Evidence-based policymaking in a VUCA world*

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Abstract

In a volatile, uncertain, complex and ambiguous (VUCA) world, responses by governments to global shocks will vary in substance and rate of success. We argue that policymakers can make better decisions when high-quality evidence is incorporated into an evidence-based policymaking (EBP) process. To generate high-quality evidence for analysing shock events, researchers should use event analysis, a methodological approach for exploring research questions such as the timing, frequency and patterns of events and their antecedents and consequences. We discuss four types of research methods used in event analysis and their relative appropriateness for analysing different categories of events. In particular, we argue that one method – the event study – is well suited for analysing crises, i.e. shock events that involve high threat, short decision-making time and surprise. We conclude that understanding and using the tools of event analysis is key to successful EBP in a VUCA world.

Keywords: shock, crisis, VUCA, event analysis, evidence-based policymaking, research methods, case study, event study

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1. Introduction

Within 20 days of the World Health Organization declaring a global pandemic on 11 March 2020, almost 60 countries had instituted quarantines, closed public buildings and shut down cross-border travel (Sim et al., 2021). Government policymakers were forced to make decisions in the face of disparate evidence and conjectures about the cause, nature and impact of the virus. Both the pandemic and the changes in government policies that followed caused huge demand and supply shocks to the global economy. Massive disruptions in international trade and investment flows and in international production and global value chains (GVCs) followed (Elia et al., 2021; UNCTAD, 2020 and 2021; Zhan, 2021) and, as of late November 2021, more than five million people have died (https://covid19.who.int).

The COVID-19 pandemic clearly satisfies the definition of a *global shock*; i.e. "a rapid onset event with severely disruptive consequences covering at least two continents" (OECD, 2011, p. 12). The pandemic is, however, only one example of a stream of disruptive occurrences that have erupted in the 21st century. Other examples include the 11 September 2001 terrorist attack on the World Trade Center, the collapse of Lehman Brothers on 15 September 2008 and the 23 June 2016 decision by the United Kingdom electorate to leave the European Union (Brexit). In addition, there have been natural disasters (e.g. the 2010 Icelandic volcanic disruption (OECD, 2011)) that meet the Organisation for Economic Co-operation and Development (OECD) definition of a global shock. While most of these occurrences were tied to specific dates, others have been more gradual, such as Industry 4.0, the long-run technological shift from a brick-and-mortar world to a digitalized global economy (Schwab, 2016; Eden, 2019; Srinivasan and Eden, 2021). As a result, international business (IB) scholars have begun to refer to the 21st century as a VUCA (volatile, uncertain, complex and ambiguous) world (Buckley, 2020; Van Tulder, Verbeke and Jankowska, 2019).

The World Investment Forum on October 18–22, 2021 (WIF2021) focused on global shocks, in particular, the COVID-19 pandemic and Industry 4.0, and their impacts on international trade, investment and GVCs. A core theme of WIF2021 was how government policymakers could revitalize the 2030 UN Agenda for the Sustainable Development Goals (SDGs) given the negative impacts of global shocks on the 2030 Agenda. This core theme was evidenced by the frequency of the words "COVID" (56 times), "pandemic" (72), "crisis(es)" (31) and "change" (85) on the WIF programme.[1]

[1] The word frequencies reflect the importance that policymakers and researchers now place on understanding global shocks and how to design appropriate policy responses. The general public is also paying far more attention to global shocks. For example, a search on 16 November 2021 for the word "crisis" generated more than 952 million results in less than one second using the Google search engine. The words "pandemic" and "Brexit" generated 726 million and 144 million results, respectively. Even the relatively new acronym "VUCA" generated an astonishing 4.28 million results.

The themes of WIF2021 draw our attention to a critically important question: *How can government policymakers make more effective decisions in a VUCA world?* Our answer to this question is that policymakers make better decisions when high-quality evidence is generated and used in evidence-based policymaking (EBP). EBP puts "the best available evidence from research at the heart of policy development and implementation" (Davies, 2004, p. 3).

To assist policymakers in using EBP in a VUCA world, we argue that researchers need to provide insights and evidence from *event analysis*, which is a broad theoretical framework for analysing research questions such as the timing, frequency and patterns of events, and their antecedents and consequences. Researchers must also use empirical techniques appropriate for studying events. In this paper, we outline four research methods for analysing event-centred questions: qualitative methods (in particular, longitudinal case studies), regression analysis, time-to-event (TTE) and rare event methods, and the event study method (ESM). We discuss each method's strengths and weaknesses and argue that the best evidence requires a sophisticated understanding of the category of event together with the application of the most appropriate research method. In particular, we argue that the ESM is well suited for analysing *crises*, i.e. shocks that decision makers perceive as involving high impact, short time and surprise. Our paper draws on insights from the literatures on EBP (Davies, 2004; Eden and Wagstaff, 2021), events (Hermann, 2012a and 2012b) and crises (Hermann, 1963, 1969, 1971 and 1972; Morgenson, Mitchell and Liu, 2015). We conclude that understanding and using the tools of event analysis is key to successful EBP in a VUCA world.

