

Does ease of product litigation affect innovation? evidence from the agrochemical industry

Matt Wilder[†] Andrew McDougall[‡]

May 31, 2021

draft 1.0 — comments welcome; **please do not cite without permission**

Abstract

Countries vary in terms of consumers' ability to bring product litigation suits against firms. Although indices for rule of law have been devised by innovation scholars for purposes of cross-country comparison, the literature on the comparative political economy of innovation has been almost entirely silent on the product litigation dimension of law. This paper presents a theory whereby ease of product litigation serves two functions, one pro-social and one anti-social. Pro-socially, threat of product litigation checks firms' incentive to externalize risk of injury on to consumers. Anti-socially, frivolous litigation deters innovation by negatively affecting the stock price of risk-bearing firms. The empirical section estimates the economic shock caused by product litigation by comparing stock price responses to litigation surrounding glyphosate herbicides. The findings indicate that product litigation has negative industry-wide impacts on stock value. Implications for regulation, national innovation systems and the literature on varieties of capitalism are discussed.

Keywords: national innovation systems; product litigation; regulation; rent-seeking; stock value; varieties of capitalism

JEL classification: K13, K41, L51, O31, Q13, C22

[†] Postdoctoral Fellow, Harvard University Department of Government. Email: matt@mattwilder.net.

[‡] Assistant Professor, University of Toronto, Scarborough Department of Political Science.
Email: andrew.mcdougall@utoronto.ca.

1 Introduction

American institutions are considered by many to be among the most business-friendly in the world. But are US institutions most conducive to innovation and economic growth? This paper investigates an aspect of national innovation systems that has received relatively little attention in the public policy literature: ease of product litigation. The topic is important, as having too many barriers to product litigation increases society's vulnerability to harmful product externalities, while having too few barriers invites frivolous claims that may deter investment in innovative ventures.

Although advocates of the precautionary principle are reasonable to urge restraint regarding the release of novel technologies, harms associated with innovation drag should not be discounted (Orset 2014). For decades, the OECD has advised governments to adopt policies that stimulate innovation on the basis that a high rate of innovation complements gains from trade and economic competition by advancing the global technology frontier (OECD 1999). Yet, the success of supply side intervention depends on the degree to which stimulus capital is invested in productive assets (Krugman 1993: 162; Rodrik 2007: 101). Moreover, returns to society are a function of the rate at which product innovations are commercialized (Breznitz 2007; Porter 1990). The disappointing track record of supply side intervention —characterized as it is by sluggish growth, inequitable distribution and slower than expected innovation uptake— suggests that greater incentives toward innovative investment are required (Atkinson 2006; Mokyr 1998; Piketty 2014).

Incidentally, many innovations currently under development are vulnerable to disincentive effects associated with product litigation. Affected industries include pharmaceuticals, agricultural biotechnology, green energy (e.g., wind turbines) and wireless technologies (e.g., 5G), to name but a few. The case examined herein falls under the umbrella of agricultural biotechnology, as it involves a herbicide compound, glyphosate, which is used intensively in the cultivation of crops genetically-modified to withstand its application in the field. While the environmental and yield benefits associated with herbicide-tolerant crops are well documented, glyphosate has recently become the target of class action lawsuits on the basis of belief that the compound causes non-Hodgkin's lymphoma (Richmond 2018; Smyth et al. 2011).

We begin by reviewing the comparative literature on institutions and innovation in order to articulate a theory of innovation that distinguishes between pro-social and anti-social rents. After establishing that market-based institutions are widely considered to facilitate innovation, and that existing cross-national measures for rule of law neglect the ease with which product litigation can be brought against firms, we specify a simple model that considers innovation to be a function of investor preferences for risk-taking given institutions governing product market regulation and ease of product litigation. Next, we demonstrate empirically the extent of cross-national institutional variation and the extent to which countries cluster into regime types by devising indices representative

of product market regulation and ease of product litigation. Finally, we investigate causes and consequences of product litigation surrounding glyphosate herbicides.

While class actions concerning glyphosate have been initiated in the United States, Canada and Australia, at the time of writing, cases have only progressed to a decision in the United States —the country with the fewest barriers to product litigation. Regarding stock market responses to product litigation, regression discontinuity analysis finds that product litigation can lower stock value up to 75 percent for firms that sell products targeted by litigation. For firms in the same industry that do not sell products targeted by litigation, the negative effect on stock value may be as high as 59 percent. The results indicate that institutions governing product litigation can strongly affect investment in industries vulnerable to product litigation.

Although further research is needed to confirm the robustness of our results, some tentative implications may be deduced. While it is widely acknowledged that “markets need states” to function properly, the concept of market-based institutions is underdeveloped in the literature on institutions and innovation, much of which seems to imply that all regulation is anti-market. Yet anti-social, opportunistic rent-seeking and rent-taking may thrive in unfettered markets. Such behavioural pathologies include, but are not limited to, frivolous product litigation. This point draws attention to theoretical ambiguities in the literature on comparative capitalism regarding how liberal institutions are conceptualized and defined. A richer appreciation of the many ways rules and regulations impact the economy may permit a more precise conceptualization of genuinely liberal institutions, which could inform policymaking and institutional design to society’s benefit.

2 Innovation and institutions

Following North (1990), we conceive of institutions as rules that constrain and enable behaviour. Institutions facilitate or stymie innovation to the extent that they permit entrepreneurial actors to satisfy demand for goods and services (Kirzner 1973). Entrepreneurs are assumed to be primarily motivated by the prospect of capturing rents from innovation (i.e., profit), which is considered pro-social behaviour because innovation lowers the aggregate cost of goods and services for society (Schumpeter 1911; Walras 1954). However, institutions that facilitate pro-social entrepreneurial rent-seeking may also encourage anti-social opportunistic rent-seeking, which occurs when rents far-exceed any value created for society (Tullock 2005). Moreover, institutions intended to check tendencies against anti-social opportunistic rent-seeking may actually create avenues through which rent-seeking agents may exploit society, as occurs when government becomes captured by special interests (Quirk 2006; Stigler 1971).

The possibility that innovative pursuits will fail also makes it difficult to predict ex ante whether a venture will be pro-social. It is also sometimes difficult to evaluate ex post

whether an innovation is pro- or anti-social. As our case study illustrates, ideas, narratives, discourse and rhetoric matter because they establish causal stories that assist in making such evaluations (Schmidt 2010; Stone 1988).

Some have argued that society ought to take the bad with the good by designing institutions so as to maximize the number of attempts at innovation (Alchian 1950; Hayek 1960). Others have argued, conversely, that institutions which permit “the socialization of risk” not only unduly expose society to negative externalities associated with attempts at innovation but also invite anti-social opportunistic behaviour by absolving entrepreneurs from liability for their actions (Mazzucato 2013). Liberal theory considers the latter to take precedent over the former; negative freedoms from harmful externalities trump positive freedoms that entail the imposition of costs onto others (Rawls 1971; Sen 1970). Yet, this facet of liberal theory is scarcely respected in real-world economies —a point to which we return in the discussion section.

Institutional failure occurs when institutions permit anti-social opportunistic behaviour, or when institutions do not promote enough pro-social entrepreneurial behaviour. Correcting institutional deficiencies is challenging, as there is an ever-present tension between market failure and governance failure, both of which are deleterious to society. Regarding market failure, unregulated markets may permit undue externalization of costs onto society. Moreover, productive opportunities may be missed if transactions are limited to spot contracts in the competitive market (Coase 1937; Scharpf 1994; Williamson 1971). Regarding governance failure, removing transactions from the market reduces incentive effects, introduces moral hazard and invites opportunism (Krueger 1974; Le Grand 1991; Miller 1992). Given this tension, it is customary to classify institutions according to their position on a continuum that ranges from “market-based” to “non-market” (Hall & Soskice 2001; Williamson 1973).

Much of the literature on the economics of innovation considers market-based institutions to be better equipped at fostering innovation than non-market institutions (Acemoglu et al. 2017; North 1990; Porter 1990). Yet, some have argued that institutions which constrain “rational voluntarism” fare better than purely market-based institutions because they resolve market failures without creating conditions necessary for complete governance failure (Streeck 1997; cf. Blyth 2002; Polanyi 1944). In any case, hypothesis testing requires comparable measures of the degree to which institutions are market-based or non-market.

Several attempts have been made to devise comparable measures of institutional similarities and differences across countries (Amable 2003; Cawson 1985; Crouch 2005; Esping-Andersen 1990; Schneider & Paunescu 2012). Recent literature has identified more than sixty “varieties of institutional systems” consistent with earlier theory that grouped countries into liberal, coordinated and mixed configurations (Witt et al., 2018: 22; cf. Fainshmidt et al. 2018). Standard practice involves using dimensionality reduction techniques, such as factor analysis or principal components analysis, to generate indices representative of institutional continua that range from fully market-based to fully non-

market (Hall & Gingerich 2009). Fuzzy set or clustering methods are then used to classify countries according to their “institutional configuration” as determined by the intersection of values across indices (Kogut & Ragin 2006; Schneider et al. 2010; Witt et al. 2018).

Recent literature in the comparative political economy of innovation posits eight institutional indices classified according to the following descriptors: corporate governance, inter-firm relations, finance, employment relations, firm hierarchy, occupational training, rule of law, and government regulation (Witt et al 2018). As shown in Table 1, these indices are generated from a variety of data sources. Operationally, low values denote market-based institutions while high values denote non-market institutions.

Indicator	Description and Measurement	Data Sources
corporate governance	concentration of corporate ownership, shareholder protection, stock market size, dispersion of control	Botero et al. (2004), La Porta et al. (1999), World Bank (2020)
inter-firm relations	merger and acquisitions transactions by domestic acquiring firms	La Porta et al. (1999), Thomson One (2021)
finance	primary source of funding (e.g., banks, capital markets), extent of stipulations for allocation	ITUC (2020) UNCTAD (2020)
employment relations	degree of wage coordination (i.e., peak bargaining), proportion of workforce with short-term employment, union rights	Visser (2019), OECD (2020)
firm hierarchy	degree of employee representation on corporate boards, works council rights	Jackson (2005), Visser (2019)
occupational training	proportion of workers with occupational training versus university training	OECD (2020)
rule of law	protection of property rights, enforcement of property rights and contracts	Kaufmann et al. (2010)
government regulation	top-down vs participatory decisionmaking, government effectiveness, regulatory quality	Kaufmann et al. (2010)

Table 1: Existing institutional indices

Source: adapted from Witt and Jackson (2016: 791-792), Witt et al (2018: 14). See also the World Institutional Systems Repository (Witt 2021): <https://faculty.insead.edu/michael-witt/world-institutional-systems-repository>

Regarding institutional configurations, American-style capitalism is identified as the intersection of low values across all indicators, which is to say that American institutions are considered the most market-based of any (Witt & Jackson 2016: 793). Inversely, varieties of European corporatism are identified as intersections among moderate and high values on the institutional indices, denoting non-market coordination. Other configurations fall somewhere in the middle. For instance, Japanese-style corporatism is identified as the intersection of high values on inter-firm and employee relations indices, and low values on occupational training, firm hierarchy and corporate governance indices (cf. Aoki et al. 2007).

While current institutional measures capture some constraints on rent-seeking and rent-taking, they deal almost exclusively with product regulation—that is, ex ante pre-commercial deterrents to rent-taking. For their part, indices for rule of law do not account for ease of product litigation. Rather, they measure “perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence” (Kaufmann et al. 2010). To account for cross-national variation regarding ease of product litigation it is necessary to take several other aspects of the legal system into consideration, particularly characteristics under the ambit of tort law.

