The Unintended Consequence of Anti Patent Troll Laws on State Tax Revenues

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2024

UNIVERSITY OF CALIFORNIA,
IRVINE

The Unintended Consequence of Anti Patent Troll Laws on State Tax Revenues

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Management

by

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2024

DEDICATION

To my mom, who instilled in me that I can do anything I set my mind to, and that no mountain is too high for me to climb. Thank you for being the most loving mother in the world, and for giving me the courage to chase my dreams. To my dad, the smartest man I know, for inspiring me to be an academic and for teaching me what it means to be a father. Dad, you are my hero and the role model I have looked up to my whole life. Thank you both for your sacrifice, support, and guidance in making this journey possible.

To my dearest, most beautiful wife Lily, for always believing in me no matter the circumstances and for encouraging me to be my best. Your support of me goes beyond what words can adequately express. Thank you for being my biggest cheerleader, and for your unwavering patience, understanding, and love.

To my sons Logan and Rowan, the light of my life. You have made me stronger and more fulfilled than I could have ever imagined. I look forward to creating a life full of lasting memories and magical adventures together as a family.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation for my dissertation chair, Terry Shevlin. You are an academic in the truest sense of the word, and your dedication to furthering our understanding of taxation and accounting has been a constant source of inspiration for me. Thank you for taking me on as your student and for always being generous with your time in guiding me. For the past five years, it has truly been an honor and a privilege to have learned from one of the most accomplished minds in accounting academia.

I would also like to thank my committee members, Devin Shanthikumar and Liz Chuk. Devin, for always providing me with detailed feedback on my work and for teaching me that accounting is an inter-disciplinary subject. Liz, for always challenging me to think more critically about my research and for being a trusted mentor I could lean on. You always had my best interest at heart in advising me, and your encouragement and advice motivated me to pursue my dissertation topic.

I am also grateful to Chenqi Zhu and Omri Marian for their insightful and thoughtful comments. Thank you, Chenqi, for helping me whenever I had questions about coding and research. Omri, your legal expertise was pivotal in the refinement of my thesis. Your helpful feedback greatly enhanced the depth and contribution of my dissertation.

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ABSTRACT OF THE DISSERTATION

The Unintended Consequences of Anti Patent Troll Laws on State Tax Revenues

by

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Doctor of Philosophy in Management

University of California, Irvine, 2024

Professor Terry Shevlin, Chair

I study whether the adoption of state anti-patent troll laws incentivizes protected firms to be more tax aggressive. Non-practicing entities, or patent trolls, have widely been recognized as a social detriment by regulators, prompting many states in the U.S. to enact legislature designed to counteract patent trolling and spur within-state innovation. While prior studies have shown that anti-troll laws generally associate with ex-post positive outcomes (e.g., increased innovation), I predict and find that the adoption of anti-troll laws gives rise to a loss in state tax revenues by firms exploiting the resulting increase in intellectual property (IP) to shift profits to lower-tax jurisdictions. Specifically, following the passage of anti-troll laws, 1) firms operating in adopting states report lower state effective tax rates and assign significantly more patents to tax havens, and 2) adopting states experience lower corporate income tax revenue growth. Economically, my results suggest that firms operating in anti-troll states lower state tax burdens by 19 percent relative to unprotected firms on average. I also find that U.S. multinationals operating in anti-troll states engage in more tax-motivated outbound income shifting. My study is the first to provide evidence that state legislators' efforts to protect local firms from patent trolls could have unintended negative state tax revenue consequences.

1. Introduction

The patent system in the U.S. protects inventors by granting them exclusive rights over their intellectual property (IP). The United States Patent and Trademark Office (USPTO) states that when a patent is granted, it gives the patent owner the "right to exclude others from making, using, offering for sale, or selling the invention in the United States." Patent owners defend these rights by taking legal action against any infringing party, which makes patent litigation an essential enforcement tool for patent owners. In recent years, however, non-practicing entities (NPEs), also known as patent trolls, have seemingly exploited the patent litigation system by coercing settlement payments from target firms through frivolous patent right assertions. In this paper, I study a potential negative unintended consequence of states' efforts to protect local businesses from patent trolls: A loss in state tax revenues.

NPEs are business entities that amass a wide range of patents without making or selling any products using the patented technology. NPEs often obtain patents at a discounted price from financially constrained companies looking to monetize their remaining resources, such as IP.[1] NPEs purchase patents from already bankrupt companies as well, because firms that file for bankruptcy can also sell their IP during reorganization. In some cases, NPEs also partner with other patent owners to go after target firms together, with the intention of splitting any potential proceeds (Electronic Frontier Foundation, 2020).

Patent trolls primarily operate by sending demand letters alleging patent right infringement to coerce settlement payments from target firms.[2] Cohen et al. (2019) provide the first large sample

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[1] Electronic Frontier Foundation, *Patent Trolls (May 1, 2017)*; TT Consultants, *All About Patent Trolls (April 13, 2023)*.

[2] In an address made about PAEs (patent assertion entities; another name for patent trolls) on February 14th, 2013, former President Barack Obama states: "they don't actually produce anything themselves. They're just trying to essentially leverage and hijack somebody else's idea and see if they can extort some money out of them… (Executive Office of the President, 2013)."

evidence that the increase in the number of NPEs correlates with an exponential rise in patent litigation cases in recent years, and that firms targeted by NPEs reduce R&D expenditures by roughly 20% going forward relative to ex ante similar control firms. Patent infringement is easy to allege but costly to refute, and the direct costs (e.g., legal costs, settlement costs) imposed by NPEs have been estimated to be greater than $29 billion in 2011 alone (Bessen and Meurer, 2014). Congress and the media have extensively highlighted the growing concern regarding NPEs as well, prompting many state legislators to respond by drafting anti-patent troll laws (APTL).

The primary objective of anti-troll laws is to spur within-state innovation by protecting local businesses from "unfair and deceptive efforts to license and enforce patents." For example, in 2013, Vermont became the first state to adopt an APTL by enacting 9 V.S.A. §§4195-4199 "to build an entrepreneurial and knowledge-based economy".[3] However, because a common tax avoidance strategy utilizes intangible assets like patents to shift income to lower-tax jurisdictions, these efforts could inadvertently harm adopting states' collection of corporate income taxes. Specifically, if APTL passage increases state-level innovation output as intended, innovating firms can capitalize on the realized IP by shifting patent-related income to lower-tax jurisdictions. In other words, firms operating in protected states may behave opportunistically at the states' expense because patent-related income shifting is one of the most prominent tax avoidance strategies available to U.S. firms (e.g., Grubert and Slemrod, 1998; Grubert, 2003; De Simone et al., 2020; Li et al., 2021). Such behavior can have economically significant consequences because state-level tax avoidance accounts for a large part of U.S. firms' overall tax avoidance.[4]

[3] Attracting small- and medium-size Internet technology ("IT") and other knowledge-based companies is one of the explicitly stated goals of 9 V.S.A. §§4195-4199. The provisions further outline the importance of patents in encouraging innovation for these firms, and how investments in research and innovation spur economic growth.

[4] The Institute on Taxation and Economic Policy (2017) finds that, while the average statutory state corporate tax rate is roughly 6.25 percent, the state effective tax rate for the 258 profitable Fortune 500 companies in 2015 was only 2.9 percent. With respect to income shifting, the OECD estimates a loss of $100 - 240 billion in global tax revenue each year due to profit shifting. Clausing (2020) estimates that the U.S. has likely lost more than $100 billion in tax revenue

Using a generalized difference-in-differences model as in Bertrand et al. (2004), I empirically test whether the protection from patent trolls afforded by anti-troll laws enables greater tax avoidance by firms operating in protected states. Consistent with corporate opportunism, I find that the state effective tax rates (SETR) of firms headquartered in anti-troll states significantly decrease following the adoption of APTLs. Specifically, I find a 0.77% decrease in SETR as a result of APTL implementation on average, which translates to a 19% reduction in state tax burdens with respect to the pre-treatment average state effective tax rate of 4.05%. Consistent with prior studies which examine the consequences of anti-patent troll laws, I further show that these findings are concentrated among firms in the high-tech industry.

While SETR is the most appropriate measure for assessing the changes in state-level tax aggressiveness (e.g., Gupta and Mills, 2002), one caveat is that SETR is a coarse measure which aggregates the taxes paid across all states a firm operates in. I mitigate this concern in the analyses by focusing on firms headquartered in APTL states because the headquarter state commonly signals the firm's principal place of business.[5] To further address such concerns, I next examine and find that APTL adoption adversely affects the collection of state corporate income taxes: States which implement anti-troll laws associate with lower year-over-year collection of corporate tax revenues relative to non-adopting states in the current and subsequent years. Overall, my findings are consistent with protected firms "biting the hand that feeds them:" firms take advantage of increased tax avoidance opportunities at the state's expense.

due to outbound income shifting in 2017 alone, which is about a third of the total federal corporate tax revenues. Adjusting for the treatment of indirectly-owned foreign affiliates in the U.S. international economic accounts data, however, Blouin and Robinson (2021) find that this estimate reduces to be about 4 – 8% of total corporate tax revenues, or roughly $10 billion (at the 4% bound).

[5] A firm's principal place of business (PPB) is the main location where its business is performed, which is generally the firm's headquarters. For example, in *Hertz Corp. v. Friend*, Supreme Court Justice Breyer states that a firm's PPB should be its headquarters because it is where "a corporation's officers direct, control, and coordinate the corporation's activities."

In subsequent analyses, I explore whether the observed increase in state tax aggressiveness may be attributed to increased intangible-related income shifting. While the implementation of such tax strategies is difficult to observe, I provide a direct test of this channel in my setting by examining the ex-post patent assignment decisions of protected firms. Namely, if tax considerations induce firms to exploit the increase in IP following APTL adoption, patents should strategically be assigned to no-tax states. I indeed find that treated firms assign significantly more patents to subsidiaries in states which do not tax corporate intangible income.

I conduct three additional tests to provide further support that patent-related income shifting contributes to the observed increase in state tax aggressiveness. First, I verify that firms increase innovation when protected from patent trolls. Consistent with prior studies, I find that firms headquartered in anti-troll states file for more patents in the year of APTL passage. My findings provide evidence that APTL protection is not only valuable for the innovative efforts of small firms, but for firms of all sizes.[6] Next, I examine the cross-sectional variation in the effect of APTL adoption on state tax avoidance with respect to Addback Statutes, which are state provisions designed to prohibit income shifting transactions using intangible assets (Li et al, 2021). Consistent with my predictions, I find that the ex-post increase in state tax aggressiveness is only observed among firms headquartered in non-Addback states. Last, I test whether the adoption of anti-troll laws affects U.S. multinational corporations' (MNC) outbound income shifting decisions. Adapting Klassen and Laplante (2012)'s income shifting model, I find that U.S. MNCs protected from non-practicing entities are significantly more responsive to the incentive to shift income out of the U.S. relative to unprotected MNCs. Overall, consistent with anti-troll laws motivating firms to engage in more intangible-related income shifting, the increase in state tax aggressiveness

[6] Appel et al. (2019) find an increase in IT/software patents filed by individual inventors and small firms following APTL adoption, but find no evidence with respect to patent applications filed by firms with over 500 employees.

following anti-troll law adoption 1) is not observed within states which actively combat such strategies, and 2) aligns with a corresponding increase in U.S. outbound income shifting responsiveness by multinational firms.

