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DISCUSSION PAPER

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Did the Defend Trade Secrets Act Spur the Reliance on Trade Secrets?

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Abstract

This paper explores whether the U.S. Defend Trade Secrets Act (DTSA) increased the declaration of trade secrets. Leveraging cross-sectoral variation in the importance of trade secrets prior to the DTSA, empirical results show that the DTSA was followed by an increase in the intensive margin of trade secrets declaration in service industries, not in manufacturing industries though. The extensive margin of trade secret declaration increased in both services and manufacturing, where the surge was strongest in manufacturing. The extensive margin increased most strongly for manufacturing with a high sectoral R&D intensity. The results are of interest to policy makers as trade secrets can hinder knowledge flows with potential implications for innovation.

Key words: Defend Trade Secrets Act; trade secrets; extensive and intensive margin

JEL codes: O34, O31, O32, L60, L80

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INTRODUCTION

The protection of trade secrets is a critical consideration for firms seeking to safeguard their competitive advantage (Cohen et al., 2000; Png, 2017a,b). With the Uniform Trade Secrets Act (UTSA) of the 1980s, policy makers made a pivotal step in fostering trade secret laws across U.S. states providing firms with a legal framework to address misappropriation (Lemley, 2008; Sandeen, 2010). The staggered adoption of the UTSA by individual states, each with its own timeline and interpretation of the trade secret laws, resulted in considerable variation across states in the strength of trade secret protection and enforcement (Png, 2017a,b; Castellaneta et al., 2017) so that decades later, the U.S. Defend Trade Secrets Act (DTSA) was introduced to create a federal cause of action for trade secret protection (Dole, 2017; Wang, 2023). The DTSA did not replace the UTSA so that, since 2016, plaintiffs have the option to sue in either state or federal court. The DTSA's addition to trade secret protection was a federal framework which streamlined the legal treatment of trade secret misappropriation across different states (Pooley, 2022).[1,2]

This study investigates whether the DTSA increased corporate reliance on trade secrets, analyzing both the intensive and extensive margins of their use across manufacturing and service industries. By leveraging variation in the pre-DTSA importance of trade secrets, this research highlights the law's distinct effects on service and manufacturing industries, offering critical insights into its implications for knowledge diffusion and innovation management.

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[1] Additionally, the DTSA introduced an ex parte seizure provision and a specific immunity provision for whistleblowers (Pooley, 2022).

[2] While the assumption that the UTSA improved trade secret protection is agreed on in the economics and management literature (e.g. Png, 2017 a,b; Liu, 2025; Hussinger and Issah, 2022, 2025), some legal scholars (e.g. Sandeen, 2010; Graves and Tippett, 2012) argue that the scope of trade secret protection was narrowed through the UTSA as compared to the common law.

The question whether the DTSA increased corporate reliance on trade secrets holds significance for at least two main reasons. First, since the UTSA already provides state-level protection for trade secrets, it is valuable to examine whether and to which extent the DTSA, as a subsequent federal measure, further impacts firms' intellectual property strategies. Second, an increase in trade secret declarations may have unintended implications. Trade secrets are attractive to firms as they avoid the administrative costs associated with patents (De Rassenfosse & Jaffe, 2018), require no disclosure, and have no fixed expiration date (Hall et al., 2014). Additionally, trade secrets cover a broader scope of intellectual property beyond technological inventions, unlike patents (Linton, 2016). Evidence suggests that increased R&D investment in many sectors has followed the UTSA implementation (Png, 2017a). However, strengthened trade secret protection can hinder knowledge flows, potentially reducing patenting (Png, 2017b), especially of high-quality inventions (Contigiani et al., 2019), and limiting technology spillovers (Wang, 2023), mainly by curtailing employee mobility (Png & Samila, 2015; Castellaneta et al., 2017). This restriction in knowledge sharing may lead to adverse long-term effects (Searle, 2021). Yet, stronger trade secret protection can also offer advantages for collaborative firms, as they may provide additional security for in-progress innovations (Png, 2017a). More sophisticated collaboration models (Langlois et al., 2023) or firm acquisitions (Arroyabe et al., 2025) may be needed to either balance secrecy with knowledge sharing or access knowledge of other firms.