2. Evidence-based policymaking

Conducting high-quality research based on the best available research methods and practices is critical for the integrity and success of both academic research and policymaking (Eden, Nielsen and Verbeke, 2020). EBP embodies the idea that policy decisions lead to better outcomes when the decisions are informed by good evidence (Hewlett Foundation, 2018; Scott, 2006; Sutcliffe and Court, 2005 and 2006).[2]

[2] See Eden and Wagstaff (2021, p. 28) for a review of EBP, where the authors argue that EBP is useful even when policymakers are faced with wicked problems, i.e. problems that are "systemic, ambiguous, complex, and conflictual". High-quality evidence and EBP can help policymakers manage or cope with wicked problems, even though they cannot be permanently solved. In a case study of SDG 5, Gender Equality, the authors argue that good evidence is necessary but not sufficient for forward progress on SDG 5 and outline several additional recommendations for governments and MNEs including public-private partnerships.

The four stages in EBP are agenda setting; policy formulation; policy adoption and implementation; and policy monitoring, evaluation and revision. Good evidence matters at several steps in the EBP process (figure 1), in particular collection and dissemination of best available evidence (#5); interpretation of evidence from different perspectives and policy contexts (#7); monitoring procedures, measures and instruments (#13); and policy evaluation using monitoring evidence (#14).

Figure 1. The evidence-based policymaking process

Source: Adapted from Eden and Wagstaff (2021, p. 40).

To understand how EBP can be used successfully by government policymakers in response to global shocks such as the COVID-19 pandemic, we start by exploring event analysis and then turn to the empirical methods researchers can use to study the antecedents and consequences of global shocks.

3. Event analysis: the study of events

The study of events has a long history in the social sciences (Morgenson et al., 2015, pp. 518–519), especially in political science (Hermann, 1971, 2012a and 2012b). Researchers in a wide variety of disciplines currently engage in event-centered research, which we refer to as *event analysis*. Scholars in different disciplines use varying terms[3] for the study of events and slightly different definitions; our terms and definitions draw on well-established ones and are designed to be cross-disciplinary.

3.1 What is an event?

We define an *event* as a bounded, observable action in a definable system. A system consists of a set of actors or members that are connected to one another through rules, shared practices or similar means of engagement; examples include a market, industry or political jurisdiction. Within that system, we define an *action* as an occurrence that affects, directly or indirectly, one or more members in the system. The action can be a human initiative (e.g. a new policy) or natural event (e.g. a hurricane). When an action is bounded (occurs at a point in time) and observable (visible to some or all members), the action becomes an event. An action may be initiated by a member of the system or from outside the system, creating cross-system actions. When cross-border actions are bounded and observable, we define them as inter-system events. The announcement of an action also constitutes an action, which if it is bounded and observable is also an event.

Event analysis is a methodological approach or framework for the study of event-centered research questions. Time matters in event analysis (Hedaa and Törnroos, 2008; Reimann, 2009). In most systems, events occur in patterns that are routinely assumed by the members of the system to have specific properties and consequences. Recurrent events that share similar properties across time create a pattern with common properties. Event analysis can examine event-oriented patterns or disruptive events that occur across time.

In event analysis the unit of analysis is an event rather than a feature or variable (Reimann, 2009). Whereas in feature- or variable-centred research, researchers study routine patterns with common properties that are "relatively salient, enduring,

[3] For example, event-centred research is referred to as *event studies* or *crisis studies* in political science (Hermann, 1971; Stern, 2003), the *event-based approach* in network theory and marketing (Halinen, Törnroos and Elo, 2013; Hedaa and Törnroos, 2008), *event systems theory* in organizational theory (Morgenson et al. 2015), the *process approach* in entrepreneurship (Van de Ven and Engleman, 2004) and *event-centred analysis* in communication studies (Reimann, 2009).

and stable representative" aspects of a system, in event-centred research, the focus on time and change can generate "unique insights and forces scholars to theorize across space and time" (Morgenson et al., 2015, pp. 515–516). Event-centred research, however, necessitates "extensive use of event descriptions" that involve "defining, identifying, distinguishing events and event sequences as well as providing qualitative, narrative accounts of events and sequences" (Reimann, 2009, p. 253).