The substantial growth in the activities of patent trolls is a recent development, and thus my study has meaningful implications for policy makers who are interested in understanding the potential consequences of implementing anti-patent troll laws. While the literature has documented that anti-patent troll laws have 1) achieved the intended purpose of curbing patent trolling within state borders and 2) facilitated positive corporate outcomes such as an increase in employment and innovation, our understanding of the potential costs associated with APTL adoption is thus far limited.[7] In particular, in the rush to protect local firms, state governments may not have recognized the full ramifications of prohibiting NPE operations: A loss in state corporate tax revenues. The evidence I present could inform legislators in states that have proposed (but have yet to implement) anti-troll laws on the financial costs which could potentially dampen the corresponding benefits that come from protecting local businesses.[8] More generally, my findings could be relevant for all state governments in the U.S., including those of anti-troll states, because state law may be repealed at discretion. Overall, I find that non-tax-motivated state law changes could have unintended negative state tax consequences that are economically significant.

My study also contributes to the literature on tax-motivated income shifting both domestically and internationally. State taxes are an important, yet often overlooked, aspect of a

[7] Studies like Dayani (2023) and Appel et al. (2019) show that the decrease in the number of NPE-related patent litigation coincides with the enactment of anti-troll laws, and that there is an increase in innovation following the passage of anti-patent troll laws. I provide a more detailed discussion of the literature examining the consequences of anti-patent troll laws in Section 2.

[8] California, Connecticut, Iowa, Kentucky, Massachusetts, Nebraska, New Jersey, Ohio, and Pennsylvania have all introduced anti-troll bills, but have yet to sign them into law. Consistent with increased state corporate tax aggressiveness potentially undermining the benefits stemming from APTL implementation (e.g., an increase in employment), I fail to find any observable change in individual state income tax revenue growth ex-post in Table 10.

firm's overall tax liabilities.[9] I show that state laws intended to facilitate an entrepreneurial economy could exacerbate the problem faced by policy makers who have been facing shrinking corporate tax revenues through the years.[10] Further, I find that such state laws could have broader implications for the cross-border income shifting activities of U.S. MNCs, which has been a significant regulatory concern over the last decade. For example, to combat the increased income shifting incentives that arose for U.S. MNCs following the enactment of the Tax Cuts and Jobs Act of 2017, the U.S. government also chose to implement three additional provisions: global intangible low-taxed income (GILTI), base erosion and anti-abuse tax (BEAT), and foreign-derived intangible income (FDII).[11] Understandably, much of the existing income shifting literature has focused on the influence of federal regulation on multinational firms' profit shifting outcomes.[12]To the best of my knowledge, my study is the first to show evidence that, much like federal regulation which influences the profit relocation decisions of U.S. MNCs, state laws could similarly have a direct impact on tax-motivated U.S. outbound income shifting outcomes as well.

2. Institutional Background and Prior Literature

2.1 Non-Practicing Entities (Patent Trolls)

[9] Bankman (2007) provides an in-depth discussion of the economic importance of understanding state tax shelters to prevent aggressive tax planning aimed at reducing state tax liabilities, and Li, Ma, and Shevlin (2021) specify that state tax avoidance accounts for a large part of U.S. firms' overall tax avoidance activities. Heider and Ljungqvist (2015) and Ljungqvist et al. (2017) also provide evidence that state taxes are a material consideration for firms in that it induces significant changes in firm behavior, such as risk-taking and capital structure choices.
[10] State corporate net income tax revenues have been consistently decreasing in recent years (Census, 2011). Dyreng et al. (2013) report that corporate tax revenues previously accounted for 10.2% of total state tax revenues in 1979, but only accounted for 5.4% of total state tax revenues in 2010. In my sample, I find that this statistic has further decreased to 3.97% for the 34 anti-troll states by 2016.
[11] GILTI imposes a minimum tax on foreign income that exceeds 10% return on qualified business income and targets tech firms with low assets and high margins. BEAT imposes a minimum tax on certain payments made to foreign affiliates, which targets outbound income shifting arrangements by U.S. firms through foreign subsidiaries. FDII provides U.S. firms a lower tax rate on excess income earned in the U.S. from export sales of goods and services, thus reducing the tax incentive to engage in cross-border income shifting and incentivizing U.S. firms to own IP in the U.S.
[12] Outside the U.S., the European Union mandated multinational firms to provide country-by-country reporting to European tax authorities to transparently indicate country-level economic activity for every tax jurisdiction a multinational firm has operations in (e.g., De Simone and Olbert, 2022).

Patent trolls are licensees of patents who exist "to sue, or collect money by threatening to sue, companies for infringing the patents they own".[13] NPEs primarily operate by sending demand letters to unsuspecting businesses, alleging infringement of patent rights with the intention of coercing settlement payments. For example, MPHJ Technology Investments LLC (MPHJ), an iconic patent troll, sent 16,456 demand letters over a period of two years. MPHJ obtained patents which covered any networked "scan-to-email" function and targeted any company that may have scanned a document directly to e-mail at any point during its operations. While patent trolls more frequently target smaller firms, firms of all sizes face heightened litigation risk from patent trolls. For example, MPHJ has previously targeted the largest of companies such as Coca-Cola and Dillard's.[14]

News outlets and regulators have widely recognized the activities of patent trolls to be a social detriment for several years. Accordingly, on Dec. 2013 and again on Feb. 2014, 42 State Attorneys General wrote letters to the Federal Trade Commission (FTC) and the Senate leadership respectively, communicating the urgent need for intervention against NPEs. The activities of patent trolls were a concern at the Federal level as well, which pushed the Obama Administration to produce a report highlighting the problematic nature of patent trolling in 2013. The report clearly establishes the Federal government's stance against the activities of patent trolls, and outlines potential legislative measures that can be taken to protect the innovation of American firms.[15]

[13] Sylvia Hsieh, *Will Obama's Proposals Rein in Patent Trolls?, Lawyers USA (June 6, 2013).*

[14] Dayani (2023) and Chien (2013) argue that patent trolls primarily target smaller firms because they do not have sufficient financial resources or legal knowledge to defend themselves in patent infringement lawsuits. Cohen et al. (2019) also find that firms with smaller legal teams more often targeted by NPEs on average. Anecdotally, however, NPEs also target larger firms. For example, Samsung Electronics has been dealing with a patent litigation suit filed by Scramoge Technology, a European non-practicing entity, since January 10th, 2022. Cohen et al. (2019) also find that NPEs target conglomerate firms that generate revenues in segments unrelated to the alleged infringement.

[15] In 2011, Congress passed The Leahy-Smith America Invents Act (AIA), which was signed into law by President Obama with the goal of improving the quality of patents that are granted. The AIA aids in the fight against patent trolls on a key front, since the prevalence of low-quality patents allowed patent trolls to thrive by bringing nuisance lawsuits designed to extract settlements rather than enforce legitimate patent rights (Ford, 2017).

Patent trolls could have a deterrent effect on corporate innovation through two potential channels (Cohen et al. 2017). First, patent trolls could have direct negative cash flow consequences on the firms they target through costs related to the patent litigation process, thus limiting resources available for innovation. For example, Bessen and Meurer (2014) estimate that from 2005 to 2010, the aggregate direct costs imposed by NPE patent assertions increased rapidly from about $7 billion to $29 billion. The 2015 report produced by the American Intellectual Property Law Association also present survey evidence which find the median cost of seeing a patent lawsuit through the discovery phase to be $400,000 for suits with less than $1mm at stake, and just under $1mm for suits in the range of $1mm to $10mm. The activities of patent trolls could impose indirect costs on innovation as well. For example, because NPEs tend to "cast a wide net," patent trolling could also have repercussions for peer firms of targets. Chen et al. (2021) show that when a technology firm is sued by a patent troll, the likelihood of a peer firm being targeted in the subsequent year increases significantly, and that the non-litigated peer firm experiences a decrease in market value and an increase in lower quality R&D investments in search of "workaround technologies." Thus, the mere presence of patent trolling can deter firm innovation. Overall, these studies indicate that nuisance patent litigation cases filed by patent trolls impose significant costs on corporate innovation (Bessen and Meurer, 2014).

2.2 Consequences of Anti-Patent Troll Laws

In May 2013, the Vermont Legislature unanimously passed a bill directly targeting patent-related demand letters that are sent in bad faith, becoming the first state to implement an anti-patent troll law.[16] The Vermont Legislature aims to "protect Vermont businesses from abusive and bad faith assertions of patent infringement… while at the same time respecting federal law and

[16] The Vermont Statutes Annotated (V.S.A.) Title 9: Chapter 120: Bad Faith Assertions of Patent Infringement consists of §§4195-4199, which outlines the details of the anti-patent troll law.

being careful to not interfere with legitimate patent enforcement actions (9 V.S.A. §§4195).” In effect, if the Vermont state court rules that the defendant has sufficiently established that a demand letter has been sent in bad faith, the alleging party is heavily fined. Many states have since followed suit and have implemented anti-troll laws that are similar in content to the Vermont legislation.[17]

Existing literature examining the consequences of anti-patent troll laws has primarily documented that APTL adoption tends to induce positive corporate and social outcomes on average. Appel et al. (2019) focus on the influence of anti-troll adoption on small startups’ operations and find that APTL passage improves high-tech startups’ ability to innovate, create jobs, and raise capital via VC funding. These findings are more pronounced among firms in the IT sector, and are generally not observed among non-IT firms or larger firms.[18] Dayani (2023) finds that the passage of state anti-troll laws benefits the acquisition outcomes of small firms in the tech industry as well. Specifically, protection from patent trolls enables smaller tech firms to continue operations instead of exiting prematurely via discounted acquisitions, and when agreeing to a buyout, the acquisition price tends to be higher. Thus, anti-troll laws allow small inventors to attain higher payoffs for their inventive efforts. Relatedly, Siddiqui and Shams (2022) show that, while high-tech firms are more likely to delist following NPE litigation, the enactment of anti-troll laws mitigates this effect. Last, in a quasi-natural experiment around a 2017 U.S. Supreme Court decision which limited the ability of patent trolls to seek favorable venues outside the target’s state

[17] While the majority of state anti-troll laws are modeled after that of Vermont, there are some variations. For example, the Texas APTL has opted for a much narrower scope which similarly hinges on bad faith assertion letters, but specifically focuses on the communication between the NPE and the target (e.g., the demand letters), rather than broad assertions. In this way, it is considered to be a less protective provision (Huang et al., 2016). Virginia’s APTL represents a middle ground between Vermont and Texas in that only the Attorney General may act against NPEs that are potentially acting in bad faith, with no established private cause of action as with Vermont.

[18] Appel et al. (2019) find no evidence that APTL adoption affects employment at older high-tech firms or at non-high-tech firms. The authors also do not find any evidence that non-IT firms benefit from greater access to VC funding, and that APTL implementation does not influence the number of software and IT patents filed by firms with more than 500 employees.

of incorporation, Duan (2023) finds that firms operating in anti-troll states optimally revise overly conservative capital structures by increasing leverage.

