

Exogenous Shocks in Leadership and Management Research: Types, Challenges, and Opportunities

Simone Santoni[•], Jost Sieweke^{*} and Michael Withers[°]

[•]Bayes Business School — City, University of London

^{*}Vrije Universiteit Amsterdam

[°]Mays Business School — Texas A&M University

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Abstract

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1 Introduction

2 What is an exogenous shock?

2.1 Exogenous shocks in the literature on natural experiments

The literature on natural experiments offers several elements to appreciate the conceptual category of ‘exogenous shocks’ (for an overview of the natural experiment design, see for example Withers and C. Li [2021](#); Dunning [2012](#); Craig, Katikireddi, Leyland, and Popham [2017](#); Keele and Titunik [2016](#); for a review of the application of this design, see Sekhon and Titunik [2012](#); Sieweke and Santoni [2020](#); Rosenzweig and Wolpin [2000](#)). Particularly, the extant works draw a line between an exogenous shock and the interrelated but distinct concept of naturally-occurring event. While one can observe events such as diplomatic crises, institutional reforms, or terrorist attacks, exogenous shocks are situated in abstract models that illustrate how economic and social formations work in the real world (Morgan [2012](#)). In other words, impactful naturally-occurring events, such as Covid-19 global pandemic, could be challenging to fit within a model of interest and, therefore, do not lead to any exogenous shock. At the same time, a certain event could provide multiple models with an exogenous shock. For example, the reunification of Eastern Germany and Western Germany has been exploited to address diverse research questions, including the impact of income on health (e.g. Frijters, Haisken-DeNew, and Shields [2004](#)), the transmission of preferences for entrepreneurship from parents to children (e.g. Wyrwich [2015](#)), or the legitimization of inequality (e.g. Haack and Sieweke [2018](#)).

Figure 1 pictorially depicts the idea that exogenous shocks emerge from purposive associations of naturally-occurring events, which create the ‘variance’ that is necessary to test a model with observational data, and research questions. The nature of these associations can be substantive — when the environmental variation becomes an integral part of a study’s theorizing —, empirical — if an analyst exploits the variation to deal with endogeneity concerns — or entail a combination of substantive and empirical elements.

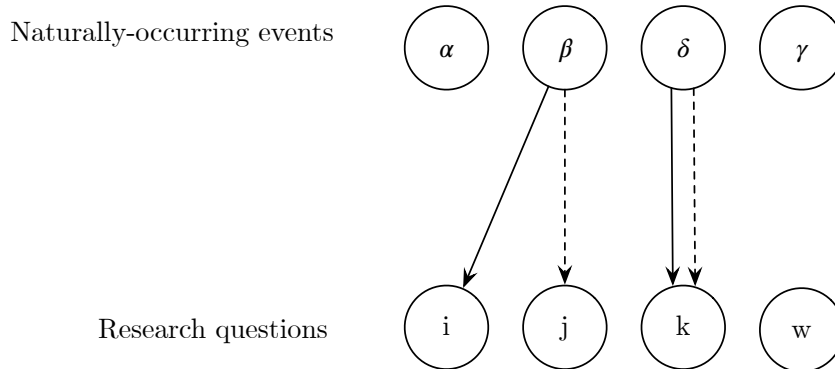


Fig. 1: Exogenous shocks map naturally-occurring events onto research questions via empirical and substantive relevance. Notes: \longrightarrow = empirical relevance; \dashrightarrow = substantive relevance.

The lack of *substantive relevance* is one of the most common terrains in which naturally-occurring events are criticized. For instance, in his critical analysis of Instrumental Variable (IV) applications,¹ the prominent economist Deaton (2009) observes that:

“[omitted] randomized evaluations of projects are useful for obtaining a convincing estimate of the average effect of a program or project. The price for this success is a focus that is too narrow to tell us ‘what works’ in development, to design policy, or to advance scientific knowledge about development processes.” (page 3)

Hence, he argues:

“[omitted] the analysis of programs or project needs to be refocused towards the investigation of potentially generalizable mechanisms that explain why and in what contexts projects can be expected to work. The best of the experimental work in development economics already does so, because its practitioners are too talented to be bound by their own methodological prescriptions. Yet there would be much to be said for doing so more openly. I concur with the general message in Pawson and Tilley (1997), who argue that thirty years of project evaluation in sociology, education and criminology was largely unsuccessful because it focused on whether projects work instead of on why they work.” (page 4)

Coming from an econometric background, Heckaman and Urzua (2010) share Deaton’s concerns about IV as a lever to approximate the experimental ideal:

