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Lawsuit events and stock returns: A meta-analysis

Master's thesis

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Declaration of Authorship

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Abstract

Headlines relaying hot new information about lawsuits and court decisions affecting publicly traded companies are commonly found on the front pages of financial newspapers. However, the effect of these lawsuit events on the stock returns of affected firms is not well understood, as published studies present contradictory findings. Consequently, managers and investors have to often rely on conventional wisdom. To introduce clarity into this complexity, I have collected 882 estimates from 64 primary studies on price responses to announcements of major lawsuit events, constituting a unique dataset comprising over half a million lawsuits. By applying nine methods for detecting publication bias, I find little empirical evidence for its presence. Additionally, I control for more than 50 research design characteristics to capture some of the inherent heterogeneity in the characteristics of lawsuits and underlying modeling choices. Using the modern method of Bayesian model averaging, I find that the effects of class-action lawsuits are stronger, investors react more positively to news of a lawsuit being resolved than to news of a lawsuit being filed, and, apart from the length of the announcement period, all decisions defining event study methodology can be considered minor modeling choices.

JeL Classification	
Keywords	lawsuits, event study, publication bias, model averaging
Title	Lawsuit events and stock returns: A meta-analysis

Abstrakt

Na titulních stranách finančních novin se běžně objevují titulky přinášející nové horké informace o soudních sporech a soudních rozhodnutích, které se týkají veřejně obchodovaných společností. Vliv těchto soudních sporů na výnosy akcií postižených firem však není dobře znám, protože publikované studie uvádějí rozporuplné výsledky. V důsledku toho se manažeři a investoři často musí spoléhat na konvenční moudrost. Abych do komplexního stavu vnesl jasno, shromáždil jsem 882 odhadů z 64 primárních studií o cenových reakcích na oznámení významných soudních sporů, které tvoří jedinečný soubor dat zahrnující více než půl milionu soudních sporů. Při použití devíti metod pro zjišťování publikačního zkreslení jsem našel jen málo empirických důkazů o jeho přítomnosti. Kromě toho kontroluji více než 50 charakteristik výzkumného designu, abych zachytil část přirozené heterogenity v charakteristikách soudních procesů a základních modelových rozhodnutí. Pomocí moderní metody bayesovského průměrování modelů zjišťuji, že účinky hromadných žalob jsou silnější, že investoři reagují pozitivněji na zprávu o vyřešení žaloby než na zprávu o podání žaloby a že kromě délky oznamovacího období lze všechna rozhodnutí definující metodiku studie událostí považovat za nepodstatné modelové volby.

Klasifikace JeL	
Klíčová slova	soudní spory, cenová odezva, publikační zkreslení, průměrování modelů
Název práce	Soudní spory a výnosy akcií: Meta-analýza

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Acronyms

AR Abnormal returns

BE Between effects model

BMA Bayesian model averaging

CAR Cumulative abnormal returns

CAAR Cumulative average abnormal returns

CAPM Capital asset pricing model

CRSP Center for Research in Security Price

EMH Efficient market hypothesis

FAT Funnel asymmetry test

FE Fixed effects model

FMA Frequentist model averaging

IV Instrumental variable model

MRA Meta regression analysis

OLS Ordinary least squares

PET Precision asymmetry test

PIP Posterior inclusion probability

PMP Posterior model probability

RE Random effects model

UIP Unit information prior

Master's Thesis Proposal

Author	Bc. Tomáš Suchomel
Supervisor	Mgr. Josef Bajzík
Proposed topic	Lawsuit outcomes and stock returns

Motivation Headlines relaying hot new information about lawsuits and court decisions affecting publicly traded companies can be commonly found on front pages of financial newspapers. Deciphering the markets reaction on these new facts has intrigued not only interested financial professionals and casual news readers, but also a number of scholars. For example, Gande and Lewis (2009) quantify in their paper how firm's stock prices react negatively to the news of class-action lawsuits being initiated by the firm's shareholders. Hilliard et al (2018) examine the stock market reaction to a Supreme Court of the United States ruling regarding a healthcare provision, finding that stock prices of the deemed benefactors soared and loser ones dropped. And Wei et al (2011) describe the negative effect on stock prices that companies face when environmental lawsuits are filled against them.

Overall, financial literature is interested in effects of a wide spectrum of litigation types and court rulings, with the differentiation being based on the covered case's merits, such as antitrust policy, product liability, contract enforcement, environmental issues, intellectual property resolutions, employee discrimination, securities law abridgements and others (Haslem et al, 2017). And while inquiries into the issue have been abundant, a comprehensive meta-analysis of the literature studying the effects associated with lawsuits on the affected firms' stock returns has yet to be conducted. Hence, the main motivation of my thesis is to fill this gap.

Hypotheses

Hypothesis #1: The academic literature studying the effect of lawsuits on firms' stock returns suffers from publication bias and that towards more negative market reaction.

Hypothesis #2: The 'true' effect of a negative lawsuit outcome on the affected firm's stock returns is negative, while the positive outcome will either have positive or no impact.

Hypothesis #3: Class-action lawsuits losses will have the most severe negative impact on the publicly traded firms' stock returns.

Methodology The first step in the process of conducting a meta-analysis is to construct a dataset of primary studies. For the main source of academic papers I will rely on the Google Scholar web search engine. There I will search for to my topic relevant articles using a refined search query composed of keywords referring to various aspects of a litigation process and measurements of financial market performance, namely the stock returns. From the query I will gather the first 500 studies, which I will then filter for the ones that, according to the paper's title and abstract, could be pertinent to my research question.

The inclusion of specific papers into the dataset ought to be guided by a formal rule, which in my thesis will be along the following lines: I will only consider papers that study the effect of lawsuits through implementing the event study methodology, as developed in MacKinlay (1997). The scope will be limited to only a certain set of litigation types. Primarily I will look for papers that study the financial markets reaction on outcomes of lawsuits concerning securities law, intellectual property, and resolutions of environmental cases. Additionally, I will include both published and unpublished papers, but not theses or dissertations. And finally, only those studies which report the standard error, or other statistical measures that can be used to derive it, will be considered.

As the final step in the dataset construction I will examine relevant references in the previously identified papers and adding those found suitable. Overall, I intend to identify all research articles which are topically relevant to my research question for a to have the final meta-dataset as comprehensive as possible. The dataset creation process will be summarized with a PRISMA diagram.

I will test for publication bias, the preference of researchers for reporting only significant estimates, which has been suspected to be prevalent within the economic literature (Ioannidis et al, 2017). The bias will be first visualized by means of a funnel plot and the eventual asymmetry tested also empirically. If publication bias is detected, I will attempt to correct it with the aim of revealing the true effect that lawsuits have on the firm's stock returns.

At last, I will proceed to explain the variation between individual studies and attempt to determine how the particular paper characteristics, such as the type of lawsuit, the country's legal origin, or the length of the event window, influence the estimation of the parameter of my interest. To evaluate the drivers of heterogeneity I will apply both frequentist model averaging and Bayesian model averaging methods, since these are used in recent meta-analyses such as Ehrenbergerova et al (2022) or Bajzik (2021).

Expected Contribution My thesis would expand the growing field of meta-analysis that examine financial markets related research questions. To my knowledge, there is so far only one similarly oriented meta-analysis in which De Batz and Kocanda (2020) synthesize the academic literature studying market reaction on news of intentional financial crime. By not limiting my interest to a single lawsuit type, my meta-analysis would represent the first comprehensive quantitative synthesis of a wide spectrum of academic literature. Therefore, by its design the thesis would serve as an up-to-date quantitative and systemic overview for those interested in the link between lawsuit outcomes and the following financial market performance of the affected firms, now with the added information on publication bias and drivers of heterogeneity in the field. Ideally, my findings could then form the basis for novel trading strategies on stock exchanges.

Outline

1. Introduction: I will introduce the topic of the thesis, explain my motivation, and discuss conclusions of previous research.
2. Literature Review: I will explain what methods researchers apply to estimate the relationship between stock returns and lawsuits, with special attention paid to the event study methodology. Moreover, I will outline backgrounds and the reasoning for the inclusion of the specific legal actions that are studied in the financial literature and are simultaneously subject to this thesis's findings.
3. Data: I will describe the paper selection criteria, how and why I cleaned the dataset, of which the summary statistics will be presented.
4. Methodology: I will explain modern meta-analysis methods, including the funnel asymmetry test, precision effect test, and multilevel variants of these regressions.
5. Results: I will discuss my baseline regressions and robustness checks.
6. Conclusion: I will summarize my findings and their implications for policy recommendation and future research. I will also discuss the thesis limitations.

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Chapter 1

Introduction

Headlines relaying hot news about lawsuits and court decisions affecting publicly traded companies can be commonly found on the front pages of financial newspapers. It is therefore not surprising that corporate lawsuits has evolved into a major source of risk for publicly traded companies (Arena & Ferris 2017).

As Prince & Rubin (2002) some time ago noticed, no one has yet provided a comprehensive analysis of the effect that particular lawsuits events, such as the lawsuit initiation or resolution, have on the value of firms, in regard to when the most of the market lawsuit effect realizes. This thesis ambition is to finally provide help to bridge this gap.

The overarching goal of my thesis is to examine three hypotheses: First, I aim to test whether the academic literature studying the effect of major lawsuit events, such as lawsuit filings, settlements, and court verdicts, on firms' stock returns suffers from publication bias. If such bias is indeed present, I hypothesize that it will lean towards reporting more negative market reactions. To test this hypothesis, I constructed a unique meta-dataset containing 882 estimates from 64 primary studies, spanning 33 years of research. Subsequently, I applied one graphical, five linear, and four non-linear tests, which were recently developed for this purpose and applied in well-published meta-analyses, to detect and measure the bias. While there is strongly entrenched conventional wisdom supporting certain effects, namely that being targeted with a lawsuit inevitably results in market value destruction, for which I also provide graphical evidence fueling this suspicion, I find little empirical evidence for the presence of publication bias.

Secondly, I hypothesize that the 'true' effect of a negative lawsuit event on the affected firm's stock returns is negative, while a positive lawsuit event will either have a positive impact or no impact at all. To evaluate this hypothesis, I extract intercepts from the previously conducted empirical tests for detecting publication bias and interpret their magnitude, sign, and statistical significance. I then compare these bias-corrected estimates with their uncorrected equivalents. My findings confirm the hypothesis.

Finally, I aim to confirm or refute the hypothesis that one particular lawsuit characteristic, namely being a class-action - legal dispute where the plaintiff party represents a larger group of interest - has the most market value -destroying impact on targeted public companies. To verify this, I complement the meta-dataset by collecting over 50 moderator variables covering event study, lawsuit, sample, and publication characteristics. These so-called *drivers of heterogeneity* are then examined using two modern model averaging techniques: Bayesian model averaging and Frequentist model averaging. The Bayesian procedure confirms my hypothesis, that the effect of class-action lawsuits are more pronounced than those for individual plaintifs. As byproduct, I find that the only step of event study methodology that can be considered as a major modelling choice for the purposes of conducting a meta-analysis.

The original focus of the thesis was primarily on *lawsuit outcomes*, such as court rulings, settlements, or judicial decisions or penalties issued by a judge. However, since these events are incredibly difficult to gather in sufficient number, as is showed in later chapter, the focus was expanded to cover also the act of filling a lawsuit, i.e. the act which initiates the legal action, and starts a sequence of official acts that eventually ends in a court hearing and judicial decision. To include also this event to the analysis, the title of the thesis was changed to include the term *lawsuit events*, as to clearly indicate the expanded focus. This term will be utilized in further text to refer to the all above mentioned official acts, that represent the most impactful parts of the subset of litigation which are *lawsuits*.

The thesis is structured in the following way: Chapter 2 presents the theoretical frameworks necessary for understanding the lawsuit effect literature, which is the focus of my meta-analysis. Chapter 3 documents the construction of the data set for my meta-analysis, including the data collection process and the subsequent summary through the interpretation of descriptive statistics. Chapter 4 details my efforts to control for publication bias in the magnitude and sign of the effect sizes. Chapter 5 seeks to explain the observed variation in estimates by implementing modern meta-analytical methods, namely Bayesian and Frequentist model averaging. Chapter 6 concludes the thesis.

Chapter 2

Literature Review

This chapter begins with a discussion of the theoretical mechanisms through which lawsuits are expected to influence the market value of the affected firms, following which the empirical research conducted on the impact of lawsuit events on stock prices is summarised. Afterwards, the study design which ensures comparability across all included primary studies, the *event study methodology*, is reviewed in detail. The chapter concludes with an overview of the strand of meta-analyses that synthesize financial research.

2.1 Lawsuits and Market Value of Firms

Theoretical Background

Surprisingly, very few structural models of the relationship between *corporate litigation*[1] and its effects on market value exist, as most studies only state a hypothesis which they then quantitatively verify. In the singleton case, Haslem (2005) presents a very simple model of market reaction to lawsuit events, namely to the announcements of lawsuit filings and settlements.

His model suggests a positive market reaction to the announcements of settlements and a negative reaction to the announcements of being sued to the market value of the concerned firm. However, the model considers only the direct costs of litigation; in other words, it includes only the costs incurred for actively participating in the lawsuit, and the eventual penalty issued by the court. This has been found to be insufficient to wholly explain the market reaction (Karpoff *et al.* 2008).

[1] 'Corporate' implies that at least one of the litigation parties is a firm. Since all lawsuits covered in this thesis are of that kind, I will henceforth omit the adjective when referred.

My synthesis of prior research, namely of Van den Broek *et al.* (2012) and Karpoff *et al.* (2008), would suggest that the effect of the announcement that a public company is experiencing a certain lawsuit event on its market value (MV)[2], can be generally decomposed into the following three major components:

$$\Delta\text{MV} = \text{Direct Costs} + \text{Reputational Loss} + \text{Readjustment Effect}, \quad (2.1)$$

where *Direct Costs* encompass all the expenses that are directly associated with the lawsuit itself. *Reputational Loss* describes the diminished future income streams as customers, investors, and suppliers are expected to change the terms of trade with the firm in response to the announcement of the particular lawsuit event. Finally, the *Readjustment Effect* captures the direct change in expected future earnings streams, which is consequential to the outcome of the lawsuit.

Each lawsuit event effect on market value can be interpreted using a differently weighted combination of the aforementioned components.

Empirical Findings

Given that I attempt to conduct a meta-analysis, the focus should be primarily placed on the empirically oriented papers. The oldest commonly cited paper specifically studying the effects of various lawsuits events is Cutler & Summers (1988) who attempt to gauge the financial cost surrounding the Texaco v. Pennzoil lawsuit. Most important upshot for the literature was that among the costs they also computed the drop in the stock prices of both companies at specific events of the lawsuit, such as the announcement of the initial filling and the concluding settlement. This study has inspired Bhagat *et al.* (1994) to conduct the first large sample analysis of the stock market responses to lawsuits, where both defendant and plaintiff are publicly traded companies. Ever since the literature investigated a wide spectrum of lawsuits events and their effects on the financial performance of the litigated firms, the plaintiffs, or possible industry spillovers.

[2]This metric is obtained by multiplying the stock price by the number of outstanding shares. A stock price is commonly understood to reflect the risk- and time-discounted present value of all future cash flows that are expected to be collected by the stockholder (Bhagat & Romano 2002).

2.2 Event Study Methodology

Financial market reactions to a specific corporate event is commonly measured using so-called *event study methodology.* All empirical studies mentioned in the previous section employ a distinct form of the event study design, therefore, in order to understand to what extent the method's users can influence the magnitude of the findings, it may be worthwhile to review the various aspects of the methodology in the greatest detail.

The main idea behind the development of the financial event study methodology[3] was to empirically test the *efficient market hypothesis* (EMH), that the stock price reflects all, at the time available information concerning the publicly listed company (Fama 1991)[4] and therefore the prices adjust instantaneously to new information (Fama *et al.* 1969). Event study framework was designed with the purpose to quantify the stock price adjustment originating in the *event* of stock price relevant up-to-date knowledge being available. Next to lawsuits, such events may be press releases announcing mergers or acquisitions, upcoming stock splits, earning reports, or other news that the markets would interpret as impactful through some channel on future cash flows of the publicly traded company. In other words, an event study detects and quantifies the impact of a specific event on the market value of a firm[5].

Lets have an event with potentially stock-relevant information become universally known at certain time $\tau = 0$. To measure the impact of this newly discovered knowledge, a continuous time window - an *event window*[6] - within

[3]The contents presented here are based on the works of MacKinlay (1997), Pynnönen (2005), Kolari & Pynnönen (2023) and Kliger & Gurevich (2014). Note that the event study applied in financial research is to a large extent methodologically different from the event studies commonly utilized in microeconometrics, which are described, for example, in Borusyak *et al.* (2024).

[4]To be precise, Fama distinguishes between three types of *Efficient Markets Hypotheses*: *week*: stating that only historical information is included and no technical expertise, *semi-strong*: implying that market prices reflect all publicly available information including technical expertise, and *strong*: stipulating that all public and private information are reflected in the market prices. In the context of event studies, the semi-strong version is the one examined (Fama 1970). The theory is not without its critics. One famous example is the *Grossman-Stiglitz Paradox* introduced by Grossman & Stiglitz (1980) which argues that perfectly efficient markets cannot exist, since they would imply that arbitrage profits cannot occur, and therefore, there is no profit in gathering information and little reason to trade.

[5]Interestingly, event studies have a long tradition of application in financial research, the first ever is thought to be conducted in the 1930s by Dolley (1933), who studied the price effects of stock splits by examining nominal price changes at the of the split, but the 'original' methodological paper is dated 30 years later when a seminal one by Fama *et al.* (1969) was published.

[6]In some studies, it is also referred to with the term *announcement period.*

which the price adjustment resulting from the event could reasonably be expected to realize itself, needs to be defined. Typically, the event window is composed of a number of trading day, but its unit choice as well as the delineation of the borders of the event window is decided ad hoc by the researcher. Nonetheless, it should be inferred based on the knowledge of the phenomenon of interest[7]. Interestingly, the event window does not even need to be symmetric around the event day and even does not need to include it.

Lets from now $\tau_1 \leq \tau \leq \tau_2$ denote the lower and upper border of the event window[8], respectively, where τ denotes the time unit of the event window. Having defined the period of interest, a metric of financial performance to evaluate the event's induced abnormality is to be selected. The most convenient choice arguably are *stock returns*[9], as they have the advantage over stock prices by being comparable between different stocks and studies. It should be noted that stock returns can be measured across a variety of frequencies, but in an event study they should correspond to the unit utilized in the composition of the event window. In the 'lawsuit effect' literature of the last three decades, the *daily stock returns*, where P_t is the opening stock price of the day t and P_{t-1} is the closing price on the day $t-1$, are the ones predominantly utilized[10]. Hence, from now on if necessary, I will demonstrate the event study on daily stock returns.

In a next step, a portfolio of firms on whom the impact is to be quantified needs to be selected. Importantly, each stock of the sample should experience a certain common type of event, so the findings can be reasonably interpreted as being a consequence of the event. Such event may be, for example, an announcement of a firm being a target of a legal action or being a party in a settlement agreement.

[7]Example: For the event of earnings announcement MacKinlay (1997) recommends a 41 day long event window, i.e. such event window that is composed of four trading weeks prior to the event and four trading weeks past it.

[8]Meaning, if $\tau_1 = -1$ and $\tau_2 = 1$, the event window consists of three days, the day prior to the event day, the event day, and the day post the event day. This particular window can be written as [-1, 1].

[9]Stock returns are defined as: $\mathrm{R}_t = log(\mathrm{P}_t/\mathrm{P}_{t-1})$, where P_t is the stock price at time t.

[10]Only older studies, such as Ellert (1976) or Burns (1977), used monthly stock returns to measure the stock market impact of antitrust litigation. A single relatively recent study, Badrinath & Bolster (1996) utilized a weakly frequency. It is very reasonable to assume that when data become available, future studies will utilize returns of higher frequency, but none such have been identified thorough the data collection phase of my meta-analysis.

Then the evaluation of the event's impact on a stock i may be expressed as:

$$\mathrm{AR}_{i\,\tau} = \mathrm{R}_{i\,\tau} - \mathrm{E}(\mathrm{R}_{i\,\tau}|\,\mathbf{I}_\tau) \tag{2.2}$$

where $\mathrm{AR}_{i\,\tau}$ is the *abnormal return* of stock i on day τ, $\mathrm{R}_{i\,\tau}$ is the realized return of stock i on day τ, $\mathrm{E}(\mathrm{R}\,|\,\mathbf{I}_\tau)$ is the (conditional) expected return of stock i on day τ given the conditioning information $\mathbf{I}_\tau$ of all being 'expected' except for the occurrence of the event.