2.3 Federal Preemption

While anti-patent troll laws are motivated by the clear objective of protecting local businesses, they may not achieve the intended purpose of spurring within-state innovation due to federal preemption. Specifically, because patent law is exclusively a federal issue, any state patent law may be superseded by federal patent law. According to the standards of the Federal Circuit (e.g., Maine Supreme Court), for a state claim to avoid federal preemption, infringement assertions must have been 1) objectively baseless and 2) made in subjective bad faith. Thus, APTLs would only be effective against NPEs who have asserted patent rights with no real basis at all, and any amount of arguable claim could preempt the jurisdiction of APTLs over patent infringement cases heard in federal courts. For example, Salomone (2019) notes that Wisconsin's anti-troll law is likely preempted by the Federal Circuit's objectively baseless requirement derived from the *Noerr-Pennington* doctrine.[19]

Despite the threat of federal preemption, state anti-troll laws likely deter the activities of NPEs for several reasons. First, the Federal Circuit has affirmed that the *Noerr-Pennington* doctrine does not bar claims where the patent holder's assertions were made in subjective "bad faith." In line with this, many state legislators have adopted Vermont's approach and have structured APTLs around broadly prohibiting bad faith infringement assertions to circumvent federal preemption concerns (Huang et al., 2016). Further, in an effort to avoid federal jurisdiction of patent law, Vermont has framed 9 V.S.A. §§4195-4199 as consumer protection laws by filing

[19] The *Noerr-Pennington* doctrine grants antitrust immunity to private parties petitioning the government to adopt laws or rulings that may be anticompetitive. In the context of NPEs, it would allow patent trolls to argue against state APTLs by stating that it is anticompetitive in the way it prevents assertions of patent rights. However, it still does not apply to sham petitions.

the legislation under Title 9: "Commerce and Trade." Thus far at the state level, Vermont, New York, and Minnesota have all successfully barred the patent trolling activities of MPHJ Technology Investments within the borders of each respective state, and Washington is currently enforcing its anti-troll law in a lawsuit against Landmark Technology A for its "predatory" patent assertions.[20]

The Supreme Court's decisions in early jurisprudence also demonstrate that it is possible for state laws to maintain jurisdiction in the domain of federal patent law. In *Allen v. Riley 203 U.S. 347 (1906),* the Supreme Court ruled that states may enact regulation for the protection of local businesses as long as the legislation is not oppressive, unreasonable, or interferes with the rights of patent holders.[21] Last, there is federal precedence which supports state governments that act to stop the activities of NPEs within its borders. For example, in *Vermont v. MPHJ Technology Investments LLC,* MPHJ twice attempted to have the case moved to federal court to circumvent Vermont's anti-patent troll law, but was denied both times by the Federal Circuit.

3. Hypothesis

The use of intangible assets to shift income from high-tax to lower-tax jurisdictions is an important and frequently used tax strategy employed by U.S. firms. Importantly, the domestic parent company can transfer patents to low-tax affiliates in different states or different countries at an "arm's length price," which is a comparable price that is charged for a similar transaction between unrelated parties. Because intangible assets like patents or copyrights tend to be difficult to value, it can be challenging for regulators to identify comparable benchmark transactions,

[20] *State of Washington v. Landmark Technology A LLC* has been listed as one of the 'Trials to Watch in 2023' by Kirkland & Ellis LLP. In an update on Oct. 28th, 2022, U.S. District Judge Ricardo Martinez rejected Landmark's request for the dismissal of Washington's anti-troll law claims, which cited violation of free speech and conflicts with federal patent law. In 2021, A North Carolina federal court similarly rejected such a challenge from Landmark.

[21] In *Allen*, the Supreme Court ruled that Kansas had the right to require proof of patent ownership in all transactions involving patent rights and upheld a Kansas statute on patents. The Court noted that "some fair latitude must be allowed to the states in the exercise of their powers on this subject."

making such intra-firm transactions difficult for regulators to police. Upon transfer of patent rights, the profits generated by the patent flow to the low-tax subsidiary and lowers tax liabilities. While the incentive to shift profits using intangible assets is unlikely to change before or after the enactment of anti-troll laws, the opportunity to do so should significantly increase for firms located in anti-troll states if the protection offered by APTL adoption encourages greater innovation. Therefore, anti-troll laws present an opportunity for protected firms to "double-dip" in the benefits of innovation: promote firm growth through R&D investments,[22] then utilize the resulting patents to shift income to lower tax jurisdictions.

An example of a common state tax avoidance strategy involves the use of a Passive Investment Company (PIC) (e.g., Dyreng et al. 2013; Bankman, 2007).[23] While Delaware has a relatively high top statutory corporate tax rate of 8.7%, it is the most widely known domestic tax haven because it does not levy tax on income related to intangible assets. Take, for example, an income shifting arrangement in which a parent company based in Oregon transfers a patent to its PIC established in Delaware. Once protected from the threat of NPE litigation with the enactment of the Oregon anti-troll law in March of 2014, the Oregon parent files for more patents which are then transferred to the PIC in Delaware. The parent (or any of its subsidiaries located in high-tax states) makes royalty payments to the PIC for the use of the intangible asset, which is a deductible business expense in the high-tax state. The royalty revenues which arise as a result of the patent then flow to the Delaware PIC, where it is exempt from taxation.[24] In this way, the Oregon parent

[22] With an increase in R&D expenditures, state corporate tax revenues may also decrease due to firms' use of R&D tax credits. As such, I control for state R&D tax credit incentives in the main analyses.
[23] PICs are also known as Delaware Holding Companies. Bankman (2007) states that a domestic income shifting arrangement utilizing a PIC is "probably the most well-known aggressive tax planning technique" in state taxation.
[24] A key difference between state and cross-border outbound income shifting is that the cash tax savings resulting from the domestic income shifting arrangement using a Delaware PIC are permanent, whereas the cash savings using foreign tax havens in the pre-TCJA period were deferred until if and when the foreign profits are repatriated to the U.S.

could entirely escape state taxation related to its patent by establishing a Delaware PIC for income shifting purposes. The state legislator's decision to protect local businesses through anti-troll laws, then, could unintentionally harm the state government's collection of state taxes that otherwise would have been earned in the absence of adoption.

A loss in state tax revenues stemming from the passage of anti-troll laws could also result from multinational firms relocating patents to foreign countries (e.g., Dischinger and Riedel, 2011; Karkinsky and Riedel, 2012). For example, multinational firms operating in anti-troll states could create a foreign holding company which owns foreign subsidiaries. If U.S. MNCs leverage the protection afforded by anti-troll laws to file for more patents, they can then transfer the IP at an arm's length price to a low-tax foreign subsidiary (e.g., in Ireland). As with the domestic income shifting example, the other foreign subsidiaries that are also owned by the holding company can then make royalty payments to the low-tax subsidiary for use of the patented technology. Subsequently, all subsidiaries under the holding company make check-the-box elections to be treated as passthrough entities such that the intra-company royalty payments are eliminated for U.S. tax purposes.[25] Based on the above discussion, I predict that the enactment of anti-patent troll laws could lead to greater tax aggressiveness by treated firms, formally stated below:

H_1: Following the adoption of state anti-patent troll laws, the tax avoidance of firms operating in adopting states increases.

Notwithstanding the potential increase in income shifting opportunities afforded by the enactment of anti-troll laws, state-level protection from patent trolls may not lead to increased tax avoidance by firms operating in adopting states for several reasons. First, as previously discussed, non-practicing entities may not deem state anti-patent troll laws as an effective deterrent to their

[25] Without such arrangements, royalty payments made between foreign subsidiaries would be treated as subpart F income, which is taxed immediately at the U.S. statutory tax rate.

activities due to federal preemption. Second, state-level intervention constraining income shifting could hinder firms' ability to capitalize on increased tax avoidance opportunities. Namely, since 1999, various states have adopted Addback statutes which specifically target and hinder income shifting transactions using intangible assets (Borens and Kerner, 2013; Li et al., 2021). Because more than half of the states with Addback statutes have also chosen to adopt APTLs, ex ante, it is unclear whether APTL adoption would lead to increased tax avoidance on average.[26] Third, firms operating in non-APTL states could be incentivized to relocate to anti-troll states. Thus, at the state level, corporate income tax revenues may even increase if there are more firms operating in the state as a result of anti-troll protection.

Last, while there are significant economies of scale with corporate tax avoidance strategies, and especially with income shifting arrangements, prior studies have shown that anti-patent troll laws primarily benefit smaller firms in the tech industry. For example, Appel et al. (2019) find that information technology (IT) patents filed by small firms significantly increase following the passage of anti-troll laws, but find no evidence that anti-troll laws affect patent applications filed by firms with more than 500 employees. Firm size is an important determinant of income shifting, with larger firms transferring more profits to lower-tax jurisdictions on average. Both Scholes et al. (1992) and Klassen et al. (1993), for example, find that only the largest firms in their respective test samples engage in intertemporal and geographic income shifting.[27] If the increase in corporate innovation resulting from anti-troll protection is primarily driven by small firms, then changes in corporate tax avoidance following APTL adoption may not be observable because 1) small firms

[26] Among the 24 states which had adopted Addback Statutes, 15 states implemented APTLs. However, Louisiana and Rhode Island did not have Addback Statutes in place when the APTL was adopted.

[27] Scholes et al. (1992) find evidence of intertemporal income shifting by the largest firms around the 1986 Tax Reform Act, with firms in the highest size quintile shifting income forward in time to take advantage of lower corporate tax rates. Klassen et al. (1993) examine geographical income shifting around tax rate changes, and only find that the largest firms in the sample end up shifting income to lower-tax jurisdictions.

tend not to rely on tax strategies centered around using intangible assets to lower tax liabilities, or 2) the innovative incentives of larger firms that engage in income shifting do not change. Therefore, whether state tax avoidance increases after the adoption of anti-troll laws remains an empirical question.

4. Empirical Methodology

4.1 Data and Sample

In line with the exponential rise in the number of NPEs starting from 2010, I begin with all U.S.-incorporated nonfinancial, nonutility firm-years listed on *Compustat* during the period 2010 to 2018. Extending the sample beyond 2016 allows for the inclusion of all APTL events in my sample, but does introduce two potential concerns. First, the Tax Cuts and Jobs Act of 2017 (TCJA) affected state tax planning by implementing a variety of changes that expanded the states' tax bases (Walczak 2019; Laplante et al., 2021). Second, on May 2017, the U.S. Supreme Court ruled that patent infringement cases must be heard in the defendant's state of incorporation in *TC Heartland LLC v Kraft Foods Group Brands LLC* (TC Heartland). Thus, the behavior of NPEs may have been influenced by the Supreme Court arbitration in the later years in my sample. For these reasons, I test whether the main findings are robust to limiting the sample to 2010 – 2016 in additional analyses.

Without adjustment, the *Compustat* database only contains the current headquarter state information for each firm-year observation, thus it is possible to misattribute a firm's headquarter state solely based on *Compustat* data. This could have material implications for my study because 1) I focus on the headquarter state to identify the principal place of business for each firm, and 2) Gao et al. (2021) estimate that 2 – 3% of *Compustat* firms change their headquarter state each year. To mitigate such concerns, I follow the approach taken by Bai et al. (2020) and Gao et al. (2021)

and extract each firm-year headquarter state from the firm address reported in the latest SEC 10-K/Q filing using the Augmented 10-X Header Data provided by the Notre Dame Software Repository for Accounting and Finance.[28] I next incorporate state-level data in the sample such as the state gross domestic product, state unemployment rates, and state tax revenues from the Bureau of Economic Analysis and the U.S. Census Bureau's State and Local Finances Database, respectively. To account for multinational firms' outbound income shifting activities, I identify foreign sales from *Compustat Segment* based on the reported geographic segments. Last, I obtain patent data from Kogan et al. (2017). In the innovation analyses, I further require firm-year observations to have non-missing patent data to compute the variables used in the main analyses. For the tax avoidance tests, I do not impose any restrictions regarding patent data and instead exclude observations that have either negative state income tax or domestic pretax income as these firms do not pay income taxes.

