0.055	0.057
		[0.34]	[0.35]		[0.13]	[0.14]
LEV_{t-1}		-0.470***	-0.471***		-0.542***	-0.542***
		[-3.78]	[-3.80]		[-3.88]	[-3.90]
ROA_{t-1}		-0.389**	-0.389**		-0.416**	-0.416**
		[-2.32]	[-2.32]		[-2.30]	[-2.31]
$CASH_{t-1}$		0.497***	0.497***		0.541***	0.541***
		[7.72]	[7.75]		[7.43]	[7.48]
SI_{t-1}			-0.006			-0.017
			[-0.20]			[-0.30]
SI_GR_{t-1}			-0.090			-0.240
			[-0.24]			[-0.41]
SI_CAPITA_{t-1}			0.019			0.003
			[0.08]			[0.01]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	41,626	41,626	41,626	32,245	32,245	32,245
Adjusted R-squared	0.693	0.695	0.695	0.689	0.691	0.691

Appendixes

Table A1
Variable Definitions

Variable	Definition	Data Source
Panel A: Dependent variables		
$PATENT_{t+3}$	Number of patents over sales in year *t+3*, where firm-level patents are calculated following Kogan et al. (2017)	https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data
$CITATION_{t+3}$	Number of citations over sales in year *t+3*, where firm-level citations are calculated following Kogan et al. (2017)	
$R\&D_{t,t+2}$	Average R&D expenditure over sales (*xrd/sale*) from year *t* to *t+2*	Compustat
$DPROB_{t,t+2}$	Average default probability over 3-year period from year *t* to *t+2*, where annual default probability is calculated following Merton (1974) and Bharath and Shumway (2008)	Compustat & CRSP
$SG_{t,t+2}$	Average sales growth over 3-year period from year *t* to *t+2*, where annual sales growth rate ($SG_t = (sale_t - sale_{t-1})/sale_{t-1}$) is calculated following Billett, Garfinkel, and Yu (2017)	Compustat
$MSG\_SIC_{t,t+2}$	Average market share growth over 3-year period from year *t* to *t+2*, where annual market share growth rate is calculate as *SG* minus the industry median *SG* for the same year (with each industry being defined as a four-digit SIC code), following Billett, Garfinkel, and Yu (2017)	Compustat
$MSG\_FF_{t,t+2}$	Average market share growth over 3-year period from year *t* to *t+2*, where annual market share growth rate is calculate as *SG* minus the industry median *SG* for the same year (with each industry being defined as one of the Fama-French 49 industries), following Billett, Garfinkel, and Yu (2017)	Compustat
Panel B: Right-to-work indicator variables		
RTW_t	An indicator variable indicating whether a firm's headquarter state has adopted the right-to-work laws by year *t*, following Chava, Danis and Hsu (2020)	Compustat
Panel C: Firm-level control variables		
$LNASSET_{t-1}$	Natural logarithm of total assets (log(*at*)) in year *t-1*	Compustat
$CAPX_{t-1}$	Capital expenditure over total assets (*capex/at*) in year *t-1*	Compustat
LEV_{t-1}	Long- and short-term debt over total assets (*(dltt+dlc)/at*) in year *t-1*	Compustat
ROA_{t-1}	Operating income before depreciation over total assets (*oibdp/at*) in year *t-1*	Compustat
$CASH_{t-1}$	Cash and cash equivalents over total assets (*che/at*) in year *t-1*	Compustat
Panel D: State-level control variables		
SI_{t-1}	Natural logarithm of total income of the firm's headquarter state in year *t-1*	Bureau of Economic Analysis
SI_GR_{t-1}	Growth rate in the total income of the firm's headquarter state in year *t-1*	Bureau of Economic Analysis
SI_CAPITA_{t-1}	Natural logarithm of per capita income of the firm's headquarter state in year *t-1*	Bureau of Economic Analysis
Panel E: Cross-sectional Variables		
$TSIM_t$	Text-based network industry classification total similarity index, calculated following Hoberg and Phillips (2016), in year *t*	http://hobergphillips.tuck.dartmouth.edu/industryclass.htm
$RIVAL_t$	Number of firms in the same two-digit SIC industry code in year *t*	Compustat

