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AN IGNORED RELATIONSHIP: EXTREME EVENTS AND FISCAL CENTRALISM IN CHILE

UNA RELACIÓN IGNORADA: EVENTOS EXTREMOS Y CENTRALISMO FISCAL EN CHILE

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ABSTRACT

Chile is a highly centralized country with high levels of risk from disasters and extreme events. This double feature has encouraged the creation of several public organizations with a strong territorial vocation, and public innovations have been developed in subnational public management to improve emergency containment, recovery, or reconstruction when necessary. However, even if strong local and subnational governments are considered essential for risk prevention, it seems that the occurrence of extreme events tends to reinforce fiscal centralism, and not to empower local administrations. This article analyses the budgetary effects of extreme events on the relationship between the central government and the Chilean regions between 1992 and 2022. For this, a measurement is designed to compare the amount of money invested by the sixteen regional governments versus the central government's investment in each region over three decades, putting a special focus on years with extreme events. The results show that central investment increases in regions where extreme events are highly destructive, which reinforces fiscal centralism. This goes in the opposite direction to current risk prevention literature, which points to the need for strong subnational governments capable of facing extreme situations.

Keywords: Fiscal Decentralization, Extreme Events, Centralism, Subnational Governments, Chile.

RESUMEN

Chile es un país altamente centralizado con altos niveles de riesgo de desastres y eventos extremos. Esta doble característica ha impulsado la creación de varios organismos públicos con fuerte vocación territorial, y se han desarrollado innovaciones públicas en la gestión pública subnacional para mejorar la contención, recuperación o reconstrucción de emergencias cuando sea necesario. Sin embargo, incluso si se considera que los gobiernos locales y subnacionales fuertes son esenciales para la prevención de riesgos, parece que la ocurrencia de eventos extremos tiende a reforzar el centralismo fiscal y no a empoderar a las administraciones locales. Este artículo analiza los efectos presupuestarios de eventos extremos en la relación entre el gobierno central y las regiones chilenas entre 1992 y 2022. Para ello, se diseña una medición que compara la cantidad de dinero invertida por los dieciséis gobiernos regionales versus la inversión del gobierno central en cada región durante tres décadas, poniendo especial atención en años con eventos extremos. Los resultados muestran que la inversión central aumenta en regiones donde los eventos extremos son altamente destructivos, lo que refuerza el centralismo fiscal. Esto va en dirección opuesta a la literatura actual sobre prevención de riesgos, que señala la necesidad de gobiernos subnacionales fuertes y capaces de enfrentar situaciones extremas.

Palabras clave: Descentralización Fiscal, Eventos Extremos, Centralismo, Gobiernos Subnacionales, Chile.

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1. INTRODUCTION

In 1939, the city of Chillán, located 450 kilometres south of Santiago de Chile, was devastated by an earthquake measuring 7.8 degrees on the Richter scale. 21 years later, the south of the country was hit again by the Valdivia earthquake, the largest of which humanity has recorded: 9.5 degrees on the Richter scale. In those times, the central government lacked systematized policies with a territorial focus. It lacked political-administrative units as such at the regional level. Nor did it have a decentralized network of ministerial offices that would allow the central government to have clear notions of the country's territorial needs.

The magnitude of both disasters evidenced the need to have a territorial focus on state management. So, after the Chillán earthquake, the government designed a series of strategies to lift the affected area, like the creation of the Production Promotion Corporation (CORFO), which later continued to develop studies and local production plans. After the Valdivia disaster, the Provincial Development Committee was created. Both processes fuelled the subsequent creation of the National Planning Office (ODEPLAN) in 1966, with its respective territorial offices throughout the country (Boisier, 2007). As it is, the ODEPLAN depicted the idea of a territorial division of the country into 12 regions, instead of the traditional 28 provinces existing at that time (ODEPLAN, 1968), which would later serve as the basis for the political-administrative division imposed since 1974 (Boisier, 2007).

Recent extreme events have also triggered some state reforms to promote regionalization, this time with a special focus on decentralization. After the earthquake of February 27, 2010, a rich decentralization legislative agenda emerged that included two laws for strengthening regional governments (Laws 21.074 and 21.075). Based on the catastrophic consequences of the 'earthquake effect', the idea that the *Gobierno Regional* (GORE) should have more freely allocated resources was consolidated, since their lack of patrimony was exposed. Innovations have also been developed in subnational public management to improve emergency containment and recovery or reconstruction when necessary. In line with the last event described, in 2021 a law was approved that grants powers so that the *Gobernador Regional* the highest authority of the GORE, is a permanent part of the Regional Committee for Risk and Disaster Management.

This is not exclusive to Chile. Evidence shows that windows of opportunity open after disasters to generate relevant political reforms that would otherwise be difficult to develop (Davidsson, 2020; Kneeland, 2020). Such windows of opportunity will be directly related to the magnitude of the disaster, since this reveals the weakness of the institutional framework and, consequently, would facilitate the reformulation of state management mechanisms (Birkland, 2007). Indeed, this type of debate has occurred frequently in the global south, such as Indonesia (Putra & Matsuyuki, 2019), Thailand (Marks & Lebel, 2015), Vietnam (Garschagen, 2015), and South Korea (Bae et al., 2015), Turkey (Hermansson, 2019) and China (Zang, 2021), among others.

