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Natural Disasters and Government Size: A Cross-Country Analysis

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Table of Contents

ABSTRACT

There have been multiple studies within the field of economics concerning the various effects that natural disasters have on countries. The goal of the present study is to address the seemingly forgotten area of how natural disasters affect the size of a government. Using data from both the Emergency Events Database and the World Bank, a cross-country panel data analysis is performed to test the impact of natural disasters on government size. The results show that more deaths from a natural disaster is associated with countries having a larger government. These results aim to be useful for allowing governments to help develop mitigation techniques to better prepare and preserve governments against future natural disasters.

INTRODUCTION

In the vast topics of research throughout economics, an increasingly important and relevant focus is the varying impacts of climate change. Climate change continues to be a popular topic in many areas of study because of its varying effects on so many disciplines. The field of economics is no different with recent research on the micro and macro effects of climate change (Ishizawa & Miranda 2019, Vanderveen 2004). One area within climate change that economists conduct their research is on natural disasters and their effects on nations. Natural disasters prove to be an increasingly important area of study due to their impact on people all over the world (Noy & Coffman, 2011). Within the last ten to twenty years natural disasters have increased in both size and severity.

The effect that natural disasters have on a nation can be widespread ranging from reconstruction efforts to stimulus relief for citizens. Economists have placed greater emphasis on studying the results of natural disasters on nations due to the varying pressures they put on the government and its fiscal institutions. Batten (2018) highlights the importance of understanding natural disaster events to allow institutions to create plans to combat these events. For example, the hurricane that landed in the Caribbean islands in 2017 (Hurricane Irma) left over 70,000 people misplaced and almost half the roadways were impassable (United Nations, 2018). Similarly, the typhoon that hit the Philippines in 2020 that resulted in 32 deaths and damages totaling over 415 million dollars (Mogul 2021). Even worse was that El-Nino flash flood and mudslides in Peru from 2017 that left 120 people dead and it was estimated that reconstruction would cost anywhere from eight to ten billion dollars (Collyns 2017). These are just a few recent examples of the devastation that natural disasters can have on a nation and its people.

As the effects of these events escalate, research in this area has continued to expand by investigating the different impacts from disasters such as, components of a nation’s income, the death rates, the infrastructure codes and more (Burnside et al., 2003). An important role for many economists is to forecast for macro-economic conditions. It is crucial to understand whether a disaster will increase government spending, lower GDP, or even cause technological and industrial development (Cuaresma et al., 2008).

Another major factor that has the potential to be affected from these natural disasters is trade and foreign relations. Many existing studies focus on how the importing of goods has the potential to rise in poorer nations as they are trying to access materials to rebuild following a disaster event (Mohan et al., 2018). Mohan et al. (2018) find that the GDP of many Caribbean countries fluctuate due to changes in demands from other countries who were hit by disaster events. This also has the potential to effect foreign relations as well, due to governments giving or receiving aid from the resulting destruction. Many developing nations do not have the funds readily available or the policy power to draw from funds in a timely manner to help reconstruction efforts, and instead turn to other countries as a support system. These are just a few reasons that are highlighted in the existing literature that show the importance of studying natural disasters. This leads into a major point in the literature regarding whether natural disasters impact developed and developing nations differently.

The existing literature clearly shows numerous impacts that natural disasters have on countries worldwide. The effect disasters have on fiscal policy have the potential to significantly decline real wages, taxes, government purchases, and hours worked in an economy (Burnside et al., 2003). The overarching question to be addressed by the proposed study is to see how natural disasters affect government size. It is crucial to understand these effects to better prepare for the consequences and for future policymaking. Our results show that natural disasters have a limited impact on government size and the measure of natural disasters that is consistently statistically significant is number of deaths. Interestingly, when the full sample is broken down to developed and developing nations, the majority of the statistical significance is being driven by the developing nations.

LITERATURE REVIEW

The heart of the present study is to examine the effects that natural disasters have on government spending and taxes that in turn will impact government size. For example, Benson and Clay (2004) obtained conflicting results about the effects of natural disasters on the fiscal budget. The main reason for this is because in many cases like Fiji for example, the government reallocated prior money from the budget and put it towards reconstruction efforts after the disaster (Benson & Clay, 2004). Their study included research in nearby countries like Dominica and the Philippines with matching results.

An interesting point about taxation that Benson and Clay (2004) discuss is that the effect on government income from taxes depend on the country. For example, a country like Dominica has very little direct taxation on things like agricultural goods, which are hit the worst from natural disasters (Benson & Clay, 2004). Similarly, their research found that countries that put less importance on export taxes resulted in those countries being less effected from tax revenue than countries with higher export taxes. The idea of tax reductions and deferrals is explored further in Lindell and Prater (2003). They discuss how natural disasters can cause major burdens on not only governments, but on the citizens as well. They propose some ways governments and organizations can help against these effects after a natural disaster occurrence. The literature highlights that governments should provide tax deferrals or reductions to reduce the financial burdens after a disaster and to help stimulate the economy after a disaster (Lindell & Prater, 2003).

Tol (2021) looks at state capacity against natural disasters, and although the research doesn't focus directly on taxes, it does include consequences natural disasters have on taxes. The study looks at how a country's ability to overcome/rebuild after a natural disaster is heavily dependent on the government, and in particular, the ability to raise taxes and provide goods during the reconstruction phase (Tol, 2021). For example, in some cases governments try to offset their unexpected increase in government expenditure by increasing tax rates (Kousky, 2014). Kousky (2014) explains that this causes deadweight losses resulting in even further costs in the future. This literature illustrates that governments have changes in their taxes following a natural disaster.

A study that focuses more directly on government spending itself is Miao et al (2018), where 50 states are examined to identify changes in federal spending due to disasters. Miao et al. (2018) showed that budgets were stressed from more spending and decreased revenues. Many state governments budgets took a hit from decreased revenues as a result from interrupted local businesses. More importantly, government expenditure is stressed through response from the disaster, recovery efforts and public relief efforts (Miao et al., 2018). Similar results were found by Ouattara and Strobl (2019) in their study of fiscal hardships in the Caribbean region. They found that directly following a hurricane the Caribbean states' fiscal budgets were significantly negative due to an increase in government spending and a fall in federal revenues (Ouattara and Strobl, 2019). Another interesting study that points out the increase in government spending is Padli et al. (2018), which focuses on the impact of human development by natural disasters. Although not directly focusing on government expenditure, Padli et al. (2018) found that there is potential increase in spending due to increasing building codes, safety measures and adding warning systems for future disasters that cause increases in spending.