I first provide visual evidence consistent with my predictions. Similar to the findings of prior studies, in Figure 1 I find that the enactment of state anti-patent troll laws induces firms headquartered in adopting states to file for more patents. Namely, while there is no observable difference in the number of patents filed by the treated and non-treated firms during the pre-treatment period, I observe a significant increase in the number of patents filed by firms headquartered in anti-troll states with treatment at time *t*. It is also evidence that the patent filings of non-treated firms remain relatively stable through event time. Thus, in line with the stated goal of APTLs, its implementation appears to positively affect the innovation of protected firms as measured by patent filings.

[28] The Augmented 10-X Header Data are available from Bill McDonald at: https://sraf.nd.edu/data/augmented-10-x-header-data/.

I report descriptive statistics for both the tax avoidance and innovation samples in Table 1.[29] Panel A (Panel B) shows that about 20 (16.5) percent of firm-years in the tax avoidance (innovation) sample have *APTL* = 1. As evidenced by the smaller sample size, the difference in these summary statistics is primarily driven by the restriction I impose only on the innovation sample of non-missing patent data. The positive mean values of *FRoS* and *RoS* (9.83% and 6.35%, respectively) indicate that the sample is comprised of firms with positive profit margins on average, and is generally consistent with the distribution of both variables from prior income shifting studies.[30] The positive mean of *FTR* further highlights the high outbound income shifting incentives that U.S. multinational firms had during my sample period.

In Panel C, I compare the characteristics of firms headquartered in APTL states with those headquartered in non-APTL states. First, I note that the distribution of the outcome variables of interest such as state effective tax rates and patent filing are very similar between the two groups. Similarly, I find that other covariates included in the analyses are generally similar between the two groups as well. Last, while the proportion of firms affected by Addback Statutes (*AB*), which combat intangible-related income shifting, are relatively similar between the two groups, I find that a greater proportion of firms operating in anti-troll states belong in the high-tech industry and has access to R&D tax credits. This indicates that anti-troll firms faced greater opportunities to engage in income shifting strategies which utilize intangible assets. Last, I note that the state corporate income tax rate is lower for the anti-troll states on average.

4.2 Research Design

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[29] The definition and construction of all variables are reported in Appendix B.

[30] *FRoS* is foreign pre-tax income scaled by foreign sales, and captures multinational firms' overseas profit margins from foreign operations. *RoS* is measured as pre-tax income scaled by total sales and is used to control for cross-sectional variation in firms' overall profitability. *FTR* is the difference between the U.S. statutory tax rate and the firm's weighted foreign tax rate, and captures the cross-border income shifting incentives for U.S. multinational firms. These variables are discussed in greater detail in Appendix A as well as in Section 6.3.

To empirically test H_1, I employ a generalized difference-in-differences (DID) model as in Bertrand et al. (2004) and estimate Equation (1):

$$State\ Tax_{i,s,t} = \beta_1 APTL_{s,t} + \lambda X_{i,s,t} + State\ FE + Year\ FE + \varepsilon_{s,t} \qquad Eq. (1)$$

I examine state tax avoidance outcomes (*State* $Tax_{i,s,t}$) with both state effective tax rates and state corporate income taxes. $SETR_{i,s,t}$ represents the state effective tax rate of firm *i* headquartered in state *s* at year *t*, which is calculated as the current state income tax expense scaled by pre-tax domestic income truncated at 0 and 1 (e.g., Dyreng et al. 2013; Koester et al. 2017; Shevlin et al. 2017). *StateTax_Corp* is the year-over-year growth in state corporate income taxes for each state *s* in year *t*.

The variable of interest is $APTL_{s,t}$, which is an indicator variable equal to 1 in the current and all subsequent years for firms headquartered in state *s* if state *s* passes an anti-patent troll law in year *t*, and equal to 0 if not. Estimating a generalized difference-in-differences regression requires a set of group- and time- fixed effects. Accordingly, I include state and year fixed effects in both models and cluster standard errors by state (e.g., at the treatment level) to account for within state correlation in the residuals and the covariates (Bertrand et al., 2004). I also include $X_{i,s,t}$ in the model, which is a vector of firm- and state-level control variables that potentially correlate with both state tax avoidance outcomes and the implementation of anti-troll laws. Equation (1) tests for differences in state tax avoidance outcomes between firms headquartered in states which have adopted APTLs relative to firms headquartered in non-APTL states. Following the discussion outlined in Section 3, I predict β_1 to be negative.

As I expect the increase in the number of patents to be the primary channel through which protected firms achieve greater tax avoidance, in subsequent analyses I also test whether the implementation of anti-troll laws increases the innovation of treated firms with Equation (2) as follows:

$$Innovation_{i,s,t} = \beta_2 APTL_{s,t} + \lambda X_{i,s,t} + State\ FE + Year\ FE + \varepsilon_{s,t} \qquad Eq.(2)$$

Equation (2) examines the difference in the log-transformed number of patents filed (*Patents*) and R&D expenditures (*RD*) by firms operating in anti-troll states relative to other states following APTL passage. In addition to its importance in enabling increased tax avoidance, I follow the innovation literature and use patent-based innovation measures for two main reasons. First, a patent is an output measure that captures both observable and unobservable inputs into innovation, whereas R&D expense only reflects observable inputs (He and Tian, 2013; Li et al., 2021). Second, reported R&D expenditures on *Compustat* tend to contain significant measurement error. For example, Koh and Reeb (2015) show that almost 50% of *Compustat* firms report missing R&D expenditures, and that among firms with no reported R&D expenditures, about 10% still file patents. Nonetheless, I supplement the analyses by also examining R&D expenditures as a secondary outcome variable which measures innovation inputs. $APTL_{s,t}$ is as defined above, and consistent with a generalized DID model, I again include state and year fixed effects. With $X_{i,s,t}$, I control for a separate set of firm- and state-level control variables that may be correlated with innovation outcomes and the enactment of anti-troll laws. If the observed increase in state tax avoidance can be attributed to intangible-related income shifting, I predict β_2 to be positive in Equation (2): firms headquartered in anti-troll states and thus less likely to face NPE litigation innovate more and file for more patents, which provides more tax avoidance opportunities.

5. Results

5.1 Anti-Patent Troll Laws and State Tax Avoidance

I examine whether firms exploit the increase in potential tax avoidance opportunities that arise from the adoption of state anti-patent troll laws by estimating Equation (1). First, at the firm-state-year level, I compare state tax avoidance outcomes between firms headquartered in states which pass anti-troll laws against firms headquartered in non-APTL states by employing $SETR_{i,s,t}$ as the dependent variable. In Table 2, I find that the coefficient on *APTL* is significantly negative: Upon anti-troll law adoption, protected firms exhibit greater state tax aggressiveness. The decrease in state effective tax rates is not fully explained by observable determinants of tax avoidance, state tax incentives such as R&D tax credits, or by the economic conditions of the state. The coefficient of interest indicates that, on average, there is a -0.77% difference in state tax liabilities between firms operating in anti-troll states relative to non-protected firms. Economically, this suggests that firms headquartered in adopting states reduced state tax liabilities by 19% on average relative to non-APTL firms.[31]

In accordance with prior studies which find that the benefits of anti-troll laws are more concentrated among firms operating in high-tech industries (e.g., Appel et al., 2019; Dayani, 2023), I next examine cross-sectional variation in the effects of APTL adoption on state tax avoidance outcomes. In columns (2) and (3), I find that the subsequent increase in state tax aggressiveness is indeed more pronounced for firms with more reliance on intangible assets. Specifically, greater ex-post state tax aggressiveness is only observed among high-tech firms that are likely to benefit more from patent troll protection. Overall, Table 2 provides evidence that firms headquartered in states enacting anti-troll laws subsequently increase state tax avoidance, and that there is intuitive cross-sectional variation in such state tax aggressiveness.

[31] The average SETR prior to APTL adoption is 4.05%. Thus, -0.77/4.05 = -19.01%. In dollar terms, a 0.77% reduction in SETR equates to $35,035,000 lost in state tax revenues combined across APTL states because the collective state corporate income tax expense across all treated firms in the year prior to APTL adoption in my sample is $4.55 billion.

One caveat to the above discussion is that *SETR* is a coarse measure which aggregates the state taxes that are paid in all states that a firm operates in. To an extent, focusing on firms headquartered in APTL states mitigates this concern because a firm's principal place of business is often indicated by the headquarter state. To further address such concerns while providing more direct state-level evidence regarding the potential negative tax consequences of APTL adoption, I next examine state corporate tax revenue outcomes by estimating Equation (1) at the state-year level. I test whether APTL adoption negatively affects state corporate income tax revenue growth and tabulate my findings in Table 3. Consistent with my predictions, I find that adopting states experience a reduction in corporate income tax revenue growth, as evidenced by the significantly negative coefficient on *APTL* in the first two columns.[32] I next test whether the treatment effect persists into the next period in column (3), and find that anti-troll law passage negatively impacts corporate tax revenue growth in the subsequent year as well.[33] Overall, Tables 2 and 3 present evidence consistent with H_1: Firms protected from patent trolls engage in opportunistic tax avoidance at the expense of state governments' efforts to ward off NPEs.

5.2 Intangible-Related Income Shifting

While I find evidence consistent with an ex-post increase in state tax avoidance following the enactment of state anti-patent troll laws, income shifting using patents, the predicted channel through which state tax aggressiveness would increase, is difficult to observe. In this section, I conduct four tests to isolate intangible-related income shifting as the primary channel through which firms exploit the protection afforded by anti-troll laws.

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[32] Economically, the coefficient of -0.0047 indicates that the state corporate income tax revenue growth at time *t* for treated states is 3.58% lower relative to those of treated states based on the mean level of state corporate income taxes of 13.12 at time *t-1*.

[33] It is possible that the immediate effects of anti-troll law adoption on state tax revenues is negative, but that states recover these losses in subsequent periods as the effects of innovation are realized and begin to generate additional revenues. However, I do not expect to observe this outcome if the realized IP is relocated outside the state as I predict. I do not examine longer post-period windows (e.g., 5 years) due to my relatively short sample period.

5.2.1 Anti-Patent Troll Laws and Innovation

I first verify that firms operating in APTL states increase innovation and file for more patents than firms operating in non-APTL states, thus facilitating the increase in patent assignments to tax-advantaged jurisdictions. I estimate Equation (2) and report the findings in Panel A of Table 5. In the first two columns, I find that, following APTL passage, treated firms file for significantly more patents than non-treated firms on average.[34] Additionally, in columns (3) and (4), I confirm a corresponding increase in R&D investment by treated firms as well. My findings are consistent with the contention of The White House that NPE activities hurt firms of all sizes (Executive Office of the President, 2013), and complement Appel et al. (2019) by documenting a more general result that the enactment of anti-patent troll laws facilitates more patent filings by all firms on average.[35]

The results I thus far present also indicate that corporate innovation outcomes reflect the benefits of anti-troll laws relatively quickly, as headquartered firms file for and shift significantly more patents in the year of APTL adoption by the headquarter state. The rate at which anti-troll firms increase patent filing is consistent with Appel et al. (2019), who find that over a similar period spanning 2011 Q2 to 2016 Q2, the amount of IT and software patents filed by small tech firms significantly increase in the quarter of anti-troll law adoption. Such an immediate response to APTL passage is noteworthy given the longer-term nature of R&D investments.[36] A potential explanation for these findings is that firms continued to invest in innovation without patenting the developed technology due to the threat of NPE litigation based on overlapping technologies. Thus,

[34] In untabulated analyses, I find that the results are robust to abstracting from the effects of the Supreme Court's ruling in TC Heartland by limiting the sample to 2010 – 2016.