However, in Chile, it seems that extreme events and disasters have tended to reinforce the fiscal centralism of the country and not to increase its decentralisation. This article analyses the budgetary effects on the central-subnational government's relationship after 29 extreme events and natural disasters produced from 1992 to 2022. For this, a measurement is designed to compare the amount of money invested by the sixteen regional governments versus the central government's investment in each region over three decades, putting a special focus on years with extreme events. The results show that central investment increases considerably in regions where extreme events are highly destructive, which reinforces fiscal centralism. This goes in the opposite direction to current risk prevention literature, which points to the need for strong subnational governments capable of facing extreme situations. For this, this article is divided into seven parts. Firstly, we present what the literature shows on fiscal decentralisation and its potential for efficiency in the provision of public goods and services. Secondly, we present a brief review of the possible relationship between extreme events and fiscal decentralisation. Thirdly, we present the Chilean case, with both high levels of centralism and risk of disaster and extreme events. Then, we present the methodology of this research, based on quantitative data on both disaster occurrence and central and regional expenditure. After that, we present the main results, to finally present our conclusions, pointing out the limits of this research and potential future approaches on this matter.

2. FISCAL DECENTRALIZATION AND PROVISION OF PUBLIC GOODS AND SERVICES

Defenders of decentralization point out that transferring competencies to subnational and local governments may increase efficiency in the allocation of public services. Paul Samuelson (1954) establishes that the provision of public services is not towards the individual preferences of its inhabitants, but rather towards an aggregation of these. This creates an efficiency problem, even more so when contrasted with the provision of private goods, where the market can respond individually. Charles Tiebout (1956) added that this efficiency problem would be reduced when such public services are decentralized, due to the exit capacity of 'vote with the feet', where citizens would choose the location of residence according to their preferences and needs in public services.

In 1972 Wallace Oates published Fiscal Federalism, where he shows that a decentralized model of state organization represents a multiplicity in the unit. This means that it can deliver unity when and where it is needed, but at the same time, it guarantees variety and independence when and where unity is not essential. Oates also assures that one of the fundamental theoretical problems of fiscal federalism is the articulation of the different levels of government for the provision of public goods because the demands do not necessarily coincide with the territorial units of the political-administrative division. In addition, there would not be such a unit with an optimal size because this would be defined by each good or public service (1972). Due to all this, positive and negative externalities are created that must necessarily be compensated. However, assuming this imperfection, the local jurisdictional limits would be more efficient than the national ones to satisfy the territorial demands.

The fiscal federalism approach to decentralization processes is fundamentally based on the principal-agent model. This model emerged to analyse relationships between companies with different roles in the market (Levinthal, 1988) but was replicated in public policy by David Heymann (1988), specifically in cases of central governments that transferred the provision of public services to subnational administrations. In this context, the central government defines a public policy but considers that it is more efficient for it to be operationalized in a decentralized manner, through local governments.

Federalism was born after the need for communities to associate around common objectives and interests, generating a limited alliance towards such spheres of action and respecting the heterogeneity of its constituents (Elazar, 1987). In a unitary model, decentralization is not the product of the basic and natural agreements of the alliance but is the free choice of the central government. Hence, in a unitary state decentralization is reflected in a hierarchical structure, while in a federal one in a figure of large and small areas of political decision (Elazar, 1987). Falleti (2005) adds that the structure of the political organization of nations is a process of continuous reform and that the centre-periphery dichotomy evolves for one or the other according to the circumstances, a situation that applies both to unitary and federal countries. As it is, decentralisation is understood as a constant process of negotiation between the representatives of the central power and the sub-national governments (Mardones, 2008).

Rondinelli, Nellis, and Cheema (1983) manage to group the traditional political and economic approaches to the concept of decentralization. The problem they observed in developing countries was that an important part of public spending is oriented towards the provision of public services, but central governments show notorious deficiencies in providing them equitably and efficiently, so local governments, companies, and non-governmental organizations would necessarily have to play an active role. Then, they define decentralization as the transfer of funds and competencies for the planning, management, collection, and allocation of funds from the central government to subnational administrations and private organizations. Thus, as part of decentralization, they include concepts such as deconcentration, delegation, and privatization.

Eduardo Palma and Dolores Rufián (1989) make an important distinction by separating the concepts of decentralization, deconcentration, and delegation: unlike the previous conceptualization, the last two are no longer part of the first. All three are defined as a transfer of powers, but in the case of decentralization, the transfer is to democratically elected entities that act autonomously, in opposition to a transfer of power towards deconcentrated entities that respond to the central government, or

towards officials appointed by the central government without autonomy. As it is, the authors emphasize that the fundamental variable is political, which involves the possibility of the democratically elected authorities and that exercise their functions autonomously.

At present, a consensus on the concept of decentralization points to the positions exposed by Falleti (2005) and, Rodden (2004), defining it as a process of public policies that transfer responsibilities, resources, or authority from central to subnational governments, endowed with autonomy for decision-making. This definition marks three relevant points: it is a process independent of specific political, administrative, or fiscal situations; privatizations and deregulations are excluded because the recipients of the transfers are units of subnational governments; and accentuates the autonomous character of said recipients, responding primarily to sub-national citizens.

According to Falleti (2005), there are three types of decentralization: political, administrative, and fiscal. This last category refers to the group of public policies aimed at increasing the revenue or fiscal autonomy of subnational governments. Thus, different formulas or mechanisms can be assumed, such as fiscal transfers from the central government, the creation of subnational taxes, or the delegation of the tax authority to authorities at this level. This implies, among other things, special attention to the different responsibilities associated with spending. Because of this, decentralized spending analysis is precisely the main approach to empirically studying fiscal decentralization (Letelier, 2012).