In many studies, researchers have found that overall spending rises following a disaster. There are different interpretations for the drivers of these changes highlighted in different studies. Such a study, by Cavallo and Noy 2009, the authors found that in the short-term, government deficits increase, suggesting that the government spending increased directly following a disaster event or tax revenue fell. Opposing results are found in Kousky (2014), who proposes a different idea. Kousky (2014) suggests that with climate change increasing the occurrences and severity of natural disaster events, governments have started instituting long-term policies to battle climate change that are costly.

In much of the existing research, a common interest is in the differences between developed and developing countries. This trend also continues in the existing literature regarding the effects that natural disasters have on a country. The way in which the literature captures this difference is in the number of people affected and the total value of the damage (Rasmussen, 2004). In several of the existing literature, it is evident that developing countries were worse off than developed ones after being struck by a natural disaster. A notable point from Rasmussen (2004) was that developing nations had greater number of people affected and larger damage amounts by natural disasters because many developing nations are geographically located where natural disasters happen more frequently (Rasmussen, 2004). This makes it difficult for many developing countries to regain financial and infrastructure stability. Since developing countries have much less disposable income, these events make it even harder for them to develop (Toya & Skidmore, 2007).

Further, Ilzetzki and Vegh (2008) focused on effects from disasters by looking at procyclical or cyclical governments instead of geographic location. In most cases it is seen that developing countries are procyclical while developed use more cyclical actions. Simply put, procyclical policy occurs when a government limits growth and spending in periods of negative economic condition and grows and spends in times of positive economic conditions. (McManus & Ozkan, 2015). In contrast, cyclical policy is when a government tries to encourage growth in times of distress and worry less about increasing growth in times of stability (McManus & Ozkan, 2015). Ilzetzki and Vegh (2008) found that there was sufficient evidence to conclude that developing countries use a more pro-cyclical approach. This was a suggestion of why developing nations have a harder time recovering from events such as natural disasters. Their suggestion was that cyclical policy results in more government consumption which developing countries have less ability to do than developed countries.

Anbarcia et al. (2004) explore another reason for different outcomes of natural disasters between developed and developing countries. The authors examined different inequality levels in countries and their results after being struck by an earthquake. The study explores how the financial stress caused by an earthquake can result in various forms of destruction for a government. The findings indicate that governments who are known to have lower income inequality in their country are more concerned with the well-being of all their citizens. Thus, potentially leading to a reduced number of fatalities and lower damage amounts from earthquakes (Anbarci et al., 2004).

A further possibility of why developed and developing nations have varying effects to similar natural disasters is addressed in Toya and Skidmore (2007). The authors look at factors including higher education attainment, more economic openness, and a stronger financial sector (Toya & Skidmore, 2007). In particular, Toya and Skidmore (2007) analyzed countries with differing economic development and the death toll and damage value caused by natural disasters. They found similar results to the existing literature, demonstrating that higher income countries have fewer damages and death tolls than that of lower income countries. Based on subnational and government expenditure, countries that are more decentralized and have economic openness proved to experience fewer deaths from natural disasters (Skidmore & Toya, 2012). Many developing nations do not have the funds readily available or the policy power to draw from funds in a timely manner to help reconstruction efforts, and instead turn to other countries as a support system. This also the potential to effect foreign relations because of governments giving or receiving aid from other countries following a severe natural disaster.

Most of the existing literature on economic impacts of natural disasters focuses on the immediate affects and efforts to help the economy become more stable (Khan, 2005; Raschkly, 2008). Clearly, there are many facets of the economy that could be affected by such disasters. However, many studies tend to combine these into one test. In the study performed by Mohan et al. (2018), the effects of disasters are broken down on a national income accounting measure. This proved to show interesting results by export, import, public consumption, private investment, and private consumption individually. Looking at 21 Caribbean countries struck by hurricanes, Mohan et al. (2018) showed that exports declined, government spending increased immediately and then returned to normal, imports increased, public investments were inconclusive, and private investments decreased following hurricanes.

Taking Mohan's (2018) study in a different direction, Noy and Nualsri (2011) focused on how government spending changed after a disaster occurred. This study looked at both developed and developing nations government financials before and after disasters to see how they changed because of the disasters. Interestingly, developed nations' government spending rose and revenues fell, while developing nations' cash surplus rose and consumption fell (Noy & Nualsri, 2011). They suggest that this is due to the cyclicality of the governments addressed in existing research (e.g., Ilzetzki & Vegh 2008), suggesting the importance of understanding the effects of natural disasters. Countries and their governments have the ability to play a major role in the outcome of natural disasters based upon their reactions. Specifically, policymakers, need to be prepared for the varying effects on government spending from factors such as cleanup efforts and reconstruction programs. Policymakers can look at data such as Noy and Nualsri (2011), to take actions to mitigate the devastating results of some natural disasters. Similarly, Raschky (2008) analyzed the effects of government stability and its link to government expenditure. Raschky (2008) showed that government institutions play a major role in the outcome of the death toll and damage toll from natural disasters. A more stable government with the needs of their people in mind perform better against natural disasters (Raschky, 2008).

DATA AND MODEL

To test the impact of natural disasters on government size, the following model is estimated:

$$Government\ Size_{it} = \beta_0 + \beta_1 Disaster_{it} + \beta_2 X_{it} + \mu_i + \rho_t + €_{it}$$

Where *i* represents country and *t* represents year; the dependent variable *Government Size* measures the size of the government; the variable *Disaster* consists of the natural disaster variables which include deaths, affected, and damages; *X* represents a vector of control variables shown to influence the size of the government; μ_i denotes country-specific heterogeneity; ρ_t denotes time-specific effects; and $€_{it}$ is the error term. We use country and time fixed effects model with robust standard errors to estimate the above equation.

Data is collected from a variety of different sources. We use data from the Emergency Events Database (EMDAT), which is an international disaster database created by the Centre for Research on the Epidemiology of Disasters (CRED) in the late 1990s**.** This database includes natural disasters from 1900 to the present for numerous countries. EMDAT classifies an event a disaster if one of the following four criteria are met: "ten or more people have died as a result, 100 or more people area affected by it, a declaration of a state of emergency, and/or the event resulted in a call for international assistance". Once an event meets one of these criteria, the database records several different variables relating to geographical, temporal, human, economic information**,** and value of damage which is standardized to be reported in U.S. dollars in thousands. We took disaster data from the years starting in 1995 and goes to 2018 where the most recent data for the explanatory variables exist. It is important to note that the data we use is taken from those disasters under the "hydrological" (dealing with water or precipitation) sub-category. We decided to focus on one specific category to better categorize the effects of specific disasters, and the "hydrological" type is chosen because it occurs in the most variety of countries.