3.2 Shocks and crises

The characteristics of events in a system may be markedly different. Perhaps the most interesting events are nonroutine, disruptive events (Hermann, 1971; Morgeson, Mitchell and Lee, 2015; Reimann, 2009; Van de Ven and Engleman, 2004). When a nonroutine event occurs in the system that interrupts or transforms an established event pattern, the event is referred to as a *shock event*. The shock may be either anticipated or unanticipated by some or all actors in the system. We follow OECD (2011, p. 12) and define a *global shock* as a rapid-onset event with high-impact consequences that affects at least two continents, i.e. as a nonroutine, disruptive event with global consequences.

Event analysis has been used primarily for studying nonroutine and disruptive events or shocks (Hermann, 1971; Morgeson et al., 2015; Reimann, 2009; Van de Ven and Engleman, 2004). In event analysis, shock events create *situations or occasions for decision-making*. When an event is "sufficiently jarring" (Lee and Mitchell, 1994, p.60), the shock disturbs the system and may generate a wave of responses, much like a rock falling into a pond creates ripples in the water. Behaviours of system members (e.g. individuals (Crawford, Thompson and Ashforth, 2019) or firms (Atanasov and Black, 2016; Bloom, 2009)) may change as they respond to the system disturbance. Non-members outside the system may also respond if they are affected by disruptive events.

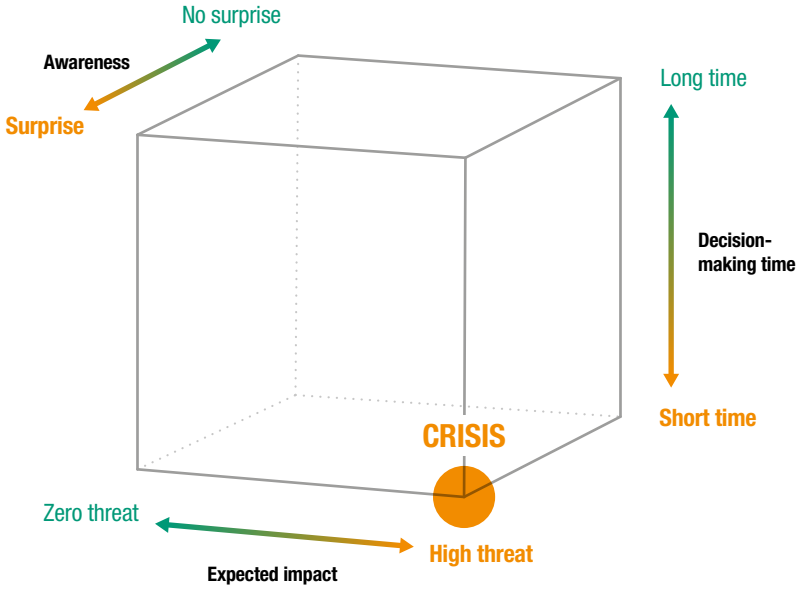
How decision makers observe and respond to a shock event depends on how they perceive it. Three key situational characteristics are (i) *impact:* the perceived impact (high or low) of the shock on the decision makers' goals and outcomes, (ii) *time:* the amount of time the affected member has available for decision-making (short or long), and (iii) *surprise:* the extent to which the event is anticipated or unanticipated (Hermann, 1969 and 1971). Actor responses are also likely to vary depending on whether they view the occasion for decision-making as having a negative (threat) or positive (opportunity) impact.

One of the most studied combinations of situational characteristics has been crisis (Boinet al., 2017; Hermann, 1963 and 1969; Stern, 2003). An event is defined as a *crisis* when it creates an occasion for decision-making where actors

perceive the event as affecting them very negatively (high threat), they have little time for decision-making (short time) and the event was not anticipated (surprise). When the occasion for decision-making is a surprise with short decision-making time but presents a high opportunity to advance the actors' goals, we call the event a *breakthrough*.

Figure 2 illustrates how different combinations of the three situational characteristics – impact on goals, decision-making time and degree of anticipation – represent different types of events. Depicted as a cube, each corner represents a strikingly different type of occasion that policymakers may address. Crises, for example, are represented by the high threat, short time and surprise corner of the cube (Hermann, 1971).[4]

Figure 2. The crisis cube



Source: Adapted from Hermann (1969, p. 415).

[4] Dai, Eden and Beamish (2017) find that high threat (measured by exposure and at-risk resources), short time and surprise are key factors affecting MNE subsidiaries' response to the outbreak of war, providing cross-disciplinary empirical support for Hermann (1971).