As written in the equation above, abnormal returns can be understood as being the forecast error[11], i.e. the residual $\varepsilon_{i\,\tau}$ between the observed and predicted return of the stock i on day τ. Hence, the abnormal return is a direct measure of the (unexpected) change in the shareholder wealth associated with the event.

The conditional expected returns from the equation above are sometimes referred to with the term *normal returns*, as to imply that they present what the value of the realized returns would have been, had the event not occurred. Naturally, a great number of models can be used for simulating the normal returns. The definition of abnormal returns then changes according to the applied model. The following ones, presented in the order of ascending complexity, were applied in the recent lawsuit effect literature:

1) *mean adjusted returns* model:

$$\mathrm{AR}_{i\,\tau} = \mathrm{R}_{i\,\tau} - \mu_i,$$

where μ_i is the unconditional expected return of the stock i, computed as the sample average of the stock returns[12].

2) *market adjusted returns* model:

$$\mathrm{AR}_{i\,\tau} = \mathrm{R}_{i\,\tau} - (\mathrm{R}_{mkt\,\tau}),$$

where R_{mkt} is the return on market portfolio on day τ. In a typical case, returns on a broad stock index, such as 'CRSP Value Weighted Index' or 'S&P

[11] For this reason, in literature predating MacKinlay (1997) abnormal returns are sometimes referred to with the term *prediction error* (PE) and *cumulative prediction error* (CPE) or *forecast error* (FE) and *cumulative forecast error* (CFE), such examples are Cutler & Summers (1988) or Bosch & Eckard Jr (1991).

[12] Notably, the definition was derived by modifying and fitting coefficients by OLS of the model equation: $\mathrm{R}_{i\,\tau} = \mu_i + \varepsilon_{i\,\tau}$, where $\varepsilon_{i\,\tau}$ is the idiosyncratic error. The rest of the definitions is derived in the same fashion.

500 Equally Weighted Index', are supplemented for the returns on the market portfolio.

3) *capital asset pricing model*:

$$\mathrm{AR}_{i\,\tau} = \mathrm{R}_{i\,\tau} - (\mathrm{R}_f + \hat{\beta}_i(\mathrm{R}_{mkt\,\tau} - \mathrm{R}_f)\,),$$

where $\mathrm{R}_{f\,\tau}$ is the risk free return on day τ and $\hat{\beta}_i$ is the estimated sensitivity.

4) *market model*:

$$\mathrm{AR}_{i\,\tau} = \mathrm{R}_{i\,\tau} - (\hat{\alpha}_i + \hat{\beta}_i \mathrm{R}_{mkt\,\tau}),$$

where $\hat{\alpha}_i$ is the estimated Jensen's alpha.

5) *factor models*:

$$\mathrm{AR}_{i\,\tau} = \mathrm{R}_{i\,\tau} - (\hat{\alpha}_i + \hat{\beta}_{mkt}(\mathrm{R}_{mkt\,\tau} - \mathrm{R}_{f\,\tau})\, + X\hat{\beta}),$$

where X is a set of risk factors[13] with estimated weights $\hat{\beta}$, which measure the sensitivity of the returns to the factors. Factor models differ from each other in the composition of the utilized risk factors. Some examples utilized in the lawsuit effect literature are the *three-factor model* (FF3) of Fama & French (1993), the *four-factor model* (FF4) of Carhart (1997), or the *five-factor model* (FF5) of Fama & French (2015).

The most frequently utilized model in the literature is the market model, but with better data availability the practice of applying factor models is gaining on prominence. In 1970s and 1980s, CAPM used to be the predominant choice of researchers, but after its bad predicting capabilities were discovered, it ceased to be the default option (MacKinlay 1997). Ideally, more than one model is applied in an event study for bench-marking purposes and comparative analysis.

All of the models above need a consecutive sample of daily stock returns to estimate some of their parameters. The so-called *estimation window* is typically set to compose around 250 trading days, in other words, one 'trading year', but the choice always depends on the applicants and on the richness of data at their hand. The main condition for the window is to be located entirely before, or, in rare cases, after the event, so the fitted parameters are not influenced by the potentially abnormal stock activity surrounding the event day. Accordingly,

[13] Such as *robust profit minus weak profit* (RMW_τ) factor, or *small minus big* (SMB_τ) factor of Fama & French (2015). These can be easily downloaded from the Kenneth French data library.

Bhagat & Romano (2002) recommend that the estimation window should be at least 120 trading days long, as shorter ones may be contaminated with short-term significant price movements.

Naturally, estimation and event windows should not overlap, as that could skew the interpretation of the study results. The ideal relation can be seen in Figure 2.1. While the event window is always defined as a closed interval, the estimation window may be reported as a right-open one.

Next step is to run regression of realized returns from the estimation window on the variables characterizing the normal returns model. While in all reviewed studies the regression method type was the ordinary least squares (OLS), no such constriction is required by the methodology[14]. The model with estimated parameters is then used to predict returns for each day of the event window[15]. These *expected returns* are then placed in Equation 2.2 to compute the daily abnormal returns.

Having now calculated abnormal returns for each day of the event window, it is necessary to aggregate the values into a single number, since inference for the whole period is the aim. The *cumulative abnormal returns* for the stock i over the event window delimited by days τ_1 and τ_2 can be written down as:

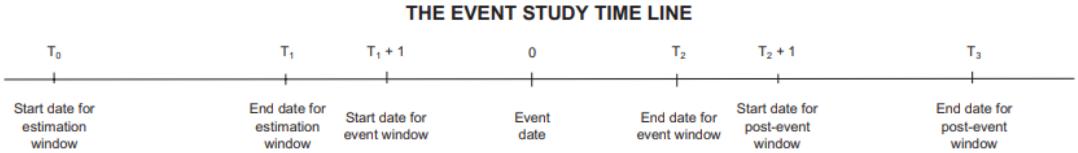
$$\mathrm{CAR}_i(\tau_1,\, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \mathrm{AR}_{i\,\tau} \tag{2.3}$$

A natural way of interpreting cumulative abnormal returns from a stock portfolio of interest involves focusing on a measure of their central tendency, such as the median or average. In some cases, both of these measures are reported and analysed in the lawsuit effect literature, for instance in Bizjak & Coles (1995), but the statistical significance of median value is usually tested using non-parametric tests, thus making it unsuitable for being considered the effect size of interest of a meta-analysis. Hence, I focus only on findings aggregated through averaging. Returns can be averaged either over the event window or across the stock portfolio for each day of the event window, and then summed[16].

[14]Some event studies may use weighted least squared (WLS), or any method that yields statistically sound estimates of the parameters.

[15]It may be pertinent to mention that the approach described in this chapter yields in essence the same results as the so-called *dummy event studies* (Pynnönen 2005), which run OLS on a sample that consists of returns from both estimation and event windows, with the ones from the latter window being denoted with a dummy variable.

[16]In other words, cumulative average abnormal return (CAAR) yields the same result for a given portfolio at certain time, as the average cumulative abnormal return (ACAR).



Note: The figure shows a time diagram of an event study from Benninga (2014). The post-event window is not used in any of the primary studies, hence it is not discussed in the text.

Figure 2.1: Diagram of an event study

The *cumulative average abnormal returns* for a portfolio consisting of n stocks can be computed as:

$$\text{CAAR} = \frac{1}{n}\sum_{i=1}^{n} \text{CAR}_i \tag{2.4}$$

which may be rewritten together with (2.6) and abnormal returns definition as:

$$\text{CAAR}(\tau_1,\, \tau_2) = \frac{1}{n}\sum_{i=1}^{n} \text{CAR}_i = \frac{1}{n}\sum_{i=1}^{n}\sum_{\tau=\tau_1}^{\tau_2} \varepsilon_{i\,\tau},$$

The impact of the event over the event window is thus captured in the value the cumulative average abnormal returns. This fact makes it to be the effect size of interest for this meta-analysis. As was mentioned in the previous section, in lawsuit setting, the CAAR around the time a filing is announced could be interpreted as the change in investors' expectations about the wealth effects of the suit, as well as information on economic losses that are to be induced by the litigation (Firth *et al.* 2011b), paramount of which are likely the ones related to the incurred reputational damage (Karpoff *et al.* 2008).

Before proceeding to the next subsection, let's review the statistical properties of the metrics derived so far. This subsection is freely based on the work of Pynnönen (2005). The crucial assumption is that the original stock returns are jointly multivariate normal and independently and identically distributed through time (MacKinlay 1997). Under this assumption the abnormal returns are also normally distributed. However, they are not independent, as the model parameter had to be estimated, and hence contain estimation error. Their expected value will depend on the effect of the event. In the most general case each day day in the event window has a separate effect. Using a market model, this can be written as $\text{R}_{i\,\tau} = \alpha_i + \gamma_{i\,\tau} + \beta_i\,\text{R}_{mkt\,\tau} + \varepsilon_{i\,\tau}$, where $\gamma_{i\,\tau}$ is the true returns effect induced by the event on day τ to stock i. Then the abnormal returns can be written as:

$$\begin{aligned}
\mathrm{AR}_{i\,\tau} &= \mathrm{R}_{i\,\tau} - (\hat{\alpha}_i + \hat{\beta}_i\,\mathrm{R}_{mkt\,\tau}) \\
\mathrm{AR}_{i\,\tau} &= \alpha_i + \gamma_{i\,\tau} + \beta_i\,\mathrm{R}_{mkt\,\tau} + \varepsilon_{i\,\tau} - (\hat{\alpha}_i + \hat{\beta}_i\,\mathrm{R}_{mkt\,\tau}) \\
\mathrm{AR}_{i\,\tau} &= \alpha_i - \hat{\alpha}_i + (\beta_i - \hat{\beta}_i)\,\mathrm{R}_{mkt\,\tau} + \gamma_{i\,\tau} + \varepsilon_{i\,\tau}
\end{aligned}$$

From the properties of OLS estimators stems that $\mathrm{E}(\alpha_i) = \hat{\alpha}_i$ and $\mathrm{E}(\beta_i) = \hat{\beta}_i$, and therefore holds that the expected value of the abnormal returns equals to $\mathrm{E}(\mathrm{AR}_{i\,\tau}\,|\,\mathrm{R}_{mkt\,\tau}) = \gamma_{i\,\tau}$. Hence under the normality assumptions the abnormal returns for stock i on day τ are distributed as $\mathrm{AR}_{i\,\tau} \sim \mathrm{N}(\gamma_{i\,\tau}, \mathrm{Var}(\mathrm{AR}))$. It can be shown that as the length of the estimation window increases, $\mathrm{Var}(\mathrm{AR})$ can be approximated with $\mathrm{Var}(\varepsilon_{i\,\tau})$. The statistical properties of $\mathrm{CAR}_{i\,\tau}$[17] directly stem from the above, meaning they are normally distributed with the mean:

$$\Psi_{i\,\tau} = \mathrm{E}(\mathrm{CAR}_{i\,\tau}) = \sum_{j\,=\,\tau_1}^{\tau} \gamma_{i\,j},$$

which gives us that $\mathrm{CAR}_{i\,\tau} \sim \mathrm{N}(\Psi_{i\,\tau}, \mathrm{Var}(\mathrm{CAR}))$ and for large estimation windows, the variance can be approximated with $(\tau - \tau_1 + 1)\,\mathrm{Var}(\varepsilon_{i\,\tau})$.

Finally, by building on the previously derived terms, the following holds for cumulative average abnormal returns:

$$\Psi_{\tau} = \mathrm{E}(\mathrm{CAAR}_{\tau}) = \frac{1}{n}\sum_{i\,=\,1}^{n}\sum_{j\,=\,\tau_1}^{\tau} \gamma_{i\,j},$$

and if the stock returns can be considered sufficiently independent, then:

$$\sigma_{\tau}^2 = \mathrm{Var}(\mathrm{CAAR}_{\tau}) = \frac{1}{n^2}\sum_{i\,=\,1}^{n} \mathrm{Var}(\varepsilon_{i\,\tau}),$$

which all together implies that: $\mathrm{CAAR}_{\tau} \sim \mathrm{N}(\Psi_{\tau}, \sigma_{\tau}^2)$.

Hypothesis testing in Event Study framework

The final part of any event study involves conducting a hypothesis test for the presence of abnormal performance of the stock portfolio over the time period of interest. While the null hypothesis in most cases is that the event has no

[17] $\mathrm{CAR}_{i\,\tau}$ denotes $\mathrm{CAR}_i(\tau_1,\,\tau) = \sum_{j\,=\,\tau_1}^{\tau} \mathrm{AR}_{i\,j}$. This notation is used for brevity. The same convention applies to CAAR_{τ}.

impact on the distribution of returns in the event window, the utilized test statistics differ among applications.

In general, the tests can be divided into two classes: *parametric* and *non-parametric*. Since I only need to collect information on parametric tests for the purposes of the meta-analysis, non-parametric tests[18] are not covered in more detail in further text.

Parametric tests are statistical methods that make explicit assumptions about the distributional form of the data. As shown above, the underlying assumption manifests itself through the error terms of the normal returns models. The biggest advantage of parametric tests is the simplicity with which they can be applied. The drawback is that they require symmetry in returns distributions, which is not commonly encountered[19]. The parametric tests differ in the way CAAR had been adjusted in the formula, but overall they follow the same procedure with inference depending on the asymptotic normality of the test statistics stemming from the Central Limit Theorem (Patell 1976).

Either of the following two parametric tests was applied in most of the studies composing the eventual meta-dataset, these tests are ordered by their frequency in the sample:

i) t-test is the most rudimentary approach to drawing statistical inference from an event study. Under the null hypothesis, there is no effect induced by the event on the portfolio over the event window, in other words $\Psi = 0$, which would imply that $\text{CAAR} \sim \text{N}(0, \sigma^2)$. Then, according to the CLT, holds that $\frac{\text{CAAR}}{\sigma} \sim \text{N}(0, 1)$, where σ needs to be estimated. Estimating it with the standard error of CAAR allows for the application of common t-test statistical inference.

ii) A *Patell* test follows a similar approach to the t-test described above, but employs a transformation of abnormal returns, specifically using *standardized abnormal returns* (SAR). These are obtained by dividing the AR with the square root of its estimated forecast variance, i.e. $\text{SAR}_{i\,\tau} = \frac{\text{AR}_{i\,\tau}}{\text{sd}(\text{AR}_{i\,\tau})}$. The test than follows the same procedure as the one described above. The chief distinction between the two tests lies in Patel's standardization, which is by

[18]Non-parametric tests do not make any assumptions about the data generating process and are simply a function of the data. Commonly applied non-parametric tests are the rank test of Corrado (1989) or the sign test of Brown & Warner (1985). For a neat review of non-parametric tests, see Dutta (2014).

[19]Notably, the assumption is not often discussed in the methodological parts of the lawsuit effect literature. Similar observation was made by de Batz & Kočenda (2023) for their event study utilizing strand of academic literature.

definition designed to account for the event-induced volatility of individual estimates.

When referred to in further text, I will associate the term 't-statistic' with a t-test, and 'z-statistic' with a Patel test, as it is a common convention in the literature.

After drawing statistical inference from the applied hypothesis test, the event study is completed and its results can be utilized to evaluate whether the the portfolio of interest experienced over the specified period abnormal market performance that may be attributable to the common type of event, and if so, it provides quantitative evidence on the magnitude of the effect. This information is, for instance, used in legal liability cases to quantify incurred damages (Bhagat & Romano 2002). Other usual utilization of statistically significant CARs is to set them as the dependent variable for a cross-sectional regression analyses examining a financial research question at hand[20].

Summary

The event study methodology is a powerful while relatively straightforward tool of counterfactual analysis for detecting and measuring abnormal stock market performance. It may be worth noting the rather high number of choices a researcher needs to make in order to properly utilize the method. To highlight this feature of the study design, I can decompose the process of conducting an event study into the following steps:

1. Define an event of interest.
2. Assemble a collection of stocks experiencing the common type of event.
3. Identify the event date for each firm composing the portfolio.
4. Construct the event window, i.e. the time period over which the stock prices affected by the event are to be examined.
5. Choose a model for simulating normal returns.
6. Set a length of the estimation window, i.e. choose the time series of returns for estimating the coefficients of the normal returns model which will be utilized to fit expected returns.

[20]In such settings, it is common practice to optimize the event window length to find such window that yields statistically significant CARs and then to try to explain this abnormality with a set of firm- or event-specific variables.

7. Fit the normal returns model on the realized returns from the estimation window.

8. Simulate expected returns from the normal return model for the event window.

9. Compute abnormal returns, cumulative abnormal returns, and cumulative average abnormal returns.

10. Test the null hypothesis of the presence of abnormal stock performance in the event window.

11. Interpret results based on the magnitude, sign and statistical significance of the abnormal market performance metric.

For brevity, I will follow Bajzik *et al.* (2023) and use the term *price response*[21] to refer to the cumulative average abnormal returns metric. Apart from practical considerations, this term facilitates the understanding of the interpretation of effect sizes. Moreover, I will use the terms *value creation* and *value destruction* to denote positive and negative price responses, respectively.

Given the variability in how the methodology may be applied and the heterogeneity of the results reported in the lawsuit effect literature, the topic could benefit from a synthesis of these findings.

2.3 Meta-analyses and Financial Literature

Meta-analyses, systematic and statistical analyses of all comparable empirical estimates of a specific effect size (Gechert *et al.* 2023), were initially developed in the field of medical research as a tool for drawing statistical conclusions from studies performed on small samples of prohibitively expensive clinical trials. In short time, the practice has been adopted in other areas of academic research.

Meta-analyses play a crucial role in empirical research by aggregating and examining data from multiple studies, which then provides a thorough and quantitatively sound overview of existing research. Such approach is arguably more likely to yield substantive conclusions about the topic of interest, than those conclusions which could be derived from single studies alone. For example, in an influential meta-analysis, Ioannidis *et al.* (2017) finds on a sample

[21] An alternative could be the expression *short-term market reaction* to the announcements of lawsuit events.

of 6700 empirical economic studies covering 159 strands of literature that four fifths of the published research strongly exaggerate the reported effect by a factor of two[22] or more. Moreover, meta-analyses may be a convenient tool for overturning conventional wisdom[23] in the specific field, as they utilize comprehensive datasets of all published empirical estimates. Nowadays, meta-analyses are a fundamental component of any scientific field which frontier may benefit from synthesising the already conducted empirical research.

Until relatively recently, the academic field of financial literature had not been a focus for meta-researchers, even though the practice had already become well-established in the closely related fields, such as economics (for example, Bajzik *et al.* (2020)), management (for instance, Joshi *et al.* (2015)), or business research (namely, Carney *et al.* (2011)), but the figurative explosion in the volume of produced empirical financial research in the last decade[24] motivated the expansion of its application into this sphere as well.

Some prime examples of meta-analysis summarizing finance related research questions may be: Bajzik (2021) who synthesized the published empirical literature on the relationship between trading volume and stock returns, or Astakhov *et al.* (2019), who conducted a quantitative survey of research relating firms' size to their stock returns. Quantitative finance field practitioners may benefit from insights of Holderness (2018) who summarized the academic papers that document the impact of publicly traded corporations announcing equity issuance on their stock prices, or of Gric *et al.* (2023) who reviewed literature studying the relationship between investor's sentiment and stock returns. Banking regulation discussions may be enriched by findings of Malovana *et al.* (2024) who collated and summarized empirical studies estimating the effects of changes to capital reserves requirements for banks on their subsequent credit provision. A wider overview of the recent application of meta-analysis in finance, and other examples, may be found in Geyer-Klingeberg *et al.* (2020).

While the above-mentioned meta-analysis cover important topics, none of them focuses on effect sizes collected from event studies. In this aspect, the meta-analysis that has the most significant influence on mines is Bajzik *et al.* (2023), in which the authors examined abnormal returns (or *price responses*) related to the events of shareholder activism, detecting publication bias in the

[22]"Paldam's rule of thumb" states that publication bias typically increases the reported mean of the effect size by a factor of two (Doucouliagos *et al.* 2018).

[23]Gechert *et al.* (2023) present a detailed survey of meta-analyses in which the conventional wisdom of the investigated field was challenged.

[24]From 1 publication in 1965 to 11 120 in 2019 Geyer-Klingeberg *et al.* (2020).

literature, and finding that markets reacts more positively to the activism of individual investors with the effects being stronger in environments with better protected shareholder rights. The article was both expanded in the number of estimates and narrowed down to focus on publication bias in Bajzik (2023).

To the author's knowledge, there is so far only one similarly oriented meta-analysis attempting to synthesize the interplay between new information relayed by corporate litigation events and the following performance of the concerned publicly traded firms on financial markets. de Batz & Kočenda (2023) examine the literature studying the relationship between news of intentional financial crime and the stock returns of concerned publicly-traded firms, by gathering 480 estimates from 111 research articles on which they run a meta-regression analysis. Their findings suggest a strong presence of negative publication bias, with effect sizes being exaggerated by the factor of 3 in the literature, and that the effects tend to be systematically stronger in common law countries, such as the United States.

