International Review of Law and Economics 66 (2021) 105979

Contents lists available at ScienceDirect

International Review of Law and Economics

How does liability affect prices? Railroad sparks and timber

Colin Doran [a,*], Thomas Stratmann [b]

[a] Regulatory Economics Group, LLC, United States
[b] George Mason University, United States

ARTICLE INFO

Article history:
Received 29 December 2020
Accepted 15 January 2021
Available online 19 January 2021

Keywords:
Liability
Property rights
Law and economics
Event study

ABSTRACT

This paper analyzes how judicially-determined liability assignments affect valuations and prices. On two occasions in 2007, a railway company caused a fire to break out in the State of Washington. The two fires burned down some of the neighboring properties' timber. These two incidents led to two companion court cases that made it all the way to the Washington Supreme Court. The court rulings, both made on May 31, 2012, held that the railway company was not liable for timber damages under Washington's timber trespass statute, despite having acted negligently. As a consequence of these decisions, economic theory predicts a decrease in the value of timber in those areas associated with higher risk of fire, and an increase in the value of Washington railway companies. Using a triple difference model and an event study, we test and find evidence supporting this prediction.

1. Introduction

In an economy characterized by costless market transactions and well-defined property rights, the outcome of the dispute is independent of the initial allocation of the rights.[1] Underlying this theoretical construct is the idea that the parties will negotiate until they maximize their surplus, given the initial allocation of rights. However, when a court assigns liability, there may be economic effects. This is particularly true when the ex ante rights are not well-defined and market transactions are costly. Therefore, changes in liability assignments can affect the valuation of goods. In fact, "courts directly influence economic activity" when they assign liability to a disputed issue where market transactions are costly and the initial rights are unclear (Coase, 1960, 19).

Various economic models show how liability assignments affect economic activity (*e.g.*, Calabresi and Melamed, 1972; Brown, 1973; Diamond, 1974; Shavell, 1980a, b; Landes and Posner, 1980; Shavell, 2007). However, there is still only a limited literature on empirically testing how liability assignment affects economic activity (*e.g.*, Hill and Kiewiet, 2015; Beltrametti and Marrone, 2016). In a related literature, scholars study how United States Supreme Court decisions affect equity prices (*e.g.*, McWilliams et al., 1993; Hersch, 1994; Stratmann and Verret, 2015; Christensen and Hausman, 2016). Here, scholars study the effect that liability assignments have on the valuation of firms. This paper contributes to both literatures in that it empirically estimates the impact that liability assignment has on the valuation of a commodity and of a firm.

There is a challenge in estimating the effect of liability assignments on prices due to the fact that the liability rule may already be embedded in the price. We attempt to overcome this identification issue by studying the effect of a court decision that clarified liability assignments associated with damage resulting from accidental fires. We argue that the outcome of the court decision had an element of surprise as the parties may have anticipated a different outcome in light of the situational facts of the case. The specific case we study involved sparks from railroads that set neighboring property and timber on fire. In that case, the court, rather than applying a timber trespass statute or waste statute, chose to strictly construe a statute to hold that the timber owners' only remedy was common law negligence. Considering how courts in neighboring states had previously interpreted similar situations, the actors may have assumed that the railway companies would be strictly liable for such damages.[2]

We test the effect of the change in expectations about liability assignments by analyzing how the court's decision impacted the winners and losers of the decision. We first test the hypothesis that the timber owners were negatively impacted by estimating the loss

* Corresponding author.
E-mail address: cdoran3@gmu.edu (C. Doran).

[1] See Coase (1960).

[2] In Oregon (a neighboring state), there is evidence that the court would have ruled differently. See *Wyatt v. Sweitz,* 146 Or. App. 723, 728, 934 P.2d 544, 546–47 (1997); Also, the case ended in a 6–3 decision in a court where 70 % of the cases are basically unanimous (*i.e.*, 9–0 or 8–1). *Jongeward v. BNSF R. Co.*, 174 Wash. 2d 586, 612, 278 P.3d 157,170 (2012). See Appendix A.3 for a table of the percentages.

https://doi.org/10.1016/j.irle.2021.105979
0144-8188/

they incurred for their timber sales now that the auction winners had to assume additional fire liability. We then test the hypothesis that railway companies were positively impacted by estimating the change in their market value following the court decision.[3]

On two separate occasions in 2007, the operations of the Burlington Northern Santa Fe, LLC railway company ("BNSF") accidently sparked fires that burned down neighboring property to their railway in Washington State. Along with other property damage claims, the plaintiffs sued for triple damages for their burnt timber.[4] To correctly establish liability under Washington State's timber trespass statute, two U.S. District Courts certified questions to the Washington State Supreme Court on whether BNSF violated Washington's timber trespass statute and therefore owed triple damages for the timber. The two cases, *Broughton Lumber Co. v. BNSF Ry. Co*. (hereafter, *Broughton*) and *Jongeward v. BNSF R. Co*. (hereafter, *Jongeward*), became companion court cases in the State of Washington's highest court.[5] The court decisions, dated May 31, 2012, stated that BNSF would not be liable for *single or triple* damages to the plaintiff's timber under Washington's timber trespass statute or Washington's fire act. The plaintiffs were only awarded a common law remedy for negligence by the railway.[6]

To test how the court's assigned liability affected the price of timber, we estimate a triple interaction model and a triple difference model that analyzes timber auction prices associated with higher risk of catching fire, before and after the court case, in three Western states: Washington, Oregon, and Idaho. Oregon and Idaho are used as control states.[7]

To estimate how the ruling affected the value of railroad companies, we conduct an event study to test how the liability assignment affected the value of the railway companies operating in Washington State.[8] Overall, our findings show a decrease in the value of timber associated with higher risk of fire damage, and an increase in the value of railway companies operating in Washington State following the two court decisions. In particular, timber prices fell in areas of high burn probability, as well as in areas with close proximity to railroads. These findings are consistent with economic models showing how court rulings affect economic activity.

Section II describes the context of the two court cases. Section III discusses the Washington Railway Companies and the relevant information pertaining to them. Section IV and V present the conceptual framework and empirical models, respectively. Section VI discusses the data. Section VII presents the findings. Section VIII concludes the study with a brief discussion.

2. The court cases

In August 2007, a fire broke out in southwest Spokane, Washington. The fire destroyed 365 acres of land located nearby, but not adjacent to, the railroad. The property damage included over 4,000 trees.[9] The fire was named the Marshall Complex Fire.[10] An internal investigation by BNSF determined that an employee did not properly clean the carbon retention traps on the train. The Washington Department of Natural Resources (WADNR) attempted to investigate the cause of the fire, but were denied access to the BNSF train. The WADNR ultimately determined that the BNSF train started the fire. To reach that conclusion, they eliminated other possible causes of the fire.[11] On January 12, 2009, 11 property owners filed a complaint with the United States District Court for the Eastern District of Washington.[12] In the complaint, they alleged that the defendant, BNSF Railway Company, caused the fire and resulting damages.

The second fire occurred in September 2007 near Underwood, Washington. The fire destroyed 62 acres of land.[13] It was determined that the fire was started by a process known as "grinding," which is used to extend the life of railroad tracks. BNSF, and its contractor, Harsco Corporation, were grinding the tracks when the fire broke out. In 2009, the plaintiff, Broughton Lumber Company, filed a complaint with the United States District Court for the District of Oregon.[14] The two defendants, BNSF and Harsco Corporation, admitted they had acted negligently in causing the fire.

In both complaints, the plaintiffs sought triple damages for their destroyed timber under Revised Code of Washington (RCW) 64.12.030. The former version of RCW 64.12.030 was in place at the time of the fires and had been the statute since 1869. It officially became Washington's timber trespass statute at statehood.[15]

> Whenever any person shall cut down, girdle or otherwise injure, or carry off any tree, timber or shrub on the land of another person, or on the street or highway in front of any person's house, village, town or city lot, or cultivated grounds, or on the commons or public grounds of any village, town or city, or on the street or highway in front thereof, without lawful authority, in an action by such person, village, town or city against the persons committing such trespasses or any of them, if judgment be given for the plaintiff, it shall be given for treble the amount of damages claimed or assessed therefor, as the case may be (Wash. Rev. Code Ann. § 64.12.030).

In 1869, the territorial legislature also passed RCW 64.12.040, which served as a "mitigation provision." It stated that "involuntary or casual" trespass would result in a single damage payment.

In Washington state, a plaintiff must bring a timber trespass claim under RCW 64.12.030. Once the plaintiff demonstrates that trespass occurred on their land, the burden shifts to the defendant to show that the trespass was either involuntary or casual. If it is determined that the trespass was involuntary or casual, then the plaintiffs may recover only single damages, as opposed to triple.

