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Natural Disasters and Entrepreneurship: Institutional Conditions and Underlying Mechanisms

Rodrigo Alberto Fuentes-Solis

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Doctoral Thesis

PhD in Entrepreneurship and Management (IDEM)
Department of Business, Faculty of Economics and Business Studies

Natural Disasters and Entrepreneurship: Institutional Conditions and Underlying Mechanisms

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Barcelona, July 10, 2026

General acknowledgments

This doctoral thesis has been a long, intense, and profoundly meaningful journey. It has required perseverance, discipline, and the ability to keep working even in moments of uncertainty and difficulty. At the same time, it has been a wonderful yet very challenging experience, through which I have grown not only as a researcher but also as a person.

I would like to express my deepest gratitude to my thesis supervisors, Joan-Lluís Capelleras and Victor Martin-Sanchez. Over these years, they have devoted countless hours to reading my work, discussing ideas, correcting drafts, and guiding the development of my research. Their academic advice, critical feedback, patience, and constant support have been fundamental throughout the doctoral process. I have learned a great deal from them, not only about research and academic writing but also about thinking more rigorously and on the importance of baseline theory. I sincerely thank them for their guidance, commitment, and encouragement over these three years. I also want to thank myself for continuing to write, study, and move forward during the most difficult moments of this process.

I would like to express my special thanks to my parents. I will write these words in Spanish: “muchas gracias Papá y Mamá por su apoyo incondicional. Su apoyo fue fundamental para llegar hasta aquí”.

I also want to leave a message for my son. I hope that when you are older, you will be able to read these words. You were born during my thesis journey and have become the most important person in my life. I love you. Sending you a big hug.

Thanks to the Autonomous University of Barcelona, especially the IDEM doctoral programme, for providing the academic context in which this thesis was developed. Mireia Cirera, thank you so much for your kindness and availability, and for answering all my questions throughout the process.

I also appreciate the valuable comments and suggestions from Alexandra Simon Villar, Maria Teresa Bolívar Ramos, and Victor Giménez, as well as the discussions and feedback received during the IDEM workshops at the Autonomous University of Barcelona.

Finally, I thank the University of Talca for the opportunity to pursue this doctorate. I also thank Christopher Boudreaux for his hospitality and the time he devoted to providing feedback on my research; thanks to his support, my research stay was a very valuable experience. I also thank Florida Atlantic University for allowing me to conduct my research stay on its campus.

Abstract thesis

This doctoral thesis examines how natural disasters influence entrepreneurship and how institutional conditions and crisis-related mechanisms shape these effects. Natural disasters disrupt infrastructure, markets, and expectations, creating uncertainty and urgent needs for recovery and adaptation. Yet their entrepreneurial consequences are not uniform: depending on the outcome examined, natural disasters may discourage entrepreneurial ambition, weaken innovation, or push individuals towards entrepreneurship when other income opportunities become limited. The thesis studies three complementary outcomes: entrepreneurial growth aspirations, innovative entrepreneurship, and necessity-motivated entrepreneurship. Drawing on institutional theory and a crisis perspective, the thesis develops three empirical studies using cross-country, multilevel data. The first study analyses whether natural disasters affect entrepreneurial growth aspirations and whether governance quality moderates this relationship. The findings show that natural disasters reduce growth aspirations, but this negative relationship is mitigated in countries with higher governance quality. The second study examines the relationship between natural disasters and innovative entrepreneurship, focusing on the moderating role of populist discourse. The results show that natural disasters generally discourage innovative entrepreneurship, although this relationship varies across levels of populist discourse. The third study investigates whether opportunity perception and economic uncertainty mediate the relationship between natural disasters and necessity-motivated entrepreneurship. The findings show that both pathways operate, but the uncertainty pathway is stronger than the opportunity pathway. The thesis contributes to entrepreneurship research by showing that the effects of natural disasters depend on the entrepreneurial outcome, the institutional and political context, and the interpretation of crisis conditions. The findings highlight the roles of governance quality, populist discourse, economic uncertainty, and opportunity perception, while offering policy-relevant insights into institutional credibility, predictable political communication, uncertainty reduction, and recovery policies that support entrepreneurial responses to natural disaster crises.

Keywords: Natural disasters · Entrepreneurship · Crisis context · Entrepreneurial growth aspirations · Innovative entrepreneurship · Necessity-motivated entrepreneurship · Institutional quality · Governance quality · Populist discourse

JEL Classification: L26 · M13 · Q54 · O17 · O31 · P16

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Chapter 1

1 General Introduction

1.1 Problem statement and motivation

Natural disasters have become more frequent and severe in recent decades, causing widespread disruption across economic and social systems worldwide (Boudreaux et al., 2021, 2023; Report CRED, 2022). Beyond their immediate human and material costs, these shocks alter infrastructure, supply chains, local markets, and institutional environments, with significant impacts on productive activity and entrepreneurial behaviour (McFarlane & Norris, 2006; Vegt et al., 2015; Zhao et al., 2022). In this context, entrepreneurship is particularly relevant because it is a way in which societies respond to disruption, rebuild productive capacity, and adapt goods and services to post-disaster needs (Eggers, 2020; Miao & Popp, 2014). Therefore, it is important to understand how entrepreneurship responds to natural disasters, as entrepreneurs can contribute to recovery by producing essential goods and services, adapting them to emerging post-disaster needs, rebuilding damaged economic activity, generating employment in affected communities, and, in some cases, creating their own employment when other income opportunities are limited.

In this thesis, natural disasters are conceptualised as exogenous crisis events that originate outside the control of entrepreneurs and organisations, disrupt normal routines and coordination, and create ambiguity about future economic conditions (Pearson & Clair, 1998; Williams et al., 2017). Crisis research emphasises that such events are heterogeneous: they may differ in origin, predictability, scope, scale, and duration, and may be experienced either as discrete shocks or as processes that unfold over time (Doern et al., 2019; Williams et al., 2017). Consistent with the CRED/EM-DAT classification used in this thesis, the empirical chapters focus on natural disasters such as droughts, earthquakes, extreme temperatures, floods, dry mass movements, wet mass movements, storms, volcanic activity, and wildfires. These events are operationalised as annual country-level exposure to disaster impacts, rather than as direct individual exposure to a specific disaster or as permanent residence in an extreme context. Accordingly, the thesis captures cross-country variation in natural disaster exposure and its association with entrepreneurial outcomes, while recognising that more localised, qualitative, or event-level research is better suited to studying chronic exposure, proximity to recurring hazards, and entrepreneurial perseverance in extreme contexts.

The entrepreneurial responses to natural disasters are heterogeneous. Existing research shows that natural disasters can suppress entrepreneurial activity by increasing uncertainty,

disrupting coordination, and limiting access to resources, but they can also stimulate entrepreneurial efforts by highlighting reconstruction needs, creating new market niches, and reshaping opportunities (Boehm et al., 2015; Brück et al., 2011; Carvalho, 2014; Monllor & Murphy, 2017; Zhao et al., 2022). This tension indicates that natural disasters should not be viewed merely as external shocks but also as a specific type of crisis that changes expectations, planning horizons, and the perceived feasibility of entrepreneurial actions (Agarwal & Audretsch, 2020; Doern et al., 2019). Crisis research is therefore useful because it helps explain why the same shock can lead to diverse entrepreneurial responses across actors, contexts, and time horizons.

To address this issue, this thesis examines three complementary entrepreneurial outcomes that capture different dimensions of entrepreneurial response to natural disasters: defensive entry, adaptive innovation, and forward-looking growth expectations. Necessity-motivated entrepreneurship captures a defensive or survival-oriented response, as disasters may reduce paid employment, weaken income security, and push individuals towards self-employment when alternative labour-market options become limited (Bosma et al., 2018; Dencker, Bacq, Gruber, et al., 2021; Puente et al., 2019). Innovative entrepreneurship captures an adaptive response, as post-disaster environments may generate new needs, alter demand conditions, and create pressures to introduce new products, technologies, or processes (Amini-Sedeh et al., 2022; Koellinger, 2008a; Miao & Popp, 2014). Entrepreneurial growth aspirations capture forward-looking growth expectations, reflecting whether entrepreneurs expect to expand, create employment, and develop their ventures despite heightened uncertainty (Autio & Acs, 2010; Capelleras et al., 2019; Estrin et al., 2013). Examining these outcomes together allows the thesis to move beyond a single view of entrepreneurship after disasters and to analyse how the same crisis context may shape why individuals enter entrepreneurship, how entrepreneurs adapt their ventures, and whether they expect future growth. These outcomes are therefore complementary, but they may also move in different directions under disaster conditions, making their joint analysis central to understanding the heterogeneous entrepreneurial consequences of natural disasters.

Each of these outcomes holds significance for different reasons. Growth aspirations warrant attention because previous research on natural disasters and entrepreneurship has mainly concentrated on short-term outcomes such as business entry and survival, leaving the longer-term impacts on entrepreneurial ambitions underexplored (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2021, 2023; Mendoza et al., 2018; Salvato et al., 2020).

Innovative entrepreneurship merits focus because post-disaster environments can either hinder experimentation due to increased uncertainty or encourage it through adaptation, learning, and the emergence of new demands (Miao & Popp, 2014; Vegt et al., 2015; Zhao et al., 2022). Necessity-motivated entrepreneurship deserves attention because it demonstrates how crises may compel individuals to pursue entrepreneurial activities when paid work becomes less available or dependable, capturing a more immediate and defensive form of entrepreneurial response (Audretsch et al., 2022; Dencker, Bacq, Gruber, et al., 2021; Nikiforou et al., 2019). Together, these outcomes are not treated as interchangeable indicators of entrepreneurship, but as distinct dimensions through which natural disasters may reshape entrepreneurial behaviour.

Another reason to study this relationship is that both natural disasters and entrepreneurship are global and multilevel phenomena. Natural disasters occur across countries, yet their impacts vary widely with broader institutional and political conditions. In turn, entrepreneurial responses emerge at the individual level but are shaped by country-level environments that influence uncertainty, incentives, credibility, and access to opportunities (Bjørnskov & Foss, 2016; Estrin et al., 2013; North, 1990; Williamson, 2000). This makes a comparative, multilevel approach particularly appropriate. It also suggests that the effect of natural disasters on entrepreneurship cannot be fully understood through direct relationships alone. Moderating factors are needed to explain when and under which institutional or political conditions natural disasters become more or less harmful to entrepreneurial action.

At the same time, understanding heterogeneous entrepreneurial responses requires attention to the mechanisms through which natural disasters operate. Crisis research suggests that natural disasters disrupt coordination, increase uncertainty, and reconfigure perceived opportunities (Agarwal & Audretsch, 2020; Doern et al., 2019). Institutional theory further suggests that entrepreneurs interpret these disruptions through the surrounding rules, signals, and political environments that shape expectations and decision-making (Acemoglu & Robinson, 2012; Dixit, 2009; North, 1990; Williamson, 2000). Therefore, moderators help explain the conditions under which the effects of natural disasters vary, while mediators help explain the processes through which these effects unfold. This distinction motivates the need to examine entrepreneurial responses to natural disasters across different outcomes, institutional conditions, and crisis-related mechanisms.

1.2 Main research objectives

The main aim of this thesis is to deepen the understanding of how natural disasters influence entrepreneurship, along with the institutional conditions and underlying mechanisms that shape these effects. Recognising that entrepreneurial responses to natural disasters are diverse, and that no single outcome can fully capture this complexity, the thesis focuses on three complementary entrepreneurial outcomes: entrepreneurial growth aspirations, innovative entrepreneurship, and necessity-motivated entrepreneurship. Although this approach does not encompass all potential entrepreneurial consequences of natural disasters, it enables the thesis to explore how shocks linked to natural disasters affect entrepreneurship across different temporal and strategic dimensions.

The thesis examines three objectives. First, to examine the relationship between natural disasters and entrepreneurial growth aspirations, and to analyse whether governance quality moderates this relationship. Second, to investigate the link between natural disasters and innovative entrepreneurship, and to assess whether populist discourse moderates this relationship. Third, to examine the connection between natural disasters and necessity-motivated entrepreneurship, and to test whether economic uncertainty and perceptions of opportunity mediate this relationship.

These objectives provide a more comprehensive understanding of entrepreneurial responses to natural disasters by integrating institutional conditions and underlying mechanisms within a multilevel and cross-country framework. By exploring how natural disasters impact various entrepreneurial outcomes, and under which political, institutional, and crisis-related conditions these effects vary, this thesis contributes to entrepreneurship research and provides insights for policies that support growth-oriented, innovative, and necessity-driven entrepreneurial responses in crisis contexts.

1.3 Theoretical framework

This thesis is grounded primarily in institutional theory and is complemented by a crisis perspective. Institutional theory provides the main theoretical foundation for explaining why entrepreneurial responses to natural disasters vary across countries and contexts. In turn, a crisis perspective helps explain how disruptive events alter entrepreneurial environments and trigger competing mechanisms of uncertainty and opportunity (Agarwal & Audretsch, 2020; Doern et al., 2019; Pearson & Clair, 1998; Williams et al., 2017). Together, these perspectives enable the thesis to explain not only

whether natural disasters affect entrepreneurship, but also why these effects differ across entrepreneurial outcomes, institutional conditions, and underlying mechanisms.

Institutional theory understands institutions as the formal and informal rules that structure social, political, and economic exchange (North, 1990). Formal institutions include laws, regulations, property rights, contract enforcement, and governance arrangements, whereas informal institutions encompass norms, values, beliefs, and shared expectations that shape behaviour and legitimacy. This distinction is central to new institutional economics (NIE), in which institutions operate at different levels, from deeply embedded social norms to formal rules and governance structures that organise transactions and reduce uncertainty (Williamson, 2000). For entrepreneurship, institutions matter because they shape the incentives, constraints, and expected returns associated with entrepreneurial action, influencing whether entrepreneurial effort is directed towards productive, unproductive, or destructive activities (Acemoglu & Robinson, 2012; Baumol, 1990). This thesis builds on this logic by distinguishing between formal institutional conditions, captured by governance quality, and political-institutional signals, captured by populist discourse, which shape how entrepreneurs interpret and respond to natural disasters.

Building on this view, entrepreneurship does not occur in a vacuum. Entrepreneurs make decisions within broader institutional environments that shape incentives, constraints, uncertainty, and the credibility of economic exchange (Acemoglu & Robinson, 2012; North, 1990; Williamson, 2000). Institutions define the "rules of the game" by shaping property rights, contract enforcement, regulatory predictability, access to resources, and trust in public and private coordination (Bjørnskov & Foss, 2016; Dixit, 2009; Estrin et al., 2013). These conditions become especially important after natural disasters, when uncertainty rises and entrepreneurs must decide whether to invest, innovate, grow, or enter entrepreneurship amid greater instability. From this perspective, similar natural disasters may elicit different entrepreneurial responses depending on the institutional context in which they occur.

This institutional perspective is particularly useful for understanding how governance quality and populist discourse moderate outcomes. Governance quality reflects the strength and credibility of formal institutions, including voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption (Kaufmann et al., 1999). Strong governance can reduce uncertainty, improve coordination, protect contracts, and increase entrepreneurs' confidence in recovery processes (Dixit, 2009; Webb et al., 2020). By contrast, weak governance can amplify uncertainty, raise transaction

costs, and reduce the feasibility of entrepreneurial action. Populist discourse also matters from an institutional perspective because political discourse signals the credibility, predictability, and stability of the institutional environment. When political discourse weakens trust, increases regime uncertainty, or undermines expectations about future rules, it can shape whether entrepreneurs interpret post-disaster conditions as opportunities or threats (Acemoglu et al., 2013; Bennett et al., 2023; Pappas, 2019; Rodrik, 2018; Tang et al., 2024; Yoon et al., 2024).

A crisis perspective views crises as disruptive episodes that threaten existing routines, create time pressure, and increase uncertainty about future conditions (Pearson & Clair, 1998; Williams et al., 2017). In entrepreneurship research, this perspective is useful because crises alter the conditions under which entrepreneurs evaluate opportunities, mobilise resources, and coordinate with stakeholders. Rather than assuming that crises produce a single type of entrepreneurial response, the crisis perspective emphasises that disruptive events can generate both constraints and possibilities. Some entrepreneurs may postpone entry, innovation, or growth because crises increase uncertainty and restrict access to resources, whereas others may respond by recombining resources, addressing urgent market needs, or creating new ventures under necessity conditions (Aparicio et al., 2025; Doern et al., 2019; Monllor & Murphy, 2017). This makes the crisis perspective particularly relevant for explaining why natural disasters can have heterogeneous effects across different forms of entrepreneurship.

Applied to natural disasters, this perspective clarifies that these events are sudden, external, and disruptive shocks. Natural disasters damage infrastructure, interrupt routines, disrupt coordination, and increase ambiguity about future economic conditions (Boehm et al., 2015; Carvalho, 2014; Doern et al., 2019; Vegt et al., 2015; Zhao et al., 2022). This matters because such disruptions do not prompt a single entrepreneurial response. Instead, they can activate competing mechanisms. On the one hand, natural disasters may increase uncertainty, shorten planning horizons, constrain access to resources, and discourage entrepreneurial action (Bylund & McCaffrey, 2017; Schultz, 1975). On the other hand, they may reconfigure markets, create reconstruction needs, and open space for adaptation and opportunity recognition (Brück et al., 2011; Monllor & Murphy, 2017; Starbuck et al., 1978). Thus, the crisis perspective helps explain why the consequences of natural disasters for entrepreneurship are theoretically ambiguous and empirically heterogeneous.

The combination of institutional theory and a crisis perspective provides the thesis with theoretical unity. Institutional theory explains why the effects of natural disasters depend on broader governance and political environments, while the crisis perspective explains how natural disasters activate mechanisms of uncertainty and opportunity. This distinction is reflected across the three empirical chapters. Chapter 2 uses institutional theory to examine whether a formal institution, i.e. governance quality, moderates the relationship between natural disasters and entrepreneurial growth aspirations. Chapter 3 extends this institutional logic by analysing whether an informal institution, i.e., populist discourse conditions the relationship between natural disasters and innovative entrepreneurship. Chapter 4 draws more directly on the crisis perspective by examining economic uncertainty and opportunity perception as mediating mechanisms linking natural disasters to necessity-motivated entrepreneurship.

Overall, this framework positions natural disasters as crises whose entrepreneurial effects are shaped by institutional conditions and transmitted through crisis-related mechanisms. Institutional theory provides the core explanation for contextual variation, while the crisis perspective specifies the mechanisms through which disruption affects entrepreneurial behaviour. This integrated framework enables the thesis to move beyond a direct-effects view of natural disasters and to develop a more nuanced explanation of how, when, and through which mechanisms natural disasters influence entrepreneurship.

1.4 Main contributions

The main contribution of this thesis is to improve the understanding of how natural disasters affect entrepreneurship by demonstrating that their impacts are heterogeneous rather than uniform. Instead of viewing entrepreneurship as a single outcome, the thesis explores three related entrepreneurial responses: entrepreneurial growth aspirations, innovative entrepreneurship, and necessity-motivated entrepreneurship, and explains how these responses differ based on institutional settings and underlying mechanisms. In doing so, the thesis moves beyond a one-dimensional view of post-disaster entrepreneurship and develops a more comprehensive account of how crises influence entrepreneurial behaviour across different timescales, strategies, and contexts. This contribution is enhanced by a comparative, multilevel, and cross-country approach that links individual entrepreneurial outcomes with broader institutional and political environments at the national level.

The first contribution is to expand the literature on natural disasters and entrepreneurship by incorporating the less-studied outcome of entrepreneurial growth aspirations. Prior research has mainly concentrated on short-term results such as business entry and survival, whereas this chapter shifts the focus to entrepreneurs' long-term ambitions (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2021, 2023; Mendoza et al., 2018; Salvato et al., 2020). Furthermore, it demonstrates that governance quality moderates the link between natural disasters and growth aspirations, helping to explain when disaster-related shocks are more likely to dampen ambition and when strong institutions can alleviate those effects (Epure et al., 2024; Estrin et al., 2013; North, 1990). In doing so, the chapter advances research on institutions and entrepreneurship during crises and aligns this discussion with broader calls to reconsider entrepreneurship under conditions of multiple simultaneous crises (Klyver & McMullen, 2025; Shantz & McMullen, 2024).

The second contribution is to deepen comprehension of the link between natural disasters and innovative entrepreneurship by clarifying why previous findings have been inconsistent. This chapter points out that natural disasters generally hinder innovative entrepreneurship at the individual level, thereby moving analysis beyond sectoral or patent-based innovation metrics (Miao & Popp, 2014; Zhao et al., 2022). It also introduces populist discourse as a political factor influencing this relationship, showing that the entrepreneurial effects of natural disasters depend not only on the shock itself but also on the political environment in which entrepreneurs interpret uncertainty and opportunities (Bennett et al., 2023; Tang et al., 2024; Yoon et al., 2024). In this way, the chapter integrates political discourse into the literature on natural disasters and entrepreneurship, demonstrating how populism can moderate the balance between uncertainty and opportunity.

The third contribution is to shift focus from boundary conditions to underlying mechanisms, explaining how natural disasters influence entrepreneurship. While much of the existing literature concentrates on moderators, this chapter explores how natural disasters translate into necessity-motivated entrepreneurship through economic uncertainty and perceptions of opportunity (Audretsch et al., 2022; Dencker, Bacq, Gruber, et al., 2021; Doern et al., 2019). It contributes by situating natural disasters within a broader crisis framework and by refining opportunity-based interpretations through the distinction between macro-level opportunity creation and individual-level opportunity perception (Agarwal & Audretsch, 2020; Doern et al., 2019; Monllor & Murphy, 2017). This explanation is further supported by mediation analysis and KHB decomposition, which help

identify how these mechanisms operate. The findings deepen understanding of how crisis conditions translate into entrepreneurial responses, revealing that the pathway through uncertainty is more influential than that through opportunity.

These contributions demonstrate that entrepreneurship after natural disasters cannot be understood through a single outcome, a single institutional condition, or a single explanatory mechanism. The thesis shows that different entrepreneurial responses emerge depending on whether the focus is on long-term ambitions, innovative adaptation, or necessity-motivated action, and whether the relevant explanations relate to institutional quality, political discourse, or mediating processes. Overall, the thesis enriches entrepreneurship research by providing a more nuanced and theoretically integrated perspective on how natural disasters shape entrepreneurial activity across varied crisis contexts.

1.5 Structure, data and methods

This doctoral thesis is organised as follows. Chapter 1 provides a general introduction to the thesis, including the research problem, objectives, theoretical framework, main contributions, and an overview of the structure, data, and methods. Chapter 2, the first empirical study, investigates the relationship between natural disasters and entrepreneurial growth aspirations, emphasising the moderating role of governance quality. The chapter begins with an introduction, followed by a review of relevant literature and the development of theoretical arguments and hypotheses. It then describes the data, variables, and econometric strategy, and concludes with the empirical results, robustness checks, and a discussion of the main findings, contributions, policy implications, limitations, and future research. Chapter 3 examines the connection between natural disasters and innovative entrepreneurship, paying particular attention to the moderating effect of populist discourse. Chapter 4 examines the link between natural disasters and necessity-motivated entrepreneurship, focusing on economic uncertainty and opportunity perception as mediating mechanisms. Chapters 3 and 4 follow a structure similar to that of Chapter 2, including an introduction, literature review, theoretical development and hypotheses, data and methodology, results, discussion, and conclusion. Finally, Chapter 5 presents the thesis's general conclusions. It summarises the key findings across the three studies, discusses their broader theoretical and practical implications, and outlines the main limitations of the research along with suggestions for future research.

Across the three empirical studies, the thesis uses cross-country, multilevel quantitative data that combine individual-level information from the Global Entrepreneurship Monitor (GEM) with country-level indicators from international databases. Natural disaster measures are drawn from the Centre for Research on the Epidemiology of Disasters (CRED), while institutional, political, and macroeconomic variables are obtained from sources such as the Worldwide Governance Indicators (WGI), the Global Populism Database (GPD), the Fraser Institute (FI), and the World Development Indicators (WDI). This structure allows the thesis to link individual entrepreneurial outcomes to national-level shocks, institutional conditions, and crisis-related mechanisms. Methodologically, the empirical chapters use multilevel models to account for the nesting of individuals within countries, including multilevel mixed-effects and multilevel logistic models, as well as mediation analysis and KHB decomposition in Chapter 4.

Table 1 provides an overview of the key characteristics, the thesis structure, and the data and methods.

At the time of thesis submission, none of the empirical chapters had been published as journal articles. Chapter 2 has been developed as a manuscript, presented at academic conferences in Pamplona and at the Babson conference to solicit feedback, and previously submitted to a leading peer-reviewed journal. The feedback received will inform further revisions before a future journal submission. Chapter 3 is currently under review at a peer-reviewed journal. Chapter 4 has not yet been submitted to a journal. Therefore, the empirical chapters are presented in this thesis as unpublished doctoral research.

Table 1: Summary and structure of the research

Chapter	Key literature and theoretical framework	Key variables	Moderator and Mediator variables	Sample and methods	Contributions
Chapter 2. Natural Disasters and Entrepreneurial Growth Aspirations: The Role of Governance Quality	Growth aspirations literature (Autio & Acs, 2010; Capelleras et al., 2019; Covin & Wales, 2012; Delmar & Wiklund, 2008; Epure et al., 2023; Estrin et al., 2013; Hermans et al., 2015). Natural disasters literature (Boudreaux et al., 2019, 2021, 2023; Cordero, 2023; Dutta, 2017; Eggers, 2020; McFarlane & Norris, 2006; Mechler, 2003; Mendoza et al., 2018; Salvato et al., 2020; Spillius, 1957). Institutional theory (Acemoglu & Robinson, 2012; Bjørnskov & Foss, 2016; Bylund & McCaffrey, 2017; Dixit, 2009; Epure et al., 2023; Estrin et al., 2013; Kaufmann et al., 1999; North, 1990; Webb et al., 2020; Williamson, 2000).	DV: Entrepreneurial growth aspirations (GEM) IV: Natural disasters (CRED)	Moderator: Governance quality (WGI)	91,997 individual observations across 79 countries between 2004 and 2019. Multilevel mixed-effects model	1. We extend the research on natural disasters and entrepreneurship by moving beyond survival and entry to focus on entrepreneurs' long-term growth aspirations. 2. We show that governance quality moderates the relationship between natural disasters and entrepreneurial growth aspirations, highlighting how institutional dimensions such as regulatory quality, rule of law, and government effectiveness shape entrepreneurial responses under conditions of shock.
Chapter 3. Natural Disasters and Innovative Entrepreneurship: The Role of Populism	Innovative entrepreneurship literature (Amini-Sedeh et al., 2022; Koellinger, 2008a; Miao & Popp, 2014). Natural disasters literature (Boehm et al., 2015; Boudreaux et al., 2019, 2021, 2023; Brück et al., 2011; Carvalho, 2014; Monllor & Murphy, 2017; Starbuck et al., 1978; Vegt et al., 2015; Zhao et al., 2022). Populism literature (Acemoglu et al., 2013; Bennett et al., 2023; Pappas, 2019; Rodrik, 2018; Tang et al., 2024).	DV: Innovative entrepreneurship (GEM) IV: Natural disasters (CRED)	Moderator: Populist discourse (GPD)	60,631 individual observations across 45 countries between 2002 and 2019. Multilevel logit model.	1. We demonstrate that natural disasters weaken innovative entrepreneurship at the individual level. 2. We introduce the level of populism as a political factor that moderates the relationship between disasters and innovative entrepreneurship.
Chapter 4 Natural Disasters and Necessity-Motivated Entrepreneurship: Mediating Role of Opportunity and Uncertainty	Necessity-motivated entrepreneurship literature (Audretsch et al., 2022; Bosma et al., 2018; Dencker, Bacq, Gruber, et al., 2021; Nikiforou et al., 2019; Puente et al., 2019). Crisis research (Agarwal & Audretsch, 2020; Doern et al., 2019; Pearson & Clair, 1998; Williams et al., 2017). Opportunity and uncertainty mechanisms (Bennett et al., 2023; Boudreaux et al., 2023; Tang et al., 2024)	DV: Necessity-motivated entrepreneurship (GEM) IV: Natural disasters (CRED)	Mediators: Economic uncertainty (FI) and opportunity perception (GEM)	95,309 individual observations across 83 countries between 2004 and 2019. Multilevel design, mediation analysis and KHB method.	1. We situate natural disasters within a broader crisis lens and integrate crisis entrepreneurship theory with the disaster domain. 2. We refine opportunity-based expectations by distinguishing between aggregate-level opportunity creation and individual-level opportunity perception. 3. We directly and indirectly test and compare the uncertainty and opportunity pathways, documenting partial mediation with a dominant direct effect.

Note: GEM is the Global Entrepreneurship Monitor, and its data website is https://www.gemconsortium.org/data; CRED is the Centre for Research on the Epidemiology of Disasters and its data website is https://www.emdat.be/; WGI is the Worldwide Governance Indicators, and its data website is https://databank.worldbank.org/source/worldwide-governance-indicators; and GPD is the Global Populism Database, and its data website is https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/LFTQEZ.

Chapter 2

2 Natural Disasters and Entrepreneurial Growth Aspirations: The Role of Governance Quality

2.1 Abstract

Previous research has examined the short-term impacts of natural disasters on entrepreneurial activity. Yet, our focus is on entrepreneurial growth aspirations, a long-term concept. Drawing on institutional theory, we use a framework suggesting that natural disasters trigger two opposing mechanisms: uncertainty, which suppresses entrepreneurial ambition, and opportunity, which stimulates it. We argue that the quality of governance can moderate this relationship by triggering the opportunity mechanism in an environment of trust and predictability, or the uncertainty mechanism in the opposite context. To test our hypotheses, we construct a panel comprising 79 countries affected by natural disasters between 2004 and 2019, encompassing 91,997 observations. We estimate a multilevel mixed-effects model. The results demonstrate that, although natural disasters reduce growth aspirations, this adverse effect is mitigated when institutional quality is high. The level of governance moderates the effects of uncertainty and opportunity. High governance stimulates opportunities, while low governance increases damage.

2.2 Introduction

Natural disasters have long captured the attention of researchers from diverse disciplines, due to their profound and far-reaching effects on individuals and societies (Mechler, 2003). In entrepreneurship research, natural disasters are viewed as exogenous shocks that shape business activity and strain the institutional systems of affected countries (McFarlane & Norris, 2006; Vegt et al., 2015). Institutional quality encompasses dimensions such as government effectiveness, rule of law, and control of corruption (Bjørnskov & Foss, 2016; Estrin et al., 2013; North, 1990; Williamson, 2000); these dimensions shape incentives and risk perceptions and thus moderate the effects of crises like natural disasters on entrepreneurship (Boudreaux et al., 2023). Entrepreneurship is vital in disaster recovery, rebuilding lost capacity and providing goods and services adapted to local needs. The survival of businesses and increased uncertainty during crises present significant challenges, demanding adaptable strategies and institutional support (Eggers, 2020). The “natural disaster–institutions–entrepreneurship” trilogy offers a novel perspective, highlighting post-

shock mechanisms of uncertainty and opportunity, along with the moderating role of institutional quality in mitigating adverse effects on entrepreneurial activity.

However, in the context of natural disasters, entrepreneurial activity is typically examined with a short-term focus, emphasising the creation and survival of new ventures (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2021, 2023; Mendoza et al., 2018; Salvato et al., 2020). While this view is valuable, it leaves unexplored how such uncertainty affects longer-term entrepreneurial expectations, especially regarding growth ambitions. On one hand, natural disasters might prompt opportunity-seeking behaviour; on the other, it could lead to cautious strategies that limit ambitions. The institutional environment adds further complexity: although some studies highlight the role of institutions during crises (Epure et al., 2024), it remains unclear how governance quality interacts with natural disaster link uncertainty to influence entrepreneurs' long-term goals. Hence, there is an unresolved theoretical tension: do natural disasters encourage or discourage entrepreneurial growth aspirations, and what role do institutional conditions play?

Failing to consider the long-term ambitions of entrepreneurs following a natural disaster is a significant issue. Entrepreneurs not only contribute to immediate recovery but also promote the long-term growth and resilience of affected economies. Another significant issue is the rise in natural disasters in recent decades. The frequency and intensity of natural disasters have displayed a significant upward trend. In 1970, fewer than 100 catastrophic events were recorded annually, a figure that quadrupled by 2010 (Boudreaux et al., 2023). We know that entrepreneurial ambition is crucial for business expansion, job creation, and innovation (Covin & Wales, 2012; Delmar & Wiklund, 2008), but we still have limited understanding of how natural disasters influence growth aspirations. Some research examines personal traits such as entrepreneurial orientation and socioemotional wealth (Alonso-Dos-Santos & Llanos-Contreras, 2019). Moreover, although good governance can help reduce uncertainty, it remains unclear whether it also fosters or limits entrepreneurial ambition over the medium and long term in the context of natural disasters.

The purpose of this chapter is to investigate how natural disasters affect entrepreneurial growth aspirations and whether the quality of governance moderates this relationship. We integrate natural disaster impact data from the Centre for Research on the Epidemiology of Disasters (CRED) with Global Entrepreneurship Monitor (GEM) microdata on entrepreneurial intentions and characteristics, along with governance quality metrics from the World Governance Indicators (WGI), in a multi-year, cross-country panel analysis. We

employ a multilevel mixed-effects model that captures both within-country variation and between-country variation. The first hypothesis seeks to determine whether natural disasters hinder or promote entrepreneurial growth ambitions. The second hypothesis suggests that high governance stimulates opportunities, whereas low governance exacerbates damage in natural disaster contexts. Additionally, a higher level of governance quality mitigates the negative impact of natural disasters on entrepreneurial growth aspirations. This approach highlights not only immediate responses but also the long-term expectations of ambitious entrepreneurs in natural disaster settings.