The study focuses on three measures of a disaster from this data base, specifically, death, affected, and damages. Deaths represent the total number of deaths resulting from each disaster for each country; Affected denote those who are either injured, misplaced or otherwise negatively affected by a disaster, Damages are the amount in thousands of U.S. dollars that resulted from each disaster. Following Khan (2005), the disaster variables are transformed into the following:

(ln)Death = log(1+death)

(ln)Affected = log(1+affected)

(ln)Damages= log(damages)

The data for the main measure of, government size is obtained from the Fraser Institute. This data includes many variables that measure the economic freedom of countries around the world. Government size is an aggregated measure of tax revenue, tax rate, government consumption, government investment, and transfer payments. All these factors are used to create one overall measure of government size is calculated. It is important to note that the Fraser Institute has created the government size variable as an index to control for canceling shifts like tax rate and tax revenue, and where a larger index measures refers to a larger government size.

As a robustness check, we use two other measures of government size obtained from the World Bank. In particular, we use government consumption expenditure and government consumption expenditure growth. Government consumption expenditure is government spending as a percent of GDP, while government consumption expenditure growth looks at a year-to-year change of a government spending.

The following control variables were chosen after careful consideration of the existing literature. First, it is important to control for GDP per capita ((ln)GDPPC) because of Wagner's law that states as income per person rises the complexity of the economy increases requiring more aid from the government (Shelton, 2007; Potrafke, 2010; Bergh & Henrekson, 2011; Brady & Lee, 2014; Kotera & Okada, 2017). Secondly, accounting for population ((ln)Population) is critical to the model because as population rises the demand for social services by the government rises (Shelton, 2007; Benarroch & Pandey, 2008; Aregbeyen & Akpan, 2013). Other measures of population such as, fraction of working population less than 15 and fraction of population greater than 65, are used as dependency measures. Controlling for dependency in these two categories is important because the two groups have varying effects on government size. For example, the population less than 15 effects government size in areas such as childcare and education, while population over 65 effects government size in areas such as retirement and healthcare (Aregbeyen & Akpan, 2013; Shelton, 2007; Brady & Lee, 2014; Kotera & Okada, 2017). The last control variable used to take into consideration on the outlying effects related to government size is trade openness, which is measured as a percent of (exports + imports) out of GDP. Trade is vital to control for because as countries increase their openness the complexity of their economy increases, requiring more from the government to assist in economic activities (Shelton, 2007; Brady & Lee, 2014; Kotera & Okada, 2017; Facchini et al., 2016). The data for all the control variables are obtained from the World Bank. Table 11 provides the summary statistics for the control variables.

RESULTS

Baseline Results

We first test the impact of natural disasters on the main measure of government size from The Fraser Institute. The results are presented in Table 1, columns 1-3, (GOVSIZE). The results show that the variable (ln)Death is positive and statistically significant at the 10% level, suggesting that as a country experiences more deaths from a natural disaster, the size of the government increases. This is in line with, Ouattara and Strobl (2013) and Miao et al. (2013) who found that following a disaster, spending increased causing a growth in government size. Regarding the control variables in column 1 of table 1, fraction of the population greater than 65 is positive and statistically significant at the 5% level indicating that government size is impacted by the population over 65 in areas such as healthcare and retirement. Alternatively, fraction of population less than 15 is statistically insignificant thereby deeming that government size is not affected by the population of those who are still dependents. GDP per capita and population are both statistically insignificant in the baseline model suggesting that the amount of production and number of people in a country have no influence on government size. Additionally, the variable trade is statistically insignificant indicating government size is not affected by imports and exports. It is interesting to note that the disaster variables (ln)Damages and (ln)Affected are statistically insignificant in Table 1, columns 2 and 3, which were not in line with Noy and Nualsri 2011 who found that the more affected from a natural disaster causes a significant change in government size. This could potentially be a result of this study looking only at hydrological disaster variable types. Switching to the control variables for (ln)Damage and (ln)Affected, the results show that the fraction of the population less than 15 is statistically significant at the 1% level (column 2) and that fraction of the population over 65 is statistically significant at the 5% level (columns 2 and 3). This suggests that when measuring the disaster variable in terms of affected and damages that the part of the population that are “dependent” do influence government size. GDP per capita, population and trade are all statistically insignificant (columns 1,2, and 3).

Different Measures of the Dependent Variable

Next, we use two different measures of government size from the World Bank, particularly government consumption (GOVCONS) and government consumption growth (GOVCONGR). The results are displayed in Table 1, columns 4-9. The results show that, none of the three natural disaster variables are statistically significant for the dependent variables GOVCONS or GOVCONGR. This would indicate that a natural disaster, whether be measured in deaths, damages, or affected, has no impact on government consumption which coincides with Benson & Clay (2004) where they had inconclusive results if a natural disaster influenced consumption in the fiscal budget. When government size was measured by government consumption (Columns 4-6), the variable trade is positive and statistically significant at the 10% level when disaster was measured in damages. This infers that imports and exports influences the amount the government spends, consistent with research such as Noy and Nualsri (2011), who argue that trade plays an important role in government spending. Looking at the affected model for government consumption, we see that population is positive and significant at the 5% level indicating that a larger population leads to an increase in government consumption which was similarly found in Burnside et al. (2003).

Turning to the models for government consumption growth, we see that the fraction of population less than 15 is negative and statistically significant at least at the 5% level, confirming that dependents play a role in government consumption year to year. Looking at both additional measures of government size (columns 4-9) we see trade being positive and statistically significant at the 5% level and GDP per capita being positive and statistically significant at the 10% level consistent with Mohan et al. (2018) study looking at the effect trade has on GDP of a country, the higher the GDP the larger the government consumption. The variables population and fraction of the population greater than 65 are statistically insignificant for both additional measures of government size.

Additional Controls

We continue with our next round of robustness checks in the form of additional control variables for all three measures of government size. The additional variables are the Gini coefficients, the unemployment rate, and the urban population rate. The results of these three controls were conducted individually and are illustrated in Tables 2, 3, and 4 respectively. The Gini coefficient was used as an additional control variable because differences in income inequality, particularly higher levels of inequality are correlated to having a larger government as tested in previous literature (Shelton, 2007; Kotera & Okada, 2017). None of the models showed that the Gini coefficient was significant differing from Shelton's findings on its relevance to government size. The results depicted in Table 2 (GOVSIZE) (columns 1-3), the death disaster variable was positive and statistically significant at the 10% level, confirming that as deaths rise it is associated with having a larger government. The other disaster variables are statistically insignificant, which is consistent with the baseline results discussed above. Table 2, (columns 1-3) the fraction of the population greater than 65 became positive and statistically significant at the 5% level for all disaster measures and fraction of the population less than 15 was statistically significant at the 1% level for number of affected, proving that fraction of dependents in a country influence government size.