The Washington State Supreme Court has nine judges that review federally certified questions de novo.[16] The United States District Court of the Eastern District of Washington certified three questions in *Jongeward* and the United States District Court of Ore-

[3] We test our theory on both Burlington Northern Santa Fe, LLC and Union Pacific, the two major railroad companies in Washington State. Washington State is second in activity for these two companies in the region, behind California. This is measured by the number of railcarts originating in the state. See Appendix A.4 for table. Therefore, the effect on their business from the decision was not insignificant.

[4] Wash. Rev. Code Ann. § RCW 64.12.030. See Broughton Lumber Co. v. BNSF Ry. Co., 2010 WL 348362, at *1 (D.Or.,2010), where the estimated damages after trebling was in excess of ten million dollars.

[5] A companion court case is a case that is heard with another case because it involves similar or related questions of law (Definition from www.FindLaw.com).

[6] Importantly, the dissenting opinion argued that the ruling virtually eliminated involuntary timber trespass, putting the state's timber trespass statute at odds with a majority, if not all, of the other jurisdictions in the United States.

[7] The main variables are the timber auction area burn probability and the location of the timber auction in relation to a railway.

[8] There are two major public railway companies in Washington State: Burlington Northern Santa Fe, LLC, who is owned by Berkshire Hathaway Inc., and Union Pacific Railway.

[9] Information on the fire is taken from district court case: *Jongeward v. BNSF Railway Co.*, 2010 WL 5394873, at *1 (E.D.Wash.,2010).

[10] See https://www.seattletimes.com/seattle-news/landowners-suit-accuses-bnsf-of-causing-wildfire/

[11] *Jongeward v. BNSF Railway Co.*, 2010 WL 5394873, at *1 (E.D.Wash.,2010).

[12] *Jongeward v. BNSF Railway Co.*, 2012 WL 7760873, at *1 (E.D.Wash.,2012).

[13] Information on the fire is taken from the district court cases: *Broughton Lumber Co. v. BNSF Ry. Co.*, 2010 WL 348362, at *1 (D.Or., 2010).

[14] Based on the location of the fire, the Court for the District of Oregon had jurisdiction.

[15] In July 2009, the statute was amended slightly to include Christmas trees (WA Legis. Assemb. 1137 Reg. Session 2009).

[16] See *Broughton Lumber Co. v. BNSF Ry. Co*. De novo means the court considers "the legal issues not in the abstract but based on the certified record provided by the federal court."

gon certified one question in *Broughton*.[17] The U.S. District courts certified the questions for clarity on Washington State's timber trespass statute. As mentioned at the outset of this paper, the two cases ended up as companion court cases at the Washington State Supreme Court, and were both decided on May 31, 2012.[18] The main question contemplated by the court was whether RCW 64.12.030 allowed the plaintiffs to collect triple damages on the value of their burnt timber from the fires started by BNSF (and together with Harsco in *Broughton*).[19] The court argued that since RCW 64.12.030 and RCW 64.12.040 "relate to the same subject matter, they must be construed together." As a result, the court also considered whether the plaintiffs could collect single damages on their burnt timber.

The plaintiffs argued that the court should analyze the statute using the plain meaning of the term "otherwise injure,"[20] and that the term was a "catchall" category in the statute. The court, on the other hand, determined that this reading of the statute was "too limited," as it focused on only one phrase. Rather, the court determined that the statute's meaning must be "discerned from all that the Legislature has said in the statute," and that a plain meaning analysis should start with the word "trespass." Using a common law distinction to determine the meaning of "trespass," the court determined that it had two original meanings: trespass on the case and trespass *vi et armis*. Trespass on the case is an act of indirect or collateral injury. Trespass *vi et armis* is "[a]ny unlawful act committed with violence, actual or implied, to the person, property, or rights of another." It is also described as "an act done which is in itself an immediate injury to another's person or property."[21] Citing Judge Bouvier's Law Dictionary of 1867, the court argued that "trespass on the case" had been dropped from the common law in favor of the term "actions on the case." Therefore, the court determined that when the two statutes were enacted, "the term 'trespass' had a 'well ascertained and fixed meaning'," and that "it did not refer to indirect acts or culpable omissions causing collateral damage, but only to direct acts causing immediate injuries." The court decided that the original intent of the statute was for the word trespass to "carry" this "restrictive meaning," and not be applied to consequential injury.

The defendant's argument relied on Washington's fire act, RCW 4.24.040-.060. They argued that the fire act, rather than the timber trespass statute, should be applied. The fire act establishes an "action on the case" against someone who causes a fire and allows it to spread. Under the fire act, the defendant is only liable for single damages. The court, however, did not agree with the defendant's argument, reasoning that under previous precedent, the fire act had only been applied to *purposefully* kindled fires.[22]

After determining that the fire act did not apply, the court used case law and the structure of the timber trespass statute to find that the statute was not remedial, but rather penal in nature.[23] Therefore, the court determined that it could not divide the statute into penal (RCW 12.64.030) and remedial components (RCW 12.64.040).

The court disagreed with the argument put forth by the Broughton Lumber Company (a plaintiff in the case) that the timber trespass statute should "comport with the modern view of trespass." The court argued that the timber trespass statute "does not supply a common law remedy, but imposes punitive damages for specifically delineated acts." The court cited multiple cases showing direct trespass damage, not collateral damage.

Ultimately, by a vote of six to three, the Washington Supreme Court ruled that BNSF Railway (and Hasbro Corporation in *Broughton*) would not be liable for single or triple damages under Washington's timber trespass statutes, as the statutes did not apply to the situation in question. Given that the statute did not apply, the court used "judicial restraint" and did not rule on damages. Importantly, the court noted timber trespass cases from surrounding states in which courts had ruled in favor of the plaintiff; however, the court ultimately determined that those states had broader statutes pertaining to timber trespass.

The dissenting opinion cited two major objections to the majority opinion. First, it argued that the ruling "virtually eliminates" involuntary trespass. Second, it argued that the ruling put Washington at odds with other jurisdictions in the United States. Further, the dissenting judges wrote that the majority opinion "unnecessarily limits" relief for future plaintiffs, defies "the language of the statute," "subverts its purpose," and "places us [Washington State] at odds with other jurisdictions including Oregon, on whose statute ours is based."[24]

The dissenting opinion agreed that the plaintiffs in both cases "may be unable to recover treble damages." However, it suggested that the legislature wrote RCW 64.12.040 for the purpose of involuntary damage, and that the Supreme Court's decision took the timber trespass statute in an entirely new direction. The dissent argued that the court's opinion used a "distinction from the English common law that neither party [the plaintiffs and the defendants] advocates," and criticized the majority for its strict interpretation of the term "trespass." Additionally, the dissent argued that the court's strict interpretation of the word "trespass" undermined RCW 64.12.040, making it "extremely unlikely" that any plaintiff would ever recover single damages for involuntary trespass by limiting recovery to a mistaken belief of ownership.

Finally, the dissent stated that Washington State had borrowed its trespass laws from Oregon, who in turn, had borrowed its own trespass laws from the New York Field Code. The dissent pointed out that neither of these states uses the common law distinction of the word "trespass." Likewise, the dissent noted that it is unlikely that the Washington State legislature wanted to create a different statute than Oregon, from whom they had borrowed the text of their statute. The dissent suggested that the ruling "contradicts" New York, Oregon, and Alaskan law. In support, it cited various cases from courts across the nation, *e.g.*, a case in Oregon, in which a truck slid off the road and damaged trees (*Wyatt v. Sweitz*, 146 Or. App. 723, 728, 934 P.2d 544, 546–47 (1997)), and the plaintiffs collected damages for casual and involuntary timber trespass. Further, the dissent points out that Oregon has interpreted "[c]ausal or involuntary" as "encompassing accidental and even as 'non-negligent, non-volitional trespass'." And that a case in Alaska interpreted "casual" as an "accident or negligence," while a case in New York defined "casual or involuntary" as "accidental." Thus, the dissent concluded that "Oregon, Alaska, and New York all allow timber trespass liability on accidental, negligent, or involuntary

[17] See the Appendix A.1 for the certified questions.

[18] A companion court case is a case that is heard with another case because it involves similar or related questions of law (www.FindLaw.com).

[19] The first question in *Jongeward*: Does a defendant who negligently causes a fire that spreads onto a plaintiff's property, and damages or destroys the plaintiff's trees, "otherwise injure" trees, timber or shrubs for purposes of [former] RCW 64.12.030? The only question in *Broughton* was: Can a plaintiff recover damages under [former] RCW 64.12.030 for trees damaged by a fire that spreads from a defendant's neighboring parcel, where the alleged acts or omissions of the defendant were not directed at plaintiff's trees or property, and did not occur on plaintiff's property?

[20] The quoted phrases in the current section of this paper are excerpts taken from the opinions in both *Broughton Lumber Co. v. BNSF Ry. Co.*, 174 Wash. 2d 619, 2012 (Wash., 2012) and *Jongeward v. BNSF R. Co.*, 174 Wash.2d 586 (Wash., 2012). Black's Law Dictionary (10th ed. 2014) defines a plain meaning analysis as, "The doctrine that if a legal text is unambiguous it should be applied by its terms without recourse to policy arguments, legislative history, or any other matter extraneous to the text unless doing so would lead to an absurdity."