Our study presents at least two contributions. First, we offer a theoretical contribution by linking the literature on natural disasters to the underexplored outcome of long-term growth aspirations. We complement prior work (Boudreaux et al., 2021, 2023; Mendoza et al., 2018; Salvato et al., 2020) on entry and survival by adopting a forward-looking, ambition-based perspective on how shocks shape entrepreneurs' long-term growth orientation. Our work demonstrates that natural disasters do not just have short-term effects but also long-term effects through entrepreneurial growth aspirations. Second, we demonstrate that governance quality moderates the impact of natural disasters on entrepreneurial growth aspirations. This adds to our knowledge on the role of institutions during crisis episodes. While work has considered how pro-market institutions affect entrepreneurial growth aspirations during crisis episodes (Epure et al., 2024), our study suggests that institutions also play an important role in encouraging entrepreneurship during these episodes. Lastly, our work aligns with recent calls to rethink entrepreneurship under poly-crisis conditions, where overlapping, causally entangled crises challenge core assumptions of stability (Klyver & McMullen, 2025), and with the Humanistic turn, with emphasises a focus on entrepreneurs as whole persons navigating complex contexts (Shantz & McMullen, 2024).

2.3 Literature review

Natural disasters represent exogenous shocks with significant socioeconomic effects, impacting infrastructure, supply chains, and institutions (McFarlane & Norris, 2006; Report CRED, 2022; Vegt et al., 2015). Within the field of entrepreneurship, some studies examine the short-term repercussions of these events on new business formation and firm survival (Boudreaux et al., 2021, 2023; Mendoza et al., 2018), describing mechanisms of uncertainty (disruption of resources and information) and opportunity (new emerging market niches)

(Brück et al., 2011; Epure et al., 2024). However, studies primarily focus on short-term horizons (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2021, 2023), neglecting the development of entrepreneurs' growth aspirations beyond the initial recovery phase. Since growth aspirations affect investment, employment, and innovation, the lack of a long-term perspective restricts both theoretical progress and the formulation of policies that support high-potential ventures in the post-disaster stages. Consequently, there is an issue in understanding how shocks affect long-term growth aspirations under different levels of institutional quality. We will address these points below.

2.3.1 Natural disasters and ambitious entrepreneurship

In recent decades, the frequency and intensity of natural disasters have displayed a significant upward trend. In 1970, fewer than 100 catastrophic events were recorded annually, a figure that quadrupled by 2010 (Boudreaux et al., 2023). In 2021, the Centre for Research on the Epidemiology of Disasters (CRED) reported 432 disasters, resulting in 10,492 fatalities, 101.8 million people affected, and economic losses of USD 252.1 billion. Floods emerged as the most prevalent type of disaster, with 223 events compared to an average of 163 between 2001 and 2020 (Report CRED, 2022). These exogenous shocks substantially alter the infrastructure, supply chains, and institutional systems of the affected countries, thereby creating a context of profound socioeconomic impact (McFarlane & Norris, 2006). The first academic article on natural disasters was written by Spillius (1957), who provided an ethnographic and operational-research account of two cyclones and a political crisis on Tikopia. Reviews of case studies further highlight the necessity for broader, comparative, quantitative frameworks (Vegt et al., 2015), especially given recent research documenting the vulnerability and recovery dynamics of small family firms after large-scale disasters (Mahto et al., 2022).

The specialised literature identifies two opposing theoretical mechanisms that emerge after a natural disaster. First, uncertainty increases abruptly when storms, earthquakes, or floods damage roads, ports, and logistics networks, as well as disrupting production plants and telecommunications networks. These disruptions raise transaction costs and heighten the perception of risk among entrepreneurs, who grapple with questions regarding recovery times, the reliability of suppliers, and the stability of post-crisis regulatory frameworks (Boehm et al., 2015; Carvalho, 2014; Schultz, 1975). For instance, empirical studies demonstrate that disasters with severe impacts reduce investment in expansion projects and

dissuade the undertaking of capital-intensive growth initiatives (Cordero, 2023). Moreover, Dutta (2017) demonstrates that pre-existing organisational networks and resilience mechanisms can buffer firms against the adverse growth shocks resulting from natural disasters.

In contrast, the same destruction can reveal urgent market niches that did not previously exist (opportunities), such as reconstruction services, emergency logistics, and risk management. According to the theory of prospective entrepreneurship, these emerging spaces offer signals of scalability and potential returns, which can boost the growth aspirations of entrepreneurs who identify and capitalise on these opportunities (Brück et al., 2011; Monllor & Murphy, 2017; Starbuck et al., 1978). The emergence of these opportunities largely depends on entrepreneurs' ability to access resources, information, and institutional support networks. In the absence of a stable environment, these demands may go unmet, as a lack of financing and uncertainty in contract fulfilment often inhibit the materialisation of ambitious projects (Epure et al., 2024).

Despite the relevance of both mechanisms, most research has concentrated on new venture creation or short-term survival, neglecting the examination of entrepreneurs' growth aspirations following exogenous shocks. This issue hinders an understanding of how entrepreneurial expansion ambition is influenced by the tension between uncertainty and opportunity in natural disaster contexts (Boudreaux, Escaleras, et al., 2019; Capelleras et al., 2019; Estrin et al., 2013).

2.3.2 The quality of governance and natural disasters

Institutional theory postulates that formal institutions, comprising laws, regulations, and oversight bodies, constitute the framework within which economic activity develops (North, 1990; Williamson, 2000). In this sense, the quality of governance encompasses dimensions such as voice and accountability, political stability, government effectiveness, regulatory quality, the rule of law, and control of corruption, all of which contribute to the predictability of the rules of the game and bolster the confidence of economic agents (Kaufmann et al., 1999). Extensive macro-level research shows that institutions underpin entrepreneurship (Aidis et al., 2012; Aparicio et al., 2026; Assenova, 2021; Autio & Acs, 2010; Baumol, 1990, 1993, 1996; Bjørnskov & Foss, 2016; Capelleras et al., 2025; Chowdhury et al., 2019; Eberhart et al., 2017; Mukhtar et al., 2022; Rodríguez-Pose, 2013). In natural disaster contexts, these dimensions become especially pertinent. A government

with high administrative effectiveness can mobilise and allocate resources swiftly, reconstructing critical infrastructure and restoring essential services in shorter timeframes, which diminishes the initial phase of uncertainty. Similarly, a robust judicial system and low levels of corruption enhance legal certainty, ensuring that contracts for the provision of inputs or post-disaster insurance are honoured and that recovery funds are not diverted into informal practices (Dixit, 2009; North, 1990; Williamson, 2000). At the same time, the existence of effective channels for accountability and citizen participation enables entrepreneurs and communities to influence the prioritisation and oversight of reconstruction projects, aligning incentives and promoting a coordinated response (Webb et al., 2020).

Some studies provide evidence that governance can mitigate the adverse effects of entrepreneurial activity following disasters (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2021, 2023). They demonstrate that in countries with high levels of regulatory effectiveness and the rule of law, new business formation recovers more swiftly after catastrophic events. (Bustamante et al., 2022) document that, in the case of hurricanes in the Caribbean, government response capacity positively correlates with business recovery. At the micro level, research conducted by Epure et al. (2024) and Wei et al. (2023) reveals that entrepreneurs who depend on institutional strength support greater growth ambitions and social entrepreneurship during crises. However, none of these studies examines how governance quality influences entrepreneurial growth aspirations in the context of natural disasters. This shortcoming motivates us to explore how formal institutions can convert the exogenous shock of a disaster into an opportunity for entrepreneurial ambition.

2.4 Theory and hypothesis

As discussed in the literature, we identify a need to theorise how these forces function in the long term to shape entrepreneurs' growth aspirations. Studies emphasise entry or immediate survival decisions but provide little guidance on the evolution of expansion objectives beyond the initial recovery phase. This issue is crucial because a clear theoretical foundation is necessary to derive hypotheses that capture both the direct effect of disasters on growth aspirations and the conditions under which the institutional context may moderate this effect. In the following subsections, we develop arguments based on the specific mechanisms linking natural disasters and growth aspirations and on institutional theory to address governance moderation, thereby justifying our two central hypotheses: first, that

natural disasters can weaken or stimulate growth aspirations; and second, that high-quality governance mitigates this negative impact.

2.4.1 Linking natural disasters to entrepreneurial growth aspirations

Growth aspirations refer to the expansion goals that entrepreneurs set for their businesses, such as increasing staff, boosting sales, or expanding operations into new markets (Capelleras et al., 2019; Estrin et al., 2013; Hermans et al., 2015). In this study, we identify two mechanisms operating after a natural disaster that, while in tension, can influence these aspirations: uncertainty and opportunity.

Uncertainty mechanism. The uncertainty arises from the loss of reliable information about the economic environment and the temporal uncertainty surrounding recovery. According to Schultz (1975), this uncertainty intensifies risk aversion, as it complicates the estimation of future costs and benefits. When roads, ports, and communication networks become inoperative, entrepreneurs lack accurate data on delivery times, input availability, and price stability (Carvalho, 2014). Furthermore, rising risk premiums and credit restrictions increase the cost of financing and limit access to the capital required for expansion projects (Boehm et al., 2015). This environment of operational and financial risk compels entrepreneurs to adopt more conservative strategies, prioritising survival over growth ambitions (Bullough et al., 2014). Based on this reasoning, we propose the following hypothesis.

Hypothesis 1a: An increase in natural disasters will discourage entrepreneurial growth aspirations.

Opportunity mechanism. In addition to these discouraging effects, there are also reasons to believe that natural disasters might encourage entrepreneurial growth aspirations. Opportunities arise from the reconfiguration of markets following the natural disaster's exogenous shock. For instance, infrastructure destruction and the urgency of reconstruction services generate demand in areas that previously did not exist, like housing rehabilitation projects, drinking water provision, and emergency logistics. These new needs present opportunities and potential returns for those who identify and exploit such new market demands (Brück et al., 2011; Monllor & Murphy, 2017; Starbuck et al., 1978). The realisation of these opportunities hinges on entrepreneurs' ability to access information, financing, and institutional support networks, as the absence of a stable environment

complicates the execution of ambitious projects (Epure et al., 2024). Based on this reasoning, we propose the following alternative hypothesis.

Hypothesis 1b: An increase in natural disasters will encourage entrepreneurial growth aspirations.

Although some entrepreneurs might exploit these opportunities in later stages, we also think that others might lower their growth ambitions. In other words, it is not straightforward to determine the link between natural disasters and growth ambitions because of the long-term aspect. We believe it is essential to consider an additional factor to more accurately determine whether the uncertainty mechanism or the opportunity mechanism prevails.

2.4.2 Institutional governance quality as a moderator

The quality of governance is articulated through six interrelated mechanisms that shape the predictability of the institutional environment and reduce the perception of risk following a natural disaster (Acemoglu & Robinson, 2012; Bylund & McCaffrey, 2017; Kaufmann et al., 1999). First, voice and accountability provide citizens and entrepreneurs with formal channels for participation and oversight of government actions, enabling decisions on reconstruction priorities and resource allocation to align with the needs of the private sector. This, in turn, strengthens trust in public management. The second dimension, political stability and the absence of violence, ensures the continuity of authorities and the rules of the game, avoiding abrupt changes that would increase uncertainty. In a post-disaster context, this stability fosters a predictable scenario where recovery policies remain in place and long-term agreements gain greater reliability (North, 1990). Third, government effectiveness translates into the ability of state institutions to swiftly mobilise human and material resources, restore critical infrastructure, and ensure basic services. An efficient administrative response shortens the initial shock phase, reducing the window of uncertainty and enabling entrepreneurs to better project their expansion goals into recovery times (Dixit, 2009). Regulatory quality, the fourth dimension, signifies the existence of agile rules and procedures that facilitate the recovery of business operations, such as swiftly issued reconstruction permits or clear protocols for importing emergency supplies (Levie & Autio, 2011). By minimising post-crisis bureaucracy, this dimension reduces transaction costs and the risk of unforeseen delays. The rule of law, the fifth dimension, guarantees the enforcement of contracts and the impartial resolution of disputes. After a natural disaster,

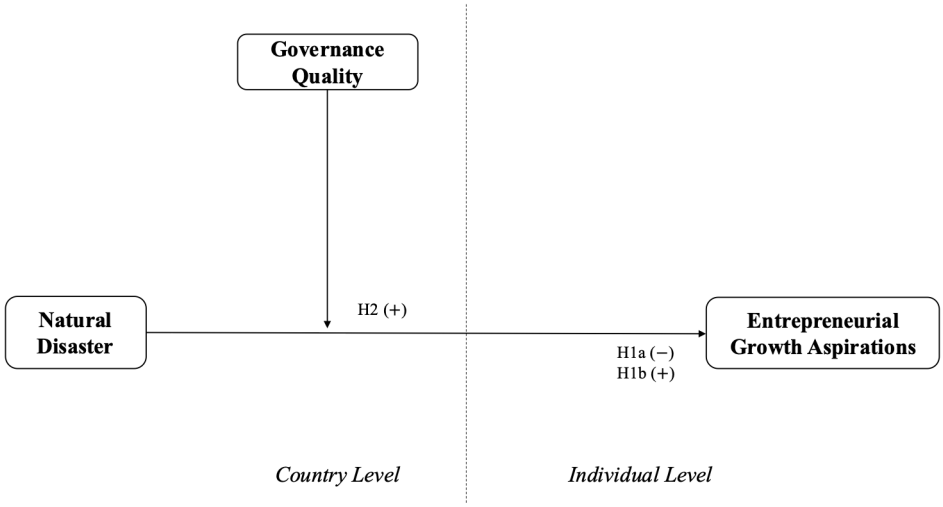
legal certainty ensures that financing, insurance, and supply agreements are executed as intended, thereby minimising losses due to non-compliance or expropriation (Levie & Autio, 2011; Williamson, 2000). Sixth, controlling corruption prevents the diversion of public funds and the misappropriation of resources intended for reconstruction. An environment characterised by low levels of corruption effectively directs state aid and private investment towards productive projects, minimising hidden costs and generating reliable signals for entrepreneurs (Dixit, 2009). Together, these six dimensions of governance work synergistically to alleviate the initial uncertainty caused by natural disasters and support growth aspirations.

Based on the moderating role of institutions in the context of natural disasters, we argue that the opportunity mechanism dominates the uncertainty mechanism when governance quality is high, and vice versa when governance quality is low. High-quality governance mitigates the adverse effects of disasters on growth aspirations by reducing uncertainty and increasing opportunities. By fostering trust and facilitating information flows, high-quality governance enables entrepreneurs to identify problems early and develop solutions more swiftly. In contrast, low governance quality increases uncertainty and discourages entrepreneurial action. The trust, transparency, and legal certainty associated with high-quality governance strengthen entrepreneurs' confidence to invest in goods and services that meet post-disaster demands. Consequently, strong governance can stimulate entrepreneurial growth aspirations while mitigating the adverse effects of natural disasters. Thus, governance quality is expected to make the relationship between natural disasters and entrepreneurial growth aspirations more favourable, either by attenuating negative effects when uncertainty dominates or by strengthening positive effects when post-disaster opportunities arise. Based on this reasoning, we propose the following hypothesis.

Hypothesis 2: Governance quality positively moderates the relationship between natural disasters and entrepreneurial growth aspirations.

Figure 1 illustrates the conceptual model. This model shows the relationships among variables and hypotheses in the analysis. The first link is a natural disaster with entrepreneurial growth aspirations. The second relationship, regarding governance quality, moderates the relationship between natural disasters and entrepreneurial growth aspirations.

Figure 1: Multilevel conceptual framework



2.5 Data and methodology

2.5.1 Data

We construct our database from several data sources. Database for a panel comprising 79 countries between 2004 and 2019, encompassing 91,997 individual observations at the entrepreneur level. We merge data from the Centre for Research on the Epidemiology of Disasters (CRED), the Global Entrepreneurship Monitor (GEM), the Fraser Institute (FI), and the World Governance Indicators (WGI).

2.5.2 Variables

Our *dependent variable* (Table 2, variable 1, EGA) captures growth aspirations using entrepreneurs' current employment and their expected employment five years ahead. Entrepreneurial growth aspirations are useful for anticipating future entrepreneurial outcomes (Covin & Wales, 2012; Estrin et al., 2013) and can explain subsequent actual firm growth (Delmar & Wiklund, 2008). We measure entrepreneurial growth aspirations by subtracting the natural logarithm of current employment from the natural logarithm of expected employment in five years. (Autio & Acs, 2010; Capelleras et al., 2019; Estrin et al., 2013). Accordingly, the measure can be interpreted as a multiplier linking the expected future size of the firm to its current size.

Table 2: Variable definitions and sources

	Variables	Definition	Source
1	EGA	Entrepreneurial growth aspirations are measured as the log difference between expected employment in five years and current employment, with the owner-manager included in both measures.	GEM
2	Age	Respondent’s age in years.	GEM
3	Gender	Binary indicator coded 1 for male respondents and 0 for female respondents.	GEM
4	Alertness	Binary indicator coded 1 when respondents report good local business opportunities in the next six months, and 0 otherwise.	GEM
5	Fear of failure	Binary indicator coded 1 when fear of failure could discourage the respondent from starting a business, and 0 otherwise.	GEM
6	Perceived self-efficacy	Binary indicator coded 1 when respondents report having the knowledge, skills, and experience required to start a business, and 0 otherwise.	GEM
7	Household income	Categorical variable. It takes the value 1 if the entrepreneur's family income is low, 2 if it is medium, and 3 if it is high.	GEM
8	Higher education	Binary indicator coded 1 for respondents with post-secondary education, and 0 otherwise.	GEM
9	Entrepreneurial experience	Binary indicator coded 1 when the respondent had owned or managed a business exited during the previous 12 months that continued operating after disengagement, and 0 otherwise.	GEM
10	Investment experience	Binary indicator coded 1 when the respondent personally funded someone else’s new business during the previous three years, excluding stocks or mutual funds, and 0 otherwise.	GEM
11	Knows other entrepreneurs	Binary indicator coded 1 when the respondent personally knows someone who started a business during the previous two years, and 0 otherwise.	GEM
12	Current employment level	Number of current employees, excluding owners.	GEM
13	Transfers and subsidies	Government transfers and subsidies relative to GDP.	FI
14	GDP growth	Annual GDP growth rate based on constant local currency.	WDI
15	Unemployment rate	Share of the labour force that is unemployed.	WDI
16	Log injured	Natural logarithm of one plus the number of people injured by natural disasters.	CRED
17	Governance quality	Mean score across six WGI governance dimensions: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption.	WGI
18	Log affected (robustness)	Natural logarithm of one plus the number of people affected by natural disasters.	CRED
19	Log homeless (robustness)	Natural logarithm of one plus the number of people made homeless by natural disasters.	CRED
20	Log total affected (robustness)	Natural logarithm of one plus total affected people, defined as injured, affected, and homeless.	CRED
21	Business freedom (robustness)	Business freedom index component capturing regulatory and infrastructure constraints on firm operation, including factors related to starting, operating, and closing a business.	FI
22	Natural disasters type event counts (robustness)	Country-year counts of discrete natural disaster events by type: drought, earthquake, extreme temperature, flood, dry mass movement, wet mass movement, storm, volcanic activity, and wildfire. These variables capture disaster frequency by category and are included as additional controls in the robustness specification.	CRED

For the *individual-level control variables* (Table 2, variables 2 to 12). We control for gender, coded as 1 for men and 0 for women, as well as for age (Epure et al., 2024; Estrin et al., 2013). We also incorporate three perceptual indicators, commonly understood as socio-cognitive traits (Bandura, 1986; Boudreaux, Nikolaev, et al., 2019; Uriarte et al., 2026b; Wood & Bandura, 1989). Alertness is coded as 1 when respondents perceive good opportunities to start a business in their area within the next six months. Fear of failure equals 1 when respondents indicate that fear of failure could discourage them from starting a business (but did not necessarily do so). Perceived self-efficacy is coded as 1 when individuals report having the knowledge, skills, and experience required to start a business. We use household income levels (Albert et al., 2023; Braggion et al., 2020; Epure et al., 2024; Kimhi, 2009; Zapata, 2023). Indicator variable 1 = low household income, 2 = medium and 3 = high. We define three proxies for human capital. First, higher education is assigned a value of 1 if participants hold a post-secondary education degree, and 0 otherwise. Second, entrepreneurial experience is a dummy variable that equals 1 when the respondent previously owned and managed a business that was sold, closed, discontinued, or exited during the past 12 months and the business has continued its activity after the entrepreneur disengaged, and 0 otherwise. third, we measure investment experience with a dummy variable equal to one when the entrepreneur personally provided funds to someone else's new business during the previous three years, excluding any purchases of stocks or mutual funds, and 0 otherwise (Alvarez-Vargas et al., 2026; Epure et al., 2024). To account for potential confounding effects between market experience, process knowledge, and social interactions, we use knowing other entrepreneurs as a dummy variable, which equals one when respondents report knowing someone who started a business during the previous two years (Capelleras et al., 2019). For firm-related variables, we account for the current employment level (including the owners) (Autio & Acs, 2010; Capelleras et al., 2019; Estrin et al., 2013).

For the *country-level control variables* (Table 2, variables 13 to 15), we first use an indicator of transfers and subsidies, defined as government transfers and subsidies relative to GDP. Second, we also control for country-level macroeconomic conditions that vary over time and may influence entrepreneurial activity. We include GDP growth as a measure of economic performance (GDP growth) and the unemployment rate as a labour-market indicator (unemployment rate).

Natural disasters are measured using data from the CRED/EM-DAT database. Following the disaster categories retained for this thesis, the analysis considers droughts,

earthquakes, extreme temperatures, floods, dry mass movements, wet mass movements, storms, volcanic activity, and wildfires. These categories allow the thesis to capture a broad range of climate-related, geophysical, hydrological, meteorological, and environmental shocks. For each country-year, natural disaster events are aggregated and then linked to individual-level entrepreneurial observations from GEM. Therefore, the natural disaster variables used in the empirical analyses represent annual country-level exposure to natural disasters rather than direct individual exposure to a specific event.

For the *country-level predictor* (Table 2 variable 16), we use the number of people injured by natural disasters to capture disaster exposure in the growth aspirations models (for Hypothesis 1). This variable comes from the Centre for Research on the Epidemiology of Disasters (CRED). The injured variable captures the total number of people injured as a consequence of natural disasters (Boudreaux et al., 2021, 2023; Wei et al., 2023). The natural disaster measure is constructed from CRED/EM-DAT event-level records, aggregated at the country-year level. In this chapter, disaster exposure is measured as the logarithm of one plus the number of people injured by natural disasters in a given country and year. When more than one disaster occurs in the same country-year, the corresponding impacts are aggregated to obtain an annual country-level measure of disaster exposure. This annual measure is then linked to all GEM respondents observed in the same country and year. Accordingly, the variable should be interpreted as a contextual measure of annual national exposure to disaster impacts, rather than as an event-level treatment indicator. The data structure does not allow us to determine whether each GEM respondent was interviewed before or after a specific disaster within the same year. This is particularly relevant because several disasters may occur in the same country-year, at different points in time and in different regions. Therefore, the empirical analysis examines whether annual country-level disaster exposure is associated with individual entrepreneurial growth aspirations, rather than whether a specific disaster event affected each respondent before or after the interview date.

For the *country-level moderator* (Table 2, variable 17), we used governance quality. This variable is computed as the average of six governance indicators: 1) Voice and accountability captures citizens' ability to participate in government selection, as well as freedom of expression, freedom of association, and free media. 2) Political stability reflects perceptions that the government may be destabilised or removed through unconstitutional or violent means, including domestic violence and terrorism. 3) Government effectiveness

measures the quality of public and civil services, their independence from political pressures, and the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. 4) Regulatory quality measures the incidence of market-unfriendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development. 5) Rule of law measures the extent to which agents have confidence in and abide by the rules of society, particularly the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. 6) Control of corruption measures perceptions that public authority is used for private benefit, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests (Dau & Cuervo-Cazurra, 2014; Wei et al., 2023).

2.5.3 Econometric strategy

The econometric technique is a linear mixed-effects model, estimated in a multilevel framework. The error distribution is assumed to be normal, and heteroscedasticity and correlations within level groups can be modelled (Stata-Manual, 2023). The multilevel linear model fits better with the hypothesis and the conceptual model proposed. Three arguments support this. First, the dependent variable, Entrepreneurial Growth Aspirations (EGA), is linear. Second, the proposal considers a relationship between variables with different levels; for example, natural disasters are at a country level and EGA at an individual level. Third, similar research articles used the same technique (Capelleras et al., 2019; Epure et al., 2024; Ye et al., 2023). Since individuals are nested within countries in the GEM dataset, for the baseline specifications, we employ a multi-level hierarchical linear model that allows country-specific intercepts (Amorós et al., 2019; Epure et al., 2024; Estrin et al., 2013). Multilevel analysis is appropriate for this type of dataset because it accounts for unobserved heterogeneity across countries, years, and individuals. It also helps address the non-independence of observations within countries. Because natural disasters are measured as annual country-level exposure, the empirical specification should not be interpreted as an event-study design. Rather, the multilevel model estimates the association between country-year disaster exposure and individual entrepreneurial growth aspirations, while accounting for the nesting of GEM respondents within countries and controlling for year-level variation using year fixed effects. We estimate our hypotheses using the following general specifications:

$$EGA_{ijt} = \alpha + \beta_1 ND_{jt} + \beta_2 Gover_{jt} + \beta_3 Gover_{jt} \times ND_{jt} + \cdots$$
$$\ldots X_{ijt}\gamma_n + Z_{jt}\delta_n + \nu_{it} + \psi_t + \mu_{ijt} + \varepsilon_{jt} \quad (1)$$

EGA_{ijt} denotes entrepreneurial growth aspirations for individual i in country j and year t, and β_1 represent the impact of natural disasters. $Gover_{jt}$ on governance quality. Governance quality is an average of six dimensions: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption. β_2 represent the impact of governance quality[1]. β_3 , which will represent the impact of the moderating variable.

For hypothesis 1, we evaluate the impact of the natural disaster variable at the country level, on EGA_{ijt} the individual level. Particularly, we use injured measure for natural disasters. We estimate equation (1), emphasising the sign, significance and marginal effect β_1. For hypothesis 2, we evaluate the impact of the interaction of $Gover_{jt}$ with $Injured_{jt}$, which are variables at the country level on EGA_{ijt} (individual level). We observe the sign, significance and marginal effect of β_3.

X_{ijt} includes individual-level controls (age, gender, alertness, perceived self-efficacy, household income, higher education, entrepreneurial experience, investment experience, knows other entrepreneurs and current employment) and Z_{jt} are country-level controls (transfer and subsidies, GDP growth and unemployment rate). In the random part of the equation, μ_{ijt} denote residuals at the individual level, while ε_{jt} the country-level residuals. We add industry effects (1-digit SIC) to control for potential endogeneity of the time constant related to omitted industry characteristics (ν_{it}) and year effects to account for systematic shocks that lead to variations in industry ambitions growth of all entrepreneurs during a given period (ψ_t).

We conduct three robustness tests. The first uses alternative measures of natural disaster severity, including the number of affected, the number of homeless, and the total number affected. The second replaces governance quality with business freedom as an alternative institutional moderator. The third adds country-year counts of discrete disaster events by type, including droughts, earthquakes, extreme temperatures, floods, dry mass movements, wet mass movements, storms, volcanic activity, and wildfires. This

[1] In our hypotheses, we do not consider the direct effect of β_2 (governance quality) on growth aspirations, as this is well established in the literature. A positive effect of a variable reflecting institutional quality on corporate performance has sufficient theoretical and empirical support.

specification complements the impact-based measure used in the main models by accounting for disaster frequency across categories.

We present a review of two tests for the assumptions of the mixed model. Firstly, we calculate the intraclass correlation coefficient (ICC). The ICC is applied to all regressions shown in Table 7. The ICC ranges from 0.049, indicating that approximately 5% of the total variability in the dependent variable (EGA) is due to differences between countries. This suggests that most variability occurs within countries rather than between them. The confidence interval does not include zero, suggesting that the intraclass correlation significantly differs from zero. Secondly, to assess non-multicollinearity, we compute the variance inflation factor (VIF). Most variables exhibit very low VIF values (near 1), indicating no significant multicollinearity issues (see Table 3). Transfers and subsidies (2.21) and quality of governance (1.79) display the highest VIF values, yet they remain below 10, suggesting no considerable multicollinearity. The average VIF value is 1.26, which is comparatively low and implies no serious concerns regarding multicollinearity in the model.

Table 3: Multicollinearity test

Variable	VIF	1/VIF
Age	1.03	0.966
Gender	1.03	0.974
Alertness	1.08	0.925
Fear of failure	1.04	0.962
Perceived self-efficacy	1.07	0.932
Higher education	1.14	0.880
Household income (2)	1.53	0.653
Household income (3)	1.64	0.611
Entrepreneurial experience	1.02	0.983
Investment experience	1.04	0.958
Knows other entrepreneurs	1.07	0.936
Current employment level	1.00	0.996
Transfers and subsidies	2.21	0.453
Unemployment rate	1.40	0.714
GDP growth	1.20	0.831
Log injured	1.09	0.918
Governance quality	1.79	0.559
Mean VIF	1.26	

Note: VIF values greater than 10 indicate reasons for concern due to collinearity among variables. No years or countries were included in the test. Natural disaster-type event-count controls are also excluded because they are used only in the robustness specification. The variables in the main model do not exhibit collinearity.

2.6 Results

2.6.1 Descriptive results

Table 4 provides descriptive statistics first at the individual and second country level. First, we describe the individual level variable. The EGA averages 0.97, with a minimum value of -7.6 and a maximum of 13.8. An EGA of 0.97 implies that the firm expects to more than double (2.6x) its employees in the next five years.[2] The average age of respondents in the entrepreneur sample is around 37 years old, and 58% are men. More than half of them (64% of the sample) see good opportunities to start a new business in the next six months. 28% say that fear of failure could prevent them from starting a business. Most (84%) entrepreneurs believe they have the knowledge, skills and experience to start a business. The average household income is 2.2; consider this variable in categories: 1 low, 2 middle, and 3 high. 36% of participants held a post-secondary education degree. 3% of them had previous business experience. 12% of participants personally provided funds for a new business

[2] This is calculated as e^x, where $x = 0.97$. Therefore, $e^{0.97} = 2.6$. Formally, EGA = ln (expected number of employees in 5 years + 1) – ln (current number of employees + 1).

started by someone else, excluding any purchases of stocks or mutual funds. 65% of sample entrepreneurs know someone who started a business in the past two years. The average number of current employees is around 4.

Table 4: Descriptive statistics

		Obs.	Mean	Std. Dev.	Min	Max
	Level 1 variables					
1	EGA	91,997	0.974	1.340	-7.601	13.816
2	Age	91,997	37.125	11.408	18	64
3	Gender	91,997	0.581	0.493	0	1
4	Alertness	91,997	0.635	0.482	0	1
5	Fear of failure	91,997	0.284	0.451	0	1
6	Perceived self-efficacy	91,997	0.844	0.363	0	1
7	Household income	91,997	2.164	0.809	1	3
8	Higher education	91,997	0.356	0.479	0	1
9	Entrepreneurial experience	91,997	0.034	0.181	0	1
10	Investment experience	91,997	0.124	0.330	0	1
11	Knows other entrepreneurs	91,997	0.654	0.476	0	1
12	Current employment level	91,997	3.913	57.478	0	2,000
	Level 2 variables					
13	Transfers and subsidies	91,997	7.572	1.839	1.94	10
14	Unemployment rate	91,997	7.681	5.220	0.11	28.01
15	GDP growth	91,997	3.355	3.080	-7.087	24.370
16	Log injured	91,997	3.034	3.025	0	11.842
17	Governance quality	91,997	0.145	0.746	-1.234	1.889
	Natural-disaster-type event counts					
1	Drought	91,997	0.188	0.420	0	2
2	Earthquake	91,997	0.496	1.236	0	8
3	Extreme temperature	91,997	0.223	0.471	0	3
4	Flood	91,997	2.149	2.599	0	20
5	Mass movement dry	91,997	0.009	0.092	0	1
6	Mass movement wet	91,997	0.345	0.837	0	8
7	Storm	91,997	1.382	3.293	0	19
8	Volcanic activity	91,997	0.105	0.391	0	3
9	Wildfire	91,997	0.269	0.643	0	5

Second, we describe the country level variables. The average of transfers and subsidies, unemployment rate and GDP growth is 7.57, 7.68 and 3.36, respectively. The average value of Log injured is 3.03. Governance quality moves between values that range from -1.23 to 1.89, with an average of 0.15. Table 4 also reports descriptive statistics for the disaster-type event-count controls used in the robustness specification. These variables capture the number of discrete natural disasters by type in each country-year. Floods and storms are the most frequent event types in the sample, whereas dry mass movements and

volcanic activity occur less frequently. These measures complement the impact-based disaster variables by capturing the frequency of disaster exposure across categories.

Table 5 shows the list of countries used in the estimates. For each country, we report the frequency and the percentage it represents of the total sample.