“The problem that plagues the IV approach is that the questions it answers are usually defined as probability limits of estimators and not by well-formulated economic problems. Unspecified ‘effects’ replace clearly defined economic parameters as the objects of empirical interest.” (page 28)

In his comprehensive work on natural experiments, Dunning (2012) pragmatically points out:

“[omitted] the causes that Nature deigns to assign at random may not always be the most important causal variables for social scientists. For some observers, the proliferation of natural experiments therefore implies the narrowing of research agendas to focus on substantively uninteresting or theoretically irrelevant topics.” (page 3)

¹It is commonly accepted that natural experiments’ forms include the ‘Instrumental Variable’ design along with the ‘Standard Natural Experiment’ and ‘Regression Discontinuity Design,’ constitutes the three forms of natural experiments (Sieweke and Santoni 2020; Dunning 2012).

A positive example showing how to turn a naturally-occurring event into a shock with substantive relevance is Miguel, Satyanath, and Sergenti’s (2004) study of the effect of economic growth on civil war in Africa. Thanks to the ingenious choice to consider weather change data, the authors broaden the conversation on institutions and economic growth. Particularly, rainfall variations facilitate an IV design that copes with longstanding endogeneity issues regarding the co-evolution of institutions and macroeconomic factors. Hence, the authors can investigate empirically a fresh and important theoretical relationship, namely, the effect of economic growth on the likelihood of civil war.

Regarding the *empirical relevance* of a naturally-occurring event, the literature on natural experiments shows a strict view: an event qualifies as an exogenous shock if and only if it allows to operate a research design with control group (Cook, Campbell, and Shadish 2004). In other words, there should be an adequate time window² in which the intervention T emerging from the exogenous shock affects a fraction a population’s units only. Such a condition is *sine qua non* to evaluate the impact of the intervention using Neyman’s potential outcome framework (1923 (1990)), an unbiased estimator of the average causal effect $T - C$ that is based on three quantities: (1) \hat{T} , the average response, if all subjects were assigned to treatment; (2) \hat{C} , the average response, if all subjects were assigned to control; and (3) the difference $\hat{T} - \hat{C}$.

The study of John Snow of London’s cholera out-break of 1853-54³ emphasizes the importance of using exogenous shocks that heterogeneously affect the units of a population. In 1852, the Lambeth Waterworks company — one of the major utility companies supplying water to several parts of the city — relocated their water works from Hungerford Market to fifteen mile upstream in the Thames, thereby “*obtaining a supply of water quite free from the sewage of London*” (Snow 1855 (1965), page 68). Contrarily, Southwark & Vauxhall, a company competing with Lambeth Waterworks in several districts of London, left its intake pipe downstream in the Thames at Battersea. Snow obtained records on cholera deaths in households throughout London, as well as information on the company that provided water to each household and the total number of houses served by each company. Figure 2 reports one of the most compelling pieces of empirical evidence included the study: fatal attacks are compared before and after the exogenous shock (Lambeth Waterworks moved their intake pipelines in 1952) and by water supply (see the column reported on the far-right hand section of the table). Consistently with Neyman model, the analyses of Snow disentangle the ‘true’ effect of the shock on cholera communication from time invariant attributes regarding the households served by different water suppliers, and, perhaps more importantly, from the time variant factors such as the state of the cholera out-break at different points in time. Should the naturally-occurring event affected the totality of households in London, unlikely Snow’s work would have addressed the problem of confounders convincingly.

²We discuss the temporal aspects of exogeneous shocks’ effects in Section 3 and Section 4.

³The project of Snow — aiming to prove that cholera did not transmit through the air, the so called ‘miasma hypothesis’— developed along two arms: he used geospatial visualizations to show that attacks clustered around Broad Street water pump in London’s Soho district; then, he conducted the standard natural experiment briefly summarized that we briefly summarize in the main text.

TABLE XII.

Sub-Districts.	Deaths from Cholera in 1849.	Deaths from Cholera in 1854.	Water Supply.
St. Saviour, Southwark .	283	371	Southwark & Vaux- hall Company only.
St. Olave	157	161	
St. John, Horsleydown .	192	148	
St. James, Bermondsey .	249	362	
St. Mary Magdalen . .	259	244	
Leather Market . . .	226	237	
Rotherhithe*	352	282	
Wandsworth	97	59	
Battersea	111	171	
Putney	8	9	
Camberwell	235	240	
Peckham	92	174	
Christchurch, Southwark	256	113	Lambeth Company, and Southwark and Vauxhall Comp'y.
Kent Road	267	174	
Borough Road	312	270	
London Road	257	93	
Trinity, Newington . .	318	210	
St. Peter, Walworth . .	446	388	
St. Mary, Newington . .	143	92	
Waterloo Road (1st) . .	193	58	
Waterloo Road (2nd) . .	243	117	
Lambeth Church (1st) . .	215	49	
Lambeth Church (2nd) . .	544	193	
Kennington (1st) . . .	187	303	
Kennington (2nd) . . .	153	142	
Brixton	81	48	
Clapham	114	165	
St. George, Camberwell	176	132	
Norwood	2	10	Lambeth Company only.
Streatham	154	15	
Dulwich	1	—	
Sydenham	5	12	
First 12 sub-districts .	2261	2458	Southwk. & Vauxhall.
Next 16 sub-districts .	3905	2547	Both Companies.
Last 4 sub-districts . .	162	37	Lambeth Company.