Using a sample of publicly listed U.S. firms in the years around the introduction of the DTSA, this paper investigates whether and to which extent the DTSA as the most recent law change towards increasing the strength of trade secret protection leads to an increased declaration of trade secrets by firms. Results from difference-in-differences (DiD) analyses relying on within-firm changes show that the DTSA was followed by a disproportionately larger increase in the declarations of trade secrets in industries in which trade secrets were more important before the DTSA. Further analysis shows an increase in the intensive margin of trade secrets declarations in services, not in manufacturing industries though. The extensive margin of trade secret declaration increased in both services and manufacturing, where it increased most in manufacturing industries. Notably, these results hold regardless of the level of trade secret protection previously established at the state level under the UTSA. This underlines the distinctness of the DTSA as compared to the UTSA.

A further noteworthy finding is that the extensive margin of trade secret declarations rises most sharply in manufacturing with high R&D intensity. Given that this increased reliance on trade secrets in R&D intensive manufacturing could impede knowledge flows (Wang, 2023) and reduce worker mobility (Png and Samila, 2015), these findings are relevant to policymakers, who might consider introducing incentive programs for knowledge sharing. The findings are also important for firms who might need to rethink their collaboration models in a regime that is increasingly shaped by trade secret protection of intellectual property rights (Langlois et al., 2023) and potentially need to consider firm acquisitions for accessing knowledge increasingly protected by trade secrets (Arroyabe et al., 2005).

METHODOLOGY

To examine whether the DTSA influenced the declaration of trade secrets, DiD analysis following Chondrakis et al. (2020) is employed. The challenge for a causal analysis is that the DTSA occurred in all U.S. states at the same time excluding the applicability of a standard DiD model with a group of treated firms and a control group of not-treated or not-yet-treated firms. Chondrakis et al. (2020) circumvent this problem by using pre-shock variation across sectors in order to identify causal effects. In this study, the pre-treatment importance of trade secrets across sectors is employed.

The following model is estimated with a trade secret dummy (trade $secret_{ist}$) as the dependent variable, indicating the probability that firm i in industry s declares at least one trade secret in year t:

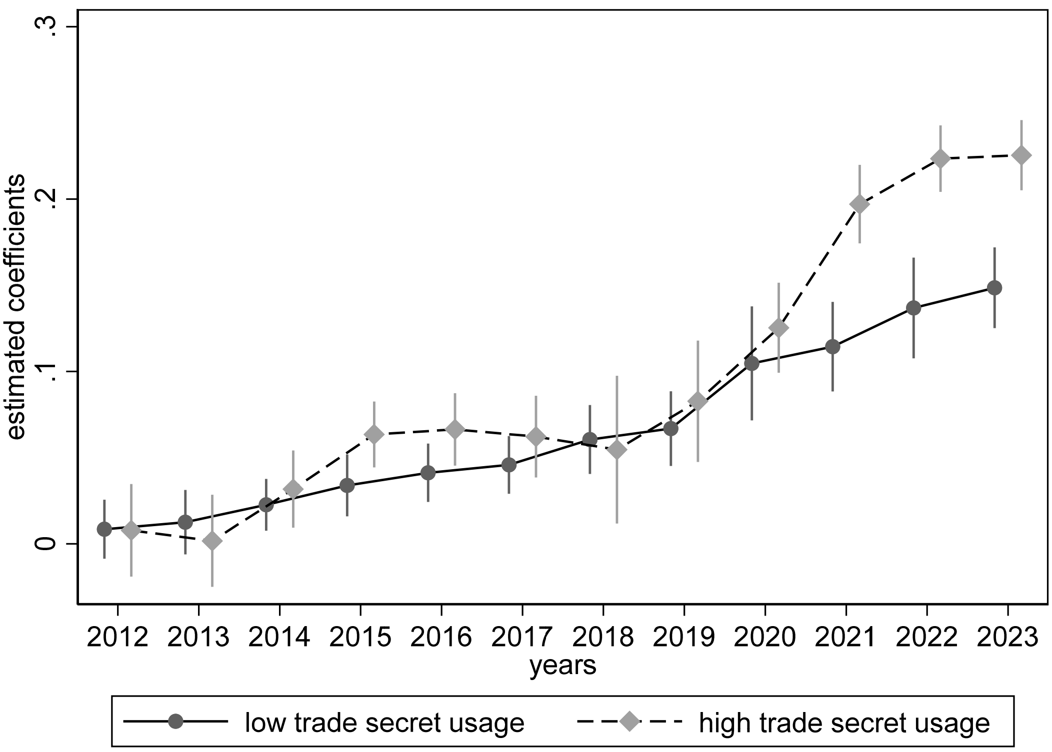
$$Trade\ secret_{ist} = \alpha + f_i + y_t + \beta X_{it} + \delta\ I_s \times DTSA_t + \varepsilon_{it} \quad (1)$$