3. EXTREME EVENTS AND FISCAL DECENTRALISATION

In general terms, there is a growing consensus regarding the efficiency and responsiveness offered by decentralized models for risk management (Putra & Matsuyuki, 2019). An example of this is that the main treaties on the subject (the Hyogo Framework for Action in 2005 and the Sendai Framework for Action in 2015) consider the role of local governments in disaster management to be key. Indeed, bottom-up governance models would seem more innovative for disaster management and recovery (Pertiwi et al., 2020).

Currently, many developing countries are implementing disaster risk prevention and mitigation models through decentralized governance because local governments have greater knowledge of the particularities of each territory, are close to the pre-and post-disaster information, and are the first state entities to arrive with mitigation measures in affected areas (Bae et al., 2015). Much of the literature that addresses the relationship between extreme events and fiscal decentralisation tends to support this thesis. For example, Escaleras & Register (2021) carried out a cross-country study where they found that countries with relatively greater fiscal decentralization tend to have better results in terms of the effects suffered by their population after natural disasters, which is further deepened in developing countries.

Skidmore & Toya (2013) analysed extreme events between 1970 and 2005, finding that countries with higher levels of fiscal decentralisation experienced fewer fatalities. Iqbal & Ahmed (2009) focused on 46 developing countries, including Chile, between 1974 and 2004. They concluded that political decentralization -through the democratic election of local authorities- by itself did not help mitigate the risks of disaster. However, if it was combined with adequate fiscal decentralization, the number of deaths associated with the catastrophes studied was significantly reduced. In the case of China, Bo (2022) used 30 data at the provincial level for the period 1997-2007, concluding that fiscal decentralization through spending through local governments has a positive impact on natural disaster relief.

However, the academy has placed less emphasis on studying the behaviour of the decentralization-re-centralization dynamics after the occurrence of extreme events. This is interesting since catastrophes and exceptional events tend to generate tensions in the fiscal balance between subnational entities and the central government (Hermansson, 2020). In a recent work, Sampedro et al. (2022) examined the effects that external shocks generate on fiscal decentralization, studying 91 countries between 1960 and 2018. They conclude that disasters, unlike internal conflicts and economic recessions, tend to reduce fiscal decentralization in non-OECD countries, but not in those that are part of the OECD.

How does Chile behave, being a centralized country with a high level of risk of extreme events? This

explorative research's main objective is to analyse how the relationship between central and regional budgetary expenditure is affected by extreme events, to better understand the interaction of different levels of government facing disastrous situations.

4. CHILE AS A CASE OF STUDY: HIGH CENTRALIZATION AND EXTREME EVENTS

Both politically and fiscally, Chile is known as a highly centralized country. Until 2021, it was the only South American country whose regional authorities were not elected but appointed by the central government. Even compared with other unitary states in the region, its decentralized spending is very low (Vial, 2021;2013). A brief comparison of subnational government participation in total public income and expenditure shows that even countries with comparatively low subnational income, such as Peru and Mexico, manage to significantly increase decentralized spending, unlike Chile (Figure 1).

After the return to democracy in 1990, there were two important political reforms with a high territorial impact: municipal democratization and the creation of Regional Governments (GORE) (Navarrete, 2008). Considering the concentration, centralization, and territorial disparities of the country, the GOREs were designed to promote harmonious and equitable development of their territories, socially, culturally, and economically, based on the assumption that decentralization would be a vitalizing process for territorial development (Galilea, Letelier, and Ross, 2011). In other words, this reform aimed to reduce centralisation and promote higher levels of development outside the Metropolitan Region of Santiago.

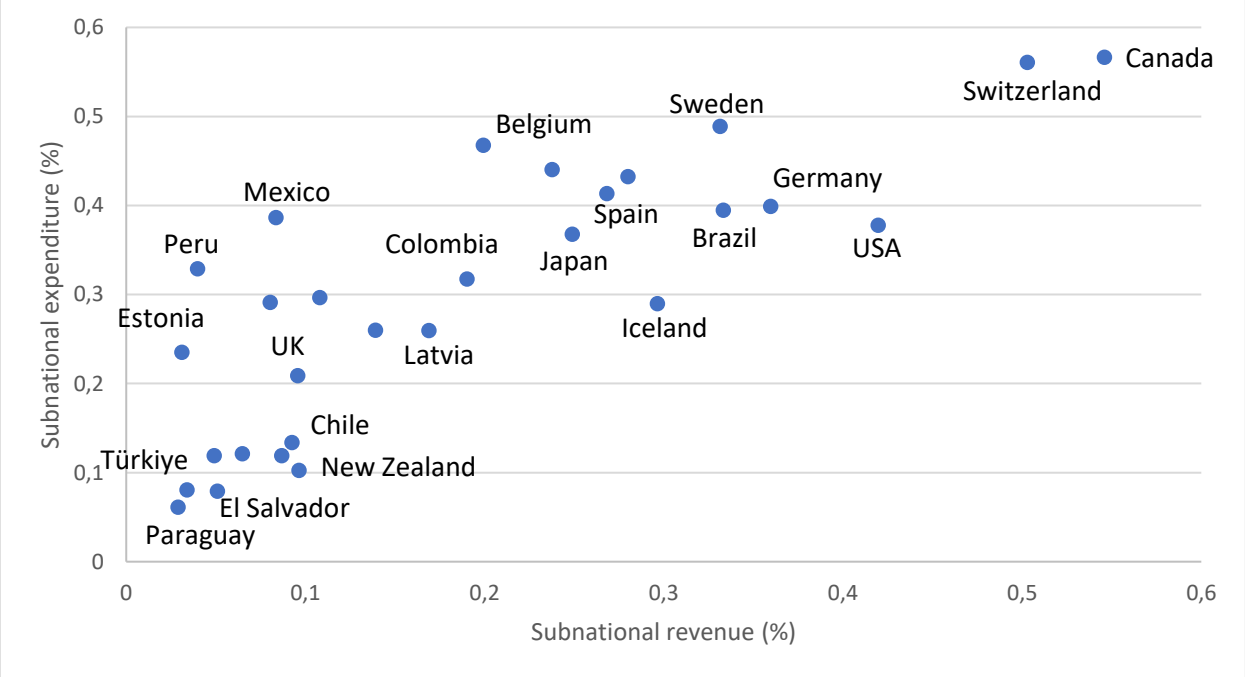

Figure 1. Ratio of expenditure and revenue of subnational governments over the general government in 29 countries (2020). Source: Own elaboration based on information available from American countries and OECD members in IMF DATA (2020)