Fig. 2: An extract of the statistical analyses reported in John Snow's 'On the mode of communication of cholera' (1855 (1965)). The table, reported at page 90, considers both pretest and posttest data-points — Lambeth Waterworks moved their intake pipes in 1952 — for treated and control households.

A related but distinct aspect of *empirical relevance* concerns the ‘exogenous’ nature of the naturally-occurring variation. The literature on natural experiment emphasizes that relevant events are not necessarily sudden, such as the death of a business leader because of heart attack (e.g. Nguyen and Nielsen 2010),⁴ uncontrollable, such as earthquakes (e.g. Belloc, Drago, and Galbiati 2016), or random, such as lotteries (e.g. Poulos 2019). Legal changes or industry regulations can be exogenous shocks to certain research questions. Dunning advances a three-step test to assess : .

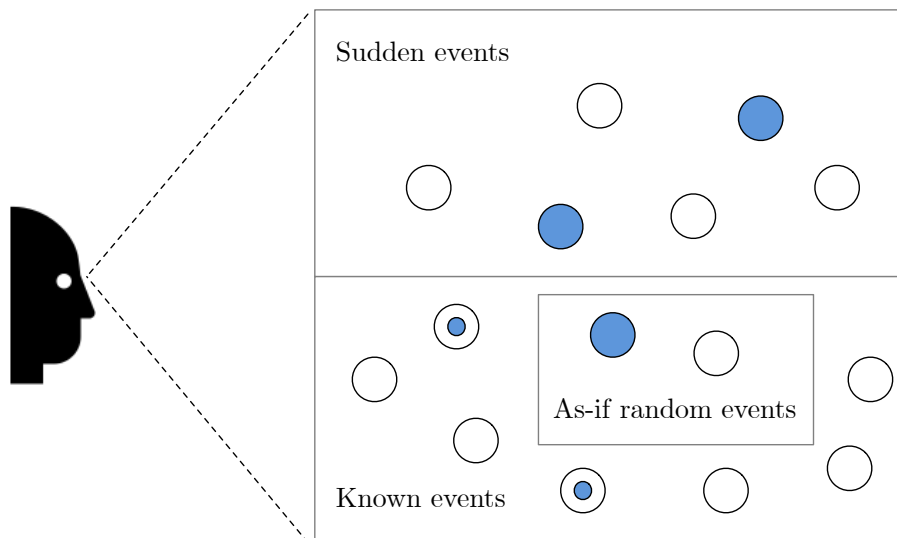


Fig. 3: Semantic representation of exogenous shocks in the natural experiment literature. Notes: ● = exogenous shocks; ⊙ = events that have substantive relevance but do not support causal inference; ○ = events that lack empirical and substantive relevance.

Finally, .

2.2 Exogenous shocks in leadership and management research

This systematic review focuses on 87 studies that leverage a natural experiment design to inquire into phenomena or theoretical relationships regarding the field of leadership (e.g., Gardner et al. 2010; Dinh et al. 2014). We identified candidate studies via an electronic search conducted within Scopus. We searched for business and management, psychology, social sciences, or multidisciplinary journal articles with the keywords ‘natural experiment,’ ‘regression discontinuity design,’ or ‘instrumental variable’ in the title, abstract, *or* set of author’s generated keywords.⁵ For January 2000 - March 2019 —the timespan of our review—the search resulted in 49 unique items.⁶

The two authors independently went through each abstract and retained all the *empir-*

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⁵The query we operated was as follows: TITLE-ABS-KEY (“natural experiment*”) OR TITLE-ABS-KEY (“regression discontinuity design”) OR TITLE-ABS-KEY (“instrumental variable*”) AND (LIMIT-TO (DOC-TYPE , “ar”)). The outcome of the query—in the form article-level metadata—is available in the supplemental materials.