α is the intercept, f_i are firm fixed-effects that capture time-invariant, firm-specific differences and y_t depicts year fixed-effects accounting for temporal patterns. X_{it} is a vector of time-varying firm controls. The effect of interest is identified from within-firm changes in the declaration of trade secrets.

The main coefficient of interest, δ, depicts changes in the declaration of trade secrets after the DTSA for firms in industries with differential importance of trade secrets I_s as measured by the average declaration rate of trade secrets in the years prior to the DTSA, i.e. the years 2011-2014. The year 2015 is used as the separating year because in this year, the DTSA was introduced in the Senate. While only implemented in 2016, the choice of the year before for operating the model aims at addressing concerns about potential anticipation biases (e.g. Barnett and Sichelmann, 2020). Under the assumption that changes in the declaration of trade secrets would be comparable for firms in sectors with higher (versus lower) importance of trade secrets had the DTSA not occurred, the DiD model allows identifying causal effects of the DTSA on the extensive and intensive margin of trade secret declaration.

Since this is the key identification assumption, Figure 1 shows estimated coefficients of linear regressions for the trade secret variable on time dummies for industries with high and low trade secret declaration, i.e. the share of firms that use trade secrets at the 3-digit industry level. Figure 1 shows that there is no significant difference in the trends for industries with high and low trade secret declarations prior to the DSTA. After the DTSA, there is a tendency for most years that trade secret declaration increases more strongly and significantly for industries with a high importance of trade secrets. Further, Figure 1 shows a general upwards trend in the declaration of trade secrets in both groups.

Figure 1: Trends in Trade Secret Declaration in Industries with High and Low Trade Secret Reliance



This graph presents estimated coefficients of the trade secret variable on time dummies for firms in industries with high and low trade secret declaration rates. The groups are separated at the man of the industry declaration of trade secrets. Standard errors are robust and clustered at the state level.

Two different setups are used to investigate the changes of the intensive and extensive margin of trade secret declarations. For the regressions for the intensive margin, only firms that declared trade secrets before 2015 are considered and the dependent variable is a dummy depicting whether trade secrets are declared in the focal year. For the investigation of the extensive margin, a second dependent variable is used which defines whether the focal firm has declared trade secrets for the first time (since 1993). After a firm declares trade secrets for the first time, it is dropped from the sample so that the samples for the analyses of the extensive margin are smaller.

Linear probability models are estimated to ease interpretation of interaction effects (see Chondrakis et al., 2020; Chen et al., 2021; Arroyabe et al., 2025). Robust, clustered standard errors at the state level are used.