[21] Trespass *vi et armis* is also known as Trespass proper.

[22] *Jordan v. Welch*, 61 Wash. 569 (Wash. 1911). The court points out that the plaintiff's remedy is limited to common law damages.

[23] A plaintiff can only bring a claim for RCW 64.12.030.

[24] *Jongeward v. BNSF R. Co.*, 174 Wash. 2d 586,607,610, 278 P.3d 157,167-68 (2012)

trespass," and that the plaintiffs should be able to recover single damages for casual or involuntary trespass.[25]

3. Washington state railway companies

Burlington Northern Santa Fe Corporation was the main defendant in both court cases. At the time of the fires and initial complaints, BNSF was an independent publicly-traded company (Ticker: BNI). As an independent railway company, Berkshire Hathaway Inc. (hereafter, Berkshire Hathaway) was a large stakeholder in BNSF. On November 3rd, 2009, Berkshire Hathaway announced its intent to purchase the remainder of BNSF. It finalized terms on February 10th, 2010 to purchase the remaining 77.5 percent of BNSF shares for roughly 26.5 billion dollars.[26] At the time, the acquisition was Berkshire Hathaway's largest purchase to date.[27] The acquisition of BNSF immediately altered Berkshire Hathaway's earnings composition. In 2010, roughly 21 percent of Berkshire Hathaway's earnings came from BNSF, and the earnings that BNSF contributes to Berkshire Hathaway have "fluctuated between 18 percent and 29 percent" since the purchase.[28]

Given the difficulty in measuring how much of an effect BNSF has on Berkshire Hathaway's common stock, we include the other major railway company in Washington, Union Pacific Railway (ÜNP), whose operations were also affected by the ruling.[29] At the time of the incidents, the former BNSF and Union Pacific Railway were relatively similar in size and revenue.[30]

As for news surrounding the date, there are no known major financial news sources discussing the court ruling. The only known major news for BNSF on May 30th and May 31st was that it announced various capital investment programs into state railways.[31] The only other news that stood out during the days surrounding the ruling was that Berkshire Hathaway would be added to the Dow Jones Global Titan 50 Index, along with five other stocks.[32] Importantly, the timing of the court decision did not coincide with quarterly earnings, as Berkshire Hathaway's first and second quarter earnings were reported on May 4th, 2012 and August 3rd, 2012, and Union Pacific's first and second quarter earnings were reported on April 19th, 2012 and July 20th, 2012.[33]

4. Conceptual framework and theory

The two courts cases in this study have a particularly helpful setup for testing the economic effects of liability assignment. First, the fact that litigation occurred at all shows that the two parties were uncertain of the outcome; therefore, valuations before the decision reflected uncertainty about the outcome of this scenario, while valuations after the decision reflect more certainty.[34] Further, the reason that the United States District Court certified questions to the Washington State Supreme Court is that the issue was unresolved. Therefore, prior to the court decision, both entities were acting under uncertainty with respect to their rights, as there was no settled legal precedent in Washington State. Last, the final vote on the certified questions was 6–3, which indicates that there was disagreement, even among the judges, over the interpretation of the statute and its application.

Coase (1960) discusses the economic efficiency of tort decisions, while also commenting on scenarios that involve high transaction costs. In discussing high transaction costs, Coase specifically uses the example of a railway that burns down the neighboring woods. The reason that transaction costs are high for a railway company is that it is costly to negotiate with each adjacent owner to the railway. This is an example where Coase argues that court liability assignment directly influences economic activity, and this is especially true when legal results cannot be easily forecast. Additionally, Demsetz (1972) discusses Coase and the rule of liability, and argues that "once significant transacting or negotiating cost is admitted into the analysis (25)," liability assignment will have both allocative and wealth effects. The fact that the case examined in this paper had an uncertain outcome coupled with a high transaction cost situation, provides an opportunity to test the theory that court liability assignment has economic effects where transaction costs are high and the outcome is uncertain.

The situation also provides an opportunity to test the direction of the effects of the liability assignment. First, the court decision shows that collecting damages from accidental fires in the future may prove difficult. In the Washington case, the plaintiffs had a remedy from common law negligence. However, in future cases, a defendant, such as a railway company, may not be liable for damages if they are able to show that they acted with due care (*i.e.*, there was a genuine accident). This shifts the demand curve for timber associated with higher risk of fire downward, so that at any given quantity offered in the market, the timber price will be lower. The downward shift is caused by the waste and trespass statute not being interpreted as strict liability statutes, coupled with the fact that the only remedy to recover damages is common law negligence.[35] Therefore, the outcome of the case predicts that timber associated with higher risk of fire damage will decrease following the court case in Washington.

Next, we use a basic activity level model for railway companies.[36] The activity model predicts that the ruling negatively affected the value of timber near railways and positively affected the value of railway companies. To test this model, we assume that, prior to the case, both parties were operating under the assumption that the waste and trespass statutes in Washington (RCW 64.12) were more plaintiff-friendly than common law. This assumption includes that the plaintiffs believed there was a probability greater than zero that the timber trespass statute imposed treble damages for burning down timber, or that even if a defendant involuntarily or casually burned down timber, they would be held liable under the

[25] *Jongeward v. BNSF R. Co.*, 174 Wash. 2d 586,612,613, 278 P.3d 157,170 (2012)

[26] Page 40, Berkshire Hathaway 2010 Annual Report (http://www.berkshirehathaway.com/2010ar/2010ar.pdf).

[27] See: http://www.foxbusiness.com/markets/2015/08/10/berkshire-hathaway-five-biggest-aquisitions.html. In 2015, Berkshire Hathaway acquired Precision Castparts Corp for 37.2 billion dollars.

[28] https://www.bloomberg.com/gadfly/articles/2016–11-11/berkshire-hathaway-bnsf-railroad-deal-shines-bright-in-hindsight

[29] The link shows the Association of American Railroad's Map of Washington State's Freight Railroads: https://www.aar.org/data-center/railroads-states#state/WA

[30] https://seekingalpha.com/article/2824356-valuing-berkshire-via-burlington-northern-santa-fe-railway

[31] For example see: (May 30, 2012) *BNSF announces capital programs in Montana, Texas, South Dakota*. "MarketLine NewsWire," Retrieved from Nexis Uni database; (May 30, 2012) BNSF Plans 86 Million Capital Program in North Dakota to Maintain and Expand Rail Capacity, 2012. "Business Wire", Retrieved from Nexis Uni database.

[32] (May 31, 2012) *BASF SE, Berkshire Hathaway, Commonwealth Bank of Australia Among Five Stocks Added to Dow Jones Global Titans 50 Index*. "Targeted News Service", Retrieved from Nexis Uni database. Two additional US stocks—McDonalds and Qualcomm—were added on this date. We run an event study on the three firms that were added to the index to check whether there is an "inclusion effect." We find that on the day of the event (May 31, 2012) the abnormal return is 0.29 percent and the estimate is not statistically significant. On the day following the event, we find that the abnormal return is -0.23 percent and the estimate is not statistically significant.

[33] https://www.sec.gov/

[34] See Gould (1973) for a model of legal conflict.

[35] The waste statute and timber trespass statute cannot apply at the same time (See RCW 4.24.630). The waste statute also requires a person to go onto the land of another.

[36] See Cooter and Ulen (2016) and Miceli (2017) for the source of this model. See Appendix A.2 for a contract for timber in Washington where the risk of a fire is transferred from the supplier to the consumer once sold. This helps the analysis, since the purchaser of timber bears the cost of any fire.

timber trespass statute.[37] Thus, parties were operating under a rule similar to a "strict liability" rule for fire damage to timber. Therefore, following the court case, the parties updated their beliefs that the only remedy for such a situation is common law negligence.

Let the railway company's activity be a, and return benefits of $B(a)$ to the railway company. Assume that $B(a)$ is single peaked and has a unique maximum, a_m. The railway's total expected costs are $c + L(c)$, where c is the cost of precaution and $L(c)$ is the expected damage from an accident.[38] L(c) is decreasing in c, and assumed to be decreasing at a decreasing rate, thus $L'(c) < 0$ and $L''(c) > 0$.

Each time the railway company engages in an activity, its total cost of the activity is its expected costs times the amount of activity, a: $a[c + L(c)]$. The optimum is:

$$max\, B(a) - a[c + L(c)] = B'(a) - (c + L(c))$$

The optimum activity, $a*$, is where the marginal benefit of activity is equal to the marginal accident cost. If there is no cost to an accident, the railway company selects a_m. Using the expected ruling of strict liability, the railway company must select an $a*$ as their optimum that is below a_m. The reason is that in the case of an accident, they owe damages payments of $L(c)$, plus the cost of c. Thus, under a strict liability ruling with respect to accidental timber damages from a fire, the railway company selects $a*$ that maximizes their activity given they are liable for accidental fires.