Table 5: Country list

	Country	Freq.	Percent	Cum.		Country	Freq.	Percent	Cum.
1	United States	242	1.68	1.68	41	Ghana	198	1.38	78.73
2	Russia	79	0.55	2.23	42	Nigeria	110	0.77	79.49
3	Egypt	80	0.56	2.79	43	Angola	163	1.13	80.62
4	South Africa	154	1.07	3.86	44	Ethiopia	15	0.10	80.73
5	Greece	139	0.97	4.83	45	Uganda	157	1.09	81.82
6	Netherlands	69	0.48	5.31	46	Zambia	165	1.15	82.97
7	Belgium	54	0.38	5.68	47	Namibia	11	0.08	83.05
8	France	79	0.55	6.23	48	Malawi	47	0.33	83.37
9	Spain	772	5.37	11.60	49	Botswana	92	0.64	84.01
10	Hungary	87	0.61	12.21	50	Portugal	48	0.33	84.35
11	Italy	95	0.66	12.87	51	Ireland	47	0.33	84.67
12	Romania	85	0.59	13.46	52	Iceland	11	0.08	84.75
13	Switzerland	78	0.54	14.00	53	Finland	5	0.03	84.79
14	Austria	31	0.22	14.22	54	Lithuania	11	0.08	84.86
15	Denmark	25	0.17	14.39	55	Latvia	31	0.22	85.08
16	Sweden	11	0.08	14.47	56	Estonia	23	0.16	85.24
17	Norway	46	0.32	14.79	57	Serbia	4	0.03	85.27
18	Poland	131	0.91	15.70	58	Croatia	62	0.43	85.70
19	Germany	148	1.03	16.73	59	Slovenia	18	0.13	85.82
20	Peru	398	2.77	19.50	60	Bosnia and Herzegovina	34	0.24	86.06
21	Mexico	421	2.93	22.43	61	Czech Republic	50	0.35	86.41
22	Argentina	173	1.20	23.63	62	Slovakia	41	0.29	86.69
23	Brazil	1,437	10.00	33.63	63	Guatemala	421	2.93	89.62
24	Chile	1,161	8.08	41.71	64	El Salvador	31	0.22	89.84
25	Colombia	1,033	7.19	48.89	65	Costa Rica	35	0.24	90.08
26	Malaysia	156	1.09	49.98	66	Panama	312	2.17	92.25
27	Australia	110	0.77	50.74	67	Venezuela	10	0.07	92.32
28	Indonesia	284	1.98	52.72	68	Bolivia	135	0.94	93.26
29	Philippines	134	0.93	53.65	69	Ecuador	358	2.49	95.75
30	New Zealand	4	0.03	53.68	70	Uruguay	62	0.43	96.18
31	Thailand	1,001	6.96	60.64	71	Dominican Republic	10	0.07	96.25
32	Japan	150	1.04	61.69	72	Jamaica	112	0.78	97.03
33	China	1,160	8.07	69.76	73	Bangladesh	195	1.36	98.39
34	Turkey	113	0.79	70.54	74	Lebanon	70	0.49	98.87
35	India	242	1.68	72.23	75	Saudi Arabia	61	0.42	99.30
36	Pakistan	97	0.67	72.90	76	United Arab Emirates	10	0.07	99.37
37	Iran	390	2.71	75.62	77	Israel	71	0.49	99.86
38	Canada	127	0.88	76.50	78	Qatar	5	0.03	99.90
39	Morocco	89	0.62	77.12	79	Georgia	15	0.10	100.00
40	Algeria	33	0.23	77.35		Total	14,374		

Figure 2 reports three panels, each reflecting a specific variable for 2004-2019. Panel A illustrates the average entrepreneurial growth aspirations (EGA) by country, utilising a blue gradient to highlight differences between countries and emphasise areas with greater EGA. Panel B illustrates the average annual number of individuals injured due to natural disasters. We have categorised them in shades of red to differentiate levels of impact by country. Finally, Panel C show the quality of Governance Quality, employing a green gradient that identifies countries with stronger institutions versus those with lower standards. Together, these three maps offer a comparative and visually clear perspective on economic, social, and institutional aspects on a global scale, facilitating interpretation and analysis.

Figure 2: World map

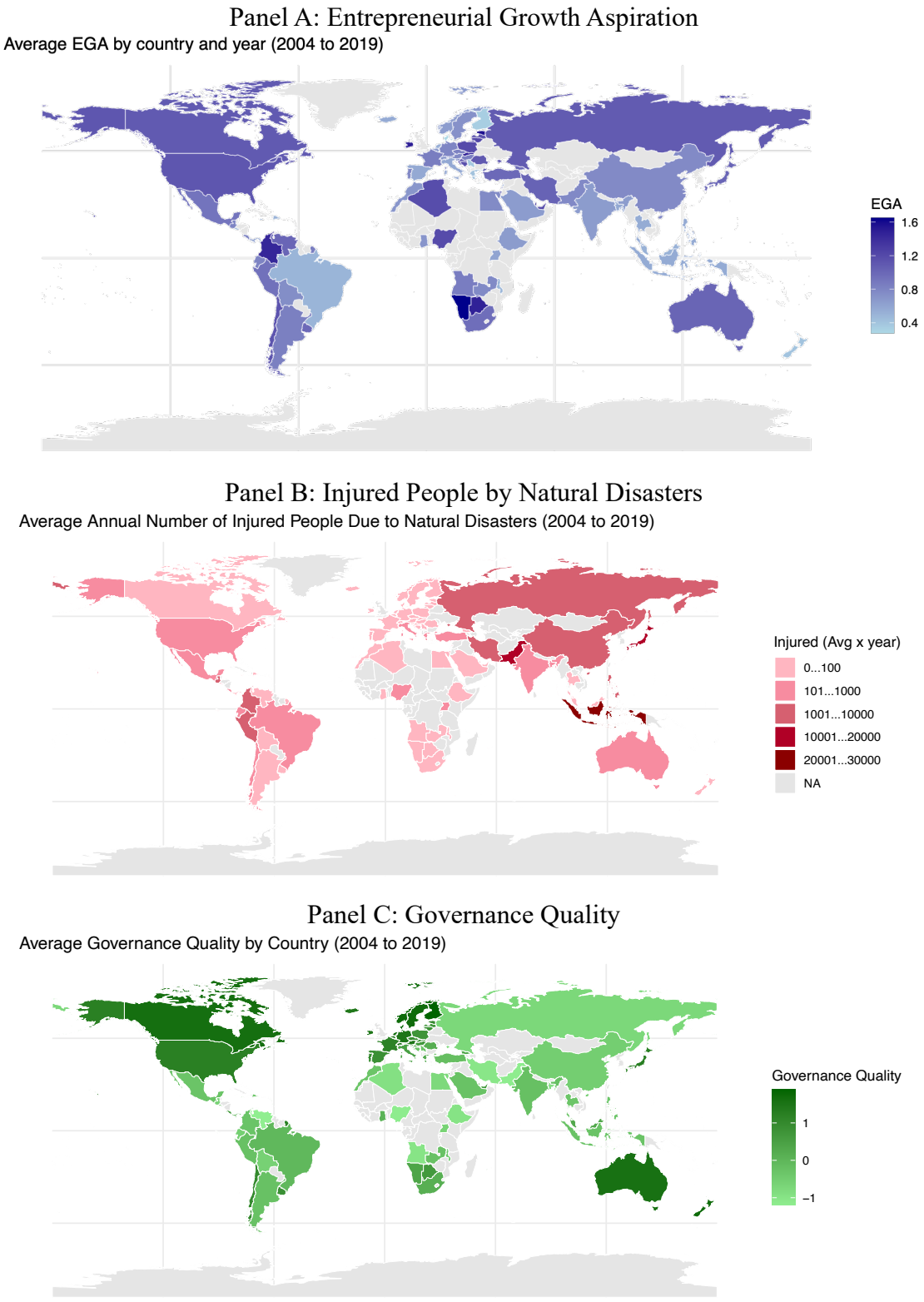


Figure 2 reflects annual averages for the years 2004 to 2019. The five countries with the highest growth aspirations (EGA) are Namibia (1.65), Estonia (1.29), Ireland (1.50), Botswana (1.47) and Slovakia (1.45). The five countries with the highest number of people injured due to natural disasters are Indonesia (22,634), Pakistan (15,372), Japan (14,860), Philippines (8,749) and China (7,287). The countries with the best quality of governance are Finland (1.88), Denmark (1.83), Switzerland (1.73), Norway (1.70) and New Zealand (1.71).

Finally, we present a correlation matrix (see Table 6). The correlation between our measure of natural disasters (log injured) and growth aspirations is 0.025. Alternative measures of natural disasters show the following correlations with growth aspirations: -0.006 (log affected), 0.027 (log homeless), 0.00017 (log total affected). Small, mostly positive correlations are observed, with one in four being negative. The correlation between log injured and governance quality is 0.025.

Table 6: Correlation matrix

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	EGA	1,000																				
2	Age	-0,035	1,000																			
3	Gender	0,071	0,001	1,000																		
4	Alertness	0,060	-0,065	0,006	1,000																	
5	Fear of failure	-0,038	0,023	-0,041	-0,103	1,000																
6	Perceived self-efficacy	0,041	0,022	0,050	0,133	-0,160	1,000															
7	Higher education	0,098	0,021	0,059	-0,008	-0,015	0,066	1,000														
8	Household income	0,074	0,002	0,108	0,050	-0,054	0,068	0,240	1,000													
9	Entrepreneurial experience	0,017	-0,007	0,015	0,019	0,017	0,022	0,005	0,011	1,000												
10	Investment experience	0,057	-0,022	0,069	0,051	-0,017	0,042	0,057	0,086	0,109	1,000											
11	Knows other entrepreneurs	0,027	-0,056	0,057	0,147	-0,037	0,142	0,094	0,116	0,035	0,102	1,000										
12	Current employment level	-0,050	0,000	0,010	0,002	0,002	-0,003	0,024	0,011	0,023	0,022	0,010	1,000									
13	Transfers and subsidies	0,018	-0,112	-0,091	0,169	-0,011	-0,011	-0,171	-0,025	0,032	0,062	0,026	-0,017	1,000								
14	GDP growth	0,017	0,041	0,064	-0,130	-0,007	0,041	0,070	0,003	-0,011	-0,036	-0,027	-0,005	-0,516	1,000							
15	Unemployment rate	-0,010	-0,056	-0,043	0,108	-0,021	-0,038	-0,062	0,013	0,027	0,039	0,025	0,007	0,378	-0,316	1,000						
16	Log injured	0,025	-0,022	-0,009	0,015	0,021	-0,039	-0,025	0,006	0,001	0,004	0,015	0,000	0,201	-0,170	0,120	1,000					
17	Log affected	-0,006	-0,056	-0,060	0,060	0,035	-0,076	-0,128	-0,009	0,014	-0,008	-0,017	-0,011	0,439	-0,305	0,255	0,473	1,000				
18	Log homeless	0,027	-0,013	-0,016	0,002	0,025	-0,061	-0,009	0,032	0,016	0,035	0,005	0,003	0,131	-0,147	0,132	0,384	0,425	1,000			
19	Log total affected	0,000	-0,060	-0,059	0,059	0,035	-0,078	-0,116	-0,006	0,016	-0,004	-0,018	-0,011	0,454	-0,315	0,262	0,524	0,978	0,463	1,000		
20	Governance quality	0,025	0,157	0,049	-0,078	-0,021	0,050	0,227	0,041	-0,027	0,007	0,001	0,019	-0,611	0,239	-0,254	-0,262	-0,476	-0,101	-0,492	1,000	
21	Business Freedom	0,110	0,117	0,061	-0,039	-0,007	0,032	0,249	0,049	-0,027	-0,011	-0,041	0,015	-0,394	0,234	-0,243	-0,210	-0,357	-0,205	-0,366	0,581	1,000

Note: Natural-disaster-type event-count controls are not reported in the correlation matrix because they are included only in the robustness specification. These variables capture country-year disaster frequency by category and are presented in the descriptive statistics.

2.6.2 Multilevel model results

Hypothesis 1a suggests that an increase in natural disasters will discourage entrepreneurial growth aspirations. This is based on the uncertainty mechanism. Hypothesis 1b suggests that an increase in natural disasters will encourage entrepreneurial growth aspirations. This is based on the opportunity mechanism. For the test of hypothesis 1, Table 7 presents the results of the multilevel model regression predicting entrepreneurial growth aspirations. Model 1 shows results for the control and predictor variables without interactions at the individual and country levels. In model 1, the natural disaster variable, measured as the logarithm of the number of people injured by natural disasters, has a negative and significant coefficient (-0.009). This provides evidence to support hypothesis 1a, i.e., when natural disasters increase, entrepreneurial growth aspirations decrease. Therefore, hypothesis 1a is supported and hypothesis 1b is not supported.

Table 7: Multilevel linear regression (EGA)

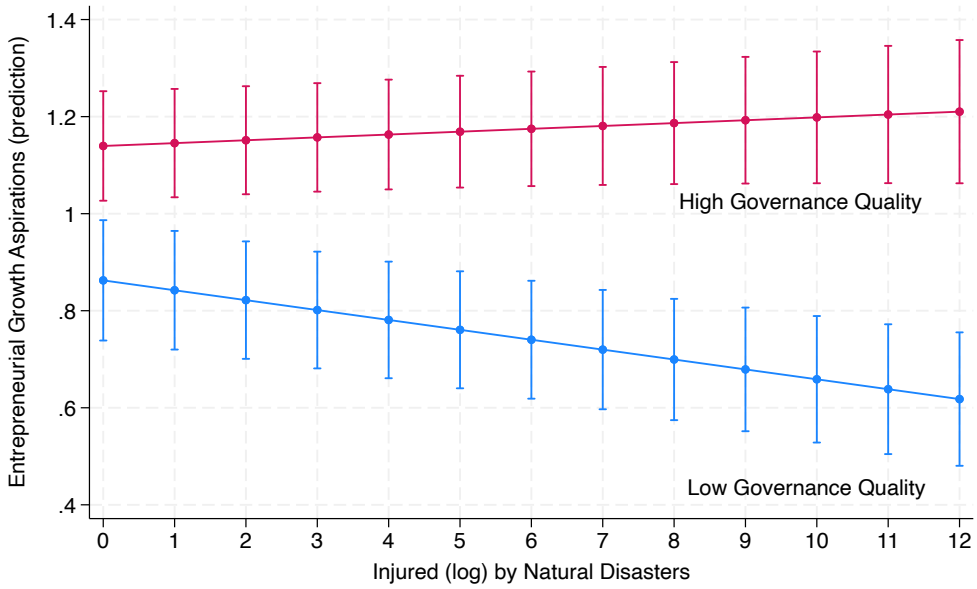
Variables	Model 1	Model 2	Model 3 Robustness
Age	-0.004***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.000)
Gender	0.123***	0.123***	0.123***
	(0.008)	(0.009)	(0.009)
Alertness	0.090***	0.090***	0.090***
	(0.009)	(0.009)	(0.009)
Fear of failure	-0.052***	-0.053***	-0.054***
	(0.009)	(0.010)	(0.010)
Perceived self-efficacy	0.059***	0.058***	0.058***
	(0.012)	(0.012)	(0.012)
Higher education	0.132***	0.131***	0.131***
	(0.010)	(0.010)	(0.010)
2.Household income	0.027**	0.028**	0.026**
	(0.011)	(0.011)	(0.011)
3.Household income	0.097***	0.098***	0.096***
	(0.011)	(0.011)	(0.011)
Entrepreneurial experience	0.066***	0.066***	0.068***
	(0.023)	(0.023)	(0.023)
Investment experience	0.113***	0.113***	0.113***
	(0.013)	(0.013)	(0.013)
Knows other entrepreneurs	0.013	0.013	0.012
	(0.009)	(0.009)	(0.009)
Current employment level	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
Transfers and subsidies	0.065***	0.065***	0.065***
	(0.011)	(0.011)	(0.011)
Unemployment rate	0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)
GDP growth	-0.006**	-0.006***	-0.008***
	(0.002)	(0.002)	(0.002)
Log injured (H1)	-0.009***	-0.009***	-0.006**
	(0.002)	(0.002)	(0.002)
Governance	0.122***	0.096***	0.076**
	(0.034)	(0.034)	(0.035)
Log injured X Governance (H2)		0.009***	0.007***
		(0.003)	(0.003)
Constant	-0.526	-0.493	-0.473
	(0.336)	(0.336)	(0.336)
Natural-disaster-type event-count controls	No	No	Yes
Years fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
ICC	0.050	0.049	0.051
Observations	91,997	91,997	91,997
Number of groups	79	79	79

Note: Model 3 includes country-year counts of discrete natural disaster events by type: drought, earthquake, extreme temperature, flood, dry mass movement, wet mass movement, storm, volcanic activity, and wildfire. These controls capture disaster frequency by category, whereas the main disaster variable captures human-impact severity via the number of injured people. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Hypothesis 2 suggests that governance quality positively moderates the link between natural disasters and entrepreneurial growth aspirations. In other words, high governance quality encourages growth ambitions, and low governance quality reduces them. For the test of hypothesis 2, model 2 in Table 7 shows the moderating effect of the variable quality of governance on the number of injuries resulting from a natural disaster. The interaction effect of both variables is positive and significant. The coefficient is estimated at 0.009. The individual effect of the variable number of injuries remains negative and significant (-0.009), while the direct effect of quality of governance (0.096) is positive and significant. We present Figure 3 to illustrate the effects of the estimates, specifically the moderating role of governance quality on entrepreneurial growth aspirations (EGA), in natural disaster contexts. Figure 3 illustrates the predicted values of EGA as the number of individuals injured by natural disasters increases (on a logarithmic scale), while holding all other variables constant at their mean values. The predictions are based on Model 2 in Table 7. The figure demonstrates a negative relationship: as the number of injuries rises, levels of EGA decrease when governance quality is low (we assume that the governance is -1.3). In contrast, we observe a positive link: as the number of injuries rises, levels of EGA increase when governance quality is high (we assume that the governance is 1.6)[3]. Therefore, we find evidence to support hypothesis 2.

[3] 1.6 and -1.3 = 0.145 +/- 2*0.746 = average governance +/- 2*Std. Dev.

Figure 3: Comparison of EGA by high and low governance quality



In Model 1 Table 7, the coefficient on log injured is −0.009. Since both the dependent variable (EGA) and the independent variable (injured) are logarithmic, this indicates that a 1% increase in injuries decreases EGA by approximately 0.009%. For example, a 10% increase in injuries results in a decrease in EGA of about 0.09%. In practical terms, percentage increases in injuries caused by natural disasters lead to very slight but consistent reductions in growth expectations. The governance coefficient is 0.122. The dependent variable is log. Exponentiating this coefficient yields exp (0.122) = 1.130, indicating that each one-unit rise in the governance index corresponds to an approximate 13% increase in the growth aspirations. Comparing these effects on a per 1% basis, a 1% increase in the governance index raises EGA by approximately 0.122%, while a 1% rise in injuries reduces it by about 0.009%. Therefore, the institutional influence is roughly 14 (0.122/0.009) times greater than the injured by natural disasters effect. This highlights that, although injury shocks only slightly diminish growth ambitions, strong institutions can significantly enhance it.

We note that several control variables are statistically significant. Not surprisingly, younger male entrepreneurs who perceive opportunities soon are unafraid of failure, see themselves as possessing entrepreneurial skills, hold higher educational levels, enjoy greater household incomes, have prior entrepreneurial experience, have financed a new business

started by someone else, and operate relatively smaller firms tend to have higher growth aspirations. Finally, countries with higher transfers and subsidies, lower growth rates, and higher levels of governance tend to have elevated growth aspirations. We incorporate controls for years (2004 to 2019) and industries in the estimations.

2.6.3 Robustness checks

We conduct three robustness tests[4]. The first is included in Model 3 of Table 7 and adds natural-disaster-type event-count controls. The results remain consistent after including these controls.

The second focuses on measures for natural disasters. We repeat the estimation in Table 7 using three other measures of natural disasters: affected, homeless, and total affected. "Affected" refers to the total number of people impacted by natural disasters. "Homeless" refers to the number of individuals left homeless due to natural disasters. "Total affected" signifies the total number of people who were injured, affected, and made homeless by natural disasters. The robustness test is presented in Table 8. Results similar to those in Table 7 are observed.

The third robustness test focused on the moderating variable, governance quality. The robustness test is presented in Table 9. This robustness test involved changing the governance measure for another similar measure. We use the business freedom from the Fraser Institute. Business freedom refers to the ability of individuals to start, operate, and close a business without undue interference from the government. This concept is closely related to economic freedom and is an essential measure in several economic freedom indices, such as the one published by the Fraser Institute. Key components of business freedom include 1) personal choice, the ability of individuals to make unrestricted economic decisions, such as what goods and services to produce, how much to produce, and at what prices to sell; 2) voluntary exchange: the possibility of exchanges being carried out freely

[4] As an additional temporal analysis, we estimated a country-year fixed-effects panel specification with lagged natural-disaster exposure. In this exercise, GEM individual-level observations were aggregated to country-year averages, so that natural disasters in year t−1 were linked to average entrepreneurial growth aspirations in year t. This specification was used to explore the temporal alignment concern, since the main annual country-year design cannot determine whether each GEM respondent was interviewed before or after a specific disaster within the same year. However, this exercise changes the unit of analysis from individual entrepreneurs to countries over time, reducing the sample from 91,997 individual observations to 308 country-year observations and removing within-country individual-level variation. In this aggregated specification, the lagged natural-disaster variable, governance quality, and their interaction were not statistically significant. This exercise is reported only as a supplementary analysis.

between parties without coercion, promoting the coordination of markets, 3) entry and competition in markets: the ease with which new participants can enter the market and compete with existing companies without facing significant barriers, 4) protection of property rights: the assurance that legally acquired goods are protected from unjust appropriations and that contracts are equitably enforced. For a country to have high business freedom, it needs to provide an environment where property rights are protected, a fair legal system is maintained, minimum regulations are imposed, and a stable monetary environment is maintained. Table 9 shows the robustness test, alternating the governance quality measure with business freedom. The results remain as in Table 7.

Table 8: Robustness alternative measures of natural disasters (EGA)

Variables	Model 1 Affected	Model 2 Homeless	Model 3 Total Affected
Age	-0.004***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.000)
Gender	0.123***	0.123***	0.123***
	(0.009)	(0.009)	(0.009)
Alertness	0.090***	0.090***	0.090***
	(0.009)	(0.009)	(0.009)
Fear of failure	-0.052***	-0.052***	-0.052***
	(0.010)	(0.010)	(0.010)
Perceived self-efficacy	0.058***	0.058***	0.058***
	(0.012)	(0.012)	(0.012)
Higher education	0.132***	0.133***	0.132***
	(0.010)	(0.010)	(0.010)
2.Household income	0.027**	0.027**	0.027**
	(0.011)	(0.011)	(0.011)
3.Household income	0.097***	0.097***	0.097***
	(0.011)	(0.011)	(0.011)
Entrepreneurial experience	0.067***	0.068***	0.066***
	(0.023)	(0.023)	(0.023)
Investment experience	0.113***	0.114***	0.113***
	(0.013)	(0.013)	(0.013)
Knows other entrepreneurs	0.013	0.013	0.013
	(0.009)	(0.009)	(0.009)
Current employment level	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
Transfers and subsidies	0.068***	0.068***	0.068***
	(0.011)	(0.011)	(0.011)
Unemployment rate	0.000	-0.000	0.000
	(0.002)	(0.002)	(0.002)
GDP growth	-0.005**	-0.005**	-0.004**
	(0.002)	(0.002)	(0.002)
Log natural disasters	-0.003**	-0.004***	-0.005***
	(0.001)	(0.001)	(0.002)
Governance	0.130***	0.137***	0.128***
	(0.033)	(0.034)	(0.033)
Constant	-0.552	-0.554*	-0.548
	(0.336)	(0.336)	(0.336)
Years fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
ICC	0.049	0.051	0.049
Observations	91,997	91,997	91,997
Number of groups	79	79	79

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Robustness business freedom

Variables	Model 1	Model 2
Age	-0.004***	-0.004***
	(0.000)	(0.000)
Gender	0.123***	0.123***
	(0.009)	(0.009)
Alertness	0.090***	0.090***
	(0.009)	(0.009)
Fear of failure	-0.054***	-0.054***
	(0.010)	(0.010)
Perceived self-efficacy	0.058***	0.058***
	(0.012)	(0.012)
Higher education	0.131***	0.131***
	(0.010)	(0.010)
2.Household income	0.028**	0.028**
	(0.011)	(0.011)
3.Household income	0.098***	0.099***
	(0.011)	(0.011)
Entrepreneurial experience	0.067***	0.066***
	(0.023)	(0.023)
Investment experience	0.112***	0.112***
	(0.013)	(0.013)
Knows other entrepreneurs	0.013	0.013
	(0.009)	(0.009)
Current employment level	-0.001***	-0.001***
	(0.000)	(0.000)
Transfers and subsidies	0.052***	0.050***
	(0.010)	(0.010)
Unemployment rate	-0.003	-0.003
	(0.002)	(0.002)
GDP growth	-0.004*	-0.004*
	(0.002)	(0.002)
Log injured	-0.008***	-0.054***
	(0.002)	(0.011)
Business Freedom	0.005***	0.003***
	(0.001)	(0.001)
Log injured X Business Freedom		0.001***
		(0.000)
Constant	-0.649*	-0.522
	(0.338)	(0.340)
Years fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
ICC	0.051	0.049
Observations	91,964	91,964
Number of groups	78	78

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

2.7 Discussion

We presented the first large-scale, multilevel analysis that integrates CRED, GEM, and WGI data across multiple years and countries to investigate the moderating role of governance quality on individual-level growth aspirations expectations. This represented a methodological advance over previous single-level regressions. Our robustness checks, including disaster-type event-count controls, alternative disaster measures, and business freedom, reinforced the stability of these findings (Tables 7, 8, and 9).

This chapter examined two core questions aligned with our hypotheses: (1) Do natural disasters encourage or discourage entrepreneurial growth aspirations? (Hypothesis 1) and (2) Does governance quality moderate the link to entrepreneurial growth aspirations? (Hypothesis 2). Our findings provide clear support for both.

Natural disasters discouraged entrepreneurial growth aspirations, indicating a decline in entrepreneurship in the long term. As observed, the incidence of injuries due to natural disasters has a negative and significant effect on entrepreneurial growth aspirations, aligning with theoretical (uncertainty domain) claims that disasters increase uncertainty by disrupting infrastructure, information flows, and credit markets (Boehm et al., 2015; Schultz, 1975), resulting in entrepreneurs adopting survival-oriented strategies (Bullough et al., 2014).

Governance quality moderated the relationship between natural disasters and entrepreneurs' growth aspirations. When governance quality was high (opportunity-dominated), opportunities were stimulated, and the adverse effects of natural disasters on entrepreneurs' ambitions were mitigated. When governance quality was low (uncertainty-dominated), growth aspirations were discouraged, and the damage caused by natural disasters was exacerbated. This finding reinforces the idea that strong institutions can transform post-disaster uncertainty into opportunities (Acemoglu & Johnson, 2005; Dixit, 2009).

2.8 Contributions

We highlight two contributions to entrepreneurship literature and institutions literature. Our study extended the entrepreneurship literature by shifting the focus from survival and entry (Boudreaux, Escaleras, et al., 2019; Bustamante et al., 2022) to a forward-looking, long-term ambition-based perspective on entrepreneurship (Capelleras et al., 2019; Estrin et al., 2013; Hermans et al., 2015). We connected disaster research with expectations of growth aspirations and institutional theory, emphasising how governance dimensions,

such as regulatory quality, rule of law, and government effectiveness, encourage entrepreneurial risk-taking and sustained expansion strategies under conditions of shock.

Unlike Boudreaux, Escaleras, et al. (2019) and Boudreaux et al. (2023), which focus on country-level new business formation following disasters, our research examined the growth aspirations of individual entrepreneurs, offering a larger perspective on post-disaster responses in the long term. Moreover, while Epure et al. (2024) consider pro-market institutions during two crisis episodes, our panel spans 79 countries and 16 years, capturing broader temporal and spatial variation in governance quality and natural disasters.

2.9 Policy implications

Our results indicated that strong governance transforms natural disaster uncertainty into opportunities for entrepreneurs' growth aspirations. Policymakers should therefore concentrate on reinforcing core institutional pillars, such as regulatory quality, the rule of law, and control of corruption, to support sustained high-growth entrepreneurship in the aftermath of natural disasters. Streamlining reconstruction permits, ensuring transparent fund allocation, and maintaining robust legal frameworks can assist entrepreneurs in assessing and capitalising on new market niches with confidence throughout the recovery phase. Simultaneously, promoting effective information-sharing channels and access to credit will encourage mindsets to shift beyond immediate survival and foster investment in growth-oriented strategies.

These results also suggest that natural disaster policy should not be understood solely as a reactive response after an event. Strengthening institutional quality before disasters occur is central to improving how entrepreneurial ecosystems absorb and respond to crises. The coefficient comparison indicates that governance quality is more strongly associated with entrepreneurial growth aspirations than the direct effect of natural disaster exposure. This suggests that weak institutional environments may be more harmful to entrepreneurs' growth expectations than an increase in disaster exposure itself. Therefore, policies aimed at disaster resilience should not only focus on emergency relief and reconstruction but also on building credible, transparent, and effective institutions capable of reducing uncertainty before, during, and after crises.

2.10 Limitations and future research

This study draws on a panel of 79 countries covering the period from 2004 to 2019, which limits subnational analysis and may not capture post-2019 crisis dynamics affecting long-term growth aspirations. The binary variables used as controls limit the explanatory power of the estimates.

A further limitation concerns the potential endogeneity of governance quality with respect to natural disaster severity. Although natural disasters are treated as exogenous shocks, countries with stronger governance may reduce observed disaster impacts through better preparedness, infrastructure, early-warning systems, emergency response capacity, and risk-reduction policies. Therefore, governance quality may be correlated with the disaster-impact measure itself, rather than operating only as an external moderator of entrepreneurial responses. This limits strong causal interpretation of the interaction effect, and the results should be interpreted as associations rather than causal estimates. Future research could address this issue using lagged governance measures, pre-disaster institutional indicators, instrumental-variable strategies, or subnational event-level designs.

A further limitation concerns the use of GEM's self-reported entrepreneurial measures. Although GEM provides harmonised cross-country microdata well suited to examining individual-level expectations, perceptions, innovation behaviour, and entrepreneurial motivations, these measures may be affected by perceptual, recall, and reporting biases. Future research could complement GEM-based analyses with registry data, administrative records, tax data, or firm-level panels, which are better suited to studying outcomes such as firm entry, survival, formalisation, employment growth, or performance. However, such sources usually do not capture the specific individual-level outcomes examined in this thesis in a comparable way across countries and over time. Therefore, administrative or registry data would extend, rather than simply replace, the GEM-based approach used here.

Future research could leverage geo-referenced entrepreneur data, incorporate longitudinal measures of growth aspirations, or focus on specific disasters to capture more detailed territorial and temporal effects on entrepreneurs' ambition expectations. Examining the role of political discourse or other informal institutions as additional moderators would deepen our understanding of how entrepreneurs sustain or adjust their growth aspirations in crisis contexts.

2.11 Conclusions

We have two conclusions. First, natural disasters discourage long-term entrepreneurial growth aspirations. We demonstrated that the incidence of injuries due to natural disasters has a negative and significant effect on entrepreneurial growth aspirations, reflecting how these events increase uncertainty by disrupting infrastructure, information flows, and credit markets. In this scenario, entrepreneurs tend to adopt survival-oriented strategies, limiting their growth aspirations. Second, the quality of governance moderates this relationship. When governance quality is high, opportunities are stimulated, and the adverse effects of natural disasters on entrepreneurs' ambitions are mitigated. Conversely, when governance quality is low, the dominance of uncertainty is reinforced, growth aspirations are discouraged, and the damage caused by natural disasters is exacerbated. This finding highlights the role of institutions in transforming crisis scenarios into more conducive environments for forward-looking entrepreneurship.

Chapter 3

3 Natural Disasters and Innovative Entrepreneurship: The Role of Populism

3.1 Abstract

Conflicting evidence on the link between natural disasters and innovative entrepreneurship suggests overlooked moderating factors. We examine whether populist discourse by a nation's leader shapes this relationship. The theoretical model argues that disasters can discourage or encourage innovative entrepreneurship, depending on the balance between uncertainty and opportunity creation. We propose that populist discourse increases uncertainty and weakens opportunity signals. Using multilevel logit models on 60,631 observations from 45 countries affected by natural disasters between 2002 and 2019, we find that natural disasters discourage innovative entrepreneurship on average, suggesting that uncertainty dominates. Yet this relationship varies across levels of populist discourse. In the high-populism subsample, natural disasters are positively associated with innovative entrepreneurship, but higher levels of populist discourse weaken this association. In the low-populism subsample, natural disasters are negatively associated with innovative entrepreneurship, although low levels of populist discourse mitigate this effect.

3.2 Introduction

In recent decades, the frequency and severity of natural disasters have increased worldwide (Boudreaux et al., 2021, 2023). Beyond their immediate human and material costs, these events have broader economic consequences, shaping productive activity, firm behaviour, and expectations regarding technological change and innovation (Zhao et al., 2022). Accordingly, understanding how natural disasters affect innovation and entrepreneurial activity has become increasingly important. In this context, innovative entrepreneurship is especially relevant because it captures an early willingness to innovate and experiment with new solutions under conditions of uncertainty, making it particularly sensitive to exogenous shocks such as natural disasters (Amini-Sedeh et al., 2022; Koellinger, 2008a).

Despite growing interest in the relationship between natural disasters and innovation, existing theory and empirical evidence remain inconclusive. Some studies suggest that natural disasters can stimulate innovation by creating new demands and problem-solving opportunities, such as increased patenting in areas related to flood control, drought-resistant

crops, and natural disaster resilient infrastructure (Miao & Popp, 2014). In contrast, other research documents adverse and persistent effects, emphasising heightened uncertainty, constrained resources, postponed investment, and the diversion of organisational attention from long-term innovative projects (Zhao et al., 2022). Taken together, this mixed evidence leaves unresolved whether natural disasters ultimately promote or hinder innovative entrepreneurship.