Turning to government consumption and government consumption growth Table 2 (columns 4-9), none of the three disaster variables were statistically significant. For government consumption, adding the Gini coefficient did not make any changes, the population and trade stayed significant at the 5% and 10% level for damage and affected respectively as discussed above. When looking at government consumption growth, all variables' significance remains consistent with the baseline results, with GDP per capita now being statistically significant at the 5% level.

The unemployment rate is an additional control variable because of its unique effect on differing aspects of the economy explained in Brady & Lee (2014). The study explains that having a higher unemployment rate causes the government to pay more unemployment benefits influencing government size. As such, we control for it here. Confirming the results from the baseline model, in Table 3 (column 1) when unemployment rate was added to the models only death was positive and significant at the 10% level. The unemployment variable was insignificant for both the dependent variables (columns 1-3 and 4-6). Matching the baseline results, fraction of the population over 65 was statistically significant at the 5% level for all three disaster measures and fraction of the population less than 15 was statistically significant (columns 4-6). The results for the dependent variables (columns 4-6 and 7-9) remained the same as the baseline results with trade and population being statistically significant. When we look to columns 7-9, the unemployment variable becomes statistically significant at the 1% level for all three disaster measures, highlighting that when government size is looked at in consumption growth that unemployment rate needs to be considered as found in Brady & Lee (2014). Overall, we see that the majority of the control variables remain consistent with the baseline results.

Thirdly, urban population was used as an additional population measure because of the varying changes urbanization has on governments, as explained in Benarroch & Pandey (2008) and Aregbeyen & Akpan (2013). The authors suggest that since urban populations are more rural, it can lead to lower pressure on the government for city-focused social services. First looking at the dependent variable in Table 4 (columns 1-3), we see that adding this control confirms the baseline results that the only natural disaster measure that is statistically significant is death, which is positive and significant at the 10% level. The control variables also match the baseline results with fraction of the population over 65 being statistically significant at the 5% level for all disaster measures, and fraction of the population less than 15 being statistically significant at the 1% level (column 3). The urban population variable is statistically significant only when disaster is measured by damage at the 10% level as seen in column 1. For government consumption (columns 4-6), trade is statistically significant at the 10% level (column 4) and population is statistically significant at the 5% level (column 5). However, for government consumption the urban population control is negative and statistically significant at the 10% level, highlighting a relationship of government consumption being smaller when there is a higher urban population. When adding the urban population, we see that it is negative and statistically significant at the 5% level (column 7) and statistically significant at the 10% level for model (columns 8 and 9), which follows the results that Benarroch & Pandey (2008) found in their research regarding the affect that urban population can have on government size.

Institution Type

Raschky (2008) has indicated that institution type has the potential to play a large role in government size. For our next set of robustness checks, we thus controlled for institution type in terms of corruption, effectiveness, and stability, from the World Governance Indicators database, and report the results in in Tables 5,6, and 7, respectively. Starting with corruption, existing literature argues that the more corrupt a government is the smaller the government size because there are less payments on public goods (Raschy, 2008). Looking at Table 5 columns 1-3 (GOVSIZE), adding in the corruption control, we see that the results again confirm the baseline results with the death disaster measure being positive and statistically significant at the 10% level. The control variables significance levels (columns 1-3) are constant with the findings from Table 1. Corruption was insignificant, implying that corruption has no impact on government size. Turning to the dependent variable in columns 4-6 we see that by adding the corruption control makes the dependent variable in column 6 negative and statistically significant at the 10% level. Although this changes the significance of the disaster measure, the corruption variable is not significant in the model. The rest of the control variables match the baseline results discussed above for columns 4-6. Moving to the dependent variable in columns 7-9, we see no difference in any significance in comparison to the baseline results discussed earlier when controlling for corruption.

Effectiveness is important to control for because as Alesina & Wacziarg (1998) point out, a government that can more effectively implement policy is associated with having a larger government. When effectiveness of institution was controlled for in Table 6 (columns 1-3), we see that the results match the baseline models. The death disaster measure is statistically significant and positive at the 10% level, confirming that as deaths rise these countries are associated with having a larger government. The fraction of the population over 65 is statistically significant at the 5% level and fraction of the population less than 15 is statistically significant at the 1% level (column1-3). Turning to the dependent variable in columns 4-6, we see similar results when we controlled for corruption, the disaster measure in column 6 becomes negative and statistically significant at the 10% level. Now, effectiveness is negative and statistically significant at the 10% level (column 6). The remaining control variables significance levels are the same as the baseline model. However, this seems to imply that accounting for effectiveness is vital to consider when looking at disaster measured in number of affected. Moving on to the third measure of government size (columns 7-9), the findings show no differences in controlling for effectiveness, and the results further confirm the baseline outcome.

Looking at the last control for institution type, the stability of a government is important to control for because in general more stable government have a larger government. Illustrated in Table 7 (columns 1-3) the results match the baseline results with the independent variable in column 1 (Death) being positive and statistically significant at the 10% level. The rest of the control variables' significance also agrees with the baseline model, with stability being statistically insignificant. Shown in Table 7 (columns 4-6), we see no difference from the baseline results in significance levels and adding in the stability control was statistically insignificant. We find similar results for the third dependent variable in Table 7 (columns 7-9), that adding in the stability control was statistically insignificant and the remaining variables stayed consistent with the baseline results.

Lagging Disaster Variable

As discussed in the literature review section, one point that many researchers have overlooked is if the disaster effects continue into the next year. As such, our next robustness check lagged the disaster variable to see if any changes in the model occurred. The results are depicted in Table 8 (columns 1-9). For GOVSIZE (columns 1-3), we see first the independent variable in column 1 (Death) mimics the baseline model with it being positive and statistically significant at the 10% level. However, differing from the baseline results, the independent variable in column 3 (Affected) is now positive and statistically significant at the 10% level. This indicates that as the number of people affected rise, the year following causes an increase in government size. A possible reason for this delayed significance is that compared to death measures, affected measures are continually reported and it takes more time for an accurate count to be realized. In both lagged models in Table 8 (columns 1 and 3) the trade control variable is now statistically significant at least at the 10% level compared to the base results.

Aside from these changes, the fraction of the population over 65 and under 15 share the same significance as the baseline results.