2.1 Institutional determinants of product litigation

Institutions surrounding product litigation affect innovation by influencing the expectations and cost-benefit calculations of investors, entrepreneurs and litigants. We focus on tort law governing the ease with which group action may be pursued, as threat of group action creates substantial risk for firms that trade in consumer products. While such risks also arise out of individual or joined claims, group action makes possible litigation in cases where damage is so widespread that it is impractical to bring a series of individual claims. The ease of bringing a claim varies along several dimensions, the most important of which include ease of class action certification, cost rules, contingency fees, damage awards, limitation periods, and whether verdicts are rendered by judges or juries.

Class action type redress has historically been associated with liberal economies, particularly the United States, where the number of tort actions has increasingly been recognized as a problem in the legal literature. Consequently, so called “tort tax” has created calls for reform. Yet many other countries, particularly in Europe, have recently moved in the direction of expanding access to this type of action. The rationale for expanding access to collective legal action is that combined actions are an effective way to hold large firms accountable for wrongdoing, especially when individual compensation for damages may be small but the overall amount of damage is substantial. While many countries do not have class action legislation in a strict sense, equivalent group actions

accomplish the same objectives. Examples of countries that have recently undergone reforms in favour of greater use of group action include Italy, New Zealand and Norway.

The ability to advance group litigation is determined largely by rules surrounding class certification. For jurisdictions where class actions are a significant component of product litigation, the ease with which classes are certified can be a barrier to litigation. Most legislation establishing class actions focuses on considerations like how easy it is to define class members, how to define a “representative plaintiff” and how similar the issues must be for members to be considered in the plaintiff’s class. In some jurisdictions, litigants must opt-in to class actions. Procedurally, before a court will certify the class, the plaintiff’s representatives must advertise opportunities for affected parties to sign on to the proposed class action by a certain date. In other jurisdictions, the rule is opt-out; a prospective class is included unless representatives send notice indicating they wish to be excluded from the action.

Regarding cost of litigation, some jurisdictions have expensive and expansive discovery rules for non-parties and individual class members. This can greatly add to the complexity of proceedings and vastly increase the costs of litigation. Other jurisdictions are far more limited in the discovery burden. Cost calculations are also affected by the “loser pays” rule, according to which the losing party is responsible for paying a portion of the winner’s costs. In some jurisdictions, these rules are supplemented with penalties that exacerbate damages owed if reasonable settlements are rejected prior to a judicial decision.

Contingency fees feature prominently in many legal cultures. Advocates point out that contingency fees promote access to legal services that would otherwise be beyond the means of many litigants. Contingency fees also create conditions under which some class actions may be possible. If a product harms many consumers to a relatively small extent, it may not be worth it for any one individual to pursue a case, thereby absolving firms from legal culpability. However, if a defendant has harmed many parties, it may be economical for a law firm to take on the litigation by consolidating many claims into one class action. Critics allege, however, that such rules create incentive for law firms to seek out litigants in order to file lawsuits that would not otherwise exist, effectively profiting from inappropriate use of the justice system.

Damage awards vary significantly across jurisdictions. Basic damage calculations are based on the concept of *restitutio in integrum* —make the plaintiff “whole” again if not for the damage suffered. Yet some systems also permit additional damages based on assessments of culpability or mechanisms of redress outlined in statutes. Aggravated damages may be awarded if the defendant did something that made the situation worse than it otherwise would have been, which is usually based on analysis of the defendants’ motives. Aggravated damages are compensatory awards for conduct determined to have led to significant hardship or humiliation by the plaintiff. Much rarer are punitive or “exemplary” damages, which are not compensatory in nature but are rather designed to punish the tortfeasor for their conduct.

Limitation periods impact whether civil litigation can proceed. Generally, rules cap liability between two and ten years. However, these rules are often attenuated by discoverability considerations that proffer extended time limits if a plaintiff discovers the cause of action after the fact. Rules surrounding limitations can have an important impact on the possibility of claims. Rules for class actions may differ, however.

Finally, whether decisions are arrived by judges or juries matters both for decisions rendered and the extent of compensation. Jury trials are almost unheard of outside the United States, the reasoning being that class action litigation is too complicated for ordinary people to adjudicate, and is best resolved by sophisticated jurists who are familiar with the complex statutes and procedures of commercial litigation. Although jury trials in the United States have a democratic basis that traces back to the constitution, jury trials are alleged to play on emotions rather than the law in order to increase the likelihood of a favorable judgement.

The following sections incorporate the considerations summarized above into a behavioural model and quantitative index that can be used for cross-national comparisons. It is important to keep in mind, however, that tort laws are not the only institutions that bear on investment decisions. Rather, avoiding potentially spurious results necessitates, at the very least, consideration of regulations on product externalities. Such an approach is necessary because investment decisions are plausibly affected by the likelihood that a product will clear regulatory hurdles. Accordingly, in addition to our ease of product litigation index, we also consider an index representative of product market regulation courtesy of the OECD (Koske et al. 2015).

2.2 A behavioural model

What determines actors' incentives to undertake innovative activity? Who are the relevant actors? In market economies, actors responsible for innovation may be classified as either entrepreneurs or financiers, the latter of whom are otherwise known as capitalists and investors (Schumpeter 1939: 102). These may be individuals or collective actors, examples of which include sole proprietors, securities holders (e.g., shareholders), firms, cooperatives, investment funds, banks and governments.

For our purposes, modelling supply of innovation requires only consideration of investors' incentives, as the entrepreneurial function of supplying the actual substance of innovation may be considered an exogenous variable, albeit one affected by other institutional determinants of innovation cataloged in Table 1 (see also Aghion & Howitt 1998). That is, we are interested in whether entrepreneurs are able to access resources required to innovate, which we assume come in the form of transfers from investors.

Investor behaviour may be considered a function of the level of certainty regarding whether an investment will pay dividends. Formally, investment is assumed to be forthcoming only when dividends exceed opportunity costs (i.e., expected benefits from the next best alternative pursuit). The level of certainty is itself a function of the profit

potential of the prospective venture, which is in turn a function of three variables: an exogenous variable that represents the market potential of forthcoming innovations; an institutional variable that represents anticipated regulatory drag on innovation (e.g., the probability that commercialization will be held up or made more costly by regulation); and an institutional variable that represents the probability that litigation will undermine the value of the investment.

Expressed as an expected utility function,

$$EU_i = u_i(c)p_i(c) + u_i^*(r)p_i(r) + u_i^*(l)p_i(l) - d_i$$

where u and u^* represent positive and negative utilities, respectively, c represents the product, r represents regulation, l represents litigation and d represents a discount term. That is, the expected utility EU of investor i is a function of the utility u that i would obtain from the commercialization of product c multiplied by the probability p assigned by i to the successful commercialization of product c , plus the loss of utility sustained by i as a consequence of regulatory hold up r multiplied by the probability assigned by i to the likelihood of regulatory hold up, plus the loss of utility sustained by i as a consequence of product litigation l multiplied by the probability assigned by i to the likelihood of litigation, minus i 's time discounting term d (i.e., the discount rate on investments given the time duration till returns are realized).

Substantively, entrepreneurs can only innovate if resources necessary to bring their ideas to fruition are made available, and investors will only offer financing if they expect positive returns—an expectation which is negatively affected by regulation and risk of litigation. Ergo, *ceteris paribus*, regulation and ease of product regulation reduce the amount of innovation in society. For their part, existing indices on the institutional determinants of innovation mostly affect $p(c)$ —the probability that novel goods will be successfully commercialized—although institutions surrounding finance may also affect the investor patience as represented by the discount term d (cf. Zysman 1983).

Given that formal models extrapolate simple abstractions from complex reality, a few caveats are in order. First, note that “positive returns” in this context refers to positive utilities, not the dollar return on investment. Because utility can come from the satisfaction of non-material desires, the model does not forbid consideration of non-materialist or other-regarding actor orientations (Coleman 1990: 274; Ostrom 2005: 146; Scharpf 1997: 64). Taking such a route entails modelling different estimates of $u(c)$, $u^*(r)$ and $u^*(l)$ based on the utility actors espousing particular values would derive from c , r and l . By contrast, a more parsimonious interpretation would avoid this ambiguity by dispensing with the prospect of non-material and other-regarding considerations, although at some cost to realism (Elster 1991; Hirschman 1984).

Second, organizational investors such as governments, firms and investment funds may be more tolerant of losses than individual investors since the former spread risk across their members (e.g., shareholders, employees, citizens). Government, in

particular, is prone to investing in ventures with low probability of positive returns, regardless of whether the venture can be classified as a public good (Buchanan & Tullock 1962; Wilson 1980). Consequently, organizational investors may opt to invest even if EU is negative. In such instances, it is appropriate to consider the individual utilities of decisionmakers and to model the social choice processes that lead to collective decisions (Arrow 1951; Black 1958).

Third, shareholders may engage in securities litigation against firms in which they own stock on the basis of reckless or incompetent management, the prospect of which may affect $u^*(r)$ and $u^*(l)$ (Kempf & Spalt 2020). For instance, an investor may anticipate a high likelihood of regulatory drag or product litigation, but may assign small values to $u^*(r)$ and $u^*(l)$ if the investor is confident that attendant costs could be recouped via successful securities litigation. In other words, ex ante risk may be offset by the availability of ex post opportunities to recoup potential losses.

Fourth, our model is decidedly “supply-side” in orientation; supply of investment is a function of the supply of innovative ideas and the supply of institutions. Yet, it is well known that regulation can stimulate demand for innovation by forbidding or taxing externalities, effectively checking anti-social rent-taking. It is also plausible that regulation and potential for litigation affect the demand side by instilling consumer confidence in products, thereby increasing sales and stock value. Regulatory effects of the former sort do not affect the investor’s utility function, as r refers to regulation of the product in question and its complements, not its substitutes. Considerations of the latter sort may be accommodated by lowering estimates of u^* or changing their signs as appropriate. For its part, increased sales potential affects $u(c)$, including that which stems from the regulation of the product’s substitutes.

Because regulation and laws governing product litigation are determined by governments, estimating $p(r)$ and $p(l)$ may be facilitated by national-level indices that capture ex ante regulatory burdens and ex post litigation risks. The following section develops a novel index for measuring ease of product litigation l and contrasts it against an existing index that purports to measure product market regulation r . Consideration of both indices permits assessment of the extent to which countries cluster into regime types.

2.3 Regime types

Whereas the previous section established why and how product market regulation and ease of product litigation may affect investors’ utilities, this section establishes empirical estimates for twenty-one countries regarding the extent of these institutional constraints. For product market regulation estimates, we use a pre-existing index courtesy of the OECD that measures overall regulatory drag across OECD economies for the 1998-2013 period (Koske et al. 2015). To measure ease of product regulation, we first assign country scores based on the aspects of tort law discussed earlier and summarized in Table 2. We

then derive an index by extracting principal components based on the weighting scheme conveyed in Table 2.

Dimension	High Barriers to Litigation	Low Barriers to Litigation	Weight
cost rules	no cost shifting based on outcome	costs dependent on outcome (i.e., loser pays)	1.0
certification rules	significant court scrutiny of certification test	little court scrutiny of certification test	0.8
representative plaintiff	strict rules surrounding choice of plaintiff and connection to class issues	loose rules surrounding choice of plaintiff and connection to class issues	0.1
opt-in, opt-out	default opt-in	default opt-out	0.2
class definition	strict threshold on what counts as a class	no threshold on what counts as a class	0.1
predominance requirements	predominance of common issues test	lack of predominance test	0.1
contingency fees/funding	strict rules, third party funding restricted	permissive rules, third party funding permitted	1.0
damages	high bar to punitive/exemplary fees	low bar to punitive/exemplary fees	1.0
trier of fact	judge only	judge / jury options	0.2
limitation periods	strict, short limitation periods	loose, generous limitation periods	0.2
discovery	strict discovery rules	lax discovery rules	0.2
settlement	significant court scrutiny of settlements	little court scrutiny of settlements	0.1

Table 2: Dimensions underlying ease of product litigation

Source: authors' assessments of the determinants of product litigation. Higher weights denote importance of dimension.