Under a negligence ruling, the activity outcome is different. The railway will not select $a*$ as the optimum. Since the railway company is not liable if it can prove it showed due care, it chooses a_n by maximizing $B(a) - ac$ so that $B'(a) = c$. If $L(c)$ is positive, then $c < c + L(c)$, and since we assumed that $B(a)$ is single peaked with a unique max a_m, $a^n > a*$. Importantly, the difference in the two activity levels will be greater the larger the expected harm $L(c)$. By having more certainty of a negligence ruling rather than a strict liability ruling, the railway company can increase its activity.

Given this outcome for railway companies, timber purchasers now update their beliefs about the railway's activity levels (*i.e.*, the railway can run more trains due to a lower expected cost of an accident), and also update their beliefs about the rights to their property (*i.e.*, the rights are not as protected as in a situation of strict liability). Thus, the activity model and its implications predict that timber values associated with accidental railway fires decrease, and that railway companies should increase in value.

5. Empirical strategy

To test the effect of unexpected liability assignment due to the court ruling, we employ auction prices from state timber harvest sales. Given that the court opinion applied to the entire state of Washington, we consider timber harvest sales in Washington as the treatment group and corresponding sales in Idaho and Oregon as control groups. We obtained data from sales for years prior and after the court decision. However, not all timber harvest sales in Washington State are impacted equally by the court ruling. We hypothesize that timber harvest sales that are geographically close to railroads are more likely to be affected, given their exposure to railroad accidents. Further, we predict that geographic areas with higher burn probabilities are also more likely to be affected. In areas with low burn probabilities, the court ruling regarding (accidental) fires are predicted to have only a small effect.

These considerations motivate the estimation of a triple difference model (Gruber, 1994; Chetty et al., 2009) to test the effect of the court ruling on timber auction prices

$$Log\left(\frac{Bid\ Price}{Volume}\right)_{ijt} = \beta_1 RR_i + \beta_2 W_j + \beta_3 CC_t + \gamma_1 RR_i CC_t + \gamma_2 RR_i W_j + \gamma_3 CC_t W_j + \delta_1 RR_i CC_t W_j + \boldsymbol{\xi X_{ijt}} + \lambda_j + \upsilon_t + \varepsilon_{ijt} \quad (1)$$

where the unit of observation is a timber auction i in state j and year t. The dependent variable is the log of the final bid price in real 2010 dollars per thousand board feet (MBF), X is a vector of covariates, λ_j is the state effect, υ_t is the year effect, CC_t the pre and post indicator of the two court cases, and W_j is a state indicator for Washington. RR_i is our treatment. RR_i is an indicator of whether or not there is a railway within one mile of the auction area (1 if within one mile, 0 otherwise). Therefore, the estimate of δ_1 provides the triple difference estimate of the effect of the Washington State Supreme Court decision on timber prices. We also estimate δ_1 on a specification where we use a continuous measure—the maximum burn probability in the auction area. This equation is a triple interaction where δ_1 is the interaction between Washington State, the burn probability of the auction, and the time period after the court case. Our regressions include a set of covariates that include the volume of Douglas-Fir tree species measured in thousand board feet (MBF) in the sale, the volume of Cedar tree species MBF in the sale, the volume of Hemlock tree species in the sale, the density of the sale (total volume/total acreage), an indicator if the sale is a clearcut, a measure of the perimeter of the timber harvest in miles, area dummies for arid land, and the percentage of the sale that uses a cable harvesting system. We use the level of density following other studies on timber prices.[39] We include indicator variables for eastern Washington and southern Idaho as these areas have arid land and include lower quality tree species due to arid growing conditions.

BNSF and UNP benefited from this court ruling, given that they experienced a reduction in the liability associated with accidental fires caused by their operations. Because these companies are publicly traded, we can study the quantitative impact of the lower liability burden on the value of the affected timber company. We thus study the change in market capitalizationafter the court ruling with an event study.

Using the market model (MacKinlay, 1997) for our event study, we estimate abnormal returns for the two Washington Railway Companies using

$$R_{it} = \alpha_i + \beta_1 R_{mt} + \varepsilon_{it} \quad (2)$$

$$AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{it} \quad (3)$$

$$AAR_{it} = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (4)$$

In Eq. (2), R_{it} is the return on the stock of the firm i on day t, and R_{mt} is the return on the S&P 500 index on day t.[40] In Eq. (3), AR_{it} is the abnormal return where $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the estimates from Eq. (2). Eq. (4) shows the average abnormal return across all companies. We estimate Eq. (2) for 250 trading days prior to two days prior to the event.[41] This is approximately one full year of trading days. We then use Eq. (4) to obtain the cumulative average abnormal returns

[37] The dissent's opinion argued that the ruling differed from Oregon and other states. Therefore, there is some evidence that expectations were not only uncertain about the ruling, but also that a ruling could be similar to those states.

[38] The expected cost of an accident is equal to the probability of an accident times the damages from the accident.

[39] See for example, Haile (2001); Lu and Perrigne (2008); Athey et al. (2011); Preget and Waelbroek (2012), and Athey et al. (2013)

[40] This is a typical index used in event studies. It is value weighted and broad based.

[41] There are many different estimation periods used in the literature. For our event study, we use 250 days. This follows MacKinlay, 1997, 17 and other event studies such as Ellison and Mullin (2001) and Mahoney (2012). Bhagat and Romano (2007) suggest that estimation periods are usually between 100 and 200 days. We discuss the results on a 100 trading day estimation period as well.

Table 1
Summary Statistics.

Variable	Description	Mean	SD	Min	Max
Bid Price/MBF	Final bid price adjusted by the producer price index (base year 2010) divided by total volume in the sale measured in thousand board feet (MBF)	264.7	101.6	21.4	580.3
Burn Probability	Likelihood of a fire in an area. The probability is measured in fires per year.	0.00017	0.00036	0.0001	0.006
Railroad	1 if the timber sale area is within one mile of an active railroad track, 0 otherwise	0.07	0.26	0	1
Court Decision	0 before court case decisions, 1 after court case decisions	0.34	0.47	0	1
Perimeter Length	Total distance (miles) of harvest area border	4.9	2.9	0.83	26.25
Volume	Total timber volume, by auction, measured in MBF	4,178.1	2,285.4	233	16,470
Douglas Fir MBF	Total MBF of Douglas fir tree species	2,483.5	1,939.4	0	11,728
Hemlock MBF	Total MBF of Hemlock tree species	1,048.5	1,372.3	0	8080
Cedar MBF	Total MBF of Cedar tree species	177.6	356.6	0	3785
Cable	Percentage of the harvest that uses a cable-logging method	0.40	0.33	0	1
Density	Timber volume divided by acreage	28.0	15.3	2.9	81.0
Clearcut	1 if the sale is a full clearcut harvest type (variable retention harvest/regeneration in WA), 0 otherwise	0.55	0.50	0	1
N = 1392					

where T_1 is the beginning of the event period and T_2 is the end of the trading period for company i:

$$CAAR_{T_1,T_2} = \Sigma_{t=T_1}^{T_2} AAR_{it} \quad (5)$$

Using equation (5), we estimate the CAAR starting one day before the event to one day after, and starting on the day of the event and one day after.

6. Data

Price data for timber comes from state-run timber auction bid prices in Washington, Oregon, and Idaho over a seven-year period, from January 2008 to December 2014. All three have state agencies (Washington Department of Natural Resources, Oregon Department of Forestry, and Idaho Department of Land) that provided us with data on timber auctions, including a prospectus for each auction.[42]

The burn probability data is collected from the 2012 Fire Program Analysis System and US Forest Service Missoula Fire Sciences GIS dataset.[43] The probability is calculated for each 270-meter grid in the United States. We overlapped these probabilities with each timber auction area.

We collected the railway data for Oregon, Washington and Idaho from a spatial map developed by the U.S. Department of Transportation (USDOT) and Bureau of Transportation Statistic's (BTS's) National Transportation Atlas Database, 2021.

Our data set includes 1392 total timber auctions spanning over three states. Table 1 provides the descriptive statistics for the variables used in our regression analysis. About seven percent of all the timber auctions have a railroad within one mile, and 34 percent of the auctions occurred after the two court decisions. Table 2 provides a breakdown of the railroad data before and after the court case. Table 3 provides a breakdown of the burn probability greater than 0.0001 before and after the court case.

7. Results

Table 4 shows the results when estimating the effect of the liability ruling for Washington State timber areas that are located within a mile of a railway.[44] In all four specifications the triple difference estimates have the hypothesized negative signs, and the estimates are statistically significant in Columns 2 through 4.