In examining the policy decisions associated with events, the perceptions of the relevant policymakers are critical for their policy responses. We provide two examples.[5] First, consider the COVID-19 pandemic. The World Health Organization announced on 30 January 2020 that COVID-19 was a public health emergency of international concern and recommended testing, tracing and social distancing. However, few governments appear to have recognized the coronavirus as a national threat until six to eight weeks later when the number of cases had increased substantially, the virus had spread to several countries and the World Health Organization declared a global pandemic (on 11 March 2020). Most governments also did not recognize that they had a short decision time for policy action (e.g. close borders, quick isolation of detected cases). Thus, the combination of high surprise, failure to recognize the threat and short decision-making time led to slow and piecemeal responses that failed to curb the spread of the virus within their countries.

As a second example, consider the announcement by the United States Environmental Protection Agency (EPA) on 18 September 2015 that Volkswagen diesel automobiles had been designed to mask the environmental impact of their exhaust, in violation of required EPA standards. The announcement was immediately recognized as a huge threat for Volkswagen, with a short window for decision-making time, and a surprise to the firm's executives (except perhaps the innermost circle) and the German government. Despite the quick resignation of several key executives, Volkswagen suffered a significant negative reaction in the stock market (Wood et al., 2018) with negative reputation spillovers that also adversely affected the market valuation of other German manufacturers (Bachmann et al., 2021).

Event analysis databases and research methods

In the preceding section we have explored some key concepts in event analysis and argued that understanding event characteristics can provide insights into the way policymakers perceive and respond to events. Other insights and guidance to policymakers depend on the collection of event data and various research methods for their analysis. We now turn to these necessary steps.

4.1 Databases

The multilayered, complex nature of the global economy (Eden and Nielsen, 2020) makes any efforts to disentangle driving forces and their effects particularly

[5] See also Hermann (1969), which provides historical examples of foreign policy events for various locations in the crisis cube.

difficult and often impossible in "large *n*" cross-section, time-series data sets. To researchers seeking to establish causality, shocks serve as natural experiments (sometimes called quasi-experiments). Shocks can facilitate controlling for some factors, allowing examination of variables of interest. Researchers may also be interested in understanding events themselves (or patterns of events), rather than their effects.

Creating event data sets provides researchers with the opportunity to explore event-centred research questions and develop hypotheses that can be tested using these data. Event data sets that include the number, timing and sequence of actions have enabled researchers to explore the antecedents and consequences of nonroutine, disruptive events (shocks). The time dimension is also central to questions of when and how events start and end, as well as causes and moderators.

Some systems have events that are regularly transmitted in quantitative form and are accessible in that manner to researchers (e.g. stock market data). Examples of event analysis data sets used in IB research include data from the Center for Research in Securities Prices on United States stock market prices and volume; Datastream, the World Bank's database on business startups; Thompson Financial SDC Platinum's databases on mergers and acquisitions, joint ventures and alliances; and the United States Patent and Trade Office's database of registered patents and trademarks.

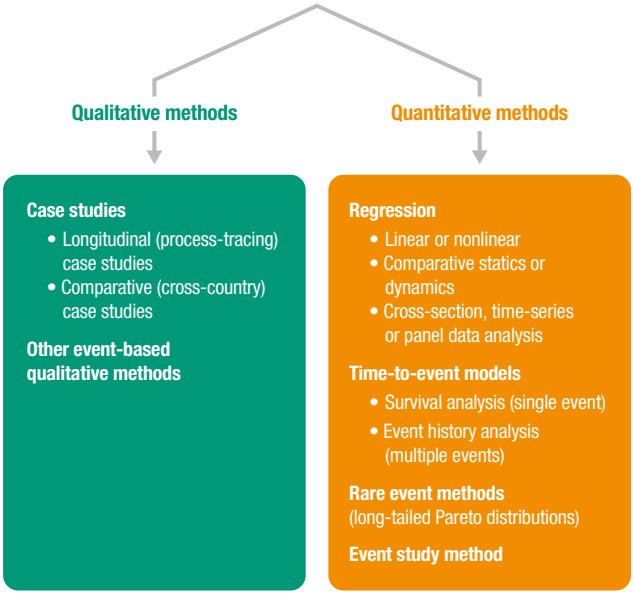
In other systems, although recognizable events may happen continuously, they are not recorded in a quantifiable manner (e.g. political events). In these cases, researchers must devise a means of stipulating such events in reliable quantitative form, using established rules for defining and coding events, such as the actor, action, one or more direct targets, and one or more indirect targets (see, for example, Hermann (1971 and 1972) and Hermann et al. (1973)). By building these event databases, political scientists have broadened notions of conflict and crises to include initiators and targets (Hermann, 1971) and coding for severity from highly cooperative to hostile (Goldstein, 1992). Text analysis has been employed to automate data collection, making possible real-time availability (Bondet al., 2003). Practitioners use coded events for forecasting, and scholars use them to examine topics such as diplomatic risk (Desbordes, 2010) and the effects of military conflict (Li et al., 2020).