The dimensions identified in Table 2 are those that have been gathered by the authors as a method of assessing the barriers to class action litigation across countries in the eyes of a plaintiff. Most of the features will be familiar to those who have worked in the area. In general, class actions must receive court approval to proceed, and that approval that rests on passing a test to show that this type of action is preferable as opposed to a joined or single action. The elements in the test include how the class is defined, how common the issues must be, the conditions under which a representative plaintiff is selected. It also looks at how such actions can be funded, either through contingency, third party funding, or whether it must be paid solely by the involved parties. The latter makes litigation more challenging.

Some of the factors overlap. For example, there is an assessment of how strictly a court will assess a test for a class action, and how easy or hard it is to clear overall. This “overall” challenge overlaps with a separate consideration of many common elements of the test, such as thresholds for plaintiffs. The availability of funding sources also combine the possibility of third party funding along with contingency funding. These could theoretically be treated differently, which may be done in a subsequent draft. Weights denote the relative importance of the dimension.

Table 1-A in the appendix conveys country-level indicators across each dimension described in Table 2 as well as each country’s loadings across three principal components that cumulatively account for 95% of the variance observed in the data. Figure 2 shows the extent to which countries cluster into regime types based on two axes: the OECD product market regulation index, and an index that represents ease of product litigation generated by summing loadings of the three aforementioned principal components and normalizing to a scale that ranges from -1 to 1 .

Nominally liberal countries —such as the United States, Canada, Australia, New Zealand and the United Kingdom— cluster as expected in the lower left quadrant, which represents simultaneously low regulatory barriers and low barriers to product litigation. Nominally coordinated countries —such as Germany, Belgium, Sweden, Norway, Austria, Japan, South Korea, Finland and Switzerland— cluster in or near the upper right quadrant, which denotes simultaneously high regulatory barriers and high barriers to product litigation. Although it is arguable that cases cluster into market-based (lower left) and non-market (top right) clusters, considerable institutional variation is evident by the degree of dispersion. Previously documented liberalization in the Netherlands and Denmark is also evident in our indicators, as is the shift toward greater coordination in Ireland (Hardiman 2002; Schneider & Paunescu 2012).

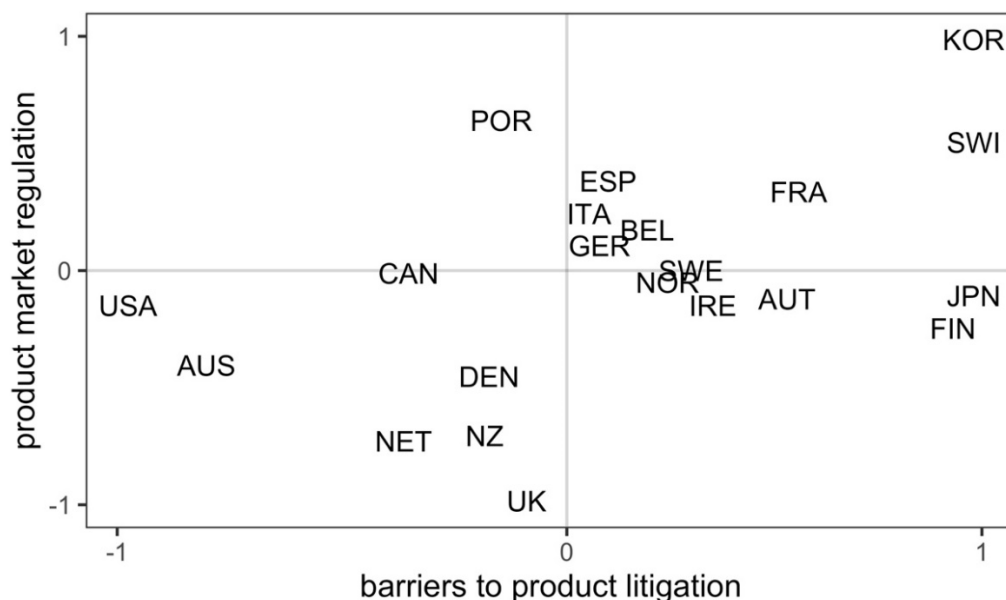


Figure 1: Countries arrayed by product market regulation and ease of product litigation

Source: product market regulation values based on OECD values for the 1998-2013 period (Koske et al. 2015). Barriers to litigation index calculated by summing country level loadings for three principal components that cumulatively account for 95% of the variance observed in the data (see Table 1-A in the appendix). AUS = Australia, AUT= Austria, BEL = Belgium, CAN = Canada, DEN = Denmark, ESP = Spain, FIN = Finland, FRA = France, GER = Germany, IRE = Ireland, ITA = Italy, JPN = Japan, KOR = South Korea, NZ = New Zealand, NET = Netherlands, NOR = Norway, POR = Portugal, SWE = Sweden, SWI = Switzerland, UK = United Kingdom, USA = United States. Historically, the legal traditions of Japan, Switzerland and Korea have not lent themselves to scoring on the criteria included in Table 2. Because product litigation is difficult in these jurisdictions, they are coded as having maximum barriers to product litigation.

Our theory predicts higher incidence of market failure within countries that fall in the lower left quadrant Figure 1, as these countries exhibit relatively few ex-ante regulatory checks on harmful product externalities. Inversely, we anticipate higher incidence of governance failure within countries that fall in the top right quadrant of Figure 1, as these countries may over-regulate the market, thereby discouraging entrepreneurship. Moreover, highly regulated economies exhibit few ex-post opportunities for judicial remedy for damages suffered as a consequence of harmful products that nevertheless clear regulatory hurdles. Put differently, countries with predominantly market-based institutions may lack sufficiently stringent regulatory safety mechanisms, while countries with predominantly non-market institutions may put too much stock in regulatory institutions or heed insufficient attention to opportunities for judicial remedy.

We return to the question of whether existing institutions are welfare-optimal in the discussion section. For now, it is prudent to mention that highly regulated jurisdictions have recently drawn fire for prompting “innovation crises” (Hemphill, 2020). The argument is that governance failures have prevented an adequate amount of

entrepreneurship. Moreover, many critics of stringent regulations, such as those put in place in the European Union under the auspices of precautionary principle, perceive regulation to be accomplishing little more than serving as a smokescreen for protectionism (Victor 2001).

The following case study sheds empirical light on the apparent trade-off between risk of market failure and risk governance failure in the context of regulation and product litigation involving glyphosate herbicides. Because both market failure and governance failure are harmful for innovation, there is good reason to correct institutional deficiencies. We return to such matters in the discussion section.

3 Product litigation involving glyphosate herbicides

Product litigation surrounding glyphosate herbicides serves as a useful, if somewhat sensational, example of how ease of litigation can affect investment. Although the previous section established that regulations on product registration and certification in the United States are comparatively lax, the preceding discussion also established that there are relatively few barriers to product litigation in the United States. Consequently, on one hand, it is not surprising that governments in the United States and other countries with similar regulatory institutions have been slower than their counterparts in Europe to deregister and decertify glyphosate on the basis that it is a potentially dangerous product. On the other hand, it is also not surprising that product litigation surrounding glyphosate herbicides has proceeded most auspiciously in the United States.

Glyphosate is a salt compound that acts as a broad-spectrum herbicide owing to the fact that it kills any plant to which it is applied that does not exhibit resistance to the chemical by genetic manipulation or natural mutation. The economic value of glyphosate increased substantially in the early 1990s with the advent of crops engineered to withstand the application of glyphosate in farmers' fields. Since then, more than 10% of the globe's arable land has been seeded with glyphosate-tolerant crops, trademarked *Roundup Ready* by Monsanto, which was acquired by Bayer AG in 2018.

Although glyphosate has been widely approved for agricultural and residential use since 1974, the herbicide has recently become subject to both regulatory action and product litigation on the basis of claims that it causes non-Hodgkin's lymphoma (cf. World Health Organization 2015). With respect to regulation, several governments in the upper right cluster in Figure 1 have either banned or have moved to ban the sale and use of glyphosate in their jurisdictions, namely Austria, Belgium, France, Norway, Denmark, the Netherlands and Sweden. By contrast, regulatory agencies in the many countries within the lower left cluster in Figure 1 have held fast to the position that glyphosate is safe, namely Australia, Canada, the United States and the United Kingdom (EPA 2020).

Notwithstanding governments' pro-glyphosate position, several lawsuits have been filed in the United States, Canada and Australia alleging that glyphosate caused non-Hodgkin's lymphoma. At the time of writing, suits have progressed to decision only in the United States, all of which found in the plaintiffs' favour. Notably, all three decisions were rendered by juries. The first trial, *Johnson v. Monsanto Co.*, 52 Cal.App.5th 434 was held in California state court between 9 July and 10 August 2018, which ended with the jury awarding the plaintiff \$289 million, of which \$250 million was awarded as punitive damages. The second trial, *Hardeman v. Monsanto Co.*, No. 19-16253 (9th Cir. 2020) was a federal trial held between 25 February and 27 March 2019, which resulted in the jury awarding \$80 million in damages (later reduced to \$25 million by the judge overseeing the trial). The third trial, *Pilliod et al. v. Monsanto Co.*, RG17862702. JCCP NO. 4953 was a California state court class action trial case involving more than 1,600 plaintiffs, which ran from to 13 May 2019, and resulted in damages exceeding \$2 billion.

In all cases, whether in the United States or elsewhere, plaintiffs allege that Monsanto, through its representatives or in concert with hired consultants, intentionally suppressed or otherwise obfuscated scientific research that found glyphosate to be a cause of cancer. In so doing, the plaintiffs allege that the defendants sought to mislead government regulators about the dangers posed by glyphosate. According to the plaintiff's narrative, Monsanto engaged in anti-social rent-taking by externalizing risk onto society without paying attendant costs. Inversely, according to the defendant's narrative, Monsanto's rent was legitimate and pro-social in the sense that society benefited from the commercialization of an innovative product which, they claim, has no adverse consequences.

The plaintiffs' narrative alleges governance failure in the sense that it centres on regulatory capture —i.e., that government regulators are beholden to regulatees for the information on which they base certification and registration decisions. Specifically, the plaintiffs claim regulatory institutions have been exploited by malevolent agents engaged in anti-social rent-seeking. By contrast, in light of trial verdicts in the United States, Monsanto's proponents claim the justice system has been exploited by rent-seeking litigants who spin facts and play on jurors' emotions in order to obtain favourable verdicts or extract settlements from innocent defendants.

Whether glyphosate lawsuits are warranted or amount to frivolous litigation remains an open question. For our purposes, we are interested in whether stock prices are negatively affected by product litigation. More specifically, we are interested in whether price responses are limited to firms targeted by litigation or whether there are discernible spillover effects onto other firms and industries. Spillover effects are important, as it is plausible that investors might opt to sell off shares in companies with legitimate product liabilities (i.e., genuinely dangerous products) and invest instead in firms that produce safe, innovative substitutes. If such is the case, then reduction in share value for culpable firms might actually signal positive effects on innovation.