However, decentralization at the subnational level in Chile has experienced limited progress, with minor reforms that have not strengthened political autonomy, allowed the prevalence of the central government agenda, and focused on deconcentrated structures over the decentralized decision-making (Boisier, 2007; Mardones, 2008;

Montecinos, 2005; Navarrete and Higueras, 2014; Raczynski and Serrano, 2001; Valenzuela, 2015).

This limited progress is perceptible through subnational spending in the last two decades. As seen in Figure 2, in 2020 regional governments and municipalities spent the same 13% of total public spending as 20 years ago, except for an evident drop in local expenditure that occurred between 2008 and 2009, as the subprime crisis hit the Chilean economy. This drop may imply an association between economic shocks and fiscal recentralisation.

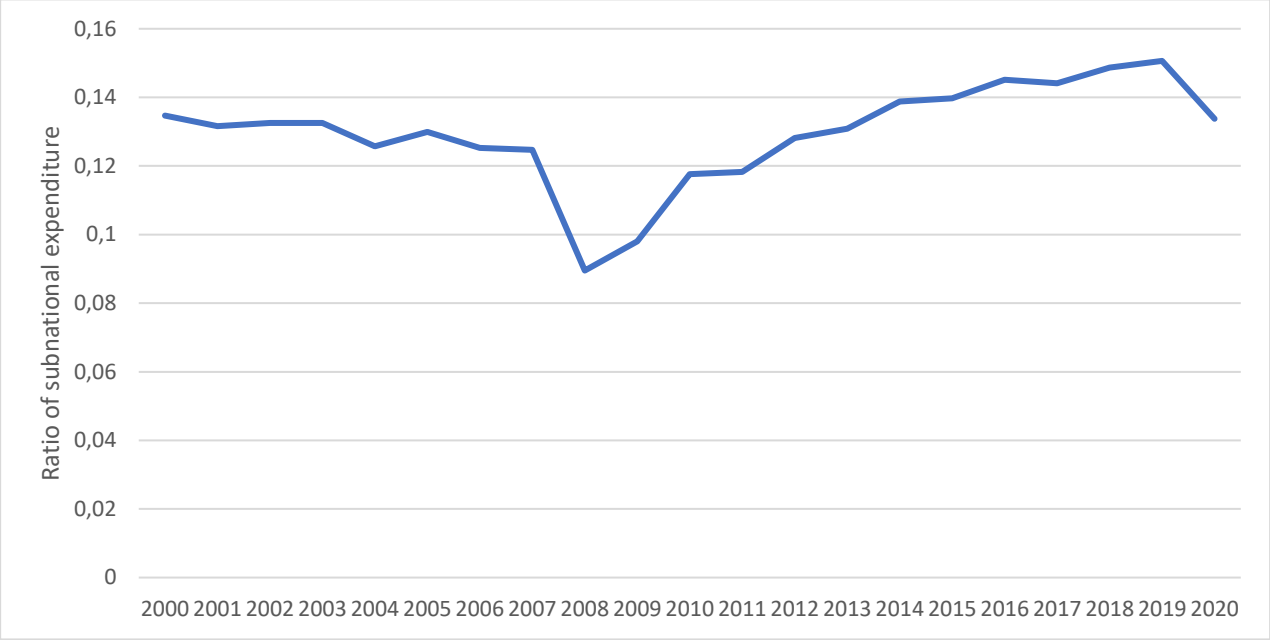

Figure 2. Ratio of subnational expenditure over the general government in Chile (2000-2020). Source: IMF DATA

Within their functions, the GOREs lack relevant powers associated with the prevention and care of emergencies and disasters. These fall on a series of deconcentrated structures of the central government in the territory. The most relevant is the National Service of Prevention and Response to Disasters (SENAPRED), formerly known as ONEMI. Its main purpose is to coordinate, manage, and plan public and private resources that were intended for the prevention and care of emergencies and disasters. SENAPRED provides the different public bodies with models and permanent management plans for preventing and managing catastrophes. For its regional articulation, it had regional offices directly related to the Presidential Delegate (formerly known as *Intendente*), another deconcentrated figure that, until 2021, was the principal regional authority.

The *Intendencias* were the highest institutions of the regional administration. Their posts were appointed and dismissed by the national government, without any opinion from the regional citizenry, and its functions were to supervise that the policies and plans implemented in their territory were oriented by national standards, in addition to internal government functions, which included powers associated with the management and containment of extreme events. In 1992 the promulgation of the Constitutional Organic Law on Regional Government and Administration (LOCGAR) created the Regional Councils (CORE), which meant the first representative regional body, even if it had very little power against the Intendente.