LSI $_t$	Industry-specific labor skill index which equals the percentage of employees whose occupations require a high degree of training and preparation (i.e., Specific Vocational Preparation (SVP) levels are equal or greater than seven), following Belo et al. (2017), in year *t*	https://sites.google.com/a/umn.edu/frederico-belo/
LSI_GHALY $_t$	Industry-specific labor skill index which equals a weighted average of the skill levels of occupations ((i.e., O*NET classification ranging from one (least) to five (most skilled)) within an industry where weightings are the percentages of employees in those occupations, following Ghaly, Dang, and Stathopoulos (2017), in year *t*	https://www.bls.gov/oes/ https://www.onetonline.org/help/online/zones
FC $_t$	An indicator variable indicating top quartile of Hadlock and Pierce's (2010) financial constraints SA index in year *t*	Compustat
FC_WW $_t$	An indicator variable indicating top quartile of Whited and Wu's (2006) financial constraints WW index in year *t*	Compustat

Table A2
Scaling Firm Innovation Outputs by Total Assets

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator, where patent and citation counts are scaled by total assets. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $PATENT_{t+3}$	(2) $PATENT_{t+3}$	(3) $PATENT_{t+3}$	(4) $CITATION_{t+3}$	(5) $CITATION_{t+3}$	(6) $CITATION_{t+3}$
RTW_t	**0.018****	**0.018****	**0.016****	**0.255*****	**0.247*****	**0.216*****
	[2.55]	[2.44]	[2.16]	[2.87]	[3.36]	[2.93]
$LNASSET_{t-1}$		-0.004*	-0.004*		-0.169***	-0.169***
		[-1.87]	[-1.94]		[-4.28]	[-4.34]
$CAPX_{t-1}$		-0.004	-0.003		-0.024	-0.015
		[-0.37]	[-0.31]		[-0.09]	[-0.06]
LEV_{t-1}		-0.007**	-0.007**		0.146**	0.145**
		[-2.52]	[-2.44]		[2.58]	[2.54]
ROA_{t-1}		-0.016***	-0.016***		-0.265***	-0.266***
		[-7.57]	[-7.75]		[-4.11]	[-4.15]
$CASH_{t-1}$		0.009***	0.009***		0.457***	0.457***
		[2.75]	[2.71]		[4.47]	[4.44]
SI_{t-1}			0.012**			0.019
			[2.32]			[0.20]
SI_GR_{t-1}			-0.049**			-0.632
			[-2.12]			[-1.28]
SI_CAPITA_{t-1}			-0.049**			-0.665
			[-2.52]			[-1.22]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	41,619	41,619	41,619	41,619	41,619	41,619
Adjusted R-squared	0.601	0.603	0.603	0.536	0.540	0.540

Table A3
Alternative Fixed Effects

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $PATENT_{t+3}$	(2) $PATENT_{t+3}$	(3) $PATENT_{t+3}$	(4) $CITATION_{t+3}$	(5) $CITATION_{t+3}$	(6) $CITATION_{t+3}$
RTW_t	**0.149*** **	**0.147** **	**0.143** **	**2.169*** **	**2.068*** **	**1.998*** **
	[2.80]	[2.63]	[2.46]	[7.56]	[6.93]	[6.78]
$LNASSET_{t-1}$		-0.009**	-0.009**		-0.379***	-0.377***
		[-2.31]	[-2.35]		[-4.92]	[-4.87]
$CAPX_{t-1}$		0.098***	0.099***		0.998	1.019
		[2.92]	[2.92]		[1.42]	[1.47]
LEV_{t-1}		-0.094***	-0.094***		-0.630*	-0.631*
		[-7.79]	[-7.71]		[-1.72]	[-1.72]
ROA_{t-1}		-0.071***	-0.070***		-1.511***	-1.510***
		[-2.80]	[-2.80]		[-3.63]	[-3.64]
$CASH_{t-1}$		0.049***	0.049**		0.882**	0.881**
		[2.71]	[2.68]		[2.11]	[2.09]
SI_{t-1}			0.026***			0.050
			[2.79]			[0.28]
SI_GR_{t-1}			0.042			-0.490
			[0.59]			[-0.36]
SI_CAPITA_{t-1}			-0.109**			-1.301*
			[-2.23]			[-1.76]
Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	41,629	41,629	41,629	41,629	41,629	41,629
Adjusted R-squared	0.603	0.604	0.604	0.555	0.557	0.557