Unfortunately, we find that product litigation surrounding glyphosate herbicides has had a negative spillover effect on the agrochemical industry, both for firms with and without glyphosate-related liabilities. This is not to say that there may not be some truth to the assertion that product litigation can promote innovation under certain circumstances. On the contrary, litigation may promote innovation in the same way regulation promotes innovation when it pre-empts the release of harmful externalities onto society by creating demand for innovations that do not externalize risk. Again, as an institution, product litigation may counterweight tendencies toward governance failure on the part of regulatory institutions. Inversely, product market regulation may counterweight failure on the part of judicial institutions.

3.1 Regression discontinuity analysis of stock market activity

This section employs regression discontinuity with interrupted time series to assess the impact of product litigation on stock prices. Although more sophisticated methods may yield more precise estimates, the advantage of regression discontinuity lies in its interpretability and intuitiveness. The approach is “quasi-experimental” in the sense that cases are divided into treatment and control groups, whereby treatment groups are hypothesized to be affected by an intervention (i.e., treatment) while control groups are hypothesized to be unaffected (Shadish & Campbell 2002).

We group cases into three categories: agrochemical firms with glyphosate-related liabilities; agrochemical firms without glyphosate-related liabilities; and a control group that consists of life science firms, pharmaceutical companies and manufacturers of specialty products (e.g., Covestro, Honeywell). We also model the effect on the S&P 500 index and the Dow Jones industrial average. Our rationale for such an approach is that it permits estimation of spillover effects of glyphosate litigation onto agrochemical firms writ large, as well as onto related industries. Because many agrochemical firms also produce pharmaceuticals and specialty products, consideration of the effect of litigation across a variety of firms is warranted.

Case selection is based primarily on the availability of data. One challenge involved in drawing inferences from stock data follows from the frequency of mergers and acquisitions in the industries analyzed. In particular, the removal of Syngenta from the Swiss stock exchange following its acquisition by ChemChina is lamentable, as Syngenta deals in glyphosate products. The unavailability of reliable stock price data from the Tokyo Stock Exchange presents another limitation that will hopefully be overcome in subsequent drafts.

We code the August 2018 *Johnson v. Monsanto* ruling as the intervention and regress monthly average stock prices on monthly time series for pre-intervention and post-intervention periods. The pre-intervention period runs from December 2015 to August 2018, while the post-intervention period runs from September 2018 to May 2021.

We opt for monthly averages over daily stock values as it helps to resolve overestimation due to serially-correlated errors. The estimated effect also errs on the conservative side owing to the fact that the Johnson ruling was handed down on 10 August 2018 yet stock prices for the remainder of August contribute to the pre-treatment estimate.

We begin by fitting a generalized least squares model with firm-level fixed effects. Because stock prices exhibit volatility, we include a quadratic term on pre- and post-intervention trends, which fits the data better than a linear fixed effects model (see Figure 1-A in the appendix).¹ Because curvilinear models cannot produce reliable counterfactual estimates into the future, our initial model takes as its counterfactual value the estimated average stock price at the time of intervention (i.e., August 2018), which may differ from the observed value because the model is fit by least squares estimation over the entire pre-intervention period. We also correct for a one period moving average to avoid overestimation.

Figure 2 displays the results of our initial model as the relative change in stock value between the pre- and post-intervention periods. Short-run response refers to relative change in stock value between August and September 2018. Long-run response refers to relative change in stock value between August 2018 and May 2021. Standard errors capture variance in the pre- and post-intervention time series. The top panels convey stock price responses at the firm level and for the two control indices, whereby error bars represent 95 percent confidence intervals. Box plots in the lower panels convey the median response and variance (in terms of interquartile range) for the three categories of cases.

As shown in Figure 2, firms with glyphosate-related liability have, on average, sustained reductions in stock value. Substantively, the short and long-run responses for Bayer stock were $-\$27$ and $-\$53$ per share, respectively. Yet, not every firm with glyphosate-related liability lost stock value, although there is some indication that stock depreciation has been a function of the extent of liability. For its part, the reduction in stock price for BASF may have something to do with product litigation surrounding another herbicide—dicamba—which has also affected Bayer. Agrochemical firms without glyphosate-related liability have neither gained nor lost stock value, on average. However, unlike firms in the control group, and with the exception of FMC, agrochemical companies without glyphosate-related liability have lost share value compared to the S&P 500 index and Dow Jones industrial average over the long run.

¹ An alternative approach is to “net out” seasonal effects. Another alternative is to model change in returns, rather than stock price changes. Subsequent drafts will experiment with alternative model specifications as robustness checks.

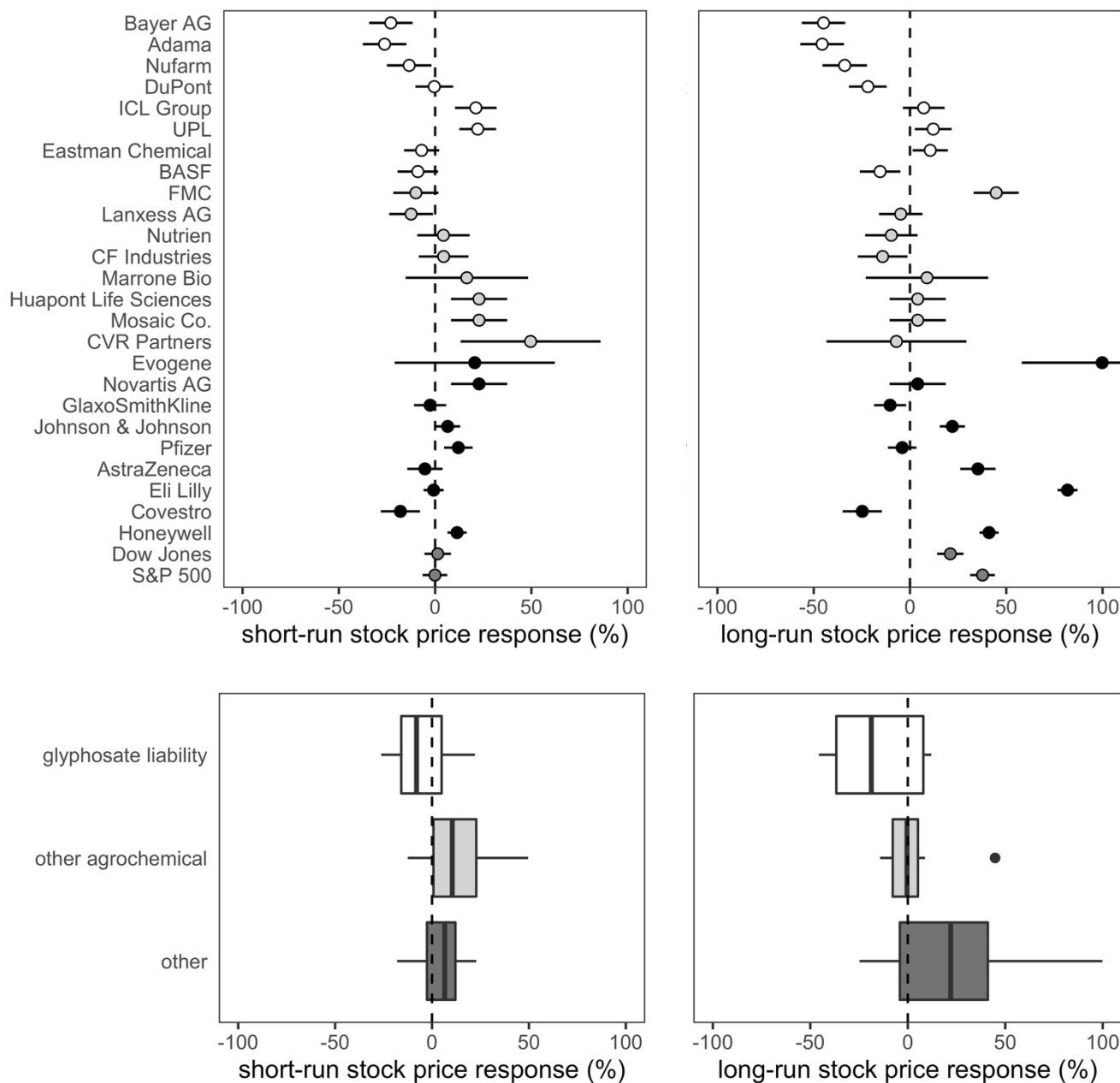


Figure 2: Short-run and long-run stock price responses to 2018 glyphosate ruling

Source: calculated based on Google Finance API (values converted to 2021 USD). Short-run response is the relative change in average stock price between August and September 2018. Long-run response is the relative change in average stock price between August 2018 and May 2021. See Appendix for all monthly average stock prices between December 2015 and May 2021. Cases grouped by industry. White points indicate glyphosate-related liability, in decreasing order of liability. Over the long-run, agrochemical firms with glyphosate-related liability (indicated by white points) lost substantially more share value than the Dow Jones industrial average and the S&P 500 index, as have agrochemical firms without glyphosate-related liability (indicated by grey points), with the exception of FMC. Life sciences, pharmaceutical firms and producers of specialty products (indicated by black points) have gained share value, on average. Error bars in top panels represent 95% confidence intervals.

A differencing approach yields similar results. To obtain a differencing estimate of the effect of the August 2018 litigation, we estimate a generalized least squares regression discontinuity model whereby the dependent variable is stock price as a proportion of the S&P 500 index. Like our initial model, we estimate firm-level fixed effects but dispense with the quadratic term, which permits counterfactual estimation into the future based on the pre-intervention trend. Figure 3 conveys the logic of the differencing model using Bayer's stock price. As shown in the upper panel of Figure 3, Bayer's stock price as a proportion of the S&P 500 index has diminished over time. Notice, however, that the downward trend precedes the intervention. Nevertheless, the level change following the intervention is substantively significant at -23% and statistically significant at the $p < 0.001$ level.

Figure 4 conveys the results of our second model for all twenty five firms in the sample. With the exception of ICL Group, firms with glyphosate-related liability experienced a short-run stock depreciation relative to the S&P 500 index, with an average depreciation of -16% . In the long run, all firms with glyphosate-related liability experienced stock depreciation as a proportion of the S&P 500 index, with an average depreciation of -47% . While stock of agrochemical firms without glyphosate-liabilities was not discernibly affected in the short run, the average long-run depreciation as a proportion of the S&P 500 index has been -13% . By contrast, stock prices for firms in the control group have experienced an appreciation in stock value as a proportion of the S&P 500 index of 28% . As shown in Figure A-2 in the appendix, these results are consistent with comparisons based on stock price as a proportion of the Dow Jones industrial average.

Our results indicate that product litigation tends to decrease stock prices across entire industries —not just for firms with product-related liabilities. Comparison of change in stock prices as a proportion of the S&P 500 index between agrochemical firms without glyphosate-related liability and firms in the control group following the 2018 Johnson ruling reveals a difference of 41% . This difference is even greater when considering stock price as a proportion of the Dow Jones industrial average, which stands at 59% (see Figure A-2 in the appendix). Substantively, the results suggest investment in the agrochemical industry has been significantly and negatively affected by product litigation surrounding glyphosate herbicides.