DATA AND VARIABLES

Data

The empirical analysis is based on a firm-year panel dataset that is based on publicly listed U.S. firms retrieved from Compustat. Data on trade secrets as reported in publicly listed firms' K-10 filings was gathered from Glaeser (2018).[3] Data on the years of introduction of the UTSA is obtained from Png (2017b). Lastly, patent data is added from Kogan et al. (2017).[4]

The final sample covers the period from 2011 to 2023. Firms affiliated with the manufacturing sector (2-digit Standard Industry Classification (SIC) >19 and SIC < 40) and service industries (SIC > 39) are included. As a DiD analysis is performed, only firms which are observed before and after the DTSA at least once are kept in the sample which leads to 44,224 observations corresponding to 7,590 firms, 2943 of which are affiliated with manufacturing

[3] https://stephenglaeser.web.unc.edu/data/
[4] https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data

sectors and 4,547 firms are affiliated with services. The sample size in the regressions varies since different dependent variables and samples are used.

Variables

The dependent variable measuring changes is a dummy variable which indicates whether a firm has declared trade secrets in its 10-K filings (Hussinger and Issah, 2025). In order to measure changes of the intensive margin, firms that did not use trade secrets in the years 1993-2014 are dropped from the analysis und changes in the annual intensity of trade secret declarations are measured. In order to measure changes of the extensive margin, a variable that takes the value one for firms when they declare trade secrets for the first time is defined. After a firm declared trade secrets in its 10-K filings for the first time, it is dropped from the respective analysis.

The independent variable of interest is the average declaration rate of trade secrets in firms' 10-K filings in the 3-digit industry in the years prior to the DTSA, 2011-2014. This variable captures the importance of trade secret protection in an industry prior to the DTSA.

Control variables include firm size (logarithm of firms' total assets), R&D expenditures (ratio of R&D expenditures to firm assets), a dummy for missing values of R&D (which are then replaced by zero), the ratio of firms' patent grant stock over R&D using a 15% depreciation rate (Hall et al., 2005; 2007), the ratio of firms' citation stock over the patent stock using a 15% depreciation rate, the debt to asset ratio as well as year dummies.

Png's (2017b) information on the years of enactment of the UTSA is used for sample split regressions distinguishing states which have and have not enacted the UTSA. For further sample splits, the industry means of the R&D intensity in the 3-digit industry sector in the years 2011-2014 is used.

Descriptive statistics

Table 1 shows descriptive statistics. 42% of the sample firms declared trade secrets. 6% of the firms declared trade secrets for the first time during the sample period. The industry share of trade secret users is 21% for the years 2011-2014.

Table 1: Descriptive Statistics

Variable	Mean	Std.dev.
trade secret	0.42	0.49
first time declaration of trade secrets*	0.06	0.24
industry share of trade secret declarations	0.21	0.27
log(total assets)	6.10	2.92
R&D/total assets	0.06	0.14
R&D not reported	0.50	0.50
patent stock/ R&D	0.26	1.28
citation stock/patent stock	0.30	1.06
debt/total assets	0.18	0.22

* For the means of the firms that declare trade secrets for the first time, firms are dropped after the first reporting.

RESULTS

Main results

Table 2 shows the main results from the regression analysis that tests for within-firm changes in the declaration of trade secrets within the sector. Models (1) and (4) show results for the full sample of firms, once without and once with covariates. The coefficient of the DiD estimator is positive and significant suggesting that there is a disproportionately larger increase in the declaration of trade secrets in industries in which trade secrets were more important before the DTSA. Models (2) and (3), and (5) and (6), respectively, distinguish between manufacturing and services. The results show that this disproportionate increase is caused by firms in services with an increase of 21-23% for firms in industries with a prior mean trade secret declaration rate.