[35] The findings are also consistent with those of Dayani (2023), which finds an increase in R&D expenditures for both large and small firms following anti-troll law adoption.

[36] R&D investments are generally considered to be long-term investments (e.g., Eberthart et al., 2004), and investments R&D are generally tied to the long-run value of firms (e.g., Koh and Reeb, 2015).

upon APTL passage, innovating firms would promptly file for patents to protect their IP. I test this prediction by examining whether there are significant differences in R&D expenditures in the pre-treatment periods between the treatment and control groups, and present the findings in Panel B. I find that there are no significant differences in R&D expenditures for up to three periods prior to APTL adoption. Overall, while there are no observable differences in R&D investments between the two groups in the pre-treatment period, firms headquartered in anti-troll states file for significantly more patents following APTL adoption relative to other firms.

5.2.2 Anti-Patent Troll Laws and Patent Location

One way to overcome the difficulty in directly observing changes in intangible-related income shifting in my setting is to examine the location of patents. This is because firms engaging in such tax avoidance strategies would strategically place patents in tax-advantageous jurisdictions, as discussed in Section 3. I next test whether firms protected from patent trolls increase intangible-related income shifting by examining the ex-post assignment of patents to tax-preferred jurisdictions. In addition to Delaware, there are three other states that do not tax corporate intangible income: Nevada, Wyoming, and Michigan (Li et al., 2021). I predict an ex-post increase in patent assignments to related entities located in these four states, which would allow assigning firms to avoid paying state-level income taxes on the shifted patents.

Following Li et al. (2021), I obtain patent location information from the USPTO Patent Assignment Dataset.[37] The database provides detailed information on patent assignments starting from 1970, including the type of assignment and the names and addresses of both patent assignors and assignees. I test whether firms headquartered in anti-troll states assign more patents to the four no-tax states by setting *Assign_NoTax* as the dependent variable in Equation (1), which is the log-

[37] I thank Qin Li, Mark Ma, and Terry Shevlin for providing the base code which identifies the assignment of patents to states which do not tax corporate intangible income from the USPTO.

transformed number of patents a firm assigns to the four no-tax states. I present my findings in Table 4. Consistent with my prediction, I find that the coefficient on *APTL* is positive and significant at the 5 percent level or better across all three specifications.[38] Economically, my findings indicate that treated firms' assignment of patents to domestic tax havens is approximately 8% higher relative to non-treated firms following treatment. Thus, the adoption of anti-patent troll law positively associates with the strategic assignment of patents to the four no-tax states. The evidence presented in Table 4 lends direct support to my prediction that anti-troll law passage encourages firms to be more tax aggressive through intangible-related income shifting strategies.

5.2.3 Addback Statutes

Addback statutes are state laws which require within-state firms to add intangible-related expenses paid to out-of-state affiliates back to the firms' state taxable income. These laws were explicitly motivated by state governments' incentives to combat income shifting using intangible assets (e.g., Li et al., 2021). Therefore, even if APTL adoption provides more opportunities to shift income to lower-tax jurisdictions through the use of intangible assets, affected firms operating in Addback states may not be able to capitalize on such opportunities. If patent-related income shifting is the primary channel through which firms exploit anti-troll law passage, I expect my findings to be more pronounced among non-Addback states.

I provide the adoption years of Addback statutes for each state in Appendix A. To test the cross-sectional variation in the effects of APTL adoption on state tax avoidance, I separately estimate Equation (1) for firms headquartered in Addback states (*AB = 1*) and for firms headquartered in non-Addback states (*AB = 0*) using both *SETR* and *Assign_NoTax* as dependent

[38] The average log-transformed number of patents assigned to domestic tax havens by treated firms one year prior to APTL adoption is 0.6209. Thus, the full specification in column (3) indicates that treated firms assigned 8.18% more patents to domestic tax havens than non-treated firms following state APTL adoption.

variables. The findings are presented in Table 6. In columns (1) and (3), I find evidence consistent with an increase in state tax aggressiveness for the *AB = 0* subsample, but not for the *AB = 1* subsample. Further, the *APTL* coefficient is statistically significantly different across the Addback partition for both sets of analyses. Overall, consistent with firms utilizing intangible assets to shift more income following APTL adoption, I find that the ex-post increase in state tax aggressiveness and strategic patent relocation to domestic tax havens is more pronounced among firms headquartered in non-Addback states.

5.2.4 Anti-Patent Troll Laws and Outbound Income Shifting

If income shifting is the primary channel through which protected firms achieve greater tax avoidance following the implementation of anti-troll laws, it is possible for the effects of APTL to manifest in cross-border income shifting outcomes for U.S. multinational corporations (MNC) as well. For example, the opaque nature of patent-related royalty payments provide MNCs with an incentive to locate intangible property to lower corporate tax burdens (Dischinger and Riedel 2011; Karkinsky and Riedel 2012). To test this prediction, I adapt the Klassen and Laplante (2012) outbound income shifting model as follows:

$$FRoS_{i,s,t} = \beta_1 FTR_{i,s,t} * APTL_{s,t} + \beta_2 APTL_{s,t} + \beta_3 FTR_{i,s,t} + \lambda X'_{i,s,t}$$
$$+State\ FE + Year\ FE + \varepsilon_{s,t} \qquad Eq. (4)$$

The dependent variable *FRoS* represents the profit margin of a firm's foreign operations. *FTR* measures the tax incentives that U.S. firms have to shift income to foreign countries, and is calculated as the estimated average weighted foreign tax rate subtracted from the U.S. statutory tax rate (STR). The U.S. STR proxies for the tax rate that would apply to U.S. MNCs if the profits were earned in the U.S. With higher *FTR* values representing greater tax-motivated outbound income shifting incentives, I expect β_3 to be positive: the profitability of a firm's foreign operations is expected to increase as *FTR* increases. The coefficient of interest is β_1, which captures the extent to which firms protected from NPEs differ in their responsiveness to income shifting incentives relative to non-protected firms. If the adoption of anti-troll laws provides greater income shifting opportunities for U.S. MNCs, I predict β_1 to be greater than 0.

I tabulate the result of estimating Equation (4) in Table 7. Consistent with my prediction, I find that $\beta_1 > 0$ in the first two columns: multinational firms headquartered in states enacting anti-troll laws are significantly more responsive to outbound income shifting incentives relative to multinational firms that do not benefit from state-level protection against patent trolls. The results are robust to the inclusion of firm-level controls as well as to state economic conditions. In columns (3) and (4), I examine and find that the findings are more pronounced among multinational firms operating in the high-tech industry. Overall, the findings presented in Table 7 are consistent with APTL adoption incentivizing protected firms to engage in greater levels of patent-related income shifting and indicate that a potential reason that state corporate tax revenues are negatively affected following APTL adoption is because in-state multinational firms shift profits to overseas affiliates operating in lower-tax jurisdictions.

Section 6: Identifying Assumptions

6.1 Parallel Pre-Treatment Trends

The staggered implementation of anti-patent troll laws across different states at different times provides a relatively clean setting to test the potential effects of APTL adoption on state tax avoidance. However, deriving reliable inferences from such an estimation method is conditional on satisfying the parallel pre-treatment trends requirement. In this section, I provide evidence consistent with the parallel-trends assumption in three main ways.

First, I follow Appel et al. (2019) and provide visual evidence of parallel pre-treatment trends in Figure 2. In Equation (1), I replace *APTL* with period-specific indicator variables $t - i$ which equal 1 in the i years before the adoption of anti-troll laws for the treated observations. For example, $t - 1$ would equal 1 in the year before the adoption of APTL, and 0 in all other years. The coefficient on each variable captures the difference-in-differences estimate of the treatment effect relative to the control group in one specific year. I examine the coefficients in the four years before treatment and do not find an observable trend in state tax avoidance outcomes over this pre-treatment period prior to APTL passage between anti-troll firms and other firms. Further, I find that the coefficients are all close to zero, suggesting that there were no discernable differences in state tax avoidance outcomes between the treated and control groups prior to the adoption of anti-troll laws. Overall, Figure 2 provides evidence consistent with the parallel pre-treatment trends assumption.

Next, following Dayani (2023), I provide two types of placebo tests to examine whether there are any observable differences in state tax avoidance outcomes between the treated and control groups in any of the pre-treatment periods. I present the findings in the first two columns of Table 8. I find that the coefficient estimates on $t - 1$, $t - 2$, and $t - 3$ are all insignificant, indicating that state tax avoidance activities do not differ between the treated and control firms for up to three years before the adoption of anti-troll laws in the headquarter state. Further, I find that treatment effects are only observed in the year of APTL adoption, evidenced by a significantly negative coefficient on $t = 0$. Together, these findings indicate that there is no significant deviation in state tax avoidance outcomes between the treated and control firms in the absence of the treatment event.

Second, I conduct an extension of the placebo test where treated states are assumed to have adopted anti-troll laws 2 years before the true adoption date. To conduct the analysis, I replace *APTL* in Equation (2) with $APTL_{t-2}$, which is a binary variable equal to 1 in year *t-2* and in all subsequent years for the treated states.[39] The findings are reported in columns (3) and (4) of Table 4. In the absence of an actual treatment, I do not expect to observe any differences in state tax avoidance outcomes between firms headquartered in the pseudo-treated and non-treated states, and consistently, I find that the coefficient on $APTL_{t-2}$ is not statistically significant at conventional levels.[40] Overall, the evidence presented in Figure 2 and Table 8 indicate that 1) there was no statistically significant difference in state tax avoidance outcomes between the treated and control groups in the pre-treatment period, and that 2) treatment effects from anti-troll law adoption are only observed following true treatment events.

6.2 Cohort Matching

Recent studies have shown that, even with random treatment assignment, it is possible for a generalized DID model with staggered treatment events to yield a biased two-way fixed effect estimator (TWFE). For example, Baker et al. (2022) and Barrios (2022) demonstrate that heterogeneous treatment effects within groups over time could be a secondary source of bias in the TWFE when the earlier-treated observations act as a control group for the later-treated observations.[41] To mitigate such concerns, I estimate a cohort-matched DID regression model

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[39] In untabulated analyses, I find similar results when setting $APTL_{t-2}$ equal to 1 only during the pre-treatment years.

[40] In an alternate specification, I limit the sample to the pre-treatment period. Using period *t-4* as the baseline period, I find that the coefficients on *t-3* to *t-1* are insignificant and shows no trends in the predicted direction as well.

[41] Baker et al. (2022) and Barrios (2022) show that in the Goodman-Bacon (2021) decomposition of the average treatment effect of the treated (ATT), a bias can arise from both the variance-weighted common trend (VWCT), an extension of the parallel trend assumption for DID to a staggered multi-even setting, and from ΔATT, which captures time-varying and/or unequal treatment effects. When pre-treatment trends are indeed parallel, VWCT is equal to 0, but a careful implementation of a staggered DID model should still check for bias arising from ΔATT. Please refer to Equation (3) in Baker et al. (2022) and Equation (12) in Barrios (2022).

following Gormley and Matsa (2011) and Gormley and Matsa (2016) by forming four cohorts for each state anti-troll law enactment event year across 2013 – 2017.