It may be pertinent to highlight that the meta-dataset constructed by de Batz & Kočenda (2023) does not serve as the basis for the meta-dataset of this thesis. Nevertheless, the text of the paper was consulted extensively on methodological issues.

Moreover, it should be stated that significant differences exist between my analysis and the meta-analysis conducted by de Batz & Kočenda (2023). Beyond certain methodological distinctions, which are discussed thorough the text, the primary difference lies in the sought types of events that were utilized by the authors of primary studies in the conducted event studies. Whereas de Batz & Kočenda (2023) synthesise price responses of the stock market to the *announcements of intentional financial crime* committed by listed firms, my focus is on the market reactions to the news of *lawsuit events officially occurring*. This difference may be subtle, yet it is fundamental: the announcement of potentially illegal activities, such as the disclosure of financial restatements, typically does not immediately involve legal proceedings or any direct engagement with the court system[25].

[25] A study which is part of de Batz & Kočenda (2023) dataset but not mine is, for instance, Firth *et al.* (2011a), who at one point of the paper quantified the abnormal returns surrounding the announcement of restatement of financial statements, which is highly indicative of previous financial crime of intentionally misreported figures in the company's balance sheet/income statement. But that is no lawsuit event. An example of paper that belongs to both datasets is Griffin *et al.* (2004), who for their event study employ the filling date of securities class-action lawsuits. This is both, an announcement of an upcoming lawsuit and news of potential, intentional financial crime to the markets.

Chapter 3

Data

To conduct a proper meta-analysis, a researcher has to construct their own dataset from existing academic literature that is pertinent to their topic of interest. The step is the critical component of any meta-analysis, and it consists of gathering all relevant estimates of the relationship and the underlying research characteristics that could influence the magnitude and sign of the reported effect sizes. To successfully take this step, I need to identify as many relevant pieces of academic literature, or *primary studies*, as is possible. All data points are then extracted from these identified studies and, hence, all of the meta-analysis findings would depend on the quality and comprehensiveness of the *meta-dataset*. For my meta-analysis, I amassed 882 estimates of cumulative average abnormal returns associated with pre-selected lawsuit events and 70 study design choices sourced from 64 primary studies.

This chapter delineates the data collection process, by first listing and explaining the selection criteria for the inclusion of primary studies into the meta-dataset, which is supplemented with a discussion of the issues encountered during the process. Afterwards, I outline the adjustments implemented on the gathered data in order to facilitate the application of the intended meta-analytical methods. At the end, the variables of the meta-dataset are introduced, rationalized, and summarized by the means of descriptive statistics.

3.1 Data Collection

The data collection process is inspired by prescriptions of Irsova *et al.* (2023). I rely on the Google Scholar as the primary source of studies, since it is utilized in the same manner in a number of recent meta-analyses, such as Bajzik (2023) or

Yang *et al.* (2023). The main advantage of Google Scholar is its search engine going through the full text of all studies in the database, not only through titles, abstracts, or lists of keywords. The output of a Google Scholar query is a list of academic writings ordered by their relevance based on the input of keywords composing the query.

I commence the search for primary studies of my meta-analysis by filling in the Google Scholar search box a simple query of the following form:

lawsuit events stock returns

This query is run with the aim of identifying 5 influential research articles[1] published in top academic journals[2], that would serve as the basis for further investigation into the literature. Drawing on the insights gained from these studies, I attempt to refine the Google Scholar search query so it captures all potential candidate papers. The search query should be neither overly restrictive nor excessively broad, as to avoid yielding a list saturated with irrelevant studies. For this reason, it is sensible to avoid using the more universal words[3]. As a validation of an attempted query, I check the presence of previously identified influential studies near the top of the query's output. After

[1]Namely, I identified Bhagat *et al.* (1994), Bizjak & Coles (1995), Gande & Lewis (2009), Haslem (2005), and Karpoff *et al.* (2005).

[2]Journal of Financial Economics, American Economic Review, Journal of Financial and Quantitative Analysis, The Journal of Finance, and The Journal of Law and Economics, respectively.

[3]For example, one tested search query used the word "abnormal", as to highlight studies using an event study methodology. Replacing the word with "event study" led to a decrease in the number of hits by tens of thousands. In this light, the main drawback of the final query is arguably the utilization of the word "outcome" in (3.2). However, this incorporation is necessary, since its combinations with the words from (3.1) are highly relevant for the research question. Nevertheless, the word "decision" was removed from (3.2) because of its broad application.

some fine-tuning, I design the *final query* to have the following form:

$$\text{(lawsuit OR litigation OR legal OR court OR judicial OR trial) AND} \tag{3.1}$$
$$\text{(verdict OR outcome OR ruling OR resolution OR} \tag{3.2}$$
$$\text{filing OR settlement) AND} \tag{3.3}$$
$$\text{("stock returns" OR "stock price" OR} \tag{3.4}$$
$$\text{"stock market reaction" OR "stock market response" OR} \tag{3.5}$$
$$\text{"shareholder wealth" OR "firm value") AND} \tag{3.6}$$
$$\text{("event study" OR "event-study")} \tag{3.7}$$

The explanation for individual components of the final query is following: The combinations of (3.1), (3.2) and (3.3) words is intended serve to filter for articles which research considers the events of litigation procedures. Adding (3.4), (3.5) and (3.6) to the previous points specifies my focus on financial markets adjusting to new information. Finally, the role of (3.7) is to make the potential primary studies that employ the event study methodology more relevant, and thus reward these preferred candidates with a higher rank in the query output.

To enhance the relevancy of the retrieved papers, I restrict the query results to include only papers published after 1990. The rationale for this decision is grounded in the observation that none of the previously identified influential papers was published later than 30 years ago[4]. This temporal limitation may also ensure that as the search results are concentrated on more contemporary studies, which are more likely to reflect modern event study methodological practices and to report more relevant findings.

The first 500 studies yielded by the final query were each individually marked and downloaded. A list with the output titles was archived in an excel worksheet[5] for transparency purposes.

Afterwards, downloaded studies are filtered for the ones relevant to the focus of my meta-analyses. The first criterion is the paper's title. If the title is found to be possibly topically pertinent, I jump to the paper's abstract. In the abstract, I pursue mentions of an event study methodology being applied in the paper and if so, whether the event concerns litigation. This firsthand filtering process yielded 81 candidates for the inclusion into the meta-dataset.

[4]Note that the thesis was completed in 2024, the referred paper is Bhagat *et al.* (1994).

[5]This is the main perk of marking each paper with the 'Save' button on the Google Scholar output page, as an already prepared worksheet listing the saved studies can be easily downloaded.

One of the candidate papers yielded by the query is the previously discussed meta-analysis by de Batz & Kočenda (2023). Considering the potential for overlap between my meta-dataset and theirs, I have incorporated all papers from their meta-analysis that were not previously identified into the pool of candidates.

Most importantly, I thoroughly apply the primary study identification practice known as *snowballing.* This method involves examining all topically relevant references cited in the previously identified primary studies. Snowballing is a common practice of accumulating primary studies in meta-analytical literature, it was applied, for example, in Gric *et al.* (2023) or Astakhov *et al.* (2019)[6]. Such newly identified studies then undergo the same title-abstract check as the initial set, and if deemed relevant, they are too subjected to further snowballing. This iterative process significantly broadens the pool of candidates by expanding it to 252 potential primary studies[7].

As lawsuit procedures tend to be complex and thus filled with overwhelming research opportunities, it is crucial to maintain high level of transparency concerning the criteria used to designate a candidate paper as a primary study. For this reason, the primary study status determination will be guided by a formal search rule. After some calibration based on information from processed studies, the *designation rule* applied to the snowballed papers is defined with the following criteria:

(i) The text of the primary study is written in English.

(ii) Theses, dissertations, essays and conference papers are not eligible.

(iii) The paper must be written between January 1990 and December 2023.

(iv) The effect of lawsuit events on stock returns is captured through an implementation of the event study methodology. Specifically, the event

[6] Astakhov *et al.* (2019) applies less thorough variant of the method in which they review only references from the 10 most-cited studies on Google Scholar and from review papers. This would likely be insufficient in the context of my thesis, due to the lawsuit effect being a multi-disciplinary issue and the absence of any recent review paper.

[7] A reasonable explanation for why the final query failed to collect such high number of papers may be the great verbosity that can be used to academically discuss both lawsuits and event studies, that I fleshed out in previous sections, and which I did not include in the already quite sizable query. Further meta-analysis into similarly oriented literature would benefit from following Bajzik (2023) and expanding the to-be-downloaded sample of studies from Google Scholar from 500 to 1000.

study must use daily stock returns, short-run event windows[8] and the effect sizes must be reported in an extractable manner[9], with the event of interest being lawsuit related.

(v) The primary study must provide the standard error, or other statistical measures that can be used to derive it, related to the abnormal returns.

(vi) The eventual outcome of the legal action examined in the primary study is ultimately decided by a court verdict.

(vii) Only studies that assess the impact of lawsuit events on the stock returns of the concerned litigation parties are considered. Additionally, the studies must not be limited to a single legal case or a single court ruling.

(viii) If a litigation type covered in the primary study, it is either antitrust, securities, employment, environmental, or intellectual property.

Studies not satisfying all eight conditions are ineligible for the primary study status. The order in which the criteria are listed corresponds, to certain extent, to the order in which the studies were filtered. The justifications for each point of the designation rule are following:

(i) arguably constitutes a potential limitation of the thesis, nevertheless it is more reasonable to omit these studies than to include them in a meta-analysis and being dependent on the quality of what would be very likely an amateurish translation[10] of possibly complex legal verbose.

(ii) is a standard practice when conducting a meta-analysis. These particular types of academic work often lack the quality assurance that is provided by a thorough peer-review process. Consequently, their findings could compromise the overall integrity of a meta-analysis. However, it is important to note that unpublished working papers may still qualify as primary studies composing my meta-dataset. This inclusion should not have a detrimental effect on the findings of the meta-analysis, since authors typically write working papers with the aim of eventual publication in a peer-reviewed journal (Doucouliagos & Stanley 2013), which might not necessarily be true for the excluded types of academic work. The same approach has been adopted, among others, in Bajzik *et al.*

[8] In this particular aspect, I follow Bajzik *et al.* (2023), who characterized the short-run event windows as having the maximum time distance of 30 trading days from the event day. In other words, the largest admissible event window is [-30, 30].

[9] An example of inextricable form may be Marco (2005) who presented the abnormal returns that could be theoretically used for comparison in this meta-analysis, only graphically.

[10] A single study, written in Mandarin, was not included due to this condition.

(2023) or de Batz & Kočenda (2023). Moreover, including unpublished academic papers could hypothetically provide valuable insights about what type of findings gets to be published.

(iii)'s aim is twofold. Firstly, it shields the relevancy of my findings. Since legal systems and information channels utilized by financial markets inherently evolve over time, pooling results from vastly[11] different time periods may not be appropriate, as it could adversely affect the interpretation. Moreover, assuming that the literature is vast, this constraint ensures that older studies do not crowd out the newer and more relevant ones in the Google Scholar output. Secondly, this limitation facilitates the scope of the thesis[12].

(iv) ensures the comparability among all primary studies. In practice, it means that only only studies that may yield the cumulative average abnormal returns as the metric of the lawsuit event impact, are eligible for a primary study status.

(v) serves primarily to filter away studies that gauge the effects of regulatory sanctions and enforcement actions on the stock returns of concerned firms. Nevertheless, studies where regulatory or government agencies act as a party of a lawsuit, are still included, as long as it is a judge that determines the final outcome of the legal process underlying the legal dispute. In practice it means that, if the event employed in the event study is an announcement of either filing a lawsuit, a settlement of a lawsuit, or a court verdict[13], the study is to be included in the meta-dataset and its estimates are to be collected. This criteria stems directly from the focus of the thesis which is on the market reaction to lawsuits, which are legal disputes which outcome is eventually decided by a judge in a court hearing.

(vi) is a necessary condition for applying any publication bias methods. Consequences of this point on the amount of amassed literature are discussed

[11]For primary studies in the final sample, the average difference between the year the study was published and the end year of the time period it covers is 7 years. The covered periods for each primary study can be found in Appendix A. The eldest lawsuit in the sample is potentially from 1964 (Hersch 1991).

[12]Notably, the dataset won't include studies written in 2024, i.e. the year in which this thesis was completed and is to be defended.

[13]The distinction is admittedly nuanced. For instance, fines or damages as ruled by a court are considered to be a verdict. Example may be Flore *et al.* (2021), who studied the effect of announcements of penalties from civil/criminal lawsuits on stock returns of banks. On the other hand, fines levied by a regulatory body, such as a central bank, are not considered, e.g. Armour *et al.* (2017) who quantified the short-term market reaction to firms targeted by regulatory sanctions of the Financial Services Authority in the United Kingdom.

more in Section 3.2 and in the next subsection covering issues encountered in the process of constructing the dataset.

(vii) focuses the meta-analysis on studies that can aspire to yield general findings, meaning the covered portfolio resembles, to a possible extent, a random sample. There are two main implications of this criteria. Firstly I do not consider papers that focus on industry spillovers of lawsuit events. Typically, this concerns studies that estimate the overall effect of judicial decisions issued by the highest court of the country, such as is the Supreme Court of the United States (SCOTUS), on firms from the affected sector[14]. Secondly, I omit studies that follow lawsuit events of a specific case[15].

(viii) seemingly imposes a limitation on the part of the thesis. Nevertheless, the chosen categories of lawsuits represent the most prevalent and consequential types of corporate litigation, as identified through an examination of a large sample of lawsuits in Haslem *et al.* (2017). Noteworthy exclusions include product liability and breach of contract types of litigation. While these are very common types of litigation, they likely lack the academic interest of researchers, as I have failed to identify thorough the process a higher number of studies that would be dedicated to them[16]. The classification of lawsuit types is based on the information relayed by the authors of primary studies[17]. In instances where the nature of suit is not explicitly stated, I assign it by comparing the lawsuits described in the paper with those in studies of comparable focus that do specify it. This approach ought to introduce some level of consistency into the classification within the analysis. Estimates related to other than mentioned litigation types are collected only if they appear in a primary study that reports them alongside the sought ones and then labeled as 'Other'. To ensure that all relevant studies examining the effects of lawsuit events related

[14]An example of this kind of paper may be Krieger & Davis (2022) who applied event study to quantify the market reaction of a portfolio of sport betting companies to an announcement of a landmark SCOTUS ruling, *Murphy v. NCAA*, which effectively removed any federal regulation on sports gambling in the United States.

[15]An example may be Assis *et al.* (2023) that studied the market effects of court rulings in a 17 years long court case on the stock returns of the litigated Swedish mining company, Bolidan-Apirsa, which was implicated in the largest mining spill in Europe, or Bouzzine & Lueg (2020) who in analogous fashion covered the 'Dieselgate' controversy.

[16]In the case of product liability litigation, I have identified only two studies, one is Prince & Rubin (2002) which yields inconclusive findings and likely demotivated researchers from continuing the inquiry. Moreover, none could be included in the meta-dataset due to not having any statistical measures reported alongside the effect sizes which I could use to derive standard errors. I failed to identify a single study that would be wholly focused on the contract violation type of lawsuits.

[17]The authors typically make the distinction based on the particular code relayed in the case docket.

to a specific litigation type are included, I select the most influential study for each type[18] and review the titles and then abstracts of the first 100 papers citing the study on Google Scholar that mention event study design[19] in their text. Newly identified studies are again snowballed, checked for adherence to the designation rule, and, if they pass, designated as primary studies.

By adhering to the designation rule, a set of 64 eligible academic papers was assembled. The search for studies was terminated on 31th December 2023. The list of all primary studies can found in Table 3.1. Specific titles, publication outlets, covered periods, and designated litigation types are reported in Appendix A.

Table 3.1: Primary studies

Authors		
Abdulmanova *et al.* (2021)	Fich & Shivdasani (2007)	Lin *et al.* (2020)
Aguzzoni *et al.* (2013)	Flore *et al.* (2017)	Liu *et al.* (2020)
Amoah & Makkawi (2013)	Flore *et al.* (2021)	Muoghalu *et al.* (1990)
Arena & Ferris (2018)	Gande & Lewis (2009)	Nam *et al.* (2015)
Bessen *et al.* (2011)	Griffin *et al.* (2004)	Nam *et al.* (2015)
Bessen & Meurer (2012)	Günster & van Dijk (2016)	Narayanamoorthy & Zhou (2016)
Bhagat & Umesh (1997)	Haslem (2005)	Oh *et al.* (2023)
Bhagat *et al.* (1994)	Henry (2013)	Pritchard & Ferris (2001)
Bhagat *et al.* (1998)	Hersch (1991)	Raghu *et al.* (2008)
Bizjak & Coles (1995)	Hirsh & Cha (2015)	Rathinasamy *et al.* (2004)
Blose & Calvasina (2002)	Hutton *et al.* (2015)	Romano (1991)
Bohn & Choi (1996)	Johnson *et al.* (2014)	Sato *et al.* (2023)
Bonini & Boraschi (2010)	Karpoff & Lott Jr (1993)	Selmi (2002)
Bosch & Eckard Jr (1991)	Karpoff *et al.* (2005)	Tsai & Huang (2021)
Brada *et al.* (2022)	Karpoff *et al.* (2008)	Wei & Zhang (2022)
Coughlan *et al.* (2014)	Klock (2015)	Wei *et al.* (2011)
Damak *et al.* (2022)	Koku *et al.* (2001)	West (2001)
Deng *et al.* (2014)	Koku & Qureshi (2006)	Woo (2007)
Engelhardt & Fernandes (2016)	Köster & Pelster (2017)	Wright *et al.* (1995)
Erragragui *et al.* (2023)	Lamba & Ramsay (2009)	Yang & Chen (2009)
Ferris *et al.* (2007)	Lee *et al.* (2013)	Yu & Shih (2021)
Firth *et al.* (2011b)	Lieser & Kolaric (2016)	
Total 64		

Note: The table shows primary studies included in the meta-analysis.

[18] Based on the number of citations on Google Scholar. The studies are: Bizjak & Coles (1995) for antitrust, Gande & Lewis (2009) for securities, Hersch (1991) for employment, Muoghalu *et al.* (1990) for environmental, and Bessen & Meurer (2012) for patent lawsuits.

[19] First I insert the (3.7) of the final query and tick in the 'search within citing' button.

Variables

In the next step, the effect sizes of lawsuit events on the stock returns of affected firms are extracted from the collected studies. A guiding principle is that each estimate needs to also be coded-in with all pertinent research characteristics of the primary study that could influence the estimate's sign and magnitude (Stanley & Doucouliagos 2012). In the choice of which variables to extract from the primary studies, I follow the previously published meta-analyses that used cumulative average abnormal returns as their effect sizes of interest, namely Bajzik *et al.* (2023) and de Batz & Kočenda (2023), which I complete with variables that were hypothesized or were found to have captured in prior research at least some of the great heterogeneity that is inherent in the ever-evolving world of complex lawsuits. The extracted variables may be divided into the following groups: (*i*) event study, (*ii*) lawsuit, (*iii*) sample, and (*iv*) publication characteristics. These so-called *moderator variables* are now reviewed, together with explanations why they may capture some of the mentioned heterogeneity in the estimate of interest. An overview of the definitions of all collected variables is located in Table 3.2 with its continuation in Table 3.3. In bucketing of effect sizes, I follow the convention that each group needs to include at least 5% of the price responses.

1. *Event Study characteristics* encompass the various choices authors made for their application of the event study methodology. Every collected variable of this group is devised to capture one or multiple steps presented in the summary of the method at the end of Section 2.2.

Event types. I distinguish between particular stages of a litigation process to which the estimate is related. I code-in specific lawsuits events, such as a *Filing* of a lawsuit, an out-of-court *Settlements* of a lawsuit, a *Verdict against* the litigant, and *Verdicts in favour*[20] of the party. Additionally, I specify one general lawsuit event. *Resolution* flags estimates which underlying lawsuit event(s) led to the end of the legal dispute. This group includes all verdicts and settlements. The reason for specifying this group is the utilization of estimates which relate generally to the termination of a lawsuit, or relate a number of distinct lawsuit events as the common event utilized in the event study methodology.

[20] Notably, I consider the judge dismissing the case as a verdict in favour of the defendant and a verdict against the plaintiff. In most of the primary studies, I rely on what the authors specify as a 'win' to be a verdict in favour, and 'lose' as a verdict against. Unfortunately, measuring lawsuit outcomes can be difficult since most lawsuits terminate in a way that make it impossible to determine the winner of the case Liu *et al.* (2020).

