

## Chapter 1. Understanding the economic and fiscal impacts of disasters

*This chapter provides an overview of the economic and fiscal impacts of large-scale catastrophic and smaller recurrent natural disasters, in particular in high- and higher-middle-income economies. It shows that the costs caused by disasters are often and to a significant extent shouldered by governments, which are asked to provide financing for both explicit and implicit commitments related to disaster response. This role for government can have important fiscal implications in governments' budgets and can also prolong negative economic impacts if not managed adequately ex ante.*

## The economic impacts of disasters: Disaster losses and damages on the rise

In high- and middle-income economies, the number of recorded disaster events has shown a tendency to increase over the last 30 years, although in the past few years it has decreased. It is expected that climate change will drive the intensity and frequency of meteorological disasters, including extreme temperatures, storms and floods, in the future (Banholzer, Kossin and Donner, 2014), whereas geophysical events are not subject to a specific trend. Disaster-related damages and losses (defined in box 2.1) have similarly been increasing, albeit with considerable year-to-year variation and largely as a result of increased vulnerability driven by economic development that has not taken risk into account. In the last decade, high- and higher-middle-income economies have experienced an estimated USD 1.2 trillion in damages from disasters stemming from natural hazards such as storms or earthquakes (OECD, 2014a). Figure 1.1 shows the increasing share of disaster losses from natural hazards suffered by fast-growing middle-income economies over the period 1990–2012. These economies are marked by a rapid growth of assets through urbanisation and construction of new infrastructure (Mahul et al., 2014a).

### Box 1.1. The economic impact of disasters: Damages and losses defined

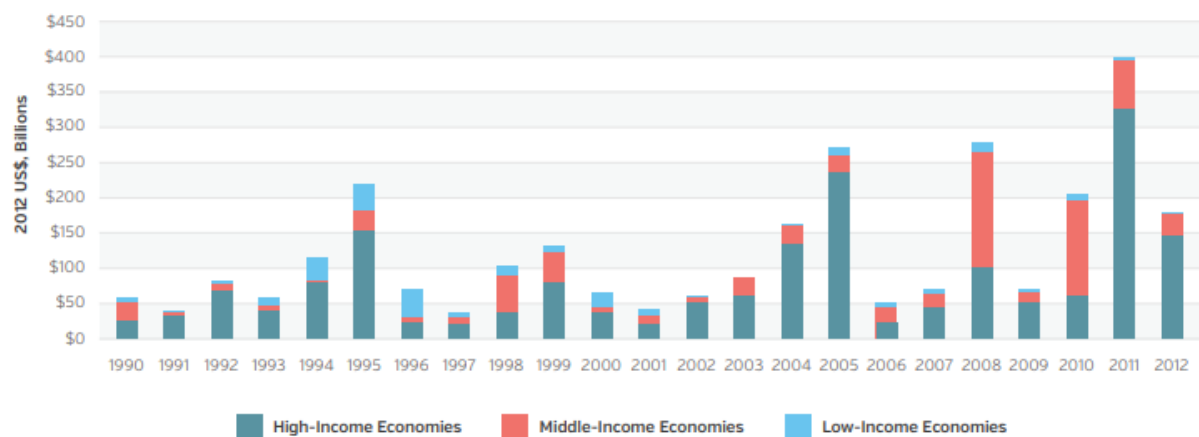
In the literature on disasters and their economic impact, the same terms are often used to denote different things, or conversely, the same thing is denoted by different terms. This report uses the following definitions of damages and losses when discussing the economic effects of disasters:

**Damage** is the replacement value of physical assets wholly or partly destroyed, built to the same standards that prevailed prior to the disaster.

**Losses** are the foregone economic flows resulting from the temporary absence of the damaged assets and/or due to any other disruption of economic activity caused by the disaster.

*Source:* GFDRR, 2017.

The impact of a disaster on human lives, livelihoods and infrastructure is the result of three parameters, namely the natural hazard, the vulnerability and the exposure of people and assets<sup>1</sup>.

**Figure 1.1. Direct disaster loss by income group, 1990–2012**

Source: World Bank Group (2014). Financial Protection against Disasters. An Operational Framework for Disaster Risk Financing and Insurance.  
<https://www.gfdr.org/sites/gfdr/files/publication/Financial%20Protection%20Against%20Natural%20Disasters.pdf>

### *Inverse relation of disaster impacts to income*

The aggregate impact of disasters on economic growth is complex to measure and depends on a number of factors. Concerning aggregate growth, most studies find a negative relationship between the occurrence of disasters and economic growth in the medium to long run. For example, von Peter, von Dahlen and Saxena (2012), using data from Munich Re's NatCat Service for 2,476 major natural catastrophes since 1960, found that the average disaster leads to a fall in growth of 1% of gross domestic product (GDP) upon impact and a cumulative loss to GDP of 2.6%. In another study, Felbermayr and Gröschl (2014) found that disasters can reduce per capita GDP by up to 6.8% on impact.