Following the addition of the perimeter length, the volume of Douglas fir, the burn probability, and the two areas with arid land as control variables in Table 4, Column 2, the coefficient of interest is not sensitive to additional controls. Using the specification with full controls, we find that when a timber auction is within one mile of a railway, holding constant its burn probability, the bid price decreases by 19 percent following the two court cases in Washington relative to similar harvest areas in Idaho and Oregon.[45] This coefficient has a p-value of 0.06, just missing the five percent level.

Table 5 shows the results from the triple interaction and estimates the effect of the liability court ruling on timber bid prices for harvest areas located in high burn probability areas. The first column includes no control variables, other than the variables required for the implementation of the triple difference method. The second specification adds controls for regional variation within states, and controls for the most common type of tree species, Douglas Fir, as well as the size of the harvest area, *via* a perimeter length variable. The third specification adds timber variables reflecting differences across harvest areas with respect to the cost of cutting timber. The fourth specification adds further controls that are likely affecting the price of timber auction.

[42] From the timber sales datasets, we exclude salvage sales and blown-down timber sales to assure that the data include timber sales that are similar and are selling undamaged trees. By excluding these sales, all of the timber auctions have been advertised for a similar length of time. Further, to compare similar auctions, exclude mixed-log sales, and cedar poles or other poles sales, because poles are an entirely different tree stand size class. We further do not consider sales data from the Oregon Klamath-lake district, because the auctions contain an almost completely different set of tree species, and thus are not comparable to auctions in Idaho and Washington State.

[43] https://tiles.arcgis.com/tiles/4OV0eRKiLAYkbH2J/arcgis/rest/services/Burn_Probability/MapServer

[44] We test the pre and post trend on the triple difference. Prior to the event, there was no clear trend in the data with only 2009 showing a statistically significant effect for the pre-event years. The post trend years are all statistically significant and negative showing a clear downward trend following the event.

[45] Halvorsen and Palmquist (1980).

Table 2
Number of Auctions by Railroad.

Railroad within 1 mile	Before Case WA, OR, & ID	After Case WA, OR, & ID	Before Court Only WA	After Court Only WA
No	853	437	438	209
Yes	67	35	23	12
Total:	920	472	461	221

Table 3
Number of Auctions by Burn Probability.

Burn Probability	Before Case WA, OR, & ID	After Case WA, OR, & ID	Before Court Only WA	After Court Only WA
0.0003	107	58	18	6
0.0006	34	10	11	2
0.001	8	2	1	2
0.003	4	3	0	1
0.006	3	0	1	0
Total:	156	73	31	11

Table 4
Triple Difference on Railway within One Mile.

	PPI-Adjusted Net Timber Price per MBF			
Independent Variables	(1)	(2)	(3)	(4)
Court Case*Railroad*Washington	−0.0583	−0.236*	−0.215*	−0.214*
	(0.160)	(0.134)	(0.117)	(0.113)
Railroad*Washington	0.0691	0.175*	0.166**	0.128*
	(0.106)	(0.0924)	(0.0832)	(0.0766)
Court Case*Railroad	0.0883	0.108	0.0808	0.0588
	(0.115)	(0.0971)	(0.0848)	(0.0834)
Washington*Court Case	−0.113**	−0.0401	−0.00951	0.000407
	(0.0444)	(0.0367)	(0.0333)	(0.0325)
Court Case Indicator	0.0545	0.0424	0.0175	0.0169
	(0.0591)	(0.0503)	(0.0468)	(0.0464)
Railroad Indicator	−0.0529	−0.0502	−0.0271	−0.0127
	(0.0629)	(0.0584)	(0.0500)	(0.0482)
Burn Probability	–	−45.44**	−60.04***	−41.43**
		(18.63)	(19.42)	(17.95)
Perimeter length	–	−0.322***	−0.241***	−0.219***
		(0.0257)	(0.0251)	(0.0260)
Douglas Fir MBF	–	0.108***	0.0847***	0.0798***
		(0.0109)	(0.00957)	(0.00961)
Eastern Washington	–	−0.271***	−0.252***	−0.331***
		(0.0469)	(0.0466)	(0.0522)
Southern Idaho	–	−0.657***	−0.713***	−0.638***
		(0.113)	(0.111)	(0.111)
Cable Harvesting	–	–	−0.342***	−0.364***
			(0.0274)	(0.0271)
Density (Volume/Acres)	–	–	0.00731***	0.00660***
			(0.000721)	(0.000724)
Clearcut (VRH – WA)	–	–	–	0.0514**
				(0.0237)
Hemlock MBF	–	–	–	−0.0192***
				(0.00397)
Cedar MBF	–	–	–	0.0294***
				(0.00435)
Constant	5.502***	5.290***	5.182***	5.186***
	(0.0316)	(0.0869)	(0.0806)	(0.0863)
Year Indicators	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes
Observations	1392	1392	1392	1392
R-squared	0.29	0.50	0.58	0.60

Notes: Robust standard errors in parentheses. The final auction price is adjusted for inflation using the Producer Price Index (PPI) (Base year: 2010). All tree species are the natural logarithm of the volume. The perimeter is also the natural logarithm of the perimeter. *** Statistical significance at 1 % level, ** at the 5 % level, * at the 10 % level.

In all specifications, the triple interaction coefficient has a negative sign and in Columns 2–4, it is statistically significant. The triple difference coefficient increases in absolute value by roughly 22 percent when adding controls in Columns 2–4. In Columns 3 and 4, the coefficient on the triple difference estimate is statistically significant at the five percent level. From the most parsimonious specification in column 1 to the specification with full controls, the coefficient only decreases in absolute value by roughly seven percent. The findings in Column 4 show that a one standard deviation increase in the burn probability of a Washington State timber auction decreases the bid price by six percent relative to the two other states following the two court decisions. Put differently, on average, a one standard deviation increase in the burn probability is associated with a $75,000 decrease in the bid price relative to the other two states following the two court cases.[46]

The control variables capturing the cost of production, perimeter length, cable harvesting density and clear-cuts have the anticipated

[46] The estimate uses Washington's average bid price and average volume.

Table 5
Triple Interaction on Burn Probability.

	PPI-Adjusted Net Timber Price per MBF			
Independent Variables	(1)	(2)	(3)	(4)
Court Case*Burn Probability*Washington	−180.1	−137.6*	−137.2**	−166.8**
	(190.7)	(72.56)	(67.07)	(65.21)
Burn Probability*Washington	−98.74	47.29	66.14*	64.43**
	(139.8)	(40.22)	(38.42)	(31.91)
Court Case*Burn Probability	78.78	50.72	61.64	86.37**
	(63.90)	(50.56)	(45.82)	(42.90)
Washington*Court Case	−0.0855*	−0.0358	−0.00255	0.0136
	(0.0496)	(0.0382)	(0.0345)	(0.0335)
Court Case Indicator	0.0507	0.0471	0.0174	0.00975
	(0.0596)	(0.0504)	(0.0467)	(0.0461)
Burn Probability	−149.0***	−53.92**	−75.45***	−59.67***
	(36.89)	(22.73)	(24.94)	(20.95)
Perimeter length	–	−0.322***	−0.242***	−0.219***
		(0.0259)	(0.0254)	(0.0262)
Douglas Fir MBF	–	0.108***	0.0847***	0.0796***
		(0.0110)	(0.00963)	(0.00967)
Eastern Washington	–	−0.271***	−0.258***	−0.337***
		(0.0499)	(0.0496)	(0.0550)
Southern Idaho	–	−0.651***	−0.700***	−0.621***
		(0.114)	(0.112)	(0.113)
Cable Harvesting	–	–	−0.343***	−0.364***
			(0.0274)	(0.0271)
Density (Volume/Acres)	–	–	0.00728***	0.00661***
			(0.000723)	(0.000725)
Clearcut	–	–	–	0.0499**
				(0.0236)
Hemlock MBF	–	–	–	−0.0197***
				(0.00396)
Cedar MBF	–	–	–	0.0299***
				(0.00438)
Constant	5.547***	5.290***	5.184***	5.189***
	(0.0352)	(0.0873)	(0.0809)	(0.0864)
Year Indicators	Yes	Yes	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes
Observations	1392	1392	1392	1392
R-squared	0.31	0.50	0.58	0.60

Notes: Robust standard errors in parentheses. The final auction price is adjusted for inflation using the Producer Price Index (PPI) (Base year: 2010). All tree species are the natural logarithm of the volume. The perimeter is also the natural logarithm of the perimeter. *** Statistical significance at 1 % level, ** at the 5 % level, * at the 10 % level.

signs and are statistically significant. Clearcut harvest sales and high-density sales are associated with higher prices. Furthermore, sales with more cable harvesting and larger perimeter sizes are associated with lower prices. The signs on the estimated coefficient for tree species reflect the value of those species relative to the left-out tree species contain smaller volumes species such as Red Alder and Ponderosa timber. Relative to these additional timbers, Douglas Fir and Cedar tree species are associated with higher prices, while Hemlock tree species are associated with lower prices.