4.2 Research methods

Scholars in many disciplines have now developed sophisticated methods for studying events (e.g. Hermann, 1972; Kauffman, Techatassanasoontorn and Wang, 2012; Van de Ven and Engleman, 2004). We have grouped the various empirical methods for analysing event-centred research questions into four broad

categories, which we explore below. The four methods have different strengths and weaknesses, and they are more or less appropriate for addressing different research questions. In each case, we provide examples of how social scientists, including IB researchers, have used these methods to study events. Figure 3 summarizes these methods.

Figure 3. Research methods suitable for event analysis



Source: Authors' elaboration.

4.2.1 Longitudinal case studies (qualitative methods)

Because event analysis involves "when" questions such as patterns and sequencing, it is appropriate to use qualitative research methods in which events are either the dependent or independent variable. If researchers want to theorize about what happened and how things evolved, longitudinal case studies are particularly useful (Halinen, Törnroos and Elo, 2013). Researchers can either start with events and "build forward" to study outcomes, or start from observed outcomes and "build backward" using prior causally significant events as explanatory variables (Aldrich, 2001; Van de Ven and Engelman, 2004).

For example, in political science, event-centred research has mostly studied political conflicts and crises (Auer, 2016; Roux-Dufort, 2016; Seeger, Sellnow and Ulmer, 1998) using comparative and/or longitudinal case studies to study the responses of political actors (see, for example, Boin et al. (2017) and Bolton (2001)). Qualitative methods have also been employed in IB research to study events but much less frequently. A recent longitudinal case study is Haley and Boje's (2014) study of storytelling the internationalization experience of McDonald's Corporation (see also the articles on qualitative methods in IB research in Eden, Nielsen and Verbeke (2020)).

4.2.2 Regression analysis

Perhaps the most common empirical technique in the social sciences is regression analysis, which encompasses both linear (single and multiple) and nonlinear (e.g. probit, tobit, logistic) regression techniques. Regressions can be conducted on cross-sectional, time-series or panel data sets. The two basic approaches used in regression analysis to test how events affect actors within a system are comparative statics and dynamics. The comparative statics technique examines the situation before and after an event, attributing the change to the event, all else being held equal (Kehoe, 1989). Dynamic models study movements in the system over time in response to events, modeling uncertainty, business cycles, feedback loops, hysteresis and other interactions (Tesfatsion, 2017). Both approaches test hypotheses that were developed typically through either mathematical modeling, verbal deductive theory or game theory.

Regression analysis can be used to analyse the consequences of events where events are used as explanatory variables, with the proviso that careful delineation of the event, together with the exclusion of possibility confounding events, is required (Rawlings, Pantula and Dickey, 1998).[6] Regression methods can also be used to explore the antecedents of events.[7] Events used as dependent variables have also been studied by IB scholars using regression methods. For example, the decision to enter a new country has long been of great interest to IB researchers and illustrates that event analysis can deal with "where" questions (surveyed by Kim and Aguilera, 2016), as well as "when" questions (surveyed by Zachary et al., 2015).

Studying shock events can also enable researchers to address empirical challenges that often face quantitative research methods, such as reverse causality, selection bias and omitted-variable bias (Atanasov and Black, 2016). When a shock affects

[6] Recent examples are Jo, Karnizova and Reza (2019) and Christiano, Eichenbaum and Trabandt (2018) in economics and Lin et al. (2019), Clougherty and Zhang (2021) and Li et al. (2020) in IB research.

[7] See, for example, Guriev, Kolotilin and Sonin (2011), Mahdavi (2014) and Dau et al. (2021).

some firms (treatment group) but not others (control group), its effects can be estimated by the difference in outcomes between the two groups, analogous to experimental trials of drug effectiveness, referred to as "difference-in-differences" (Reeb, Sakikabara and Mahmood, 2012).[8]

4.2.3 Time-to-event and rare event models

Evolutionary biologists believe that shocks can explain discrete breaks in the fossil record. The history of life on earth is best explained not by slow gradual change but rather by rapid bursts of events (*punctuated equilibria*) when new species arise very quickly following long periods of relative stability, triggered by the accumulation of stressors and random events (Eldredge and Gould, 1972; Gould and Eldredge, 1977). Organization theorists in sociology and management have adopted the punctuated-equilibrium model to analyse policy shocks that were treated as regulatory punctuations (Haveman, Russo and Meyer, 2001, p. 254).