This unresolved tension is not merely a theoretical inconsistency but has important implications for how entrepreneurs act in contexts linked to natural disasters. The effectiveness of pro-innovation policies after a natural disaster depends on which mechanism dominates: an uncertainty mechanism, characterised by heightened risk, postponed investment, and the diversion of organisational attention with potentially lasting effects, or an opportunity mechanism, driven by the replacement and diffusion of technologies and the emergence of new innovative activities (Miao & Popp, 2014; Zhao et al., 2022). Crucially, these mechanisms do not operate in a political vacuum. A growing institutional literature shows that political and institutional environments shape how economic actors interpret shocks, form expectations, and coordinate responses under uncertainty (Bennett et al., 2023; Dutta et al., 2013). In this context, political factors may determine whether natural disasters trigger innovation or instead amplify uncertainty and risk aversion. Entrepreneurs do not assess post-disaster innovation opportunities in isolation from the political environment. Political discourse signals policy continuity, regulatory stability, reconstruction priorities, and the credibility of institutional support, all of which are relevant to entrepreneurs deciding whether to invest in risky, innovation-oriented activities after a natural disaster. The level of populist discourse may shape which of these mechanisms dominates (Bennett et al., 2023), with higher levels tending to raise transaction costs and hinder the processing and circulation of information needed to mobilise resources and coordinate expectations around innovative projects, potentially weakening the effectiveness of post-disaster policy interventions (Bennett et al., 2023; Tang et al., 2024; Yoon et al., 2024). By contrast, lower levels of populist discourse may provide a less disruptive political environment in which opportunity-creation mechanisms are more likely to emerge.

Building on the tension between uncertainty and opportunity, we develop a theoretical framework explaining how natural disasters shape innovative entrepreneurship through two opposing mechanisms. We argue that, on average, uncertainty suppresses innovative entrepreneurship after natural disasters by restricting resources, increasing perceived risks,

and diverting organisational efforts, consistent with prior evidence (Zhao et al., 2022). At the same time, natural disasters may generate opportunities for innovation when institutional conditions support adaptation, learning, and technological renewal (Miao & Popp, 2014). Crucially, we propose that the political context conditions which mechanism dominates. Specifically, we argue that a national leader's populist discourse moderates the relationship between natural disasters and innovative entrepreneurship. We argue that this moderating role differs across levels of populist discourse. Low levels of populist discourse may provide a less disruptive political environment in which opportunity-creation effects are more likely to emerge, whereas high levels of populist discourse are expected to exacerbate uncertainty by intensifying instability, increasing transaction costs, and hindering the processing and circulation of information necessary to coordinate expectations and mobilise resources for innovative projects, thereby weakening the opportunity-creation effects of natural disasters (Bennett et al., 2023; Tang et al., 2024; Yoon et al., 2024). To examine these arguments, we assemble a data pool of 45 countries affected by natural disasters between 2002 and 2019, comprising 60,631 individual observations, and estimate multilevel logit models. We combine data from the Centre for Research on the Epidemiology of Disasters (CRED), the Global Entrepreneurship Monitor (GEM), the Fraser Institute (FI), and the Global Populism Database (GPD).

This study makes two key contributions to the literature on natural disasters, entrepreneurship, and political institutions. First, it advances prior research by developing an integrative theoretical framework that reconciles mixed findings on the relationship between natural disasters and innovative entrepreneurship. The framework explains why natural disasters may either discourage or stimulate innovative entrepreneurship, depending on the political-institutional context in which entrepreneurs interpret signals of uncertainty and opportunity. Second, the study highlights the moderating role of political discourse by showing how different levels of populist discourse shape uncertainty and opportunity mechanisms. The analysis identifies the political conditions under which one mechanism is more likely to dominate than the other. In doing so, the study brings political discourse into the entrepreneurship and natural disasters literature and demonstrates how political environments shape entrepreneurial responses to large-scale shocks.

3.3 Literature review

3.3.1 Natural disasters and innovative entrepreneurship

The empirical evidence indicates that the effects of natural disasters on innovative entrepreneurship are heterogeneous and highly context dependent. However, a comparative review of the available findings reveals a relatively consistent pattern: negative and persistent effects are more commonly documented in cross-country aggregate analyses, whereas positive effects are typically confined to specific sectors, regions, or events (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2021, 2023; Miao & Popp, 2014; Uriarte et al., 2026a; Zhao et al., 2022).

However, existing empirical evidence suggests that the uncertainty mechanism generally predominates, whereas the opportunity mechanism emerges in a more conditional and context-dependent manner. The literature has not systematically established why one mechanism or the other prevails, nor under what institutional and political conditions each is activated, leaving an unresolved question that this study seeks to address.

A useful way to organise this mixed evidence is through two opposing channels, uncertainty and opportunity.

3.3.2 Natural disasters and uncertainty versus opportunity mechanisms

Empirical research on the effects of natural disasters on entrepreneurship can be organised into two opposing mechanisms: uncertainty and opportunity. On the one hand, an uncertainty mechanism, associated with disruptions, resource constraints, and deteriorating conditions for long-term projects, tends to discourage risk-intensive entrepreneurial activities, such as innovation (Boehm et al., 2015; Zhao et al., 2022). On the other hand, an opportunity mechanism, linked to new demands, adaptation processes, and organisational learning, can foster innovative responses in specific contexts (Brück et al., 2011; Miao & Popp, 2014; Monllor & Murphy, 2017).

From an uncertainty perspective, studies document that natural disasters cause severe disruptions to infrastructure, supply chains, and production networks, raising transaction costs and reducing the availability of reliable information for business decision-making (Boehm et al., 2015; Carvalho, 2014). Empirical studies show that these disruptions translate into financial constraints, investment delays, and a reduced willingness to undertake capital-intensive or long-term projects, including those focused on innovation (Boudreaux, Escaleras, et al., 2019; Zhao et al., 2022). Furthermore, recent evidence indicates that the

negative effects of disasters are not merely transitory but can persist over time, thereby sustaining their impact on entrepreneurial activity and innovative investment (Boudreaux et al., 2021; Cordero, 2023; Wei et al., 2023).

In contrast, another line of empirical research highlights an opportunity mechanism, according to which natural disasters can reveal new demands and market niches linked to reconstruction, the provision of emergency services, and adaptation to higher-risk environments. Studies show that, in certain contexts, extreme events are associated with entrepreneurial responses centred on innovation, organisational learning, and the development of technical solutions for mitigation and resilience (Brück et al., 2011; Miao & Popp, 2014; Vegt et al., 2015). Furthermore, micro-level research shows that some entrepreneurs interpret post-disaster environments as spaces for creation and experimentation, relying on processes of adaptation and reconstruction (Monllor & Murphy, 2017; Salvato et al., 2020).

However, empirical evidence also indicates that the opportunity mechanism does not automatically emerge after a natural disaster. Studies suggest that these positive responses tend to be concentrated in specific sectors, territories, or contexts where pre-existing capacities and more supportive economic conditions exist to transform new demands into viable projects (Miao & Popp, 2014; Vegt et al., 2015). In the absence of these conditions, uncertainty tends to dominate, limiting the realisation of innovative opportunities and reinforcing business strategies geared towards survival rather than innovation (Boudreaux, Escaleras, et al., 2019; Zhao et al., 2022).

Taken together, these findings suggest that disasters activate both uncertainty and opportunity channels, but the balance between them is contingent on context.

3.3.3 The populism discourse as a moderator

Empirical evidence shows that populist governments tend to undermine institutional quality, distort innovation incentives, and foster environments less conducive to entrepreneurial activity (Acemoglu et al., 2013; Corrales & Penfold, 2011; Rodrik, 2018). Empirical studies document that populist political contexts are associated with higher policy volatility, weaker protection of property rights, and greater discretionary intervention, all of which negatively affect long-term investment and innovation-oriented entrepreneurial activity (Acemoglu et al., 2013; Rodrik, 2018). In this sense, populism has been empirically linked to deteriorating conditions for forward-looking economic decision-making and

reduced incentives for experimentation and innovation (Corrales & Penfold, 2011; Rodrik, 2018). While this work often conceptualises populism at the level of governments and policy orientations, we focus on populist discourse as a specific channel through which these broader political dynamics translate into uncertainty for economic actors.

More recent analyses of populist political discourse provide further evidence that populism increases uncertainty and constrains entrepreneurship. Studies show that populist discourse amplifies uncertainty, weakens coordination among economic actors, and disrupts the informational environment necessary to mobilise resources for innovative projects (Bennett et al., 2023). Empirical findings also indicate that these effects are unevenly distributed across the entrepreneurial population, with vulnerable groups, such as women entrepreneurs, disproportionately affected by the uncertainty and instability associated with populist rhetoric (Tang et al., 2024). Taken together, this evidence suggests that populist discourse operates primarily through channels aligned with the uncertainty mechanism, reinforcing risk aversion and discouraging engagement in innovation entrepreneurial activities (Bennett et al., 2023; Tang et al., 2024).

Despite these advances, prior empirical research has not explicitly examined whether populist discourse conditions the relationship between natural disasters and innovative entrepreneurship. While existing studies analyse the effects of populism on entrepreneurship and innovation (Acemoglu et al., 2013; Bennett et al., 2023; Tang et al., 2024), and a separate body of research investigates the economic and entrepreneurial consequences of natural disasters (Amini-Sedeh et al., 2022; Carvalho, 2014; Miao & Popp, 2014), these two strands of literature have largely evolved in parallel. As a result, little is known about whether and how populist discourse influences the balance between the uncertainty and opportunity mechanisms associated with natural disasters.

This omission is particularly consequential in a global context characterised by the increasing frequency and severity of natural disasters (Report CRED, 2022) and the growing prevalence of populist rhetoric across regions (Dalio et al., 2017). Understanding whether populist discourse shapes the relative salience of uncertainty and opportunity in post-disaster settings is therefore essential to explaining the heterogeneous entrepreneurial responses documented in the empirical literature on disasters and innovation (Boudreaux, Escaleras, et al., 2019; Zhao et al., 2022). Addressing this issue requires an integrated analytical framework that explicitly links political discourse to the mechanisms by which natural disasters shape innovative entrepreneurship.

3.4 Theory and hypothesis

3.4.1 Natural disasters discourage innovative entrepreneurship

The relationship between natural disasters and innovative entrepreneurship is theoretically complex because these events activate opposing forces that shape entrepreneurial decisions. Natural disasters constitute exogenous shocks that abruptly alter the economic, social, and psychological conditions under which entrepreneurs operate. By damaging infrastructure, disrupting supply chains, and affecting the provision of services, disasters suddenly modify expectations about the future environment, making planning and evaluation more difficult (Boehm et al., 2015; Carvalho, 2014; Zhao et al., 2022).

From a theoretical perspective, these effects can be organised around two opposing mechanisms. On the one hand, natural disasters activate a mechanism of uncertainty, characterised by increased perceived risk, informational ambiguity, and difficulty in anticipating future returns. This uncertainty directly affects entrepreneurial decisions, as innovative projects often involve high sunk costs, long time horizons, and uncertain outcomes. In contexts of high uncertainty, entrepreneurs tend to postpone investments, scale back their projects, or redirect efforts towards short-term strategies focused on survival, to the detriment of experimentation and innovation (Boehm et al., 2015; Boudreaux et al., 2021; O'Reilly, 2015; Zhao et al., 2022).

On the other hand, natural disasters can also create opportunities. By generating urgent needs for goods, services, and technical solutions related to reconstruction, adaptation, and risk mitigation, disasters can open space for new entrepreneurial initiatives. From this perspective, disasters can stimulate organisational learning, resource recombination, and the search for innovative solutions to address emerging problems (Brück et al., 2011; Monllor & Murphy, 2017; Starbuck et al., 1978; Vegt et al., 2015).

In this theoretical analysis, it is important to clarify what is meant by innovative entrepreneurship. It refers to the creation or introduction of new products, processes, or technologies that aim to drive market change and enhance competitiveness, rather than formal innovation outcomes such as patents or intensive R&D activities (Amini-Sedeh et al., 2022; Koellinger, 2008a). In this sense, innovative entrepreneurship captures an early willingness to innovate and experiment with new solutions under conditions of uncertainty, making it particularly sensitive to exogenous shocks such as natural disasters.

From this perspective, the mechanisms of uncertainty and opportunity do not operate symmetrically, either in time or in scope. The uncertainty mechanism tends to manifest immediately, typically following a disaster, and to affect a wide range of entrepreneurs and projects. By contrast, the opportunity mechanism is usually more gradual and selective, as it requires time to identify new demands, mobilise resources, and transform emerging needs into viable innovative initiatives. This temporal and cognitive asymmetry implies that, especially in activities characterised by high levels of risk and long horizons, such as innovative entrepreneurship, uncertainty tends to weigh more heavily in decision-making than potential opportunities (Boehm et al., 2015; Vegt et al., 2015; Zhao et al., 2022).

Consequently, although natural disasters can create opportunities for innovation, the abrupt and widespread rise in uncertainty tends to dominate entrepreneurs' decision-making. When uncertainty exceeds the perceived capacity to translate new needs into concrete opportunities, natural disasters are more likely to discourage, rather than encourage, innovative entrepreneurship. This predominance of the uncertainty mechanism helps explain, from a theoretical perspective, why natural disasters tend to be associated with reduced innovative entrepreneurship (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2023; Zhao et al., 2022).

Hypothesis 1: An increase in natural disasters will weaken innovative entrepreneurship.

3.4.2 The moderating role of populist discourse

Following Pappas (2019), populism can be understood as a form of illiberal democracy, characterised by access to power through democratic processes and, once in government, by the progressive weakening of liberal institutions. From this perspective, populism claims the will of the people as the ultimate source of legitimacy and often operates outside or against the norms, checks and balances, and procedures inherent to liberal democracy. This approach is particularly relevant to institutional theory, as it illustrates how populism erodes the predictability, legality, and normative stability that underpin economic decision-making, including innovative entrepreneurship (Bjørnskov & Foss, 2016; North, 1990; Williamson, 2000).

When natural disasters occur, entrepreneurs operate in an environment already marked by material disruptions, resource constraints, and high economic uncertainty (Boudreaux et al., 2023; Vegt et al., 2015; Zhao et al., 2022). In this context, political discourse plays a

central role as an institutional signal, shaping how economic agents interpret the shock, form expectations, and coordinate their responses. The literature shows that populist discourse generates regime uncertainty, understood as uncertainty about the future direction of public policies, regulatory stability, and the mechanisms for enforcing regulations, thereby hindering the planning and evaluation of long-term projects (Acemoglu et al., 2013; Bennett et al., 2023). This additional source of uncertainty is particularly relevant in post-disaster scenarios, where state interventions, reconstruction programmes, and regulatory changes with direct effects on investment and innovation are anticipated (Rodrik, 2018).

From a theoretical perspective, four arguments help explain why populist discourse may moderate the relationship between natural disasters and innovative entrepreneurship. These arguments suggest that populist discourse reinforces the uncertainty channel and limits the opportunity channel identified in the previous section.

First, populism tends to redirect resources towards short-term objectives, such as subsidies, transfers, or immediate consumption, at the expense of long-term investments in innovation, R&D, or entrepreneurial projects with uncertain returns (Dornbusch & Edwards, 1989; Rodrik, 2018). In post-disaster contexts, this reallocation further reduces the availability of capital and support needed to translate new demands into innovative initiatives, reinforcing a bias towards survival strategies rather than exploration (Boudreaux et al., 2023; Rodrik, 2018). Second, populism erodes institutional credibility and legitimacy, weakening checks and balances, accountability, and the rule of law. This deterioration heightens perceptions of risk and amplifies uncertainty about the stability of rules, contracts, and public policies, thereby intensifying the uncertainty mechanism already triggered by natural disasters (Acemoglu et al., 2013; Bennett et al., 2023; Pappas, 2019). Under these conditions, entrepreneurs face greater difficulty in assessing expected returns and coordinating innovation-oriented investments. Third, populist discourse reinforces social norms and symbolic frameworks that penalise disruption, exalting traditional practices and delegitimising innovative activities perceived as elitist or disconnected from “the people.” This normative environment diminishes the social legitimacy of experimentation and discourages the adoption of innovative entrepreneurial behaviours, particularly in crisis contexts where pressure to conform tends to intensify (Scott, 1995; Tang et al., 2024). Fourth, populism shapes how entrepreneurs perceive the opportunities and risks associated with disasters. Under populist leadership, crises are often discursively framed as threats requiring immediate, centralised, and exceptional responses, which intensifies perceptions

of insecurity and reduces the willingness to take innovative risks. In contrast, in non-populist contexts, disasters can be interpreted as collective challenges that create space for decentralised responses, learning, and innovative solutions (Monllor & Murphy, 2017; Yoon et al., 2024).

These arguments suggest that populist discourse shifts the balance between uncertainty and opportunity following a natural disaster. By amplifying political and institutional uncertainty, undermining the credibility of rules, and restricting the mobilisation of resources for long-term projects, populism reduces the likelihood that the opportunities generated by disasters will translate into innovative entrepreneurship (Acemoglu et al., 2013; Bennett et al., 2023; Rodrik, 2018). In this sense, populist discourse is not treated as an isolated political phenomenon, but as an institutional signal that shapes how entrepreneurs interpret post-disaster uncertainty, assess the credibility of policy responses, and evaluate whether emerging opportunities can be transformed into viable innovative projects.

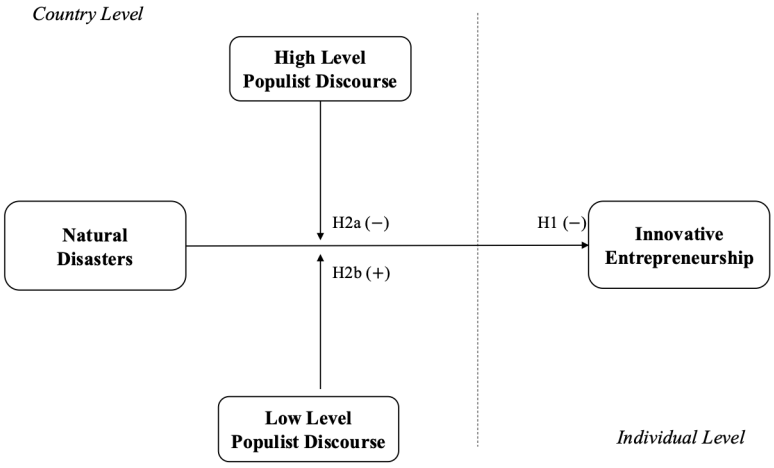
However, the arguments discussed above also suggest that the moderating role of populist discourse may not be best captured by a single, undifferentiated expectation. Rather, the relationship between natural disasters and innovative entrepreneurship is likely to vary more clearly across levels of populist discourse. At high levels of populist discourse, the uncertainty channel should become more dominant, making the relationship more adverse. At low levels of populist discourse, where institutional signals are more predictable and opportunity-creation processes face fewer political constraints, the relationship should become less adverse and potentially more favourable. For this reason, the moderating role of populist discourse is expressed through two complementary hypotheses.

Hypothesis 2a: High levels of populist discourse worsen the relationship between natural disasters and innovative entrepreneurship.

Hypothesis 2b: Low levels of populist discourse improve the relationship between natural disasters and innovative entrepreneurship.

Figure 4 illustrates the conceptual model. This model depicts the relationships between the variables and the analysis hypotheses. The first link is between natural disasters and innovative entrepreneurship. The second relationship, related to populist discourse, moderates the link between natural disasters and innovative entrepreneurship.

Figure 4: Multilevel conceptual framework



3.5 Data and methodology

3.5.1 Data and sample description

We construct a multilevel dataset in which individual entrepreneurs are nested within country-year contexts. The final database combines entrepreneur-level information from the Global Entrepreneurship Monitor (GEM) with country-level data on natural disasters, populist discourse, and macro-institutional conditions. To do so, we merge data from the Centre for Research on the Epidemiology of Disasters (CRED), the Global Entrepreneurship Monitor (GEM), the Global Populism Database (GPD), the Fraser Institute (FI), and the World Development Indicators (WDI).

The individual-level data come from the GEM Adult Population Survey (APS), which provides harmonised, comparable information on entrepreneurial activity across countries. GEM is particularly suitable for this study because it captures entrepreneurs' characteristics, perceptions, and behaviours through standardised survey procedures, enabling individual-level entrepreneurial outcomes to be linked to national-level conditions (Estrin et al., 2013). Following the GEM definition, we focus on early-stage entrepreneurs, that is, individuals involved in nascent ventures or owner-managed businesses that have been operating for up to 42 months. This focus is appropriate for our research question because innovative entrepreneurship, as measured by GEM, captures early entrepreneurial experimentation and the introduction of new products, technologies, or processes rather than formal innovation

outputs. This feature has made GEM a widely used source in comparative entrepreneurship research examining how institutional and economic environments shape entrepreneurial behaviour (Amini-Sedeh et al., 2022; Epure et al., 2024).

We complement GEM with country-level data from independent sources. Natural disaster exposure is drawn from CRED, which provides internationally comparable information on disaster events and their consequences. Populist discourse is measured using the GPD, which captures the degree of populism in speeches by national leaders. We also incorporate macroeconomic and institutional controls from the Fraser Institute and the World Bank's World Development Indicators, including measures of government spending, economic freedom, GDP growth, and unemployment. Combining these sources enables us to analyse whether country-level shocks and political discourse are associated with individual-level innovative entrepreneurship while mitigating common-source concerns.

The resulting dataset offers two main advantages for testing our hypotheses. First, it links micro-level entrepreneurial outcomes to macro-level disaster and political conditions, which is consistent with our theoretical argument that national shocks and institutional signals shape entrepreneurs' innovation decisions. Second, its country-year structure provides variation across countries and over time, enabling us to examine whether the relationship between natural disasters and innovative entrepreneurship differs across levels of populist discourse. At the same time, GEM provides repeated cross-sectional data rather than a longitudinal panel following the same entrepreneurs over time. Therefore, our empirical strategy estimates associations between country-year conditions and individual entrepreneurial outcomes, using multilevel logit models to account for the nesting of entrepreneurs within countries.

Our final sample comprises 60,631 entrepreneur-level observations from 45 countries between 2002 and 2019. It includes observations with available information on the main individual-level variables, the natural disaster measure, the populist discourse score, and country-level controls. Table 10 reports the definitions and sources of all variables used in the analysis. Table 12 presents descriptive statistics for the full sample and the low- and high-populism subsamples, while Table 13 reports the country composition of the sample.

3.5.2 Variables and measures

Our *dependent variable* (Table 10, variable 1) is innovative entrepreneurship, a binary variable representing entrepreneurs who innovate in products or technology. We used this

variable following (Amini-Sedeh et al., 2022; Koellinger, 2008a). The source of this variable is GEM. Our innovation measure combines two questions answered by entrepreneurs in a specific year and country: Is the product new to all or some customers? and, Was the technology or procedure not available in the country more than a year ago? This measure of innovative entrepreneurship is particularly well suited to analysing entrepreneurial responses to natural disasters, as it captures early, adaptive forms of innovation rather than formal or resource-intensive outcomes such as patents.

For the *individual-level control variables* (Table 10, variables 2 to 10), we included an indicator variable equal to 1 for men and 0 for women, and controls for age (Epure et al., 2024; Estrin et al., 2013). Higher education equals 1 if respondents have a post-secondary education degree, and 0 otherwise. We included knowing other entrepreneurs as a dummy variable equal to 1 if the respondent reported personally knowing someone who started a business in the past two years. Investment experience was also controlled for by a dummy variable equal to 1 if the entrepreneur, within the past three years, had personally contributed funds to a new business started by someone else, excluding any purchases of stock or mutual funds, and 0 otherwise (Epure et al., 2024). We included three perceptual measures or socio-cognitive traits (Boudreaux et al., 2023; Boudreaux, Nikolaev, et al., 2019; Wood & Bandura, 1989). Alertness is scored as 1 if individuals perceive that there will be good business opportunities to start a business in the next six months. Perceived self-efficacy is scored as 1 if individuals perceive they have the necessary knowledge, skills, and experience to start a new business. Fear of failure is scored as 1 if the respondent reports that fear of failure could prevent them from starting a business (although it did not necessarily prevent them from doing so). Current employment is measured by the current number of employees (excluding owners) that entrepreneurs report. Table 10 presents the variables used, their definitions, and sources.

For the *country-level control variables* (Table 10, variables 11 to 14), the level of government spending is measured on a scale of 0 to 100. Next, we account for the country's macroeconomic characteristics, which vary over time and influence business activity. We include indicators of the growth cycle (GDP growth) and the labour market (unemployment rate). Lastly, we incorporate a measure of institutional quality, utilising the index of economic freedom, which has been linked to firm-level differences in perceived corruption and business conditions (Dutta et al., 2024).

Natural disasters are measured using data from the CRED/EM-DAT database. Following the disaster categories retained for this thesis, the analysis considers droughts, earthquakes, extreme temperatures, floods, dry mass movements, wet mass movements, storms, volcanic activity, and wildfires. These categories allow the thesis to capture a broad range of climate-related, geophysical, hydrological, meteorological, and environmental shocks. For each country-year, disaster events are aggregated and then linked to individual-level entrepreneurial observations from GEM. Therefore, the disaster variables used in the empirical analyses represent annual country-level exposure to natural disasters rather than direct individual exposure to a specific event.

For the *country-level predictor* (Table 10, variable 15), we utilise the variable "homeless" (Boudreaux et al., 2021, 2023; Wei et al., 2023) to reflect the impact of natural disasters on innovative entrepreneurship in our estimates (for Hypothesis 1). The Centre for Research on the Epidemiology of Disasters (CRED) produced this variable. The variable "homeless" denotes the total number of homeless individuals caused by natural disasters. The natural disaster measure is constructed from CRED/EM-DAT event-level records, aggregated at the country-year level. In this chapter, disaster exposure is measured as the logarithm of one plus the number of people made homeless by natural disasters in a given country and year. When more than one disaster occurs in the same country-year, the corresponding impacts are aggregated to obtain an annual country-level measure of disaster exposure. This annual measure is then linked to all GEM respondents observed in the same country and year. Accordingly, the variable should be interpreted as a contextual measure of annual national exposure to disaster impacts, rather than as an event-level treatment indicator. The data structure does not allow us to determine whether each GEM respondent was interviewed before or after a specific disaster within the same year. This is particularly relevant because several disasters may occur in the same country-year, at different points in time and in different regions. Therefore, the empirical analysis examines whether annual country-level disaster exposure is associated with individual innovative entrepreneurship, rather than whether a specific disaster event affected each respondent before or after the interview date.

For the *country-level moderator* (variable 16 in Table 10), we use a measure of populist discourse (populism). The total range is from 0 to 2. We utilised data from the Global Populism Database (GPD), which measures the degree of populism present in the speeches of political leaders (presidents or prime ministers) during their terms in office. The GPD

employs a technique called "holistic grading", based on a qualitative assessment rubric. This method, drawn from the field of education, enables the identification of latent aspects of the text, such as tone and argumentative style. Each speech is evaluated by at least one trained coder (ideally two), who assigns a score according to the elements of populist discourse present. The analysis is conducted in the speech's original language. If two coders score the same speech, their results are averaged; discrepancies greater than 0.5 are reviewed during reconciliation sessions. The final score is derived by averaging the scores of four representative speeches from each political term. For the empirical analysis, leader-term scores were transformed into a country-year variable by expanding each leader-term across its corresponding years. In country-years with more than one leader or more than one populism score, we treated the observation as a transition or overlap year and excluded it from the populism dataset rather than averaging scores across leaders. This procedure ensures that each country-year has a single populist discourse value before merging with the GEM and CRED data. Regarding the scoring ranges and interpretations: 0 indicates that the speech does not present relevant populist elements and does not express a clear popular will; 1 suggests that the speech contains notable populist elements but also includes non-populist elements or inconsistencies, such as having a romanticised idea of the people without confrontational language or references to specific enemies; 2 signifies a highly populist speech that features almost all the ideal elements of populism with very few non-populist elements (Hawkins et al., 2019; Hawkins, 2009; Tang et al., 2024). We reinterpreted definitions of populism and non-populism to facilitate understanding. We define low populism as the range [0 to 0.5] and high populism as the range]0.5 to 2].

Table 10: Variable definitions and sources

	Variables	Definition	Source
1	Innovative entrepreneur	Binary indicator coded 1 when the entrepreneur reports product or service novelty for some or all customers, or the use of technology or production processes not available in the country more than one year ago; 0 otherwise.	GEM
2	Age	Respondent's age in years.	GEM
3	Gender	Binary indicator coded 1 for male respondents and 0 for female respondents.	GEM
4	Higher education	Binary indicator coded 1 for respondents with post-secondary education, and 0 otherwise.	GEM
5	Knows other entrepreneurs	Binary indicator coded 1 when the respondent personally knows someone who started a business during the previous two years, and 0 otherwise.	GEM
6	Investment experience	Binary indicator coded 1 when the respondent personally funded someone else's new business during the previous three years, excluding stocks or mutual funds, and 0 otherwise.	GEM
7	Alertness	Binary indicator coded 1 when respondents report good local business opportunities in the next six months, and 0 otherwise.	GEM
8	Perceived self-efficacy	Binary indicator coded 1 when respondents report having the knowledge, skills, and experience required to start a business, and 0 otherwise.	GEM
9	Fear of failure	Binary indicator coded 1 when fear of failure could discourage the respondent from starting a business, and 0 otherwise.	GEM
10	Current employment level	Number of current employees, excluding owners.	GEM
11	Government spending	Public spending index ranging from 0 to 100.	FI
12	GDP growth	Annual GDP growth rate based on constant local currency.	WDI
13	Unemployment rate	Share of the labour force that is unemployed.	WDI
14	Freedom index	Economic freedom index covering government size, legal system and property rights, sound money, freedom to trade internationally, and regulation of credit, labour, and business. Higher values indicate greater economic freedom.	FI
15	Natural disasters	Natural logarithm of one plus the number of people made homeless by natural disasters.	CRED
16	Populist discourse	The final populism score represents the average of four speeches from each leader. The original database ranges from 0 to 2. The final populist score was calculated as the average of all four speeches for each leader-term with scores below 0.5 indicating "not populist," between 0.5 and 0.99 "somewhat populist," between 1.0 and 1.49 "populist," and 1.50 and higher "very populist".	GPD
17	Innovation products (robustness)	Binary indicator coded 1 when the entrepreneur reports that the product or service is new to some or all customers, and 0 otherwise.	GEM

3.5.3 Empirical strategy

Our empirical design links country-year measures of natural disaster exposure and populist discourse to individual-level entrepreneurial outcomes from GEM. Specifically,

natural disasters are measured at the country-year level using CRED data, while innovative entrepreneurship is observed at the individual level through GEM. This creates a multilevel structure in which entrepreneurs are observed within country-year contexts and are nested within countries. Given this hierarchical structure, we estimate multilevel logistic regression models with country-level random intercepts. This modelling strategy is appropriate for three reasons. First, our dependent variable, innovative entrepreneurship, is binary, indicating whether an entrepreneur reports product and/or technology innovation. Second, our theoretical framework combines individual-level entrepreneurial characteristics with country-level disaster exposure, populist discourse, and macro-institutional conditions. Third, entrepreneurs in the same country are likely to share unobserved contextual conditions, making their responses potentially correlated. A multilevel specification accounts for this nesting by allowing the baseline likelihood of innovative entrepreneurship to vary across countries, thereby capturing unobserved between-country heterogeneity and reducing concerns about treating all individual observations as fully independent (Amorós et al., 2019; Epure et al., 2024; Estrin et al., 2013, 2022). Because natural disasters are measured as annual country-level exposure, the empirical specification should not be interpreted as an event-study design. Rather, the multilevel logit model estimates the association between country-year disaster exposure and individual innovative entrepreneurship, while accounting for the nesting of GEM respondents within countries and controlling for year-level variation using year fixed effects.

This approach is particularly suitable for comparative entrepreneurship research using GEM data, as it enables the estimation of individual-level entrepreneurial outcomes while accounting for country-level institutional and economic conditions. In our setting, natural disasters and populist discourse are measured at the country-year level, whereas innovative entrepreneurship is measured at the individual level. The multilevel logit model therefore allows us to examine whether country-level shocks and political discourse are associated with individual entrepreneurs' likelihood of innovating, while controlling for both individual-level characteristics and country-level conditions. We include year fixed effects to absorb common temporal shocks and industry fixed effects to account for systematic differences in innovation across sectors. We estimate our hypotheses using the following general specifications:

$$Innovation_{ijt} = \alpha + \beta_1 ND_{jt} + \beta_2 Populism_{jt} + \beta_3 Populism_{jt} \times ND_{jt} + \cdots + X_{ijt}\gamma_n + Z_{jt}\delta_n + \nu_{it} + \psi_t + \mu_{ijt} + \varepsilon_{jt} \quad (2)$$

$Innovation_{ijt}$ is a measure of the innovative entrepreneur of individual i within country j at year t. ND_{jt} is a measure of natural disasters for country j and year t. $Populism_{jt}$ measures the level of populist discourse. For descriptive and interpretive purposes, we report lower levels of populist discourse as populist discourse ≤ 0.5 and higher levels of populist discourse as populist discourse > 0.5, following by Tang et al. (2024) and Hawkins et al. (2019). For more details, see Table 10, variable 16.

For hypothesis 1, we evaluate the impact of the natural disaster variable at the country level on $Innovation_{ijt}$ the individual level. We estimate equation (2), emphasising the sign, significance and marginal effect β_1.