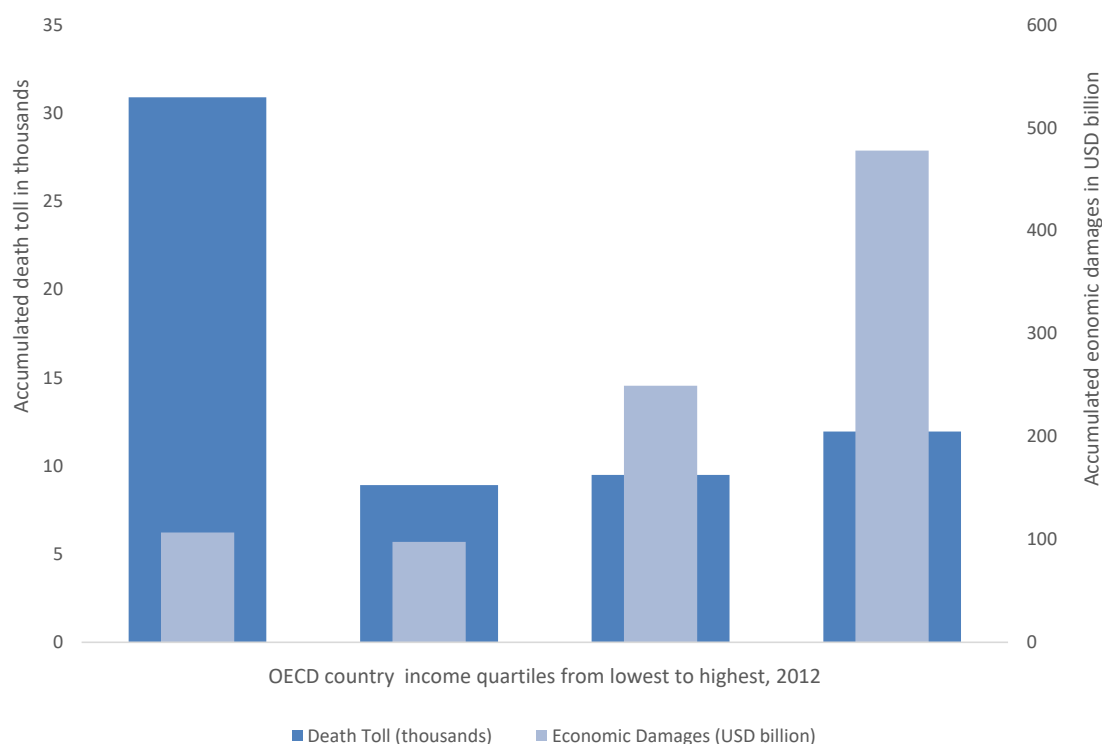
Disaster impacts are inversely related to income and an economy's size. Organisation for Economic Co-operation and Development (OECD) economies with lower GDP per capita suffer relatively more fatalities, while those with higher GDP per capita experience larger absolute costs but lower costs as a percentage of GDP, reducing their relative economic impact (Figure 1.2). Among OECD economies, the United States, Japan and Italy have been most affected by large-scale disasters over the past 40 years, while Iceland, New Zealand and Australia are among those most affected relative to population size (OECD, 2014). Recent disasters in smaller OECD economies have had a large economic impact: damages and losses from the Chile earthquake in 2010 were around 18% of GDP, and from the Canterbury earthquakes in 2010 and 2011 were approximately 20% of New Zealand GDP.

The regional economic impact can be large and long-lasting (OECD, 2014). Hurricane Katrina, for example, caused an estimated USD 96 billion to USD 108 billion in economic losses, which were felt disproportionately by the impacted geographic area, its population and related economic activities. The impact on the national level, however, was only 0.1% of GDP (OECD, 2014). Hurricanes Harvey and Irma, which hit the United States in 2017, exceed that level of losses. The Great East Japan Earthquake destroyed or damaged 190 000 buildings, left the surrounding areas of the Fukushima nuclear plant (around 800 km<sup>2</sup>) uninhabitable and ruined 23 600 hectares of farmland (Ranghieri and Ishiwatari, 2014).

The Pisco earthquake in 2007 resulted in USD 1.2 billion in economic losses, which equates to a slim 0.001% of Peru's GDP, but it left the affected area devastated (EM-DAT, 2017).

Costly disasters – ranging from earthquakes to floods, wild fires and severe storms – have occurred in all of the case study economies in the last six years (Table 1.1), with damages worth several billions of US dollars. Generally speaking, storms accounted for nearly 30% of all disaster events over the past 40 years; but average damages from earthquakes were more than four times higher than those from storms, and average damages from droughts were around twice as high. Floods are the second-most frequent source of disasters, and the damages caused by floods are growing particularly rapidly in fast-urbanising areas (OECD, 2014).

**Figure 1.2. Death toll and damages in OECD countries by income quartile, 1995–2010**



*Note:* Data on the European heat wave of 2003 are not included due to the difficulty of determining the actual causes of death during this disaster.

*Source:* OECD, 2014.