Table A4
The Effect of RTW Laws on Firm Default Probability:
Broader Sample of Compustat Firms

This table reports the results of the difference-in-differences regressions of firm default probability (*DPROB*) on *RTW* indicator, using a broader sample of Compustat firms. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) *DPROB* $_{t}$	(2) *DPROB* $_{t}$	(3) *DPROB* $_{t,t+1}$	(4) *DPROB* $_{t,t+1}$	(5) *DPROB* $_{t,t+2}$	(6) *DPROB* $_{t,t+2}$
RTW $_{t}$	**-0.025*****	**-0.018*****	**-0.022*****	**-0.017*****	**-0.020*****	**-0.015****
	[-4.48]	[-3.29]	[-4.43]	[-3.62]	[-4.23]	[-2.48]
LNASSET $_{t-1}$		0.030***		0.029***		0.026***
		[28.10]		[30.40]		[30.24]
CAPX $_{t-1}$		-0.027**		-0.020*		-0.009
		[-2.25]		[-1.90]		[-0.80]
LEV $_{t-1}$		0.120***		0.080***		0.065***
		[22.24]		[23.45]		[18.69]
ROA $_{t-1}$		-0.043***		-0.022***		-0.018***
		[-6.52]		[-9.89]		[-13.05]
CASH $_{t-1}$		-0.060***		-0.052***		-0.043***
		[-17.90]		[-13.54]		[-10.96]
SI $_{t-1}$		0.004		-0.006		-0.007
		[0.49]		[-1.29]		[-1.45]
SI_GR $_{t-1}$		-0.161***		-0.146***		-0.103***
		[-4.78]		[-6.17]		[-4.90]
SI_CAPITA $_{t-1}$		0.012		0.048**		0.050**
		[0.43]		[2.12]		[2.38]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	117,258	113,948	133,136	124,778	142,446	130,677
Adjusted R-squared	0.290	0.315	0.409	0.443	0.489	0.520

Table A5
Alternative Interaction Variables

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator, conditional on the ex-ante default risk as proxied by product market competition (Panel A), reliance on skilled labor (Panel B), and financial constraints (Panel C) using alternative measures. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) all lagged by one period. Some regressions also control for state-times-year, industry-times-year, and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $PATENT_{t+3}$	(2) $PATENT_{t+3}$	(3) $PATENT_{t+3}$	(4) $CITATION_{t+3}$	(5) $CITATION_{t+3}$	(6) $CITATION_{t+3}$
Panel A: Heterogeneous impact of rival firms						
RTW_t * $RIVAL_t$	**0.015****	**0.032*****	**0.032*****	**0.256*****	**0.324*****	**0.324*****
	[2.68]	[4.91]	[4.49]	[3.60]	[5.95]	[5.15]
RTW_t	0.091*			0.710*		
	[2.00]			[1.91]		
$LNASSET_{t-1}$			-0.001			-0.273***
			[-0.25]			[-4.81]
$CAPX_{t-1}$			0.129***			1.117
			[3.05]			[1.35]
LEV_{t-1}			-0.100***			-0.662
			[-5.47]			[-1.60]
ROA_{t-1}			-0.077**			-1.600***
			[-2.70]			[-3.95]
$CASH_{t-1}$			0.060***			0.759*
			[3.32]			[1.88]
State-Year FE	N	Y	Y	N	Y	Y
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	41,626	41,202	41,202	41,626	41,202	41,202
Adjusted R-squared	0.590	0.583	0.584	0.543	0.536	0.537

Table A5 (continued)