Overall, the estimates of the two models show that following the court cases, there is a decrease in the value of timber that is associated with a higher risk of fire, and a decrease in the value of timber that is associated with accidental railway fires. The results lend support to the prediction that following the court decision, bidders updated their beliefs about their rights and damages to timber, reflecting that in case of railroad fire, they would likely have to assume more liability than prior to the court decision.

7.1. Robustness checks on the triple difference model

Table 6 presents the results from two robustness checks on our triple difference model that focuses on the railroads within one mile. In Column 1, we limit our sample to only Washington state. This changes our model from a triple difference model to a difference-in-difference model where our interaction variable is between the court case decision and auctions within one mile of a railway. As shown in Table 6, the coefficient is similar to our main estimate and it is statistically significant at the five percent level.

In an attempt to compare similar types of auction data, we drop the auction data from Idaho and re-run our analysis using only Washington and Oregon. This is because Idaho conducts oral auctions rather than sealed bid auctions. We also include as an independent variable the number of bids in the sealed auction. As shown in Column 2, after dropping and including the number of bids, we find that our estimate is similar to our main estimate.[47]

7.2. Event study

Table 7 presents our results for the event study. The first row in Table 7 shows the results for the Washington Railway Companies: Berkshire Hathaway and Union Pacific Railway.[48] On May 31st, 2012 the two Washington railway companies had an average abnormal return (AAR) of 1.25 percent and the AAR is statistically significant at the 10 percent level.[49] On June 1st, 2012, the day after the court decision, we find an AAR of 0.94 percent, although this estimate is not statistically significant.

[47] We also run the same robustness checks on our burn probability measure. The sign remains negative in both specifications, however, the estimates just miss being statistically significant at the ten percent level.

[48] We use the Class B share class for Berkshire Hathaway. The Class A share class had approximately 600 shares traded a day, on average, during our estimation period. In addition to the tests in Table 5, we ran individual event studies on the two companies and while the results were not statistically significant on the event day, they were both negative with Union Pacific's t-statistic at 1.50.

[49] Reported are the Portfolio Time Series (CDA) test statistics (Brown and Warner, 1980, 1985).

Table 6
Robustness Checks on Railway within One Mile.

	PPI-Adjusted Net Timber Price per MBF	
Independent Variables	(1)	(2)
Court Case*Railroad*Washington	–	−0.222*
		(0.132)
Railroad*Washington	–	0.200**
		(0.0843)
Court Case*Railroad	−0.158**	0.133
	(0.0744)	(0.109)
Washington*Court Case	–	0.0354
		(0.0374)
Court Case Indicator	0.0156	−0.0130
	(0.0584)	(0.0523)
Railroad Indicator	0.0876	−0.116*
	(0.0534)	(0.0604)
Burn Probability	−0.874	−19.35
	(29.96)	(39.30)
Perimeter length	−0.246***	−0.234***
	(0.0285)	(0.0284)
Douglas Fir MBF	0.0526***	0.0710***
	(0.0104)	(0.0108)
Eastern Washington	−0.363***	−0.235***
	(0.0602)	(0.0539)
Southern Idaho	–	–
Cable Harvesting	−0.278***	−0.287***
	(0.0336)	(0.0298)
Density (Volume/Acres)	0.0172***	0.00591***
	(0.00418)	(0.000691)
Clearcut (VRH – WA)	0.0411	0.0396*
	(0.0343)	(0.0223)
Hemlock MBF	−0.0352***	−0.00994**
	(0.00494)	(0.00395)
Cedar MBF	0.0315***	0.0289***
	(0.00481)	(0.00439)
Number of Bids	–	0.0560***
		(0.00508)
Constant	5.352***	5.047***
	(0.113)	(0.0960)
Year Indicators	Yes	Yes
State Indicators	No	Yes
Observations	682	1064
R-squared	0.57	0.59

In the first row, Columns 5 and 7 show the cumulative average abnormal return (CAAR) for two time periods: the day of the event through the day after the event (0,1) and the day before through the day after (-1,1). The CAAR show roughly a 2.3 percent cumulative average abnormal return over the day of the event and the day after. This result is statistically significant at the five percent level. The estimate for the CAAR over a three-day window (-1, 1) is 2.02 percent and barely misses the ten percent level of significance with a p-value of 0.11.[50] These results lend some support for the hypothesis that following the court case ruling, railway companies increased in value due to less liability exposure.

7.3. Robustness checks on the event study

One concern may be that the railway industry as a whole may have increased in value during our event period. We implement a few robustness checks to check our results against the valuation changes of other railway companies during our event period. In the second row of Table 7, we report the results from the exact same estimation window and tests on the three other major railway companies in the S&P 500: CSX Corporation (CSX), Kansas City Southern (KSU), and Norfolk Southern Corporation (NSC). In the third row, we report the results after adding the two Canadian Railway Companies: Canadian National Railway (CNI) and Canadian Pacific Railway (CP). In the fourth and fifth row, we re-estimate the specifications in rows two and three after dropping Kansas City Southern. The motivation for dropping KSU is that during our event period (-1,1), the stock price of KSU was especially volatile. Its stock price dropped 4.5 percent on the day before our event (-1), and recovered on the day of the event (0) with a 3.8 percent return.[51] Including KSU in our robustness test "biases" the results upward on the event day, and "biases" the results downward on the day before the event. Importantly, these movements cancel out in our CAAR estimate the event period of -1 to 1.

The results of the other railway companies are not statistically significant in any row or column in Table 7. On the day of the event, the second and third rows show large abnormal returns. If we compare those estimates to rows 4 and 5 on the event day, it shows that the high abnormal returns are driven by KSU. The last column reports the event period of -1 to 1. As mentioned above, KSU's volatility around the event offsets itself; therefore, when looking at the event as a three-day period, the results show there are no drastic changes in the non-Washington railway companies over the three-day period. These results lend additional support to the claim that the Washington Railway companies were not driven higher by an increase in railway industry stocks in general, but rather, the increase in their stock prices were driven by the court case ruling.

Another concern with our estimates might be that we selected the incorrect estimation window, or that there was a structural change in the stock around the event period, or even that the Washington Railway companies had low volatility in the period before the event. We re-estimate the two Washington Railway Companies with multiple other estimation windows. We define an estimation window of 100 trading days prior starting two days before the event, and we define a pooled estimation window of 100 and 250 days split evenly before and after the event. The results are robust to these alternative definitions. In fact, the results have greater significance on the day of the event for the pooled estimation windows.

In Table 8, we report the results for the post-event 250-day estimation window on the same five samples as in Table 7.[52] Using a post-event window helps eliminate the chance that the event period coincided with a structural change in the relationship between the Washington Railway Companies and the S&P 500. The results in Table 8 are similar to the results in Table 7. The statistical significance strengthens to the five percent level on the event day for the two Washington Railway Companies, and the CAAR for the period of -1 to 1 is significant at the ten percent level. The other three S&P 500 Railway companies and the S&P 500 Railway Companies plus the Canadian Railway are significant as well on the event day. Again, this is likely driven by KSU's volatility around the event day, as shown by a reduction from 1.57 percent AAR to 0.42 percent AAR once KSU is dropped in the second row. Additionally, the CAAR for the second row through the fifth all hover around zero, whereas the two Washington Railway Companies are statistically significant over this period and have an abnormal return of 1.67 %.

Another robustness test that we undertook was to contact the Washington Supreme Court to find the time that the case was released. They responded that typically case decisions are released somewhere around 8:00 am to 9:00 am Pacific Time on Thursdays. They also mentioned that the public does not know of the decision until after it is released. We used a Bloomberg Terminal to look at the intraday stock price movements from the time of 10:00 am to 1:00 pm Eastern Time in case the release was slightly before or

[50] The results indicate that using an estimation window of 100 trading days does not alter our results. In fact, the CAAR (-1,1) becomes significant at the ten percent level.

[51] Bloomberg (2012). *Kansas City Southern Outperforms After Falling Below 200-DMA*. Retrieved February 12, 2018 from Bloomberg terminal.

[52] See Klick and Sitkoff (2008) for a similar test.

Table 7
Event Study Results.

Company (250 prior trading day window)	Day 0	t-stat	Day +1	t-stat	CAAR (0,1)	t-stat	CAAR (-1,1)	t-stat
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Two Washington Railway Companies	1.25 %*	1.82	0.94 %	1.37	2.28 %**	2.26	2.02 %	1.57
S&P 500 Railway Companies	1.61 %	1.45	0.17 %	0.15	1.68 %	1.13	0.70 %	0.35
S&P 500 Railway + Canadian	1.48 %	1.59	−0.21 %	−0.22	1.19 %	0.97	0.26 %	0.15
S&P 500 Railway (No KSU)	0.46 %	0.41	0.57 %	0.51	1.05 %	0.64	0.66 %	0.32
S&P 500 Railway + Canadian (No KSU)	0.87 %	0.96	−0.10 %	−0.11	0.81 %	0.60	0.16 %	0.06

Note: The symbols *,**, and *** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tail test. Cumulative average abnormal normal returns are reported as precision weighted CAARs. Test statistics are Portfolio Time-Series (CDA).