In 2021 there was an important structural change: the *Intendencias* were eliminated, and the COREs began to be led by democratically elected Regional Governors. However, the new Presidential Delegates maintain the leading role in risk management and prevention of extreme events. Indeed, currently, the GORE only has the role of

being part of the Regional Committee for Disaster Risk Management, while the Delegate presides over it. These committees have the authority to approve the Regional Plan for Disaster Risk Reduction and the Regional Emergency Plan. In other words, the deconcentrated structure of the central government still prevails.

5. METHODOLOGY

This research analyses the behaviour of fiscal decentralisation through spending after a selection of extreme events in the last three decades. To analyse the decentralization of public spending, we reconstructed the Regional Decision Expenditure (RDE) designed by Vial (2014), which combines all the fiscal tools where GOREs have decision-making power, including all expenses that need the GOREs approval (see Table 1). Then, we compare the RDE with the central government's regionalized investment, based on the Regionalized Investment Series of the National Investment System (SNI) Ministry of Social Development and Family (MDS). This indicator gathers all the investments made by the different Ministries and other organizations of the central government in each region of Chile, including those executed by deconcentrated structures

Table 1. Components of the Regional Decision Expenditure (RDE). Source: Vial (2014).

Fund	Origin	Source
Operating expenses.	Resources are granted and transferred from the central government by Law. Includes the Regional Investment and Reconversion Fund, the Regional Support Fund (FAR) & Convergence Program, among others.	National Budget Directorate (DIPRES)
National Regional Development Fund (FNDR) – 90%		
Own resources and those allocated by law		
National Regional Development Fund (FNDR) - 10%	GORE resources are granted by Law. They do not have an independent budgetary classification but are transferred to the GORE within the FNDR Provisions.	National Investment System (SNI) Ministry of Social Development and Family (MDS).
National Regional Development Fund (FNDR)) – Provisions	GORE resources granted by the Law of Budgets, whose origins budgets come from ministries	
Regional Investment of Local Allocation (IRAL)	Central Government (ministries)	
Programming Agreements	Central Government (ministries)	

Meanwhile, the extreme events have been selected based on the EM-DAT International Disaster Database of the Centre for Research on the Epidemiology of Disasters (CRED). Of a total of 74 extreme events registered between 1992 and 2022, six were subtracted because they lacked a clear territorial identification, in terms of affected localities, communes, provinces, or regions. Also, the catastrophes with the greatest destructive effects were selected, Identifying the impact they had on the three indicators used to measure damage: fatalities, affected population, and economic damage. Thus, a total of 29 extreme events were selected (see Table 2), with the following breakdown: 14 for their fatal consequences, 21 for the affected population, and 11 for their economic effects.

Table 2. Extreme events for the period 1992-2022. Source: Own elaboration based on EM-DAT Database, Centre for Research on the Epidemiology of Disasters (CRED)

Year	Disaster Subgroup	Disaster Type	Disaster Subtype	Region (Location)	Deaths	Affected population	Economic Damage
1995	Hydrological	Flood		Los Lagos - Former region (Puerto Varas, Ensanada)	X		
1997	Hydrological	Flood	Riverine flood	Metropolitana, Atacama	X	X	X
1997	Geophysical	Earthquake	Ground movement	Coquimbo (Elqui, Limari, Choapa)		X	
1999	Climatological	Wildfire	Forest fire	Biobío - Former region (San Fernando)			X
2000	Hydrological	Flood	Flash flood	Metropolitana, Coquimbo, Valparaiso, Maule, Araucania, Los Lagos, Los Rios, O'higgins	X	X	
2000	Hydrological	Flood	Riverine flood	Los Ríos (Valdivia), La Araucanía (Cautín)		X	
2002	Hydrological	Flood	Riverine flood	Metropolitana, Atacama, Coquimbo, Valparaiso, O'higgins, Maule, Biobío, Araucania	X	X	X
2002	Meteorological	Extreme temperature	Cold wave	Aysén, Antofagasta, Araucania, Arica y Painacota, Atacama, Biobío, Coquimbo, O'Higgins, Los Lagos, Los Rios, Magallanes, Maule, Metropolitana, Tarapaca, Valparaiso		X	
2005	Geophysical	Earthquake	Ground movement	Tarapacá (Iquique, Alto Hospicio, Pozo Almonte, Pica, Camina, Huara)	X	X	
2005	Meteorological	Storm	Convective storm	Biobío (Antuco)	X		
2006	Hydrological	Flood	Riverine flood	Biobío, Maule	X	X	
2007	Geophysical	Earthquake	Ground movement	Antofagasta (Tocopilla, Mejillones)		X	
2008	Hydrological	Flood	Riverine flood	Araucania, Biobío, Los Rios, Los Lagos, Maule		X	
2008	Hydrological	Flood	Riverine flood	Biobío, Maule, Valparaiso, Araucania, Los Rios		X	
2010	Geophysical	Earthquake	Tsunami	Biobío, O'higgins, Valparaiso, Araucania, Metropolitana, Maule	X	X	X