Table 2: Fixed-effects regressions: Effect of the DTSA on trade secret declaration

	(1) all	(2) manuf.	(3) services	(4) all	(5) manuf.	(6) services
industry share of trade secret declaration * DTSA	0.18^{***} (0.03)	-0.02 (0.04)	0.21^{***} (0.06)	0.20^{***} (0.03)	0.00 (0.03)	0.23^{***} (0.07)
log(total assets)				0.05^{***} (0.01)	0.08^{***} (0.01)	0.03^{***} (0.01)
R&D/total assets				0.11^{***} (0.03)	0.19^{***} (0.04)	-0.04 (0.06)
R&D not reported				-0.03 (0.02)	0.02 (0.04)	-0.05^{*} (0.03)
patent stock/ R&D				0.00 (0.00)	0.02^{**} (0.01)	0.00 (0.00)
citation stock/patent stock				0.03^{***} (0.00)	0.03^{***} (0.00)	0.02^{***} (0.01)
debt/total assets				-0.01 (0.02)	0.01 (0.03)	-0.02 (0.02)
Constant	0.36^{***} (0.01)	0.54^{***} (0.01)	0.25^{***} (0.01)	0.08 (0.08)	0.06 (0.08)	0.09 (0.06)
# observations	44,224	16,424	27,800	44,224	16,424	27,800
# firms	7,590	2,943	4,647	7,590	2,943	4,647
R-squared	0.06	0.00	0.06	0.04	0.04	0.05

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3 investigates the effects on the extensive and intensive margin. For Models (1)-(3), the dependent variable is a dummy that indicates whether a firm declared trade secrets for the first time. The results suggest that the increase is stronger in manufacturing with 30% for industries with a mean trade secret declaration rate (Model (2)), as compared to 20% in services (Model (3)).

Models (4)-(6) focus on the intensive margin and only include firms that declared trade secrets before 2015. The results resemble those of the full sample (Table 2) and show that the intensive margin increases only for firms in services by about 16% for industries with a mean trade secret declaration rate (Model (6)).

Table 3: Fixed-effects regressions: Effect of the DTSA on extensive and intensive margin

	(1)	(2)	(3)	(4)	(5)	(6)
	extensive margin			intensive margin		
	first time trade secret declarer			trade secret		
	all	manuf.	services	all	manuf.	services
industry share of trade secret declaration * DTSA	0.25***	0.30***	0.20***	0.15***	-0.03	0.16***
	(0.06)	(0.09)	(0.06)	(0.02)	(0.04)	(0.06)
log(total assets)	0.03***	0.07***	0.02***	0.04***	0.06***	0.02**
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
R&D/total assets	0.03	0.13***	-0.31**	0.06	0.09**	0.09
	(0.04)	(0.04)	(0.12)	(0.04)	(0.04)	(0.09)
R&D not reported	-0.03	-0.00	-0.04	-0.03	0.02	-0.05
	(0.02)	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)
patent stock/ R&D	0.01	0.01	0.03*	0.00	0.01	0.00
	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.00)
citation stock/patent stock	0.05***	0.06***	0.04***	0.02***	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
debt/total assets	-0.03	0.05	-0.05**	-0.00	0.00	-0.01
	(0.02)	(0.04)	(0.02)	(0.02)	(0.02)	(0.03)
Constant	-0.16***	-0.34***	-0.07*	0.26***	0.28***	0.26***
	(0.05)	(0.07)	(0.04)	(0.08)	(0.08)	(0.08)
# observations	25,885	6,119	19,766	29,246	12,533	16,713
# firms	5,014	1,471	3,543	4,483	1,984	2,499
R-squared	0.01	0.01	0.00	0.01	0.00	0.03

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

UTSA versus non-UTSA states

Table 4 replicates the main results for firms in states which have not enacted the UTSA and those that have. The results resemble the main findings suggesting that the DTSA is seen as a significantly different legal change compared to the UTSA.[5] Results for the extensive and intensive margin are available upon request.

[5] The results are qualitatively very similar if subsidiary locations retrieved from SEC filings (Exhibit 21) from Wharton Research Data Services (WRDS) are used and weighted regressions are conducted. The results are available upon request.