Panel B: Heterogeneous impact of skilled labor (Ghaly et al., 2017)						
RTW $_t$ * LSI_GHALY $_t$	**0.083****	**0.114*****	**0.117*****	**1.926*****	**1.946*****	**1.984*****
	[2.56]	[6.35]	[6.05]	[7.89]	[6.15]	[5.83]
LSI $_t$	-0.054**	-0.069***	-0.068***	-0.431*	-0.507**	-0.486**
	[-2.36]	[-3.25]	[-3.39]	[-1.91]	[-2.27]	[-2.36]
RTW $_t$	0.049			-0.913		
	[0.28]			[-0.55]		
LNASSET $_{t-1}$			0.012			0.113
			[1.51]			[1.56]
CAPX $_{t-1}$			0.255***			2.790***
			[4.63]			[5.99]
LEV $_{t-1}$			-0.132***			-1.305***
			[-8.32]			[-6.58]
ROA $_{t-1}$			-0.051			-1.623***
			[-1.63]			[-4.99]
CASH $_{t-1}$			0.022			-0.676*
			[0.49]			[-1.83]
State-Year FE	N	Y	Y	N	Y	Y
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	13,505	13,392	13,392	13,505	13,392	13,392
Adjusted R-squared	0.605	0.594	0.595	0.542	0.532	0.534

Table A5 (continued)

Panel C: Heterogeneous impact of financial constraints (Whited and Wu, 2006)						
RTW_t * FC_WW_t	**0.122*****	**0.130*****	**0.133*****	**1.085**	**1.229**	**1.249**
	[4.30]	[4.82]	[5.00]	[1.28]	[1.31]	[1.37]
FC_WW_t	0.035*	0.034*	0.033*	1.147***	1.131***	1.000***
	[1.95]	[1.75]	[1.73]	[4.47]	[4.34]	[3.81]
RTW_t	0.115**			1.513***		
	[2.47]			[6.60]		
$LNASSET_{t-1}$			0.002			-0.194***
			[0.57]			[-3.44]
$CAPX_{t-1}$			0.216***			1.712
			[2.82]			[1.12]
LEV_{t-1}			-0.079***			-0.744**
			[-5.11]			[-2.31]
ROA_{t-1}			-0.064**			-1.466***
			[-2.42]			[-3.35]
$CASH_{t-1}$			0.066***			0.760*
			[2.94]			[1.70]
State-Year FE	N	Y	Y	N	Y	Y
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	26,377	26,197	26,197	26,377	26,197	26,197
Adjusted R-squared	0.574	0.568	0.568	0.527	0.521	0.523

Table A6
The Effect of RTW Laws on Firm R&D Expenditure:
Broader Sample of Compustat Firms

This table reports the results of the difference-in-differences regressions of firm R&D expenditure (*R&D*) on *RTW* indicator, using a broader sample of Compustat firms. Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) *R&D* $_{t,t+2}$	(2) *R&D* $_{t,t+2}$	(3) *R&D* $_{t,t+2}$	(4) *R&D* $_{t,t+2}$	(5) *R&D* $_{t,t+2}$	(6) *R&D* $_{t,t+2}$
	Replacing missing R&D with 0			Excluding missing R&D		
RTW $_t$	**0.044***	**0.035***	**0.043***	**0.069**	**0.051**	**0.079***
	[3.15]	[2.88]	[3.14]	[2.48]	[2.06]	[2.93]
LNASSET $_{t-1}$		-0.012**	-0.013**		-0.050***	-0.051***
		[-2.32]	[-2.49]		[-5.71]	[-5.71]
CAPX $_{t-1}$		0.085*	0.081*		0.157	0.149
		[1.86]	[1.79]		[1.58]	[1.67]
LEV $_{t-1}$		-0.090***	-0.098***		-0.162***	-0.177***
		[-2.97]	[-3.61]		[-3.11]	[-3.69]
ROA $_{t-1}$		-0.123***	-0.134***		-0.203***	-0.218***
		[-4.20]	[-5.10]		[-5.20]	[-7.03]
CASH $_{t-1}$		0.412***	0.407***		0.673***	0.675***
		[3.37]	[3.32]		[4.11]	[3.99]
SI $_{t-1}$			0.051***			0.130***
			[3.57]			[3.49]
SI_GR $_{t-1}$			0.062			-0.196
			[0.40]			[-0.65]
SI_CAPITA $_{t-1}$			-0.022			0.080
			[-0.22]			[0.33]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	224,485	199,098	197,733	119,193	108,766	108,174
Adjusted R-squared	0.647	0.654	0.654	0.652	0.658	0.659