Table 8
Robustness Test Post-event 250-Day Estimation Window.

Company (250 post trading day window)	Day 0	t-stat	Day +1	t-stat	CAAR (0,1)	t-stat	CAAR (-1,1)	t-stat
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Two Washington Railway Companies	1.21 %**	2.47	0.70 %	1.43	2.04 %***	2.76	1.67 %*	1.70
S&P 500 Railway Companies	1.57 %*	1.67	−0.07 %	−0.07	1.41 %	1.13	0.23 %	0.16
S&P 500 Railway (No KSU)	0.42 %	0.41	0.37 %	0.36	0.79 %	0.55	0.26 %	0.15
S&P 500 Railway + Canadian	1.45 %*	1.90	−0.41 %	−0.53	0.95 %	0.96	−0.13 %	−0.10
S&P 500 Railway + Canadian (No KSU)	0.84 %	1.11	−0.28 %	−0.38	0.57 %	0.52	−0.22 %	−0.18

Note: The symbols *,**, and *** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tail test. Cumulative averagSe abnormal normal returns are reported as precision weighted CAARs. Test statistics are Portfolio Time-Series (CDA).

Fig. 1. Intraday Railway Stock Prices.

after the estimated time of release.[53] Fig. 1 shows the intraday stock prices movements of the S&P 500 railway companies. To simplify the graph, we normalize the stock prices to 100. During the time of 10:00 am to 1:00 pm, the two Washington Railway Companies, shown in purple (UNP) and white (BRK.B), outperformed the S&P 500 and the other three S&P 500 Railway Companies. Union Pacific roughly tripled the S&P 500 during this time period, while Berkshire Hathaway roughly doubled it.

As a final robustness check to our event study, we test the abnormal returns for two firms on a single event using an SQ test. Given the small sample size, there may be some concern over the estimates validity. Thus, we run an SQ test on both Berkshire Hathaway and Union Pacific Railway for the day of the event. The SQ test was developed and tested by Gelbach et al. (2013) in the event that you have a single-firm, single-event study. Their main argument for the SQ test is that it is not valid to invoke the Central Limit Theorem based inference approach when you only have a single firm, single event study. Therefore, one should use a non-parametric approach using the empirical distribution of residuals.

We run an SQ test on the individual firms and on the two firms following Gelbach et al.'s (2013, 518) methodology. We first estimate the market model as described below for each firm.

$$R_s = \alpha_s + \beta_1 R_{mt} + D_s\gamma \text{ for } s = 1, 2, \ldots, n+1 \quad (6)$$

where

R_s = firm j's return on date s
R_{mt} = return on the S&P 500 on date s
D_s = Dummy variable for the event date at n+1
γ = event effect
β_1 = estimated beta for the firm

We then use the SQ test against $H_1 : \gamma > 0$. After estimating (6), we calculate the fitted excess returns for every nonevent day back 250 trading days. To get the excess returns we take the actual daily return on a given day, s, and subtract the companies estimated β_1 from Eq. (6) multiplied by the market return for that day. We then sort the excess fitted returns from highest to lowest and

[53] This would be 7:00 am to 10:00 am Pacific Time.

Table 9
SQ Test Results.

	Estimate	13th highest return	25th highest return
UNP	1.60 %**	1.59 %	1.27 %
BRK.B	0.90 %	1.41 %	0.93 %
Both Firms	1.25 %**	1.22 %	0.89 %

Note: The 13th highest return tests for significance at the five percent level on a one-tailed test. The 25th highest return tests for significance at the ten percent level on a one-tailed test.

Table 10
SQ Test Results (CAAR 0,+1).

	Estimate	13th highest return	25th highest return
UNP	1.29 %	2.21 %	1.85 %
BRK.B	3.09 %**	2.05 %	1.54 %
Both Firms^	2.19 %**	1.89 %	1.27 %

Note: The 13th highest return tests for significance at the five percent level on a one-tailed test. The 25th highest return tests for significance at the ten percent level on a one-tailed test. ^The CAAR is not precision weighted in the SQ test.

use a desired significant level of 0.05 and 0.10. Using the formula provided by Gelbach et al. (2013), we locate the 13th highest (0.05 multiplied by 250) and 25th highest (0.10 multiplied by 250) fitted excess returns for the individual and combined results. Table 9 is a summary of our findings.

As shown in Table 9, Union Pacific Railway is statistically significant at the five percent level using a one-tailed test. Berkshire Hathaway is not statistically significant at either the five percent level or the ten percent level. However, this is not particularly shocking given that Berkshire Hathaway stock is comprised of more companies than BNSF railway. Therefore, the proxy for effect on railroad companies is best represented by UNP because UNP provides a way to isolate the effect on a railway company that had significant exposure to the ruling. Finally, the combined results of the two firms show that the estimate is statistically significant at the five percent level using the SQ test.

In Table 10, we test the CAAR using the SQ test. The results show that Berkshire Hathaway and the combined firms are statistically significant at the five percent level using the SQ test, while UNP is not statistically significant. Overall, the SQ test results lend additional support to the hypothesis that valuations changed following the court ruling in Washington.

8. Discussion

In this paper, we take advantage of an uncertain court ruling to show how court-determined liability assignments affect valuations. Our results indicate that following the court decisions, a one standard deviation increase in burn probability corresponded with a six percent decrease in the bid prices for timber in Washington. Additionally, following the two court decisions, purchasing timber within one mile of a railway corresponded to a 19 percent drop in the bid price for timber in Washington. Although not drastic in magnitude, there was a statistically significant increase in the two Washington Railway Companies on the day of the court ruling, as well as strong abnormal returns using the dates around the event day. Overall, these results demonstrate that court liability assignments have real economic effects.

We do not complete a wealth effect comparison on the railway and timber industries, due to the difficulty of estimating the long-run impact on the Washington Railway Companies valuation, as well as the difficulty in a short-run estimate on timber sales. However, future research on court decisions may lend itself to such comparison. This type of study would not only be interesting, but also helpful in understanding tort law liability judgments' economic and/or redistributive effects.

Appendix A1

Jongeward

Certified Question 1: Does a Defendant who negligently causes a fire that spreads onto Plaintiff's property, and damages or destroys Plaintiff's trees, "otherwise injure" trees, timber or shrubs for purposes of [former] RCW 64.12.030?

Certified Question 2: Can a Plaintiff recover damages under [former] RCW 64.12.030 for trees damaged or destroyed a Defendant who never has been physically present on Plaintiff's property?

Certified Question 3: Must damages awarded under [former] RCW 64.12.030 be reasonable in relation to the value of the underlying real property?

Broughton

Certified Question 1: Can a plaintiff recover damages under [former] RCW 64.12.030 for trees damaged by a fire that spreads from a defendant's neighboring parcel, where the alleged acts or omissions of the defendant were not directed at plaintiff's trees or property, and did not occur on plaintiff's property?

Appendix A2

Washington Contract

This excerpt was taken from a November 2009 contract for the sale, Deep Blue, and it was supplied by the WADNR.

THE PURCHASE PRICE SHALL NOT BE AFFECTED BY ANY FACTORS, INCLUDING: the amount of forest products actually present within the contract area, the actual acreage covered by the contract area, the amount or volume of forest products actually cut or removed by purchaser, whether it becomes physically impossible or uneconomic to remove the forest products, and whether the subject forest products have been lost or damaged by fire or any other cause. The only situations Purchaser may not be liable for the full purchase price are governed by clause G-066, concerning governmental regulatory actions taken during the term of the contract.

Appendix A3 Washington Supreme Court Cases Percentage of 8 to 1 and 9 to 0 Rulings

Year	Total	Unaminous Rate	Unaminous Rate*	8 to 1 Rate	Total Rate	Total Rate*
2018	104	54 %	63 %	3 %	57 %	66 %
2017	92	68 %	68 %	0 %	68 %	68 %
2016	101	59 %	64 %	3 %	62 %	67 %
2015	113	61 %	68 %	4 %	65 %	72 %
2014	129	55 %	63 %	7 %	62 %	70 %
2013	95	57 %	62 %	8 %	65 %	71 %

*No dissenting opinions but some dissent-in-parts as unaminous decisions.