Hypotheses 2a and 2b represent the moderating effect of populist discourse on innovative entrepreneurship across different levels of populist discourse. We estimate equation (2), emphasising the sign, significance, and marginal effect of β_3. To aid interpretation, we also distinguish between lower and higher levels of populist discourse and complement the full-sample interaction analysis with split-sample evidence.

X_{ijt} includes individual-level controls (age, gender, higher education, knows other entrepreneurs, investment experience, alertness, perceived self-efficacy, fear of failure and current employment) and Z_{jt} country-level controls (government spending, GDP growth, unemployment rate and freedom index). We add industry effects (1-digit SIC) to control for potential endogeneity of the time constant related to omitted industry characteristics (ν_{it}) and year effects to account for systematic shocks that lead to variations in industry innovation of all entrepreneurs during a given period (ψ_t). In the random part of the equation, μ_{ijt} are the individual-level residuals and ε_{jt} the country-level residuals.

We report two tests. First, we calculate the intraclass correlation coefficient (ICC). The ICC is applied to all regressions shown in Table 15. The ICC ranges between 0.14 and 0.23 across the six estimates, indicating that approximately 14% to 23% of the total variability in the dependent variable (innovative entrepreneurship) is attributable to between-country differences, thereby justifying the use of a multilevel modelling approach. The confidence interval of the ICC does not include zero, suggesting that the intraclass correlation differs significantly from zero. Second, to assess multicollinearity, we calculate the variance inflation factor (VIF). Most variables have very low VIF values (close to 1), indicating no significant multicollinearity issues (see Table 11). The average VIF value is 1.15, which is relatively low and does not imply serious concerns regarding multicollinearity in the model.

Following standard practice, VIF values were computed using a linear probability model with the same set of covariates, excluding country-level random effects.

Table 11: Multicollinearity test on variables

Variables	VIF	1/VIF
Age	1.03	0.972
Gender	1.02	0.981
Higher education	1.07	0.939
Knows other entrepreneurs	1.06	0.945
Investment experience	1.03	0.971
Alertness	1.08	0.923
Fear of failure	1.04	0.963
Perceived self-efficacy	1.06	0.941
Current employment level	1.00	0.998
Government spending	1.43	0.698
GDP growth	1.31	0.764
Unemployment rate	1.50	0.666
Freedom index	1.26	0.797
Natural disasters	1.16	0.862
Populism	1.25	0.799
Mean VIF	1.15	

Note: VIF values greater than 10 indicate potential concern about collinearity among variables. Year and industry indicators are not included in the test. The variables in the model do not exhibit collinearity.

3.6 Results

3.6.1 Descriptive results

Table 12, on the left, presents descriptive statistics for the full sample, first at the individual level and then at the country level. Among individual-level variables, innovative entrepreneurship averages 0.53. Importantly, our innovation indicator captures early-stage innovative entrepreneurship (GEM-based product and/or technology novelty), rather than formal R&D outputs; therefore, the mean (0.53) reflects the prevalence of this broader form of innovation in the entrepreneurial sample.

Table 12: Descriptive statistics

		Full sample					Sample split			
		Populist discourse					Low Populism		High Populism	
		Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Obs.	Mean
	Level 1 variables									
1	Innovation	60,631	0.534	0.499	0	1	52,050	0.532	8,581	0.549
2	Age	60,631	37.776	11.491	18	64	52,050	37.977	8,581	36.554
3	Gender	60,631	0.580	0.493	0	1	52,050	0.584	8,581	0.561
4	Higher education	60,631	0.367	0.482	0	1	52,050	0.377	8,581	0.305
5	Knows other entrepreneurs	60,631	0.623	0.485	0	1	52,050	0.628	8,581	0.592
6	Investment experience	60,631	0.107	0.309	0	1	52,050	0.104	8,581	0.125
7	Alertness	60,631	0.599	0.490	0	1	52,050	0.594	8,581	0.630
8	Perceived self-efficacy	60,631	0.850	0.357	0	1	52,050	0.848	8,581	0.864
9	Fear of failure	60,631	0.274	0.446	0	1	52,050	0.266	8,581	0.327
10	Current employment level	60,631	3.159	48.153	0	2,000	52,050	3.288	8,581	2.377
	Level 2 variables									
11	Government spending	60,631	64.896	19.595	0	94.4	52,050	64.429	8,581	67.723
12	GDP growth	60,631	3.028	2.930	-10.894	24.370	52,050	2.982	8,581	3.311
13	Unemployment rate	60,631	8.826	5.812	2.02	26.49	52,050	9.322	8,581	5.818
14	Freedom index	60,631	7.259	0.726	3.78	8.7	52,050	7.366	8,581	6.606
15	Natural disasters	60,631	3.541	4.364	0	15.239	52,050	3.498	8,581	3.805
16	Populism	60,631	0.262	0.388	0	1.75	52,050	0.125	8,581	1.092

The average age of respondents in the entrepreneurial sample is approximately 38 years, and 58% are male. 37% of participants hold a post-secondary education degree. 62% of the entrepreneurs in the sample knew someone who started a business in the past two years. 11% of participants personally provided funding for a new business started by someone else, excluding any purchases of stock or mutual funds. More than half of them (60% of the sample) saw good opportunities to establish a new business in their area within the next six months. The majority (85%) of entrepreneurs believe they possess the necessary knowledge, skills, and experience to become entrepreneurs. 27% indicated that fear of failure could prevent them from starting a business. The average number of employees is 3. At the country level, the average government spending level was 64.90 (scale of 0-100). The average GDP growth rate was 3%, and the average unemployment rate was 8.8%. The average Economic Freedom Index was 7.26. The average value of the natural disasters measure was 3.54, and the average populist discourse was 0.26.

Table 12 on the right splits the sample into two groups: observations with populist discourse scores of 0.5 or less and those above 0.5. According to the GPD classification, scores of 0.5 or below indicate non-populism, which we interpret as lower levels of populist discourse for explanatory purposes, while scores above 0.5 indicate populism, reflecting higher levels of populist discourse. Some differences are clear across the two contexts. Higher education levels are 0.37 in low-populism contexts compared to 0.31 in high-populism contexts. Alertness scores are 0.59 versus 0.63, fear of failure is 0.27 versus 0.33, current employment is 3.3 versus 2.4, government spending is 64.4 versus 67.7, and GDP growth is 3.0 versus 3.3. Innovative entrepreneurship is also marginally higher in high-populism contexts (0.55 versus 0.53).

The differences in macroeconomic conditions at the national level are particularly notable. In contexts of low populism, there is less public spending, slower GDP growth, and higher unemployment. Conversely, high-populism contexts tend to have higher public spending and higher GDP growth, along with lower unemployment rates.

Table 13 lists the 45 countries included in our estimates. The countries with the highest relative weight percentages in the sample are Spain (15.63%), Chile (11.47%), and Brazil (10.78%).

Table 13: Country list

	Country	Freq.	Percent	Cum.		Country	Freq.	Percent	Cum.
1	United States	1,785	2.94	2.94	24	Indonesia	2,535	4.18	77.07
2	Russia	294	0.48	3.43	25	Philippines	1,471	2.43	79.50
3	South Africa	1,190	1.96	5.39	26	Japan	177	0.29	79.79
4	Greece	549	0.91	6.30	27	Turkey	588	0.97	80.76
5	Netherlands	560	0.92	7.22	28	India	1,353	2.23	82.99
6	France	379	0.63	7.85	29	Iran	828	1.37	84.36
7	Spain	9,475	15.63	23.47	30	Canada	1,083	1.79	86.15
8	Hungary	650	1.07	24.55	31	Ireland	338	0.56	86.70
9	Italy	348	0.57	25.12	32	Latvia	225	0.37	87.07
10	Switzerland	134	0.22	25.34	33	Estonia	133	0.22	87.29
11	Austria	214	0.35	25.69	34	Croatia	683	1.13	88.42
12	Sweden	157	0.26	25.95	35	Slovenia	147	0.24	88.66
13	Norway	131	0.22	26.17	36	Slovakia	338	0.56	89.22
14	Poland	164	0.27	26.44	37	Guatemala	1,155	1.90	91.13
15	Germany	867	1.43	27.87	38	Costa Rica	228	0.38	91.50
16	Peru	2,602	4.29	32.16	39	Panama	1,354	2.23	93.73
17	Mexico	2,644	4.36	36.52	40	Venezuela	152	0.25	93.98
18	Argentina	1,424	2.35	38.87	41	Bolivia	1,065	1.76	95.74
19	Brazil	6,537	10.78	49.65	42	Ecuador	2,177	3.59	99.33
20	Chile	6,954	11.47	61.12	43	Uruguay	199	0.33	99.66
21	Colombia	5,461	9.01	70.13	44	Dominican Republic	138	0.23	99.89
22	Malaysia	692	1.14	71.27	45	Georgia	68	0.11	100.00
23	Australia	985	1.62	72.89		Total	60,631		

Finally, we present a correlation matrix (see Table 14). The correlation between our measure of natural disasters (log homeless) and innovative entrepreneurship is 0.003. The correlation between populism and innovative entrepreneurship is -0.021.

Table 14: Correlation matrix

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Innovation	1,000																
2	Innovation products	0,860	1,000															
3	Age	-0,036	-0,028	1,000														
4	Gender	0,004	0,002	-0,013	1,000													
5	Higher education	0,080	0,098	0,017	0,053	1,000												
6	Knows other entrepreneurs	0,049	0,042	-0,059	0,059	0,102	1,000											
7	Investment experience	0,087	0,101	-0,024	0,073	0,080	0,101	1,000										
8	Alertness	0,082	0,090	-0,058	0,015	0,007	0,134	0,048	1,000									
9	Perceived self-efficacy	0,043	0,046	0,039	0,053	0,076	0,133	0,038	0,101	1,000								
10	Fear of failure	-0,035	-0,035	0,006	-0,049	-0,039	-0,039	-0,019	-0,097	-0,159	1,000							
11	Current employment level	0,016	0,013	0,003	0,009	0,019	0,014	0,013	0,004	0,004	-0,010	1,000						
12	Government spending	0,234	0,215	-0,077	-0,059	-0,083	0,027	0,075	0,155	-0,008	-0,028	-0,019	1,000					
13	GDP growth	0,149	0,127	-0,029	-0,037	-0,027	0,026	0,036	0,152	0,001	-0,024	0,001	0,395	1,000				
14	Unemployment rate	-0,080	-0,078	0,041	0,058	0,063	-0,024	-0,048	-0,177	0,022	0,025	0,000	-0,456	-0,387	1,000			
15	Freedom index	0,126	0,122	0,119	0,025	0,189	0,056	0,048	-0,026	0,055	-0,043	0,025	-0,040	0,040	0,066	1,000		
16	Natural disasters	0,003	0,009	-0,050	-0,026	-0,079	-0,014	0,028	0,066	-0,049	0,017	-0,015	0,244	0,017	-0,217	-0,172	1,000	
17	Populism	-0,021	-0,006	-0,038	-0,023	-0,038	-0,035	0,003	0,008	0,020	0,026	-0,006	0,038	-0,016	-0,221	-0,351	-0,049	1,000

3.6.2 Multilevel model results

Hypothesis 1 predicts that natural disasters reduce the likelihood of innovative entrepreneurship. Consistent with this view, the coefficient on natural disasters (log(1+homeless)) is negative and statistically significant in Models 1 and 2 (Table 15). In Model 2, the coefficient is −0.027, indicating that higher natural disasters are associated with lower log-odds of innovative entrepreneurship. To express this effect in probability terms, we use the sample mean of the dependent variable (p = 0.53) as a reference point and approximate the change locally around that value. A 50% increase in the number of people rendered homeless by natural disasters corresponds to an increase of about 0.405 units in log(1+homeless). Around p = 0.53, this translates into an approximate decline of 0.003 in the probability of innovating, or about 0.28 percentage points (e.g., from 53.00% to 52.72%), holding other covariates constant.

Table 15: Multilevel logit regression (innovative entrepreneurship)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Full sample		Low Populism		High Populism	
Natural disasters (H1)	-0.010***	-0.027***	-0.020***	-0.033***	0.035***	0.186***
	(0.003)	(0.004)	(0.003)	(0.005)	(0.013)	(0.051)
Populism	0.650***	0.494***	0.454***	0.172	0.238	0.552
	(0.061)	(0.064)	(0.103)	(0.123)	(0.333)	(0.349)
Natural disasters # populism (H2)		0.059***		0.087***		-0.149***
		(0.008)		(0.021)		(0.048)
Age	-0.007***	-0.007***	-0.008***	-0.008***	-0.004*	-0.004*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Gender	0.005	0.004	0.005	0.005	0.010	0.013
	(0.020)	(0.020)	(0.021)	(0.021)	(0.051)	(0.052)
Higher education	0.134***	0.134***	0.098***	0.098***	0.322***	0.318***
	(0.021)	(0.021)	(0.023)	(0.023)	(0.056)	(0.056)
Knows other entrepreneurs	0.097***	0.094***	0.082***	0.082***	0.146***	0.151***
	(0.020)	(0.020)	(0.022)	(0.022)	(0.051)	(0.051)
Investment experience	0.264***	0.265***	0.259***	0.259***	0.297***	0.280***
	(0.031)	(0.031)	(0.035)	(0.035)	(0.077)	(0.078)
Alertness	0.171***	0.171***	0.186***	0.187***	0.144***	0.140***
	(0.020)	(0.020)	(0.022)	(0.022)	(0.052)	(0.052)
Perceived self-efficacy	0.085***	0.085***	0.109***	0.110***	-0.031	-0.036
	(0.027)	(0.027)	(0.030)	(0.030)	(0.073)	(0.073)
Fear of failure	-0.022	-0.022	-0.033	-0.033	0.034	0.033
	(0.021)	(0.021)	(0.023)	(0.023)	(0.053)	(0.053)
Current employment level	0.001***	0.001***	0.001***	0.001***	0.004*	0.004*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)
Government spending	0.014***	0.012***	0.015***	0.015***	0.019***	0.027***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)	(0.006)
GDP growth	0.063***	0.061***	0.042***	0.041***	0.133***	0.108***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.019)	(0.021)
Unemployment rate	0.003	0.001	-0.004	-0.007	0.136***	0.120***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.035)	(0.037)
Freedom index	0.216***	0.221***	0.077	0.045	1.133***	1.353***
	(0.064)	(0.064)	(0.079)	(0.079)	(0.284)	(0.301)
Constant	-0.479	-0.331	0.894	1.219**	-9.574***	-12.132***
	(0.510)	(0.510)	(0.603)	(0.606)	(2.252)	(2.474)
Years and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
ICC	0.141	0.141	0.144	0.140	0.210	0.233
Observations	60,631	60,631	52,050	52,050	8,581	8,581
Number of groups	45	45	41	41	13	13

Notes: Models 5 and 6 identify no observations in the sample for the years 2003, 2004 and 2006. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

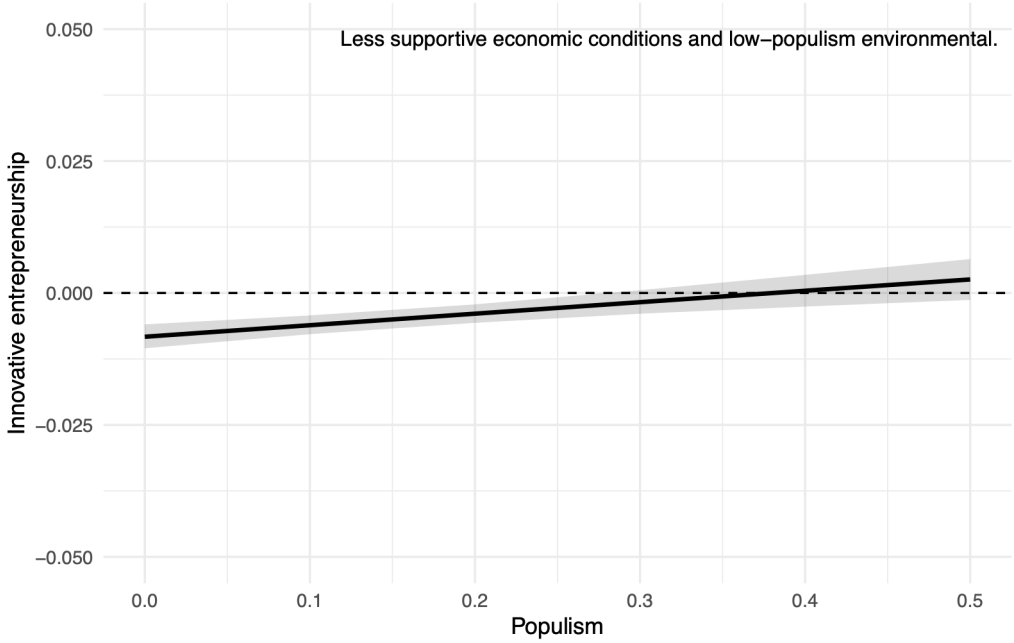
Hypotheses 2a and 2b propose that the relationship between natural disasters and innovative entrepreneurship varies across lower and higher levels of populist discourse. In Model 2 of Table 15, the full-sample estimate shows a statistically significant positive interaction term (0.059). This pattern suggests that, on average, higher levels of populism are associated with a less negative (or more positive) natural disaster innovative entrepreneurship slope. Importantly, however, this aggregate result largely reflects the distribution of populism in the sample. The average level of populism in the full sample is 0.26 (Table 12), which lies in the non-populism (low populism) range under the classification used (see Table 10) (Hawkins et al., 2019; Tang et al., 2024). Thus, the full-sample interaction is dominated by observations in relatively low-populism contexts, where the uncertainty-amplifying effect of populist discourse is expected to be weaker and the institutional change is lower.

To better capture the conditional nature of Hypotheses 2a and 2b, we examine heterogeneity by splitting the sample into low populism (populist discourse ≤ 0.5) and high populism (populist discourse > 0.5) ranges. We descriptively characterise these ranges using macroeconomic indicators. On average, the populism range exhibits higher government spending (67.7 vs 64.4), higher GDP growth (3.3 vs 3.0), and lower unemployment (5.8 vs 9.3), whereas the low-populism range reflects less supportive macroeconomic conditions. These macroeconomic differences are descriptive features of the split sample and should not be interpreted as the theoretical mechanism by which populist discourse operates. In the low-populism range, the interaction term is positive and statistically significant, indicating that increases in populist discourse within low levels mitigate the adverse association between natural disasters and innovative entrepreneurship. In the populism range, the interaction term is negative and statistically significant (Table 15, Model 6), indicating that stronger populist discourse shifts the relationship between natural disaster and innovative entrepreneurship downward by eroding the positive association between disasters and innovative entrepreneurship observed in that range. Together, these results support H2a in the high-populism range and H2b in the low-populism range.

Figures 5 and 6 illustrate how the marginal effect of natural disasters (log homeless) on the probability of innovative entrepreneurship varies with the level of populism (high-populism vs low-populism), evaluated at log homeless = 3.5. The panels are based on the split-sample estimates and therefore reflect two descriptively different macroeconomic

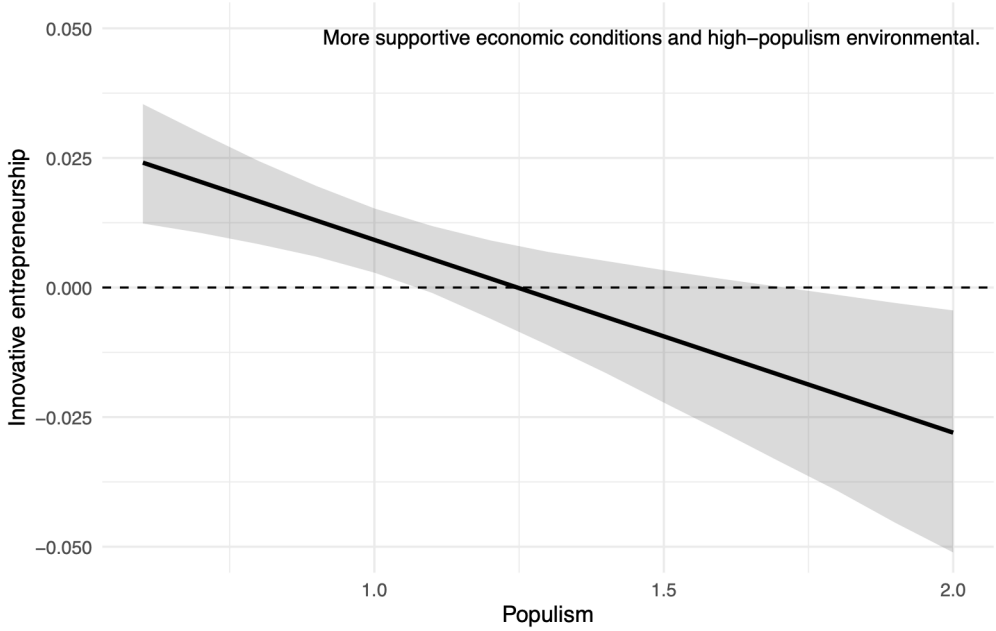
environments: the low-populism range corresponds to less supportive macroeconomic conditions on average, whereas the high-populism range corresponds to more supportive macroeconomic conditions (Table 12). Figure 5 shows that within the low-populism range (0 to 0.5), increases in populist discourse are associated with a positive marginal effect of natural disasters on innovative entrepreneurship. Figure 6 shows that within the populism range (0.5 to 2.0), higher levels of populist discourse are associated with a more negative marginal effect of natural disasters, thereby eroding the more positive association between natural disasters and innovative entrepreneurship observed in that subsample.

Figure 5: Marginal effect of natural disasters on innovation by level of low populism



Note: Marginal effects (∂Pr/∂log[h]) evaluated at log(homeless)=3.5; other covariates at sample means. Values can be negative because they are changes in predicted probability. Populist discourse ≤ 0.5.

Figure 6: Marginal effect of natural disasters on innovation by level of high populism



Note: Marginal effects (∂Pr/∂log[h]) evaluated at log(homeless)=3.5; other covariates at sample means. Values can be negative because they are changes in predicted probability. Populist discourse > 0.5.

We observed that several control variables were statistically significant (Table 15, Model 1). Younger entrepreneurs, those with post-secondary education, those who knew someone who started a business in the last two years, those who financed a new business started by others, those who foresee short-term business opportunities, those who perceive themselves as having entrepreneurial skills, and those who employ a larger number of people in their ventures tend to be more likely to innovate in their projects. Furthermore, at the national level, higher public spending, stronger economic growth, and greater economic freedom are positively associated with innovative entrepreneurship. We apply controls by year (from 2002 to 2019) and by industry in our estimates.

3.6.3 Robustness checks

We performed a robustness test by replacing the combined measure of product and technology innovation with a product-only innovation measure. Referring to the baseline estimates in Table 15, Table 16 shows that the main pattern of results remains largely consistent. Notably, the coefficient on natural disasters maintains the same directional pattern across the full sample and the two populism ranges, and the interaction with populist discourse remains positive in the full sample and negative in the high-populism range. However, unlike the baseline results, the interaction term in the low-populism range is no

longer statistically significant. Overall, this robustness test offers partial support for the baseline findings, while indicating that the moderating pattern is more pronounced in the high-populism range than in the low-populism range.

Table 16: Robustness multilevel logit regression (new products)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Full sample		Low-Populism		High-Populism	
Natural disasters (Log homeless)	-0.006**	-0.015***	-0.012***	-0.013***	0.031***	0.170***
	(0.003)	(0.004)	(0.003)	(0.005)	(0.012)	(0.045)
Populism	0.670***	0.592***	0.354***	0.320**	0.525*	0.842***
	(0.060)	(0.064)	(0.105)	(0.125)	(0.295)	(0.314)
Natural disasters # populism		0.029***		0.010		-0.138***
		(0.008)		(0.021)		(0.044)
Age	-0.006***	-0.006***	-0.007***	-0.007***	-0.003	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Gender	-0.015	-0.016	-0.013	-0.013	-0.020	-0.017
	(0.019)	(0.019)	(0.021)	(0.021)	(0.050)	(0.050)
Higher education	0.145***	0.145***	0.118***	0.118***	0.295***	0.293***
	(0.021)	(0.021)	(0.023)	(0.023)	(0.054)	(0.054)
Knows other entrepreneurs	0.111***	0.110***	0.106***	0.105***	0.129***	0.133***
	(0.020)	(0.020)	(0.022)	(0.022)	(0.050)	(0.050)
Investment experience	0.257***	0.257***	0.251***	0.251***	0.280***	0.265***
	(0.031)	(0.031)	(0.034)	(0.034)	(0.075)	(0.075)
Alertness	0.190***	0.190***	0.210***	0.211***	0.135***	0.131**
	(0.020)	(0.020)	(0.022)	(0.022)	(0.051)	(0.051)
Perceived self-efficacy	0.114***	0.114***	0.140***	0.140***	-0.028	-0.032
	(0.027)	(0.027)	(0.030)	(0.030)	(0.072)	(0.072)
Fear of failure	0.008	0.009	0.002	0.002	0.038	0.037
	(0.021)	(0.021)	(0.023)	(0.023)	(0.051)	(0.051)
Current employment level	0.001***	0.001***	0.000**	0.000**	0.004**	0.004**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)
Government spending	0.012***	0.011***	0.010***	0.010***	0.020***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)
GDP growth	0.055***	0.054***	0.036***	0.036***	0.098***	0.073***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.018)	(0.020)
Unemployment rate	-0.005	-0.006	-0.013***	-0.013***	0.103***	0.091***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.031)	(0.032)
Freedom index	0.328***	0.333***	0.214***	0.212***	0.935***	1.105***
	(0.060)	(0.060)	(0.075)	(0.075)	(0.211)	(0.228)
Constant	-4.391***	-4.342***	-3.265***	-3.235***	-10.089***	-12.151***
	(0.463)	(0.463)	(0.560)	(0.563)	(1.818)	(2.038)
Years and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
ICC	0.132	0.131	0.133	0.132	0.076	0.083
Observations	60,624	60,624	52,049	52,049	8,575	8,575
Number of groups	45	45	41	41	13	13

Notes: Models 5 and 6 identify no observations in the sample for the years 2003, 2004 and 2006. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. We used Laplace integration.

3.7 Discussion

This study examines how natural disasters shape innovative entrepreneurship and how political discourse conditions this relationship. Rather than producing a uniform entrepreneurial response, natural disasters primarily act as uncertainty shocks, suppressing innovative entrepreneurial activity in most contexts. This pattern aligns with prior research showing that disasters disrupt infrastructure, credit markets, and supply chains, thereby increasing transaction costs and constraining forward-looking economic decisions (Boudreaux et al., 2021, 2023; Zhao et al., 2022).

From a theoretical perspective, this result highlights a fundamental asymmetry between the two mechanisms often discussed in the literature. Natural disasters induce uncertainty that is immediate, generalised, and difficult to avoid, affecting expectations, access to resources, and coordination among economic actors (Boehm et al., 2015; Boudreaux et al., 2021). By contrast, opportunity creation is more selective and contingent, requiring time, stable expectations, and enabling conditions to translate new demands into innovative initiatives (Miao & Popp, 2014; Vegt et al., 2015). As a result, innovative entrepreneurship, characterised by experimentation, risk-taking, and longer time horizons, is particularly sensitive to natural disasters that create uncertainty (Koellinger, 2008b; Zhao et al., 2022).

These findings help reconcile mixed evidence in prior research. While some studies emphasise adaptive responses, resilience, and innovation following extreme events (Miao & Popp, 2014; Monllor & Murphy, 2017; Vegt et al., 2015), our results indicate that such outcomes do not represent the dominant response to natural disasters. Instead, they emerge only under specific conditions that enable entrepreneurs to overcome heightened uncertainty, such as access to finance, functional infrastructure, and reliable institutional signals (Boudreaux, Escaleras, et al., 2019; Zhao et al., 2022).

Introducing populist discourse as a moderating factor further clarifies this heterogeneity. In the aggregate sample, the moderating effect of populism is positive, which is consistent with the concentration of observations in the low-populism range of the sample (mean populism = 0.26). However, when political contexts are differentiated, a conditional and theoretically coherent pattern emerges. Descriptively, these ranges also differ in macroeconomic conditions: the high-populism range coincides with higher government spending and GDP growth and lower unemployment on average, whereas the low-populism

range reflects less supportive macroeconomic conditions (Table 12). In low-populism settings, lower levels of populist discourse are associated with a less adverse relationship between natural disasters and innovative entrepreneurship, consistent with lower regime uncertainty and more predictable institutional signals (North, 1990; Williamson, 2000). In contrast, in high-populism environments, where political discourse amplifies regime uncertainty and undermines policy credibility, the natural disaster innovative entrepreneurship relationship shifts downward, and potential opportunities are eroded (Acemoglu et al., 2013; Bennett et al., 2023; Tang et al., 2024).

These findings underscore that innovative entrepreneurship is fundamentally context dependent. Natural disasters do not produce a uniform effect on innovation; rather, they test the institutional and political capacity of societies to absorb shocks. Where uncertainty is contained by credible institutions and predictable political discourse, crises may be reinterpreted as opportunities for innovation. Where uncertainty is amplified, particularly through populist discourse, innovative entrepreneurial responses are substantially less likely to materialise (Acemoglu & Robinson, 2012; North, 1990; Rodrik, 2018).

3.8 Contributions

We contribute in two ways. First, we demonstrate that natural disasters hinder innovative entrepreneurship at the individual level, shifting attention from sectoral patenting indicators to the outcomes of innovative entrepreneurs (Miao & Popp, 2014; Zhao et al., 2022). Second, we introduce the level of populism as a political factor that moderates the relationship between disasters and innovative entrepreneurship. While the analysis of the full sample helps establish the overall negative link between natural disasters and innovative entrepreneurship, the split-sample analysis clarifies the conditional influence of populist discourse. Specifically, the results from the subsamples show a weaker negative impact of natural disasters in low-populism contexts and a decline in the relationship between natural disasters and innovative entrepreneurship in high-populism contexts, aligning with the concepts of regime uncertainty and increased transaction costs (Bennett et al., 2023; Tang et al., 2024).

3.9 Policy implications

In terms of public policy, the results suggest that political communication is an institutional instrument as relevant as physical reconstruction or economic relief. In natural

disaster settings, messages that convey institutional continuity, respect for the rule of law, and clear rules reduce regime uncertainty and facilitate investment decisions in innovation (North, 1990; Williamson, 2000; Zhao et al., 2022). This includes coordinating local governments, the media, and civil society to reinforce signals of predictability, improve information circulation, and mobilise resources for innovative projects during recovery. Furthermore, profiles with a greater propensity to innovate, such as young people with higher education, active networks, investment experience, high alertness, and high self-efficacy, indicate the usefulness of mentoring programs, targeted financing, and access to networks for entrepreneurs with less social or cognitive capital in contexts of high uncertainty (Amini-Sedeh et al., 2022; Autio & Acs, 2010).

3.10 Limitations and future research

Our findings should be read in light of the limitations of the current database. The distribution of populism is skewed toward low levels (average 0.26), which reduces variability in the moderating factor in the full sample. Furthermore, populism is measured at the national level and as an average of speeches per period, which attenuates cross-year variation and potentially hides heterogeneity within countries (Hawkins et al., 2019; Tang et al., 2024). In parallel, disasters are also captured at the country level, while the decision to innovate is local and heterogeneous within the territory. Together, these characteristics of the baseline help explain why the split-sample analysis is more informative for assessing heterogeneity across levels of populist discourse and reinforce the need for data with greater dispersion to capture moderation effects more fully (Bennett et al., 2023; Yoon et al., 2024).

A further limitation concerns the use of GEM's self-reported entrepreneurial measures. Although GEM provides harmonised cross-country microdata well suited to examining early-stage innovative entrepreneurship, these measures may be affected by perceptual, recall, and reporting biases. Future research could complement GEM-based analyses with registry data, administrative records, tax data, patent data, R&D data, or firm-level panels, which are better suited to studying more objective innovation outcomes. However, such sources usually do not capture early-stage product and technology novelty at the entrepreneur level in a comparable way across countries and over time. Therefore, these alternative data sources would extend, rather than simply replace, the GEM-based approach used here.

For future research, we suggest two main directions and one data-related extension. First, future studies could investigate in greater depth the behavioural and network mechanisms through which discourse influences perceptions of risk, trust, and coordination (Monllor & Murphy, 2017; Yoon et al., 2024), and how knowledge networks support the transformation of crises into opportunities, with particular attention to differences across social groups and entrepreneurial profiles, and firm types suchs as family firms (Filipescu et al., 2026; Garcés-Galdeano et al., 2016). Second, future research could broaden the institutional framework by incorporating other informal institutions (e.g., culture and religion) that may amplify or restrict the conversion of shocks into innovation (Acemoglu et al., 2013; Acemoglu & Robinson, 2012; Rodrik, 2018; Sobel et al., 2010; Urbano et al., 2019, 2026). Furthermore, future studies would benefit from utilising populism databases with greater temporal variability and wider coverage of high levels of populism to more accurately capture strongly populist contexts and reduce the current concentration of observations at low levels of populism.

Future research could also build directly on the boundary pattern identified in this chapter by examining whether populist discourse operates through a threshold effect. One testable expectation is that low levels of populist discourse may buffer the negative relationship between natural disasters and innovative entrepreneurship by keeping institutional signals relatively predictable, whereas high levels of populist discourse may amplify uncertainty and weaken innovative responses. Future studies could test this proposition using samples with greater variation at high levels of populism, alternative measures of political discourse, or subnational designs that capture how entrepreneurs interpret political signals following specific disasters.