⁶Data were retrieved on April 5, 2019.

ical studies that fulfilled two criteria: First, the work adopted at least one of the three forms of natural experiment, namely, ‘standard natural experiments,’ ‘instrumental variables,’ and ‘regression discontinuity designs’ (Dunning 2012). Second, the work addressed at least one leadership topic/theory included in Gardner and colleagues’ review of the theoretical conversations that characterize *The Leadership Quarterly* journal.⁷ Having completed the independent screening phase, we validated the coding decisions. We thus considered the full papers of the 87 studies that were temporarily filtered-in. Any disagreement about the theoretical focus of each individual study was reconciled through discussion and by evaluating the focal study against the conceptual categories and examples presented in Gardner and colleagues’ (2010) review. This led to the exclusion of five studies. Finally, the results achieved via the Scopus database were complemented with a Google Scholar search combining the above-mentioned keywords with the term ‘leadership.’ This led to the inclusion of five additional studies. Hence, our review was based on a set of 87 published articles.⁸

Figure ?? illustrates the distribution of the studies with respect to the form of natural experiment (panel A) and the time period (panel B) involved. Standard natural experiments ($N = 40$) and instrumental variable designs ($N = 41$) are the most popular forms of natural experiments in leadership research, and, overall, their diffusion seems to grow over time. Regression discontinuity designs are the least popular form ($N = 8$) and their use in the field of leadership is scattered over the last ten years. Appendix A provides further descriptive elements regarding the set of studies.

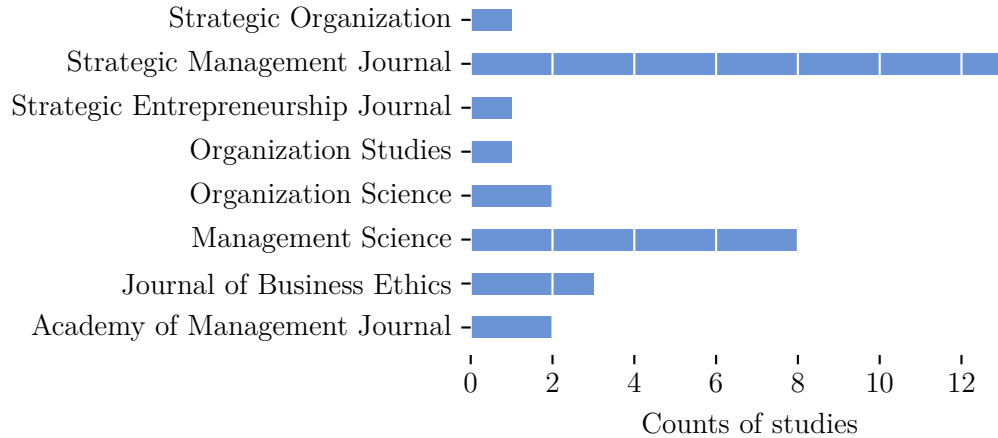


Fig. 4: Distribution of studies that claim to use an exogenous shock across management journals. Notes: $N = 32$; in the interest of consistency, we excluded ‘exogenous shock’ studies published in Management Science addressing finance or operations problems. The following journals do not have any ‘exogenous shock’ study: Administrative Science Quarterly, Entrepreneurship Theory and Practice, Journal of Business Venturing, Journal of Management, Leadership Quarterly, Research Policy.

⁷The supplemental materials report the categories associated with each individual study.

⁸The number of paper-research design instances we considered is higher than the number of studies, because two studies (Dal Bó et al. 2009; Dasgupta 2018) use two research designs.

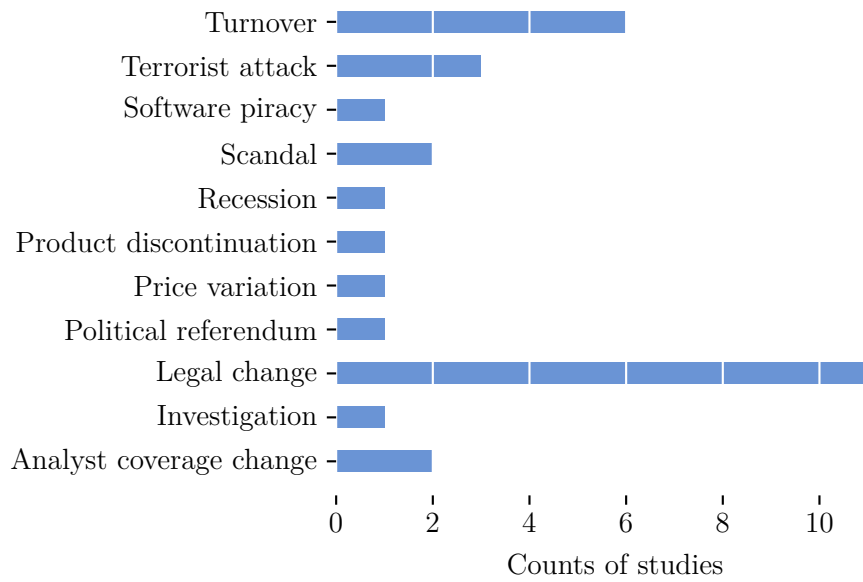


Fig. 5: Classes of naturally-occurring events presumed to create exogenous shocks.