Event impact. I differentiate the lawsuit events based on their expected[21] sign of the price response. Specifically, I denote events that should lead to a creation of market value as *Positive* (filing plaintiff, settlement, verdict in favour), events that should lead to market value destruction as *Negative* (filing defendant, verdict against). Events which effects cannot be clearly hypothesized are flagged as *Indefinite*. This group includes unspecified verdicts, and estimates that relate to the common event being both filings and settlements.

Event windows. I note the authors' choice regarding the length of the event window. First, I compute the length of the event window. Second, I control for the specific composition of the event window: *Day* flags estimates derived solely from the event day. *PriorDay* distinguishes effect sizes where the event window consists of the event day and the preceding day. The rationale for extending the event window to include the period before the event is to capture potential information leakages. *PostDay* includes price responses that encompass the event day and the subsequent day. The purpose of expanding the event window to include the period after the event is to capture the complete realization of the event's effects. As the name suggests, *PriorPostday* flags estimates that include both the prior and the post day. *Max3days* differentiates estimates where the event window comprises all combinations[22] of event windows within a maximum distance of three days from the event day, apart from the already flagged estimates. *Max5days*, *Max10days* and *Max30days* follow analogously the same logic as *Max3days*.

Estimation windows. I control for various lengths of the estimation window. Specifically, I create five buckets with increasing granularity in the length of the estimation period. As discussed in Section 2.2, longer estimation windows decrease the impact of effects that could skew the fitted parameters of the normal returns model if the period were contaminated by other significant stock-affecting events, such as earnings or stock split announcements.

Normal returns models. I note the model used in the primary study to simulate normal returns, as different models are well-documented to produce results of varying magnitudes (Kolari & Pynnönen 2023). In addition to the groups presented in Section 2.2, price responses, which generation included using the Mean Adjusted Returns model, CAPM, and Market models with EGARCH and GARCH residuals are grouped together under the *Other model* label.

[21] As hypothesized in the lawsuit effect literature.

[22] In other words, all subsets of [-3, 3] with the exception of [-1, 1] [-1, 0], [0], and [0, 1].

Index weighting. I investigate whether the results systematically differ based on what kind of stock index was used to compute the abnormal returns. For example, Brown & Warner (1985) states that the *Equally-weighted* market indexes should lead to more precise detection of abnormal returns than *Value-weighted* ones. However, prior meta-analysis of Bajzik *et al.* (2023) did not find it to be of effect on pricer responses.

2. *Lawsuit characteristics* are extracted specifically to account for the considerable lawsuit diversity within the covered literature. While it could be argued that these characteristics are inherently reflected in the composition of the events in the sample, and therefore should be grouped together with other sample characteristics, I choose to categorize them separately to emphasize their significance.

Affected party. I distinguish estimates based on to which party of the litigation process the effect size relates. Naturally, this should be a major factor differentiating the lawsuit effects, as each party tends to face different financial consequences from the legal action, which has been noted in a number of studies, such as Haslem (2005), Bhagat *et al.* (1994), or Cutler & Summers (1988). Finally, few estimates relate to a paired samples of publicly traded defendants and plaintiffs[23].

Nature of suit. As was discussed in the designation rule justification, it was found in previous research, namely Bhagat *et al.* (1998) or Haslem *et al.* (2017) that effect sizes tend to differ based on the nature of the suit. Specifically, I recognize the following categories: *Antitrust*, *Employee*, *Environmental*, *Securities*, *Intellectual property*, *Pooled*, and *Other*. A list of assigned lawsuit types to individual primary studies can be found in Appendix A

Class action. I differentiate class action lawsuits from the rest, as these are by their nature more expensive for its participants than non-class actions. This has been observed in a number of studies, such as Koku & Qureshi (2006).

Legal dispute category. I distinguish lawsuits in which the government was one of the involved parties. *Public* flags estimates where the government or a regulatory agency is either the plaintiff or the defendant in the related lawsuit[24]. *Private* distinguishes price responses where neither party is related

[23]These estimates compute the so-called *leakage* of the lawsuit, which can be interpreted as the total market value lost as the result of the legal dispute.

[24]Importantly, this means that both criminal and *civil* lawsuits are flagged by this variable. I chose not specify criminal suits as individual government group, as s not sufficient number of estimates which would compose it was identified in the data collection process.

to the government, meaning that the parties involved are either another publicly traded firm, a private company, or an individual.

Legal origin. I group estimates based on the underlying legal tradition of the legal system. *Common* flags common law countries and *Civil* denotes civil law countries. It is reasonable to suspect that the price reaction to lawsuit events will be more pronounced in the countries with legal tradition in which body of law is created by judicial rulings setting precedents. This distinction was found to have effect on the size of price responses in Erragragui *et al.* (2023).

3. *Sample characteristics* encompass variables capturing essential quality of the data used in the primary study.

Confounding effects. I search the text of a primary study for explicit mentions of taking precautions against contaminated event windows, since failing to control the lawsuit sample for events, that may confound the impact of the lawsuit event in question, was found to skew the results of the study. Specifically, Blose & Calvasina (2002) notes that when lawsuit events with possibly confounding effects occurring in the announcement period, such as earning calls, CEO changes, other lawsuits announcements and other, were filtered away, the findings of Wright *et al.* (1995) became statistically insignificant.

Specific industry. I note whether the sample was composed of only firms from a particular sector or industry.

Geography. Each country has its own legal system[25]. This heterogeneity must be accounted for in the analysis. I specifically isolate studies concerning lawsuits occurring in the United States. Following Bajzik *et al.* (2023), I group all studies from Asian countries[26] into a single category. The remaining studies, i.e., those from non-Asian countries excluding the US, are grouped into the *Other* category. Lastly, I create a group that encompasses estimates from multiple countries.

Covered time period. Given that legal landscapes may evolve over time due to changing regulations, and thus opportunities to sue, it is crucial to account for the time period during which the lawsuit events were collected. To address this, I first construct the *midyear* variable, representing the median year of the covered time period. Secondly, I calculate the length of the time period.

[25]Makris (2023) defines a *legal system* as the court system and methods for dispute resolution when two parties are involved in a legal dispute.

[26]Namely Japan, China, and South Korea.

Source of lawsuit events. I differentiate the sources from which the new information regarding lawsuit events was collected This information could be crucial since researchers almost always set the event day based on the date reported in the source documenting the lawsuit event. With few exceptions, the events are either collected from media sources, such as The Wall Street Journal, or from databases that compile information from court dockets, such as the PACER[27] database. Events announced in the media may reasonably be suspected of sample selection bias, as these sources are incentivized to report information concerning only the most significant companies or the most seemingly influential lawsuits. On the other hand, information reported in newspapers may have already been reflected in financial markets by the time the news was relayed.

Source of stock returns. I control for the database from which the returns used in the primary study were sourced. Previous research, namely Yang *et al.* (2023) or Karpoff *et al.* (2017), discuss differences in results that could be attributable to using a different database across studies for financial metrics. Specifically, I denote all studies that use the Centre for Research in Security Prices (CRSP) as the benchmark group.

4. *Publication characteristics* capture general information about the study.

Publication year. I follow the approach of recent meta-analyses and control for the year in which the study was published. Specifically, I use the publication year of Cutler & Summers (1988)[28] as the base.

Authors. Following de Batz & Kočenda (2023), I control for the number of authors of the primary study. My consideration is based on the observation made by West (2001) that the data collection process in primary studies could be described as highly labor-intensive, due to the way individual lawsuits need to be identified and then connected to financial performance metrics.

Publication quality. I employ three variables to capture the publication quality of the primary study. First I consider the quality of the journal in which the study was published by coding-in the newest *Impact factor*, as reported in

[27]PACER is an acronym for The Public Access to Court Electronic Records which is an online repository containing over 1 billion documents from lawsuits filled at Federal Courts in the United States.

[28]While there are older papers examining the lawsuit event effect, e.g Ellert (1976), they arguably failed to motivate fellow researchers to run similar studies in different and/or expanded settings. This is not the case of Cutler & Summers (1988). Notably, the convenience of conducting event studies in this sphere was greatly facilitated by the creation of lawsuits data storing databases, such as the Class Action Security Lawsuit Database in the late 1990s or the Audit Analytics Litigation Database in early 2000s (Arena & Ferris 2017).

the Clarivate database[29]. Secondly I control for the impact of the individual primary study by the number of *Citations* the paper has recorded on Google Scholar[30]. Finally, I specifically flag unpublished pieces of academic work as *Working paper* variable.

Journal field. As previously discussed, lawsuits are a multi-disciplinary issue. Naturally, the meta-dataset then includes studies from a variety of specialized journals, including those focused purely on economics, finance, law, sociology, and marketing. Therefore, it may be worthwhile to investigate whether the academic background of the primary study systematically influences the magnitude of the published estimates. For example, de Batz & Kočenda (2023) finds that business journal systematically underestimates the true effect of price responses to the news of intentional financial crime. The journal designation is determined based on the first focus specified in the Clarivate database.

Overall, 882 estimates and 70 study design choices from 64 primary studies covering 33 years of research were collected[31]. The data collection process is visualized in Figure 3.1 with a PRISMA[32] flow diagram and that in line with recommendations of Havranek *et al.* (2020). A discussion of issues and limitation of the dataset can be found in Appendix E.

3.2 Data Adjustments

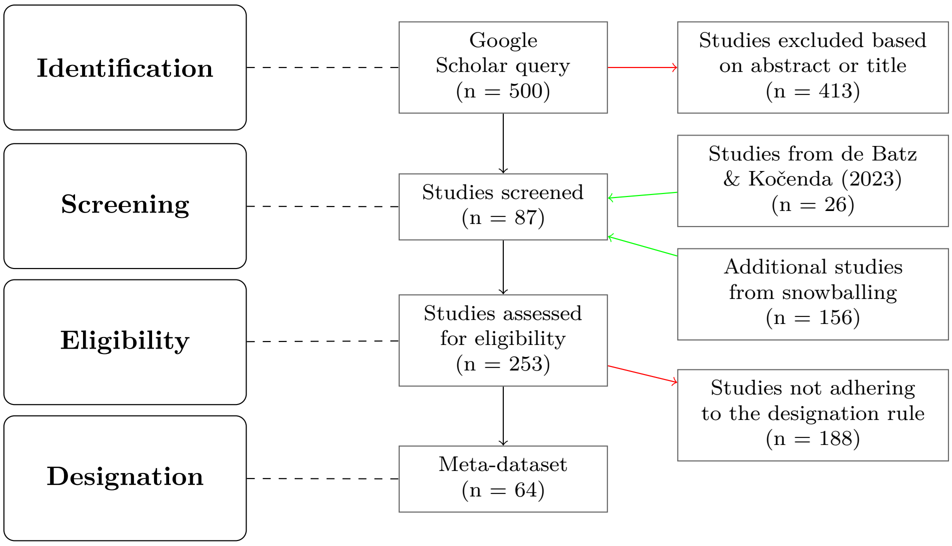
As was discussed in Section 2.2, the event study methodology utilizes at its final stage a hypothesis test to infer whether the computed average cumulative abnormal returns from the event window of interest are statistically significant. In an ideal primary study, both standard errors and test statistics associated with the conducted hypothesis test would be reported. Unfortunately, that is almost never the case for the studies constituting my meta-dataset. Because of this, the following data transformations had to be employed:

[29]The common practice in other meta-analyses is to use the Recursive Impact factor from IDEAS/RePEc. However, this setup is not applicable to my meta-analysis due to the high number primary studies published in journals not included in that database. For this reason, I had to rely on an universal publication database, as to receive a comparable number for all studies.

[30]The number of citations was collected on April 23, 2024.

[31]Both the number of observations and the number of primary studies are above the mean values of 420 and 54, respectively, reported in the summary of 61 financial meta-analysis compiled by Geyer-Klingeberg *et al.* (2020).

[32]PRISMA stands for 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses'.



Note: The figure shows the schematics of study inclusion and exclusion diagram that depicts the process of identifying primary studies included in the final meta-dataset.

Figure 3.1: PRISMA diagram

(a) As applied in de Batz & Kočenda (2023) and Bajzik *et al.* (2023), z-statistics are directly converted into t-statistics[33].

(c) If only the standard deviation of the effect size is reported, then it is converted into the standard error with the formula: $\text{SE} = \frac{SD}{\sqrt{N}}$, where N is the number of observations in the sample.

(d) t-statistics are converted into standard errors with the following formula: $\text{SE} = \frac{\text{effect size}}{t\text{-statistic}}$.

(b) If only a p-value is reported, then it is converted into a t-statistic by the means of a t-table[34] from which the value associated with the appropriate degrees of freedom N - 1, where N is the sample size, is taken.

The necessity for the statistic transformation was coded in the meta-dataset as a dummy variable and inspected for systematic issues. If several measures were reported in a primary study, the preferential rank of coding-in was following:

$$\text{SE} \succ \text{t-statistics} \succ \text{z-statistics} \succ \text{p-value} \succ \text{SD}$$

[33] Meaning, if $z = 1.26$ then $t = 1.26$. As was mentioned, I collected only test statistics of parametric tests which in their hypothesis followed Student's t-distribution, since all of these eventually converge to the same normal distribution as the sample size increases.

[34] Adjusted for when one-tailed or two-tailed tests are applied in a primary study.

Some effect sizes in need of one of the listed transformations were reported in a primary study to be equal to zero, in some instances also accompanied with a sign. In such cases, I assume that the reported zero is a consequence of rounding the result to a preferred number of decimals. To ensure that the adjustment described above is smooth, I add, when necessary, the smallest possible value in absolute term, in other words noise, to all such estimates, so when rounded down, they match the listed number of decimals while retaining the reported sign.

Finally, the cumulative average abnormal returns and the computed standard errors were winsorized at the 1% and 99% levels. This procedure was implemented to reduce the impact of potentially spurious outliers, which may arise, for example, from erroneously coded values[35] by the author.

3.3 Data Summary

Before running more advanced analysis, it is always worthwhile to scrutinize the dataset at hand by evaluating averages, weighted averages and standard deviations of the previously defined and collected variables. Descriptive statistics of all variables are reported in Table 3.2 and Table 3.3.

[35]Irsova *et al.* (2023) recommends collecting the meta-dataset in collaboration with a fellow researcher to minimize such oversights. This approach was not adopted in this thesis.

Table 3.2: Definitions and descriptive statistics of variables

Variable	Definition	Mean	SD	W_Mean
Effect Size	The impact of lawsuit events on abnormal returns, measured in %,	-0.77	2.49	-1.31
	winsorized at 1% and 99% level.	(-0.80)	(2.75)	(-1.35)
SE	(Derived) value of the standard error related to the estimate of interest.	1.18	2.59	1.04
	winsorized at 1% and 99% level.	(1.31)	(3.85)	(1.14)
Event study characteristics				
Event type				
Filing (*)	= 1 if the event is an act of filing a lawsuit.	0.65	0.48	0.66
Resolution	= 1 if the event relates to the resolution of a lawsuit.	0.28	0.45	0.29
Settlement	= 1 if the event is an out-of-court settlement.	0.12	0.33	0.12
Verdict against	= 1 if the event is a court verdict against the firm.	0.09	0.29	0.08
Verdict in favour	= 1 if the event is a court verdict in favour of the firm.	0.05	0.21	0.05
Multiple events	= 1 if a number of distinct lawsuit events constitutes the sample.	0.06	0.24	0.05
Expected impact of the event				
Positive	= 1 if the sample consist of only market value creating lawsuit events.	0.32	0.47	0.29
Negative	= 1 if the sample is composed of only market value destroying lawsuit events.	0.67	0.47	0.69
Indefinite	= 1 if the event cannot be clearly interpreted as either market value destroying or creating information for the firm.	0.01	0.09	0.02
Event window				
Length of the event window	The length of the event window related to the estimate, measured in days.	7.94	8.84	6.82
Day (*)	= 1 if the event window includes only the event day.	0.06	0.23	0.10
Prior Day	= 1 if the event window is composed of the event day and one day prior to it, i.e. [-1, 0].	0.16	0.37	0.17
Post Day	= 1 if the event window is composed of the event day and one day after it, i.e. [0, 1].	0.07	0.26	0.07
Prior Post Day	= 1 if the event window is composed of the event day, one day prior and one day after, i.e. in [-1, 1].	0.15	0.35	0.18
Max 3 days	= 1 if the event window is located within 3 trading days from the event day, i.e. in [-3, 3].	0.18	0.38	0.17
Max 5 days	= 1 if the event window is located within 5 trading days (a week) from the event day , i.e. in [-5, 5].	0.12	0.33	0.10
Max 10 days	= 1 if the event window is located within 10 trading days (two weeks) from the event day, i.e. in [-10, 10].	0.14	0.35	0.12
Max 30 days	= 1 if the event window is located within 30 trading days from the event day, i.e. in [-30, 30]	0.12	0.33	0.09
Estimation window				
Estimation window A (*)	= 1 if the length of the estimation window used to fit normal returns was shorter than 150 trading days.	0.21	0.41	0.18
Estimation window B	= 1 if the length of the estimation window used to fit normal returns was longer than or equal to 150 trading days but shorter than 190 trading days.	0.16	0.37	0.11
Estimation window C	= 1 if the length of the estimation window used to fit normal returns was equal to or longer than 190 trading days but shorter than 250 trading days.	0.33	0.47	0.31
Estimation window D	= 1 if the length of the estimation window used to fit normal returns was equal to or longer than 250 trading days, circa. one trading year.	0.30	0.46	0.39
Estimation window NA	= 1 if the length of the estimation window used to fit normal returns is not specified.	0.14	0.34	0.17
Normal returns models				
Market model (*)	= 1 if a market model is employed in the event study.	0.70	0.46	0.77
Market adjusted returns	= 1 if market adjusted returns are employed in the event study.	0.09	0.28	0.08
Factor model	= 1 if a factor model is employed in the event study.	0.10	0.30	0.07
Other	= 1 if other than one of the listed models is employed in the event study.	0.11	0.31	0.08
Index weighting				
Equally weighted index	= 1 if an equally-weighted index is utilized to compute normal returns.	0.20	0.40	0.18
Value weighted index	= 1 if a value-weighted index is utilized to compute normal returns.	0.28	0.45	0.29
Not specified index (*)	= 1 if the index utilized in computation of normal returns is not specified.	0.52	0.50	0.53
Lawsuit characteristics				
Affected party				
Defendant (*)	= 1 if the estimate relates to the defendant named in the lawsuit.	0.82	0.38	0.85
Plaintiff	= 1 if the estimate relates to the plaintiff who initiated the lawsuit.	0.16	0.36	0.11
Both parties	= 1 if the estimate relates to a matched pair of a defendant and a plaintiff.	0.02	0.15	0.03
Nature of suit				
Antitrust	= 1 if the estimate relates to antitrust type of litigation.	0.07	0.25	0.07
Employment	= 1 if the estimate relates to labor dispute or employee type of litigation.	0.12	0.33	0.08
Environmental	= 1 if the estimate relates to environmental type of litigation.	0.15	0.36	0.10
Patent	= 1 if the estimate relates to intellectual property type of litigation.	0.20	0.40	0.21
Securities	= 1 if the estimate relates to securities type of litigation.	0.20	0.40	0.36
Pooled (*)	= 1 if the estimate relates to a sample of various litigation types.	0.21	0.41	0.06
Other	= 1 if the estimate relates to other than explicitly covered type of litigation.	0.06	0.23	0.02
Class action	= 1 if only class initiated lawsuits constitute the sample.	0.18	0.39	0.31
Legal dispute category				
Private (*)	= 1 if the sample consists only of private lawsuit events	0.75	0.43	0.79
Public	= 1 if the sample consists only of public lawsuit events.	0.16	0.36	0.12
Pooled	= 1 if the sample is composed of both private and public lawsuit events.	0.10	0.30	0.16
Legal origin				
Civil	= 1 if the sample consists only of lawsuits litigated in a civil law country.	0.20	0.40	0.19
Common	= 1 if the sample consists only of lawsuits litigated in a common law country.	0.67	0.47	0.71
Pooled legal origin (*)	= 1 if lawsuits from multiple legal origins constitute the sample.	0.13	0.33	0.09

Note: (Continued on the next page)

Table 3.3: Definitions and descriptive statistics of variables (part 2)