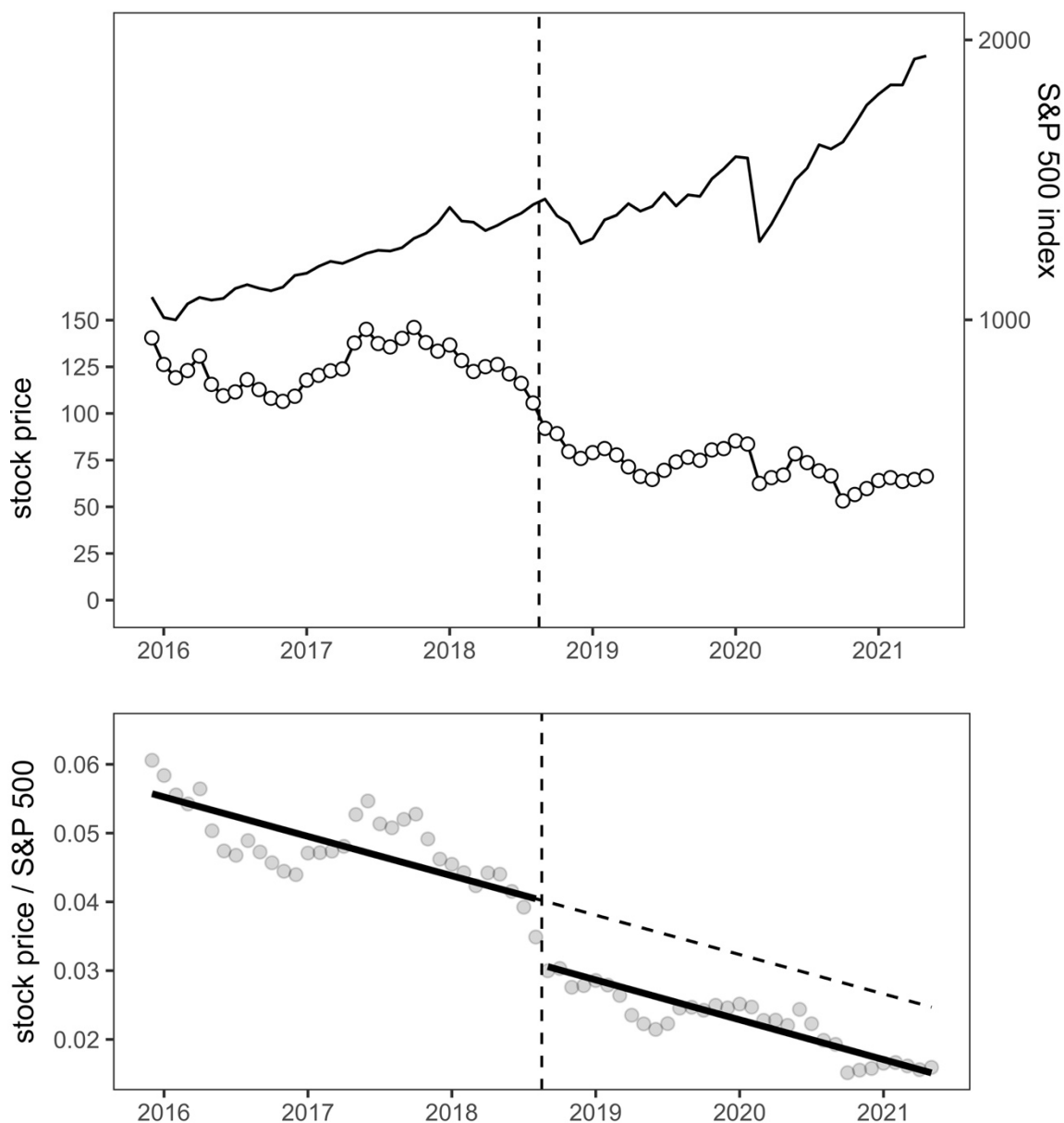


Figure 3: Bayer AG stock price as a proportion of the S&P 500 index

Source: calculated based on Google Finance API (values converted to 2021 USD). Johnson ruling represented by vertical line at 10 August 2018. Regression lines in bottom panel based on generalized least squares with a single time period moving average. Stock price as a proportion of the S&P 500 index has diminished over time. Although share price was trending downward prior to the Johnson ruling, the relative change between pre- and post-intervention levels is -23% and is statistically significant at $p < 0.001$. The post intervention trend is statistically indistinguishable from the pre-intervention trend, as indicated by the parallel relationship between estimates based on observed values (black line) and counterfactual estimates (dashed line).

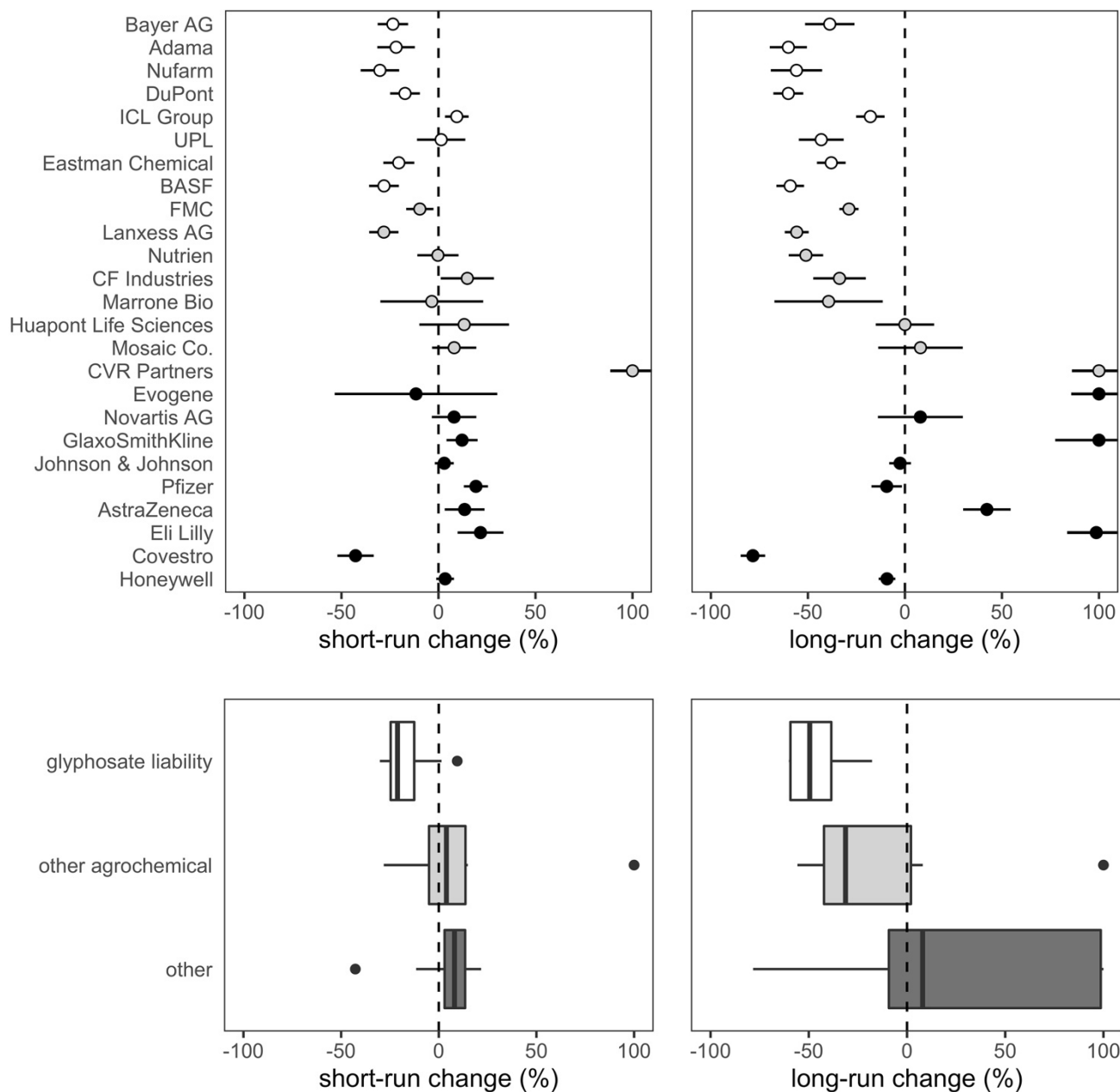


Figure 4: Stock prices as a proportion of the S&P 500 index

Source: calculated based on Google Finance API (values converted to 2021 USD). Short-run response is the difference between the post-treatment and counterfactual estimate of stock price as proportion of the S&P 500 index for September 2018. Long-run response is the difference between the post-treatment and counterfactual estimate of stock price as proportion of the S&P 500 index for May 2021. Cases grouped by industry. White points indicate glyphosate-related liability, in decreasing order of liability. Stock prices of agrochemical firms with glyphosate-related liability (denoted by white points) have decreased on average as a proportion of the S&P 500 index in both the short and long run. Stock prices of agrochemical firms without glyphosate-related liability (denoted by grey points) have decreased on average as a proportion of the S&P 500 index in the long run. Stock prices of life science companies, pharmaceutical firms and producers of specialty products (indicated by black points) as a proportion of the S&P 500 index have increased on average in both the short and long run. Error bars in top panels represent 95% confidence intervals.

4 Discussion

The section on institutions and innovation established that both market failure and governance failure can hinder innovation. On one hand, too much regulation can produce governance failures that stifle innovation and create avenues through which rent-seeking agents may exploit institutions for anti-social ends. On the other hand, too little regulation may expose society to anti-social rent-taking in the form of negative product externalities.

As a corrective to regulatory deficiencies, litigation has its own drawbacks as it too may be exploited for anti-social ends. Insofar as litigious institutions are “pro-market,” frivolous product litigation may be considered a market failure. By the same token, regulation cannot be taken for granted as a corrective to ills associated with litigation, as it may produce governance failures. Indeed, countries with substantial product market regulations did not pre-emptively ban glyphosate prior to its commercialization. Rather, many of these countries instituted bans on glyphosate only after observing successful product litigation in the United States.

In an ideal world, product litigation would promote innovation by encouraging investment in high quality substitutes. Yet, firms may not have resources at their disposal to develop alternative products due to lack of investor confidence, which may be brought on by product litigation. Although there is nothing preventing investors from shifting investments from firms with product liabilities toward innovative competitors, we do not observe evidence of such behaviour in the agrochemical industry. Instead, product litigation appears to have had negative industry-wide effects on stock value.

Public research on novel technologies could be justified on the basis of market failures caused by investor wariness of innovative industries, in much the same way that public research is justified in the defence sector (Block & Keller 2011; Weiss 2014). Other institutional remedies could involve convergence toward the centre of product market regulation and product litigation indices conveyed in Figure 1. Along these lines, several earlier works have advocated for the implementation of “beneficial institutional constraints” for the purpose of curbing pathologies associated with both market-based and non-market institutions (Breznitz 2007; Streeck 1997; Witt & Jackson 2016).

Calls for a more sophisticated appreciation of economic institutions are not new (Vogel 1996; Williamson 1985). Yet, there remains a tendency to juxtapose “non-market coordination” against “market fundamentalism” (Blyth 2002; Milgrom & Roberts 1995). This is despite the fact that unfettered markets are widely recognized as permitting anti-social behaviour. In that sense, although the market economy may be a superior alternative to mercantilism, left to its own devices, markets gravitate toward objectionable forms of “neo-mercantilism” (Gilpin 1975). Ironically, this critique of market mechanisms was first articulated in the treatise most commonly attributed to market fundamentalist ideas —Adam Smith’s *Wealth of Nations* (Smith 1776).

The preceding point draws attention to the fact that genuinely liberal institutions are characterized by features opposite to those typically associated with them, specifically anti-social rent extraction. As mentioned earlier, liberal theory emphasizes the primacy of negative freedoms, respect for which would guard against the imposition of negative externalities onto society (Rawls 1971). It may be that the institutional configuration that performs best in terms of maximizing welfare is also the fairest in terms of a liberal conception of justice (Sen 1970). Considerations of this sort may resolve ambiguities surrounding the scope, content, and function of so-called beneficial constraints (Streeck 1997).