2011	Climatological	Wildfire	Forest fire	Maule, Biobío, Magallanes, Araucania			X
2011	Meteorological	Extreme temperature	Severe winter conditions	La Araucanía (Malleco, Cautín), Biobío (Alto Biobío)		X	
2012	Climatological	Wildfire		Biobío, Magallanes			X
2012	Geophysical	Earthquake	Ground movement	Maule (Parral), Metropolitana, Biobío		X	
2013	Meteorological	Extreme temperature	Severe winter conditions	Biobío, O'Higgins, Maule, Metropolitana, Valparaiso			X
2014	Geophysical	Earthquake	Ground movement	Tarapacá (Alto Hospicio)		X	
2014	Climatological	Wildfire	Land fire	Valparaiso	X	X	
2014	Hydrological	Flood	Riverine flood	Coquimbo, Aisen, Valparaiso, Metropolitana, Los Rios, Araucania, Biobío, O'higgins, Los Lagos, Maule		X	
2015	Hydrological	Flood	Flash flood	Atacama, Antofagasta, Coquimbo	X	X	X
2015	Geophysical	Earthquake	Tsunami	Araucania, Atacama, Biobío, Coquimbo, O'Higgins, Maule, Metropolitana, Valparaiso	X	X	X
2015	Geophysical	Volcanic activity	Ash fall	Los Lagos (Ensenada)			X
2016	Hydrological	Flood	Riverine flood	Metropolitana	X		
2017	Climatological	Wildfire	Forest fire	Valparaiso (Santo Domingo, San Antonio, Casablanca), Maule (Santa Olga), Biobío, Metropolitana, O'Higgins, Araucania	X	X	X
2017	Hydrological	Landslide	Landslide	Los Lagos (Villa Santa Lucia)	X		

To analyse the relationship between the variables described two scenarios were compared, the first (scenario A) was calculated as the average of the RDE / central investment ratio three years before each catastrophe took place and the second (scenario B) used the same average ratio but considering the year that the event took place and the year immediately after it.

By doing this we tried to simulate which would be the impact of natural disasters on budgetary decisions assessing if there were any changes after they took place. This non-experimental approach seems to be suitable considering the small number of events recorded to date and the endogenous differences between regions.

Multiple factors determine the reconstruction times following disasters (de Ville, 2008; Olshansky et.al, 2012), so it is difficult to rely on a universal standard to determine the timelines for scenarios A and B. In both cases, the criteria of data availability prevailed

and avoided excessive overlapping and spillover of extreme events during the same period of analysis. In the case of scenario B, the budgetary flows seem to indicate that a significant portion of the efforts for the containment and recovery of the affected areas are usually concentrated in the first two years. There are exceptions to large events, such as the 2010 earthquake, whose reconstruction process took additional time, but this seems to be an exception rather than a common practice.

It is worth noticing that identifying budgetary elements to contain and recover areas affected by two extreme events in the same year and region would lead to an overlap so results should be cautiously considered. Also, for the events that generated profound impacts in more than one region (2010 earthquake/tsunami, 2015 rains, and 2017 forest fire), the calculated relationships are based on the averages of the regions contained in each extreme event.

6. RESULTS

The behaviour of the RDE is compared with the total public investment of the central government in each region, as a measure to understand the fiscal weight of subnational governments concerning the central government through spending. A first general look at the national level can be seen in Figure 3, where the average relationship indicates that the regionalized investment of the central government is 2.57 times higher than the RDE, with a minimum of 1.74 (2001) and a maximum of 3 .54 (1993). This demonstrates (1) that the central government has a significantly greater budgetary weight than the subnational governments themselves concerning the public investment carried out in the territory and (2) that this relationship can vary substantially (close to double) by exclusive decision of the central government. All this accounts for a weak fiscal decentralization, both due to the low subnational budgetary capacity, as well as its lack of stability

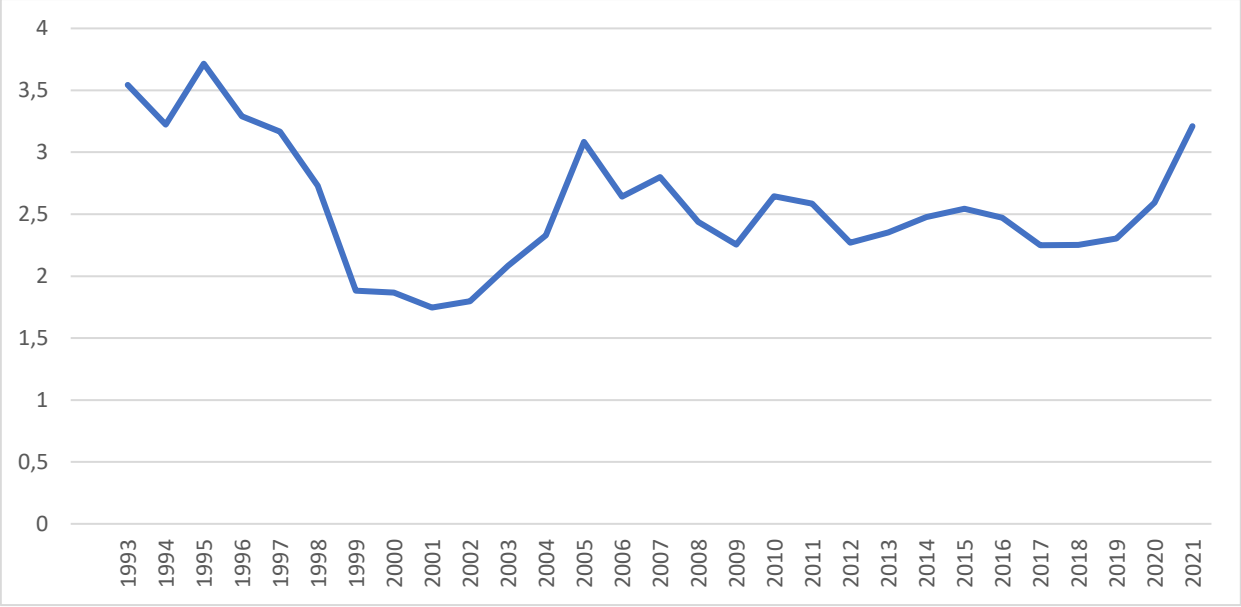

Figure 3. Ratio RDE / Central Investment (all regions,1993-2021). Source: Own elaboration based on MDS and DIPRES.

