Natural disasters and implicit government debt

Ian Koetsier[1]

1 Introduction

In recent history, there have been some major natural disasters, such as the Haiti earthquake, cyclone Nargis, hurricane Mitch, the Indian Ocean earthquake and tsunami, the Kashmir earthquake and many other large disasters. These natural disasters have a major impact on a country's economy. The occurrence of natural disasters is not limited to our times, they will also happen in the future. Climate change will increase the frequency and intensity of climate events. Even if the greenhouse gas emissions stop today, the stock of emissions will be in the air for decades or even centuries to come. This will lead to an increase in the frequency of natural disasters for the foreseeable future.

This short study will shed some light on the two important questions relating to the impact of natural disasters on government finances: Why do governments intervene after a natural disaster? How large is the impact of a natural disaster on government finances? This study gives multiple reasons for government inventions after a natural disaster. Natural disasters are implicit contingent liabilities. These liabilities are not-contractual obligations, which can occur, but do not have to occur. The materialization of these liabilities depends in our case on whether a natural disaster occurs. Even though, government intervention is not a contractual obligation, it might be socially binding. Governments intervene by providing emergency disaster aid and disaster reconstruction. Thus, it is the expectation that a government will incur costs in the aftermath of natural disaster.

This study contributes to the understanding of the size of the impact of natural disasters on government debt. We apply an innovative econometric method which allows us to show a causal disaster effect on government debt. There are 80 countries included for the period 1971-2012. A disaster can influence several aspects of government finances: government revenue, government expenditure, budget deficits, interest payments etc. We are focusing on government debt because it captures the overall effect. Natural disasters can impose considerable pressure on debt sustainability. This study provides insights into the fiscal costs in the short, medium and long-term effects. The estimation of the fiscal costs allows policymakers to make cost-benefit analyses of the possible preparation measures.

2 Implicit government debt

This study makes a distinction between different types of government obligations. Table 1 shows differences in two aspects; whether the contract is either explicit or implicit in nature and whether the obligations are either direct or contingent. In the case of natural disasters, these government obligations are implicit and contingent. Contingent government liabilities are liabilities that materialize following the occurrence of an event, in our case, a natural disaster. Note that disaster events occur but there is no absolute certainty that they would. Implicit government liabilities are seldom accounted for in government balances.

[1] The views expressed here are solely those of the authors and do not in any way represent the views of the institutions to which they are affiliated.

Liabilities	Direct *An obligation in any event*	Contingent *An obligation if an event occurs*
Explicit *Government liabilities by law or contract*	Sovereign borrowing Budgetary expenditures	State guarantees for certain loans State guarantee on private investments
Implicit *A government's moral obligation*	Future public pensions Future health care financing	Bank failure Failure of a nonguaranteed pension fund Natural disaster relief and reconstruction

Table 1: An overview of government liabilities
Source: Own elaboration.

This study estimates the effects of direct and indirect fiscal costs to get a comprehensive view of the disaster impact on government finances. Bova et al. (2016) estimate the direct fiscal costs of the initial impact of natural disaster is, on average, equal to 1.6 percent of GDP. These costs are directly related to the natural disaster, such as emergency aid and disaster relief. However, our belief is that the indirect costs make up the largest share of the disaster costs. These costs consist of the wider macroeconomic impact of a natural disaster. This includes, for example, output losses due to the destruction of factories, capital and/or crops, negative effects on tax collection capabilities, problems on the current account, employment issues and many other possible indirect impacts. The reader should note that our estimations underestimate the fiscal costs of a natural disaster because we do not include non-market losses: loss of lives, negative impacts on health, destruction of important cultural objects etc.

3 Reasons for government intervention

It is a government moral obligation to alleviate human suffering after a natural disaster. The Universal Declaration of Human Rights (p.52) even states: *"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control."* A large natural disaster clearly has an adverse impact on the standard of living. Therefore, the government has to step in with emergency relief and reconstruction efforts to fulfill the necessary conditions of well-being.

There are also numerous other reasons why governments might want to intervene in the aftermath of a natural disaster. First, elected officials are often judged on their performance in the aftermath of a natural disaster. Thus, if elected official do not intervene, they will get punished at the ballot box. The opposite also holds. When government officials react quite promptly by providing emergency relief to the affected population to limit the economic and human losses, voters reward these efforts (Cole et al., 2012). Second, there are issues of macroeconomic stability. A large natural disaster will have a large adverse impact on a country's economy. In similar vein as during an economic crisis, the government has to step in to stabilize the macroeconomic situation, which does require counter-cyclical policies. Third, the lack of private disaster insurance reinforces the necessity of government intervention. A missing markets problem exists due to supply and demand side problems. Insurance firms are exposed to very high disaster risks, especially when they operate in one local market. Whereas some risks are diversifiable across actors, disaster risk is clearly less diversifiable due to correlated risks. The insured actors are likely to be simultaneously affected (e.g. due to the occurrence of a flood or a storm). Furthermore, the lack of demand for disaster insurance rests on the presumption that people will be bailed-out after a natural disaster and the human trait of underestimating low-probability high-loss events. This makes them unwilling to buy disaster insurance themselves. As a consequence, the government has to deal with the consequences of a natural disaster. This raises an important question: Can a government pay for these necessary interventions?