Given the length of my sample period, I limit the measurement window of each cohort to the two years before and after the enactment of state APTLs. Each treatment cohort is matched with firms headquartered in states that did not enact state APTLs in the 4-year measurement window. I do not require firms to be in the sample for the full 4-year window and allow firms to be chosen as matches in multiple cohorts (e.g., matching with replacement). I then "stack" the data across cohorts and estimate the average treatment effect using the cohort-matched DID regression model specified below:[42]

$$SETR_{cisjt} = \beta_1 APTL_{cst} + \lambda X_{cist} + \rho_{cs} + \gamma_{cj} + \delta_{ct} + \varepsilon_{s,t} \qquad Eq. (3)$$

Equation (3) is specified in a similar fashion to Equation (1), but now includes cohort-state (ρ_{cs}), cohort-industry (γ_{cj}) and cohort-year (δ_{ct}) fixed effects to account for unobserved state, industry, and year heterogeneities for each treatment cohort.

Table 9 reports the results. Following the suggestions of Baker et al. (2022) and Barrios (2022), I first present the cohort-matched regression results without covariates in column (1), then with covariates in columns (2) and (3).[43] Consistent with the generalized DID research design results, I continue to find that the coefficient of interest is negative and statistically significantly different from zero across all three columns. I also find that, after adjusting for potential econometric issues, the economic magnitude of the main results further increase: rather than 0.77%, treated firms' *SETR* is 0.86% lower than that of non-treated firms following treatment. Using the

[42] In addition to mitigating concerns stemming from a staggered DID design, the cohort-matched approach also helps balance the pre- and post- periods for each treatment event.
[43] Both studies recommend researchers additionally present the two-way fixed effect DID estimator without covariates to rule out concerns that the results could be driven by the inclusion of covariates. For example, the parallel pre-treatment trends assumption may only hold after conditioning on observable covariates, or the covariates themselves could be affected by the treatment event.

same benchmark discussed in Section 5.1, this difference indicates that relative to unprotected firms, firms headquartered in anti-troll states lowered their state tax liabilities by 21% on average following APTL adoption. Overall, the results of both the generalized DID and cohort-matched DID specifications are consistent with my prediction that the enactment of state anti-troll laws induce greater state tax aggressiveness from protected firms.

6.3 Additional Identifying Tests

I conduct two additional tests to further corroborate the findings presented in Tables 2 and 3. First, a decreasing trend in state corporate income tax rates through time among adopting states may be a potential alternative explanation to the increase in state tax avoidance I observe following APTL adoption. For example, Table 1 Panel C shows that the average state corporate income tax rate is lower for adopting states in comparison to non-adopting states. In Figure 3, I provide an event-time plot of state corporate income tax rates between the treated and control states. While the state corporate income tax rates for non-adopting states remain relatively stable, I find a significant decrease among adopting states in year *t+1* on average. Figure 3 does provide evidence consistent with adopting states lowering corporate income tax rates over time, but it also mitigates the likelihood that a decreasing trend in corporate income tax rates among adopting states is a sufficient alternative explanation to my findings. Specifically, while I have documented an immediate treatment effect in year *t*, Figure 3 indicates that adopting states lowered corporate income tax rates beginning with year *t+1* on average.

Nonetheless, in addition to including state corporate income tax rates as a control variable in the main analyses, I more directly address this concern by limiting the sample to states with constant corporate income tax rates during my sample period.[44] If a decreasing trend in state corporate income tax rates among APTL-adopting states primarily explain the subsequent increase in state tax avoidance that I document, I would not expect to observe any treatment effects within this subsample. I present the findings in the first two columns of Table 10. Abstracting from the temporal variation of state corporate income tax rates, I continue to find that firms operating in adopting states increase state tax aggressiveness following treatment.

Second, I conduct a placebo test to strengthen the findings presented in Table 3 by examining whether state individual income tax revenue growth is affected by the implementation of state APTLs. Patent-related income shifting is the predicted channel through which state tax avoidance would increase post-APTL. Thus, while APTL adoption could negatively affect state corporate income tax revenues, there is no intuitive reason to expect that state individual income tax revenues would be affected by the enactment of anti-troll laws.[45] The latter three columns of Table 10 report the estimation of Equation (1) at the state-year level, where I employ state individual income tax revenue growth as the outcome variable. Consistent with anti-troll law adoption only influencing corporate tax revenue outcomes, I do not find that APTL adoption influences state individual income taxes in the concurrent and subsequent years.

7. Conclusion

In this study, I examine whether the staggered adoption of state anti-patent troll laws leads to greater tax aggressiveness by firms operating in anti-troll states. Motivated by the rapid growth

[44] Excluding states that do not levy income taxes on corporations, there are 29 states with unchanging state corporate income tax rates during my sample period: AK, AL, AR, CA, CO, DE, FL, GA, HI, IA, LA, MD, ME, MN, MO, MS, MT, NE, NJ, OK, OR, PA, SC, SD, TN, UT, VA, VT, WI.

[45] I caveat this discussion by noting that Appel et al. (2019) find an increase in employment following APTL passage, which could potentially increase state individual income tax revenues for adopting states. However, because these findings specifically relate to a small subset of firms (e.g., high-tech startups), I do not expect it to be a significant concern in these analyses.

in the number of non-practicing entities and in the amount of nuisance patent litigation cases in recent years, 34 state governments took action to protect local firms by enacting anti-troll laws designed to spur economic and innovative growth. Prior studies have predominantly shown that the passage of anti-troll laws have brought on positive social outcomes on average. However, the potential costs imposed by the enactment of state anti-troll laws have thus far been underexplored in the literature. A possible cost of implementing anti-troll laws that state legislators may not have accounted for is a loss in state tax revenues. Specifically, because a common tax avoidance strategy utilizes intangible assets to shift income to lower tax jurisdictions, an increase in within-state innovation resulting from the countermeasures taken against patent trolls could embolden protected firms to behave opportunistically by shifting profits to lower-tax subsidiaries located outside state borders.

I empirically test whether firms protected from patent trolls engage in greater tax avoidance relative to unprotected firms, and report three main findings. Consistent with corporate opportunism, I first find that firms headquartered in states implementing anti-patent troll laws associate with significantly lower state effective tax rates, and that adopting states' corporate income tax revenues are negatively affected. I provide direct evidence that intangible-related income shifting facilitates this ex-post increase in tax aggressiveness by showing that treated firms assign significantly more patents to states which do not tax corporate intangible income following APTL adoption. Last, I focus on multinational firms located in anti-troll states and find evidence consistent with anti-troll laws affecting cross-border income shifting as well.

Taken together, the evidence I present indicates that state-level intervention against patent trolls that were taken to protect local businesses could induce opportunistic behavior at the state governments' expense from the very firms that state legislators sought to protect. My study contributes to the literature on the relation between intangible assets and state tax avoidance, and the mechanisms which influence cross-border income shifting outcomes. To the best of my knowledge, my study is the first to show that state laws designed to encourage corporate innovation not only affect state tax avoidance outcomes, but also enable affected U.S. MNCs to shift more profits to lower-tax subs in foreign countries. Thus, my findings could have important policy implications for both state governments as well as for federal regulators. In addition, my findings shed light on the negative economic consequences engendered by the enactment of state anti-patent troll laws, which has not been explored in prior studies. While anti-troll laws may have achieved the intended purpose of protecting local businesses and building "a knowledge-based economy," it may also be harming the financial well-being of state governments that chose to lend a helping hand to local firms.

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Figure 1: Patent Filing in Event Time

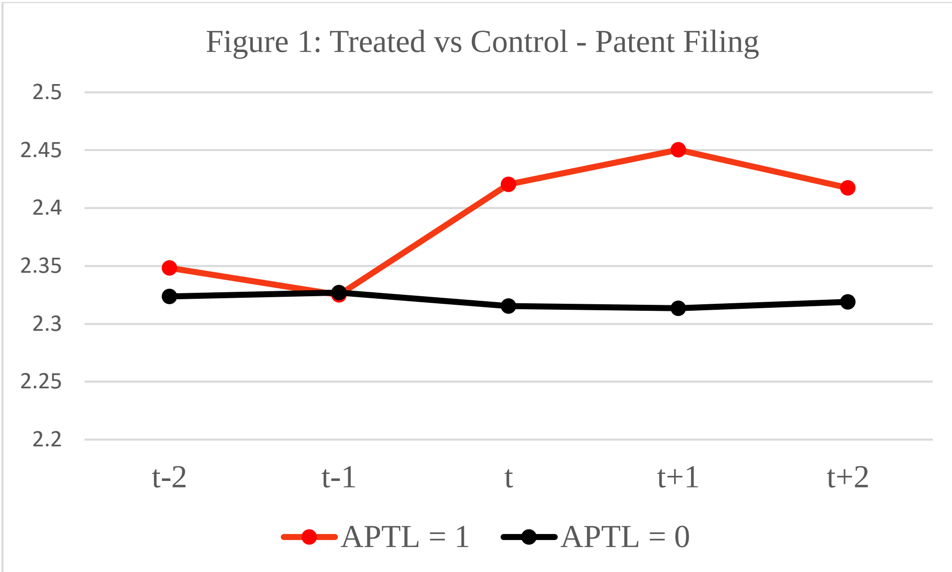

Figure 1 provides an event-time plot of the log transformed number of patents filed by firms headquartered in anti-troll law adopting states and non-adopting states.

Figure 2: Pre-Treatment Coefficient Plot

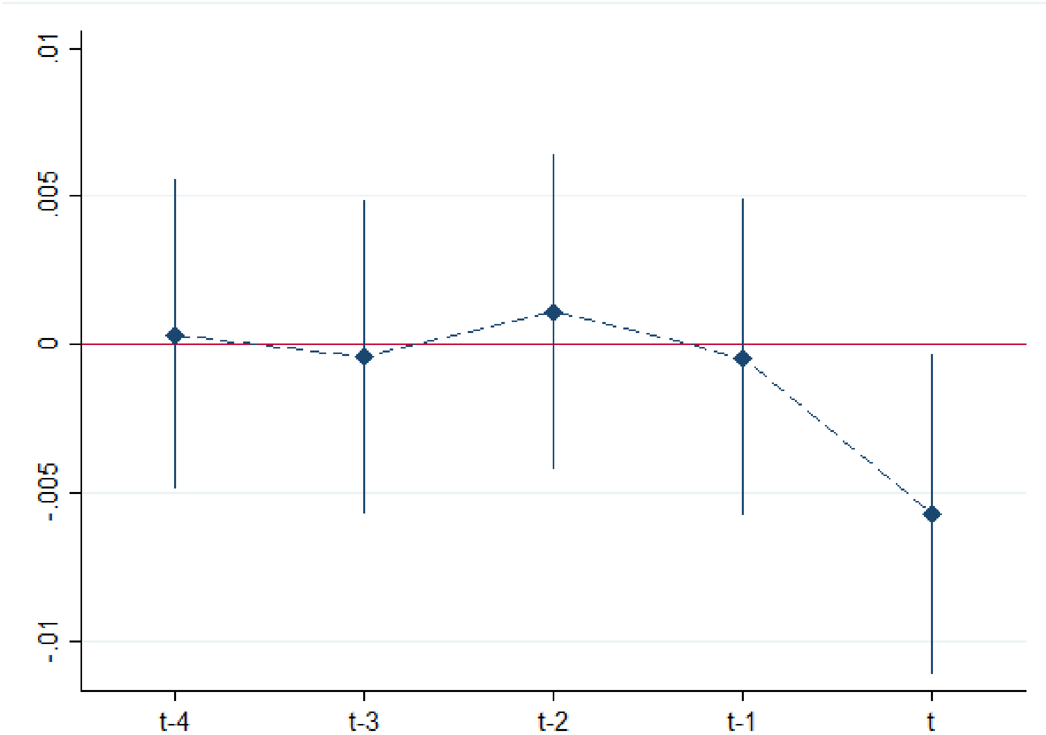

Figure 2 plots coefficients with 90% confidence intervals to provide evidence of parallel trends in the pre-treatment period. I obtain these coefficients from individual regressions of *SETR* on period-specific binary variables coded to 1 for *t*-4 to *t* and 0 otherwise. I omit firm- and state-level controls.