Two main insights can be drawn from Table 3. Firstly, it is not clear whether the types of extreme events influence the relationship between RDE and central government investment in the region. Earthquakes, fires, and floods, among others, are randomly distributed. This led us to think that the disaster type has no incidence in fiscal centralization.

Secondly, and most importantly, the data show a wide variety of results. In 13 of the 29 events, there was a clear fiscal recentralisation, with slight increases (volcanic activity in 2005) to very significant (earthquakes of 2014 and 2010). In the

other 16 events, there variations went in the opposite direction, reducing the gap between the investment of the central government and the RDE decreased, although there is always a greater weight of the central government in the territory. In other words, the level of fiscal centralization was reduced through spending. However, the latter occurred with some moderation, since the average reduction was 15.9%, while the average increase in fiscal centralization in the 13 extreme events mentioned was 35.2%.

These results made us wonder what could explain why some extreme events transformed into fiscal recentralisation and some didn't. Trying to find an explanation, we figure that the destructive capacity of the extreme event could be an important variable to observe. As seen in Table 3, the peak of fiscal recentralisation was after the most devastating disaster the country had in the three decades of our study: the 2010 earthquake, with a variation of 90% in the ratio between central and regional expens

Table 3. Effect of extreme events on the RDE / central government relationship. Source: Own elaboration based on EM-DAT Database, MDS, and DIPRES.

Year	Disaster Type	Region (Location)	Ratio RDE / Central investment - Scenario A	Ratio RDE / Central investment - Scenario B	Variation
2010	Earthquake	Biobío, O'higgins, Valparaiso, Araucania, Metropolitana, Maule	2.37	4.50	89.96
2014	Earthquake	Tarapacá (Alto Hospicio)	1.39	2.40	71.74
2017	Landslide	Los Lagos (Villa Santa Lucia)	1.83	3.14	71.67
2000	Flood	Metropolitana, Coquimbo, Valparaiso, Maule, Araucania, Los Lagos, Los Rios, O'higgins	2.22	3.46	56.13
2006	Flood	Biobío, Maule	2.77	3.90	40.96
2014	Wildfire	Valparaiso	3.80	5.07	33.36
2000	Flood	Los Ríos (Valdivia), La Araucanía (Cautín)	1.83	2.28	24.97
2017	Wildfire	Valparaiso (Santo Domingo, San Antonio, Casablanca), Maule (Santa Olga), Biobío, Metropolitana, O'Higgins, Araucania	2.85	3.53	23.77
2015	Earthquake	Araucania, Atacama, Biobío, Coquimbo, O'Higgins, Maule, Metropolitana, Valparaiso	1.76	2.09	18.71
2002	Flood	Metropolitana, Atacama, Coquimbo, Valparaiso, O'higgins, Maule, Biobío, Araucania	3.00	3.29	9.65
2005	Storm	Biobío (Antuco)	2.94	3.19	8.59
2002	Extreme temperature	Aysén, Antofagasta, Araucania, Arica y Painacota, Atacama, Biobío, Coquimbo, O'Higgins, Los Lagos, Los Rios, Magallanes, Maule,	2.49	2.64	5.74

		Metropolitana, Tarapaca, Valparaiso			
2015	Volcanic activity	Los Lagos (Ensenada)	2.59	2.66	3.01
2016	Flood	Metropolitana	4.98	4.93	-1.00
2014	Flood	Coquimbo, Aisen, Valparaiso, Metropolitana, Los Rios, Araucania, Biobío, O'higgins, Los Lagos, Maule	2.68	2.65	-1.14
2015	Flood	Atacama, Antofagasta, Coquimbo	1.79	1.68	-6.00
2013	Extreme temperature	Biobío, O'Higgins, Maule, Metropolitana, Valparaiso	3.55	3.33	-6.35
2008	Flood	Araucania, Biobío, Los Rios, Los Lagos, Maule	2.78	2.60	-6.40
2008	Flood	Biobío, Maule, Valparaiso, Araucania, Los Rios	2.94	2.75	-6.60
2011	Extreme temperature	La Araucanía (Malleco, Cautín), Biobío (Alto Biobío)	3.21	2.88	-10.28
2012	Earthquake	Maule (Parral), Metropolitana, Biobío	3.41	2.87	-15.85
1999	Wildfire	Biobío - Former region (San Fernando)	2.22	1.86	-15.89
2007	Earthquake	Antofagasta (Tocopilla, Mejillones)	1.46	1.21	-17.21
2011	Wildfire	Maule, Biobío, Magallanes, Araucania	2.91	2.32	-20.15
2012	Wildfire	Biobío, Magallanes	2.58	2.00	-22.37
2005	Earthquake	Tarapacá (Iquique, Alto Hospicio, Pozo Almonte, Pica, Camina, Huara)	2.33	1.76	-24.28
1997	Earthquake	Coquimbo (Elqui, Limari, Choapa)	2.43	1.78	-26.53
1997	Flood	Metropolitana, Atacama	2.88	2.09	-27.41
1995	Flood	Los Lagos (Puerto Varas, Ensanada)	3.04	1.59	-47.58

Tables 4, 5, and 6 show the variations of the RDE / central government investment ratio with the three indicators of the destructive capacity of extreme events: respectively, total deaths, affected population, and economic damage. Each table is ordered by destructive capacity, from highest to lowest.

Table 4. RDE / central government investment ratio and total deaths. Source: Own elaboration based on EM-DAT Database, MDS, and DIPRES.