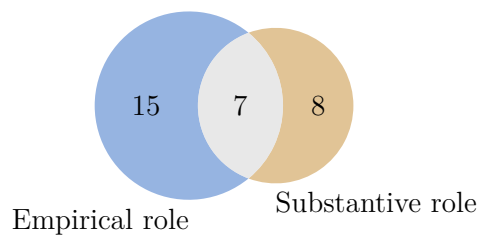


Fig. 6: Role of the naturally-occurring events presumed to create exogenous shocks.

TABLE I
Summary of study events, research questions, and exogenous shocks

Study	Event	Research question	Relevance of the event			Summary
			Empirical	Substantive		
Birhanu & Wezel (2020)	Government changes following Arab spring social movement.	How does group affiliation influence firm performance under weak market institutions?	✓	×		The use of sudden government change is presumed to affect executives' capacity to influence political leaders.
Byun et al. (2019)	Change in a politician's committee and/or committee chair assignments.	How do changes in an employee's relational capital influence mobility and entrepreneurship decisions?	×	✓		Lobbyists may experience a discontinuous shift in the value associated with a connection if there are changes to a politician's committee and/or committee chair assignments. Then, the authors can investigate empirically the consequences of social capital change on lobbyists' career.
Cabral et al. (2021)	Staggered passage of anti-takeover laws in U.S.	Does managerial job security affect the adoption of innovative practices and structures?	✓	✓		The adoption of an anti-takeover statute is a proxy of managerial job security, which changes across states and within individual states over time, and is supposed to affect the propensity to create a CVC program.
Cai & Shi (2019)	Revelation of the sex abuse of children by Catholic priests in U.S.	Does a firm's religious environment influence outside parties' perceptions in contracting with the firm?	✓	×		Revelation of the sex abuse of children by Catholic priests is an exogenous shock to the religiosity of a region, which can influence the capital structure, credit rating, cost of debt, and covenants of local firms.

TABLE I (cont'd)

Study	Event	Research question	Relevance of the event			Summary
			Empirical	Substantive		
Chatterji & Fabrizio (2016)	Department of Justice investigation against the five largest U.S. orthopedic device makers.	How does an open system of innovation affect the rate and direction of innovation?	✓	×		Department of Justice investigation increases the frictions in the market for ideas, by regulating the interactions between physicians and the medical device firms under investigation.
Chatterji & Toffel (2010) ..	Change in the scope of KLD Database, a prominent source of CSR ratings.	How do managers react to poor corporate environmental ratings?	✓	✓		The change in KLD's scope creates a subset of companies responding for the first time to a CSR rating, which allows the authors to deal with mutual causality issues regarding a firm's CSR rating and CSR strategy.
Chen & Garg (2018)	Injuries occurring to star NBA players.	Does a star's temporary absence help the organization overcome myopia?	×	✓		The absence of star players is presumed to impact the pattern of organizational routines at the team level.
Choudhury & Kim (2019) .	Change in U.S. H1B employment visas.	How do migrant inventors influence knowledge production and reuse?	×	✓		The H1B quota change exempted universities and a selected list of other entities, creating heterogeneous effects in terms of supply of first-generation ethnic migrant inventors and the rate of codification of knowledge previously locked within migrant inventors' home countries.

TABLE I (cont'd)

Study	Event	Research question	Relevance of the event		
			Empirical	Substantive	Summary
Chown & Liu (2015)	Turnover within U.S. Senate and 'iconoclastic' senators deviating from the institutionalized seating arrangement.	How does one's location in an organizational forum affect the likelihood to receive support from peers?	✓	×	Turnover within U.S. Senate and 'iconoclastic' senior senators create opportunities for freshman senators not to seat at the margins of the chamber. These elements affect the dyadic distance between senators, a factor that is presumed to affect the likelihood of joint support.
Corbo et al. (2016)	9/11.	Does a major environmental shock affect the social structure of an organizational field?	×	✓	9/11 is supposed to affect the organization and functioning of civil aviation, which allows the authors to assess the extent with which network mechanisms shape the alliances connecting airline companies under different contingencies.
Drexler & Schoar (2014)	Sick leave episodes among loan officers	How (much) does employee turnover affect organizational performance?	✓	✓	Loan officers' sick leaves alter economic and social exchange between the firm and its clients.
Gupta et al. (2020)	Sarbanes-Oxley Act (SOX) & Global Financial Crisis	Does CFO gender influence the likelihood of financial misreporting?	✓	×	The authors expect: i) SOX to lead to a larger decrease in financial misreporting for male CFO firms than female-CFO firm; ii) firms to face greater pressure to report favorable earnings during crisis periods, which is more likely to influence male compared to female CFOs (based on the logic that female CFOs will be less likely to engage in fraud regardless of stakeholder pressure).