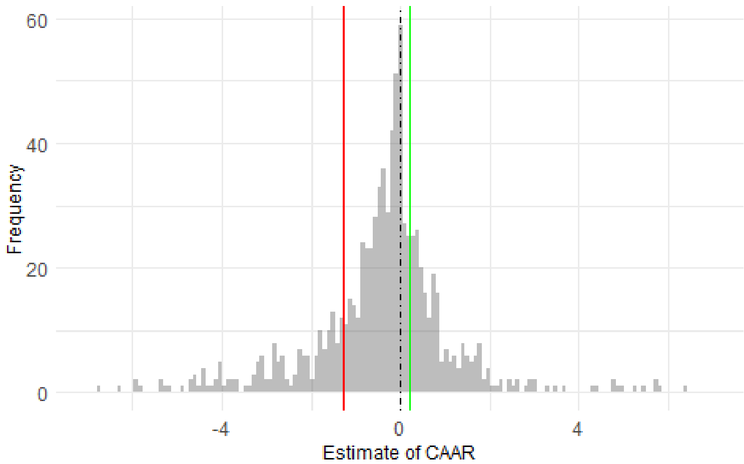
Variable	Definition	Mean	SD	W_Mean
Sample characteristics				
N of events	The number of events (lawsuits) in the sample.	666.12	351.1	478.59
Covered period length	The length of the period covered in the sample, measured in years.	13.69	7.81	13.67
Midyear	The median year of the period covered in the sample.	1996.90	10.75	1997.18
Industry	= 1 if the sample consists of only lawsuits concerning a specific industry or a sector.	0.13	0.34	0.13
No confounding events	= 1 if the sample was explicitly mentioned to be filtered for events without confounding factors occurring in the event window.	0.30	0.46	0.25
Geography				
USA (*)	= 1 if the sample is composed of only lawsuits litigated in the United States.	0.66	0.47	0.73
Asia	= 1 if the sample is composed of only lawsuits litigated in an Asian country.	0.14	0.35	0.11
Pooled	= 1 if lawsuits from multiple countries constitute the sample.	0.14	0.35	0.12
Other	= 1 if the sample is composed of only lawsuits litigated in other non-Asian country than the US.	0.06	0.23	0.04
Source of lawsuit events				
Database (*)	= 1 if the source of lawsuit events dates was a specialized database.	0.56	0.50	0.53
Media	= 1 if the dates of lawsuit events were collected from news or other media.	0.35	0.48	0.39
Other	= 1 if the dates of lawsuit events were said to be hand-collected or the source was not mentioned.	0.09	0.28	0.08
Source of stock returns				
CRSP	= 1 if the stock returns data were collected from The Center for Research in Security Price.	0.58	0.49	0.62
Publication characteristics				
Years since Texaco	The publication year minus 1988, when Cutler & Summers (1988) was published.	21.68	9.00	21.59
Authors				
Individual	= 1 if the primary study was written by a single author.	0.14	0.35	0.12
Pair (*)	= 1 if the primary study was written by a pair of authors.	0.36	0.48	0.36
Group	= 1 if the primary study was written by more than two authors.	0.50	0.50	0.52
Journal field				
Business/Management	= 1 if the primary study was published in a business or management journal.	0.18	0.38	0.14
Finance (*)	= 1 if the primary study was published in a finance journal.	0.17	0.38	0.27
Economics	= 1 if the primary study was published in an economic journal.	0.18	0.38	0.16
Law & economics	= 1 if the primary study was published in a law and economics journal.	0.16	0.36	0.14
Law	= 1 if the primary study was published in a law journal.	0.14	0.35	0.09
Other	= 1 if the primary study was published in other kind of journal.	0.09	0.28	0.11
Working paper	= 1 if the primary study was unpublished.	0.09	0.29	0.09
l_Citations	The logarithm of the number of citations on Google Scholar normalized by the number of years since the primary study first appeared plus one.	0.59	0.45	0.71
Impact Factor	The most recent Journal Impact Factor from Clarivate database zero if the journal is not indexed,	3.17	3.64	3.46

Note: The table shows the definition of collected variables together with their means and standard deviations. The W_Mean is mean weighted by the inverse of the number of estimates from the study. If the category name is in bold, then it covers the whole sample. In such cases, (*) denotes the benchmark variable utilized in BMA and FMA estimations. The unwinsorized values are in parantheses.

Figure 3.2 shows the distribution of price responses to the announcements of major lawsuit events. The plot reminds of a normal distribution centralized slightly to the left of zero, which would correspond to the derivations of Section 2.2. Additionally, the distribution is left-skewed. Decomposing the dataset based on the expected effect of the lawsuit events reveals, that the skewness is driven by the negative events in the sample. Nonetheless, the figure does not reflect the heterogeneity in lawsuit events.

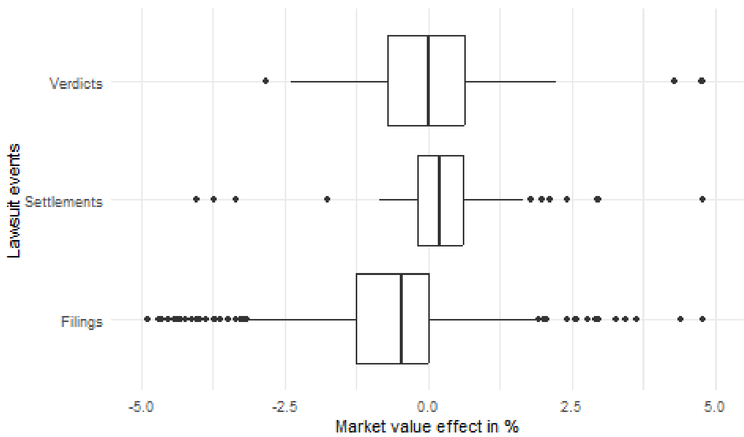
Figure 3.3 depicts the range of price responses to a particular lawsuit event. Notably, the mass of cumulative average abnormal returns moves drastically based on the underlying lawsuit event. The price response to settlements seems mostly positive, to filings negative, and to verdicts neutral. However, the figure does account for the heterogeneity within the events.

Table 3.4 numerically supplements the previous two visualizations. Notably, 90% of price responses to all major lawsuit events is located between -4.64% and 1.73%, with the bias-uncorrected mean being -0.77%. Weighting the effect sizes by the inverse of the number of observations reported in each individual



Note: The figure shows the distribution of cumulative average abnormal returns in the metadatset. Green line depicts the average CAAR for favourable lawsuit events, red line for negative ones. Black dashed line shows the value of zero.

Figure 3.2: Histogram of price responses



Note: The figure shows the distribution of price responses to particular major lawsuit events. The boxes represent the interquartile range, which contains the middle 50% of the data. The line inside each box represents the median value. The whiskers extend from the boxes to the smallest and largest values within 1.5 times the interquartile range from the lower and upper quartiles, respectively. Data points outside the whiskers are considered outliers.

Figure 3.3: Boxplots for major lawsuit events

study changes these values to -5.76%, 1.69% and -1.31%, respectively. Filing is the pre-dominant lawsuit event in the dataset, composing over 65% of the sample, and being reported in over two thirds of the primary studies. This is not surprising, as Haslem *et al.* (2017) notes, a lawsuit filing is the most conveniently identifiable event of the litigation process. Interestingly, the event of settling a lawsuit is a value creating event only when the effect sizes are not weighted by the number of estimates in individual studies. The rest of the reported numbers correspond to what would be expected. A table containing price responses for all qualitative moderator variables subsets can be found in Appendix B.

Table 3.4: Price responses to lawsuit events

Variable	N of estimates	N of studies	Mean	5%	95%	Weighted mean	5%	95%
Lawsuit event								
All	882	64	-0.77	-4.64	1.73	-1.31	-5.76	1.69
Filing	577	51	-1.27	-7.55	1.47	-1.98	-8.27	1.08
Resolution	266	29	0.21	-1.65	2.1	-0.01	-1.83	2.69
Verdict against	80	13	-0.25	-2.13	1.74	-0.44	-1.17	1.73
Verdict in favour	40	10	0.65	-1.19	2.34	0.7	0.28	4.29
Settlement	110	14	0.35	-0.72	2.71	-0.04	-2.6	3.54
Pooled	54	5	-0.07	-1.77	0.96	0.03	-0.05	1.58
Expected impact of the event								
Positive	279	35	0.21	-1.92	2.26	0.15	-1.66	3.06
Negative	583	58	-1.26	-7.11	1.16	-1.98	-8.13	0.73
Indefinite	20	4	-0.35	-2.89	1.37	-0.58	-0.55	3.63

Note: The table shows the number of estimates, the number of studies, the (weighted) mean and the quantiles delineating 90% of effect sizes for every specific and general lawsuit event. The values are in percentages. The applied weight is the number of estimates per a study.

Table 3.5 dissects the price responses to a particular lawsuit event according to the nature of the suit and to which lawsuit party is affected. According to the table, the most value destructive event is being named defendant in a securities law related lawsuit, as it results on average in a decrease[36] of 3.6% in market value of the litigated firm. Interestingly, the commonly hypothesized value creating effect of announcements of out-of-court settlements is reversed in the cases of employee and environmental lawsuits. This may be due to the fact that in such cases, the announcement of settlement could be considered by investors to be the equivalent to an admission of guilt, and thus destroying the market value through the reputation channel. However, the great variability and small number of estimates complicate the interpretation of the averages reported in the table. Notably, there is not a single subset with more than 30 observations which estimate's magnitude is larger then the associated standard deviation.

[36]It is worth reminding, that this value does not correspond to a single day drop, but to an accumulated abnormal market performance of the stock over the particular event window.

This would indicate that the magnitude and sign of the estimate may depend heavily on the context and composition of the sample in an individual study.

Table 3.5: Decomposition of price responses on lawsuit characteristics

	Defendant		Plaintiff		Both parties	
Filings						
All	456	-1.56	104	-0.17	17	-0.11
		(2.95)		(2.04)		(0.96)
Pooled	65	-1.26	33	-1.47	1	-3.15
		(1.44)		(2.69)		
Antitrust	14	-0.6	14	0.67	1	-0.21
		(0.44)		(0.8)		
Employment	48	-0.49				
		(1.71)				
Environmental	95	-0.65				
		(0.89)				
Patent	73	-0.57	26	0.64	14	0.11
		(1.71)		(1.4)		(0.61)
Securities	124	-3.6	18	0.75	1	-0.12
		(4.56)		(0.8)		
Other	37	-1.28	13	-0.66		
		(1.56)		(1.48)		
Settlements						
All	99	0.18	11	1.85		
		(1.11)		(1.93)		
Pooled	56	0.32	9	1.2		
		(0.67)		(1.42)		
Employment	28	-0.34				
		(1.06)				
Environmental	4	-0.1				
		(0.13)				
Patent	2	2.28	2	4.79		
		(0.22)		(0.01)		
Securities	9	0.62				
		(2.4)				
Verdicts						
All	116	0.18	14	0.56		
		(1.11)		(1.05)		
Pooled	10	0.88				
		(0.49)				
Antitrust	29	0.09				
		(1.39)				
Employment	30	0.06				
		(1.19)				
Environmental	8	-0.42				
		(1)				
Patent	34	-0.45	2	0.08		
		(1.33)		(0.69)		
Securities	5	-0.22	12	0.63		
		(1.12)		(1.16)		

Note: The table shows the number of estimates, the mean and standard deviation (in brackets) of cumulative average abnormal returns for every subsample of lawsuit types and affected party for a particular lawsuit event. The values are in percentages.

In the following paragraphs, salient characteristics of each group of moderator variables reported in Table 3.2 and Table 3.3 are discussed:

1. *Event study characteristics*: The average length of the event window applied in individual primary studies is approximately seven days. Notably, summing the weighted averages reveals that over two-thirds of primary studies use announcement periods within one day of the event day. This seems reasonable, as the rapid spread of news typically leads to quick price adjustments on stock exchanges.

As expected, a classic market model is the dominantly utilized model for simulating normal returns, with nearly four-fifths of the primary studies implementing it. Surprisingly, most of the studies do not specify which market index the authors used to capture the returns on market portfolio.

Commendably, most of studies belong to the bucket flagging the largest estimation window. In other words, most of the primary studies composing the meta-dataset fitted their normal returns models on a sample consisting of, or more than, a trading year of stock returns. However, a surprisingly large number of studies does not specify the particular length of the period over which the normal returns models were fitted.

2. *Lawsuit characteristics*: Notably, over 80% of the estimates pertain to the price response of the defendant's stock to the announcement of a lawsuit event. This may be expected, as the defendant, being the passive party in the lawsuit, is likely to suffer the most significant market value destruction, making it the most intriguing subject for researchers, and arguably, the most relevant one for managers. Dominant part of the sample relates to lawsuits in which neither party is related to government. Finally, most of the lawsuits arise in jurisdictions with common legal tradition, which is expected given the larger role that judicial rulings play in these systems by setting precedents.

3. *Sample characteristics*: There is a concerningly high deviation in the number of studies comprising the dataset, as there are studies with very few observations composing the sample, e.g. Damak *et al.* (2022) with 13 observations at maximum, and studies with very large pool of events, such as Griffin *et al.* (2004) with more than 2,000 lawsuits.

Most of the studies concern lawsuits litigated in the US, which is in line with the previous observation that most lawsuits originate in common law countries. This is not a surprising revelation, as the US is home to the world's largest financial market and, according to , is also the most litigious country. Moreover, it has a long academic tradition in applying event studies, as all influential papers identified in Section 3.1 were conducted on data from the US. Interestingly, there is a significant number of recent studies from Asian countries, namely China and the so-called 'Asian Tigers' of Taiwan and South Korea[37], which may be a consequence of financial markets gaining prominence

[37]e.g., Wei & Zhang (2022), Oh *et al.* (2023), and Lin *et al.* (2020), respectively.

in these countries.

Notably, only quarter of the studies explicitly stated that the data set was cleaned from lawsuits events which effect may be measured over contaminated event windows. This may be harmless as long as the data sample is sufficiently large (Blose & Calvasina 2002). Finally, around 40% of studies sourced the announcement of lawsuit events from media reports.

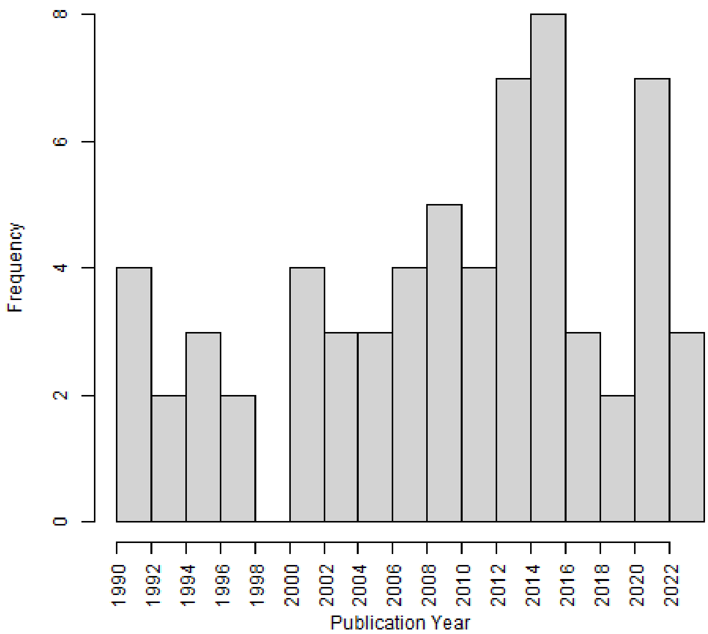
4. *Publication characteristics*: Unsurprisingly, the most highly cited article by far is the seminal paper on the computation of reputational costs by Karpoff *et al.* (2008), which has garnered over 1,600 citations on Google Scholar. Notably, there is a sizeable number of articles published in obscure journals that did not obtain a single citation on Google Scholar, such as Damak *et al.* (2022), Rathinasamy *et al.* (2004) or Woo (2007). Following the recommendation of Irsova *et al.* (2023) on evaluating a study based on its publication outlet or perceived quality, I do not a priori discard these studies[38] from the meta-dataset.

On the first sight, the estimates from primary studies are approximately uniformly distributed across the types of journals. However, after weighting by the inverse of the number of estimates reported in a study, the Table 3.3 reveals that most of the estimates originate in a finance focused journals, which is what would be expected. Finally, it is noteworthy that approximately 10% of estimates are sourced from unpublished research papers.

Figure 3.4 shows the distribution of publication years for the primary studies. The pattern is right-skewed yet relatively uniform, with the majority of studies emerging after the Global Financial Crisis of 2008. While it may seem intuitive that a period of prolonged financial distress would motivate researchers to focus more on the effects of failures in corporate governance - of which being the target of a lawsuit is a likely consequence (Gande & Lewis 2009) - no author explicitly mentions the crisis as their research motivation.

Notably, the peak of publications occurred in the 2014-2015 period, with eight studies, whereas 1999-2000 represents the nadir, with no studies published. The most recent study, Sato *et al.* (2023), was published in 2023, while the earliest study, Romano (1991), dates back to 1991. Thus, the sample encompasses 33 years of research.

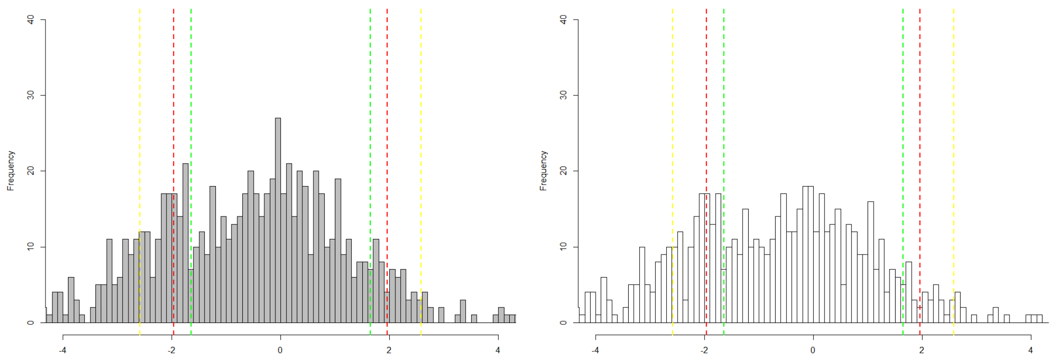
[38]It could be therefore argued, that being part of this meta-analysis on the general effect is the biggest impact of these papers on the academic literature.



Note: The figure shows the distribution of publication years of the primary studies constituting the meta-dataset.

Figure 3.4: Histogram of publication years

Before examining publication bias, it may be worthwhile to check the distribution of test statistics associated with effect sizes. This visual check may validate whether suspicions of the bias are reasonable. Figure 3.5 shows histogram of normally asymptotic test statistics from primary studies constituting my meta-dataset. Dashed lines denote the values of test statistics that correspond to commonly used benchmarks for statistical significance. The figure suggest that there is potential for the presence of the publication bias, as there are noticeable peaks around the benchmark values for negative values. Further investigation yields, that the potential is driven primarily by the subset of estimates that relate to the event of being named as a defendant in a lawsuit filing, as can be seen in the visual comparison of the two histograms in Figure 3.5, where the left histogram corresponds to the whole meta-dataset, while the one on the right represents the mentioned subsample.



Note: The figure presents the distribution of parametric test statistics. The left side of the figure encompasses all estimates, while the right side specifically displays the test statistics associated with the effect of filing a lawsuit on the defendant party. Red dashed line shows the value corresponding to the 95% significance level, yellow dashed line to 90% level, and green dashed line to 99% level.

Figure 3.5: Distribution of test statistics

Chapter 4

Publication Bias

As Ehrenbergerova *et al.* (2023) eloquently stated: '*Publication bias is the systematic difference between the distribution of results produced by researches and the distribution of results reported by researchers*'.

Publication bias has been found to be a prevalent issue in the academic literature (Ioannidis *et al.* 2017). It can occur due to various factors, such as editorial or authorial preferences for estimates that have the conventional sign and are statistically significant (Stanley & Doucouliagos 2012). This may lead to a severe exaggeration of the reported, and published, effect sizes, potentially skewing the well-intentioned views of policymakers and fellow researchers.

This chapter presents my thesis's investigation into the presence of publication bias in the lawsuit effect literature. To perform this task, I apply three classes of tests used in recent and well-published meta-analyses examining finance-related research questions, such as Bajzik (2023). Specifically, I employ one graphical test, five linear methods, and four non-linear methods. These methods together with their results are discussed in the following sections of the chapter and that in the above listed order.

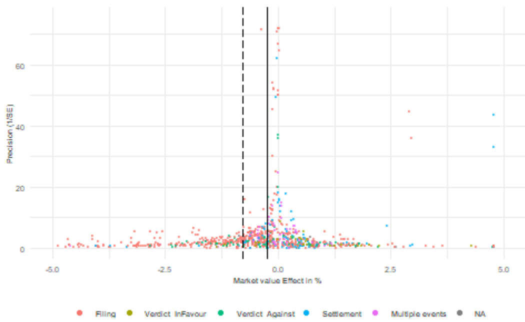
4.1 Graphical Test

A neat test for visual detection of publication bias is the so-called *funnel plot* (Egger *et al.* 1997). In a funnel plot, the effect size is on the horizontal axis and the *precision* of the estimate, which is defined as the inverse to the standard error, is on the vertical axis. In the absence of publication bias, the funnel plot should be symmetrical around the most precise estimates. Moreover, with decreasing precision, the estimates ought to become more dispersed around the mean underlying effect and thus form an inverted symmetrical funnel. If publication bias is indeed present, the funnel plot would exhibit signs of *hollowness*, which could be attributable to the exclusion of statistically insignificant estimates, and/or *asymmetry* that would arise from the selective non-reporting of effect sizes based on an 'incorrect' sign or magnitude.