3.11 Conclusions

This study advances understanding of how natural disasters affect innovative entrepreneurship by showing that their overall association is negative and that populist discourse is a key moderator. While natural disasters are associated with a lower likelihood of innovative entrepreneurship on average, this relationship varies across political and macroeconomic contexts. In the low-populism range, which is descriptively characterised by less supportive macroeconomic conditions, higher levels of populist discourse within that range are associated with a less adverse relationship between natural disasters and innovative entrepreneurship. In the high-populism range, which is descriptively characterised by more

supportive conditions, higher levels of populist discourse shift the relationship downward, eroding the more positive association observed in that context. These findings suggest that natural disasters do not inherently generate innovation; instead, political environments shaped by populist discourse and the macroeconomic conditions in which they operate help determine whether shocks suppress or allow innovative entrepreneurship to materialise.

Chapter 4

4 Natural Disasters and Necessity Motivated Entrepreneurship: Mediating Role of Opportunity and Uncertainty

4.1 Abstract

Natural disasters are exogenous, sudden-onset crises that originate outside organisational control and generate large-scale disruption across economic and social systems, with important consequences for entrepreneurship. Existing research focuses on the direct and moderating effects of natural disasters on entrepreneurship, omitting mediation analyses. This implies that the current literature assumes mechanisms that have not yet been tested. We argue from crisis theory that natural disasters shape necessity-motivated entrepreneurship through two mechanisms: economic uncertainty and opportunity perception. We examine the mediating roles of opportunity perception and economic uncertainty in the relationship between natural disasters and necessity-motivated entrepreneurship, using cross-national and entrepreneur-level data in a multilevel design. We use data from the Global Entrepreneurship Monitor merged with data from the Centre for Research on the Epidemiology of Disasters, the World Development Indicators, and the Fraser Institute. We estimate multilevel logistic models and a nonlinear mediation approach suitable for binary outcomes. We find that both pathways operate and, together, account for a statistically significant yet modest effect, indicating partial mediation. The uncertainty pathway is substantively stronger than the opportunity pathway, consistent with the view that natural disasters heighten perceived instability and shorten planning horizons. We clarify a key distinction between opportunity creation in general and individual opportunity perception by showing that natural disasters dampen perceived opportunities, thereby weakening the opportunity pathway, even when reconstruction needs may expand. Importantly, the decomposition also shows that the direct component is dominant.

4.2 Introduction

Natural disasters have become increasingly frequent and severe in recent decades, causing large-scale disruption to economic and social systems (Boudreaux et al., 2021; Report CRED, 2022). In the broader crisis literature, such events are understood as exogenous, sudden-onset crises that disrupt coordination, information flows, and resource allocation, thereby reshaping local market conditions (Doern et al., 2019). In entrepreneurship and management research, natural disasters are widely viewed as consequential for entrepreneurial activity because they simultaneously disrupt the material

foundations of economic life, such as infrastructure and supply chains, and alter the perceived feasibility and desirability of entrepreneurial action (Miao & Popp, 2014; Nikiforou et al., 2019; Zhao et al., 2022). Importantly, entrepreneurial responses to crises are not purely mechanical: they depend on how individuals interpret shocks and update beliefs about risks and opportunities (Boudreaux et al., 2023; Wei et al., 2023). In this chapter, we focus on necessity-motivated entrepreneurship, a form of entrepreneurial entry driven by constrained employment alternatives, for which crisis induced shifts in perceived risks and perceived options may be especially consequential.

Despite growing interest in natural disasters and entrepreneurship, the literature still lacks an integrative theoretical explanation of how natural disaster shocks prompt entrepreneurial responses. Existing arguments often invoke opposing logics (constraint versus stimulation), yet these are difficult to reconcile because crisis concepts and processes are inconsistently defined and theorised, limiting cumulative insight (Sætren et al., 2024). Reflecting this ambiguity, natural disaster shocks are theorised to suppress entrepreneurship by increasing risk, transaction costs, and financial frictions (Boehm et al., 2015; Carvalho, 2014; Schultz, 1975; Zhao et al., 2022), but they are also theorised to trigger entrepreneurial activity by generating reconstruction needs and urgent market (Brück et al., 2011; Monllor & Murphy, 2017; Starbuck et al., 1978; Vegt et al., 2015). A crisis lens suggests that these competing expectations stem from countervailing mechanisms, heightened uncertainty and opportunity reconfiguration, whose relative strength may vary across actors and settings (Agarwal & Audretsch, 2020; Doern et al., 2019). Yet this leaves an unresolved puzzle for necessity-motivated entrepreneurship: when choice is constrained, economic uncertainty and perceived opportunities may coexist but push behaviour in opposite directions, making it unclear which mechanism dominates (Audretsch et al., 2022; Boudreaux et al., 2023; Dencker, Bacq, Gruber, et al., 2021; Wei et al., 2023).

This unresolved issue matters because, without tested the mechanisms linking natural disaster shocks to entrepreneurial behaviour, the literature cannot build cumulative theory or generate clear predictions about when natural disasters will increase or suppress entrepreneurship. Although crisis research acknowledges conceptual fragmentation and identifies at least five channels linking crisis to entrepreneurship, we argue that, in the case of natural disasters, two opposing pathways, greater economic uncertainty and the reconfiguration of perceived opportunities, are emphasised as central channels through which crises shape entrepreneurial responses (Agarwal & Audretsch, 2020; Doern et al.,

2019; Sætren et al., 2024). Yet most natural disasters entrepreneurship studies examine direct or moderator effects, leaving these pathways largely implicit rather than empirically tested (Bennett et al., 2023; Boudreaux et al., 2023; Tang et al., 2024). This limitation is particularly consequential for necessity-motivated entrepreneurship: when choice is constrained, economic uncertainty and perceived opportunities may coexist yet push behaviour in opposite directions, making mechanism-based predictions especially difficult (Bosma et al., 2018; Dencker, Bacq, Gruber, et al., 2021; Puente et al., 2019). Addressing this concern therefore requires an empirical approach that directly tests and compares the uncertainty and opportunity pathways (Zhao et al., 2022).

To address this concern, we develop and test a mechanism-based model of necessity-motivated entrepreneurship grounded in a crisis lens. We theorise that opportunity perception and economic uncertainty are central pathways through which natural-disaster shocks shape necessity-motivated entrepreneurship, and we derive five hypotheses linking natural disasters to each pathway and, in turn, to necessity-motivated entrepreneurship. We test the model using cross-national and entrepreneur-level data within a multilevel framework and estimate indirect effects for binary outcomes, enabling a direct comparison of the uncertainty and opportunity pathways rather than treating them as implicit assumptions.

This study makes three contributions to research on crises, natural disasters, and entrepreneurship. First, it situates natural disasters within a broader crisis lens and integrates crisis entrepreneurship theory with the disaster domain to explain why entrepreneurial responses may be heterogeneous. Second, it refines prevailing opportunity-based expectations by showing that, although disasters may generate reconstruction needs, they can reduce individuals' perceived opportunities, highlighting a critical distinction between aggregate-level opportunity creation and individual-level opportunity perception. Third, it examines the relationship between natural disasters and necessity entrepreneurship by directly testing and comparing the uncertainty and opportunity pathways, showing that the overall mediated effect is modest, the uncertainty pathway is larger than the opportunity pathway, and the direct effect is dominant.

4.3 Literature review

Empirical findings remain heterogeneous. Some studies report that natural disasters discourage entrepreneurship by increasing transaction costs, risk exposure, and financial

frictions, discouraging business formation and investment (Boehm et al., 2015; Carvalho, 2014; Zhao et al., 2022). Others find that natural disasters can encourage entry by creating urgent reconstruction needs and reshaping markets in ways that open niches for new ventures (Brück et al., 2011; Monllor & Murphy, 2017; Vegt et al., 2015). This mixed evidence suggests that natural disasters may simultaneously generate forces that hinder and enable entrepreneurial activity.

Despite this growing body of evidence, most studies focus on estimating direct or moderator effects, leaving the underlying mechanisms largely implicit. Opportunity creation and uncertainty are frequently invoked to interpret results but are rarely modelled as causal pathways or empirically compared as competing explanations (Bennett et al., 2023; Boudreaux et al., 2023; Boudreaux et al., 2023; Tang et al., 2024). This limits cumulative insight because heterogeneous findings cannot be reconciled without identifying the processes driving behavioural responses.

This limitation is particularly consequential for necessity-motivated entrepreneurship, where entry reflects constrained employment alternatives rather than discretionary opportunity pursuit. Although some work hints that natural disasters may push individuals towards subsistence-oriented self-employment, necessity entrepreneurship is often treated as secondary or pooled with broader entrepreneurial outcomes, leaving limited understanding of how natural disasters translate into necessity entry specifically (Bosma et al., 2018; Puente et al., 2019).

4.4 Theory and hypothesis

4.4.1 Natural disasters are a type of crisis

Crisis research commonly defines crises as low-probability, high-impact events that threaten core goals and create ambiguity, disrupting normal routines and coordination (Pearson & Clair, 1998). A key implication is that "crisis" is not a uniform category: scholars distinguish crises by origin (endogenous vs. exogenous), predictability (sudden onset vs. smouldering), and scope/scale, and they also differ in whether they conceptualise crises as discrete events or unfolding processes (Doern et al., 2019; Williams et al., 2017). When discussing crises generally, the literature body include examples like the 2007-2008 global financial crisis, natural disasters such as the 2001 Christchurch earthquake, Hurricanes Katrina (2005), Harvey (2017), and Irma (2017), acts of terrorism like 9/11 (2001) and the

London Bridge/Borough Market stabbings (2017), as well as conflicts in Syria and Sudan (Doern et al., 2019).

The natural disasters represent a distinctive class of exogenous, sudden-onset crises that can disrupt individuals, firms, and communities simultaneously and with limited warning (Doern et al., 2019). Mechanism or channels-oriented research at the crisis entrepreneurship interface identifies five potential pathways through which crises can shape entrepreneurial responses: Uncertainty, opportunity, resilience, compassion and ecosystem. (i) Uncertainty or threat pathway, where disruption increases ambiguity and reduces the predictability needed to plan and evaluate alternatives (Doern et al., 2019). (ii) Opportunity reconfiguration pathway, where shocks can expose urgent needs and "resource voids" that open niches for entrepreneurial action (Doern et al., 2019; Linnenluecke & McKnight, 2017). (iii) Resilience capacities to absorb disturbance and "bounce back" (Korber & McNaughton, 2018; Linnenluecke & McKnight, 2017). (iv) Compassion/prosocial venturing, centred on mobilising responses to alleviate suffering (Williams & Shepherd, 2018). (v) Ecosystem or community-support dynamics, highlighting how support structures condition responses under persistent crisis conditions (Audretsch & Kariv, 2025). Because our focus outcome is necessity-motivated entrepreneurship in natural disasters, we prioritise the two mechanisms most conceptually proximal to this behavioural response, economic uncertainty and opportunity perception. We ruled out the following three potential channels for the following reasons. Resilience is more naturally treated as an adaptive capacity/outcome reflected in coping responses, rather than a distinct mediator. Compassion-based venturing is typically theorised in prosocial/community response domains that fall outside the private-income logic of necessity entry (Cruz et al., 2014; Shepherd & Williams, 2014). Ecosystem dynamics primarily condition resources and coordination, making them better aligned with contextual contingencies or moderators than with the focal mediating channels tested here. Accordingly, we next develop expectations about the direct association between natural disasters and necessity-motivated entrepreneurship.

4.4.2 Natural disasters and necessity-motivated entrepreneurship

Natural disasters should increase the likelihood of necessity-motivated entrepreneurship by eroding employment-based livelihoods and narrowing the set of viable income alternatives. Three arguments support this hypothesis.

First, natural disasters disrupt local production and exchange, often resulting in job loss, unstable earnings, and weakened labour-market prospects. When paid work becomes unavailable or unreliable, self-employment becomes a more plausible fallback, particularly for individuals with limited savings and weaker labour-market attachment. This logic aligns with necessity-entrepreneurship accounts that link necessity entry to contexts of unemployment, recession, and poverty, where entrepreneurship is undertaken "because there are no better options for work" (Amorós et al., 2019; Nikiforou et al., 2019).

Second, natural disasters can temporarily reproduce features of contextual fragility at the local level by disrupting coordination and basic market functioning (e.g., transaction reliability, service provision, and the predictability of exchange). Even if transitory, these disruptions can generate acute episodes of constrained livelihoods, during which informal and subsistence-oriented activities become relatively more attractive as coping responses. In this sense, the mechanism is not that disasters are "fragility," but that they can create short-lived conditions that resemble the constraints under which necessity oriented entrepreneurial efforts are more prevalent (Amorós et al., 2019).

Third, a basic-needs perspective implies that when material pressures intensify, individuals prioritise immediate income stabilisation and are less able (and less willing) to delay action until higher-quality opportunities emerge. Under conditions of salient basic needs, entrepreneurial motivation and evaluation shift towards coping and short-term horizons, making subsistence entry more likely (Dencker, Bacq, Gruber, et al., 2021).

This focus on necessity-motivated entrepreneurship does not imply that opportunity-motivated entrepreneurship is irrelevant in post-disaster contexts. Natural disasters may indeed create new demands and opportunities for reconstruction, adaptation, and local problem-solving. However, the theoretical focus of this chapter is on constrained entrepreneurial responses. When disasters disrupt labour markets, reduce income stability, limit access to resources, and heighten economic uncertainty, individuals may be pushed towards entrepreneurship as a fallback income-generating activity rather than as a voluntary, opportunity-seeking choice. In this sense, opportunity perception is treated as a mechanism that may shape necessity-motivated entrepreneurship, not as the main entrepreneurial outcome. Opportunity-motivated entrepreneurship remains an important complementary outcome for future research, but analysing it would address a different question: whether disasters stimulate voluntary opportunity-seeking entry, rather than whether they push individuals into entrepreneurship under constrained conditions.

H1: Natural disasters are positively associated with necessity-motivated entrepreneurship.

4.4.3 Natural disasters and economic uncertainty

Natural disasters should increase economic uncertainty because they constitute sudden-onset crises that disrupt coordination and create ambiguity about future economic conditions. Crisis research emphasises that such events interfere with normal functioning and decision-making routines by undermining predictability and generating ambiguity about outcomes and responses (Doern et al., 2019; Pearson & Clair, 1998). In this context, three arguments suggest that natural disasters will heighten uncertainty.

First, natural disasters destabilise the material basis of production and exchange, making near-term income and employment outcomes harder to forecast. When infrastructure and productive capacity are damaged, firms and households face interruptions to activity, volatile earnings, and uncertainty over the timing and strength of recovery. Importantly, these effects extend beyond directly affected locations because shocks propagate through production networks: disruptions to upstream and downstream linkages can amplify and transmit disturbances, widening uncertainty about demand, inputs, and deliveries across the economy (Boehm et al., 2015; Carvalho, 2014).

Second, natural disasters degrade the informational environment that underpins expectation formation. When markets and routines are disrupted, economic actors face noisier signals, fewer stable reference points, and greater ambiguity about whether and when coordination will be restored. Crisis accounts highlight that disrupted coordination and ambiguous operating conditions are central reasons why crises heighten uncertainty beyond "volatility" (Doern et al., 2019; Vegt et al., 2015).

Third, natural disasters intensify uncertainty through behavioural and cognitive channels. Under acute disruption, actors revise beliefs using less reliable cues, shorten planning horizons, and place greater weight on downside risk, reinforcing perceptions that future outcomes are difficult to anticipate. This mechanism aligns with socio-cognitive arguments linking contextual disruptions to expectations and cautious decision-making, and with institutional-uncertainty views emphasising how uncertainty constrains forward-looking evaluation when rules, enforcement, or recovery trajectories are unclear (Bylund & McCaffrey, 2017; Stuetzer et al., 2014).

H2: Natural disasters are positively associated with economic uncertainty.

4.4.4 Economic uncertainty and necessity-motivated entrepreneurship

Economic uncertainty should increase the likelihood of necessity-motivated entrepreneurship by reducing the perceived reliability of wage employment and shifting decision-making towards short-horizon coping. In crisis settings, uncertainty is not only volatility; it reflects degraded signals, ambiguity about "what will hold", and weakened coordination, making near-term expectations harder to form (Doern et al., 2019; Vegt et al., 2015). When expectations about jobs and income become less credible, the motivational basis for entry is more likely to shift towards necessity. In this context, uncertainty is expected to increase necessity-motivated entrepreneurship for three reasons.

First, uncertainty amplifies push forces by undermining wage work as a dependable income anchor. As households perceive a higher risk of job loss or insufficient earnings, self-employment becomes a pragmatic fallback, particularly where buffers are limited and alternatives are narrow. This logic aligns with integrative accounts of necessity entrepreneurship that emphasise entry driven by constrained options and labour-market adversity (Mueller & Pieperhoff, 2023) and with needs-based theorising that treats necessity entry as a defensive response to threatened livelihood security (Dencker, Bacq, & Gruber, 2021).

Second, uncertainty compresses planning horizons and reorients choice criteria towards downside protection. When returns are difficult to forecast, and the stability of the environment is in question, actors are less willing (and less able) to delay action while waiting for clearer information. Under such conditions, low-capital, quick-cash-flow activities become relatively more attractive than projects requiring longer horizons and more committed investment, features that align more closely with subsistence-oriented venturing than with proactive opportunity exploitation (Bylund & McCaffrey, 2017; Schultz, 1975).

Third, a basic-needs lens suggests that the effect of uncertainty is particularly pronounced when material pressures are salient. Basic needs act as boundary conditions that narrow the feasible choice set and prioritise immediate security; as uncertainty rises, necessity motives become more prominent and defensive entry becomes a more likely coping response (Dencker, Bacq, & Gruber, 2021).

H3: Economic uncertainty is positively associated with necessity-motivated entrepreneurship.

4.4.5 Natural disasters and opportunity perception

Natural disasters can plausibly increase objective entrepreneurial opportunities by generating reconstruction demand and urgent market gaps. Post-disaster environments may expose unmet needs in rebuilding, logistics, basic inputs, and adaptation solutions, which can be construed as "new opportunities" (Brück et al., 2011; Monllor & Murphy, 2017; Vegt et al., 2015; Zhao et al., 2022). However, objective opportunity creation does not imply that most individuals will perceive "good opportunities" to start a business, especially when opportunity perception is a short-horizon, forward-looking judgment about whether favourable and actionable conditions exist soon. Accordingly, our model focuses on opportunity perception, a cognitive evaluation of whether "good opportunities" are available for starting a business, and we argue that, for the broad population of potential entrepreneurs, sudden-onset natural disasters are more likely to dampen such perceptions. Opportunity perception is commonly treated as a socio-cognitive evaluation rooted in social cognitive theory, capturing individuals' forward-looking judgment about whether favourable and actionable conditions for starting a business exist in the near term (Bandura, 1986; Boudreaux et al., 2023; Stuetzer et al., 2014; Wood & Bandura, 1989). In GEM, this item is explicitly short horizon (e.g., good opportunities in the next six months) (Bosma et al., 2018), so it is conceptually distinct from aggregate opportunity creation after natural disasters. We expect that increased natural disasters will reduce individual perceived opportunity for at least three reasons.

First, natural disasters degrade the informational environment that underpins opportunity evaluation. When routines and market functioning are disrupted, individuals face noisier signals about demand, costs, and feasibility, making it harder to assess whether favourable conditions exist. As a result, even if needs rise, perceived opportunities can fall because the environment becomes harder to read and forecast (Stuetzer et al., 2014; Vegt et al., 2015).

Second, natural disasters typically intensify resource constraints and coordination frictions (damaged infrastructure, disrupted supply chains, and tighter credit) that make potential niches appear less actionable. Because perceived opportunities embed assessments of feasibility, constrained access to inputs and finance reduces the likelihood that individuals

interpret post-disaster change as “a good opportunity” they can realistically pursue (Boehm et al., 2015; Doern et al., 2019).

Third, a crisis lens suggests that sudden disruption reallocates attention towards loss avoidance and short-term coping. Heightened uncertainty and material pressure narrow time horizons and crowd out opportunity scanning, further lowering perceived opportunities among those facing constrained livelihoods (Dencker, Bacq, Gruber, et al., 2021; Vegt et al., 2015).

H4: Natural disasters are negatively associated with perceived opportunity.

4.4.6 Opportunity perception and necessity-motivated entrepreneurship

Opportunity perception should be negatively associated with necessity-motivated entrepreneurship because perceiving “good opportunities” reframes entrepreneurial entry as a discretionary choice rather than a last-resort coping response. Opportunity perception captures individuals’ forward-looking evaluation of whether conditions are favourable and actionable for starting a business, which is conceptually closer to “pull” motives than to subsistence-driven entry (Camelo-Ordaz et al., 2020; Stuetzer et al., 2014). In contrast, necessity entrepreneurship is typically theorised as “pushed” entry that arises when individuals face constrained employment alternatives and salient basic needs (Audretsch et al., 2022; Dencker, Bacq, Gruber, et al., 2021). We expect that opportunity perception will reduce necessity-motivated entrepreneurship for at three reasons.

First, perceiving good opportunities expands the perceived choice set beyond subsistence self-employment. When individuals believe the environment offers viable entrepreneurial prospects, entrepreneurship is less likely to be interpreted (and reported) as primarily driven by a lack of alternatives; instead, it aligns with opportunity-driven entry, pulled by expected gains and feasibility. This push pull logic implies that higher perceived opportunities should be associated with a lower incidence of necessity motivation among entrants (Amorós et al., 2019; Audretsch et al., 2022).

Second, a needs-based view holds that basic needs serve as boundary conditions that shape motivation and evaluation. Under heightened material pressure, individuals prioritise immediate income stabilisation and low-commitment actions, thereby increasing the prevalence of necessity-type venturing. However, when individuals perceive “good opportunities,” they are more likely to evaluate venturing through a value-creation lens, i.e.,

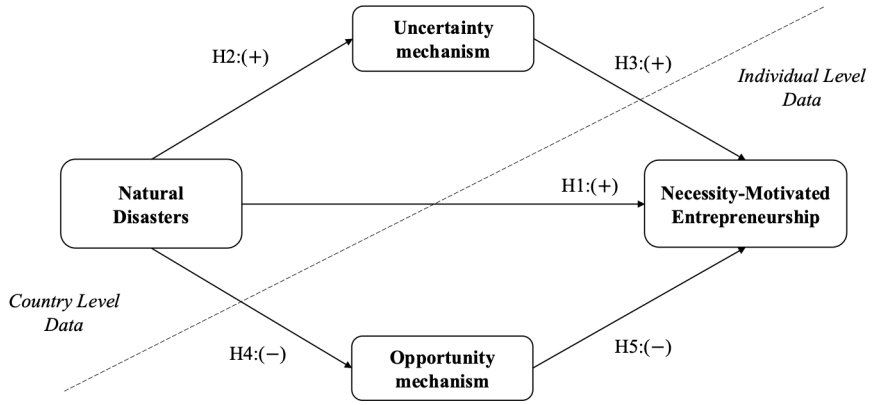
as an avenue for pursuing better prospects, rather than through a survival lens. In this sense, opportunity perception does not merely increase entrepreneurship; it shifts the motivational basis for entry away from necessity (Dencker, Bacq, Gruber, et al., 2021).

Third, opportunity perception serves as a sorting mechanism across entrepreneurial types. Individuals who perceive favourable opportunities are more likely to pursue proactive projects with higher expected returns, whereas those who perceive few opportunities are more likely to treat self-employment as a fallback in response to constrained alternatives. This implies a compositional effect: as perceived opportunities rise, the share of necessity-motivated entry should fall (Mueller & Pieperhoff, 2023; Puente et al., 2019).

H5: Opportunity perception is negatively associated with necessity-motivated entrepreneurship.

Figure 7 illustrates the proposed conceptual model. This model shows the relationships among variables and hypotheses in a two-level perspective: individual-level and country-level data. The base link is a natural disaster with necessity-motivated entrepreneurship. The first mechanism is a channel between natural disasters, opportunity perception, and necessity-motivated entrepreneurship. The second mechanism is a channel between natural disasters, economic uncertainty, and necessity-motivated entrepreneurship.

Figure 7: Multilevel conceptual framework



4.5 Data and methodology

4.5.1 Data

The database is constructed from several data sources. We established a single database using data from a panel comprising 83 countries impacted by natural disasters between 2004 and 2019, encompassing 95,309 individual observations at the entrepreneur level. We merge data from the Centre for Research on the Epidemiology of Disasters (CRED), the Global Entrepreneurship Monitor (GEM) Adult Population Survey (APS), World Development Indicators (WDI) and the Fraser Institute (FI).

4.5.2 Variables

Our *dependent variable* (individual level) (Table 17, variable 1) is necessity-motivated entrepreneurship. It takes the value 1 if the entrepreneur states that they started the firm because they had no better employment alternatives or work options, and 0 otherwise. The source of this variable is GEM. This variable is particularly important in a crisis context (Dencker, Bacq, & Gruber, 2021; Nikiforou et al., 2019).

For the *independent variable* (country level) (Table 17, variable 13), we use the log of deaths from natural disasters to capture the impact of these events (Kahn, 2005). Natural disasters are measured using data from the CRED/EM-DAT database. Following the disaster categories retained for this thesis, the analysis considers droughts, earthquakes, extreme temperatures, floods, dry mass movements, wet mass movements, storms, volcanic activity, and wildfires. These categories allow the thesis to capture a broad range of climate-related, geophysical, hydrological, meteorological, and environmental shocks. For each country-year, disaster events are aggregated and then linked to individual-level entrepreneurial observations from GEM. Therefore, the disaster variables used in the empirical analyses represent annual country-level exposure to natural disasters rather than direct individual exposure to a specific event. When integrating with the GEM database, we use annual CRED data. This means we sum all deaths from different types of natural disasters for a given country each year, producing a single value for the total number of deaths from natural disasters for country j in year t. The natural disaster measure is constructed from CRED/EM-DAT event-level records, aggregated at the country-year level. In this chapter, disaster exposure is measured as the logarithm of one plus the number of deaths caused by natural disasters in a given country and year. When more than one disaster occurs in the same

country-year, the corresponding impacts are aggregated to obtain an annual country-level measure of disaster exposure. This annual measure is then linked to all GEM respondents observed in the same country and year. Accordingly, the variable should be interpreted as a contextual measure of annual national exposure to disaster impacts, rather than as an event-level treatment indicator. The data structure does not allow us to determine whether each GEM respondent was interviewed before or after a specific disaster within the same year. This is particularly relevant because several disasters may occur in the same country-year, at different points in time and in different regions. Therefore, the empirical analysis examines whether annual country-level disaster exposure is associated with individual necessity-motivated entrepreneurship, rather than whether a specific disaster event affected each respondent before or after the interview date.

For the *mediating variables*, we use two. Opportunity perception (individual level) and economic uncertainty (country level). Opportunity is scored as 1 if individuals perceive that there will be good business opportunities to start a business in the next six months. This variable is commonly used as one of the three socio-cognitive traits (Boudreaux et al., 2023; Wood & Bandura, 1989), but in our case, it is more useful to treat it as a concept closer to its definition. That is, a measure of an entrepreneur's perception of short-term (6-month) opportunities. Economic uncertainty is a continuous variable that measures price level volatility, defined as the annual standard deviation of each country's inflation rate. Higher values indicate greater macroeconomic uncertainty in the economic environment in which entrepreneurs operate (Bennett et al., 2023). This measure is also appropriate for the comparative country-year design of this chapter because it provides broad annual coverage across the countries and years included in the GEM-CRED sample.

For the *individual-level control variables* (Table 17, variables 2 to 10), we included controls for age (in years) and gender (an indicator variable equal to 1 for men and 0 for women) (Epure et al., 2024; Estrin et al., 2013). We included two perceptual measures or socio-cognitive traits (Boudreaux et al., 2023; Boudreaux, Nikolaev, et al., 2019; Wood & Bandura, 1989). Perceived self-efficacy is scored as 1 if individuals perceive they have the necessary knowledge, skills, and experience to start a new business. Fear of failure is scored as 1 if the respondent reports that fear of failure could prevent them from starting a business (although it did not necessarily prevent them from doing so). Higher education equals 1 if respondents have a post-secondary education degree, and 0 otherwise (Capelleras et al., 2026). We use household income levels (Albert et al., 2023; Braggion et al., 2020; Epure et

al., 2024; Kimhi, 2009; Zapata, 2023). Indicator variable 1 = low household income, 2 = medium and 3 = high. Investment experience is captured by a dummy variable that takes the value of one if the entrepreneur has, in the past three years, personally provided funds to a new business started by someone else, excluding any purchases of stocks or mutual funds, and 0 otherwise (Epure et al., 2024). We included knowing other entrepreneurs as a dummy variable equal to 1 if the respondent reported personally knowing someone who started a business in the past two years (Capelleras et al., 2025). Current employment is measured by the current number of employees (excluding owners) that entrepreneurs report (Capelleras et al., 2026).

For the *country-level control variables* (Table 17, variables 11 to 12). The Freedom Index evaluates aspects such as the size of government, legal structure and property rights, access to sound currency, freedom to trade internationally, and the regulation of credit, labour, and business. Index values range from 0 to 10, with a higher value indicating a greater level of economic freedom.

Table 17: Variable definitions and sources

	Variables	Definition	Source
1	Necessity motivated entrepreneurship	Binary indicator coded 1 when the entrepreneur reports starting the business because no better employment alternatives were available, and 0 otherwise.	GEM
2	Age	Respondent's age in years.	GEM
3	Gender	Binary indicator coded 1 for male respondents and 0 for female respondents.	GEM
4	Perceived self-efficacy	Binary indicator coded 1 when respondents report having the knowledge, skills, and experience required to start a business, and 0 otherwise.	GEM
5	Fear of failure	Binary indicator coded 1 when fear of failure could discourage the respondent from starting a business, and 0 otherwise.	GEM
6	Higher education	Binary indicator coded 1 for respondents with post-secondary education, and 0 otherwise.	GEM
7	Household income	Household income category coded as 1 = low, 2 = medium, and 3 = high.	GEM
8	Investment experience	Binary indicator coded 1 when the respondent personally funded someone else's new business during the previous three years, excluding stocks or mutual funds, and 0 otherwise.	GEM
9	Knows other entrepreneurs	Binary indicator coded 1 when the respondent personally knows someone who started a business during the previous two years, and 0 otherwise.	GEM
10	Current employment level	Number of current employees, excluding owners.	GEM
11	Unemployment rate	Share of the labour force that is unemployed.	WDI
12	Freedom index	Economic freedom index covering government size, legal system and property rights, sound money, freedom to trade internationally, and regulation of credit, labour, and business. Higher values indicate greater economic freedom.	FI
13	Log deaths	Natural logarithm of one plus the number of deaths caused by natural disasters.	CRED
14	Log injured (robustness)	Natural logarithm of one plus the number of people injured by natural disasters.	CRED
15	Opportunity	Binary indicator coded 1 when respondents report good local business opportunities in the next six months, and 0 otherwise.	GEM
16	Uncertainty	Price-level volatility, measured as the annual standard deviation of each country's inflation rate. Higher values indicate greater macroeconomic uncertainty.	FI

4.5.3 Econometric strategy

In this section, we pursue two complementary objectives: (1) to test hypotheses H1 to H5 in a multilevel design and (2) to assess whether mediation exists in the link between natural disasters and necessity-motivated entrepreneurship (NME). For the first objective, we estimate a multilevel logit model (individuals nested within countries) as the base

specification. This model respects the hierarchical structure of the data and allows us to evaluate whether the estimated associations have the expected signs of the proposed associations. For the second objective, we follow the classic intuition of mediation, that the effect of X on Y is reduced by incorporating mediators (Baron & Kenny, 1986), but recognise that in nonlinear models it is not valid to directly compare coefficients between nested models due to rescaling problem (Karlson et al., 2012). Therefore, we complement the multilevel analysis with logit estimates and report standardised coefficients as descriptive evidence of directional consistency. We then apply the KHB method to decompose the total effect into direct and indirect components and to isolate mediation effects from rescaling in nonlinear models (Karlson et al., 2012). This decomposition also allows us to report the percentage reduction net of rescaling (partial vs. total mediation) and compare the relative contribution of each channel, as has been applied in recent work on entrepreneurship (Boudreaux et al., 2023).

Because natural disasters are measured as annual country-level exposure, the empirical specification should not be interpreted as an event-study design. Rather, the multilevel and mediation models estimate the association between country-year disaster exposure and individual necessity-motivated entrepreneurship, including the opportunity perception and economic uncertainty pathways, while accounting for the nesting of individual respondents within countries and controlling for year-level variation using year fixed effects.

4.5.3.1 Multilevel logit

Our baseline specification is a multilevel logistic regression model that accounts for the hierarchical structure of the data (individuals nested within countries). We estimate logit models with a country-level random intercept, assumed to be normally distributed, to capture unobserved cross-country heterogeneity and the within-country dependence in individual outcomes (Stata-Manual, 2023). Thus, observations are assumed to be conditionally independent given the covariates and the country-level random intercept.