Although we saw a change for GOVSIZE, turning to Table 8 (columns 4-6), we see no differences in significance levels from that in the baseline results for any three disaster measures or control variables. However, when we view Table 8 (columns 7 and 9) we see that these disaster measures are statistically significant and positive at the 10% level. A potential reason for this is since the dependent variable is a growth measure lagging the disaster variables, allows the model to better detect the growth or lack thereof from year to year. The control variables also slightly differ when the disaster measures are lagged in Table 8 (columns 7-9). We see that the population control is statistically significant for all three disaster measures at least at the 5% level. Additionally, the fraction of the population over 65 and less than 15 is statistically significant for the independent variable (column 1,2,3, and 8) and are statistically insignificant for the remaining models.

Developed vs Developing

Our last round of robustness checks takes into consideration the status of each country in terms of developed vs developing. The way we measured developing or developed was by classifying each country as OECD or not. The model is then run separately with just OECD countries and then ran again for non-OECD countries following existing literature (Rasmussen, 2004; Ilzetzki & Vegh, 2008; Skidmore, & Toya, H, 2012). These authors find that developing nations see larger consequences following a natural disaster than developed nations. The results for the OECD and non-OECD models are illustrated in tables 9 and 10 respectively. First, looking at the first dependent variable in Table 9 (columns 1-3), disasters measured in Death (column 1) is statistically insignificant for OECD countries. When we look at the same model but for non-OECD countries it is statistically significant and positive at the 5% level. This indicated that the significance we find in the baseline results are driven by the developing countries. Looking at OECD, we find that the dependent variable in column 3 is positive and statistically significant at the 5% level. This suggests that for OECD countries, the number of affected might be a better measure for disasters. We suggest that this is due to developed countries having more advanced warning systems, infrastructure, and safety codes lowering the death rates. When turning to the control variables for OECD (columns 1-3) we see that population, and GDP per capita become statistically significant at least at the 5% level and the rest are consistent with significance levels we find in the baseline results. However, for non-OECD, no other disaster measures are statistically significant, and the results for the control variables very closely match the baseline results (columns 1-3).

When we switch the dependent variable to the one in columns 4-6, none of the disaster variables were significant. The OECD model control variables were in line with the baselines results in terms of being statistically significant or not. The control variables in Table 10 (columns 4-6) were all statistically insignificant.

Finishing up with the dependent variable seen in columns 7-9 for OECD and non-OECD, we see a flip from when GOVSIZE was the dependent variable. Now for OECD countries we see that the affected disaster measure (columns 9) is negative and statistically significant at the 1% level, inferring that for OECD countries, as the number of people affected rise, the countries are linked with a smaller government. For non-OECD countries, none of the disaster measures are significant and we find that for OECD countries (columns 7-9) that the results for the control variables match those in the baseline findings. This is compared to non-OECD countries in where the only statistically significant control variables are trade (column 8) at the 5% level and the fraction of the population less than 15 (column 9) at the 10% level.

CONCLUSION

This research shows that that when disasters are measured in death numbers, we see a statistically significant increase in government size. To put it more simply, the data shows that when a disaster results in more deaths, the size of the government will rise. Although this is the main conclusion, the results reveal that when studying developed and developing countries separately, natural disasters measured in death has a limited impact on developed countries compared to developing.

Future work in this area could try focusing on a different disaster type: biological, climatological, extraterrestrial, geophysical, meteorological; or looking at the types in aggregate in the EMDAT database compared to the current research's focus on hydrological disasters. Furthermore, it would also be worth trying to distinguish between developed or developing nations in another way beyond OECD vs non-OECD to see if any differing results occur.

With the continuing rise of weather-related events in the world, research in this area will continue to grow more valuable and more insightful for policy recommendations. Various forms of insurance might be a possible option to hedge against the negative consequences brought by a country being hit by a natural disaster. Those who believe in government insurance programs suggest that countries can use a GDP to debt ratio along with their average cost to such disasters a year to compute this amount (Borensztein et al., 2009). Although this is a possibility for more developed nations, developing countries do not have the funds necessary to put aside for such emergencies.

Another possible way for countries to insure against natural disasters is to sell or use government catastrophe (CAT) bonds. Borensztein et al. (2017) focus on governments issuing CAT bonds to pay for the effects if a natural disaster hit. The authors find that small countries who issue CAT bonds improve the welfare of the country compared to not issuing these bonds. The bonds result in improvement in welfare by smoothing out consumers incomes and consumption and allows the country to issue more default free debt (Borensztein et al., 2017).

Another seemingly simple yet effective strategy for disaster mitigation is to know whether the country is in a geographical location that is more prone to such disasters (Kahn, 2005). Governments can benefit from knowing if they are in a vulnerable location so that they can be prepared to face more of these events and make simple precautionary actions to mitigate the effects. A less common option, but a rising opportunity, lies in the hands of private insurance companies. As argued in the literature, a major expense for the government after disasters is to pay for damages (McAneney et al., 2015). A possible way to lessen this expense is to require citizens to have disaster insurance so that they are partially reimbursed for damages caused by these events. These are only a few ways that previous studies have found to help mitigate disasters' effects, but more research should be conducted to further understand and develop mitigation efforts.

APPENDICES

APPENDIX A – TABLE 1

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.050*			5.742			0.205		
	(0.027)			(9.541)			(8.875)		
(ln)Damage		-0.006			-4.965			2.258	
		(0.021)			(4.942)			(4.973)	
(ln)Affected			0.010			-7.410			0.793
			(0.014)			(4.555)			(8.943)
(ln)GDP per capita	-0.005	-0.034	-0.008	-20.562	-23.240	-44.521	-3.460	8.094	32.105*
	(0.052)	(0.055)	(0.075)	(17.594)	(16.955)	(29.841)	(10.859)	(10.750)	(16.548)
(ln)Population	0.081	0.087	0.061	35.143	23.558	76.720**	-14.543	-14.169	-6.713
	(0.068)	(0.064)	(0.051)	(43.114)	(39.132)	(36.784)	(25.370)	(20.432)	(44.203)
Trade	-0.000	-0.000	-0.000	0.063	0.087*	0.073	0.096**	0.040	0.026
	(0.000)	(0.000)	(0.000)	(0.046)	(0.048)	(0.063)	(0.045)	(0.040)	(0.055)
Fraction < 15	-0.000	-0.000	-0.001***	0.119	0.177	0.206	-0.135**	-0.061	-0.382***
	(0.000)	(0.000)	(0.000)	(0.128)	(0.123)	(0.125)	(0.064)	(0.109)	(0.128)
Fraction >65	0.000**	0.000**	0.000**	0.030	0.039	-0.009	0.006	0.005	0.059
	(0.000)	(0.000)	(0.000)	(0.043)	(0.053)	(0.029)	(0.060)	(0.058)	(0.085)
Observations	612	661	316	653	708	332	653	708	332
R-squared	0.115	0.114	0.256	0.056	0.053	0.130	0.052	0.059	0.151
Number of Countries	78	77	61	85	85	68	85	85	68
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX B – TABLE 2