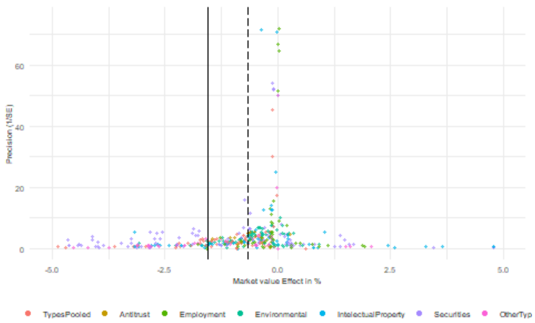
Figure 4.1 displays six funnel plots of price responses to lawsuit events, each visualizing a different subset of the meta-dataset. The subsets correspond to the most prevalent specific lawsuit event, and to the contrasting general ones.

As hypothesized, the funnel plot of all estimates forms an inverse funnel around the most precise data points, with noticeable asymmetry to the left. This could be interpreted as an indication that neutral or value-creating reactions to lawsuit events are under-reported in the literature. Subsetting for theoretically value-creating lawsuit events and for lawsuit-terminating events yields two almost perfectly symmetrical funnel plots, which visually imply that there is no publication bias for these particular price responses. On the other hand, funnel plots for value-destroying lawsuit events, the most prominent being named a defendant in a filing, all demonstrate significant asymmetry to the left, suggesting a bias toward publishing, conventionally sound, negative price responses.

While visual inspections are useful for forming general hypotheses about the data, they cannot alone provide sufficient evidence for the presence of publication bias. Hence, the observations made here will be tested empirically in the following sections

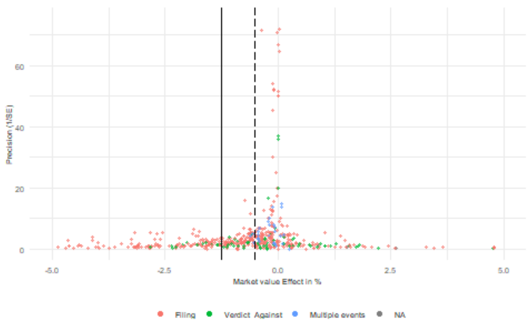


(a) All estimates

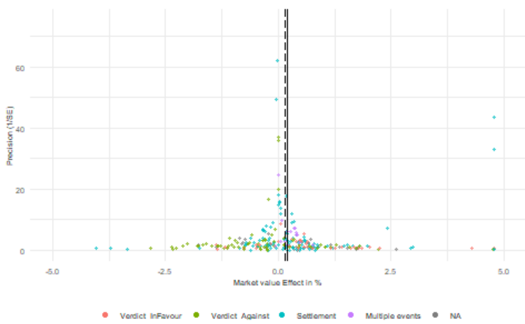


(b) Fillings defendants

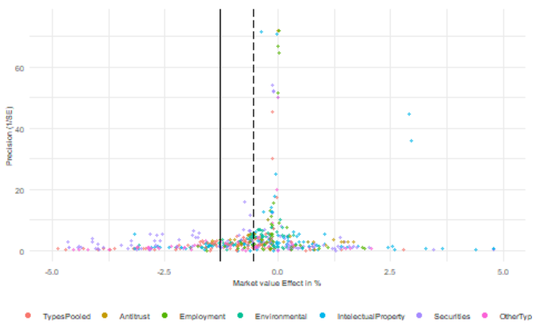
(c) Positive events



(d) Negative events



(e) Resolutions



(f) Filings

Figure 4.1: Funnel plots

Note: The figure shows funnel plots for various subsamples of the meta-dataset. The dashed black line depicts the mean and the dashed one the median of the subsample. Funnel plots (a), (c), (d) and (e) differentiate between various lawsuit events. Funnel plots (b) and (f) show all lawsuit types.

4.2 Linear Tests

To provide empirical evidence on previous visual inspections, a publication bias is commonly diagnosed with regression-based *funnel asymmetry tests* (FAT) which estimate the following equation:

$$\hat{x}_{ij} = \beta_0 + \beta_1 \, \mathrm{SE}(\hat{x}_{ij}) + e_{ij} \tag{4.1}$$

where $\hat{x}_{ij}$ denotes the ith estimate of the abnormal returns due to litigation events in the j study, and SE denotes its corresponding standard error as reported in, or derived from[1], a given primary study, and $e_{ij} \sim \mathrm{N}(0, \sigma^2)$ is the idiosyncratic error.

The then computed regression coefficients would have the following interpretation: The β_0 is the *'true' mean underlying effect* beyond publication bias, which can be interpreted as the bias-corrected estimate. The β_1 is the *intensity* of the publication bias, $\beta_1 = 0$ would indicate that publication bias is not an issue in the field.

If the publication bias is present, then the reported estimates and standard errors are correlated (Stanley & Doucouliagos 2012), and therefore, estimating the equation would yield a statistically significant slope coefficient. However, this specification inherently exhibits heteroskedasticity as the independent variable accounts for the variance of the dependent variable, which limits the validaty of statistical inference.

Table 4.1 displays results of 6 publication bias detection methods for different subsamples of the meta-dataset. As the sample is composed of more than 40 studies, I follow the suggestion of Irsova *et al.* (2023) and cluster all standard errors at the study level for all of the following methods.

Notably, most of the methods do not detect publication bias. Comparison with uncorrected estimates reported in Table 3.4 would suggest that the bias-corrected results do not differ significantly in magnitude.

[1] As described in Section 3.2.

Table 4.1: Publication bias - linear methods

	All	Negative	Positive	Resolution	Filing
β_0: OLS effect beyond bias	-0.755***	-1.223***	0.305	0.186	-1.19***
	(0.207)	(0.271)	(0.168)	(0.128)	(0.279)
β_1: OLS bias	-0.015	-0.035	-0.066	0.018	-0.069
	(0.037)	(0.037)	(0.059)	(0.023)	(0.049)
β_0: FE effect beyond bias	-0.78***	-1.255***	0.229	0.185	-1.239***
	(0.206)	(0.265)	(0.199)	(0.122)	(0.273)
β_1: FE bias	0.005	-0.002	-0.015	0.018	-0.024
	(0.017)	(0.026)	(0.04)	(0.018)	(0.026)
β_0: BE effect beyond bias	-1.165***	-1.704***	0.262	0.175	-1.733***
	(0.274)	(0.307)	(0.198)	(0.199)	(0.346)
β_1: BE bias	0.003	-0.007	-0.022	0.018	-0.029
	(0.018)	(0.026)	(0.043)	(0.018)	(0.027)
β_0: Study effect beyond bias	-1.29***	-1.903***	0.223	-0.033	-1.886***
	(0.289)	(0.363)	(0.272)	(0.234)	(0.383)
β_1: Study bias	-0.016	-0.085	-0.054	0.02	-0.097
	(0.052)	(0.084)	(0.092)	(0.031)	(0.093)
β_0: Precision effect beyond bias	-0.195	-0.28***	0.572	0.304	-0.273***
	(0.099)	(0.07)	(0.477)	(0.331)	(0.068)
β_1: Precision bias	-0.492*	-0.996***	-0.242	-0.071	-0.903**
	(0.186)	(0.284)	(0.299)	(0.224)	(0.264)
Nobs.	882	583	279	266	577
Studies	64	58	35	29	51

Note: The table shows estimation results for 6 linear methods of detecting publication bias for various subsamples. Standard errors are clustered at the study level. The particular methods were developed in Cameron *et al.* (2011), Astakhov *et al.* (2019) and Stanley & Doucouliagos (2012), the first method is simple OLS. All of these are described in more detail in Bajzik *et al.* (2023).
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 4.2 shows publication bias detection results for the most commonly studied lawsuit event - the announcement that the firm is named a defendant in a lawsuit filing - decomposed according to the nature of the suit.

4.3 Non-linear Tests

The previously conducted tests rely on the assumption that there is a testable linear relationship between collected effects sizes and the associated standard errors, as indicated in Equation 4.1. To account for the possibility that the assumption does not hold and to complement the results obtained from testing the linear specification., I apply the following 4 non-linear methods:

1. *Top 10* of Stanley *et al.* (2010).
2. *Selection* of Andrews & Kasy (2019).

Table 4.2: Publication bias - linear methods - filings effect

	All	Pooled	Antitrust	Employment	Environmental	Patent	Securities	Other
β_0: OLS effect beyond bias	-1.4***	-1.19*	-0.693**	-0.384	-0.544**	-0.599**	-2.519**	-1.082**
	(0.327)	(0.358)	(0.041)	(0.443)	(0.104)	(0.151)	(0.847)	(0.354)
β_1: OLS bias	-0.084	-0.05	0.179*	-0.087.	-0.226	0.027	-1.316	-0.161
	(0.063)	(0.032)	(0.023)	(0.033)	(0.261)	(0.052)	(0.974)	(0.319)
β_0: FE effect beyond bias	-1.523***	-1.337***	-0.764***	-0.375	-0.556***	-0.612***	-1.14	-1.255**
	(0.323)	(0.366)	(0.048)	(0.414)	(0.123)	(0.151)	(0.872)	(0.369)
β_1: FE bias	-0.039	0.06	0.316**	-0.095*	-0.199	0.038	-2.988*	-0.022
	(0.043)	(0.036)	(0.072)	(0.036)	(0.345)	(0.059)	(1.366)	(0.217)
β_0: BE effect beyond bias	-2.066***	-1.295***	-0.693***	-0.551	-0.558*	-0.599***	-1.597*	-1.152**
	(0.35)	(0.373)	(0.041)	(0.483)	(0.253)	(0.151)	(0.697)	(0.381)
β_1: BE bias	-0.048	0	0.179***	-0.093*	-0.204	0.027	-2.497*	-0.105
	(0.044)	(0.023)	(0.023)	(0.035)	(0.325)	(0.052)	(1.158)	(0.283)
β_0: Study effect beyond bias	-2.266***	-1.388**	-0.688**	-0.332	-0.684*	-0.547***	-1.978*	-1.041*
	(0.424)	(0.407)	(0.034)	(0.465)	(0.194)	(0.134)	(0.851)	(0.341)
β_1: Study bias	-0.133	-0.045	0.175*	-0.041	-0.114	-0.01	-2.306*	-0.154
	(0.138)	(0.036)	(0.024)	(0.066)	(0.199)	(0.017)	(1.065)	(0.31)
β_0: Precision effect beyond bias	-0.297***	-0.151	-0.603**	-0.029	-0.331***	-0.376	-0.177	-0.027
	(0.067)	(0.11)	(0.054)	(0.016)	(0.036)	(0.335)	(0.163)	(0.038)
β_1: Precision bias	-1.353**	-0.82**	0.004	-0.391	-0.694.	-0.171	-4.156**	-1.004*
	(0.395)	(0.238)	(0.178)	(0.422)	(0.286)	(0.283)	(1.386)	(0.276)
Nobs.	456	65	14	48	95	73	124	37
Studies	50	9	3	4	7	16	25	5

Note: The table shows estimation results for 5 linear methods of detecting publication bias for the subsample of price responses to the announcements of firm being named the defendant in a lawsuit. Standard errors are clustered at the study level.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

3. *Stem* of Furukawa (2019).
4. *Kink* of Bom & Rachinger (2019).

As in the previous sub-chapter, Table 4.3 displays the results of four mentioned publication bias detection methods for different subsamples of the meta-dataset and Table 4.4 lists publication bias detection results for the most commonly studied lawsuit event - the announcement that the firm is named a defendant in a lawsuit filing - decomposed according to the nature of the suit.

Table 4.3: Publication bias - non-linear methods

	All	Negative	Positive	Resolution	Filing
β_0: Top 10	0.044	-0.216***	0.658*	0.464.	-0.125
	(0.103)	(0.06)	(0.272)	(0.253)	(0.097)
β_0: Selection	-3.768***	-7.235***	3.413***	2.455***	-6.807***
	(0.05)	(0.028)	(0.285)	(0.192)	(0.043)
β_0: Stem	-0.2	-0.2	0.261	0.211	-0.2
	(0.175)	(0.154)	(0.381)	(0.24)	(0.16)
β_0: Kink	-0.25***	-0.26***	0.31***	0.16***	-0.267***
	(0.013)	(0.014)	(0.058)	(0.045)	(0.015)
Nobs.	882	583	279	266	577
Studies	64	58	35	29	51

Note: The table shows estimation results for 4 non-linear methods of detecting publication bias for various subsamples. Standard errors are clustered at the study level.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 4.4: Publication bias - non-linear methods - filings effect

	All	Pooled	Antitrust	Employment	Environmental	Patent	Securities	Other
β_0: Top 10	-0.253***	-0.114**	-0.555***	-0.003	-0.21**	-0.544	-0.265**	-0.005**
	(0.074)	(0.034)	(0.045)	(0.021)	(0.078)	(0.358)	(0.085)	(0.002)
β_0: Selection	-9.117***	-1.692***	-2.077	-0.558*	-29.518***	-6.508***	-5.553***	-1.071***
	(0.027)	(0.116)	(2.276)	(0.275)	(0.081)	(0.038)	(0.095)	(0.038)
β_0: Stem	-0.2	-0.062	-0.627**	0.018	-0.2	-0.007	-0.037	-0.004
	(0.155)	(0.139)	(0.153)	(0.048)	(0.15)	(0.492)	(0.182)	(0.024)
β_0: Kink	-0.267***	-0.002	-0.43	0.028*	-0.285***	-0.274**	-0.003	0.003
	(0.016)	(0.004)	(0.288)	(0.013)	(0.035)	(0.096)	(0.019)	(0.004)
Nobs.	456	65	14	48	95	73	124	37
Studies	50	9	3	4	7	16	25	5

Note: The table shows estimation results for 4 non-linear methods of detecting publication bias for the subsample of price responses to the announcements of the firm being named the defendant in a lawsuit. Standard errors are clustered at the study level.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Chapter 5

Drivers of Heterogeneity

This chapter presents the results of an investigation into the reasons behind the variation in price responses. To perform this task, I employ novel methods of *meta-regression analysis* (MRA). First, I present and discuss the upshots of *Bayesian model averaging* (BMA), which goal is to identify the best possible approximation of the true model consisting of the input moderator variable, and that by assigning a weight to each averaged model based on how well the model explains the underlying data. These findings are subsequently verified using OLS check and the *Frequentist model averaging* (FMA) method. Finally, I evaluate the sensitivity of the Bayesian procedure results to the pair of selected priors.

In this chapter, I closely follow the methodology applied in Bajzik *et al.* (2023) and Malovana *et al.* (2024). All computations were conducted using the R programming language, based on an outline of the code provided by the thesis supervisor.

5.1 Meta Regression Analysis

The general aim of multivariate meta-regression is to determine whether the effect sizes systematically vary across the different settings in which authors estimate the effect.

$$\hat{x}_{ij} = \beta_0 + \beta_1 \, \mathrm{SE}(\hat{x}_{ij}) + \mathbf{M}\,\gamma + e_{ij}, \tag{5.1}$$

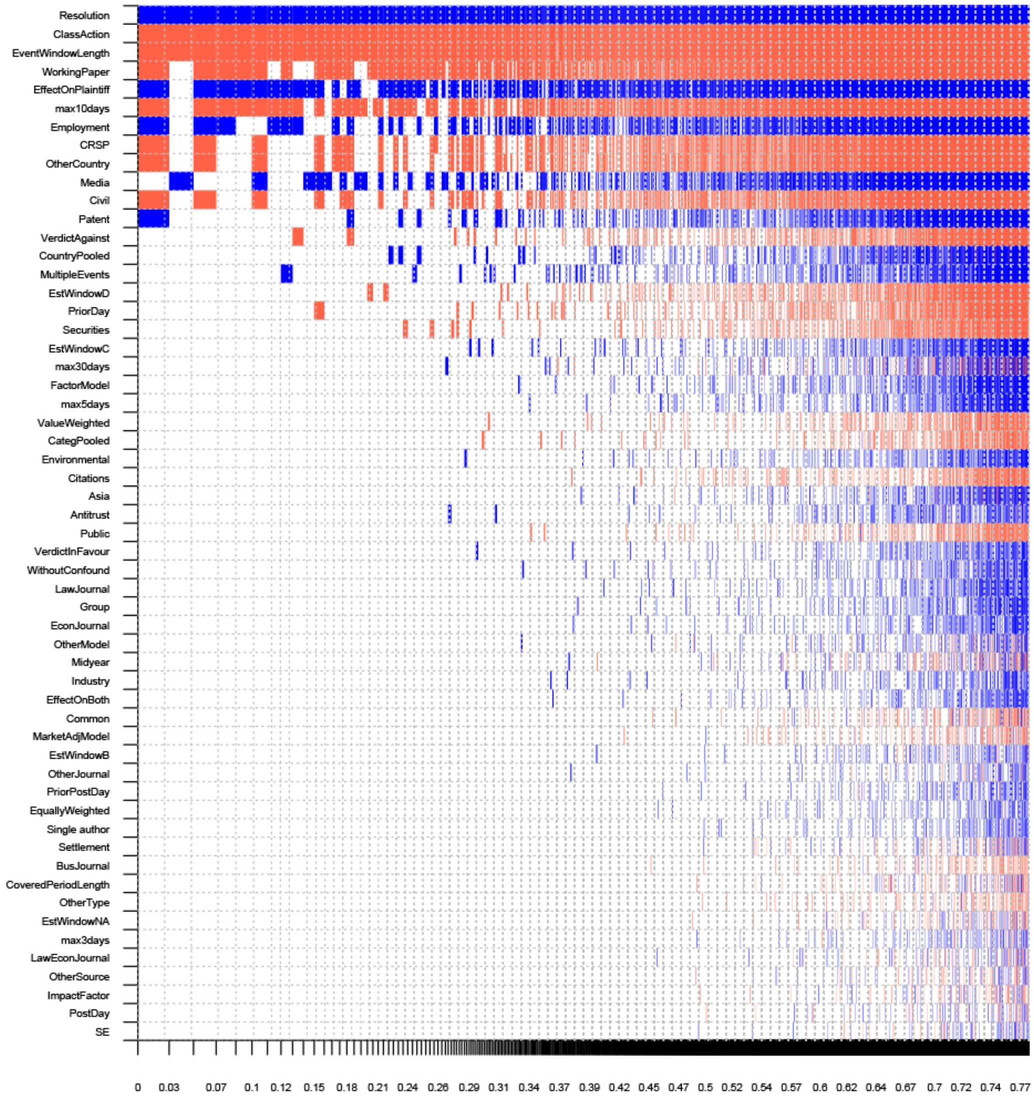
where M is a certain set of moderator variables that have been reasoned to affect the reported estimates and γ is a vector of associated coefficients.

The problem is what particular combination of moderator variables to use to explain the effect size, as considering every possibility would mean, in case of my meta-dataset, estimating 2^{71} models. This model uncertainty problem can be resolved by applying the Bayesian model averaging method[1], with, following Malovana *et al.* (2024), the great number of possible models being tackled with a Markov chain Monte Carol process with the Metropolis-Hastings algorithm of Zeugner & Feldkircher (2015), that considers only the most likely models.

Before running BMA, I examine the correlation matrix of the moderator variables and exclude one variable, *YearsSinceTexaco*, due to its high correlation (>0.85) with another, namely *Midyear*. I choose Midyear over YearsSince-Texaco due to the fact, that Midyear was found to have decisive effect on the cumulative average abnormal returns in the closely followed meta-analysis of Bajzik *et al.* (2023). The correlation matrix can be found in Figure C.1.

Figure 5.1 visualizes BMA results. On the vertical axis, the moderator variables are ordered from highest *posterior inclusion probability*[2] (PIP) at the top to the lowest at the bottom. On the horizontal axis the individual model specifications are ranked from left to the right according to how well they fit the data based on *posterior model probability*[3] (PMP). A blue color indicates that the corresponding moderator variable has a positive effect on the dependent variable in a given model specification. Conversely, a red color means that the moderator variable has a negative impact. No color indicates that the moderator variable was not used in the specification.

[1]Described in the greatest detail in Steel (2020) or Moral-Benito (2015).
[2]PIP represents the probability that the moderator variable is specified in the *true* model.
[3]PMP can be interpreted as the 'goodness-of-fit' of the model in Bayesian econometrics.