**Table 1.1. Selected high-economic-impact disasters in case study economies**

	Disaster event/location	Year	Fatalities	USD billion
Japan	Great East Japan Earthquake	2011	19,846	210
New Zealand	Canterbury earthquake sequence	2010/11	181	21.5
France	Storms Martin and Lothar & subsequent landslides	1999	92	8.5
Colombia	Floods	2010/11	1 374	6.3
Mexico	Hurricanes Manuel and Ingrid	2013	192	5.7
Canada	Fort McMurray wildfire	2016	2	4.6
Australia	Queensland floods	2010	36	4.5
Peru	Pisco earthquake	2007	596	1.2
Costa Rica	Hurricane Johan	1988	28	0.736

Source: Case study reports.

Past economic damage figures provide important information on disaster trends and (indirectly) on the potential need for governments' financial assistance. However, given the rapidly changing factors that are driving damage potential, estimates of future expected damages and their implications for government assistance are equally important; they help governments avoid underestimating and take worst-case scenarios into account. While there is a high degree of uncertainty concerning future trends in disaster exposure, several forces have been identified as drivers. Apart from socio-economic development (OECD, 2014), climate change is expected to affect the frequency and severity of extreme weather events (UNFCCC, 2012; World Bank Group, 2012; World Bank Group, 2014; Wolfrom and Yokoi-Arai, 2016). As a result, there is a need to refine deterministic analyses and interpretations of historical disaster events as well as available retrospective data, which tend to under-report low-frequency but high-impact events.

While this report is concerned with disasters caused by natural hazards, many of the approaches discussed could provide a basis for looking at contingent liabilities associated with man-made, technological or health hazards and their fiscal impact if these materialise.

Data on the estimates of past economic damage caused by (especially larger-scale) disasters can be found relatively easily, although the degree of comprehensiveness and accuracy varies (OECD, 2018). Significantly fewer sources and less systematic accounts can be found on disasters' fiscal impact, i.e. the impact on government revenues and spending and related fiscal indicators, which is crucial information for governments' identification of their contingent liabilities and adequate financial planning for disasters as part of public financial frameworks. The next section sheds light on this issue and provides evidence found through case studies.

## The fiscal impacts of disasters: Understanding the key determinants

### *The determinants of fiscal impacts of disasters*

The fiscal impact of a disaster is a function of the changes in government expenditures and revenues caused by the disaster. Future potential expenditures that governments are expected to or legally obliged to make in response to disasters – that is, disaster-related contingent liabilities of government, can cause potential disaster-related fiscal risks (Box 1.2). Once a disaster event occurs, contingent liabilities turn into actual expenditures. Particularly in case of a major disaster, the expenditures resulting from such liabilities may cause deviations from the forecast fiscal outcomes. As a consequence, such expenditures could lead to an increase in public debt and, depending on their size, create a fiscal risk to

government finances (Box 1.3), especially if a government has not made ex ante provisions to meet these possible costs (OECD, 2012; Mahul et al., 2014).

The size of the government's expenditure in the event of a disaster depends of course on the severity of the disaster itself, but also on the government's rate of compliance with meeting its liabilities – that is its ability and willingness to meet its ex ante commitments to shoulder specific disaster-related costs, or to go beyond them.

**Box 1.2. Sources of disaster-related government contingent liabilities and changes in government revenues**

Potential government expenditures following disasters can include payments for the following costs:

- relief payments to affected populations
- spending for the temporary recovery of public infrastructure/services – e.g. costs for renting temporary shelter premises or costs for restoring essential services such as water or electricity
- spending for the reconstruction of damaged public infrastructure and assets, particularly in case of damage to uninsured public corporation assets
- cash transfers to public health facilities and to publicly owned or guaranteed insurance companies to address claims obligations
- an increase in short-term social transfers (such as health and medical support, temporary debt or tax relief) due to an economic slowdown that follows a disaster
- expenditure to stimulate the economy following a disaster – e.g. support to key industries or businesses and providers of critical infrastructure, capital injections or loans to public or private corporations, or financial incentives for housing (re)construction
- expenditures due to guarantees issued to public or private entities suffering disaster losses -, for example financing to restore public services provided under a public-private partnership (PPP) contract where the PPP operator's assets were not covered by disaster insurance and the government faces pressure to step in
- payments to subnational levels of government faced with fiscal constraints in the aftermath of a disaster

Potential disaster-related changes to government revenues can be caused by the following:

- reductions in tax bases through e.g. the negative impact of disasters on personal and corporate income, natural resource extraction and consumption.
- deliberate tax cuts, e.g. in business taxes, which reduce government tax revenue at first but can speed up recovery in the long term, enabling a potential net gain for tax revenues.
- business interruption risks to revenue collection authorities.

- disrupted operations of public corporations (including natural resource extraction companies) that result in changes in income and production and risks to royalties and dividends to government.

*Source:* IMF (2016), “Analyzing and managing fiscal risks—Best practices”, June, [www.imf.org/external/np/pp/eng/2016/050416.pdf](http://www.imf.org/external/np/pp/eng/2016/050416.pdf). OECD (2015), *Disaster Risk Financing: A Global Survey of Practices and Challenges*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264234246-en>. Mahul, O., C. Benson and L. Boudreau (2013), “Risk assessment and management of natural disasters from a fiscal perspective in developing economies”, World Bank working paper (draft).