TABLE I (cont'd)

Study	Event	Research question	Relevance of the event			Summary
			Empirical	Substantive		
Haveman et al. (2019) . . .	California Legislature enactment of the nation's first comprehensive managed competition program, and Garn-St. Germain Act	How do organizations respond to discontinuous industry-level change?	×	✓		The authors use a series of regulatory changes to investigate how organizations respond to punctuated changes in the environment and with what performance consequences.
Hilary & Huang (2021) .	Revelation of the sex abuse of children by Catholic priests in U.S.	Does generalized trust affect the power of CEO contracts?	✓	×		Revelation of the sex abuse of children by Catholic priests reduces generalized trust for certain counties only, which helps to reveal the causal effect of generalized trust on the characteristics of executives' contracts.
Jie et al. (2020)	2005 Regulation SHO by which SEC removes the uptick restriction for a set of randomly selected pilot firms.	Do managers use CSR to insure against stock price risk?	✓	✓		SEC program changes stock risk price for pilot firms only, which helps to assess whether firms invest in CSR in response to greater stock price risk, and whether such investments provide intended insurance-like benefits.
Kang & Kim (2020)	Staggered changes in inheritance, gift, and estate taxes in U.S. & sudden deaths of business owners.	Do family-firms invest more in employee relations than non-family firms?	✓	×		Taxation changes provide family owners with incentives to continue their businesses, which helps to reveal the relationship between governance forms and investment in employee relations. Sudden death of family members alter a firm's status, a variation that attenuates the concerns time-invariant characteristics jointly affect performance and ability to implement employee-friendly policies.

TABLE I (cont'd)

Study	Event	Research question	Relevance of the event			Summary
			Empirical	Substantive		
Ke et al. (2018)	Sudden deaths and retirements of executives.	How do social connections among executive team members affect management forecast accuracy?	✓	×		Sudden turnover events alter the social connections within a team of executives, and, in turn, help to reveal the causal effect of social capital on decision-making quality.
Koh et al. (2018)	Staggered adoption of the Inevitable Disclosure Doctrine (IDD). in U.S.	Are confident CEOs more likely to report R&D expenditures than cautious CEOs?	✓	×		The staggered U.S. state courts' verdict on the IDD helps to reveal the relationship between CEO confidence and R&D disclosure by attenuating market competition.
Krishnan & Wang (2019)	1992 and 1998 Higher Education Amendments (HEA)	How does student debt influence the propensity to start a firm?	✓	×		1998 HEA alters the cost of discharging student debt through bankruptcy — which increases the cost of entrepreneurship, that is, new venture failure — while it is unlikely to affect financing availability to start a venture. Hence, the authors can assess the causal relationship linking student debt with propensity to create a new venture. 1992 HEA affects the volume of student loans thought the federal government. Students who spend more time in college during the post-1992 HEA regime will have more student loans. Hence, they will have lower likelihood to start a new venture.
Li & Tallman (2011)	9/11.	Does a sudden change in the environment influence the economic returns of international diversification?	×	✓		9/11 is a “reorienting disruptive change” that alters international business logics, particularly, the economic and financial returns of international diversification.

TABLE I (cont'd)

Study	Event	Research question	Relevance of the event			Summary
			Empirical	Substantive		
Li & Zhan (2019)	Reductions in import tariffs initiated by U.S. authorities.	How does product market threats affect stock crash risk?	✓	×		Reduction in import tariffs increases competitive pressure, which aggravates executives' incentive to withhold negative information and increases and make firms more prone to stock crashes.
Mahmood et al. (2017)	Global Financial Crisis.	How does centralization of intragroup equity ties affects the performance of group affiliates?	✓	✓		Global Financial Crisis creates environmental turbulence exogenously for Taiwanese firms, and, in turn, helps to appreciate the contingent role of equity tie centralization.
Natarajan et al. (2019) ..	Indian Government's demonetization measure.	How do middle managers influence resource allocation choices?	✓	×		The decision to withdraw almost 85% of bank notes in circulation (all 500-rupee and 1,000-rupee bills, the most common units of circulating currency) increased bank headquarters' control over ATM deployment, which resulted in tighter monitoring of middle managers' allocation decisions.
Qian et al. (2019)	Brokerage house mergers and closures in U.S.	How do financial analysts influence managers' choice to invest in CSR?	✓	✓		The closure or merger regarding a brokerage house reduces financial analyst coverage for some firms only, which allow the authors to assess the causal relationship between the (change in the) extent of analyst coverage and CSR.