Both equations (3) and (4) are estimated as multilevel logit models, i.e., the linear predictor maps into $Pr(Y_{ijt} = 1)$ through the logit link. We test H1, H3 and H5 using the following specifications:

$$NME_{ijt} = \alpha + (H1)\beta_1 Natural_disasters_{jt} + (H3)\beta_2 Uncertainty_{jt} + (H5)\beta_3 Opportunity_{ijt} + \cdots \ldots X_{ijt}\gamma_n + Z_{jt}\delta_n + Industry_{it} + \mu_j \quad (3)$$

NME_{ijt} is a measure of necessity motivated entrepreneurship of individual i within country j at year t. $Natural_disasters_{jt}$ is measured as log deaths by natural disasters. $Uncertainty_{jt}$ is price-level volatility (the annual standard deviation of inflation). $Opportunity_{ijt}$ captures individual opportunity perception (a binary indicator equal to 1 if the respondent reports good business opportunities for starting a business in the next six months in the area where they live). Hypotheses H1, H3, and H5 are evaluated through the sign and statistical significance of β_1, β_2, and β_3, respectively. We test H4 using a second multilevel logit model in which opportunity perception is the dependent variable:

$$Opportunity_{ijt} = \alpha + \beta_4 Natural_disasters_{jt} + \cdots$$
$$\ldots X_{ijt}\gamma_n + Z_{jt}\delta_n + Industry_{it} + \mu_j \quad (4)$$

H4 is evaluated through the sign and statistical significance of β_4. X_{ijt} includes individual-level controls (age, gender, perceived self-efficacy, fear of failure, higher education, household income level, investment experience, knows other entrepreneurs and current employment) and Z_{jt} country-level controls (unemployment rate and freedom index). We add industry fixed effects (1-digit SIC) to account for unobserved industry heterogeneity. We do not include year fixed effects because years fixed effects would absorb important part of the time-varying macroeconomic uncertainty captured by our uncertainty measure (the standard deviation of inflation), which is central to the proposed mechanism. In the random part of the model, μ_j denotes the country-level random intercept, assumed $\mu_j \sim \mathcal{N}(0, \sigma_\mu^2)$.

We report two checks for the assumptions of multilevel regression. First, we calculate the intraclass correlation coefficient (ICC). The ICC is applied to multilevel logit (model 1, 3 y 4) and multilevel linear regressions (model 2) shown in Table 22. The ICC for multilevel logit regressions ranges from 0.11 to 0.12, indicating that approximately 11%–12% of the variance in the latent propensity to engage in NME is attributable to between-country differences, thereby justifying the use of a multilevel modelling approach. The confidence interval of the ICC does not include zero, suggesting that the intraclass correlation differs significantly from zero. The ICC for the multilevel linear mixed-effects model predicting uncertainty (Table 22, Model 2) is 0.89, suggesting that most of the residual variance (89%) is between countries. This is unsurprising because uncertainty is measured at the country–year level and is common to all individuals within the same country-year: consequently,

most of the residual variance is located at the macro level, yielding a high ICC in the country-random-intercept specification.

Second, to assess non-multicollinearity, we calculate the variance inflation factor (VIF). Most variables have very low VIF values (close to 1), indicating no significant multicollinearity issues (see Table 18). The average VIF value is 1.20, which is relatively low and does not imply serious concerns regarding multicollinearity in the model. Following standard practice, VIF values were computed using a linear probability model with the same set of covariates, excluding country-level random effects.

Table 18: Multicollinearity test on variables

Variable		VIF	1/VIF
Age		1.03	0.975
Gender		1.03	0.975
Perceived self-efficacy		1.07	0.932
Fear of failure		1.04	0.962
Higher education		1.10	0.908
Household income			
	2	1.54	0.650
	3	1.65	0.607
Investment experience		1.03	0.971
Knows other entrepreneurs		1.07	0.938
Current employment level		1.00	0.999
Unemployment rate		1.09	0.914
Freedom index		1.60	0.625
Log deaths		1.20	0.836
Opportunity		1.07	0.937
Uncertainty		1.50	0.667
Mean VIF		1.20	

Note: VIF values greater than 10 indicate potential concern due to collinearity among variables.
We don't include control for year and industry in the test. Our variables do not suffer from collinearity.

4.5.3.2 Multilevel mixed

To test H2, we estimate a linear mixed-effects model because our economic uncertainty measure is continuous (price-level volatility). Specifically, we model uncertainty with a country-level random intercept to capture unobserved cross-country heterogeneity. The random intercept is assumed to be normally distributed, and observations are assumed to be conditionally independent given the covariates and the random intercept (Stata-Manual, 2023).

$$Uncertainty_{jt} = \alpha + \beta_5 Natural_disasters_{jt} + \cdots$$
$$\ldots X_{ijt}\gamma_n + Z_{jt}\delta_n + Industry_{it} + \mu_j + \varepsilon_{ijt} \quad (5)$$

Where $Uncertainty_{jt}$ is the annual standard deviation of inflation in country j and year t, and $NaturalDisasters_{jt}$ is measured as the log of deaths by natural disaster. H2 is evaluated through the sign and statistical significance of β_5.

X_{ijt} includes individual-level controls (age, gender, perceived self-efficacy, fear of failure, higher education, household income level, investment experience, knows other entrepreneurs, and current employment), and Z_{jt} includes country-level controls (unemployment rate and the economic freedom index). We also include 1-digit SIC industry fixed effects ($Industry_{it}$) to account for unobserved industry heterogeneity. We do not include year fixed effects because year fixed effects would absorb important part of the time-varying macroeconomic uncertainty captured by our uncertainty measure, which is central to the proposed mechanism. In the random part of the model, μ_j denotes the country-level random intercept, assumed $\mu_j \sim N(0, \sigma_\mu^2)$, and ε_{ijt} is an idiosyncratic error term.

4.5.3.3 Mediation

In mediation models, the classic intuition is that the effect of X on Y should be reduced when the mediators Z are included (Baron & Kenny, 1986). In our case, X is natural disasters (log deaths), Y is necessity-motivated entrepreneurship (NME), and Z denotes the two proposed channels (uncertainty and opportunity). Therefore, our empirical strategy combines three complementary pieces: (i) a multilevel logit as the base specification for testing H1 to H5 while respecting the individual-country structure; (ii) a logit with the same sample and covariates to report standardized coefficients as evidence of attenuation in the effect of natural disasters when including the mediators; and (iii) the KHB method, which is the central step for estimating a valid decomposition of the total effect into direct and indirect components in nonlinear models. Importantly, we treat the standardised logit coefficients as descriptive evidence of attenuation, whereas the formal direct–indirect decomposition (net of rescaling) is obtained from the KHB procedure.

The selection of economic uncertainty and opportunity perception as mediators is consistent with prior research on natural disasters and entrepreneurship (Boudreaux et al., 2023) and with the theoretical development presented in Section 4.4.1. The crisis and disaster entrepreneurship literature commonly distinguishes between an uncertainty or threat

pathway and an opportunity-reconfiguration pathway (Agarwal & Audretsch, 2020; Doern et al., 2019; Sætren et al., 2024). Consistent with this distinction, this chapter treats economic uncertainty and opportunity perception as two conceptually distinct mechanisms through which natural disasters may shape necessity-motivated entrepreneurship. Economic uncertainty captures a macro-level condition characterised by instability and reduced predictability, whereas opportunity perception captures individuals' assessment of whether there are good local opportunities to start a business. The empirical analysis therefore models them as parallel mediators and uses the KHB decomposition to estimate the indirect contribution of each pathway while accounting for the other. The results show that both indirect pathways are statistically significant but modest in magnitude, supporting a partial mediation interpretation and indicating that the direct effect remains dominant. Future research with longitudinal data could further examine whether these mechanisms also operate sequentially.

The reason for using KHB is that, in binary models like the logit, it is not valid to directly compare coefficients between nested models (e.g., with and without mediators), because adding variables changes the model's scale ("rescaling"), which contaminates the difference in coefficients. Karlson et al. (2012) formalise this with the latent variable representation. In their notation, the reduced model (without mediators) and the full model (with mediators) are:

$$H_R : y^* = \beta_{yx}X + e \quad (6)$$

$$H_F : y^* = \beta_{yx.z}X + \beta_{yz.x}Z + v \quad (7)$$

Where $H^5{}_R$ and H_F denote the reduced and full model, respectively. With $y = 1$ if $y* > 0$ and $y = 0$ otherwise (Karlson et al., 2012). In the case of logit, the same is expressed as nested probability models (via the logit link), but the key point is that the difference between β in the reduced and full models mixes mediation and rescaling (Karlson et al., 2012). Therefore, standardised logit coefficients are used only as descriptive evidence of directional attenuation. Inference about mediation, namely the decomposition of the total effect into direct and indirect components that is comparable across nested nonlinear models, relies on KHB because it separates the component attributable to Z (interpreted as indirect when Z are mediators) from rescaling.

[5]In the original paper, H_R and H_F denote Hypothesis reduced and Hypothesis full (Karlson et al., 2012).

The KHB method solves the problem with a simple idea: it construct an “adjusted” version of the reduced model, in which the mediators are replaced by their residuals with respect to X (i.e., mediators “purified” of their correlation with X). This construction allows comparison between the full model and the “adjusted reduced” model on the same scale, separating changes due to mediation from those due to rescaling.

In Stata software, the implementation KHB method need applied to a logit model and defining the key variables. The key variables are Y (dependent variable NME), X (independent variable log deaths), Z represents mediators (uncertainty and opportunity), and concomitant (controls). Concomitants are included to ensure that the reduced and full models are not confounded by the same set of controls, so the decomposition isolates the role of *Z* net of rescaling. Controls variables include individual-level and country-level controls, as well as industry and country fixed effects[6]. The output of KHB (summary) is interpreted methodologically as follows (as indicated in the command's help): Reduced corresponds to the "total effect" of X; Full corresponds to the "direct effect" of X net of Z; Diff is the portion attributable to Z (interpreted as indirect when Z are mediators); and the summary reports the “percentage reduction due to confounding” (net of rescaling) and the rescale factor.

4.6 Results

4.6.1 Descriptive results

Table 19 provides descriptive statistics first at the individual and second country level. First, we describe the individual level variable. The NME averages 0.31, indicating that 31% of the entrepreneurs in the sample started out of necessity. The average age of respondents in the entrepreneur sample is around 37 years old, and 58% are men. Most (84%) entrepreneurs believe they have the knowledge, skills and experience to start a business. 29% say that fear of failure could prevent them from starting a business. 36% of participants hold a post-secondary education degree. Regarding entrepreneurs' family income, 26% is low, 32% medium and 42% high. 12% of participants personally provided funds for a new business started by someone else, excluding any purchases of stocks or mutual funds. 66% of sample entrepreneurs know someone who started a business in the past two years. 63% of the sample see good opportunities to start a new business in the next six months. The average number of current employees is around 4.

[6] The same controls are using in multilevel logit, multilevel linear, logit, logit standardized coefficients and KHB estimations.

Table 19: Descriptive statistics

			Obs.	Mean	Std. Dev.	Min	Max
	Individual level						
1	Necessity motivated entrepreneurship (NME)		95,309	0.310	0.462	0	1
2	Age		95,309	37.091	11.393	18	64
3	Gender		95,309	0.580	0.494	0	1
4	Perceived self-efficacy		95,309	0.843	0.364	0	1
5	Fear of failure		95,309	0.287	0.452	0	1
6	Higher education		95,309	0.357	0.479	0	1
7	Household income						
		1	95,309	0.260	0.439	0	1
		2	95,309	0.319	0.466	0	1
		3	95,309	0.421	0.494	0	1
8	Investment experience		95,309	0.124	0.330	0	1
9	Knows other entrepreneurs		95,309	0.657	0.475	0	1
10	Opportunity		95,309	0.634	0.482	0	1
11	Current employment level		95,309	3.907	57.154	0	2,000
	Country level						
12	Unemployment rate		95,309	7.615	5.215	0.11	28.01
13	Freedom index		95,309	7.089	0.784	3.78	8.58
14	Log deaths		95,309	3.463	2.119	0	10.930
15	Log injured (robustness)		95,309	3.049	3.038	0	11.842
16	Uncertainty		95,309	8.856	1.282	1.02	9.95

Second, we describe the country level variables. The average unemployment rate was 7.6%. The Freedom Index ranges from 3.78 to 8.58, with an average of 7.1. The average number of deaths from natural disasters is 31 (exp (3.46) - 1 = 30.8), with a minimum of 0 and a maximum of 55,825 (exp (10.93) - 1). The average standard deviation of inflation is 8.86, with a minimum of 1.02 and a maximum of 9.95.

Table 20 shows the list of countries used in the estimates. For each country, we report the frequency and the percentage it represents of the total sample.

Table 20: Country list

	Country	Freq.	Percent	Cum.		Country	Freq.	Percent	Cum.
1	United States	2,327	2.44	2.44	43	Ghana	1,362	1.43	73.82
2	Russia	433	0.45	2.90	44	Nigeria	1,832	1.92	75.74
3	Egypt	439	0.46	3.36	45	Angola	1,036	1.09	76.83
4	South Africa	1,312	1.38	4.73	46	Ethiopia	300	0.31	77.14
5	Greece	782	0.82	5.55	47	Uganda	1,878	1.97	79.12
6	Netherlands	755	0.79	6.35	48	Zambia	1,373	1.44	80.56
7	Belgium	360	0.38	6.72	49	Namibia	120	0.13	80.68
8	France	436	0.46	7.18	50	Malawi	1,036	1.09	81.77
9	Spain	7,369	7.73	14.91	51	Botswana	787	0.83	82.59
10	Hungary	598	0.63	15.54	52	Portugal	431	0.45	83.05
11	Italy	388	0.41	15.95	53	Ireland	424	0.44	83.49
12	Romania	497	0.52	16.47	54	Iceland	64	0.07	83.56
13	Switzerland	594	0.62	17.09	55	Finland	26	0.03	83.59
14	Austria	324	0.34	17.43	56	Lithuania	59	0.06	83.65
15	Denmark	134	0.14	17.57	57	Latvia	158	0.17	83.81
16	Sweden	174	0.18	17.75	58	Estonia	120	0.13	83.94
17	Norway	241	0.25	18.01	59	Serbia	33	0.03	83.97
18	Poland	967	1.01	19.02	60	Montenegro	34	0.04	84.01
19	Germany	1,213	1.27	20.30	61	Croatia	612	0.64	84.65
20	Peru	2,789	2.93	23.22	62	Slovenia	168	0.18	84.83
21	Mexico	2,285	2.40	25.62	63	Bosnia and Herzegovina	205	0.22	85.04
22	Argentina	1,366	1.43	27.05	64	Czech Republic	254	0.27	85.31
23	Brazil	6,002	6.30	33.35	65	Slovakia	397	0.42	85.73
24	Chile	9,400	9.86	43.21	66	Guatemala	2,808	2.95	88.67
25	Colombia	6,996	7.34	50.55	67	El Salvador	190	0.20	88.87
26	Malaysia	825	0.87	51.42	68	Costa Rica	250	0.26	89.13
27	Australia	867	0.91	52.33	69	Panama	1,609	1.69	90.82
28	Indonesia	3,008	3.16	55.48	70	Venezuela	160	0.17	90.99
29	Philippines	1,387	1.46	56.94	71	Bolivia	978	1.03	92.02
30	New Zealand	51	0.05	56.99	72	Ecuador	3,100	3.25	95.27
31	Thailand	3,158	3.31	60.31	73	Uruguay	590	0.62	95.89
32	Japan	365	0.38	60.69	74	Dominican Republic	128	0.13	96.02
33	Vietnam	739	0.78	61.46	75	Trinidad & Tobago	42	0.04	96.07
34	China	3,556	3.73	65.20	76	Jamaica	1,379	1.45	97.51
35	Turkey	688	0.72	65.92	77	Bangladesh	224	0.24	97.75
36	India	1,426	1.50	67.41	78	Lebanon	664	0.70	98.45
37	Pakistan	334	0.35	67.76	79	Saudi Arabia	840	0.88	99.33
38	Iran	2,230	2.34	70.10	80	United Arab Emirates	170	0.18	99.50
39	Canada	1,128	1.18	71.29	81	Israel	318	0.33	99.84
40	Morocco	603	0.63	71.92	82	Qatar	90	0.09	99.93
41	Algeria	302	0.32	72.24	83	Georgia	64	0.07	100.00
42	Libya	148	0.16	72.39		Total	95,309		

Finally, we present a correlation matrix to visualise the correlations between the variables (see Table 21). The correlation between our measure of natural disasters (log deaths) and necessity-motivated entrepreneurship is 0.032. The alternative measure of natural disasters (log injured) is 0.060. Small and positive correlations are observed.

Table 21: Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Necessity motivated entrepreneurship	1,000															
2	Age	0,045	1,000														
3	Gender	-0,074	0,001	1,000													
4	Perceived self-efficacy	-0,059	0,023	0,051	1,000												
5	Fear of failure	0,075	0,022	-0,043	-0,159	1,000											
6	Higher education	-0,141	0,017	0,060	0,066	-0,017	1,000										
7	Household income	-0,175	0,002	0,109	0,067	-0,055	0,241	1,000									
8	Investment experience	-0,046	-0,021	0,068	0,044	-0,017	0,058	0,088	1,000								
9	Knows other entrepreneurs	-0,058	-0,056	0,056	0,140	-0,036	0,093	0,114	0,101	1,000							
10	Current employment level	-0,010	-0,000	0,010	-0,003	0,002	0,025	0,012	0,022	0,010	1,000						
11	Unemployment rate	0,022	0,042	0,066	0,042	-0,012	0,070	0,002	-0,035	-0,032	-0,004	1,000					
12	Freedom index	-0,061	0,121	0,010	0,066	-0,036	0,146	0,032	0,018	0,010	-0,002	0,074	1,000				
13	Log deaths	0,032	-0,032	-0,034	-0,059	0,035	-0,063	0,015	-0,001	-0,008	-0,005	-0,242	-0,237	1,000			
14	Opportunity	-0,075	-0,065	0,007	0,136	-0,103	-0,006	0,050	0,053	0,147	0,002	-0,124	-0,024	0,030	1,000		
15	Uncertainty	-0,022	0,100	-0,009	-0,025	0,033	0,028	0,001	-0,058	-0,046	-0,007	0,042	0,525	0,074	-0,059	1,000	
16	Log injured (robustness)	0,060	-0,022	-0,009	-0,042	0,022	-0,029	0,004	0,001	0,019	0,001	-0,173	-0,122	0,700	0,013	0,034	1,000

4.6.2 Results by hypothesis

Hypothesis 1 suggests that natural disasters are positively associated with necessity-motivated entrepreneurship. To test this hypothesis, Table 22 presents the results of the multilevel regression. Model 3 reports the results for H1. The natural disaster variable, measured as the logarithm of the number of people deaths by natural disasters, has a positive and significant coefficient (0.038) on necessity-motivated entrepreneurship. This provides evidence supporting Hypothesis 1.

Table 22: Multilevel Regression

Dependent variable:	Opportunity	Uncertainty	Necessity	Necessity
Variables	Model 1	Model 2	Model 3	Model 4
Natural disasters	-0.017***(H4)	0.025***(H2)	0.038***(H1)	0.036***
	(0.006)	(0.001)	(0.006)	(0.006)
Uncertainty				0.063***(H3)
				(0.014)
Opportunity				-0.257***(H5)
				(0.016)
Age	-0.007***	0.000*	0.012***	0.012***
	(0.001)	(0.000)	(0.001)	(0.001)
Gender	0.034**	0.014***	-0.225***	-0.225***
	(0.015)	(0.003)	(0.016)	(0.016)
Perceived self-efficacy	0.586***	-0.007	-0.185***	-0.151***
	(0.020)	(0.005)	(0.020)	(0.021)
Fear of failure	-0.326***	0.031***	0.319***	0.299***
	(0.016)	(0.004)	(0.016)	(0.016)
Higher education	-0.040**	0.028***	-0.382***	-0.388***
	(0.017)	(0.004)	(0.018)	(0.018)
2.Household income	0.058***	-0.014***	-0.341***	-0.338***
	(0.019)	(0.004)	(0.019)	(0.019)
3.Household income	0.174***	-0.048***	-0.805***	-0.795***
	(0.019)	(0.004)	(0.019)	(0.019)
Investment experience	0.135***	-0.005	-0.217***	-0.210***
	(0.023)	(0.005)	(0.024)	(0.024)
Knows other entrepreneurs	0.522***	0.014***	-0.094***	-0.066***
	(0.015)	(0.003)	(0.016)	(0.016)
Current employment level	0.000*	0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate	-0.053***	-0.006***	0.049***	0.046***
	(0.003)	(0.001)	(0.004)	(0.004)
Freedom index	0.206***	0.740***	0.282***	0.249***
	(0.047)	(0.011)	(0.050)	(0.052)
Constant	-1.165***	3.211***	-3.036***	-3.191***
	(0.345)	(0.178)	(0.367)	(0.379)
Years fixed effects	Not	Not	Not	Not
Industry fixed effects	Yes	Yes	Yes	Yes
ICC	0.117	0.897	0.116	0.124
Observations	95,309	95,309	95,309	95,309
Number of groups	83	83	83	83

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. We do not control for years because this control captures part of the uncertainty effect (standard deviation of inflation) that we aim to observe. Models 1, 3, and 4 are multilevel logistic regressions. Model 2 is a multilevel linear mixed-effects regression because its dependent variable (economic uncertainty) is continuous.

Hypothesis 2 suggests that natural disasters are positively associated with economic uncertainty. To test this hypothesis, Table 22 presents the results of the multilevel regression. Model 2 reports the results for H2. The natural disaster variable, measured as the logarithm of the number of people deaths by natural disasters, has a positive and significant coefficient (0.025) on economic uncertainty. This provides evidence supporting Hypothesis 2.

Hypothesis 3 suggests that higher economic uncertainty is positively associated with necessity-motivated entrepreneurship. To test this hypothesis, Table 22 presents the results of the multilevel regression. Model 4 reports the results for H3. The economic uncertainty variable, measured as the price level volatility, has a positive and significant coefficient (0.063) on necessity-motivated entrepreneurship. This provides evidence supporting Hypothesis 3.

Hypothesis 4 suggests that natural disasters are negatively associated with perceived opportunity. To test this hypothesis, Table 22 presents the results of the multilevel regression. Model 1 reports the results for H4. The natural disaster variable, measured as the logarithm of the number of people deaths by natural disasters, has a negative and significant coefficient (-0.017) on opportunity perception. This provides evidence supporting Hypothesis 4.

Hypothesis 5 suggests that opportunity perception is negatively associated with necessity-motivated entrepreneurship. To test this hypothesis, Table 22 presents the results of the multilevel regression. Model 4 reports the results for H5. Opportunity perception, measured as the expectation of good business opportunities in the next 6 months, has a negative and significant coefficient (-0.257) on necessity-motivated entrepreneurship. This provides evidence supporting Hypothesis 5.

4.6.3 Results by mediators

We assessed whether the relationship between natural disasters and necessity-motivated entrepreneurship (NME) operates partially through the proposed channels of economic uncertainty and opportunity perception. As a first descriptive check consistent with our mediation setup, Tables 22 and 23 compare the coefficient of natural disasters on NME in models without and with the mediators. In the multilevel specification (Table 22), the coefficient of natural disasters on NME decreases when uncertainty and opportunity are added (from 0.038 in Model 3 to 0.036 in Model 4). The same attenuation pattern is observed in the logit models used for standardised comparisons (Table 23): the coefficient decreases from 0.037 (Model 3) to 0.035 (Model 4), and the corresponding standardised coefficient also declines (from 0.037 to 0.035). Taken together, these patterns provide descriptive evidence that part of the total association between natural disasters and NME is captured by the proposed channels.

We relied on the KHB decomposition to obtain a formal direct–indirect decomposition that is comparable across nested nonlinear models. Table 24 presents the KHB results for the

joint mediation model with both channels included. The “Reduced” coefficient captures the total effect of natural disasters on NME, while the “Full” coefficient represents the direct effect of natural disasters on NME net of uncertainty and opportunity; the difference (“Diff”) is interpreted as the component attributable to the mediators, net of rescaling. The decomposition indicates a statistically significant indirect component (Diff = 0.00269), corresponding to a mediated fraction of 7.20%. At the same time, the direct component remains clearly dominant (Full = 0.03464), indicating partial mediation: the indirect component is distinguishable from zero, but the bulk of the total association remains direct (i.e., not channelled through the two mediators). Finally, the single-mediator decompositions in Table 24 show that, within the mediated component, the uncertainty channel accounts for the larger share (5.11%), while opportunity contributes a smaller but non-negligible share (2.39%). Overall, these results are consistent with partial mediation: uncertainty and opportunity together account for a modest share of the total association (7.20%), while the direct component remains dominant (92.8%).

Table 23: Logit regression

Dependent variable:	Opportunity	Uncertainty	Necessity	Necessity
Variables	Model 1	Model 2	Model 3	Model 4
Natural disasters	-0.017***	0.025***	0.037***	0.035***
	(0.006)	(0.001)	(0.006)	(0.006)
Uncertainty				0.071***
				(0.015)
Opportunity				-0.258***
				(0.016)
Age	-0.007***	0.000*	0.012***	0.012***
	(0.001)	(0.000)	(0.001)	(0.001)
Gender	0.034**	0.014***	-0.226***	-0.226***
	(0.015)	(0.003)	(0.016)	(0.016)
Perceived self-efficacy	0.587***	-0.007	-0.186***	-0.151***
	(0.020)	(0.005)	(0.020)	(0.021)
Fear of failure	-0.325***	0.031***	0.319***	0.300***
	(0.016)	(0.004)	(0.016)	(0.016)
Higher education	-0.040**	0.028***	-0.381***	-0.387***
	(0.017)	(0.004)	(0.018)	(0.018)
2.Household income	0.058***	-0.014***	-0.341***	-0.338***
	(0.019)	(0.004)	(0.019)	(0.019)
3.Household income	0.174***	-0.048***	-0.807***	-0.796***
	(0.019)	(0.004)	(0.019)	(0.019)
Investment experience	0.134***	-0.005	-0.219***	-0.213***
	(0.023)	(0.005)	(0.024)	(0.024)
Knows other entrepreneurs	0.522***	0.014***	-0.095***	-0.067***
	(0.015)	(0.003)	(0.016)	(0.016)
Current employment level	0.000*	0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate	-0.053***	-0.006***	0.050***	0.048***
	(0.003)	(0.001)	(0.004)	(0.004)
Freedom index	0.336***	0.740***	0.448***	0.418***
	(0.051)	(0.011)	(0.053)	(0.054)
Constant	-2.417***	3.211***	-5.118***	-5.410***
	(0.434)	(0.178)	(0.446)	(0.452)
Years fixed effects	Not	Not	Not	Not
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	95,309	95,309	95,309	95,309
Number of groups		83		

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. We do not control for years because this control captures part of the uncertainty effect (standard deviation of inflation) that we aim to observe. We controlled for country in models 1, 3 and 4. Model 2 is the same as Table 22. We calculated standardised coefficients for models 3 (0.037) and 4 (0.035). The natural disaster (logarithm of deaths) standardised coefficient decreases. Models 1, 3, and 4 are logistic regressions. Model 2 is a multilevel linear mixed-effects regression because its dependent variable (economic uncertainty) is continuous (same table 22).

Table 24: KHB mediation analysis results

Dependent variable: Necessity Motivated Entrepreneurship			
Variable of interest: Natural disasters (Log deaths)	**Total effect**	**Direct effect**	**Indirect effect**
Model with mediators (opportunity + uncertainty)	0.03733***	0.03464***	0.00269***
	(0.00583) Reduced	(0.00584) Full	(0.00049) Diff.
Model only mediator opportunity	0.03741***	0.03652***	0.00089***
	(0.00583) Reduced	(0.00583) Full	(0.00031) Diff.
Model only mediator uncertainty	0.03717***	0.03527***	0.00190***
	(0.00582) Reduced	(0.00583) Full	(0.00038) Diff.
Percentage mediated by both mediators			7.20%
Percentage mediated by opportunity			2.39%
Percentage mediated by uncertainty			5.11%

KHB effects are reported to five decimal places because the indirect effects are small, and additional precision helps preserve the reduced–full–difference decomposition within each model. Percentages mediated are reported to two decimal places for simplicity. All control variables from Table 23 are included in the mediation models. *** p<0.01, ** p<0.05, * p<0.1. Model type: logit. Number of observations 95,309

4.6.4 Robustness checks

To assess the robustness of our findings to alternative operationalisations of natural-disaster exposure, we replicate the full three-step mediation strategy, replacing our baseline disaster indicator (log deaths) with an alternative measure of disaster severity based on human injuries (log injured). Specifically, we re-estimate the multilevel models used to test the main hypotheses (Table 25), the logit models used to report standardised coefficients for descriptive attenuation checks (Table 26), and the KHB decomposition used to obtain a scale-adjusted direct–indirect decomposition in nonlinear models (Table 27). All specifications retain the same sample restrictions and covariate set as in the baseline models, ensuring that any differences are attributable to the natural disaster measure rather than to changes in model structure or sample composition.

Table 25: Multilevel regression (robustness)

Dependent variable:	Opportunity	Uncertainty	Necessity	Necessity
Variables	Model 1	Model 2	Model 3	Model 4
Log injured (natural disasters)	-0.007**(H4)	0.006***(H2)	0.042***(H1)	0.041***
	(0.003)	(0.001)	(0.003)	(0.004)
Uncertainty				0.064***(H3)
				(0.014)
Opportunity				-0.257***(H5)
				(0.016)
Age	-0.007***	0.000*	0.012***	0.012***
	(0.001)	(0.000)	(0.001)	(0.001)
Gender	0.034**	0.014***	-0.226***	-0.226***
	(0.015)	(0.003)	(0.016)	(0.016)
Perceived self-efficacy	0.586***	-0.007	-0.187***	-0.153***
	(0.020)	(0.005)	(0.020)	(0.021)
Fear of failure	-0.325***	0.031***	0.319***	0.300***
	(0.016)	(0.004)	(0.016)	(0.016)
Higher education	-0.040**	0.028***	-0.382***	-0.387***
	(0.017)	(0.004)	(0.018)	(0.018)
2.Household income	0.057***	-0.012***	-0.339***	-0.336***
	(0.019)	(0.004)	(0.019)	(0.019)
3.Household income	0.172***	-0.046***	-0.803***	-0.793***
	(0.019)	(0.004)	(0.019)	(0.019)
Investment experience	0.135***	-0.005	-0.215***	-0.208***
	(0.023)	(0.005)	(0.024)	(0.024)
Knows other entrepreneurs	0.523***	0.013***	-0.096***	-0.068***
	(0.015)	(0.003)	(0.016)	(0.016)
Current employment level	0.000*	0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate	-0.052***	-0.007***	0.045***	0.043***
	(0.003)	(0.001)	(0.004)	(0.004)
Freedom index	0.213***	0.728***	0.267***	0.235***
	(0.046)	(0.011)	(0.049)	(0.051)
Constant	-1.254***	3.349***	-2.884***	-3.067***
	(0.343)	(0.179)	(0.364)	(0.378)
Years fixed effects	Not	Not	Not	Not
Industry fixed effects	Yes	Yes	Yes	Yes
ICC	0.117	0.897	0.112	0.121
Observations	95,309	95,309	95,309	95,309
Number of groups	83	83	83	83

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. We do not control for years because this control captures part of the uncertainty effect (standard deviation of inflation) that we aim to observe. Models 1, 3, and 4 are multilevel logistic regressions. Model 2 is a multilevel linear mixed-effects regression because its dependent variable (economic uncertainty) is continuous.

Table 26: Logit regression (robustness)

Dependent variable	Opportunity	Uncertainty	Necessity	Necessity
Variables	Model 1	Model 2	Model 3	Model 4
Log injured (natural disasters)	-0.007**	0.006***	0.0413***	0.0408***
	(0.003)	(0.001)	(0.004)	(0.004)
Uncertainty				0.074***
				(0.015)
Opportunity				-0.258***
				(0.016)
Age	-0.007***	0.000*	0.012***	0.012***
	(0.001)	(0.000)	(0.001)	(0.001)
Gender	0.034**	0.014***	-0.227***	-0.227***
	(0.015)	(0.003)	(0.016)	(0.016)
Perceived self-efficacy	0.587***	-0.007	-0.187***	-0.153***
	(0.020)	(0.005)	(0.020)	(0.021)
Fear of failure	-0.325***	0.031***	0.320***	0.300***
	(0.016)	(0.004)	(0.016)	(0.016)
Higher education	-0.040**	0.028***	-0.380***	-0.386***
	(0.017)	(0.004)	(0.018)	(0.018)
2.Household income	0.057***	-0.012***	-0.339***	-0.336***
	(0.019)	(0.004)	(0.019)	(0.019)
3.Household income	0.172***	-0.046***	-0.805***	-0.794***
	(0.019)	(0.004)	(0.019)	(0.019)
Investment experience	0.134***	-0.005	-0.217***	-0.210***
	(0.023)	(0.005)	(0.024)	(0.024)
Knows other entrepreneurs	0.522***	0.013***	-0.097***	-0.069***
	(0.015)	(0.003)	(0.016)	(0.016)
Current employment level	0.000*	0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate	-0.052***	-0.007***	0.047***	0.044***
	(0.003)	(0.001)	(0.004)	(0.004)
Freedom index	0.344***	0.728***	0.436***	0.406***
	(0.051)	(0.011)	(0.053)	(0.054)
Constant	-2.537***	3.349***	-5.043***	-5.371***
	(0.431)	(0.179)	(0.443)	(0.450)
Years fixed effects	Not	Not	Not	Not
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	95,309	95,309	95,309	95,309
Number of groups		83		

Natural disaster coefficients in Models 3 and 4 are reported to four decimal places because the decrease is small and would be lost if rounded to three decimal places. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. We do not control for years because this control captures part of the uncertainty effect (standard deviation of inflation) that we aim to observe. We controlled for country in models 1, 3 and 4. Model 2 is the same as Table 25. We calculated standardised coefficients for models 3 (0.0413) and 4 (0.0408). The natural disaster (logarithm of injured) standardised coefficient decreases. Models 1, 3, and 4 are logistic regressions. Model 2 is a multilevel linear mixed-effects regression because its dependent variable (economic uncertainty) is continuous (same table 25).