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.051*			5.436			0.191		
	(0.027)			(9.527)			(8.890)		
(ln)Damage		-0.006			-4.931			2.260	
		(0.021)			(4.986)			(4.972)	
(ln) Affected			0.010			-7.135			1.168
			(0.014)			(4.538)			(8.892)
(ln)GD per capita	-0.006	-0.036	-0.010	-20.156	-22.905	-43.330	-3.442	8.113	33.734**
	(0.051)	(0.054)	(0.074)	(17.690)	(17.108)	(30.182)	(11.008)	(10.916)	(16.553)
(ln)Population	0.078	0.081	0.061	37.075	25.041	76.962**	-14.455	-14.082	-6.383
	(0.069)	(0.063)	(0.052)	(43.316)	(39.531)	(37.092)	(25.856)	(20.869)	(43.492)
Trade	-0.000	-0.000	-0.000	0.062	0.087*	0.072	0.096**	0.040	0.023
	(0.000)	(0.000)	(0.000)	(0.046)	(0.048)	(0.063)	(0.046)	(0.040)	(0.053)
Fraction <15	-0.000	-0.000	-0.001***	0.114	0.176	0.197	-0.135**	-0.061	-0.393***
	(0.000)	(0.000)	(0.000)	(0.128)	(0.123)	(0.129)	(0.065)	(0.109)	(0.132)
Fraction >65	0.000**	0.000**	0.000**	0.030	0.039	-0.010	0.006	0.005	0.058
	(0.000)	(0.000)	(0.000)	(0.044)	(0.053)	(0.028)	(0.060)	(0.058)	(0.085)
Gini	0.000	0.001	0.000	-0.282	-0.226	-0.231	-0.013	-0.013	-0.317
	(0.000)	(0.001)	(0.001)	(0.284)	(0.300)	(0.268)	(0.280)	(0.255)	(0.276)
Observations	612	661	316	653	708	332	653	708	332
R-squared	0.116	0.118	0.257	0.060	0.055	0.133	0.052	0.059	0.156
Countries	78	77	61	85	85	68	85	85	68
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX C – TABLE 3

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.050*			5.735			0.250		
	(0.027)			(9.556)			(8.760)		
(ln)Damage		-0.006			-4.951			2.070	
		(0.021)			(4.941)			(5.035)	
(ln)Affected			0.009			-7.435			1.836
			(0.014)			(4.538)			(8.715)
(ln)GDP per capita	-0.005	-0.034	-0.012	-20.409	-23.159	-44.601	-4.406	6.987	35.408**
	(0.051)	(0.055)	(0.076)	(17.490)	(16.936)	(30.036)	(10.827)	(10.967)	(16.290)
(ln)Population	0.081	0.086	0.068	35.557	23.706	76.882**	-17.090	-16.175	-13.368
	(0.068)	(0.064)	(0.054)	(42.910)	(39.166)	(36.252)	(24.839)	(20.680)	(42.250)
Trade	-0.000	-0.000	-0.000	0.062	0.086*	0.073	0.097**	0.047	0.033
	(0.000)	(0.000)	(0.000)	(0.046)	(0.048)	(0.064)	(0.045)	(0.037)	(0.053)
Fraction <15	-0.000	-0.000	-0.001***	0.117	0.176	0.205	-0.125**	-0.049	-0.345***
	(0.000)	(0.000)	(0.000)	(0.127)	(0.122)	(0.127)	(0.057)	(0.108)	(0.107)
Fraction >65	0.000**	0.000**	0.000**	0.029	0.039	-0.009	0.010	0.008	0.059
	(0.000)	(0.000)	(0.000)	(0.043)	(0.053)	(0.029)	(0.055)	(0.052)	(0.081)
Unemployment	0.000	0.000	-0.000	-0.019	-0.013	-0.005	0.117***	0.175***	0.224***
	(0.000)	(0.000)	(0.000)	(0.057)	(0.051)	(0.052)	(0.044)	(0.040)	(0.067)
Observations	612	661	316	653	708	332	653	708	332
R-squared	0.115	0.114	0.262	0.057	0.053	0.130	0.061	0.077	0.189
Countries	78	77	61	85	85	68	85	85	68
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX D – TABLE 4

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.051*			4.320			-0.283		
	(0.026)			(9.632)			(8.846)		
(ln)Damage		-0.006			-4.892			2.326	
		(0.021)			(4.996)			(4.962)	
(ln)Affected			0.010			-7.401			1.097
			(0.014)			(4.452)			(8.945)
(ln)GDP per capita	-0.005	-0.035	-0.014	-20.246	-23.135	-44.429	-3.352	8.191	35.494**
	(0.052)	(0.055)	(0.077)	(17.402)	(16.851)	(30.846)	(10.893)	(10.742)	(16.179)
(ln)Population	0.080	0.082	0.069	38.082	25.170	76.575**	-13.536	-12.660	-12.125
	(0.069)	(0.066)	(0.049)	(43.025)	(38.770)	(34.347)	(26.425)	(21.043)	(44.707)
Trade	-0.000	-0.000	-0.000	0.066	0.088*	0.074	0.097**	0.041	0.035
	(0.000)	(0.000)	(0.000)	(0.045)	(0.048)	(0.067)	(0.045)	(0.040)	(0.053)
Fraction<15	-0.000	-0.000	-0.001***	0.105	0.139	0.204	-0.140**	-0.097	-0.430***
	(0.000)	(0.000)	(0.000)	(0.125)	(0.116)	(0.130)	(0.066)	(0.100)	(0.140)
Fraction>65	0.000**	0.000**	0.000**	0.025	0.035	-0.009	0.004	0.001	0.062
	(0.000)	(0.000)	(0.000)	(0.042)	(0.051)	(0.028)	(0.061)	(0.059)	(0.087)
Urban Population	0.000	0.000*	0.001	-0.199	-0.182*	-0.012	-0.068	-0.171**	-0.433*
	(0.000)	(0.000)	(0.001)	(0.125)	(0.098)	(0.324)	(0.060)	(0.074)	(0.253)
Observations	612	661	316	653	708	332	653	708	332
R-squared	0.115	0.119	0.259	0.063	0.059	0.130	0.053	0.064	0.161
Countries	78	77	61	85	85	68	85	85	68
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX E – TABLE 5