5 Conclusion

This paper began with a discussion of how supply side interventions commonly justified on the basis of cultivating welfare-enhancing national innovation systems may nevertheless fail to adequately foster innovation (OECD 1999). In that context, we argued that investors may not be properly incentivized to provide financial backing for the development of innovative technologies, not only due to the inherent risk of investing but also because regulation and the prospect of product litigation may thwart positive returns on investment. While the existing literature on the political economy of innovation has something to say about the regulatory dimension, it has neglected almost entirely the product litigation dimension of law. As a corrective to this oversight, we have developed an index useful for cross-country comparisons of the ease with which product litigation may be pursued.

We also noted ambiguities in the varieties of capitalism literature surrounding how liberal, market-based institutions are defined (cf. Hall & Soskice 2001). While several political economists have suggested a change of focus from a “states versus markets” orientation to one that recognizes the welfare-enhancing effects of beneficial institutional constraints, there remains a tendency to frame the issues in terms of market-based and non-market institutions (Blyth 2002; Ostrom 2010; Streeck 1997). Moreover, the concept of beneficial constraints remains rather opaque. As a potential solution, we situated our discussion of institutions within a theory of political economy that distinguishes between pro-social and anti-social rents (Tullock 2005). From such an angle, real-world institutions commonly associated with liberal principles are anything but. Furthermore, because markets require stewardship on the part of government or some other non-market entity to function properly, it may also be necessary to rethink the meaning of market fundamentalism.

Substantively, while it is no doubt true that investment and innovation may be helped or hindered by institutions, the intelligent calibration of institutions surrounding product litigation is but one potential remedy among many. Although discursive battles can be expected to ensue when contention exists regarding whether behaviour should be

classified as pro-social or anti-social, society should aspire to adopt institutions that guard against patently anti-social rent-seeking and rent-taking. Unfortunately, institutions that do precisely the opposite abound in nominally liberal societies. Moreover, many of the same institutions that permit anti-social rent extraction also facilitate political resistance to institutional change, with negative consequences for innovation (Frieden & Silve 2020).

Lawsuits surrounding glyphosate herbicides provide a sensational example of the economic consequences of product litigation. Further case studies of spillover effects of product litigation in other industries will be informative for assessing the robustness of our findings. Does product litigation against one automaker deter investment across the entire auto industry? Is the effect on investment only significant in cases where there is reasonable suspicion that the defendants were negligent, or does plainly frivolous litigation also deter investment? On the last point, it has been found that litigation slows the rate at which firms file patents (Kempf & Spalt 2020). A cursory analysis of patents filed by Bayer and Monsanto before and after the 2018 Johnson ruling suggests there may be some truth to the premise, but further analysis with a control group is needed to confidently estimate the gravity of the effect.

- Acemoglu, D., Robinson, J. A., & Verdier, T. (2017). Asymmetric growth and institutions in an interdependent world. *Journal of Political Economy*, 125(5), 1245–1305.
- Aghion, P., & Howitt, P. (1998). *Endogenous growth theory*. MIT Press.
- Alchian, A. A. (1950). Uncertainty, evolution, and economic theory. *Journal of Political Economy*, 58(3), 211–221.
- Amable, B. (2003). *The diversity of modern capitalism*. Oxford University Press.
- Aoki, M., Jackson, G., & Miyajima, H. (Eds.). (2007). *Corporate governance in Japan: Institutional change and organizational diversity*. Oxford University Press.
- Arrow, K. J. (1951). *Social choice and individual values*. John Wiley & Sons.
- Atkinson, R. D. (2006). *Supply-side follies: Why conservative economics fails, liberal economics falters, and innovation economics is the answer*. Rowman & Littlefield.
- Black, D. (1958). *The theory of committees and elections*. Cambridge University Press.
- Block, F., & Keller, M. R. (2011). *State of innovation: The U.S. Government's role in technology development*. Paradigm Publishers.
- Blyth, M. (2002). *Great transformations: Economic ideas and institutional change in the twentieth century*. Cambridge University Press.
- Botero, J. C., Djankov, S., Porta, R. L., Lopez-de-Silanes, F., & Shleifer, A. (2004). The regulation of Labor. *The Quarterly Journal of Economics*, 119(4), 1339–1382.
- Breznitz, D. (2007). *Innovation and the state: Political choice and strategies for growth in Israel, Taiwan, and Ireland*. Yale University Press.
- Buchanan, J., & Tullock, G. (1962). *The calculus of consent: Logical foundations of constitutional democracy*. University of Michigan Press.

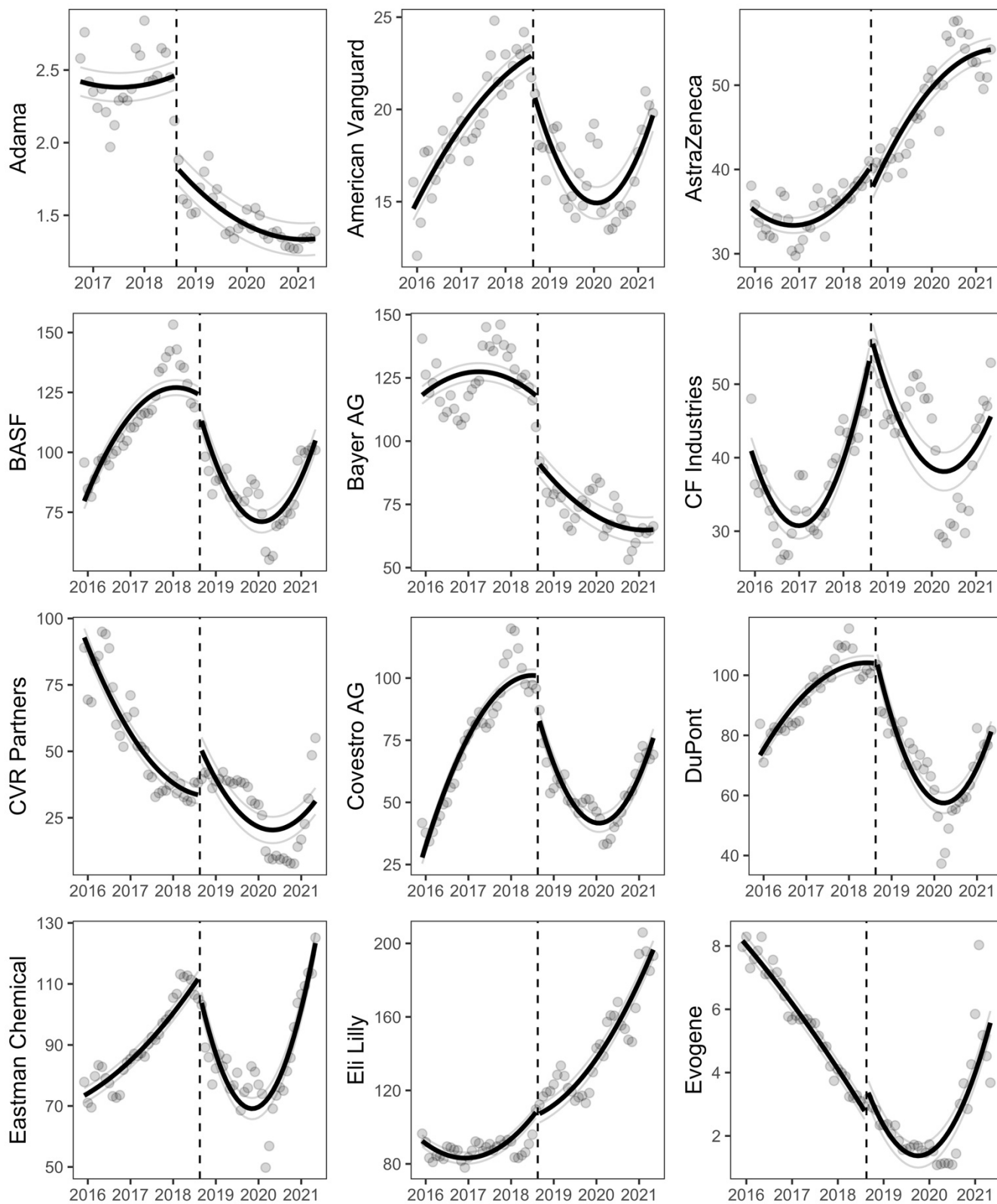
- Cawson, A. (1985). Varieties of corporatism: The importance of the meso-level of interest intermediation. In A. Cawson (Ed.), *Organized interests and the state: Studies in meso-corporatism* (pp. 1–21). Sage.
- Coase, R., H. (1937). The nature of the firm. *Economica*, 4(16), 386–405.
- Coleman, J. S. (1990). *Foundations of social theory*. Harvard University Press.
- Crouch, C. (2005). *Capitalist diversity and change: Recombinant governance and institutional entrepreneurs*. Oxford University Press.
- Elster, J. (1991). Rationality and social norms. *European Journal of Sociology*, 32(1), 109–129.
- EPA. (2020). *Glyphosate interim registration review decision case* (No. 0178; p. 36). United States Environmental Protection Agency.
- Esping-Andersen, G. (1990). *The three worlds of welfare capitalism*. Polity Press.
- Fainshmidt, S., Judge, W. Q., Aguilera, R. V., & Smith, A. (2018). Varieties of institutional systems: A contextual taxonomy of understudied countries. *Journal of World Business*, 53(3), 307–322.
- Frieden, J., & Silve, A. (2020). *The political reception of innovations*. SSRN Working Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3848203
- Gilpin, R. (1975). Three models of the future. *International Organization*, 29(1), 37–60.
- Hall, P. A., & Gingerich, D. (2009). Varieties of capitalism and institutional complementarities in the political economy: An empirical analysis. *British Journal of Political Science*, 39(3), 449–482.
- Hall, P. A., & Soskice, D. W. (2001). An introduction to the varieties of capitalism. In P. A. Hall & D. W. Soskice (Eds.), *Varieties of capitalism: The institutional foundations of comparative advantage* (pp. 1–68). Oxford University Press.
- Hardiman, N. (2002). From conflict to co-ordination: Economic governance and political innovation in Ireland. *West European Politics*, 25(4), 1–24.
- Hayek, F. A. von. (1960). *The constitution of liberty*. University of Chicago Press.
- Hemphill, T. A. (2020). The innovation governance dilemma: Alternatives to the precautionary principle. *Technology in Society*, 63, 1013–81.
- Hirschman, A. O. (1984). Against parsimony: Three easy ways of complicating some categories of economic discourse. *Bulletin of the American Academy of Arts and Sciences*, 37(8), 11–28.
- ITUC. (2020). *ITUC global rights index*. International Trade Union Confederation. https://www.ituc-csi.org/IMG/pdf/ituc_globalrightsindex_2020_en.pdf
- Jackson, G. (2005). Employee representation in the board compared: A fuzzy sets analysis of corporate governance, unionism and political institutions. *The German Journal of Industrial Relations*, 12(3), 252–279.
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010). The Worldwide Governance Indicators: Methodology and analytical issues. SSRN Scholarly Paper. <https://papers.ssrn.com/abstract=1682130>
- Kempf, E., & Spalt, O. G. (2020). Attracting the sharks: Corporate innovation and securities class action lawsuits. SSRN Scholarly Paper. <https://doi.org/10.2139/ssrn.3143690>
- Kirzner, I. M. (1973). *Competition and entrepreneurship*. University of Chicago Press.