In punctuated equilibria research, a core topic is the duration and timing of events. Research methods for analysing punctuated equilibria include *time-to-event (TTE) models* such as hazard or survival models, which are used where the outcome variable predicts the likelihood of a particular event happening or not happening (Vermunt and Moors, 2005). Whereas survival analysis focuses on the likelihood of a single event, event history analysis has the ability to analyse events that occur multiple times (and may be possibly overlapping) and events with multiple outcomes. Event history analysis has been used in many social science disciplines, including IB research, to analyse punctuated equilibria; see, for example, Box-Steffensmeier and Jones (1997), Haveman et al. (2001) and Perez-Batres and Eden (2008).

Geographers have used punctuated equilibria models to examine the impact of natural disasters on communities and businesses (Adger, 2006; Aubrecht et al., 2013; Gallopín, 2006), treating natural disasters as rare events. Rare events need modeling with Pareto-based statistics (i.e. data points are independent-multiplicative, and distributions are asymmetric with long tails) rather than Gaussian-based statistics (data points are independent-additive, with normal distributions), according to Andriani and McKelvey (2007 and 2009). Specialized methods such as catastrophe, input-output and computable general equilibrium modeling can be used to analyse rare or long-tailed shocks (Atanasov and Black, 2016; Botzen, Deschenes and Sanders, 2019). Rare events also occur in IB research.

[8] For examples using difference-in-difference treatment, see Kanagaretnam, Kong and Tsang (2020) and Bachmann et al. (2021).

Andriani and McKelvey (2007, p. 1211) argue "there is a far higher probability of fractals, Pareto distributions and power laws in IB than in domestic settings", and IB scholars are starting to adopt rare event techniques.[9]

4.2.4 Event study method

The *event study method (ESM)* is an analytical technique designed to capture the impact on market value of an announcement relevant to the future earnings of a firm or firms, by examining the behaviour of the stock price around the announcement, i.e. investors' short-term reaction to an event.[10]

In ESM, the researcher looks for evidence of an abnormal return on the day of the event announcement. The abnormal return provides a measure of the unanticipated effect of the event on the firm's value. Whether the stock market response is normal or abnormal is determined by comparing expected returns (which are estimated based on modeling and data for an estimation window) and then comparing them with actual returns during the "event window", typically a three-day window around the event (McWilliams and Siegel, 1997). For time periods longer than one day, the daily abnormal returns are added and referred to as the cumulated abnormal returns (Brown and Warner, 1980 and 1985).

The ESM can also analyse event patterns. Because the ESM can be used to identify stock market reaction to an event, the accumulation of daily reactions over time or at different points in time makes it possible for scholars to study not only the immediate impact of a policy shock but also the temporal patterns of those impacts. ESM is also useful for studying events that affect many firms and potentially identifying systematic patterns of firm behaviours and market features. For example, the method can be used to examine linkages between an MNE's home and host markets or understand how MNEs respond to sudden policy changes in a host country. Another use of the ESM is to examine shocks such as foreign exchange crises or natural disasters; e.g. King (2015) used the ESM to study bank bailouts during the global financial crisis.

[9] For example, Dai, Eden and Beamish (2013 and 2017) use rare event, nonparametric, Cox proportional hazard modeling with multiple onsets of risk to explore MNE responses to wars. Liu and Li (2020) use generalized estimating equations that accommodate non-independent observations to explore MNE responses to terrorist attacks.

[10] For literature reviews of ESM, see Fama et al. (1969); Campbell, Lo and MacKinlay (1997), McWilliams and Siegel (1997) and Eden et al. (2021).

4.3 Which method is appropriate for which events?

Although it is useful to explore four types of research methods for studying events, the relevant question for researchers is which method or methods are most appropriate for understanding the antecedents and consequences of specific types of events, such as global shocks or crises. We believe that the range of possible research questions suitable for event analysis methods is quite broad, given that the inherent complexity of the global economy lends itself to interesting and important research involving dynamics (Buckley, 2020; Eden and Nielsen, 2020). For instance, the process of deglobalization and reshoring discussed in UNCTAD (2020 and 2021) is due in part to policy shocks such as the introduction of import and FDI barriers, pathogen diffusion, trade and travel restrictions, and intercountry tensions (Evenett, 2019 and 2020).