Table A7
The Effect of RTW Laws on Firm Product Market Outcomes:
Innovation Sample and Broader Sample of Compustat Firms

This table reports the results of the difference-in-differences regressions of firm product market outcomes (*SG*, *MSG_SIC*, or *MSG_FF*) on *RTW* indicator, using the baseline innovation sample (Panel A) and a broader sample of Compustat firms (Panel B). Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) $SG_{t,t+2}$	(2) $SG_{t,t+2}$	(3) $MSG\_SIC_{t,t+2}$	(4) $MSG\_SIC_{t,t+2}$	(5) $MSG\_FF_{t,t+2}$	(6) $MSG\_FF_{t,t+2}$
Panel A: Innovation sample only						
RTW_t	**0.045****	**0.038****	**0.048*****	**0.043****	**0.041****	**0.034****
	[2.59]	[2.44]	[3.51]	[2.37]	[2.53]	[2.03]
$LNASSET_{t-1}$		-0.147***		-0.139***		-0.145***
		[-12.72]		[-11.91]		[-12.58]
$CAPX_{t-1}$		0.500***		0.490***		0.499***
		[8.07]		[7.30]		[7.91]
LEV_{t-1}		-0.041***		-0.042***		-0.041***
		[-3.55]		[-3.67]		[-3.50]
ROA_{t-1}		-0.366***		-0.365***		-0.367***
		[-15.11]		[-15.41]		[-15.22]
$CASH_{t-1}$		0.509***		0.503***		0.509***
		[17.50]		[17.68]		[17.47]
SI_{t-1}		-0.023		-0.021		-0.021
		[-1.15]		[-1.00]		[-1.06]
SI_GR_{t-1}		0.148**		0.172***		0.148**
		[2.26]		[2.73]		[2.25]
SI_CAPITA_{t-1}		0.038		0.068*		0.042
		[0.83]		[1.72]		[0.99]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	41,537	41,537	41,537	41,537	41,537	41,537
Adjusted R-squared	0.384	0.477	0.368	0.461	0.369	0.464

Table A7 (continued)

Panel B: Broader sample of Compustat firms						
RTW $_{t}$	**0.063***	**0.045*****	**0.057***	**0.044*****	**0.057**	**0.043*****
	[1.71]	[2.88]	[1.68]	[3.03]	[1.58]	[2.77]
LNASSET $_{t-1}$		-0.128***		-0.120***		-0.125***
		[-20.78]		[-19.27]		[-20.52]
CAPX $_{t-1}$		0.525***		0.487***		0.513***
		[13.47]		[12.72]		[12.87]
LEV $_{t-1}$		-0.065***		-0.063***		-0.064***
		[-9.48]		[-9.26]		[-9.59]
ROA $_{t-1}$		-0.099***		-0.101***		-0.101***
		[-7.24]		[-7.42]		[-7.41]
CASH $_{t-1}$		0.501***		0.489***		0.499***
		[21.25]		[20.35]		[20.64]
SI $_{t-1}$		-0.017		-0.011		-0.014
		[-1.21]		[-0.74]		[-0.91]
SI_GR $_{t-1}$		0.189***		0.109**		0.135***
		[4.05]		[2.09]		[2.71]
SI_CAPITA $_{t-1}$		-0.131***		-0.051		-0.065
		[-2.95]		[-1.13]		[-1.40]
Ind-Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y	Y	Y
Observations	239,403	212,280	239,403	212,280	239,403	212,280
Adjusted R-squared	0.408	0.415	0.399	0.403	0.403	0.409