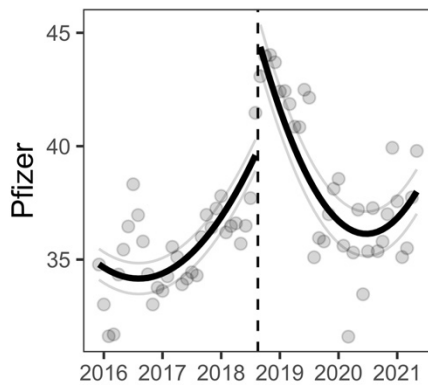
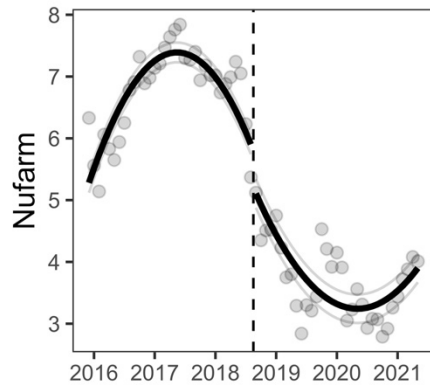
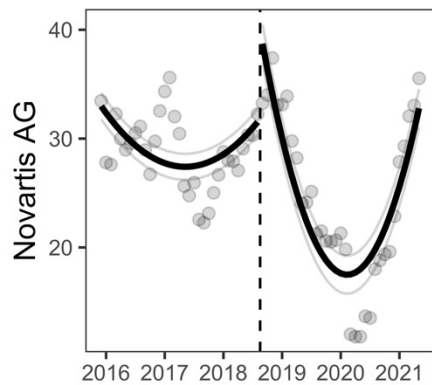
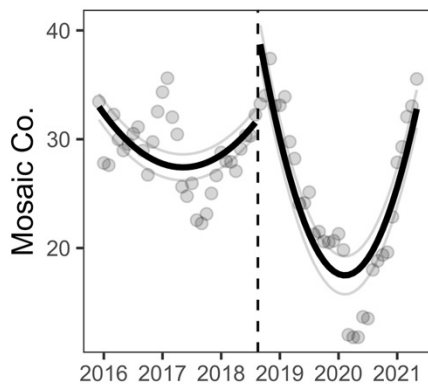
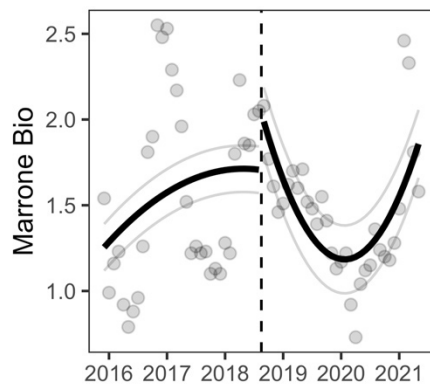
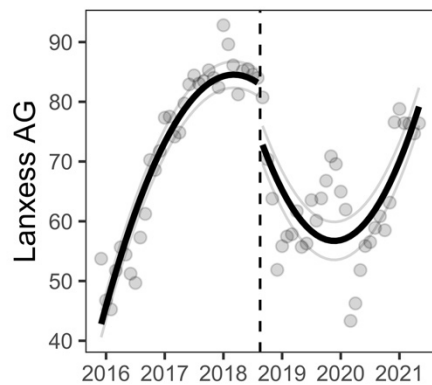
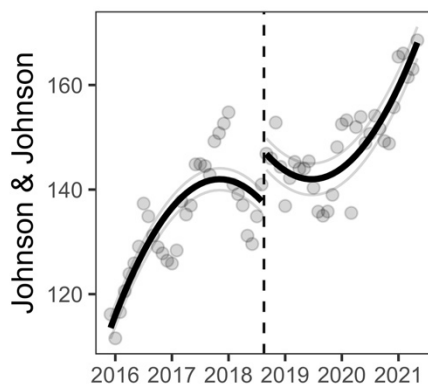
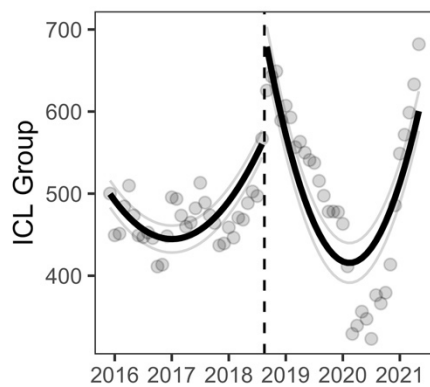
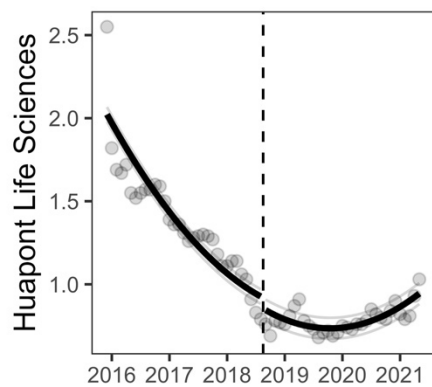
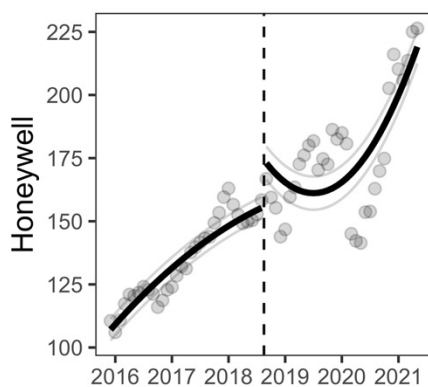
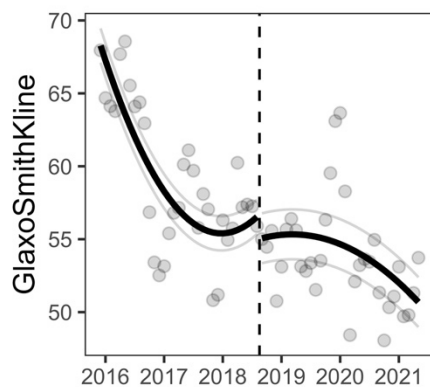
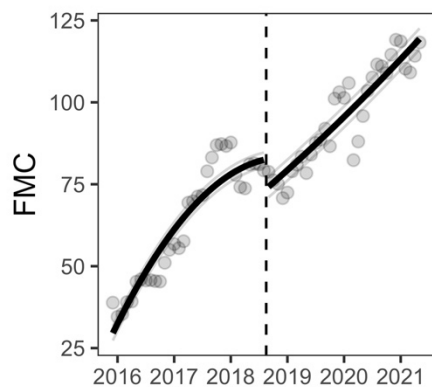
- Kogut, B., & Ragin, C. (2006). Exploring complexity when diversity is limited: Institutional complementarity in theories of rule of law and national systems revisited. *European Management Review*, 3(1), 44–59.
- Koske, I., Wanner, I., Bitetti, R., & Barbiero, O. (2015). *The 2013 update of the OECD's database on product market regulation*. OECD. https://www.oecd-ilibrary.org/economics/the-2013-update-of-the-oecd-s-database-on-product-market-regulation_5js3f5d3n2vl-en
- Krueger, A. O. (1974). The political economy of the rent-seeking society. *The American Economic Review*, 64(3), 291–303.
- Krugman, P. (1993). The current case for industrial policy. In D. Salvatore (Ed.), *Protectionism and world welfare* (pp. 160–179). Cambridge University Press.
- La Porta, R., Lopez-De-Silanes, F., & Shleifer, A. (1999). Corporate ownership around the world. *The Journal of Finance*, 54(2), 471–517.
- Le Grand, J. (1991). The theory of government failure. *British Journal of Political Science*, 21(4), 423–442.
- Mazzucato, M. (2013). *The entrepreneurial state: Debunking public vs. private sector myths*. Anthem Press.
- Milgrom, P., & Roberts, J. (1995). Complementarities and fit strategy, structure, and organizational change in manufacturing. *Journal of Accounting and Economics*, 19(2–3), 179–208.
- Miller, G. J. (1992). *Managerial dilemmas: The political economy of hierarchy*. Cambridge University Press.
- Mokyr, J. (1998). The political economy of technological change: Resistance and innovation in economic history. In M. Berg & K. Bruland (Eds.), *Technological revolutions in Europe* (pp. 39–64). Edward Elgar Publishers.
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- OECD. (1999). *Managing national innovation systems*.
- Orset, C. (2014). Innovation and the precautionary principle. *Economics of Innovation and New Technology*, 23(8), 780–801.
- Ostrom, E. (2005). *Understanding institutional diversity*. Princeton University Press.
- Ostrom, E. (2010). Beyond markets and states: Polycentric governance of complex economic systems. *American Economic Review*, 100(3), 641–672.
- Piketty, T. (2014). *Capital in the twenty-first century*. Belknap Press.
- Polanyi, K. (1944). *The great transformation*. Beacon Press.
- Porter, M. E. (1990). *The competitive advantage of nations*. Macmillan.
- Quirk, P. J. (2006). Greasing the wheels: Using pork barrel projects to build majority coalitions in Congress. *Congress & the Presidency*, 33(1), 101.
- Rawls, John. (1971). *A theory of justice*. Belknap Press.
- Richmond, M. E. (2018). Glyphosate: A review of its global use, environmental impact, and potential health effects on humans and other species. *Journal of Environmental Studies and Sciences*, 8(4), 416–434.
- Rodrik, D. (2007). *One economics, many recipes: Globalization, institutions, and economic growth*. Princeton University Press.

- Scharpf, F. W. (1994). Games real actors could play: Positive and negative coordination in embedded negotiations. *Journal of Theoretical Politics*, 6(1), 27–53.
- Scharpf, F.W. (1997). *Games real actors play: Actor-centered institutionalism in policy research*. Westview Press.
- Schmidt, V. (2010). Taking ideas and discourse seriously: Explaining change through discursive institutionalism as the fourth ‘new institutionalism. *European Political Science Review*, 2(1), 1–25.
- Schneider, M. R., & Paunescu, M. (2012). Changing varieties of capitalism and revealed comparative advantages from 1990 to 2005: A test of the Hall and Soskice claims. *Socio-Economic Review*, 10(4), 731–753.
- Schneider, M. R., Schulze-Bentrop, C., & Paunescu, M. (2010). Mapping the institutional capital of high-tech firms: A fuzzy-set analysis of capitalist variety and export performance. *Journal of International Business Studies*, 41(2), 246–266.
- Schumpeter, J. (1939). *Business cycles: A theoretical, historical, and statistical analysis of the capitalist process* (Vol. 1). McGraw-Hill.
- Schumpeter, J. (1911). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. University of Chicago Press.
- Sen, A. K. (1970). *Collective choice and social welfare*. Holden-Day.
- Shadish, W. R., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin Company.
- Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. Strahan and Cadell.
- Smyth, S. J., Gusta, M., Belcher, K., Phillips, P. W. B., & Castle, D. (2011). Environmental impacts from herbicide tolerant canola production in Western Canada. *Agricultural Systems*, 104(5), 403–410.
- Stigler, G. J. (1971). The theory of economic regulation. *The Bell Journal of Economics and Management Science*, 2(1), 3–21.
- Stone, D. A. (1988). *Policy paradox and political reason*. Scott, Foresman.
- Streeck, W. (1997). Beneficial constraints: On the economic limits of rational voluntarism. In J. Hollingsworth & R. Boyer (Eds.), *Contemporary Capitalism: The Embeddedness of Institutions* (pp. 197–219). Cambridge University Press.
- Thomson One. (2021). Thomson One database.
<https://www.thomsonone.com/DirectoryServices/2006-04-01/Web.Public/Login.aspx?brandname=www.thomsonone.com&version=3.7.9.18833&protocol=0>
- Tullock, G. (2005). *The rent-seeking society*. Liberty Fund.
- UNCTAD. (2020). *UNCTAD handbook of statistics*. United Nations.
- Victor, M. (2001). Precaution or protectionism? The precautionary principle, genetically modified organisms, and allowing unfounded fear to undermine free trade. *Transnat'l Law.*, 14, 295.
- Visser, J. (2019). *ICTWSS database, version 6.1*. Institute for Advanced Labour Studies.
- Vogel, S. K. (1996). *Freer markets, more rules: Regulatory reform in advanced industrial countries*. Cornell University Press.