### Box 1.3. Fiscal risks and contingent liabilities: Definitions

**Fiscal risks** describe changes in the expected fiscal outcomes as outlined in an economy’s annual budget or forecasting documents. Fiscal risks may have positive or negative effects on the annual budget. While governments tend to foresee and arrange for positive fiscal risks with relative accuracy, the possible negative impact of fiscal risks is often underestimated.

Governments may face different types of fiscal risks, including various shocks to macroeconomic variables and the realization of contingent liabilities, such as in the event of disasters. Other fiscal risks can include government bailouts for troubled financial institutions, state-owned enterprises and private corporations; demands for government compensation; and financial support to subnational governments in need.

**Contingent liabilities** refer to (government) obligations that are triggered when a potential but uncertain future event occurs. Contingent liabilities can cause large unexpected increases in government debt.

Contingent liabilities may be **explicit or implicit**. Explicit contingent liabilities are expenditures that might arise from pre-arranged explicit commitments made (for example) in contracts or through laws, or from clear policy commitments that could fall due in the event of disaster. Implicit contingent liabilities are expenditures that might arise due to moral obligations without any prior commitments, or due to public expectations or political pressure on the government.

The impact of fiscal risks may be **direct**, e.g. in the case of foreign and domestic sovereign debt (explicit liability) or in the case of future recurrent costs of public investments (implicit liability). They may also be **indirect**, as in the case of state insurance schemes (explicit liability) or bank failures (implicit liability).

*Sources:* IMF (2016), “Analyzing and managing fiscal risks—Best practices”, June, [www.imf.org/external/np/pp/eng/2016/050416.pdf](http://www.imf.org/external/np/pp/eng/2016/050416.pdf). OECD (2015), *Disaster Risk Financing: A Global Survey of Practices and Challenges*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264234246-en>. Brixi, H. Polackova and A. Schick (2002), *Government at Risk: Contingent Liabilities and Fiscal Risk*, World Bank and Oxford University Press, Washington, DC.

### *Disaster impacts on government spending: Explicit contingent liabilities*

Explicit disaster-related contingent liabilities are payment obligations based on government contracts, laws or clear policy commitments that could fall due in the event of disaster. Expenditures triggered by the destruction of public assets and infrastructure, along with spending due to pre-arranged commitments, fall under this category. The exact level of explicit contingent liabilities depends on the legal and contractual payment obligations that could be triggered by a disaster. The role of governments as providers and owners of public infrastructure, as set out in various government policies, also influences the level of explicit contingent liabilities. Moreover, where the government has a role in providing insurance for public or private assets, such as in New Zealand (Earthquake Commission, EQC), France (CATNAT scheme) and Japan (Japan Earthquake Reinsurance, JER) (Box 1.4), this role creates an explicit contingent liability for a portion of the claims payments due under the insurance coverage provided (OECD, 2015)<sup>2</sup>.

Governments may find alternative ways to meet their pre-disaster commitments in nominal terms, such as through inflationary money creation, thereby not meeting them in real terms.

#### **Box 1.4. Explicit contingent liabilities: The case of government-backed insurance schemes in New Zealand, France and Japan**

In some economies, disaster-related contingent liabilities arise for governments through publicly backed insurance schemes against disasters, such as the New Zealand Earthquake Commission (EQC), France's Natural Catastrophes (CATNAT) insurance scheme or the Japan Earthquake Reinsurance (JER).

The EQC is a New Zealand government entity providing insurance to residential property owners for damages to houses and contents stemming from an earthquake, landslide, volcanic eruption, hydrothermal activity or tsunami. It also provides storm and flood coverage for those areas of residential land that allow property access or that include building platforms. The EQC transfers the financial risk posed by New Zealand's natural hazards through financial arrangements, including 1) the Natural Disaster Fund; 2) an international reinsurance programme renewed every year; and 3) a backstop government guarantee in the event that EQC's reserves and reinsurance lines are exhausted (under Section 16 of the Earthquake Commission Act 1993). The Treasury may meet the deficiency of funds by providing either a grant or a loan.

The CATNAT insurance scheme, a public-private partnership based on the constitutional principle of solidarity, has been the backbone of disaster recovery financing in France since its establishment in 1982. The scheme has been put in place to provide insurance for hazards otherwise considered "uninsurable", i.e. hazards affecting a limited area, such as flooding, avalanches, volcanic activity or earthquakes. Both private and public assets can be covered by hazard insurance via the CATNAT scheme. Funding for CATNAT comes from an additional premium, fixed by the state at a mandatory uniform rate, for all property and motor vehicle insurance policies. To prevent illiquidity in case a major disaster triggers insurance payouts beyond available reserves, CATNAT is backed by a state guarantee. If claims exceed 90% of the special reserve and annually defined equalisation reserves, the government is required to step in.