Table 4: Fixed-effects regressions: Effect of the DTSA on trade secret declaration in states without and with UTSA

	(1)	(2)	(3)	(4)	(5)	(6)
		No UTSA			UTSA	
	all	manuf.	services	all	manuf.	services
industry share of trade secret declaration * DTSA	0.18***	-0.02	0.19**	0.21***	0.01	0.25**
	(0.04)	(0.05)	(0.07)	(0.04)	(0.05)	(0.10)
log(total assets)	0.04**	0.09***	0.02**	0.05***	0.08***	0.04***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
R&D/total assets	0.14***	0.23***	0.02	0.09	0.16**	-0.07
	(0.04)	(0.05)	(0.10)	(0.06)	(0.06)	(0.08)
R&D not reported	-0.06	-0.06	-0.03	-0.01	0.07	-0.06
	(0.04)	(0.08)	(0.05)	(0.03)	(0.04)	(0.03)
patent stock/ R&D	0.00	0.05**	0.00*	0.01	0.01	0.03**
	(0.00)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)
citation stock/patent stock	0.03***	0.03***	0.02*	0.03***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
debt/total assets	-0.04	-0.06***	-0.02	0.02	0.05	-0.02
	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)	(0.03)
Constant	0.11	0.03	0.11	0.05	0.07	0.07
	(0.11)	(0.16)	(0.07)	(0.10)	(0.10)	(0.09)
# observations	16,925	6,206	10,719	27,299	10,218	17,081
# firms	2,912	1,121	1,791	4,678	1,822	2,856
R-squared	0.06	0.06	0.04	0.03	0.03	0.05

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

High R&D intensity industries

Table 5, show results for the extensive and intensive margin for high R&D intensity sectors, defined by the industry mean of 4% of R&D over total assets. The effect on the extensive margin (Models (1) – (3)), is largest for firms manufacturing with about 40% for firms in industries with a with a mean level of trade secret declaration. The results for the intensive margin are not significant (Models (4) – (6)). The results for low R&D industries, available upon request, show no significant or much smaller effects.

Table 5: Fixed effects regressions: Effect of the DTSA on the extensive and intensive margin in sectors with high R&D intensity

	(1)	(2)	(3)	(4)	(5)	(6)
	extensive margin			intensive margin		
	first time trade secret declarer			trade secret		
	all	manuf.	services	all	manuf.	services
industry share of trade secret declaration * DTSA	0.38***	0.40***	1.55	-0.16	-0.17	0.23
	(0.12)	(0.12)	(2.80)	(0.11)	(0.11)	(0.40)
log(total assets)	0.06***	0.07***	0.04**	0.06***	0.07***	0.04*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
R&D/total assets	0.12***	0.16***	-0.22	0.07	0.11**	0.01
	(0.04)	(0.04)	(0.16)	(0.04)	(0.04)	(0.08)
R&D not reported	-0.01	0.02	-0.08	-0.04	0.02	-0.09
	(0.05)	(0.04)	(0.08)	(0.04)	(0.04)	(0.06)
patent stock/ R&D	0.02	0.01	0.06	0.00	0.02**	0.00
	(0.02)	(0.02)	(0.04)	(0.00)	(0.01)	(0.00)
citation stock/patent stock	0.08***	0.07***	0.10***	0.03***	0.02***	0.03***
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
debt/total assets	0.10***	0.13***	0.07	-0.01	-0.01	-0.05
	(0.03)	(0.04)	(0.07)	(0.02)	(0.02)	(0.05)
Constant	-0.32***	-0.35***	-0.22**	0.40***	0.32***	0.49***
	(0.07)	(0.07)	(0.11)	(0.09)	(0.08)	(0.14)
# observations	5,060	3,533	1,527	11,686	8,491	3,195
# firms	1,400	956	444	1,940	1,386	554
R-squared	0.02	0.02	0.04	0.04	0.03	0.10

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Placebo Test

Table 6 shows a placebo test with patent applications as the dependent variable. If the observed effect of the DTSA is truly attributable to changes in the perceived protection of trade secrets, patent applications should not be affected. Table 6 shows no significant effect of the DTSA on patent applications.