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.049*			4.953			0.428		
	(0.026)			(9.079)			(8.879)		
(ln)Damage		-0.007			-6.258			2.927	
		(0.021)			(4.898)			(4.933)	
(ln)Affected			0.010			-7.729*			0.580
			(0.014)			(4.570)			(8.920)
(ln)GDP per capita	-0.004	-0.033	-0.008	-20.073	-21.513	-45.396	-3.599	7.200	31.523*
	(0.051)	(0.054)	(0.075)	(17.412)	(17.024)	(29.603)	(10.765)	(10.502)	(16.135)
(ln)Population	0.082	0.086	0.061	35.472	23.177	75.880**	-14.636	-13.971	-7.271
	(0.068)	(0.063)	(0.051)	(42.935)	(39.190)	(36.487)	(25.602)	(20.676)	(44.935)
Trade	-0.000	-0.000	-0.000	0.055	0.070	0.084	0.098**	0.049	0.033
	(0.000)	(0.000)	(0.000)	(0.047)	(0.048)	(0.063)	(0.045)	(0.040)	(0.054)
Fraction<15	-0.000	-0.001	-0.001***	0.098	0.146	0.207	-0.129*	-0.045	-0.381***
	(0.000)	(0.000)	(0.000)	(0.124)	(0.120)	(0.126)	(0.066)	(0.111)	(0.130)
Fraction>65	0.000**	0.000**	0.000**	0.031	0.040	-0.002	0.005	0.005	0.064
	(0.000)	(0.000)	(0.000)	(0.044)	(0.054)	(0.030)	(0.059)	(0.058)	(0.085)
Corruption	-0.000	-0.000	-0.000	-0.600	-0.750	0.373	0.169	0.388*	0.248
	(0.001)	(0.001)	(0.001)	(0.474)	(0.477)	(0.260)	(0.222)	(0.205)	(0.388)
Observations	612	661	316	653	708	332	653	708	332
R-squared	0.116	0.115	0.257	0.074	0.079	0.138	0.054	0.066	0.154
Countries	78	77	61	85	85	68	85	85	68
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX F – TABLE 6

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.049*			5.352			0.266		
	(0.026)			(9.291)			(8.893)		
(ln)Damage		-0.007			-6.393			2.519	
		(0.021)			(4.714)			(4.911)	
(ln)Affected			0.016			-9.121*			0.940
			(0.016)			(4.887)			(9.170)
(ln)GDP per capita	-0.004	-0.035	-0.007	-20.950	-24.700	-44.791	-3.400	8.360	32.128*
	(0.051)	(0.054)	(0.075)	(17.600)	(17.232)	(29.532)	(10.842)	(10.712)	(16.487)
(ln)Population	0.081	0.087	0.057	35.242	24.724	77.465**	-14.559	-14.382	-6.777
	(0.067)	(0.063)	(0.050)	(43.099)	(38.735)	(36.192)	(25.639)	(20.610)	(44.134)
Trade	-0.000	-0.000	-0.000	0.056	0.075	0.080	0.097**	0.042	0.025
	(0.000)	(0.000)	(0.000)	(0.046)	(0.046)	(0.063)	(0.045)	(0.040)	(0.055)
Fraction<15	-0.000	-0.001	-0.001***	0.110	0.154	0.172	-0.134**	-0.057	-0.379***
	(0.000)	(0.000)	(0.000)	(0.122)	(0.113)	(0.137)	(0.064)	(0.111)	(0.129)
Fraction>65	0.000**	0.000**	0.000**	0.037	0.052	-0.007	0.005	0.003	0.059
	(0.000)	(0.000)	(0.000)	(0.043)	(0.054)	(0.031)	(0.059)	(0.057)	(0.086)
Effectiveness	-0.001	-0.001	-0.001	-0.418	-0.743*	0.413	0.065	0.136	-0.035
	(0.001)	(0.001)	(0.001)	(0.404)	(0.383)	(0.257)	(0.220)	(0.203)	(0.370)
Observations	612	661	316	653	708	332	653	708	332
R-squared	0.119	0.116	0.266	0.067	0.085	0.141	0.053	0.060	0.151
Countries	78	77	61	85	85	68	85	85	68
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX G – Table 7

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.049*			5.269			0.341		
	(0.026)			(9.227)			(8.960)		
(ln)Damage		-0.006			-5.294			2.338	
		(0.021)			(4.928)			(4.987)	
(ln)Affected			0.010			-7.405			0.795
			(0.014)			(4.556)			(8.914)
(ln)GDP per capita	-0.003	-0.033	-0.008	-19.077	-21.083	-45.424	-3.887	7.566	31.571*
	(0.051)	(0.055)	(0.075)	(17.591)	(16.983)	(29.579)	(10.828)	(10.748)	(16.312)
(ln)Population	0.083	0.087	0.062	37.148	24.868	75.720**	-15.119	-14.489	-7.304
	(0.067)	(0.063)	(0.051)	(42.235)	(38.311)	(36.616)	(25.914)	(20.942)	(44.909)
Trade	-0.000	-0.000	-0.000	0.057	0.075	0.077	0.098**	0.043	0.028
	(0.000)	(0.000)	(0.000)	(0.046)	(0.048)	(0.063)	(0.045)	(0.040)	(0.055)
Fraction <15	-0.000	-0.000	-0.001***	0.121	0.176	0.181	-0.136**	-0.061	-0.396***
	(0.000)	(0.000)	(0.000)	(0.125)	(0.116)	(0.128)	(0.064)	(0.110)	(0.132)
Fraction >65	0.000**	0.000**	0.000**	0.035	0.045	-0.007	0.004	0.004	0.061
	(0.000)	(0.000)	(0.000)	(0.042)	(0.052)	(0.030)	(0.059)	(0.058)	(0.085)
Stability	-0.000	-0.000	-0.000	-0.320	-0.470	0.198	0.092	0.115	0.117
	(0.000)	(0.000)	(0.000)	(0.296)	(0.292)	(0.125)	(0.133)	(0.126)	(0.198)
Observations	612	661	316	653	708	332	653	708	332
R-squared	0.116	0.115	0.257	0.069	0.079	0.136	0.053	0.060	0.153
Countries	78	77	61	85	85	68	85	85	68
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX H – TABLE 8