The first three methods outlined for analysing events – longitudinal case studies, regression analysis, and time-to-event and rare event methods – have all been used frequently by researchers to analyse global shocks. The ESM, in contrast, has been used almost wholly in accounting and finance to analyse stock market reactions to events.

An advantage of case studies, regression analysis, and the TTE and rare-event methods is that they are most useful when the researcher has multiple years of historical data available for analysis. Longitudinal case studies, for example, are well suited for tracing over time (often years or decades) the antecedents and consequences of events. Tracing is easier if the event affects fewer actors or there are multiple sequential events and the researcher is looking for event patterns. Regression analysis, both comparative statics and dynamics, typically requires large panel data sets, as do TTE and rare event methods.

For policymakers to use any of the four research methods successfully, it is important that they understand the difficulties of using evidence in EBP (Eden and Wagstaff, 2021). As Eden and Wagstaff explain, multiple problems can derail the role of evidence in EBP. First, good evidence is necessary but may not be sufficient for EBP because the definition of good evidence often varies among stakeholders, leading to frequent disputes. The bias towards quantitative ("hard") evidence also disadvantages qualitative ("soft") evidence. Second, good evidence may be misunderstood or misused by policymakers, especially if they do not have the staff or expertise to understand the research findings or cherry-pick the results they favor. Moreover, researchers often do not explain their results in a policy-friendly manner. A third problem is that empirical evidence collected in one country may not be applicable in another.

Our answer to the question about which method works best for which events is therefore "it depends" – the same conclusion reached by Eden and Wagstaff (2021). What is clear, however, is that the first three methods – case studies,

regression techniques, and TTE and rare event studies -- by their very nature must be historical since they rely on the creation of multiple-year data sets. Their usefulness in analysing global shocks therefore depends on how similar the current event is to events that happened in the past.

By contrast, the ESM has the advantage of timeliness, as event data can be analysed in real time. Therefore, the ESM lends itself well to one particular type of event – crisis – because it shares the three characteristics of crisis events: high impact, short decision-making time and surprise:

- *High impact:* The ESM by construction is most effective at capturing high-impact events that affect a firm's market valuation, either positively or negatively. Crisis events are defined similarly as high-impact (usually threat) events.
- *Short time:* The ESM by construction also involves a short time horizon. An announcement is made and investors must react in a timely fashion by buying or selling shares of the stock if they are to profit from the new information. The cumulated abnormal returns provide an ex-ante measure of the unanticipated effect of an event on the firm's market capitalization at a point in time, typically measured as a three-day window around the event. Crisis events are also characterized by short time to decision-making, i.e. a short window before the situation is expected to change again.
- *Surprise:* In the ESM, the abnormal return associated with an anticipated event should be zero because a critical assumption underpinning the ESM is market efficiency; i.e. new information is fully reflected in stock prices soon after the announcement (Fama et al., 1969). When there is no surprise, the ESM should normally not be used.[11] Surprise is also a key characteristic of crisis (and breakthrough) events.

Key to using the ESM to analyse global shocks is therefore the requirement that the shocks must also be crises or breakthroughs; i.e. they must involve high impact, short time and surprise for the decision-making actors. Events that are low impact, long time or not a surprise are not suitable research questions to address using the ESM. In such situations other research methods (e.g. multiple regression, cases studies) present better alternatives.

[11] The ESM can be used to capture the impacts of disappearing surprise over time; see Eden, Juarez Valdez and Li's (2005) study of United States tax penalties on Japanese automotive and electronics MNEs. Lack of stock market reaction to an announcement can also provide indirect evidence of information leakages; see Miller et al. (2008).

We therefore propose that event analysis researchers consider reframing the ESM more broadly than the traditional definition used by accounting and finance researchers:

- *Traditional definition: The ESM is an empirical method used to capture investors' reactions on a stock market to an announcement that may affect the future earnings of one or more firms.*
- *Event analysis definition: The ESM is an empirical method used to capture stakeholders' reactions on a high-frequency market to an event that is observed and perceived as high impact by one or more actors.*

Our new event-centred definition of the ESM broadens the traditional definition in three ways: from investors to stakeholders, from the stock market to high-frequency markets, and from publicly traded firms to organizational actors. The definition more clearly centres the ESM as an appropriate method for analysing events characterized by high impact, short decision-making time and surprise.