4 The price tag of a natural disaster

This study only investigates the largest natural disasters over the period from 1971 to 2012 and their impact on government debt. These are low-probability high impact events, which increases the likelihood of an adverse impact on government debt. We apply a panel synthetic control method following Cavallo et al. (2013). For this methodology, we split our sample in disaster and non-disaster countries. The synthetic control group consists of non-disaster countries; these non-disaster countries are weighted to represent the disaster country.[2] The match is based on similarity of the non-disaster and disaster country on indicators, like development, economic circumstances, institutional factors and climatological conditions. In this way, this study constructs the government debt trajectory, as if the disaster country did not experience a natural disaster. We are interested in the difference between the trajectory of the disaster country and the trajectory of the

[2] The non-disaster countries receive a weight between zero and one. The weights add up to one. Normally, different non-disaster countries with different weights make up the synthetic control group. For example, a synthetic control group for the Netherlands can consist of 0.15 Germany, 0.4 Belgium, 0.2 Sweden and 0.25 France. The other non-disaster countries receive a weight of zero in this example.

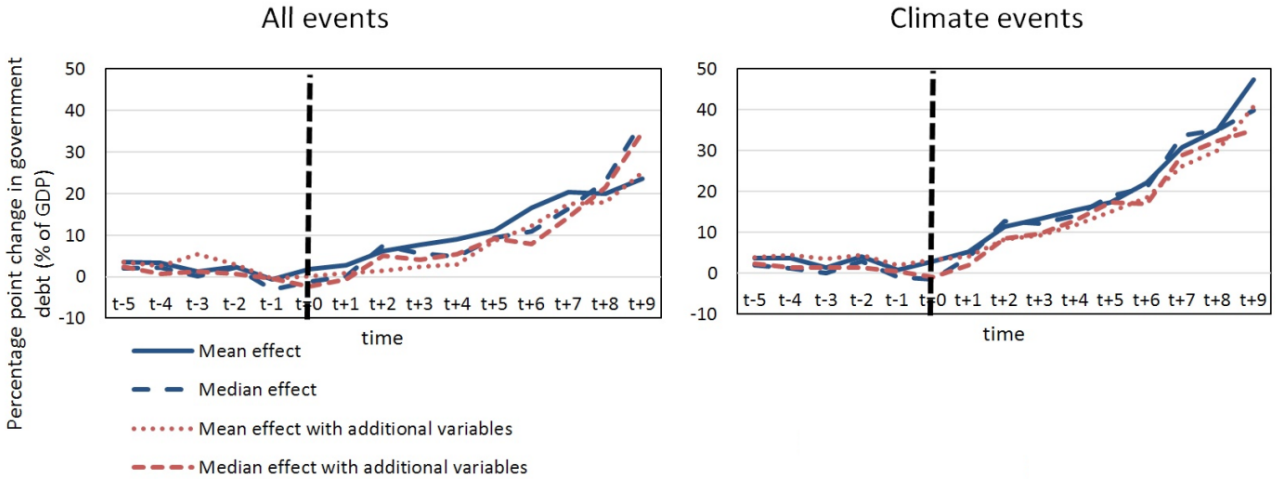

Figure 1: The impact of natural disasters on government debt
Source: *Own elaboration.*

synthetic control group. We are able to track this development up to 10 years after the natural disaster. Thus, this study presents short-, medium- and long-term estimations of the disaster impact on government debt.

We find a considerable increase in government debt in the aftermath of natural disaster in Figure 1. The level of government debt increases between 23% and 37% of GDP compared to the synthetic control group. This increase of government debt proves robust across different specifications of our model. Furthermore, the disaster impact is not driven by potential outliers because the median and average disaster impacts give relatively similar results. The economic significance is even greater when we regard the fact that the average level of government debt is equal to 62% of GDP in our sample. Our results exclude the countries which experience a sovereign default in the 10 years before and after the occurrence of a natural disaster. If there is a sovereign default, the post-disaster trajectory might differ because investors are more reluctant to invest in government bonds of these countries. This might have consequences for their ability to conduct counter-cyclical policies. It can potentially bias our estimates downward because the countries, which experience the largest adverse impact of a natural disaster default on their debt obligations. Thus, it might be that the 'true' effect on government debt is even larger.

This study also looks at the potential consequences of climate change on the fiscal costs of natural disasters. We define climate events as droughts, extreme temperatures, storms and floods. There is very compelling evidence that the frequency and intensity of such events is increasing and will continue to do so in the future (IPCC, 2014). Koetsier (2017) even shows that historical data also reveals an increase in the frequency of climate events compared to non-climate events. Due to the comparative nature of this estimation, it is unlikely that this increase of climate events is driven by technological progress or population developments.

We find an even larger impact of climate events on government debt than for all disaster events. The increase of government debt ranges from 34% to 47% of GDP compared to the synthetic control group. A climate event can lead to a debt increase of 75 percent. Thus, there is a very substantial impact of a climate event on government finances. This is an even more acute problem when we regard the predictions regarding the frequency and intensity of these types of events. In summary, these findings indicate that natural disasters have a considerable impact on government debt and the implicit government obligations are likely to increase due to climate change.

5 Conclusions

It is clear that government intervention after a natural disaster is warranted. It is a government's moral obligation to alleviate human suffering and destress. It is also required because there is an insufficiently developed private disaster insurance market, it is beneficial from a macroeconomic stability perspective and it is in the interest of elected officials themselves. It should be noted that, although this intervention is justified and a necessary, it is not without fiscal costs. Our study reveals a considerable impact of natural disasters on government debt. Government debt increases between 23% and 47% of GDP compared to our synthetic control group. The largest impacts are observed for climate events. This is especially worrisome because these events are likely to increase in frequency and intensity in the (near) future. Thus, there is a substantial contingent government liability regarding natural disasters and this liability grows over time.

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