Year	Disaster Type	Variation	Total Deaths
2010	Earthquake	89.96	562
2015	Flood	28.44	178
2005	Storm	44.18	45
1995	Flood	30.86	28
1997	Flood	-5.66	22
2017	Landslide	57.743	22
2015	Earthquake	18.71	19
2006	Flood	35.37	18
2000	Flood	-37.12	15
2002	Flood	7.16	14
2014	Wildfire	-7.09	12
2016	Flood	-23.25	12
2005	Earthquake	16.22	11
2017	Wildfire	-8.37	11

Table 5. RDE / central government investment ratio and affected population. Source: Own elaboration based on EM-DAT Database, MDS, and DIPRES.

Year	Disaster Type	Variation	Affected Population
2010	Earthquake	89.96	2,671,556
2015	Earthquake	18.71	681,499
2014	Earthquake	71.74	513,387
2002	Flood	7.16	221,842
2015	Flood	28.44	193,881
2000	Flood	-37.12	139,667
2008	Flood	-14.41	104,755
2006	Flood	35.37	95,862
1997	Flood	-5.66	76,800
1997	Earthquake	-1.56	53,098
2000	Flood	-13.55	42,000
2008	Flood	-11.66	40,000
2005	Earthquake	16.22	27,645
2011	Extreme temperature	7.92	25,475
2007	Earthquake	-2.06	25,155
2002	Extreme temperature	-1.89	25,000
2012	Earthquake	24.79	24,297
2017	Wildfire	-8.37	13,173
2014	Flood	-2.62	12,555
2014	Wildfire	-7.09	11,000

Table 6. RDE / central government investment ratio and economic damage. Source: Own elaboration based on EM-DAT Database, MDS, and DIPRES.

Year	Disaster Type	Variation	Economic Damage
2010	Earthquake	89.96	40,263,352
2015	Flood	28.44	1852,113
2013	Extreme temperature	-9.11	1,256,261
2015	Earthquake	18.71	987,794
2015	Volcanic activity	0.07	740,845
2017	Wildfire	-8.37	656,660
1999	Wildfire	-0.75	491,931
1997	Flood	-5.66	332,553
2002	Flood	7.16	325,398
2011	Wildfire	30.85	260,208
2012	Wildfire	14.01	254,933

At first glance, in the three tables, a certain association is observed between the variation of the RDE ratio – central government investment with the destructive capacity of the event. We calculated the correlation between the variation of the RDE and the three indicators of destruction capacity (casualties, population affected and economic damage), and they all show a positive correlation. However, after a closer look, much of that correlation is carried out by the earthquake in 2010, with its devastating effects. As shown in Table 7, only the number of people affected by the catastrophe maintains a positive and significant correlation with fiscal centralization when measured without the 2010 earthquake

Table 7. Correlation coefficients fiscal centralisation and destruction indicators of extreme events. Source: Own elaboration

	Correlation coefficient including the 2010 earthquake	Correlation coefficient without the 2010 earthquake
Casualties	0.658	0.295
Economic damages	0.873	0.173
Affected Population	0.725	0.521

7. DISCUSSION AND CONCLUSIONS

The results of the analysis show a significant correlation between the affected population by extreme events and fiscal recentralisation, this is, when the number of people that suffer the aftermath of an extreme event is high, the fiscal centralization of the region or regions affected by it gets stronger. However, this association is less evident when the disaster has a lower destructive capacity. Even though the central government's expenditure is always stronger than the regional, in cases with lower damages, the ratio between central and regional expenditure seems to decrease.

These results may imply that in regions affected by comparatively minor disasters, the regional government may have a clear presence in the aftermath of the extreme event, something that could explain why regional expenditures increase in comparison to central expenditures. On the contrary, in major catastrophes with greater destructive power, a greater presence of the central government would be required, which implies that fiscal centralization would end up being reinforced.

As it seems, the Chilean case may show that central governments are bonded to intervene when a catastrophic event occurs. This is mostly understandable, precisely because disasters with great impact do not concentrate on one administrative subdivision, which will require a

leading role from the national institutions (Bae et al., 2015). However, these waves of recentralisation seem to go against the idea of strengthening subnational governments and their capacity to face major disasters. This, in a country as centralized as Chile, with high exposure to extreme events and where, historically, such disasters have led to critical reflection on the weaknesses in territorial planning, the lack of multilevel articulation, and the scant margin of manoeuvre that is delivered to subnational governments.

On the other hand, these results may imply that regional governments are consistently becoming important in public expenditures after comparatively minor and more focalized disasters. This is good news, as in the theory of decentralisation, local decision-making is fundamental for the efficient provision of public goods and services, something much needed in emergencies.

At this point, we would like to present some limitations of this research and suggest future lines of work. As mentioned above, the number of extreme events in Chile, even if they are substantially large in comparison with other countries, is still a very low number of cases, which does not allow us to make a strong quantitative and statistically significant analysis on the subject. Yet, the possibility of mixing this approach with qualitative methods could be a future line of work to better understand the impact of extreme events and fiscal decentralisation. Secondly, the nature of public expenditure is complex and multiple variables may impact decentralisation and recentralisation, besides the occurrence of extreme events. This also could be a future line of work.

Thirdly, it seems that a good way of increasing the number of observations would be to make an international analysis of the association of extreme events and fiscal decentralisation. Finally, we would like to reflect on the need for stronger and more capable subnational administrations in a country with high-risk levels of disaster. Even if it is obvious that the central government need to lead and intervene in the face of major disasters, it seems counterproductive to still rely fundamentally on national agencies when the local administrations are closer to the people's needs, especially when faced with disaster

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