Table 6: Fixed-effects poisson regressions: Effect of the DTSA on patent applications

	(1) all	(2) manufacturing	(3) services	(4) all	(5) manufacturing	(6) services
industry share of trade secret usage * DTSA	-0.11	-0.12	-0.01	-0.23	-0.16	-0.34
	(0.18)	(0.27)	(0.29)	(0.17)	(0.24)	(0.28)
log(total assets)				0.44***	0.38***	0.59***
				(0.05)	(0.06)	(0.12)
R&D/total assets				1.46***	1.16***	2.93***
				(0.26)	(0.27)	(0.74)
R&D not reported				0.10	0.34	0.08
				(0.40)	(0.30)	(0.59)
patent stock/R&D				0.13**	0.10**	0.24***
				(0.05)	(0.05)	(0.08)
citation stock/patent stock				0.03***	0.03**	0.03*
				(0.01)	(0.01)	(0.02)
debt/total assets				-0.22*	-0.32**	0.26
				(0.12)	(0.13)	(0.32)
# observations	11,557	7,881	3,676	11,557	7,881	3,676
# firms	1,724	1,189	535	1,724	1,189	535

Robust standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

DISCUSSION

This study shows that the DTSA led to increases in the declaration of trade secrets. The increase realizes in both, the extensive and intensive margins of trade secret declarations. These findings suggest that the DTSA, by providing a unified federal framework for trade secret protection across U.S. states, incentivized firms to utilize trade secrets more extensively, even though the UTSA had already fostered trade secret protection since the 1980s. Although both the UTSA and the DTSA legally defined trade secrets and provided remedies for misappropriation (Dole, 2017), the effect of the DTSA was notably similar for firms in states with and without UTSA trade secret protection. This suggests that the federal nature of the DTSA made a significant and distinct contribution to enhancing firms' reliance on trade secrets, building upon the foundation established by the UTSA.

Since the DTSA provided a uniform federal framework, including access to federal courts and remedies such as ex parte seizure, legal uncertainty and transaction costs associated with protecting confidential business information may have decreased. As a result, firms may have begun to view trade secrets as an even more reliable and important strategic intellectual property protection means, especially in industries where innovation cycles are fast, reverse engineering is a risk, or patent disclosure could undermine competitive advantage. The strengthened legal protection increased the relative value of trade secrets further, prompting a shift toward retaining knowledge in-house rather than publicly disclosing it through formal intellectual property channels.

A noteworthy finding is that firms in high R&D intensive manufacturing sectors are the most likely to declare trade secrets for the first time following the introduction of the DTSA. This finding is important, as previous research highlighted potential negative effects of trade secrets on technology spillovers (Wang, 2023). In response, more sophisticated collaboration models (Langlois et al., 2023) or firm acquisitions (Arroyabe et al., 2025) may be needed to either balance secrecy with knowledge sharing or access knowledge of other firms.

A limitation of this study is its focus on publicly listed firms. Prior research suggests that firm size significantly influences the reliance on trade secrets relative to other forms of intellectual property protection. Smaller firms and privately held firms often rely less on formal intellectual property protection means (Kitching & Blackburn, 1998) and more heavily on secrecy and informal appropriation strategies due to limited resources, higher relative costs of patenting, and the need for faster commercialization (Leiponen and Byma, 2009). By concentrating only on listed firms, which tend to be larger and have greater capacity to secure and enforce formal rights, the study does not illustrate the prevalence and strategic importance of trade secrets in smaller or privately held firms. As a result, the findings may not fully capture the heterogeneity in appropriation practices across the broader population of enterprises.

Another limitation of this study is that firms are associated to states based on the location of the firm's headquarters as assigned by Compustat. Robustness checks using different weights for subsidiary locations show qualitatively very similar results to the findings of Table 4. Ideally, these weights would take financial figures of the subsidiaries in addition to their location into account.

A further limitation is the binary split between manufacturing and services which downplays within-group heterogeneity, especially in services, where only a subset of sectors meaningfully relies on patents.

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