TABLE I (cont'd)

Study	Event	Research question	Relevance of the event			Summary
			Empirical	Substantive		
Ramirez & (2018)	Price variation in the global copper industry.	How does the value appropriated by employees varies in response to an exogenous shock to the price of the firm's product?	✓	✓		Copper mines' size is homogeneous. Hence, price fluctuations in the global copper industry are exogenous variations for individual mines and can reveal the mechanisms behind value distribution within organizations.
Seebeck & Vetter (2021)	Brexit Referendum.	Does board gender diversity affect corporate risk disclosure?	×	✓		The outcome of Brexit Referendum increases the amount of risk environment for all UK-based companies, which attenuates reverse causality concerns regarding board gender diversity on corporate and risk disclosure.
Tan & Netessine (2014) .	Adoption of a new staffing system.	How does workload impact worker productivity?	✓	×		The staggered adoption of a new computer-based scheduling system prescribes different staffing levels from those that managers might suggest because it uses more historical sales data than a manager can handle. Hence, authors can make cross-restaurant comparisons involving similar servers experiencing different workload levels.

TABLE I (cont'd)

Study	Event	Research question	Relevance of the event			Summary
			Empirical	Substantive		
Vergne (2012).....	9/11.	Does straddling multiple product-market categories dilute stakeholder attention to the stigma of operating in the global army industry?	×	✓		Since attackers used commercial airlines hijacked by terrorists armed with kitchen knives, the definition of the weapons category was questioned in the post-9/11 period.” Hence, 9/11 allows the author to test whether the salience of the category ‘weapons’ weakens ‘the negative relationship between stigma dilution (i.e., the situation in which a diversified business operates also in a stigmatized sector, such as ‘arms’) and media disapproval.
Wang et al. (2016).....	Delaware’s 1996 ruling against hostile takeovers.	Do takeover threats affect a firm’s knowledge structure?	✓	×		A series of law cases make takeover less favorable for target firms incorporated in Delaware, allowing the authors to assess the impact of (an increase in) takeover protection on firm-level knowledge production.
Zhang et al. (2020).....	iOS 7 jailbreak.	Does a lapse in gatekeeping reduces knowledge sharing among developers?	✓	✓		The event is an exogenous shock to Apple’s gatekeeping policy, aiming to orchestrate developers’ value creation activities in the AppStore. That allows scholars to appreciate the impact of platform governance on knowledge sharing among developers.
Zheng & Wang (2020) ..	2014 Google blockade in China.	How does Google’s search engine influence the search process of inventors?	×	✓		The blockade of Google affects inventor’s information processing and, in turn, innovation output.

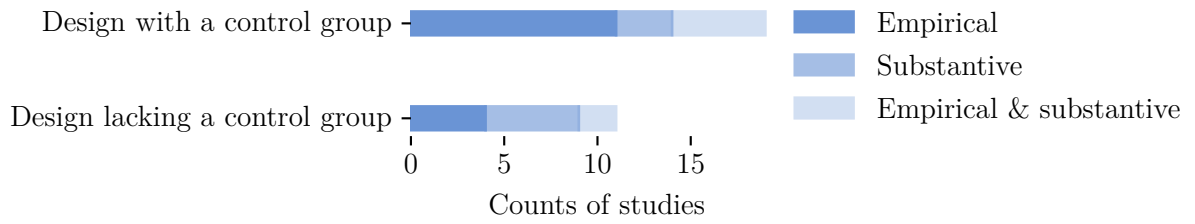


Fig. 7: Distribution of ‘exogenous shock’ studies across research design types and by role of the naturally-occurring event. A design lacking a control group has pre-test and post-test datapoints for one group only; a design with a control group has pre-test and post-test both for units that are affected by the exogenous shock and those that are not.