- Walras, L. (1954). *Elements of pure economics*. American Economic Association.
- Weiss, Linda. (2014). *America inc? Innovation and enterprise in the national security state*. Cornell University Press.
- Williamson, O. E. (1971). The vertical integration of production: Market failure considerations. *The American Economic Review*, 61(2), 112–123. JSTOR.
- Williamson, O. E. (1973). Markets and hierarchies: Some elementary considerations. *The American Economic Review*, 63(2), 316–325.
- Williamson, O. E. (1985). *The economic institutions of capitalism: Firms, markets, relational contracting*. Free Press.
- Wilson, J. Q. (Ed.). (1980). *The politics of regulation*. Basic Books.
- Witt, M. A., & Jackson, G. (2016). Varieties of Capitalism and institutional comparative advantage: A test and reinterpretation. *Journal of International Business Studies*, 47(7), 778–806.
- Witt, M. A., Kabbach de Castro, L. R., Amaeshi, K., Mahroum, S., Bohle, D., & Saez, L. (2018). Mapping the business systems of 61 major economies: A taxonomy and implications for varieties of capitalism and business systems research. *Socio-Economic Review*, 16(1), 5–38.
- World Bank. (2020). *Doing business 2020: Comparing business regulation in 190 economies*. World Bank. <https://doi.org/10.1596/978-1-4648-1440-2>
- World Health Organization. (2015). Evaluation of five organophosphate insecticides and herbicides. *IARC Monographs*, 112.
- Zysman, J. (1983). *Governments, markets, and growth: Financial systems and the politics of industrial change*. Cornell University Press.

Appendix





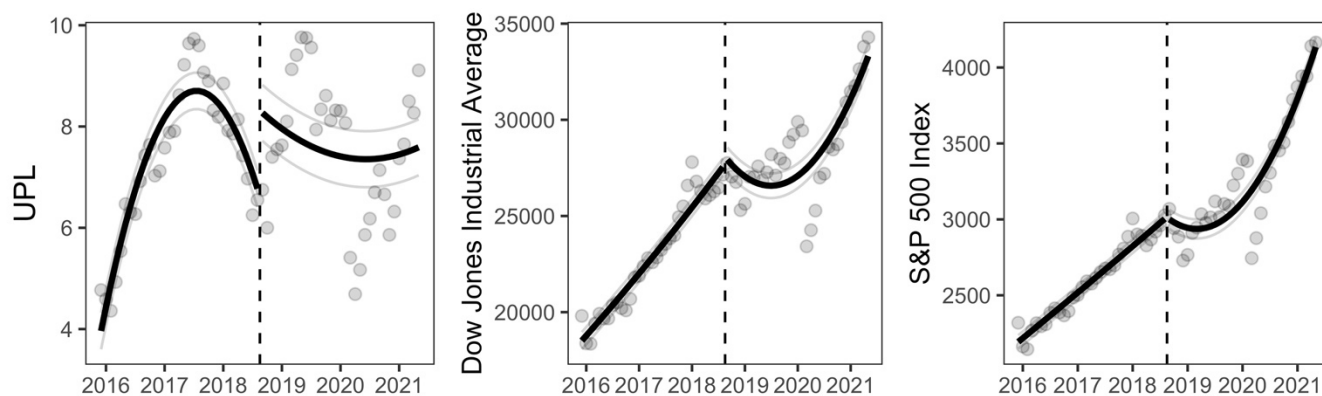


Figure A-1: Regression discontinuity estimates

Source: calculated based on Google Finance API (values converted to 2021 USD)

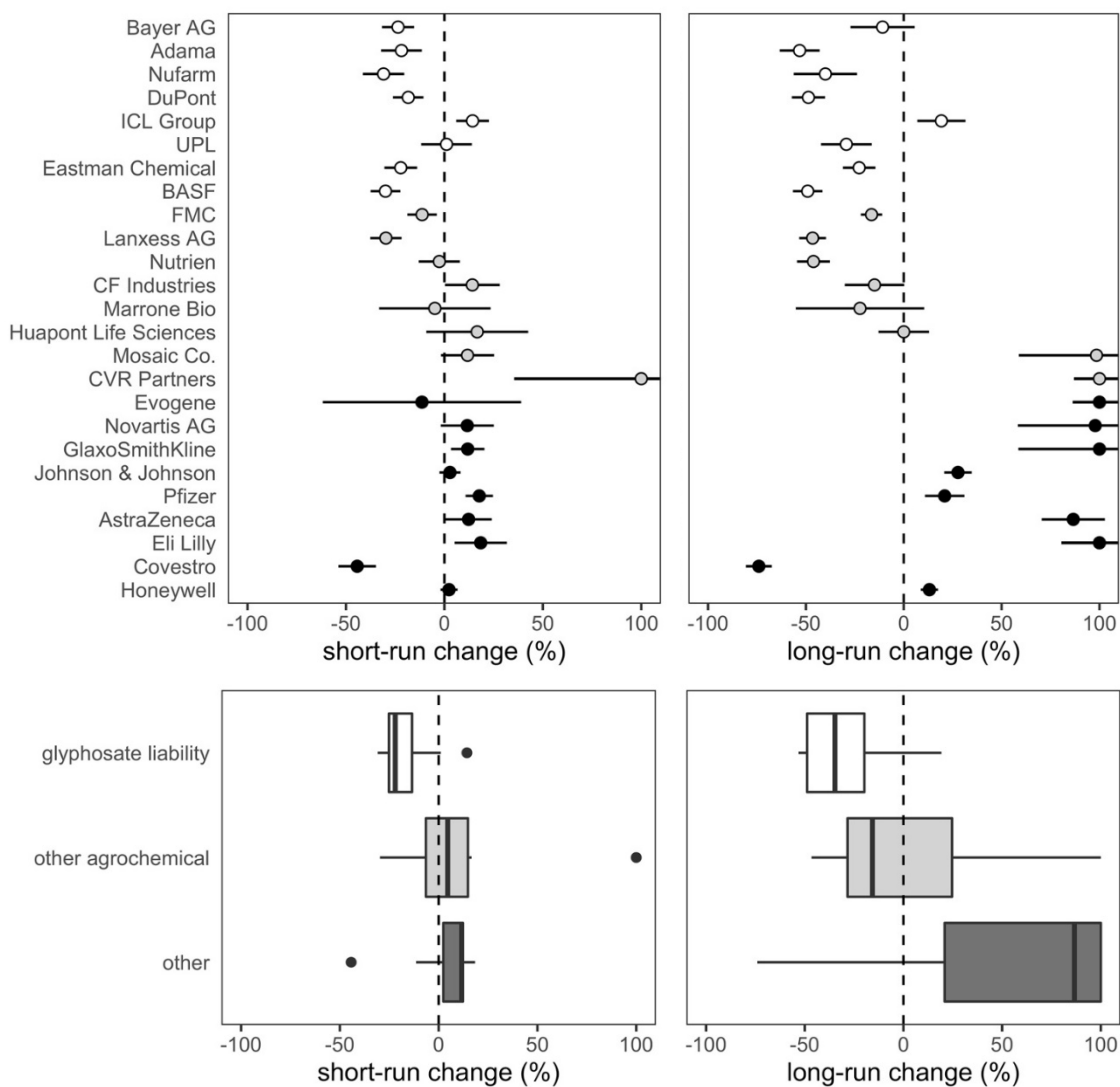


Figure A-2: Stock prices as a proportion of Dow Jones industrial average

Source: calculated based on Google Finance API (values converted to 2021 USD)

country	Cost Rules	Cert. Rules	Rep. Plaintiff	Opt in/out	Class Def	Pred. Req	Fees	Dam-ages	Tier of Fact	Limits	Disc.	Settle-ment	PC1	PC2	PC3
Australia	5.0	0.8	0.3	0.8	0.4	0.0	3.0	0.0	1.2	1.0	0.8	0.5	-2.35	-0.40	-2.46
Austria	4.0	2.4	0.8	1.6	0.3	0.3	5.0	0.8	2.0	1.0	2	0	0.46	0.67	2.06
Belgium	6.0	4.8	0.3	0.6	0.4	0.3	7.0	0.8	2.0	1.0	2	0	-1.17	1.53	-0.20
Canada	5.0	3.2	0.3	0.8	0.4	0.4	3.0	0.7	1.6	1.0	0.8	0.5	-1.03	-0.14	-1.11
Denmark	5.0	6.4	0.6	1.4	0.8	0.8	4.0	0.7	2.0	0.0	0.8	0.5	0.34	-2.63	1.16
Finland	10.0	8.9	1.0	1.4	0.6	0.5	10.0	1.0	2.0	2.0	2	1	6.70	0.78	-1.90
France	5.0	2.4	0.9	1.4	0.2	0.6	6.0	0.8	2.0	1.0	1.6	0.5	1.40	0.16	1.79
Germany	5.0	4.8	0.6	1.0	0.6	0.3	5.0	0.6	2.0	0.8	2	0.3	0.40	-0.03	0.09
Italy	4.0	6.4	0.8	1.4	0.5	0.8	6.0	0.7	1.0	0.8	1.2	0	0.49	-2.20	2.03
Ireland	5.0	0.0	0.5	0.6	0	0.9	8.0	0.7	1.6	0.8	1.6	0	-1.29	1.78	1.62
Netherlands	5.0	2.4	0.3	0.8	0.3	0.4	4.0	0.6	1.4	1.0	1.4	0.8	-0.83	0.12	-1.64
N. Zealand	5.0	3.2	0.3	0.8	0.2	0.4	3.0	0.7	2.0	1.0	0.8	0.0	-1.77	0.61	-0.04
Norway	5.0	2.4	0.3	1.2	0.1	0.3	8.0	0.7	2.0	1.0	1.4	0.3	-0.44	1.79	0.10
Portugal	6.0	1.6	0.4	0.6	0.3	0.4	8.0	0.4	2.0	0.8	1.2	0.4	-1.02	1.14	-1.07
Spain	5.0	4.0	0.6	1.0	0.2	0.5	4.0	0.8	2.0	1.0	1	0.2	-0.30	0.33	0.57
Sweden	5.0	4.0	0.4	1.4	0.1	0.5	9.0	0.6	2.0	1.0	1.4	0.5	0.47	1.03	0.30
UK	5.0	3.2	0.4	0.8	0.2	0.4	7.0	0.8	1.6	1.0	0.6	0.3	-0.88	0.71	-0.41
USA	5.0	6.4	0.8	1.4	0.7	0.8	2.0	0.2	0.2	1.0	0.4	0.5	-0.20	-5.25	-0.89

Table 1-A: Weighted country scores for barriers to product litigation

Source: based on 10 point Likert scaling of author's assessments of barriers to product litigation, multiplied by weights given in Table 2. Principal components (PC1 through 3) calculated based on scores in columns to the left.