Through the JER, which offers insurance through the private insurance market, the government of Japan has a key role in retaining a portion of the liability. Under this scheme, the private and public sectors share the aggregate limit of indemnity for a single seismic event (up to JPY 11.3 trillion; ~ USD 103 billion) as follows:

- For earthquake insurance liabilities up to JPY 88 billion (~USD 804 million), the JER is liable for 100% of insurance claims.
- For amounts over JPY 88 billion and up to JPY 224 billion (~ USD 2.06 billion), the central government is liable for 50% and the JER and private insurers (i.e. those to which the JER has retroceded risk) are liable for 50%.
- For amounts from JPY 224 billion to JPY 11.3 trillion (~USD 103 billion), the central government is liable for approximately 99.8% and private insurers (including the JER) are liable for approximately 0.2%.

If earthquake insurance liabilities for one event exceed the indemnity cap of JPY 11.3 trillion, the government can decide to provide additional resources on a needs basis. In response to reductions in the private sector's reserve balance following recent large-scale disasters, the Ministry of Finance has increased the government's share of indemnity.

Sources: OECD, 2015, Case study reports.

### ***Disaster impacts on government spending: Implicit contingent liabilities***

Implicit disaster-related contingent liabilities are expenditures the government makes in response to a disaster without any previous formal commitment to make them. The expectation for such payments might arise from political or moral pressure, or could reflect the government's attempt to speed up recovery in order to stimulate growth. The size of a government's implicit contingent liability may be influenced by a government's past spending on disaster recovery and compensation beyond its legal obligation, or by the relative political power of key affected population groups.

Unlike explicit contingent liabilities, implicit contingent liabilities tend to be challenging to identify and quantify<sup>3</sup>. Although recovery and compensation expenditure in response to previous disasters should serve as a point of reference for estimating expected post-disaster government assistance, it can be difficult for governments to accurately predict the contingent liabilities arising from moral expectations and political pressure (Brixi and Schick, 2002; OECD, 2015). When statutory levels of compensation or cost-sharing arrangements between levels of government are exceeded in response to a disaster, explicit commitments can generate additional implicit commitments. In other words, due to the implicit assumption that the government will serve as insurer or guarantor of last resort, implicit contingent liabilities may arise even from explicit contingent liabilities. Still, high levels of insurance coverage for exposed assets may help limit the size of a government's implicit contingent liabilities: if economic costs to households and businesses are covered by insurance, the political pressure on governments to provide economic relief may be smaller, hence reducing the government's implicit contingent liability.

### ***Disaster impacts on government revenues***

Disasters can also have impacts on government revenues, especially through their negative impact on economic activity. This is usually the consequence of a decline in various tax as well as non-tax revenues, but it could also be caused by disruptions to tax collection efforts.

In principle, disasters could also lead to revenue gains, either through increased revenues following a strong post-disaster economic rebound fuelled by reconstruction activities, or through increased receipts in international aid. Changes to the value of assets and liabilities of governments are often directly linked to changes in expenditure and revenue flows. For example, a reduction in the value of public infrastructure assets due to a disaster might be responsible for a corresponding increase in expenditure on the affected assets. While the latter clearly constitutes a fiscal impact caused by a disaster, a change in government asset values by itself might be overlooked in accounting for the fiscal impacts of disasters, not least because many governments do not publish comprehensive balance sheets that include non-financial assets. To properly assess fiscal impacts, the effect of disasters on an economy's balance sheet should be comprehensively taken into account.

### *Indirect fiscal impacts of disasters*

In addition to government expenditures and risks to revenues arising from disasters, there are a number of potential indirect disaster-related fiscal impacts, which are more difficult to observe, but no less important to consider. These include the possible deterioration in the terms at which the government can refinance public debt or raise additional debt in the short term. For example, Standard & Poor's Rating Services (2015a, 2015b) estimate that a 1-in-250-year cyclone could downgrade ratings by four or more notches in many economies. A four-notch credit rating downgrade is likely to lead to an increase in borrowing costs of 20–40 basis points or more (Hanusch et al., 2016). Disasters might also weaken public finances through the impact on domestic equity markets, where public financial asset portfolios (e.g. sovereign wealth funds) could lose value, and through a reduction in the net worth of government-owned insurance companies or banks exposed to the disaster.

When assessing fiscal risks posed by disasters, it is important to keep in mind that disasters can also raise additional revenues. Additional revenues, albeit earmarked, may be obtained through inflow of financial assistance (e.g. financial support from other governments or organisations for recovery interventions), which may reduce the government's reconstruction liabilities. Insurance payments may also reduce the government's liability, as they cover at least part of the spending demands arising from disaster recovery needs.

### **Past fiscal impacts of disasters**

Despite the considerable interest in and research on disasters and their social and economic impact, data on the fiscal costs of past disasters are comparatively very limited. A number of factors contribute to this:

- Accounting systems do not directly record spending related to disasters. Such spending may be undertaken by a wide range of entities, across different functions, programmes, projects and outputs. While some data may be available on spending by a particular ministry or by a disaster fund for a particular disaster response, recording total disaster-related expenditures requires ad hoc exercises, since standard budget classification and accounting systems do not include this process.
- Some expenditures, such as emergency relief and early recovery activities, are financed by transferring funds from other budget heads that are unspent; or by deferring maintenance spending or new capital spending in favour of disaster response; or, in economies receiving development assistance, by diverting funds from existing projects to disaster relief. Often, these transfers from other budget

lines are poorly captured in reporting systems, particularly when funds are rededicated within the same budget line (e.g. in operation and maintenance budgets).