Note: The figure shows BMA results On the vertical axis, the moderator variables are arranged from highest to lowest PIP, with the highest at the top and the lowest at the bottom. On the horizontal axis, the individual model specifications are ranked from left to right based on how well they fit the data according to PMP. A blue color indicates that the corresponding moderator variable has a positive effect on the dependent variable in a given model specification. Conversely, a red color indicates a negative impact of the moderator variable. No color signifies that the variable was not included in the specification. The pair of applied priors was model dilution prior of George (2010) and

Figure 5.1: Model inclusion in Bayesian model averaging

Table 5.1 and Table 5.2 numerically supplement the previous visualization. To interpret the findings of the BMA analysis, I will rely on convention of Raftery (1995), who differentiates effects based on their calculated PIP in the following manner:

- 0.99 < PIP ... *decisive effect*

- 0.95 < PIP < 0.99 ... *strong effect*
- 0.75 < PIP < 0.94 ... *substantial effect*
- 0.5 < PIP < 0.75 ... *weak effect*

Individual results are discussed in relation to the underlying class of moderator variables. These discussions now follow:

Event study characteristics. There are only two event study choices that can be interpreted, according to their PIP, as having an effect on the magnitude of price responses: the length of the event window and a particular event type. The event type will be covered in the next class, while the focus here will be on methodological choices.

The length of the event window (P. mean = -0.051, P. SD = 0.002) was found to have a decisive effect on the magnitude of the effect sizes. Given the extensive discussion of Section 2.2, this particular finding is not surprising, as by their definition, cumulative average abnormal returns changes with every additional expansion of the event window. In particular, my result states that expanding the event window by day would decrease the price response by 0.05%.

Moreover, according to the BMA results, the author's choices regarding the estimation window length, the normal returns model, and the index representing the market portfolio do not systematically affect the magnitude of the cumulative average abnormal returns. These choices clearly fail to reach even the weak effect classification and can thus be considered minor modeling decisions.

Lawsuit characteristics. A singleton lawsuit characteristics was found to have decisive effect on the effect on the effect size. According to the BMA, class-action lawsuits have a significant negative impact on the magnitude of the effect size. This is not a surprising finding, as the reason for their institutional development was to facilitate legal disputes which would have a numerous plaintiffs. In other words, they were explicitly designed to the impact of a larger number of individual lawsuits. The finding can be empirically interpreted as that the stat of being a class-action (P. mean = -1.884, P. SD = 0.335) magnifies the negative lawsuit effect by approximately 2%. This is in line with findings of prior literature, namely Koku & Qureshi (2006).

Finally, regarding the lawsuit events, the BMA output suggest that the price response to the resolution of a lawsuit is decisively more positive (P. mean = 1.458%, P. SD = 0.002) than the market reaction to lawsuit initiation.

This well complements the prior literature, such as Haslem (2005) or Koku & Qureshi (2006) which suggest that settlements and verdicts in favour, which together dominate the subsample of lawsuit resolving events, are a market value creating events.

Sample characteristics. All sample characteristics were found to have less than a weak effect on the price response estimate.

Publication characteristics. Most of the publication characteristics were found to have less than a weak effect on the price response estimate. Interestingly, the BMA assigns substantial effect to the pieces of academic writing that were unpublished in academic journals. Specifically, working papers are associated with weakening the effect size by 0.889%.

Table 5.1: MRA results (Part 1)

	Bayesian model averaging			OLS check			Frequentist model averaging		
Variable	PIP	P. mean	P. SD	Coef	SE	p-value	Coef	SE	p-value
SE	0.003	0.000	0.002				0.001	0.022	0.967
Event study characteristics									
Event type									
Resolution	**1**	**1.458**	**0.203**	**1.644**	**0.253**	**0**	**1.737**	**1.163**	**0.135**
Settlement	0.005	0.000	0.029				-0.948	0.784	0.227
Verdict against	0.109	-0.084	0.262				-0.922	0.873	0.291
Verdict in favour	0.016	0.011	0.097				-0.129	0.498	0.796
Multiple events	0.091	0.077	0.262				0.263	0.374	0.482
Event window									
Length of the event window	**0.992**	**-0.051**	**0.012**	**-0.050**	**0.022**	**0.023**	**-0.034**	**0.025**	**0.185**
Prior Day	0.086	-0.047	0.169				0	0.077	1
Post Day	0.003	0.000	0.017				0	0.562	1
Prior Post Day	0.006	0.001	0.029				0	0.997	1
Max 3 days	0.004	0.001	0.016				0	0.681	1
Max 5 days	0.028	0.013	0.088				0	0.983	1
Max 10 days	0.734	-0.646	0.445	-0.775	0.371	0.041	0	0.224	1
Max 30 days	0.038	0.023	0.230				0	0.648	1
Estimation window									
Estimation window B	0.007	0.002	0.033				0	0.189	1
Estimation window C	0.046	0.019	0.098				0	0.128	1
Estimation window D	0.090	-0.044	0.153				0	0.470	1
Estimation window NA	0.004	0.000	0.024				0	0.198	1
Normal returns models									
Market adjusted returns	0.007	-0.003	0.044				-0.352	0.470	0.454
Factor model	0.032	0.020	0.127				0.499	0.557	0.370
Other	0.011	0.004	0.061				0.023	0.407	0.954
Index weighting									
Equally weighted	0.005	0.001	0.020				-0.210	0.291	0.471
Value weighted	0.024	-0.009	0.063				-0.012	0.177	0.945
Lawsuit characteristics									
Affected party									
Plaintiff	0.773	0.618	0.388	0.745	0.227	0.002	0.479	0.429	0.264
Both parties	0.010	0.008	0.093				0.228	0.593	0.701
Nature of suit									
Antitrust	0.019	0.012	0.103				1.034	0.900	0.250
Employment	0.481	0.448	0.505				0.080	0.896	0.929
Environmental	0.022	0.011	0.085				0.071	0.389	0.856
Patent	0.208	0.127	0.268				0.095	0.850	0.911
Securities	0.067	-0.046	0.186				0	0.285	1
Other	0.005	-0.001	0.030				0	0.149	1
Class action	**1.000**	**-1.884**	**0.335**	**-1.969**	**0.473**	**0.000**	**-1.164**	**0.769**	**0.130**
Legal dispute category									
Public	0.018	-0.008	0.072				-0.827	0.599	0.167
Pooled	0.022	-0.012	0.094				-0.422	0.421	0.316
Legal origin									
Civil	0.382	-0.334	0.456				-1.459	1.068	0.172
Common	0.008	-0.002	0.049				-0.500	0.552	0.366

Note: (Continued on the next page)

Table 5.2: MRA results (Part 2)

	Bayesian model averaging			OLS check			Frequentist model averaging		
Variable	PIP	P. mean	P. SD	Coef	SE	p-value	Coef	SE	p-value
Sample characteristics									
Covered period length	0.005	-0.000	0.001				0.001	0.027	0.988
Midyear	0.011	0.000	0.002				0.011	0.018	0.557
Industry	0.010	0.004	0.043				0	0.136	1
No confounding events	0.014	0.005	0.049				0.238	0.440	0.589
Geography									
Asia	0.020	0.019	0.172				0.344	0.648	0.596
Pooled	0.094	0.069	0.236				-0.382	0.570	0.502
Other	0.446	-0.650	0.775				-1.048	0.966	0.278
Source of announcements									
Media	0.387	0.235	0.319				0.647	0.512	0.206
Other	0.004	0.000	0.021				-0.146	0.516	0.777
Source of stock returns									
CRSP	0.451	-0.458	0.546				-0.731	1.051	0.487
Publication characteristics									
Authors									
Individual	0.005	0.001	0.023				0.443	0.679	0.514
Group	0.013	0.003	0.037				0.534	0.695	0.442
Journal field									
Business/Management	0.005	-0.001	0.019				0.082	0.311	0.793
Economics	0.012	0.004	0.039				0.457	0.433	0.291
Law & economics	0.004	0.000	0.016				0.404	0.595	0.497
Law	0.014	0.006	0.060				0.434	0.496	0.382
Other	0.006	0.002	0.034				-0.405	0.602	0.501
Working paper	0.810	-0.955	0.556	-1.018	0.767	0.189	-1.151	0.831	0.166
l_Citations	0.021	-0.007	0.056				-0.327	0.365	0.370
Impact Factor	0.004	-0.000	0.002				-0.039	0.042	0.360
Observations		882			882			882	
Studies		64			64			64	

Note: Figure shows the MRA results for my meta-dataset. PIP is the posterior inclusion probability. P. mean is the posterior mean, which is the typical value of a coefficient associated with the particular moderator variable. P. SD is the posterior standard deviation, which documents how the coefficient differs on average in various model specifications. Zeroes written with decimals indicate, that the value obtained from the computation was rounded down to 3 decimal places. Strong and decisive effects are highlighted.

Following Gechert *et al.* (2022), as a robustness check, I run a simple OLS regression with clustered standard errors at the study level, regressing the effect size on the moderator variables that the BMA computed as having at least a coin-toss posterior probability of being included in the 'true' model specification. In all cases, this confirmed the decisive effects findings of the BMA. Moreover, it revealed that the effects on plaintiffs, in comparison to the effects on defendants, are positive and statistically significant with p-value of 2%. This correspond to the conventional wisdom that plaintiffs only fill lawsuits when they can reasonably expect financially profit for it .

Table 5.1 and Table 5.2 also show the results of the Frequentist Model Averaging robustness check. N otably, not a single moderator variable obtained a p-value indicating statistical significance at a level lower than 5%. Only two variables approached the highest conventional statistical significance level of

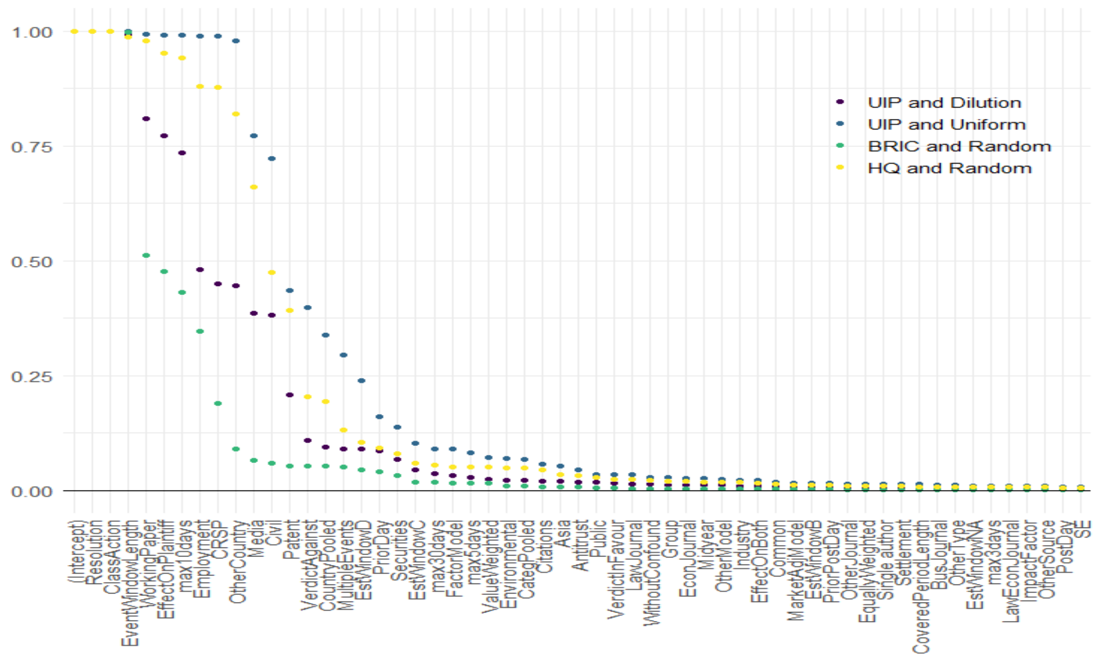
10%: *Resolution* (p-value = 0.135) and *Class-action* (p-value = 0.130). This conflict with output from the BMA computations would suggest that colinearity is indeed an issue for the model specification, which was expected since I used a large number of moderator variables. Therefore, I reasonably applied the dilution model prior of George (2010) in the BMA, which was specifically designed to address the multicollinearity problem.

5.2 Prior Sensitivity Analysis

Given the rather inconclusive results from the previous section, it is more than reasonable to check for the robustness of the Bayesian procedure, by analysing how the results would change with the selection of different priors. This robustness check will be done by recalculating the BMA results using several different priors and then examining whether these changes have any effect on the considerations about the explanatory power of the individual variables.

As was briefly mentioned in the previous section, the BMA method requires two input priors, a *model prior* and a *g-prior.* Following Bajzik *et al.* (2023) and Malovana *et al.* (2024) I use the *Uniform* model prior and a *unit information g-prior* (UIP) as the baseline prior for the sensitivity analysis. As the name indicates, the uniform prior distributes weights to the evaluated models uniformly.

Figure 5.2 shows the results of the comparative sensitivity analysis. On horizontal axis, there are moderator variables used in the BMA calculation. On vertical axis, there is the computed posterior inclusion probability, which represents how likely it is that the particular moderator variable is specified in the *true* model.



Note: The figure illustrates how BMA results are influenced by the significance of individual moderator variables in explaining the variation in price responses reported in primary studies, in relation to the different pairs of priors applied in the Bayesian model averaging procedure.

Figure 5.2: Sensitivity of BMA calculation to different prior selection

Based on the observations drawn from Figure 5.2, I can state that all moderator variables with decisive effects were found to be robust in terms of the selected pair of priors. However, the whole specification of the 'true' model depends on the particular selection.

Chapter 6

Conclusion

I have applied recently developed methods to control for publication bias and model uncertainty in the academic literature that estimates financial markets' short-term reactions to the announcements of major lawsuit events. Although, there is a strong intuition supporting certain effects, I find little empirical evidence for the presence of publication bias.

Notwithstanding the inconclusive results, this thesis makes several contributions. First, I constructed an original meta-dataset on the issue, therefore becoming the first author to check for the presence of publication bias in this particular strand of literature. Second, I examined the drivers of heterogeneity in the lawsuit effect literature and found that price responses are stronger to the class action lawsuits, investors react more positively to the news of lawsuit resolution than to the news of their filling, and that the only major choice in event study methodology is the length of the period over which the expected effect of examined event is to be realized. Finally, future similarly oriented meta-analyses may benefit from the very detailed description of the dataset construction and the findings that certain steps of event study methodology can be considered minor modeling choices.

However, a number of limitations must be mentioned. First of all, the sample of primary studies was severely limited by the conventions in the examined literature. Many studies that would otherwise be ideal primary studies, such as Haslem *et al.* (2017), lacked any statistical measure associated with price responses that could be used to derive standard errors, as they reported statistical significance only through stars accompanying the estimate. The omission of these 22 papers, which would increase the number of studies by roughly a third, could have significantly influence the precision of results of my analysis.

Secondly, it could be argued that the focus of the thesis is too general and should be more narrowly defined, for example, to a specific type of lawsuit. While this generality claim cannot be entirely dismissed, it should be noted that, as shown in Table 3.2, Table 3.5, or Table 4.2, there are currently not enough studies and estimates for any individual lawsuit type to conduct a focused meta-analysis. When the time is ripe, future meta-analyses on individual classes of lawsuits could benefit from the base of primary studies that I have identified through the data collection process.

This research can expended by identifying and coding-in additional moderator variables to the dataset, that may be better suited to explain the variation in price responses, as discussed in Appendix E, this will be a rather formidable challenge. Moreover, similarly oriented meta-analysis could be for price responses to the events of regulators enforcement actions, these are Finally, the study could be expended by focusin in deeper detail on the event study methodology and based on it to construct the best practice estimate.

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Appendix A

Primary Studies

Study	**Title**	**Publication Outlet**	**Period**	**Lawsuit Type**	**N of Estimates**
Abdulmanova *et al.* (2021)	The effect of investor attention on fraud discovery and value loss in securities class action litigation	Journal of Financial Research	2004-2019	Securities	2
Aguzzoni *et al.* (2013)	The Effect of EU Antitrust Investigations and Fines on a Firm's Valuation	Journal of Industrial Economics	1969-2009	Antitrust	18
Amoah & Makkawi (2013)	Determinants of Investor Reaction to Announcement of SEC 10B-5 Lawsuit	Journal of Accounting, Ethics & Public Policy	1996-2005	Securities	1
Arena & Ferris (2018)	A global analysis of corporate litigation risk and costs	International Review of Law and Economics	1999-2008	Pooled	20
Bessen *et al.* (2011)	The private costs of patent litigation	Journal of Law, Economics & Policy	1984-1999	Patent	9
Bessen & Meurer (2012)	The Private and Social Costs of Patent Trols	Regulation	1990-2010	Patent	2
Bhagat & Umesh (1997)	Do Trademark Infringement Lawsuits Affect Brand Value: A Stock Market Perspective	Journal of Market-Focused Management	1981-1983	Patent	8
Bhagat *et al.* (1994)	The costs of inefficient bargaining and financial distress: Evidence from corporate lawsuits	Journal of Financial Economics	1975-1990	Pooled	28
Bhagat *et al.* (1998)	The Shareholder Wealth Implications of Corporate Lawsuits	Financial Management	1981-1983	Pooled	23
Bizjak & Coles (1995)	The Effect of Private Antitrust Litigation on the Stock-Market Valuation of the Firm	American Economic Review	1973-1983	Antitrust	21
Blose & Calvasina (2002)	Employment discrimination litigation and the value of the firm	Journal of Legal, Ethical and Regulatory Issues	1979-1991	Employment	61
Bohn & Choi (1996)	Fraud in the New-Issues Market: Empirical Evidence on Securities Class Actions	University of Pennsylvania Law Review	1975-1986	Securities	2
Bonini & Boraschi (2010)	Corporate Scandals and Capital Structure	Journal of Business Ethics	1996-2005	Securities	8
Bosch & Eckard Jr (1991)	The Profitability of Price Fixing: Evidence From Stock Market Reaction to Federal Indictments	The Review of Economics and Statistics	1962-1980	Antitrust	2
Brada *et al.* (2022)	Value creation and value destruction in investor-state dispute arbitration	Journal of Multinational Financial Management	2005-2019	Securities	26
Coughlan *et al.* (2014)	Brand value and stock markets: Evidence from trademark litigations	Working paper	2000-2012	Patent	4
Damak *et al.* (2022)	The Stock Market Reaction to Securities Class Action Filings	International Journal of Economics and Financial Issues	2013-2015	Securities	3
Deng *et al.* (2014)	Shareholder Litigation, Reputational Loss, and Bank Loan Contracting	Journal of Financial and Quantitative Analysis	1996-2006	Securities	3
Engelhardt & Fernandes (2016)	An event study of patent verdicts and judicial leakage	Working paper	2000-2015	Patent	16
Erragragui *et al.* (2023)	Stock market reactions to corporate misconduct: The moderating role of legal origin	Economic Modelling	2010-2015	Environmental	9