In addition to broadening the definition of the ESM, we also support broadening the types of databases that can be used with ESM. A key advantage of ESM is that it uses high-frequency (typically, daily) stock market data so events can be analysed almost in real time. In contrast, most data sets are annual, so that analysis of interesting and important phenomena must wait for years. For example, the impacts of the COVID-19 pandemic on Chinese firms (He et al., 2020) and United States firms (Albuquerque et al., 2020) have already been studied using the ESM. Thus, policymakers can use it to acquire timely evidence on global shocks by examining the impacts of shocks on one or more stock markets. It is important to note also that new databases using big data are now being developed that are often collected in real time (Delias, Zoumpoulidis and Kazanidis, 2019). Since the ESM is a forward-looking method that focuses on expectations, the potential usages of it in policymaking should grow as new forms of high-frequency big data become available (e.g. Internet tweets and clicks, and geotracing using mobile phones). When these data are correlated with organizational goals and outcomes, the ESM can be used on other high-frequency markets or to supplement stock market data. Big data can also supplement monthly data in regression analysis; e.g. Bachmann et al. (2021) use Twitter data together with monthly automotive sales to estimate the reputation impacts of the Volkswagen emissions scandal.

We are therefore supportive of recent proposals that unofficial data and statistics, both national and international, be certified for use in EBP processes (MacFeely, 2019; MacFeely and Nastav, 2019). Expanding the range of acceptable data sources for government policymaking would be particularly helpful for developing countries, where limited policy capacity and resources restrict the provision of official data sources. MacFeely (2019), for example, argues that big data may be

more cost effective, efficient, and finer grained than official sources and of better quality than survey data. Scholars are already studying the use of big data in EBP (Giest, 2017; Poel, Meyer and Schroeder, 2018).

5. Discussion and conclusions

Event analysis recognizes that events differ in their characteristics and patterns. Global shocks are events that happen rapidly and have large, typically negative impacts on at least two continents. Other events such as technological change can also have global impacts but unfold over decades. Some events are predictable; others are not. The time available for decision-making can also vary from short to unlimited. In sum, events differ in their impact (sign, size and duration), predictability and time for decision-making. Policymakers need to distinguish between long-term global shocks such as Industry 4.0 and global crises such as the pandemic, recognizing that they may require different EPB processes.

The nature of the event and how it is perceived by actors within the system are important for understanding the antecedents and consequences of the event. Policymakers are likely to react differently depending on the characteristics of the event, especially where the event is unexpected and disruptive. As such, we believe that exploring how the various corners of the crisis cube in figure 2 affect the EBP process would be a useful extension to this paper. We expect that varying any of the situational characteristics (impact, decision time, surprise) is likely to affect the EBP process.

When the global shock is a decision-making situation that involves high threat, short time and surprise (a crisis event), the ESM is an appropriate research method. Whether an event is perceived by decision makers as a breakthrough (opportunity) or crisis (threat) can significantly alter the occasion for decision and the likely response. For example, decision making in crisis (to avoid a loss) may result in substantially greater risk taking than reacting to a breakthrough event that provides an unexpected change to advance goals (Kahneman, 2011). In addition, both crises and breakthrough events involve turning points when significant change is expected and tough decisions must be made. Both also involve costs and resources in making and implementing decisions – change is not cost free – even if crises involve primarily big downside risks while breakthroughs involve big upside risks. Recognizing the characteristics of the situation faced by policymakers affords them an opportunity to improve the quality of their response and to avoid pitfalls frequently initiated by less careful responders.

A natural extension to our study would therefore be for researchers to examine how the nature of the event affects the EBP process. Are policymakers likely to engage in the same EBP process when faced with a high-threat event that is a

surprise versus one that is anticipated? How does the length of the decision-making process affect the EBP process? Some insights can be found in Hermann (1969), who argues that in crises, decision-making is made quickly at the highest level by a small number of officials using information available to the group, i.e. the EBP process is short and truncated. In contrast, a high-threat surprise situation with extended time provides policy room for search and opportunities for innovative options, i.e. a more full-fledged EBP process. Monitoring a stream of events and noting their variation on these dimensions may help policymakers confronting a particular type of event to improve their decision making. It also enables other members of the system – who are alert to different event characteristics – to anticipate the more likely responses of those facing a given type of event.

In conclusion, WIF2021 was focused on the key question facing policymakers in the decade ahead: How can policymakers make better decisions in a VUCA world? Our answer has been that better decisions are made when high-quality evidence is generated and used in EBP. To assist policymakers in using EBP in a VUCA world, we argue that researchers need to provide insights and good evidence drawn from event analysis. Key to the creation and dissemination of good evidence is (i) understanding the nature of the global shock and situating it within event analysis and (ii) choosing the appropriate event-analysis research method or methods for analysing the shock's antecedents and consequences. We hope that our paper will encourage researchers and policymakers to apply the insights of event analysis and EBP to their policy responses.

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