Table 27: KHB mediation analysis results (robustness)

Dependent variable: Necessity Motivated Entrepreneurship			
Variable of interest: Log injured (robustness)	**Total effect**	**Direct effect**	**Indirect effect**
Model with mediators (opportunity + uncertainty)	0.04172***	0.04085***	0.00087***
	(0.00352) Reduced	(0.00352) Full	(0.00022) Diff.
Model only mediator opportunity	0.04153***	0.04113***	0.00040**
	(0.00352) Reduced	(0.00352) Full	(0.00019) Diff.
Model only mediator uncertainty	0.04152***	0.04102***	0.00050***
	(0.00352) Reduced	(0.00352) Full	(0.00011) Diff.
Percentage mediated by both mediators			2.10%
Percentage mediated by opportunity			0.97%
Percentage mediated by uncertainty			1.21%

KHB effects are reported to five decimal places because the indirect effects are small, and additional precision helps preserve the reduced–full–difference decomposition within each model. Percentages mediated are reported to two decimal places for simplicity. All control variables from Table 26 are included in the mediation models. *** p<0.01, ** p<0.05, * p<0.1. Model type: logit. Number of observations 95,309

Overall, the robustness estimates corroborate the substantive pattern of results. The association between natural disasters and necessity-motivated entrepreneurship remains positive and statistically significant, and the estimated relationships for the proposed channels remain directionally consistent with the baseline evidence. As in the main analysis, the coefficient for natural disasters on NME attenuates when opportunity perception and economic uncertainty are included as mediators in both the multilevel specification (Table 25) and the logit specification used for standardised comparisons (notes Table 26). This repeated attenuation provides descriptive support for the claim that the inclusion of the mediators accounts for a non-zero share of the total association between disasters and NME.

Turning to the formal mediation test, Table 27 shows that the KHB decomposition also identifies partial mediation using log injured, though the mediated fraction is smaller than in the baseline results. In particular, the share of the total association attributable to the two mediators falls to around 2.1% under the injured-based measure, while the direct component remains dominant. The single-channel decomposition further indicates that economic uncertainty accounts for the larger share of the mediated fraction (1.2%), whereas opportunity perception contributes a smaller share (0.97%).

4.7 Discussion

The literature shows that natural disasters can alter economic and social conditions in ways that affect entrepreneurship, but the direction of the effect is not consistent across settings. Some studies emphasise negative effects from asset losses and disruption, while others highlight post-disaster reconstruction and reallocation processes that can increase entrepreneurial activity. Empirical evidence, therefore, remains mixed and context dependent. Comparative work reports systematic associations between natural disasters and entrepreneurship (Brück et al., 2011), research on recovery points to "creation after destruction" dynamics (Monllor & Murphy, 2017), and institutional capacity is often discussed as shaping how societies absorb shocks (Boudreaux et al., 2021). More recent studies reinforce that results vary by event type, context, and measurement choices (Zhao et al., 2022).

Even so, much of the recent progress has focused on when or for whom natural disasters matter, rather than on how they matter. Influential studies show that institutional quality and governance can dampen or amplify the association between shocks and economic decisions (Bennett et al., 2023; Boudreaux et al., 2023). In parallel, crisis–entrepreneurship research notes that the field remains fragmented and calls for clearer accounts of the processes linking contextual shocks to entrepreneurial action (Doern et al., 2019; Sætren et al., 2024). This emphasis on moderators has improved our understanding of boundary conditions, but it does not test the channels through which natural disasters translate into necessity-motivated entrepreneurship.

This chapter addresses this limitation by focusing on mechanisms linking natural disasters to necessity-motivated entrepreneurship, emphasising economic uncertainty and opportunity perception. This focus aligns with work that treats need- and opportunity-motivated entrepreneurship as a continuum and argues that basic needs shape how people evaluate options and act (Dencker, Bacq, & Gruber, 2021; Dencker, Bacq, Gruber, et al., 2021). It is also consistent with research that conceptualises perceptions as central to the context–action link (Bosma et al., 2018; Boudreaux et al., 2023; Stuetzer et al., 2014). A key interpretive point is the distinction between opportunities that may emerge after natural disasters and opportunity perception as a short-horizon cognitive assessment. The latter is measured in GEM as whether individuals see good opportunities to start a business within the next six months (Bosma et al., 2018). From this perspective, our evidence that natural disasters are negatively associated with opportunity perception is not inconsistent with the

idea that post-disaster environments can generate new needs or niches. Rather, it indicates that natural disaster contexts can reduce the probability that individuals judge the near-term environment as favourable for starting a business, even if opportunities exist in an aggregate sense. Methodologically, we support this mechanism-based interpretation using a decomposition approach designed for nonlinear models, which allows us to discuss the total association and the portion consistent with the proposed channels without conflating results with logit rescaling (Karlson et al., 2012). Overall, these findings support a process-based reading of the natural disasters–NME relationship and clarify how shocks may translate into necessity-motivated entrepreneurship. Consistent with this mechanism-based view, we find partial mediation, with a larger uncertainty pathway than the opportunity pathway, and a dominant direct component.

4.8 Contributions

This study makes three contributions to research on crises, natural disasters, and entrepreneurship. First, it situates natural disasters within a broader crisis lens and integrates crisis entrepreneurship theory with the disaster domain to explain why entrepreneurial responses may be heterogeneous. Second, it refines prevailing opportunity-based expectations by showing that, although disasters may generate reconstruction needs, they can reduce individual perceived opportunities, highlighting a critical distinction between aggregate-level opportunity creation and individual-level opportunity perception. Third, it examines the relationship between natural disasters and necessity-motivated entrepreneurship by directly and indirectly testing and comparing the uncertainty and opportunity pathways, providing a direct comparison of the two, and documenting partial mediation with a dominant direct effect. The uncertainty pathway is larger than the opportunity pathway, and the direct effect is dominant.

4.9 Practical implications

These implications follow directly from our findings. First, if natural disasters increase necessity-motivated entrepreneurship partly by heightening economic uncertainty, response policies should prioritise early stabilisation of income and employment (e.g., rapid transfers, temporary employment support, and insurance mechanisms), thereby reducing the pressure to become self-employed out of necessity. Second, the findings caution against assuming that reconstruction automatically translates into more perceived opportunities: although

niches may emerge in aggregate terms, the perception of opportunities declines in the short term. Therefore, in addition to resources, information and coordination mechanisms (one-stop shops, sectoral guidance, local demand signalling) are needed to transform potential opportunities into recognisable and actionable ones. Third, in practice, it is advisable to differentiate instruments according to the type of entrepreneurship induced by the shock. For necessity-motivated entrepreneurship, subsistence and continuity support (flexible microfinance, small seed capital, gradual formalisation, basic assistance) is more appropriate, enabling businesses to sustain income without over-indebtedness. In contrast, for initiatives with scalability, productivity-oriented instruments (technical assistance, supply chains, and market access) are justified. Fourth, given that the direct impact is dominant, intervening solely on perceptions is insufficient: the response must be comprehensive, simplifying procedures and accelerating asset replacement and service continuity. Fifth, since the measurement of perceived opportunities is anchored in a short-term horizon, these actions should focus on the immediate post-disaster window, when informational and coordination shocks are most intense.

4.10 Limitations and future research

The main limitation of this chapter concerns the structure and level of aggregation of the data. By measuring natural disasters at the country-year level (for example, by summing annual deaths across different event types) and linking this information to individual GEM surveys, we capture a national-level contextual shock but lose local and event-specific variation. Consequently, we do not observe direct exposure to or the territorial intensity of the natural disaster, nor can we accurately distinguish mechanisms that operate differently across event types. Furthermore, the country-year link does not allow us to identify whether the entrepreneur interview was conducted before or after a particular event, nor how much time elapsed since the shock. This introduces temporal misalignment between the measurement of the "treatment," the mediators (uncertainty and perception of opportunities), and the outcome (NME). This set of measurement errors likely attenuates the estimated effects and contributes to small coefficient magnitudes, particularly when the actual impacts are spatially concentrated or manifest within limited timeframes. Simultaneously, this limitation highlights an inherent trade-off in global comparative research. While more detailed data would be ideal for pinpointing local exposure and interview timing relative to specific events, no currently available dataset combines comparable cross-country coverage,

entrepreneur-level information, and enough temporal scope to explore these mechanisms globally. Therefore, the current design is the best option available for addressing this question comparatively, even though it loses some territorial and temporal precision.

A further limitation concerns the measurement of economic uncertainty. This chapter operationalises uncertainty using price-level volatility at the annual country level, following prior entrepreneurship research that uses inflation volatility as a proxy for macroeconomic uncertainty (Bennett et al., 2023). Although this measure provides broad cross-country and longitudinal coverage and is consistent with the country-year structure of the GEM and CRED data used in this chapter, it does not capture all dimensions of economic uncertainty, such as policy unpredictability, exchange-rate volatility, fiscal instability, or broader macroeconomic ambiguity. A more direct measure, such as the Economic Policy Uncertainty index, could capture policy-related uncertainty more precisely. However, EPU data are available for a smaller and uneven set of countries and country-years than the 83-country annual sample used in this chapter, and its monthly frequency does not fully align with the annual country-level structure of the empirical design. Using EPU would therefore reduce the sample and affect the comparability of the multilevel cross-country analysis. Future research could revisit this mechanism using EPU or other high-frequency uncertainty indicators if broader harmonised monthly data on natural disasters, uncertainty, and entrepreneurial outcomes become available.

A further limitation concerns the use of GEM self-reported measures of necessity-motivated entrepreneurship and opportunity perception. Although GEM is particularly useful for examining individual-level entrepreneurial motivations and perceptions in a comparable way across countries, these measures may be affected by perceptual, recall, and reporting biases. Future research could complement GEM-based analyses with registry data, administrative records, tax data, labour-market records, or firm-level panels, which are better suited to studying objective outcomes such as transitions into self-employment, business registration, survival, formalisation, or income trajectories. However, such sources usually do not capture whether individuals enter entrepreneurship because they perceive no better employment alternatives, nor do they observe short-term opportunity perception at the entrepreneur level in a comparable cross-country format. Therefore, these alternative data sources would extend, rather than simply replace, the GEM-based approach used here.

These limitations open clear avenues for future research. A first step is to bring the analysis closer to event- and territory-level designs, ideally using subnational (ideally city-

level) data to link specific shocks to locally exposed entrepreneurs and to employ finer timeframes to observe immediate versus persistent effects. Second, it is important to differentiate between types of disasters and their severity, since different events can activate distinct mechanisms and, when aggregated, can average effects of different signs. Third, future research could strengthen the validity of the mechanisms by distinguishing between "objective opportunities" that may emerge after reconstruction and the perception of opportunities as a short-term evaluation, and by incorporating additional outcomes that capture the quality of entrepreneurship (e.g., formalisation, survival, or performance) to differentiate subsistence responses from trajectories with greater potential. Taken together, these developments would allow for a more precise evaluation of the proposed channels and the estimation of effects that are currently partially diluted by country-year aggregation and uncertainty about the exact moment of exposure to the shock.

Future research could also build on the finding that the uncertainty pathway is stronger than the opportunity pathway. One testable expectation is that uncertainty mechanisms are more influential immediately after natural disasters, when income, employment, infrastructure, and coordination are disrupted, whereas opportunity-based mechanisms may become stronger in later stages of recovery or in contexts with stronger institutional support. Future studies could test whether the relative strength of these pathways varies across disaster types, recovery phases, and entrepreneurial profiles, distinguishing, for example, necessity-driven entrepreneurs from opportunity-driven, innovative, or growth-oriented entrepreneurs.

4.11 Conclusions

This chapter examined how natural disasters are linked to necessity-motivated entrepreneurship (NME) and, more importantly, why this relationship occurs. Unlike a body of literature that often emphasises moderating conditions, this chapter helps to explain why the natural disaster-NME link exists by evaluating intermediate mechanisms consistent with a crisis logic: (i) increased economic uncertainty and (ii) changes in the perception of opportunities. In doing so, the chapter contributes to refining the theoretical interpretation of the effect of natural disasters on NME, shifting the focus from "when it intensifies" to "through what processes it manifests."

In line with the hypotheses, the results support the baseline relationship between natural disasters and NME and provide evidence consistent with the proposed channels:

disasters are associated with increased economic uncertainty and shifts in perceptions of opportunities, and both mechanisms are linked to NME. By integrating both mediators into the same empirical framework, the evidence confirms partial mediation: a share of the total effect operates indirectly through uncertainty and opportunity, while the direct component remains substantial. These findings suggest that natural disasters trigger additional pressures and constraints that help explain why, after these shocks, some individuals become entrepreneurs out of necessity.

5 General conclusions

5.1 Main findings and discussion

This thesis offers new insights into how natural disasters influence entrepreneurship across entrepreneurial outcomes, institutional settings, and mechanisms. Overall, the findings suggest a clear pattern: natural disasters tend to weaken more aspirational and innovation-oriented forms of entrepreneurship, while increasing necessity-motivated entrepreneurship. This pattern aligns with crisis research showing that disruptive events alter expectations, coordination, resource availability, and perceived opportunities, rather than producing uniform entrepreneurial responses (Agarwal & Audretsch, 2020; Doern et al., 2019; Williams et al., 2017). At the same time, the magnitude and expression of these effects vary depending on whether the focus is on entrepreneurial growth aspirations, innovative entrepreneurship, or necessity-motivated entrepreneurship, as well as on the institutional and political conditions under which entrepreneurs interpret and respond to these shocks.

These findings are important because they move beyond a traditional view of entrepreneurship after natural disasters. Prior research has often focused on business entry, survival, or aggregate entrepreneurial activity following natural disasters (Boudreaux, Escaleras, et al., 2019; Boudreaux et al., 2021, 2023; Mendoza et al., 2018; Salvato et al., 2020). By contrast, this thesis shows that natural disasters influence entrepreneurship across temporal and strategic dimensions. In some cases, they hinder long-term ambitions and innovative efforts; in others, they increase necessity-motivated entrepreneurial activity. This heterogeneity suggests that entrepreneurial responses to natural disasters are shaped not only by the shock itself but also by the type of entrepreneurial outcome under examination, the institutional context in which the shock occurs, and the mechanisms through which individuals interpret uncertainty and opportunity.

The findings from Chapter 2 show that natural disasters generally reduce entrepreneurial growth aspirations, indicating that natural disasters related shock tend to dampen entrepreneurs' long-term ambitions. This result extends prior work on natural disasters and entrepreneurship by shifting attention from immediate outcomes, such as entry and survival, to a more forward-looking form of entrepreneurship associated with employment growth, expansion, and future-oriented business development (Autio & Acs, 2010; Capelleras et al., 2019; Estrin et al., 2013). The finding is also consistent with the view that disasters increase uncertainty, disrupt coordination, and raise the perceived risks of

committing resources to long-term projects (Boehm et al., 2015; Carvalho, 2014; Schultz, 1975). In this sense, natural disasters appear to encourage more cautious entrepreneurial behaviour by weakening expectations of future expansion. At the same time, Chapter 2 shows that governance quality moderates this relationship. When governance quality is high, the negative impact of natural disasters on entrepreneurial growth aspirations is mitigated; when governance quality is low, the adverse effect is more severe. This finding reinforces institutional theory by showing that formal institutions shape how entrepreneurs interpret and respond to crisis conditions (North, 1990; Williamson, 2000). Strong governance can reduce uncertainty, improve coordination, protect contracts, and increase confidence in recovery processes, thereby making post-disaster environments more conducive to entrepreneurial ambition (Dixit, 2009; Webb et al., 2020). By contrast, weak governance amplifies uncertainty and makes growth-oriented action less feasible. Thus, the same type of shock can generate different entrepreneurial responses depending on the institutional quality of the country in which it occurs.

The findings from Chapter 3 indicate that natural disasters generally hinder innovative entrepreneurship at the individual level. This result contributes to the literature by suggesting that, although disasters may create new needs and opportunities for adaptation, their overall effect on innovative entrepreneurship is negative. This finding helps reconcile mixed evidence in prior research. While some studies show that natural disasters can stimulate innovation in specific sectors or technologies, such as disaster-mitigation patents or reconstruction-related solutions (Miao & Popp, 2014), other work highlights persistent negative effects stemming from uncertainty, resource constraints, and delayed investment (Miao & Popp, 2014). The results of this thesis suggest that, at the individual entrepreneurial level, the uncertainty mechanism tends to dominate the opportunity mechanism, especially because innovation requires experimentation, resources, and longer planning horizons.

However, Chapter 3 also shows that the relationship between natural disasters and innovative entrepreneurship varies across political contexts. Populist discourse moderates this relationship by shaping the balance between uncertainty and opportunity. This finding extends institutional approaches to entrepreneurship by highlighting political discourse as an institutional signal that shapes how entrepreneurs interpret crisis conditions (Acemoglu et al., 2013; Bennett et al., 2023; Rodrik, 2018). In low-populism contexts, increases in populist discourse within a low range are associated with a less adverse natural disasters innovative entrepreneurship relationship. In high-populism contexts, however, stronger

populist discourse weakens the positive association between natural disasters and innovative entrepreneurship. This pattern suggests that political environments influence whether post-disaster conditions are interpreted as spaces for innovation or as sources of additional uncertainty, instability, and risk (Bennett et al., 2023; Tang et al., 2024; Yoon et al., 2024).

The findings in Chapter 4 demonstrate that natural disasters are positively associated with necessity-motivated entrepreneurship and, importantly, clarify why this relationship exists. This result aligns with the idea that crises can constrain employment alternatives, pushing individuals into entrepreneurship as a fallback rather than a purely opportunity-driven choice (Audretsch et al., 2022; Bosma et al., 2018; Dencker, Bacq, & Gruber, 2021; Nikiforou et al., 2019). By focusing on necessity-motivated entrepreneurship, the thesis shows that natural disasters do not simply suppress entrepreneurship; instead, they may reallocate entrepreneurial activity towards more defensive, livelihood-oriented forms of entry. This distinction is important because an increase in entrepreneurship after a disaster does not necessarily indicate opportunity creation or economic dynamism. It may also reflect constrained choices, job losses, and heightened livelihood pressures.

Chapter 4 further contributes by directly testing the mediating mechanisms linking natural disasters to necessity-motivated entrepreneurship. The evidence supports two pathways: economic uncertainty and opportunity perception. When both mediators are considered together, the results indicate partial mediation, with part of the effect of natural disasters operating indirectly through these mechanisms, while the direct effect remains dominant. The uncertainty pathway is stronger than the opportunity pathway, reinforcing the idea that crisis-induced instability, rather than opportunity perception, is the main mechanism linking disasters to necessity-motivated entrepreneurship. This finding contributes to crisis and entrepreneurship research by moving beyond the assumption that uncertainty and opportunity operate in the background and by empirically comparing their relative importance (Doern et al., 2019; Karlson et al., 2012; Zhao et al., 2022).

Taken together, the findings of this thesis suggest that entrepreneurship following natural disasters is heterogeneous, context-dependent, and driven by mechanisms. Natural disasters can discourage long-term entrepreneurial ambitions, reduce innovative entrepreneurship, and increase necessity-motivated entrepreneurship. However, the extent and direction of these effects depend on institutional quality, political discourse, and the relative strength of uncertainty and opportunity mechanisms. This integrated interpretation advances the literature by showing that natural disasters should not be understood simply as

shocks that increase or decrease entrepreneurship. Rather, they reshape the composition, motivation, and strategic orientation of entrepreneurial activity across crisis contexts.

5.2 Theoretical implications

This thesis has several theoretical implications for research on natural disasters, crises, and entrepreneurship. First, it extends the entrepreneurship literature by showing that natural disasters do not produce a single entrepreneurial response. Instead, their consequences vary across different entrepreneurial outcomes, including entrepreneurial growth aspirations, innovative entrepreneurship, and necessity-motivated entrepreneurship (Boudreaux et al., 2021, 2023; Doern et al., 2019; Williams et al., 2017). This moves the literature beyond a narrow focus on business entry or survival and towards a more differentiated understanding of how natural disasters shape entrepreneurial behaviour. More specifically, each empirical chapter advances this theoretical argument in a distinct way. Chapter 2 contributes to institutional theory by showing that formal institutional quality, captured by governance quality, conditions the extent to which natural disasters undermine entrepreneurial growth aspirations. This finding suggests that institutions not only shape entrepreneurship under stable conditions but also influence whether entrepreneurs maintain future-oriented ambitions when facing crisis-related disruption. Chapter 3 extends this argument by showing that political-institutional signals, captured by populist discourse, shape the relationship between natural disasters and innovative entrepreneurship. This indicates that institutional environments operate not only through formal rules and governance arrangements but also through political narratives that affect uncertainty, expectations, and the perceived feasibility of innovation during crises. Chapter 4 contributes more directly to the crisis perspective by identifying economic uncertainty and opportunity perception as mechanisms linking natural disasters to necessity-motivated entrepreneurship. This shows that crises affect entrepreneurship not only by changing external conditions but also by altering the mechanisms through which individuals interpret constraints and opportunities. Together, these findings advance existing theory by showing that natural disasters should be understood as institutionally embedded crises, whose entrepreneurial consequences depend on both contextual conditions and crisis-related mechanisms.

Second, the thesis shows that the entrepreneurial effects of natural disasters are embedded not only in institutional and political environments but also in broader economic conditions. The findings suggest that whether uncertainty or opportunity becomes more

salient depends on the interaction between the shock itself and the surrounding context. In this regard, governance quality, populist discourse, and varying economic conditions help explain why similar natural disaster shocks may lead to different entrepreneurial responses across settings. This implication reinforces the idea that entrepreneurship during a crisis cannot be understood apart from the wider institutional, political, and macroeconomic environment in which it unfolds (Acemoglu et al., 2013; North, 1990; Webb et al., 2020; Williamson, 2000).

Third, the thesis provides a more mechanism-based explanation of how natural disasters influence entrepreneurship. While earlier research has often highlighted moderators or boundary conditions, this thesis also explores the mechanisms through which disasters affect entrepreneurial responses. Specifically, the results from the third study indicate that economic uncertainty and opportunity perception serve as mediators, with the uncertainty pathway being stronger than the opportunity pathway. This enhances theory by showing that the entrepreneurial effects of natural disasters are not only context-dependent but also driven by identifiable underlying processes (Doern et al., 2019; Karlson et al., 2012; Williams et al., 2017).

5.3 Practical implications

This thesis also has several practical implications for policymakers and institutions involved in disaster recovery and entrepreneurship support. First, the findings suggest that post-disaster policy should not treat entrepreneurship as a single or uniform outcome. Natural disasters may weaken entrepreneurial growth aspirations and innovative entrepreneurship while increasing necessity-motivated entrepreneurship. This implies that a rise in entrepreneurial activity after a disaster should not automatically be interpreted as a positive signal of recovery (Bosma et al., 2018; Dencker, Bacq, & Gruber, 2021; Nikiforou et al., 2019). Policymakers should therefore distinguish between different forms of entrepreneurship and design support instruments that not only encourage business creation but also foster more ambitious and innovative entrepreneurial responses.

Second, the findings highlight the importance of institutional quality in shaping entrepreneurial responses after natural disasters. Strong governance can mitigate the adverse effects of natural disasters on entrepreneurial growth aspirations by reducing uncertainty and supporting recovery-oriented expectations (Dixit, 2009; North, 1990; Webb et al., 2020). This suggests that post-disaster strategies should go beyond emergency relief and include

efforts to strengthen institutional credibility, coordination, and predictability. Measures that improve government effectiveness, regulatory quality, and the rule of law may help create environments in which entrepreneurs are more likely to pursue expansion and long-term business development rather than retreat into more defensive strategies.

Third, the findings indicate that political discourse and broader economic conditions also matter for entrepreneurial adaptation after natural disasters. In particular, the results suggest that political environments characterised by higher levels of populist discourse may weaken innovative entrepreneurial responses (Acemoglu et al., 2013; Bennett et al., 2023; Rodrik, 2018), while less favourable economic conditions may reinforce uncertainty. This implies that post-disaster recovery policies should pay attention not only to physical reconstruction and financial assistance but also to the broader political and macroeconomic environment in which entrepreneurs operate. Policies that reduce uncertainty, improve access to reliable information, and support opportunity recognition may be particularly important for preventing post-disaster entrepreneurship from becoming primarily defensive and for sustaining more growth-oriented and innovative entrepreneurial responses.

These practical implications vary across audiences, though they should be interpreted within the limits of the thesis's cross-country, multilevel design. For policymakers, the findings suggest that disaster recovery strategies should distinguish between forms of entrepreneurship rather than treating business creation as a uniform indicator of recovery. Public action should therefore combine emergency support with measures that reduce uncertainty, strengthen institutional credibility, ensure predictable rules, and support growth-oriented, innovative entrepreneurial responses. For entrepreneurs operating in disaster-prone contexts, the findings offer broad guidance rather than individual-level prescriptions. They emphasise the need to interpret post-disaster environments carefully, distinguish between short-term survival pressures and longer-term opportunities, and rely on reliable information, networks, and institutional support when making decisions about entry, innovation, or growth. For international development institutions designing resilience programmes, the findings indicate that entrepreneurship support should be integrated into broader institutional and crisis-resilience agendas. Such programmes should not only provide financial assistance after disasters but also help strengthen governance capacity, information systems, predictable recovery procedures, and support mechanisms that prevent post-disaster entrepreneurship from becoming primarily necessity-driven or defensive.

5.4 Limitations and future research

This thesis offers important insights into how natural disasters influence entrepreneurship across various outcomes, institutional conditions, and mechanisms. However, several limitations should be recognised.

First, the thesis is limited by the structure and level of aggregation of the available data. Across the three studies, natural disasters are measured at the country-year level and linked to individual GEM observations, which allows for cross-country comparison but constrains the ability to capture local exposure, territorial intensity, and event-specific variation (Bosma et al., 2018; Estrin et al., 2013). Additionally, this design makes it difficult to determine whether interviews were conducted before or after a specific disaster or how much time had passed since the shock. These limitations may weaken the estimated effects, particularly when the impacts of disasters are spatially concentrated or unfold over short periods. Future research could address this by employing subnational or geo-referenced data, ideally at the city or event level, and by implementing finer temporal designs that differentiate immediate responses from longer-term entrepreneurial reactions. Future research could complement the cross-country approach used in this thesis by examining extreme and place-based contexts where entrepreneurs face recurring or chronic exposure to hazards. While this thesis operationalises natural disasters as annual country-level exposure, some entrepreneurial responses may be better understood in settings where disaster risk is embedded in everyday life, community memory, and protracted recovery processes. Recent qualitative research on entrepreneurs affected by the Calbuco Volcano eruptions in Chile, for example, shows how repeated exposure to crises can foster relational entrepreneurial perseverance through recovery memories, social support, recovery work ethics, and community-level recovery legacies (Muñoz et al., 2025). Such research would deepen understanding of how entrepreneurs interpret, endure, and respond to persistent disaster risk over time.

Future research could also engage more directly with cross-disciplinary disaster studies and resilience research. These literatures show that disasters are not only physical shocks but also socially embedded processes, with consequences that depend on vulnerability, place, recovery trajectories, governance, and adaptive capacity. Sociological research distinguishes between people's recovery and the recovery of places, and stresses that short- and long-term recovery trajectories may diverge (Arcaya et al., 2020). Geography and resilience research emphasise that resilience should not be reduced to a technical index,

as it is shaped by structural socio-political processes, power relations, scale, and context-specific knowledge (Donovan, 2017; Weichselgartner & Kelman, 2015). Research on place-based disaster perception also shows that communities interpret future risks through local meanings, identities, and narratives of preparedness or survival (Shtob, 2019). Development economics adds that resilience depends on ex ante investments, fiscal buffers, and the capacity to protect public and private capital in disaster-prone contexts (Marto et al., 2018). Incorporating these perspectives would enable future studies to examine more directly how entrepreneurial responses to disasters are shaped by exposure, vulnerability, recovery capacity, and local interpretation, alongside formal institutions and crisis-related mechanisms.

This level of aggregation also limits the policy implications' micro-level applicability. Because the empirical analyses identify average associations across countries and individuals, the findings are better suited to informing broad institutional and crisis-related policy orientations than to prescribing specific interventions for particular entrepreneurs, communities, or local ecosystems. For example, the results suggest that governance quality, predictable political signals, and uncertainty reduction matter after natural disasters, but they cannot identify which local instruments, delivery mechanisms, or community-level practices are most effective in specific post-disaster settings. Future qualitative and mixed-methods research could bridge this gap by examining how entrepreneurs, policymakers, support organisations, and local communities interpret disaster-related uncertainty and opportunities in practice, and how national-level institutional conditions are translated into concrete recovery actions at the local level.

A related limitation concerns potential endogeneity in the relationship between natural disasters and entrepreneurial outcomes. Although natural disasters are often treated as exogenous shocks, the observed severity of their impacts may still be associated with country-level characteristics such as infrastructure quality, disaster preparedness, institutional capacity, population density, reporting capacity, and economic development. Therefore, the results should be interpreted as multilevel associations between annual country-level disaster exposure and individual entrepreneurial outcomes, rather than as fully causal estimates. An instrumental-variable strategy would require an instrument correlated with disaster exposure or severity but unrelated to entrepreneurial growth aspirations, innovative entrepreneurship, or necessity-motivated entrepreneurship, except through the disaster measure. In this cross-country annual setting, identifying such an instrument is

difficult. Future research could address this limitation by developing subnational, georeferenced, event-level datasets that allow researchers to link entrepreneurs to specific disasters with greater spatial and temporal precision.

Second, the findings are also limited by the characteristics of the available measures. Some variables depend on broad country-level indicators or self-reported perceptions, while others oversimplify complex phenomena into relatively coarse measures. For example, in the third study, the distinction between aggregate opportunity creation and individual perception suggests that current indicators do not fully distinguish between objective post-disaster opportunities and entrepreneurs' short-term perceptions (Doern et al., 2019; Williams et al., 2017). Likewise, the use of binary controls and broad contextual indicators may restrict explanatory precision. Future research could enhance measurement by more carefully differentiating between event types and disaster severity, refining the operationalisation of opportunities and uncertainty, and incorporating richer outcomes related to entrepreneurial quality, such as formalisation, survival, or performance. Qualitative or mixed-method approaches could also help to better understand how entrepreneurs interpret disasters, uncertainty, and opportunity in practice.

Relatedly, the GEM-based measures used in this thesis should be understood as capturing individual-level entrepreneurial expectations, perceptions, behaviours, and motivations rather than administrative outcomes. Future research could complement this approach by using registry data, administrative records, tax data, patent data, or firm-level panels to examine more objective outcomes such as firm entry, survival, employment growth, innovation outputs, formalisation, or performance. However, these sources usually do not capture entrepreneurial growth aspirations, early-stage innovation, opportunity perception, or necessity motivations in a harmonised cross-country format. For this reason, such data would extend rather than simply replace the GEM-based approach used in this thesis.

Third, the institutional and political variables examined in the thesis, while theoretically relevant, do not encompass the broader context in which entrepreneurial responses unfold. In particular, Chapter 3 suggests that the role of populist discourse should be interpreted alongside the macroeconomic conditions that characterise the low- and high-populism subsamples. Although these conditions are not the thesis's main theoretical focus, they are important for understanding why the balance between uncertainty and opportunity may differ across contexts (North, 1990; Webb et al., 2020; Williamson, 2000). Future

research could expand the framework by incorporating other informal institutions, such as culture or religion, and by analysing in greater depth the behavioural, cognitive, and network mechanisms through which discourse and institutions shape perceptions of risk, trust, coordination, and opportunity recognition. This would deepen understanding of how context influences whether uncertainty or opportunity becomes more prominent after a disaster.

Fourth, the current evidence on populist discourse remains limited by the characteristics of available databases. As noted in Chapter 3, future work would benefit from populism measures with greater temporal variability and broader coverage of strongly populist contexts, reducing the concentration of observations at low levels of populism and enabling stronger tests of highly populist environments (Bennett et al., 2023; Hawkins et al., 2019). More generally, future research could continue to explore how political discourse interacts with institutional quality and economic conditions in shaping entrepreneurial responses to crises.

Overall, these limitations do not diminish the contribution of the thesis, but they do suggest that understanding the relationship between natural disasters and entrepreneurship would benefit from more detailed, longitudinal, and context-sensitive research designs. Progressing in these areas would allow future studies to better identify how disasters influence different forms of entrepreneurship, through which mechanisms, and under what institutional, political, and economic circumstances.

More specifically, future research could address several testable questions that arise directly from this thesis's findings. Do entrepreneurs located closer to a disaster experience stronger declines in growth aspirations than those located farther away, and is this relationship weaker in regions with higher governance quality? Does populist discourse reduce innovative entrepreneurship after disasters by increasing perceived uncertainty or by weakening entrepreneurs' interpretation of post-disaster opportunities? Do opportunity perception and economic uncertainty operate differently for necessity-driven and opportunity-driven entrepreneurs after natural disasters? Are certain disaster types, such as floods, earthquakes, storms, or droughts, more strongly associated with growth-oriented, innovative, or necessity-motivated entrepreneurship? Addressing these questions would help future studies move from broad institutional and mechanism-based explanations towards more precise empirical tests of how natural disasters shape different entrepreneurial responses.

Future research could also move towards a more unified comparative framework for examining the dominance of mechanisms across entrepreneurial outcomes. This thesis shows that natural disasters may affect growth aspirations, innovative entrepreneurship, and necessity-motivated entrepreneurship through different institutional conditions and crisis-related mechanisms. However, it does not fully compare whether uncertainty, opportunity, governance quality, or political discourse dominate across all outcomes. A promising extension would be to examine whether formal institutional quality moderates or mediates the relationship between natural disasters and necessity-motivated entrepreneurship, and whether strong governance reduces the uncertainty pathway or alters the relative importance of opportunity perception. Such research could help explain why some entrepreneurs respond to disasters by lowering growth or innovation expectations, whereas others enter entrepreneurship out of necessity.

6 References

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