Appendix A4 Union Pacific Railcars by State for 2018

State	Cars Originated	Cars Terminated
Washington	271,828	259,989
California	1,577,618	1,614,440
Oregon	211,250	330,193
Nevada	31,696	76,411
Utah	250,178	210,731
Arizona	14,441	77,782
Colorado	164,969	143,461
New Mexico	66,856	67,048

Source:https://www.up.com/cs/groups/public/@uprr/@corprel/documents/up_pdf_nativedocs/pdf_washington_usguide.pdf

BNSF by State for 2018

State	Orginiated	Terminated	Within
Washington	521,473	1,015,484	1,870,794
Oregon	125,631	176,479	383,566
Idaho	11,824	6153	1,581,708
California	2,152,213	2,089,435	4,176,983

Source: https://bnsfnorthwest.com/washington/

References

Athey, S., Levin, J., Seira, E., 2011. Comparing open and sealed bid auctions: evidence from timber auctions. Q. J. Econ. 126, 207–257.

Athey, S., Coey, D., Levin, J., 2013. Set-asides and subsidies in auctions. Am. Econ. J. Microecon. 5 (1), 1–27.

Beltrametti, S., Marrone, J.V., 2016. Market responses to court rulings: evidence from antiquities auctions. J. Law Econ. 59 (4), 913–944.

Bhagat, S., Romano, R., 2007. Empirical studies of corporate law. In: Mitchell Polinsky, A., Shavell, Steven (Eds.), Handbook of Law and Economics, Vol. 2, Chapter 13.

Bloomberg, L.P., Retrieved February 12, 2018 from Bloomberg terminal 2012. Kansas City Southern Outperforms After Falling Below 200-DMA.

BNSF Plans $86 Million Capital Program in North Dakota to Maintain and Expand Rail Capacity. (2012, May 30). Business Wire.

Broughton Lumber Co. v. BNSF Ry. Co., 174 Wash. 2d 619, 639, 278 P.3d 173,183 (2012).

Brown, J., 1973. Toward an economic theory of liability. J. Legal Stud. 2 (2), 323–349.

Brown, S.J., Warner, J.B., 1980. Measuring security price performance. J. Financ. Econ. 8 (3), 205–258.

Brown, S.J., Warner, J.B., 1985. Using daily stock returns: the case of event studies. J. Financ. Econ. 14 (1), 3–31.

Calabresi, G., Melamed, A., 1972. Property rules, liability rules, and inalienability: one view of the cathedral. Harv. Law Rev. 85 (6), 1089–1128.

Chetty, R., Looney, A., Kroft, K., 2009. Salience and taxation: theory and evidence. Am. Econ. Rev. 99 (4), 1145–1177.

Christensen, D., Hausman, D.K., 2016. Measuring the economic effect of alien tort statute liability. J. Law Econ. Organ. 32 (4), 794–815.

Coase, R., 1960. The problem of social cost. J. Law Econ. 3, 1–44.

Cooter, R., Ulen, T., 2016. Law and Economics. Addison-Wesley.

Demsetz, H., 1972. When does the rule of liability matter? J. Legal Stud. 1 (1), 12–28.

Diamond, P.A., 1974. Single activity accidents. J. Legal Stud. 3 (1), 107–164.

Ellison, S., Mullin, W., 2001. Gradual incorporation of information: pharmaceutical stocks and the evolution of president Clinton's health care reform. J. Law Econ. 44 (1), 89–129.

Gelbach, J., Helland, E., Klick, J., 2013. Valid inference in single-firm, SingleEvent studies. Am. Law Econ. Rev. 15 (2), 495–541.

Gould, J.P., 1973. The economics of legal conflicts. J. Legal Stud. 2 (2), 279–300.

Gruber, J., 1994. The incidence of mandated maternity benefits. Am. Econ. Rev. 84 (3), 622–641.

Haile, A. Philip, 2001. Auctions with resale markets: an application to U.S. Forest service timber sales. Am. Econ. Rev. 91 (3), 399–427.

Halvorsen, R., Palmquist, R., 1980. The interpretation of dummy variables in semilogarithmic equations. Am. Econ. Rev. 70 (3), 474–475.

Hersch, P.L., 1994. The effects of resale price maintenance on shareholder wealth: the consequences of schwegmann. J. Ind. Econ. 42 (2), 205–216.

Hill, S.A., Kiewiet, D.R., 2015. The impact of state supreme court decisions on public school finance. J. Law Econ. Organ. 31 (1), 61–92.

Jongeward v. BNSF R. Co., 174 Wash. 2d 586, 593,610,612, 278 P.3d 157,160,167-68,170 (2012).

Jongeward v. BNSF Railway Co., No. CV–09–0010–RMP, 2010 WL 5394873 (E.D. Wash. Dec. 22, 2010).

Jongeward v. BNSF Railway Company, No. CV-09-0010-RMP, 2012 WL 7760873 (E.D. Wash., Nov. 30, 2012).

Jordan v. Welch, 61 Wash. 569 (Wash 1911).

Klick, J., Sitkoff, R., 2008. Agency costs, charitable trusts, and corporate control: evidence from Hershey's kiss-off. Columbia Law Rev. 108 (4), 749–838.

Landes, W.M., Posner, R.A., 1980. The positive economic theory of tort law. Georgia Law Rev. 15 (4), 851–924.

Lu, Jingfen, Perrigne, Isabelle, 2008. Estimating risk aversion from ascending and sealed-bid auctions: the case of timber auction data. J. Appl. Econom. 23 (7), 871–896.

MacKinlay, A.C., 1997. Event studies in economics and finance. J. Econ. Lit. 35 (1), 13–39.

Mahoney, P., 2012. The public utility pyramids. J. Legal Stud. 41 (1), 37–66.

McWilliams, A., Turk, T.A., Zardkoohi, A., 1993. Antitrust policy and mergers: the wealth effect of supreme court decisions. Econ. Inq. 31 (4), 51.

Miceli, T.J., 2017. The Economic Approach To Law, 3rd ed. Stanford University Press, Stanford, California.

National Transportation Atlas Database, Retrieved from https://www.bts.gov/geospatial/national-transportation-atlas-database.

Preget, R., Waelbroek, P., 2012. what is the cost of low participation in french timber auctions? Appl. Econ. 44, 1337–1346.

Shavell, S., 1980a. An analysis of causation and the scope of liability in the law of torts. J. Legal Stud. 9 (3), 463–516.

Shavell, S., 1980b. Strict liability versus negligence. J. Legal Stud. 9 (1), 1–25.

Shavell, S., 2007. Liability for accidents. In: Mitchell Polinsky, A., Shavell, Steven (Eds.), Handbook of Law and Economics, Vol. 1, Chapter 2.

Stratmann, T., Verret, J.W., 2015. How does corporate political activity allowed by citizens united v. federal election commission affect shareholder wealth? J. Law Econ. 58 (3), 545–559.

Further reading

Buffett, W., I.N.C. 2011. Berkshire Hathaway, Annual Report 2010. Retrieved from http://www.berkshirehathaway.com/2010ar/2010ar.pdf.

Dow Jones Indexes, BASF, S.E., 2012. Berkshire Hathaway, Commonwealth Bank of Australia Among Five Stocks Added to Dow Jones Global Titans 50 INDEX May 3, Retrieved from https://www.globenewswire.com/news-release/2012/05/31/478287/257884/en/BASF-SE-Berkshire-Hathaway-Commonwealth-Bank-of-Australia-Among-Five-Stocks-Added-to-Dow-Jones-Global-Titans-50-INDEX.html.

Elavia, S., 2015. Warren Buffett's 5 Biggest Acquisitions, August 10, Retrieved from Fox Business https://www.foxbusiness.com/markets/warren-buffetts-5-biggest-acquisitions.

Morlin, B., 2009. Landowners' suit accuses BNSF of causing wildfire January 13 Seattle Times.

Railroads & States, 2017. Association of American Railroads Retrieved from https://www.aar.org/data-center/railroads-states/#state/WA.

Short, Karen C., 2015. Spatial Wildfire Occurrence Data for the United Statesm 1992–2013, [FPA_FOD_20150323], 3rd ed. Forest Service Research Data Archive Fort Collins, CO. doi: 10.2737/RDS-2013-0009.3.

Spatial Map Railway Data, U.S. Department of Transportation (USDOT) Retrieved from https://www.transportation.gov/gis.

Tan, G., 2016. That Big Berkshire Hathaway Railroad Deal, November 11, Retrieved from Bloomberg Opinion https://www.bloomberg.com/opinion/articles/2016-11-11/berkshire-hathaway-bnsf-railroad-deal-shines-bright-in-hindsight.

Timber Auction Data, Idaho Department of Land Retrieved from https://web.idl.idaho.gov/timbersale/search.aspx.

Timber Auction Data, Oregon Department of Forestry Retrieved from https://www.oregon.gov/ODF/Working/pages/TimberSales.aspx.

Timber Auction Data, Washington State Department of Natural Resources Retrieved from https://www.dnr.wa.gov/programs-and-services/product-sales-and-leasing/timber-sales/timber-auction-packets.

Valuing Berkshire Via Burlington Northern Santa Fe Railway, 2015. Seeking Alpha January 15, Retrieved from https://seekingalpha.com/article/2824356-valuing-berkshire-via-burlington-northern-santa-fe-railway.