Figure 3: State Corporate Income Tax Rate

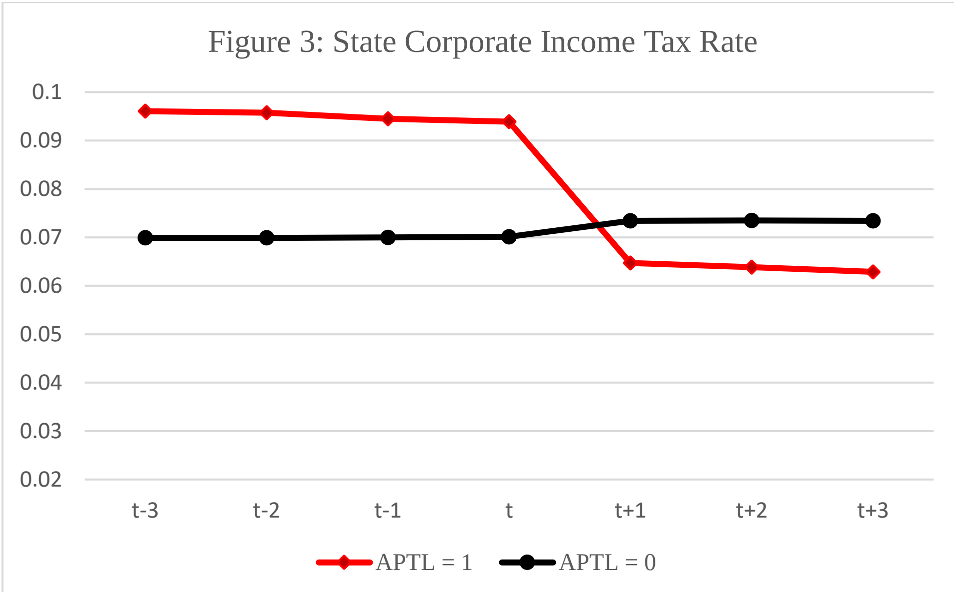

Figure 3 provides an event-time plot of the average state corporate income tax rate each period for anti-troll law adopting states and non-adopting states.

Appendix A: Adoption Dates of Anti-Patent Troll Laws and Addback Statutes by State

Anti-Patent Troll Laws		
State	Adoption Year	R&D Tax Credit
AL	2014	
AZ	2016	Y
CO	2015	Y
CT	2017	Y
FL	2015	Y
GA	2014	Y
ID	2014	Y
IL	2014	Y
IN	2015	Y
KS	2015	Y
LA	2014	Y
MD	2014	Y
ME	2014	Y
MI	2017	Y
MN	2016	Y
MO	2015	Y
MS	2014	
MT	2015	Y (Expired 2015)
NC	2014	Y
ND	2014	Y
NH	2015	Y
OK	2014	
OR	2014	Y
RI	2016	Y
SC	2016	Y
SD	2014	
TN	2014	
TX	2015	Y
UT	2014	Y
VA	2013	Y
VT	2014	Y
WA	2015	Y
WI	2014	Y
WY	2016	

Addback Statutes	
State	Adoption Year
AL	2001
AK	2004
CO	1999
GA	2006
IL	2005
IN	2006
KY	2005
LA	2016
MD	2004
MA	2002
MI	2008
MS	2001
NJ	2002
NY	2003
NC	2001
OH	1999
OR	2005
PA	2015
RI	2008 (repealed 2015)
SC	2005
TN	2004
VA	2004
WV	2009
WI	2009

APTL Adopting States by Year	
Year	N
2013	1
2014	17
2015	9
2016	5
2017	2
2018	0
Total	34

Appendix B: Variable Definitions

Dependent Variables	
FRoS	Foreign pre-tax income (PIFO) scaled by foreign sales from Compustat Historical Segments
Patents	The natural logarithm of one plus the number of patents filed in year t. Source: Kogan et al. (2017)
SETR	Current state income tax expense (TXS) divided by pre-tax domestic income (PIDOM) truncated at 0 and 1. If a firm has missing pre-tax domestic income, TXS is scaled by pre-tax income (PI) less special items (SPI) instead
StateTax_Corp	The year-over-year change in the log-transformed state corporate income tax revenues for each state in year t. Source: U.S. Census Bureau State and Local Finances
StateTax_Indiv	The year-over-year change in the log-transformed state individual income tax revenues for each state in year t. Source: U.S. Census Bureau State and Local Finances
Assign_NoTax	The natural logarithm of one plus the number of patents assigned to entities in the four states that do not tax corporate intangible income (Delaware, Nevada, Wyoming, Michigan. Source: USPTO
Independent Variables	
APTL	A binary variable equal to 1 in the current and all subsequent years if state *s* implements an anti-patent troll law (APTL) and equal to 0 otherwise.
FTR	Calculated as (US statutory tax rate - estimated foreign statutory tax rate). I estimate Foreign STR as foreign tax expense (TXFO + TXDFO) scaled by foreign pre-tax income (PIFO).
$APTL_{t-2}$	A binary variable equal to 1 from 2 years before state *s* implements an APTL and in all subsequent years, and equal to 0 otherwise
t = 0	A binary variable equal to 1 in the year in which state *s* adopts an APTL and equals 0 in all other years
t - 1	A binary variable which equals 1 in the year prior to the adoption of an APTL by state *s* and equals 0 in all other years
t - 2	A binary variable which equals 1 two years prior to the adoption of an APTL by state *s* and equals 0 in all other years
t - 3	A binary variable which equals 1 three years prior to the adoption of an APTL by state *s* and equals 0 in all other years
Control Variables	
RoS	Pre-tax income (IB) scaled by total sales (SALE)
Size	The natural logarithm of total assets (AT)
CFO	Operating cash flow (OANCF) scaled by beginning-of-year total assets (AT)
Leverage	Total liabilities (LT) scaled by beginning-of-year total assets (AT)
Tobin's Q	Computed as (abs(PRCC_F)*CSHO) + DLTT + max(0, DLC))/(LT + CEQ) and set to missing if CEQ is less than zero.

CapEx	Capital expenditure (CAPX) scaled by beginning-of-year total assets (AT)
FI	Pre-tax foreign income (PIFO) scaled by beginning-of-year total assets (AT)
ROA	Operating income before depreciation (OIBDP) scaled by beginning-of-year total assets (AT)
RD	R&D expenditures (XRD) scaled by beginning-of-year assets (AT)
NOL	A binary variable equal to 1 if a firm has tax loss carryforwards (TLCF) at the beginning of the year, and 0 if not
MTB	Market value of equity (PRCC_F * CSHO) divided by book value of common equity (CEQ)
StateTaxRate	The top corporate income tax rate for each state in each year. Source: Tax Foundation.
RDTC	A binary variable equal to 1 if state *s* had state-level R&D tax credits in place in year *t*, and 0 otherwise. This information is hand-collected for all U.S. states through online searches of state code legislation.
Δ*RealGSP*	The year-over-year change in real gross state product. Source: Bureau of Economic Analysis
ΔUnemployment	The year-over-year change in the state unemployment rate. Source: Bureau of Labor Statistics
Cross-Sectional and Other Variables	
AB	A binary variable equal to 1 in the current and all subsequent years if a firm's headquarter state *s* implements an Addback statute and equal to 0 otherwise.
HT	A binary variable equal to 1 for firms operating in high-tech industries (SIC codes 73 and 35) and equal to 0 otherwise following Cohen et al. (2019).

Table 1. Descriptive Statistics

The sample period is 2010 to 2018 and has been constructed as described in Section 4.1. Panels A and B report firm characteristics for the tax avoidance and innovation samples, respectively. Panel C provides descriptive statistics of the variables used in my analyses based on treatment status. All variables are winsorized at the 1% level. The construction of each variable is described in Appendix B.

Panel A: Tax Avoidance Sample

Variables	N	Mean	SD	25^{th}	Median	75^{th}
SETR	6,511	0.0365	0.0578	0.0019	0.0233	0.0454
$StateTax\_Corp_t$	412	0.0022	0.0314	-0.0063	0.0026	0.0107
$StateTax\_Indiv_t$	412	0.0021	0.0056	0.0008	0.0024	0.0041
APTL	6,511	0.2075	0.4055	0.0000	0.0000	0.0000
FRoS	8,357	0.0983	0.1289	0.0123	0.0592	0.1322
FTR	8,357	0.1500	0.5523	0.0388	0.1379	0.2911
RoS	8,357	0.0635	0.0708	0.0000	0.0441	0.0938
Size	6,511	7.4128	1.7891	6.1961	7.3661	8.5416
RD	6,511	0.0734	0.0900	0.0094	0.0336	0.1114
MTB	6,511	3.5664	5.3127	1.6490	2.6157	4.2600
Leverage	6,511	0.5636	0.2912	0.3664	0.5349	0.7048
NOL	6,511	0.7103	0.4536	0.0000	1.0000	1.0000
ROA	6,511	0.1585	0.0801	0.1044	0.1426	0.1929
FI	6,511	0.0370	0.0476	0.0047	0.0241	0.0577
CapEx	6,511	0.0401	0.0346	0.0174	0.0298	0.0506
StateTaxRate	6,511	0.0923	0.1481	0.0600	0.0800	0.0884
RDTC	6,511	0.7050	0.4561	0.0000	1.0000	1.0000
$\Delta RealGSP$	6,511	0.0231	0.0145	0.0143	0.0217	0.0335
$\Delta Unemploy$	6,511	-0.0882	0.0759	-0.1442	-0.1087	-0.0410

Panel B: Innovation Sample

Variables	N	Mean	SD	25^{th}	Median	75^{th}
Patents	5,348	2.5949	1.4803	1.3863	2.1972	3.4012
Assign_NoTax	5,348	0.5077	0.9211	0.0000	0.0000	0.6931
APTL	5,348	0.1647	0.3710	0.0000	0.0000	0.0000
Size	5,348	6.8621	2.1853	5.3108	6.7672	8.2961
ROA	5,348	-0.0275	2.1053	-0.0223	0.1119	0.1710
CFO	5,348	-0.0155	0.9870	-0.0041	0.0857	0.1407
Leverage	5,348	0.6077	3.7334	0.2955	0.5013	0.6906
Tobin's Q	5,348	2.7679	4.5933	1.4448	2.0398	3.1710
RD	5,348	7.4148	92.4527	0.0314	0.1154	0.2753
CapEx	5,348	0.0386	0.0478	0.0140	0.0267	0.0470
NOL	5,348	0.7530	0.4313	1.0000	1.0000	1.0000
RDTC	5,348	0.6167	0.4862	0.0000	1.0000	1.0000
$\Delta RealGSP$	5,348	0.0244	0.0155	0.0155	0.0238	0.0352
$\Delta Unemployment$	5,348	-0.0894	0.0768	-0.1442	-0.1111	-0.0410