- Expenditures are often undertaken by all levels of government (central, regional and local), and there is typically a lack of consolidated data on the total (general government) fiscal impact.

Partial estimates of the fiscal costs of a disaster are often made using information and data from the following sources:

- expenditures reported from a general annual budget contingency appropriation, where such spending is reported against the specific disaster-related programme or activity, or is tagged to disaster response;
- expenditures reported from a dedicated disaster contingency appropriation or a dedicated disaster fund
- supplementary budget or budgets;
- expenditures financed from emergency spending authority;
- an earmarked disaster recovery line in a capital or development budget;
- identifiable projects for the reconstruction of public infrastructure<sup>4</sup>;
- transfers to subnational governments to meet the costs of disaster recovery and rehabilitation that are identifiable in separate budget lines.

A recent report on contingent liability realisations in 80 advanced and emerging economies identified 65 disasters that occurred during the period 1990–2014 and estimated the fiscal costs of 29 of these (IMF, 2016)<sup>5</sup>. On average, the fiscal cost of these events was 1.6% of GDP. The maximum fiscal cost identified was 6% of GDP. Compared to the fiscal shocks emanating from the realisation of other contingent liabilities, such as those associated with the financial sector, disaster-related fiscal shocks appear to be modest, though relatively frequent. Given the particular sample on which these figures are based, they likely understate the fiscal risk posed by disasters to economies that are strongly exposed to disaster risks across a large share of their territory. Such economies include not only Small Island Developing States, but also certain OECD economies such as Chile, where the 2010 earthquake off the central coast cost an estimated 12–15% of GDP (Government of Chile, 2013). On the other hand, the quoted figures likely overstate the size of the average fiscal shock from disasters faced by larger developed economies, not least because the study includes only events with fiscal impacts larger than 1% of GDP.

The case studies conducted for this report sought to obtain estimates on government expenditures both for disaster response (ex post) and for disaster risk reduction (ex ante). The figures in Table 1.2 do not reflect a complete picture of governments' spending, but rather an estimated average based on some identifiable and dedicated funds or specific observations over a number of past events. By and large, reporting on post-disaster government expenditure is more complete than reporting on expenditure for disaster risk management ex ante. This difference might be due to the difficulty of identifying the different sources that contribute to reducing disasters and the considerable embedded contributions governments make to reduce disaster risks (OECD, 2018). Nevertheless, the discernible pattern suggests that spending in response to disasters is (significantly) higher across the studied economies than ex ante spending on disaster risk reduction. Especially

in those economies where good spending records are available, the balance in favour of response spending is striking, such as the 97% in Mexico or 96% in Australia (Table 1.2).

This pattern highlights a reactive approach to financing disasters across economies and underlines the importance of managing disaster-related contingent liabilities adequately. This preference for ex post spending partly reflects decision makers' tendency to invest in spending that quickly translates to visible impact. Whereas spending on disaster recovery measures answers to an immediate need, with easily understandable impacts, the future positive impacts (e.g. reduced damage and destruction) resulting from investments in disaster risk reduction measures are harder to trace, while the cost of the investment directly reflects as expenditure in fiscal frameworks.

**Table 1.2. Annual average losses and total amount of government spending on disasters (ex ante versus ex post)**

	Annual average loss estimate (USD)	Annual government spending for disaster risk management (USD)	Ex ante vs. ex post expenditure estimates (per cent)
Australia	5.5 billion	528 million	4% (ex ante); 96% (ex post)
Canada	3.2 billion	Not available	Not available
Colombia	3.8 billion	300 million	Slightly above 50% ex ante, and slightly below 50% ex post, with considerable year-to-year variation
Costa Rica	280 million	Not available	Not available
France	1.24 million	413 million	Not available
Japan	61.5 billion	31.4 billion	25% (ex ante); 75% (ex post)
Mexico	2.9 billion	350 million	3% (ex ante); 97% (ex post)
New Zealand	769.2 million	Not available	Not available
Peru	4 billion	498 million	100% (ex ante)

*Note:* Ex post disaster risk management spending for Peru is currently not reported.

*Source:* Case study reports.

As mentioned above, it is rare for governments to systematically document the fiscal impact of disasters. However, given their importance for informing a government's financial planning and fiscal policy making, exercises that study fiscal impacts on an event-specific basis can be found more frequently. A summary of such studies is provided below for the Great East Japan Earthquake of 2011, the Canterbury earthquake sequence that occurred in New Zealand in 2010–11 and the Fort McMurray wildfire that affected Canada in 2016.