3 How do exogenous shock differ?

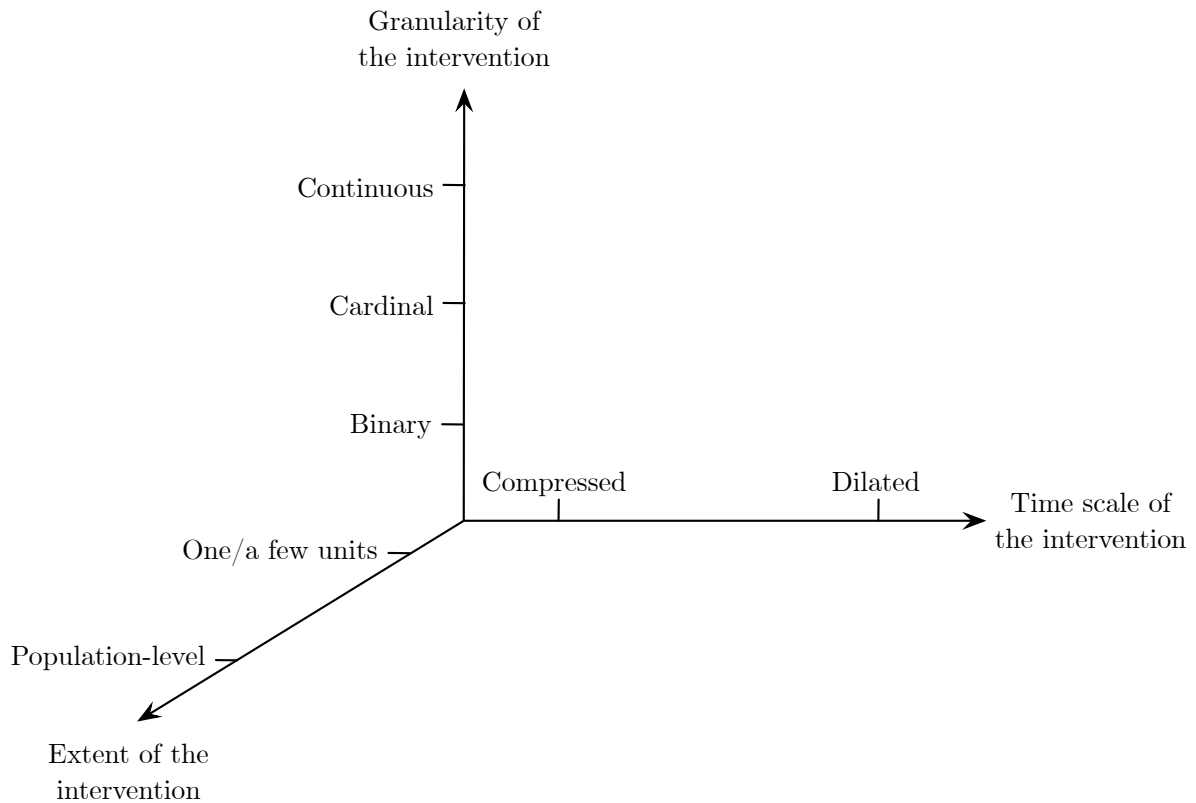


Fig. 8: A typology of exogenous shocks.

4 Harnessing exogenous shocks: opportunities and challenges

5 Coda

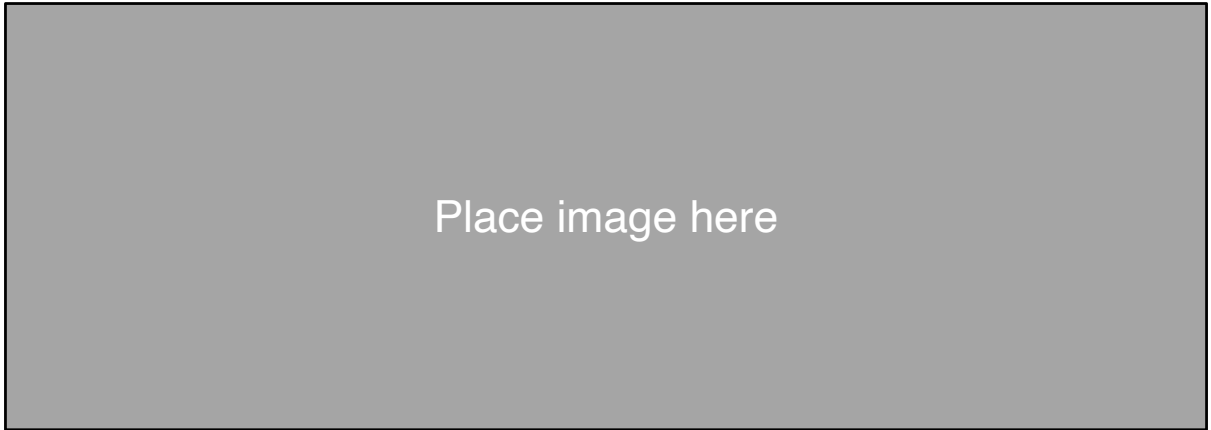


Fig. 9: A decision tree to harnessing exogenous shocks.

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