Panel C: Characteristics by Treatment Status

	APTL = 1			APTL = 0		
Variables	N	Mean	Median	N	Mean	Median
SETR	3,028	0.0359	0.0248	3,483	0.0370	0.0215
StateTax_Corp	279	0.0025	0.0033	133	0.0015	0.0013
Assign_NoTax	2,149	0.6112	0.0000	3,199	0.4381	0.0000
LnPatents	2,149	2.5980	2.1972	3,199	2.5928	2.1972
StateTaxRate	3,028	0.0590	0.0625	3,483	0.0767	0.0884
RDTC	3,028	0.7050	1.0000	3,483	0.3603	0.0000
HT	3,028	0.0119	0.0000	3,483	0.0083	0.0000
AB	3,028	0.5347	1.0000	3,483	0.5676	1.0000
Size	3,028	7.4893	7.4793	3,483	7.3462	7.2108
RD	3,028	0.0474	0.0210	3,483	0.0959	0.0602
MTB	3,028	3.4079	2.4877	3,483	3.7043	2.7111
Leverage	3,028	0.5949	0.5652	3,483	0.5364	0.5051
NOL	3,028	0.6727	1.0000	3,483	0.7430	1.0000
ROA	3,028	0.1600	0.1447	3,483	0.1572	0.1402
FI	3,028	0.0329	0.0212	3,483	0.0406	0.0275
CapEx	3,028	0.0438	0.0320	3,483	0.0369	0.0273
Δ*RealGSP*	3,028	0.0217	0.0207	3,483	0.0243	0.0238
Δ*Unemploy*	3,028	-0.0919	-0.1000	3,483	-0.0850	-0.1111

Table 2: APTL and State Tax Avoidance

	Full Sample	HT = 1	HT = 0
	(1)	(2)	(3)
VARIABLES	SETR	SETR	SETR
APTL	**-0.0077*** **	**-0.0126** **	-0.0062
	(0.0020)	(0.0055)	(0.0045)
Size	0.0004	0.0011	0.0003
	(0.0006)	(0.0010)	(0.0009)
RD	-0.0299*	0.0318	-0.0007***
	(0.0197)	(0.0440)	(0.0002)
MTB	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0001)	(0.0000)
Leverage	0.0026	0.0261**	0.0093
	(0.0023)	(0.0127)	(0.0067)
NOL	-0.0065*	-0.0201***	-0.0043*
	(0.0033)	(0.0068)	(0.0025)
ROA	-0.0291**	-0.0840**	-0.0236*
	(0.0124)	(0.0324)	(0.0117)
FI	0.0152	0.0166	0.0223
	(0.0209)	(0.0194)	(0.0197)
CapEx	0.0331	0.0231	0.0409
	(0.0417)	(0.0783)	(0.0580)
StateTaxRate	-0.6468**	-0.0124***	-0.0015
	(0.2047)	(0.0039)	(0.0029)
RDTC	0.0007	-0.0033	-0.0000
	(0.0055)	(0.0205)	(0.0053)
ΔRealGSP	0.0817	0.1269	0.0349
	(0.00887)	(0.1418)	(0.0720)
ΔUnemploy	0.0118	-0.0050	0.0160
	(0.0202)	(0.0376)	(0.0163)
		Difference across groups (t-stat): 2.03**	
Observations	6,510	1,637	4,876
Year FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes

All variables are as defined in Appendix B. I use SIC codes 73 and 35 to identify high-tech (HT=1) firms (e.g., Cohen et al., 2019, Duan, 2023). Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 3: APTL and State Tax Revenues

VARIABLES	(1) StateTax_Corp$_t$	(2) StateTax_Corp$_t$	(3) StateTax_Corp$_{t+1}$
APTL	**-0.0047****	**-0.0047***	**-0.0035****
	(0.0018)	(0.0023)	(0.0014)
StateTaxRate		-0.0027	0.0126*
		(0.0096)	(0.0061)
RDTC		-0.0030	-0.0012
		(0.0033)	(0.0031)
ΔRealGSP		0.1779***	0.0147
		(0.0471)	(0.1006)
ΔUnemploy		-0.0155	-0.0696
		(0.0273)	(0.0435)
Observations	412	412	366
Year FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes

All variables are as defined in Appendix B. Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4: APTL and Patent Location

VARIABLES	(1) Assign_NoTax	(2) Assign_NoTax	(3) Assign_NoTax
APTL	**0.0699****	**0.0672*****	**0.0508****
	(0.0294)	(0.0190)	(0.0202)
Size		0.1953***	0.1964***
		(0.0206)	(0.0220)
ROA		-0.1335	-0.1345
		(0.0838)	(0.0862)
CFO		-0.0155	-0.0597
		(0.0541)	(0.0633)
Leverage		-0.0370	-0.0423
		(0.0290)	(0.0301)
Tobin's Q		-0.0051	0.0030
		(0.0074)	(0.0075)
RD		-0.0813	-0.1183
		(0.1131)	(0.1136)
CapEx		-1.1967**	-1.5056***
		(0.3613)	(0.3924)
NOL		0.0300	0.0257
		(0.0539)	(0.0537)
RDTC		-0.0303*	-0.0448**
		(0.0138)	(0.0143)
ΔRealGSP		-0.8865***	-0.8567**
		(0.2476)	(0.3120)
ΔUnemploy		-0.1565*	-0.1230
		(0.0832)	(0.0906)
Observations	5,348	5,348	5,348
Year FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Industry FE	No	No	Yes

All variables are as defined in Appendix B. Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5: APTL and Corporate Innovation

Panel A: Patent Filing

	(1)	(2)	(3)	(4)
VARIABLES	Patents	Patents	RD	RD
APTL	**0.1872*** **	**0.1369** **	**0.0165***	**0.0213** **
	(0.0601)	(0.0601)	(0.0095)	(0.0096)
Observations	5,348	5,348	5,348	5,348
Controls	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

All variables are as defined in Appendix B. Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel B: Pre-treatment R&D Expenditures

	(1)	(2)	(3)	(4)
VARIABLES	RD	RD	RD	RD
t - 1	**-0.0054**			**-0.0074**
	(0.0065)			(0.0067)
t - 2		**-0.0030**		**-0.0057**
		(0.0047)		(0.0055)
t - 3			**-0.0049**	**-0.0070**
			(0.0049)	(0.0051)
Observations	5,348	5,348	5,348	5,348
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

All variables are as defined in Appendix B. Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Addback Statutes

	AB = 0	AB = 1	AB = 0	AB = 1
	(1)	(2)	(3)	(4)
VARIABLES	SETR	SETR	Assign_NoTax	Assign_NoTax
APTL	**-0.0151*** **	-0.0042	**0.1357*** **	-0.0142
	(0.0047)	(0.0058)	(0.0389)	(0.0112)
	Difference across groups (t-stat): 1.70*		**Difference across groups (t-stat): 3.11*** **	
Observations	3,640	2,876	3,307	2,040
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

All variables are as defined in Appendix B. Firms affected by Addback statutes have AB equal to 1 and equal to 0 if not. Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 7: APTL and MNC Outbound Income Shifting

	Full Sample		HT = 1	HT = 0
	(1)	(2)	(3)	(4)
VARIABLES	FRoS	FRoS	FRoS	FRoS
APTL x FTR	**0.0003*** **	**0.0004*** **	**0.0003*** **	**-0.0012**
	(0.0001)	(0.0001)	(0.0001)	(0.0008)
APTL	-0.0084	-0.0085	0.0015	-0.0120*
	(0.0056)	(0.0053)	(0.0071)	(0.0065)
FTR	0.0002	-0.0002	0.0057	-0.0019
	(0.0029)	(0.0028)	(0.0059)	(0.0031)
RoS	0.9134***	0.8516***	0.8814***	0.8071***
	(0.0565)	(0.0707)	(0.1537)	(0.0718)
Size		0.0077***	0.0063**	0.0083***
		(0.0020)	(0.0030)	(0.0020)
MTB		0.0003	-0.0005	0.0009
		(0.0004)	(0.0003)	(0.0006)
Leverage		-0.0108	-0.0006	-0.0116*
		(0.0065)	(0.0152)	(0.0060)
NOL		-0.0039	0.0088	-0.0101
		(0.0065)	(0.0115)	(0.0069)
ROA		-0.0098	0.0358	-0.0268
		(0.0268)	(0.0450)	(0.0314)
CapEx		0.0309	-0.1442	0.0960
		(0.1084)	(0.1387)	(0.0963)
RDTC		0.0109	0.0264	0.0078
		(0.0074)	(0.0202)	(0.0073)
ΔRealGSP		0.1215	0.0768	0.1460
		(0.1115)	(0.1516)	(0.1246)
ΔUnemploy		0.0085	-0.0110	0.0206
		(0.0211)	(0.0286)	(0.0257)
			Difference across groups (t-stat): 1.72*	
Observations	8,357	8,357	2,318	6,039
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

All variables are as defined in Appendix B. Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Identifying Assumptions

VARIABLES	(1) SETR	(2) SETR	(3) SETR	(4) SETR
t = 0	**-0.0077****	**-0.0082****		
	(0.0033)	(0.0039)		
t - 1	-0.0028	-0.0027		
	(0.0043)	(0.0043)		
t - 2	0.0061	0.0060		
	(0.0046)	(0.0049)		
t - 3	-0.0003	-0.0004		
	(0.0034)	(0.0036)		
$APTL_{t-2}$			**-0.0035**	**-0.0034**
			(0.0030)	(0.0030)
Observations	6,510	6,510	6,510	6,510
Controls	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

All variables are as defined in Appendix B. The set of controls are the same as those featured in Table 2. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Cohort Matching

	(1)	(2)	(3)
VARIABLES	SETR	SETR	SETR
APTL	**-0.0072***	**-0.0086***	**-0.0085***
	(0.0039)	(0.0044)	(0.0048)
Observations	10,264	10,264	10,262
Controls	No	Yes	Yes
Cohort x Year FE	Yes	Yes	Yes
Cohort x State FE	Yes	Yes	Yes
Cohort x Industry FE	No	No	Yes

All variables are as defined in Appendix B. Column (2) and (3) utilize the set of controls featured in Table 2. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 10: Additional Identifying Tests

	Constant Tax Rate States		All States		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	SETR	SETR	StateTax_ $Indiv_t$	StateTax_ $Indiv_t$	StateTax_ $Indiv_{t+1}$
APTL	**-0.0071***	**-0.0081***	**0.0006**	**0.0007**	**-0.0000**
	(0.0037)	(0.0047)	(0.0008)	(0.0006)	(0.0007)
Observations	3,894	3,894	414	414	368
Controls	No	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes

All variables are as defined in Appendix B. Columns (1) and (2) limit the sample to states which have constant state corporate tax rates during my sample period. Standard errors in parentheses are robust to heteroscedasticity and clustered at the state level. ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.