## Fiscal impacts of major historical disasters

### *The 2011 Great East Japan Earthquake*

The March 2011 Great East Japan Earthquake, followed by the tsunami and nuclear power accident, imposed an exceptional cost on Japan's central government. The triple disaster caused an estimated USD 300 billion in total economic costs, of which USD 210 billion was estimated to be damages. Quarterly GDP declined by 2.1% in the second quarter of 2011. The total central government funding for the event represented 4% of Japan's 2010 GDP and 20.7% of the initial general account budget. Funding was initially allocated to disaster relief, recovery and reconstruction through the general contingency budgets for fiscal years 2010 and 2011. Subsequent funding was allocated through three supplementary budgets in the 2011 fiscal year: one relied largely on the issuing of bonds, one was financed

primarily via cuts in previously authorised expenditure, and one was funded by budget surplus from the previous fiscal year. In the 2012 fiscal year, additional financing was appropriated, most of which was obtained through the issuing of reconstruction bonds (Sato and Boudreau, 2012; Mahul, Benson and Boudreau, 2013). In addition to experiencing expenditure impacts, the government also immediately enacted tax relief measures for affected populations and industries, and built tax incentives into its reconstruction policy, which were sometimes complemented by subsidies (Sato and Boudreau, 2012; Mahul, Benson, and Boudreau, 2013; Law Library of Congress, 2013).

### *The 2010–11 Canterbury earthquake sequence in New Zealand*

The most costly disaster experienced by New Zealand has been the Canterbury earthquake sequence in 2010/11. The cumulative impact of the earthquakes is an example of the significant fiscal impact major disasters can have. As happened with the Great East Japan Earthquake, the government's budget was impacted simultaneously on the expenditure side (to pay for damaged assets and other liabilities) and on the revenue side (due to foregone tax receipts and foregone revenues from the government's own operating services). In the year to June 2011, the net fiscal outlays related to the earthquake were USD 6.3 billion. The government shouldered an estimated one-third of the total estimated costs through natural disaster insurance provided by the EQC (Box 1.4) and central government resources (IMF, 2016).

The 2016 Financial Statements of the Crown present consolidated information regarding the fiscal impact of this earthquake sequence in New Zealand. The total cost at the end of fiscal year 2016 was USD 10.3 billion, and the earthquake-related obligations still faced are estimated at USD 1.5 billion. The cost of repairing or replacing physical assets owned by the central government amounted to USD 706 million, or 6.8% of total central government costs<sup>6</sup>. The central government provided significant contributions for the reconstruction of public assets owned by subnational governments (local/district councils and regional councils<sup>7</sup>); it paid USD 1.19 billion to restore essential subnational government infrastructure (such as water supply and wastewater and storm water services) damaged during the earthquakes. The government-owned Earthquake Commission, which provides insurance coverage against earthquake and other perils for residential property, has paid out (net of reinsurance receipts) about USD 5.3 billion in compensation for privately owned residential property. Finally, the central government exceptionally provided USD 806 million to settle residential property claims for policies held with a private insurance company, AMI<sup>8</sup>. See Table 1.3 for a summary of public expenses related to the earthquakes.

**Table 1.3. Public expenses arising from 2010/11 Canterbury earthquakes (2011–16)**

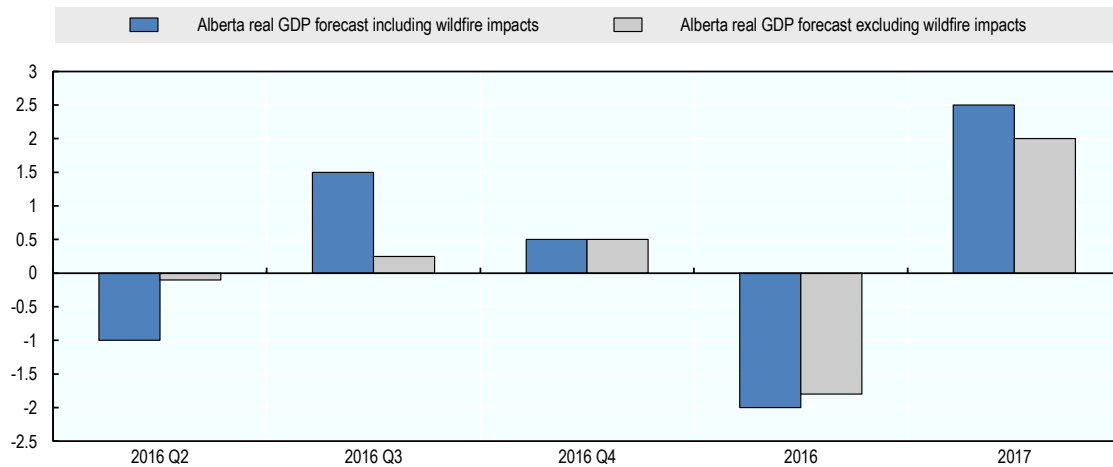
	Total to date (in million NZD)	30 June 2016 (in million NZD)	30 June 2015 (in million NZD)	Actual June 2014 (in million NZD)	Actual June 2013 (in million NZD)	30 June 2012 (in million NZD)	30 June 2011 (in million NZD)
EQC insurance claims	7 334	21	(444)	(242)	(107)	662	7 444
Local infrastructure	1 637	55	66	109	483	729	195
Land zoning	1 087	88	(1)	97	(8)	258	653
Southern Response support package	1 111	204	325	124	(53)	156	355
Christchurch central city rebuild	920	153	179	473	115	-	-
Crown assets	969	498	335	96	28	12	-
Other earthquake costs	1 242	338	129	249	17	96	413
<b>Total Crown net earthquake costs</b>	<b>14 300</b>	<b>1 357</b>	<b>589</b>	<b>906</b>	<b>475</b>	<b>1 913</b>	<b>9 060</b>
Gross earthquake expenses	20 448	1 414	904	918	815	2 823	13 574
Earthquake related revenue (e.g. reinsurance)	(6 148)	(57)	(315)	(12)	(340)	(910)	(4 514)
Operating expenses	12 084	587	(55)	326	266	1 900	9 060
Capital expenditure	2 216	770	644	580	209	13	-
<b>Total Crown net earthquake costs</b>	<b>14 300</b>	<b>1 357</b>	<b>589</b>	<b>906</b>	<b>475</b>	<b>1 913</b>	<b>9 060</b>