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
Lagged(ln)DEATH	0.047*			3.418			14.366		
	(0.025)			(7.433)			(11.868)		
Lagged(ln)DAM		0.002			-6.814			11.571*	
		(0.015)			(6.398)			(6.939)	
Lagged(ln)Affected			0.026*			5.489			15.711*
			(0.014)			(7.153)			(8.688)
(ln)GDP per capita	-0.052	-0.019	-0.117	-43.490**	-44.873**	-25.993	8.641	10.701	-11.366
	(0.061)	(0.050)	(0.074)	(21.095)	(17.989)	(36.631)	(15.482)	(13.736)	(22.747)
(ln)Population	0.072	0.065	0.081	34.703	52.253	67.385	-64.170***	-36.864**	-87.076***
	(0.071)	(0.052)	(0.053)	(36.115)	(38.216)	(65.366)	(19.765)	(17.353)	(15.324)
Trade	-0.000	-0.000*	-0.000**	0.033	0.054	0.055	0.032	0.081*	0.084
	(0.000)	(0.000)	(0.000)	(0.044)	(0.053)	(0.077)	(0.051)	(0.042)	(0.066)
Fraction<15	-0.001***	-0.001***	-0.001***	0.070	0.108	0.055	-0.111	-0.185*	-0.113
	(0.000)	(0.000)	(0.000)	(0.097)	(0.121)	(0.136)	(0.095)	(0.094)	(0.125)
Fraction>65	0.000**	0.000***	0.000**	0.085	0.041	-0.015	0.014	0.013	0.035
	(0.000)	(0.000)	(0.000)	(0.067)	(0.053)	(0.038)	(0.062)	(0.062)	(0.080)
Observations	564	604	291	601	646	304	601	646	304
R-squared	0.106	0.108	0.208	0.071	0.078	0.100	0.079	0.085	0.119
Countries	76	76	60	83	84	66	83	84	66
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX I – TABLE 9

Variables	(1) GOVSIZE	(2) GOVSIZE	(3) GOVSIZE	(4) GOVCONS	(5) GOVCONS	(6) GOVCONS	(7) GOVCONGR	(8) GOVCONGR	(9) GOVCONGR
(ln)Death	0.055			-8.828			11.877		
	(0.076)			(10.393)			(25.375)		
(ln)Damage		-0.038			7.042			-7.005	
		(0.048)			(12.158)			(17.503)	
(ln)Affected			0.075**			-58.404			-89.538***
			(0.028)			(44.929)			(22.343)
(ln)GDP per capita	-0.175**	-0.376***	1.122***	-60.361**	-22.881	-328.208	39.460*	71.968	12.350
	(0.072)	(0.065)	(0.270)	(23.972)	(25.892)	(311.425)	(21.760)	(56.537)	(278.007)
(ln)Population	-0.035	0.438**	-0.387***	273.486***	287.103***	253.242**	-0.705	10.671	68.821
	(0.082)	(0.157)	(0.100)	(30.591)	(34.890)	(102.486)	(22.377)	(32.080)	(84.130)
Trade	-0.000	0.000	-0.001***	0.076	0.066	0.343	-0.096	0.006	0.189
	(0.000)	(0.000)	(0.000)	(0.123)	(0.088)	(0.251)	(0.108)	(0.145)	(0.267)
Fraction <15	0.000	0.000	0.007**	0.060	0.278	0.739	-0.472***	-0.498***	-0.198
	(0.000)	(0.001)	(0.002)	(0.176)	(0.195)	(1.358)	(0.112)	(0.148)	(1.447)
Fraction >65	-0.000	-0.001*	0.007***	0.172	-0.011	-2.964	-0.003	-0.041	-5.216**
	(0.000)	(0.001)	(0.002)	(0.131)	(0.096)	(2.796)	(0.090)	(0.088)	(2.096)
Observations	103	104	40	106	108	41	106	108	41
R-squared	0.289	0.363	0.825	0.484	0.578	0.775	0.185	0.164	0.749
Countries	14	14	11	15	16	12	15	16	12
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX J – TABLE 10

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	GOVSIZE	GOVSIZE	GOVSIZE	GOVCONS	GOVCONS	GOVCONS	GOVCONGR	GOVCONGR	GOVCONGR
(ln)Death	0.071**			4.783			-1.427		
	(0.032)			(11.398)			(11.077)		
(ln)Damage		0.001			-6.086			3.103	
		(0.024)			(5.661)			(5.279)	
(ln)Affected			0.017			-7.387			1.622
			(0.019)			(4.699)			(9.976)
(ln)GDP per capita	0.018	-0.018	-0.016	-18.289	-20.521	-39.656	-8.521	3.997	24.686
	(0.051)	(0.054)	(0.075)	(18.755)	(18.037)	(30.260)	(10.069)	(10.223)	(15.406)
(ln)Population	0.087	0.033	0.093	-32.299	-34.686	26.761	-24.526	-18.443	9.357
	(0.080)	(0.056)	(0.066)	(22.058)	(22.534)	(25.947)	(29.434)	(25.107)	(70.600)
Trade	-0.000	-0.000	-0.000	0.062	0.080	0.021	0.142***	0.071	0.051
	(0.000)	(0.000)	(0.000)	(0.044)	(0.052)	(0.067)	(0.053)	(0.046)	(0.061)
Fraction <15	-0.000*	-0.001**	-0.001	0.149	0.168	0.295	-0.084	-0.021	-0.470*
	(0.000)	(0.000)	(0.001)	(0.128)	(0.111)	(0.234)	(0.103)	(0.106)	(0.280)
Fraction >65	0.000***	0.000***	0.000**	-0.014	-0.012	-0.006	-0.004	-0.011	0.073
	(0.000)	(0.000)	(0.000)	(0.030)	(0.031)	(0.026)	(0.065)	(0.062)	(0.087)
Observations	509	557	276	547	600	291	547	600	291
R-squared	0.160	0.149	0.267	0.075	0.057	0.114	0.072	0.089	0.169
Countries	66	65	51	72	71	57	72	71	57
Country Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *Significant at 10%, ** significant at 5%, *** significant at 1%
Robust Standard errors in parentheses

APPENDIX J – TABLE 11

Variable	Obs	Mean	Std. Dev.
GOVSIZE	1811	6.611	1.435
(ln)Death	653	3.218	1.717
(ln)Damage	708	10.029	2.906
(ln)Affected	332	11.248	2.774
(ln)GDP per capita	2396	6.16	2.057
(ln)Population	2396	6.763	1.048
Trade (%)	2396	83.947	60.944
Fraction < 15 (%)	2396	79.255	57.049
Fraction > 65 (%)	2396	66.3394	41.909

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