Table A8

The Effect of RTW Laws on Firm Innovation Outputs: Split by Subperiods

This table reports the results of the difference-in-differences regressions of firm innovation outputs (*PATENT* or *CITATION*) on *RTW* indicator in different subperiods (1950-1983 versus 1984-2017 in Panel A; 1950-1995 versus 1996-2017 in Panel B). Some regressions control for firm-level characteristics (*LNASSET*, *CAPX*, *LEV*, *ROA*, and *CASH*) and state-level characteristics (*SI*, *SI_GR*, and *SI_CAPITA*), all lagged by one period. All regressions also control for industry-times-year and firm fixed effects, but their estimates are suppressed for brevity. The *t*-statistics based on robust standard errors clustered at the state level are provided in square brackets. A detailed description of the variable construction is provided in the Appendix A1. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) *PATENT* $_{t+3}$	(2) *PATENT* $_{t+3}$	(3) *CITATION* $_{t+3}$	(4) *CITATION* $_{t+3}$
Panel A: Periods 1950-1983 versus 1984-2017				
	Period 1950-1983	Period 1984-2017	Period 1950-1983	Period 1984-2017
RTW $_{t}$	**0.122*****	**0.186****	**0.734*****	**2.348*****
	[5.74]	[2.05]	[3.63]	[4.15]
LNASSET $_{t-1}$	0.015***	-0.002	-0.211**	-0.321**
	[3.18]	[-0.29]	[-2.56]	[-2.45]
CAPX $_{t-1}$	-0.056	0.202***	-0.476	1.601
	[-1.16]	[3.80]	[-0.72]	[1.36]
LEV $_{t-1}$	-0.127***	-0.116***	-0.969*	-0.766
	[-3.45]	[-6.22]	[-1.92]	[-1.65]
ROA $_{t-1}$	-0.087	-0.074**	-0.492	-1.509***
	[-1.33]	[-2.57]	[-0.42]	[-2.98]
CASH $_{t-1}$	0.085**	0.069***	0.966	0.786
	[2.41]	[2.91]	[1.48]	[1.51]
SI $_{t-1}$	0.010	-0.016	0.057	-1.601***
	[0.84]	[-0.68]	[0.62]	[-3.12]
SI_GR $_{t-1}$	0.012	0.041	0.114	-2.033
	[0.17]	[0.28]	[0.16]	[-0.60]
SI_CAPITA $_{t-1}$	-0.009	-0.124	-0.087	-0.157
	[-0.17]	[-0.93]	[-0.18]	[-0.13]
Ind-Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y
Observations	13,722	27,607	13,722	27,607
Adjusted R-squared	0.701	0.584	0.666	0.533

Table A8 (continued)

Panel B: Periods 1950-1995 versus 1996-2017				
	Period 1950-1995	Period 1996-2017	Period 1950-1995	Period 1996-2017
RTW $_t$	**0.058*****	**0.201***	**0.381****	**2.535*****
	[3.74]	[1.98]	[2.18]	[3.48]
LNASSET $_{t-1}$	0.004	-0.002	-0.328***	-0.090
	[0.73]	[-0.30]	[-3.69]	[-1.13]
CAPX $_{t-1}$	0.136***	0.082*	0.721	1.528
	[3.44]	[1.85]	[0.78]	[1.66]
LEV $_{t-1}$	-0.053***	-0.143***	-0.982**	-1.054***
	[-2.75]	[-11.50]	[-2.37]	[-4.25]
ROA $_{t-1}$	-0.153***	-0.054*	-3.195***	-1.280***
	[-2.73]	[-1.80]	[-3.04]	[-2.77]
CASH $_{t-1}$	0.089	0.003	0.919	-0.519
	[1.51]	[0.08]	[1.21]	[-1.35]
SI $_{t-1}$	0.022*	-0.085	0.150	-1.496***
	[1.99]	[-1.61]	[0.61]	[-3.33]
SI_GR $_{t-1}$	-0.082	0.052	1.535	-5.140
	[-0.86]	[0.18]	[1.09]	[-1.50]
SI_CAPITA $_{t-1}$	-0.071*	0.117	-0.437	0.274
	[-1.99]	[0.50]	[-0.35]	[0.24]
Ind-Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
State Cluster	Y	Y	Y	Y
Observations	24,080	17,129	24,080	17,129
Adjusted R-squared	0.694	0.578	0.684	0.530