Source: Treasury, 2016 note 31, pp. 122-26.

### *The 2016 Fort McMurray wildfire in Canada*

The Fort McMurray wildfire was one of the most costly disasters in Canada's recent history. It spread across an area of 590 000 hectares in northeast Alberta between May and July 2016, destroyed 2 400 homes and buildings, affected 88 000 people and resulted in damages amounting to USD 4.6 billion (EM-DAT, 2017). Estimates suggest that an additional USD 2.2 billion in indirect damages should be included in cost estimates, with businesses in the Fort McMurray area experiencing an estimated net revenue loss of CAD 54.7 million (USD 45.1 million) (Alam and Islam, 2017).

The Fort McMurray wildfire had a negative effect on Alberta's overall GDP; the lost oil sands production alone resulted in an estimated 0.33% drop in provincial GDP in 2016, translating to a 0.06% drop in nationwide GDP. Overall, the net effect on the provincial economy in the second quarter was estimated as a 1% reduction in GDP growth. Support from the government of Alberta (such as the provision of CAD 1 250 (USD 960) per adult and CAD 500 (USD 380) per dependent to evacuated households) and reconstruction activities, however, helped offset the impact on Alberta's economy (Antunes and Bernard, 2017; Conference Board of Canada, 2016). The impact of the wildfire on Alberta GDP is shown in Figure 1.3.

**Figure 1.3. Impact of Fort McMurray wildfires on Alberta GDP**

Source: Antunes and Bernard, 2017

To support the government of Alberta in bearing the costs of this disaster, the federal government of Canada provided CAD 468.7 million (USD 385.7 million) in financial support via the Disaster Financial Assistance Arrangements (DFAA), which largely covered the costs of the initial response to the fire, including first responders and evacuee relief. In addition, the Alberta government provided around CAD 160 million in emergency funding to affected households in the Fort McMurray area. Much of the remaining cost of the wildfire has been borne by insurers, as most residential and business insurance policies cover fire damage (Antunes and Bernard, 2017).

## Notes

<sup>1</sup> In the context of disasters, “hazards” refers to the geophysical or hydrometeorological events that have the potential to cause injury or death to exposed people, to damage exposed assets, and to disrupt socio-economic activity. “Exposure” refers to the location of both assets and people in areas prone to any of the above described hazards. “Vulnerability” is defined as “the characteristics and circumstances of a community, system, or asset that make it susceptible to the damaging effects of a hazard” (World Bank, 2014a).

<sup>2</sup> The liability for claims payments is often shared between the affected households, private insurance companies and the government. The number of claims is a strong indicator of the potential contingent liability resulting from government-backed insurance.

<sup>3</sup> More details on this point can be found in the section on identifying contingent liabilities that follows.

<sup>4</sup> For instance, in New Zealand the Public Finance Act authorises expenditure on a national emergency without parliamentary appropriation, with the spending subsequently authorised in an appropriation act.

<sup>5</sup> The data set covered 34 advanced economies and 46 emerging economies. The coverage of the data depended on the economy and year, but in general data for the 1990s were for the central government, while for the 2000s the data were general government (for a number of mainly advanced economies).

<sup>6</sup> In New Zealand a significant share of public infrastructure assets, including schools, hospitals and national roads, is owned by the central government and managed by the relevant central government department.

<sup>7</sup> There are two levels of government in New Zealand, the central and the subnational. Local authorities can be cities (which serve a population of over 50,000 in a predominantly urban area) or districts (which serve towns and wider rural areas). Regional authorities are created for the functional management of some public services (e.g. transport and environmental management). Subnational authorities do not have constitutional mandates; their functions and powers are determined by the national parliament.

<sup>8</sup> In 2011, AMI Insurance requested Crown support to deal with the financial impact of the Canterbury earthquakes. Support was granted in the form of a Crown Support Deed, and in return the government gained control of AMI. In 2012, AMI sold its non-earthquake-related business to IAG New Zealand, and the Crown received the proceeds of the sale but retained direct control and ownership of the residual company. This business was renamed Southern Response Earthquake Services Limited. Since that time, the outstanding claims continue to be re-measured as settlement experience emerges, and the government continues to provide support; it will do so until outstanding claims are settled with policy holders. During 2013, the Crown subscribed additional uncalled capital to Southern Response Earthquake Services Limited.



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