Note: Continued on the next page

Study	Title	Publication Outlet	Period	Lawsuit Type	N of Estimates
Flore *et al.* (2021)	Forgive me all my sins: How penalties imposed on banks travel through markets	Journal of Corporate Finance	2005-2015	Securities	5
Ferris *et al.* (2007)	Derivative Lawsuits as a Corporate Governance Mechanism: Empirical Evidence on Board Changes Surrounding Filings	Journal of Financial and Quantitative Analysis	1982-1999	Securities	1
Firth *et al.* (2011b)	The Effects of Political Connections and State Ownership on Corporate Litigation in China	Journal of Law and Economics	1999-2005	Pooled	43
Fich & Shivdasani (2007)	Financial fraud, director reputation, and shareholder wealth	Journal of Financial Economics	1998-2002	Securities	2
Flore *et al.* (2017)	Settlement agreement types of federal corporate prosecution in the U.S. and their impact on shareholder wealth	Journal of Business Research	2001-2014	Pooled	35
Gande & Lewis (2009)	Shareholder-Initiated Class Action Lawsuits: Shareholder Wealth Effects and Industry Spillovers	Journal of Financial and Quantitative Analysis	1996-2003	Securities	4
Griffin *et al.* (2004)	Stock Price Response to News of Securities Fraud Litigation: An Analysis of Sequential and Conditional Information	Abacus	1990-2003	Securities	5
Günster & van Dijk (2016)	The impact of European antitrust policy: Evidence from the stock market	International Review of Law and Economics	1974-2004	Antitrust	9
Haslem (2005)	Managerial Opportunism during Corporate Litigation	Journal of Finance	1994-2001	Pooled	15
Henry (2013)	The Market Effects of Patent Litigation	Technology and Investment	1963-2002	Patent	12
Hersch (1991)	Equal employment opportunity law and firm profitability	Journal of Human Resources	1964-1986	Employment	30
Hirsh & Cha (2015)	Employment Discrimination Lawsuits and Corporate Stock Prices	Social Currents	1997-2008	Employment	5
Hutton *et al.* (2015)	Political Values, Culture, and Corporate Litigation	Management Science	1994-2008	Pooled	36
Johnson *et al.* (2014)	Corporate fraud and the value of reputations in the product market	Journal of Corporate Finance	1996-2009	Securities	1
Karpoff & Lott Jr (1993)	The reputational penalty firms bear from committing criminal fraud	Journal of Law and Economics	1978-1987	Pooled	2
Karpoff *et al.* (2005)	The Reputational Penalties for Environmental Violations: Empirical Evidence	Journal of Law and Economics	1980-2000	Environmental	2
Karpoff *et al.* (2008)	The Cost to Firms of Cooking the Books	Journal of Financial and Quantitative Analysis	1978-2002	Environmental	2
Klock (2015)	Do Class Action Filings Affect Stock Prices? The Stock Market Reaction to Securities Class Actions Post PSLR	Journal of Business and Securities Law	1996-2011	Securities	33
Koku *et al.* (2001)	The effects of news on initial corporate lawsuits	Journal of Business Research	1990-1994	Pooled	6
Koku & Qureshi (2006)	Analysis of the Effects of Settlement of Interfirm Lawsuits	Managerial and Decision Economics	1990-1994	Pooled	22
Köster & Pelster (2017)	Financial penalties and bank performance	Journal of Banking & Finance	2007-2014	Pooled	10
Lamba & Ramsay (2009)	The Costs of Corporate Litigation in Australia: A Research Note	Journal of Business Research	1993-1998	Pooled	20
Lee *et al.* (2013)	Information value of patent litigation and industry competition in Taiwan	Technological and Economic Development of Economy	1998-2010	Patent	20
Lin *et al.* (2020)	Shareholder wealth effects of corporate fraud: Evidence from Taiwan's securities investor and future trader protection act	International Review of Economics & Finance	1999-2005	Securities	1
Liu *et al.* (2020)	Rhetoric, Reality, and Reputation: Do CSR and Political Lobbying Protect Shareholder Wealth against Environmental Lawsuits?	Journal of Financial and Quantitative Analysis	2000-2015	Environmental	15
Muoghalu *et al.* (1990)	Hazardous Waste Lawsuits, Stockholder Returns, and Deterrence	Southern Economic Journal	1977-1986	Environmental	15
Nam *et al.* (2015)	The impact of patent litigation on shareholder value in the smartphone industry	Technological Forecasting and Social Change	2009-2012	Patent	21
Narayanamoorthy & Zhou (2016)	Litigation settlements, litigation stakes, and financial distress costs	Australian Journal of Management	2002-2006	Pooled	4
Oh *et al.* (2023)	Financial Market Reactions to Patent Litigation: An Event Study of Litigation in Korea	Korean Economic Review	1987-2011	Patent	10
Pritchard & Ferris (2001)	Stock Price Reactions to Securities Fraud Class Actions Under the Private Securities Litigation Reform Act	Working paper	1995-1999	Securities	9
Raghu *et al.* (2008)	Market reaction to patent infringement litigations in the information technology industry	Information Systems	1984-2002	Patent	9
Rathinasamy *et al.* (2004)	A Study Of The Impact Of Filing Of IPO Class-Action Lawsuits On Stockholder Wealth	Journal of Business & Economic Research	1991-1998	Securities	15
Romano (1991)	The Shareholder Suit: Litigation without Foundation?	Journal of Law, Economics, and Organization	1966-1988	Securities	4

Note: Continued on the next page

Study	Title	Publication Outlet	Period	Lawsuit Type	N of Estimates
Sato *et al.* (2023)	Impacts of climate litigation on firm value	Working paper	2010-2020	Environmental	32
Selmi (2002)	The Price of Discrimination: The Nature of Class Action Employment Litigation and Its Effects	Texas Law Review	1991-2001	Employment	2
Tsai & Huang (2021)	Internal control material weakness opinions and the market's reaction to securities fraud litigation announcements	Finance Research Letters	2000-2018	Securities	4
Wei & Zhang (2022)	Shareholder Monitoring and Securities Class Action Lawsuits	Working paper	1996-2013	Securities	9
Wei *et al.* (2011)	Does it pay to pollute? Shareholder wealth consequences of corporate environmental lawsuits	International Review of Law and Economics	1980-2001	Environmental	48
West (2001)	Why Shareholders Sue: The Evidence from Japan	Journal of Legal Studies	1993-1999	Securities	4
Woo (2007)	Impact of Intellectual Property Infringement Lawsuits in the US on Firm Value	Asian International Studies Review	1984-1999	Patent	24
Wright *et al.* (1995)	Competitiveness through Management of Diversity: Effects on Stock Price Valuation	Academy of Management Journal	1986-1992	Employment	2
Yang & Chen (2009)	Defendant Firms and Response to Legal Crises: Effect on Shareholder Value	Journal of Contingencies and Crises Management	1994-2004	Pooled	39
Yu & Shih (2021)	Financial Market Reaction to Patent Lawsuits against Integrated Circuit Design Companies	Journal of Risk and Financial Management	2010-2020	Patent	6

Note: The table shows authors, titles, publication outlet, covered time period, covered nature of suit, and the number of estimates for all primary studies included in the meta-dataset.

Appendix B

CAARs for all subsamples

Variable	N of estimates	N of studies	Mean	5%	95%	Weighted mean	5%	95%
All	882	64	-0.77	-4.64	1.73	-1.31	-5.76	1.69
The Day	49	14	-0.44	-3.53	0.62	-1.73	-3.84	0.71
Post Day	63	15	-0.17	-1.43	1.45	-0.31	-0.72	1.12
Prior Day	143	23	-0.69	-3.08	1.17	-0.88	-2.55	1.82
Prior and Post Day	129	29	-0.72	-4.39	0.76	-1.97	-4.63	1.34
Max 3 days	157	21	-0.33	-2.62	2.08	-0.13	-1.72	3.2
Max 5 days	108	19	-0.18	-2.33	1.95	-0.43	-1.01	2.37
Max 10 days	127	18	-1.69	-11.21	1.51	-3.22	-10.11	2.96
Max 30 days	106	12	-1.64	-12.59	2.53	-1.6	-3.61	3.78
Filing	577	51	-1.27	-7.55	1.47	-1.98	-8.27	1.08
Resolution	266	29	0.21	-1.65	2.1	-0.01	-1.83	2.69
Verdict against	80	13	-0.25	-2.13	1.74	-0.44	-1.17	1.73
Verdict in favour	40	10	0.65	-1.19	2.34	0.7	0.28	4.29
Settlement	110	14	0.35	-0.72	2.71	-0.04	-2.6	3.54
Pooled lawsuit events	54	5	-0.07	-1.77	0.96	0.03	-0.05	1.58
Positive	279	35	0.21	-1.92	2.26	0.15	-1.66	3.06
Negative	583	58	-1.26	-7.11	1.16	-1.98	-8.13	0.73
Indefinite	20	4	-0.35	-2.89	1.37	-0.58	-0.55	3.63
Estimation window A	189	12	-0.51	-2.84	1.46	-0.8	-2.26	1.83
Estimation window B	142	8	-0.32	-1.82	1.66	-0.01	-1.05	2.84
Estimation window C	288	20	-0.56	-5.95	1.84	-0.72	-2.34	1.92
Estimation window D	143	14	-1.64	-9.96	1.37	-2.05	-5.81	2.05
Estimation window NA	120	11	-1.2	-4.41	2.62	-2.82	-6.04	2.39
Market model	620	52	-0.89	-5.97	1.79	-1.37	-6.31	2.13
Market adjusted returns	76	7	-1.27	-4.23	0.46	-1.83	-3.41	1.54
Factor model	88	7	-0.22	-1.85	1.01	-0.9	-1.59	1.16
Other model	98	8	-0.13	-1.75	1.74	-0.6	-1.47	1.68
Equally weighted market index	176	12	-1.14	-8.54	1.76	-1.7	-4.63	1.59
Value weighted market index	249	20	-1.2	-7.31	1.77	-1.82	-7.89	2.71
Not specified market index	457	35	-0.4	-2.67	1.65	-0.89	-3.52	1.56
US	582	47	-0.9	-7.03	1.67	-1.66	-7.37	1.76
Asia	124	7	-0.88	-3.2	2	-0.55	-1.72	3.48
Other country	49	3	-1.23	-5.15	1.26	-1.25	-0.67	1.01
Pooled countries	127	8	0.07	-1.17	1.76	0.14	-0.5	2.27
Court database	494	34	-1.12	-8.45	1.59	-1.93	-8.15	1.5
Media	310	25	-0.18	-2.64	2.24	-0.63	-3.13	2.54
Other source	78	5	-0.95	-3.92	0.61	-0.48	-0.8	2.15
Defendant	726	63	-0.94	-5.38	1.51	-1.56	-6.7	1.29
Plaintiff	138	16	0.03	-3.73	2.58	0.25	-0.99	4.4
Both parties	18	6	-0.04	-1.84	0.91	0.03	0.06	0.81
Antitrust	58	6	0.06	-1.36	1.69	0.07	-0.77	2.07
Employment	106	6	-0.29	-1.75	0.94	-0.84	-1.54	0.83
Environmental	134	8	-0.52	-1.62	0.27	-0.52	-1.05	0.51
Patent	173	18	-0.09	-2.63	3.09	-0.04	-1.88	3.29
Securities	176	27	-2.39	-12.88	1.77	-3.06	-9.62	1.3
Other litigation types	50	5	-1.12	-3.99	1.19	-1	0.03	0.79
Pooled litigation types	185	14	-0.5	-3.55	1.44	-0.43	-1.7	1.64
Private	660	52	-0.93	-5.9	1.73	-1.59	-7.25	1.75
Public	137	11	-0.08	-2.26	1.8	-0.04	-0.93	2.46
Pooled legal category	85	9	-0.69	-2.6	0.1	-0.54	-1.06	0.25
Civil	179	13	-1.17	-4.62	1.8	-1.63	-6.11	1.96
Common	591	47	-0.82	-5.31	1.66	-1.41	-5.61	1.93
Pooled legal origin	112	7	0.12	-1.07	1.74	0.15	-0.33	1.78
Single author	124	8	-1.04	-9.17	1.78	-0.6	-1.8	3.4
Pair of authors	314	23	-1.15	-8.12	1.66	-2.01	-7.71	2.13
Group of authors	444	33	-0.43	-2.95	1.64	-0.99	-4.31	1.82
Business journal	157	9	-0.84	-5.81	2.18	-1.5	-4.49	3.72
Financial journal	150	17	-0.56	-4.51	1.7	-2.04	-6.54	1.41
Economic journal	155	10	-0.15	-2.36	1.91	-0.16	-1.06	3.02
Law & economics journal	139	9	-0.93	-3.16	0.37	-0.65	-1.82	2.71
Law journal	122	6	-1.39	-9.93	1.1	-1.42	-2.82	3.67
Other journal	77	7	-0.11	-4.16	3.23	-0.83	-3.78	3.81
Working paper	82	6	-1.67	-11.43	0.57	-2.28	-3.44	0.94

Note: The table shows effect sizes for all subsamples, measured in percentages.

Appendix C

Pre-BMA Correlation Matrix

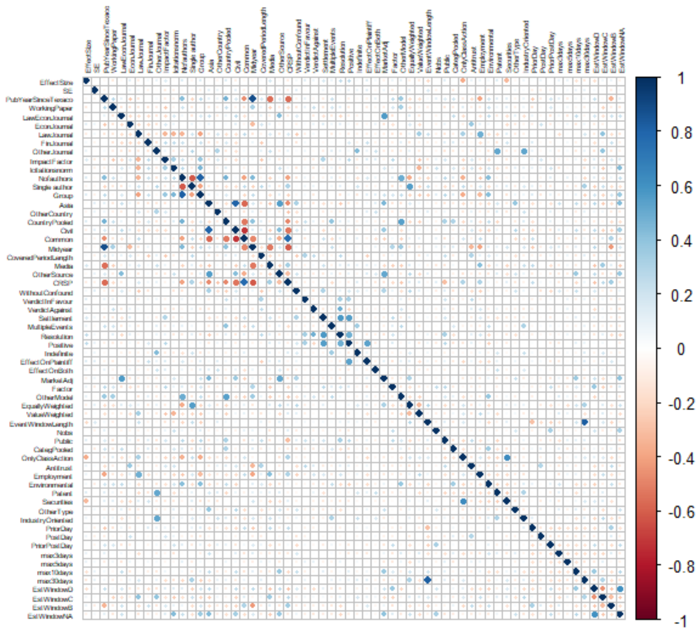


Figure C.1: Correlation matrix

Note: The figure shows correlations between variables applied in the MRA analysis.

Appendix D

Publication Bias for Journals

	Economic journal	Business journal	Financial journal	L&E journal	Law journal	Other journal	Working paper
β_0: OLS effect beyond bias	-0.633	-0.554	-0.221	-0.871**	-1.257	-0.794	-1.766
	(0.593)	(0.36)	(0.167)	(0.259)	(0.984)	(0.546)	(1.172)
β_1: OLS bias	-0.21	-0.005	0.049	-0.047*	-0.095	0.655	0.081
	(0.259)	(0.058)	(0.029)	(0.018)	(0.063)	(0.365)	(0.051)
β_0: FE effect beyond bias	-0.905	-0.559	-0.184	-0.937***	-1.284	-0.999***	-1.717.
	(0.579)	(0.372)	(0.154)	(0.253)	(0.903)	(0.235)	(1.017)
β_1: FE-bias	0.07	0.001	0.025	0.01	-0.076**	0.85.	0.038
	(0.087)	(0.02)	(0.021)	(0.01)	(0.026)	(0.482)	(0.029)
β_0: BE effect beyond bias	-1.506	-1.895**	-0.221	-0.688**	-1.423*	-1.022	-2.318
	(0.98)	(0.683)	(0.167)	(0.259)	(0.664)	(0.615)	(1.424)
β_1: BE bias	0.052	-0.004	0.049.	0.003	-0.078**	0.777.	0.04
	(0.09)	(0.02)	(0.029)	(0.01)	(0.027)	(0.434)	(0.029)
β_0: Study effect beyond bias	-1.251	-1.937**	-0.215.	-0.634**	-1.246	-1.734	-2.404
	(1.09)	(0.661)	(0.115)	(0.179)	(0.637)	(1.03)	(1.502)
β_1: Study bias	-0.236	-0.125	0.046	-0.019	-0.111	0.915	0.109
	(0.432)	(0.187)	(0.03)	(0.065)	(0.098)	(0.882)	(0.069)
β_0: Precision effect beyond bias	0.149	-0.332***	-0.175.	-0.378**	-0.07	-0.074	-0.154
	(0.182)	(0.033)	(0.083)	(0.101)	(0.11)	(0.077)	(0.153)
β_1: Precision bias	-1.019.	-0.254	0.019	-0.468*	-0.91	-0.034	-1.343
	(0.546)	(0.451)	(0.086)	(0.154)	(0.635)	(0.186)	(1.007)
Nobs.	157	150	155	139	122	77	82
Studies	9	17	10	9	6	7	6

Note: The table shows estimation results for linear methods of detecting publication bias. Standard errors are clustered at the study level.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

	Economic journal	Business journal	Financial journal	L&E journal	Law journal	Other journal	Working paper
β_0: Top 10	-0.149	-0.413***	-0.114**	-0.236***	0.007*	-0.074	-0.059
	(0.239)	(0.098)	(0.039)	(0.061)	(0.003)	(0.187)	(0.075)
β_0: Selection	1.913***	-19.215***	-0.54**	-1.256***	-1.782***	-0.424***	-2.622***
	(0.046)	(0.235)	(0.191)	(0.052)	(0.122)	(0.091)	(0.068)
β_0: Stem	-0.052	-0.2	-0.07	-0.263	-0.02	-0.199	-0.028
	(0.287)	(0.153)	(0.124)	(0.209)	(0.033)	(0.181)	(0.341)
β_0: Kink	0.013	-0.308***	-0.168***	-0.058*	0.02*	0.003	0.006
	(0.065)	(0.027)	(0.024)	(0.028)	(0.01)	(0.011)	(0.009)
Nobs.	157	150	155	139	122	77	82
Studies	9	17	10	9	6	7	6

Note: The table shows estimation results for non-linear methods of detecting publication bias.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

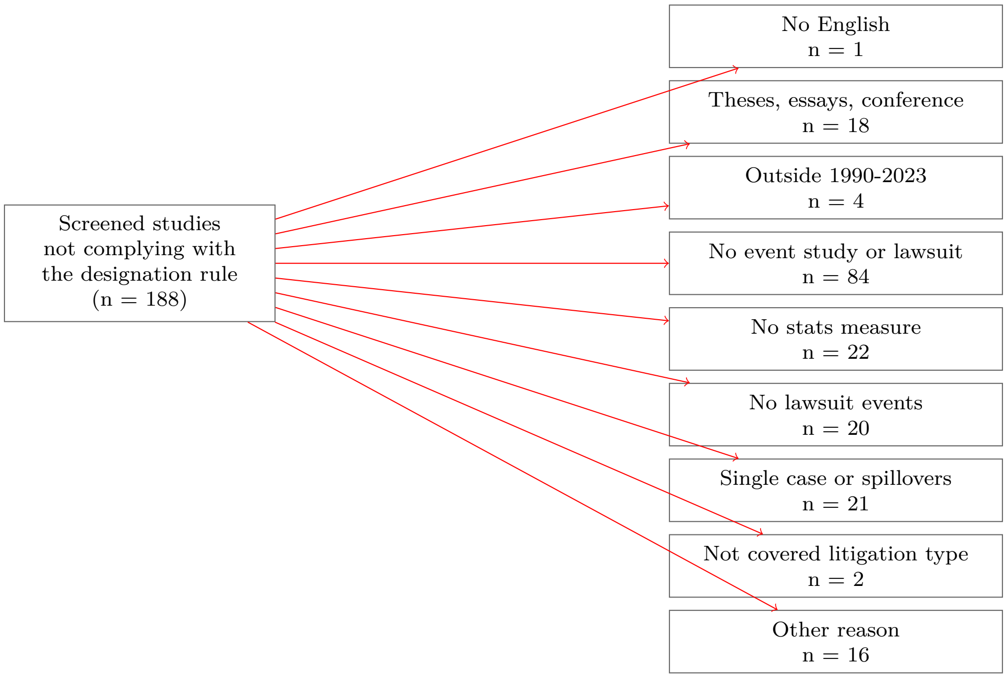
Appendix E

Issues and Limitations of Meta-dataset

The process of identifying primary studies and collecting variables was far from being trouble-free. While that is surely the case for all meta-analysis, a number of the encountered issues needs to be discussed in more detail, as they are likely to have detrimental consequences on the findings of the meta-analysis. Thorough this appendix, I will mostly refer to the elimination process which is illustrated in Figure E.1.

The main problem with the examined literature is the great number of studies that did not accompany their cumulative average abnormal returns with any statistical measure that could be used to derive their standard errors (22 to be precise, including some prime studies, such as Haslem *et al.* (2017)).

Most importantly, it can be hardly argued against that more relevant variables capturing the lawsuit heterogeneity would have to be collected to precisely gauge the impact on the firm's market value. A suitable candidates are: pre-filing leaks (which would reduce unexpectedness, seeGande & Lewis (2009)), propensity-to-bankruptcy (contributing to a level unbearable financial distress, see Bhagat *et al.* (1994)), outcome (as a proxy for the relevancy of the suit), length of the trial Haslem (2005), size of the companies Haslem *et al.* (2017), characteristics of the court (likelihood of verdicts in favour or against, see Hutton *et al.* (2015)) and other (e.g. the style of communicating the news by the litigated company, see Yang & Chen (2009)). Unfortunately, almost none of these potentially influential moderator variables are not commonly considered in the lawsuit effect literature, and as such are not reported in higher numbers than in units of studies.



Note: The figure shows the elimination of candidates for a primary study status due to not adhering to a specific criterion of the designation rule.

Figure E.1: Designation rule outflows

This is not surprising, as obtaining this data ranges from impossible to incredibly difficult, due to the small level of transparency that is omnipresent, and understandable, in the litigating world. For example, measuring lawsuit outcomes can be difficult since most lawsuits terminate in a way that make it impossible to determine the winner of the case (Liu *et al.* 2020).

Several studies had to be removed as candidates for the primary study status due to their too unique application of event study methodology, that would not be comparable with other studies composing the sample (using absolute abnormal returns, or excluding from the sample every firm without a statistically signficant CAR)

Finally, a number of articles which title would qualify them for a potential primary study status were inaccessible.