Moral Hazard and the NFIP's Efforts to Reduce Repetitive Loss Property Claims

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Abstract

The continued coverage of repetitive loss properties by the National Flood Insurance Program (NFIP) is indicative of moral hazard presence, since the program is incentivizing the risky behavior of living in a dangerous floodplain. If additional implemented policy changes the behavior of the policyholder in such a way that results in increased costs for the NFIP, the moral hazard issue is further exacerbated. The centerpiece of the Flood Insurance Reform Act of 2004 was the installation of the Repetitive Flood Claims and Severe Repetitive Loss Programs which aimed at eliminating repetitive loss properties and their associated claim value. In this paper, I find evidence to suggest that additional funds paid to a state from these grant programs in a year are associated with an increase in the value of repetitive loss property claims in that state the following year; this suggests that this policy accentuated the issue of moral hazard and limited risk reduction in the short run, while its purpose was to do the opposite.

JEL Classification: G22, Q54, Q58

Keywords: Moral Hazard, Flood Insurance

1. Introduction

Flooding and flood-related natural disasters are the most prominent and significant natural hazards in the United States, accounting for the greatest proportion of major disaster declarations and economic losses (Starbuck 2016). In 1968, the National Flood Insurance Program (NFIP) was created in response to the trend of building structures in flood-prone areas and the increasing cost of damages caused by floods. The NFIP is the main provider of flood insurance to homeowners and business and consists of three main elements: flood hazard identification and risk assessment, floodplain management (i.e., land use controls and building codes), and flood insurance (Cleetus 2014). Although the NFIP has remained fiscally solvent for the most part throughout history, the recent hurricane seasons of 2004, 2005, 2008, and 2012 caused catastrophic losses resulting in a billions dollars of debt that is unlikely to be paid back to US Treasury in the foreseeable future. This is not only due to policymakers failures to structure the program for catastrophic losses, but also due to elements of the program that limit risk reduction.

Such elements include providing highly subsidized flood insurance rates as well as permitting repetitive loss property claims. Although the majority of flood insurance policies are based on full-risk rates, about 20 percent of policies are based on grandfathered insurance rates and pay as low as 45 percent of the full-risk premium needed to fund the long-term expectation of loss (Hayes 2011). Moreover, NFIP policies specifically prevent FEMA from refusing coverage to any policyholder, and FEMA cannot force property owners to mitigate losses or impose actuarial rates on repetitive loss properties as a penalty.

These subsidized rates and allowance of repetitive loss have unintendedly encouraged policyholders to live in dangerous flood-prone areas, accentuating a problem defined as moral hazard. An issue of moral hazard is present if the NFIP encourages risky behavior by creating incentives for people to live in these vulnerable flood-plains.

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Unless there are incentives to mitigate against future flood disasters or to move out of these dangerous areas, moral hazard is present. The centerpiece of the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (FIRA 2004) was the Repetitive Loss Claims Program (RFC Program) and the Severe Repetitive Loss Program (SRL Program), which were created with a goal to reduce the number of and vulnerability of repetitive loss properties.

I find evidence that additional grant mitigation funding from the RFC and SRL Programs are associated with an increase in the value of repetitive loss property insurance claims paid and the value of severe repetitive loss insurance claims paid the following year. The consistency of this result across my models and analysis provides an implication that the RFC and SRL Programs accentuated the moral hazard problem. This suggests that these policies, which were designed to limit risk, may actually be prolonging or even increasing risk in the short run.

Since I do not study individual actions and tendencies in my analysis, only implications of moral hazard can be made. Moral hazard could be arising due to the policyholders mitigating less causing greater repetitive loss claim value after they are aware that these grants will provide the funds to mitigate. Furthermore, repetitive loss properties could be increasing at a faster rate and/or decreasing at a slower rate as a result of these availability of these funds, therefore increasing the moral hazard issue.

2. Background

Flooding and National Flood Insurance Program (NFIP)

Floods were number one in terms of number of lives lost and property damage during the 20th century in the United States (Perry 2000). Almost 90% of all presidential disaster declarations include a flooding component, and flooding caused by coastal storms, such as hurricanes and tsunamis, are projected to increase in severity and frequency over the coming decades due to climate change and trends (King 2011, IPCC 2012). The increase of both population density and the economy in coastal areas provides evidence that the US flooding problem has even greater potential to become a more severe problem. The thirty coastal states comprise of slightly over half of the U.S. land area, but more than 80% of the population and economy. Within the coastal states, the coastal zone counties account for nearly half the US GDP. It is estimated that the cumulative expected exposure of the U.S. government to natural disasters over the next 75 years could reach $7 trillion (Kildow 2016).

Prior to the National Flood Insurance Act of 1968, which authorized the creation of the National Flood Insurance Program (NFIP), there was no regulation on a standardized management procedure or strategy in the US. Furthermore, flood insurance was, and still is today, not widely available in the private sector mainly due to adverse selection and lack of marketability (cost to policyholder).

The creation of the NFIP stemmed from recommendations on a study by the Housing and Urban Development that evaluated the feasibility of different methods for providing assistance to those suffering property losses in floods, and other natural disasters. The study was conducted due to a provision in the Southeast Hurricane Disaster Relief Act of 1965. This provision was added primarily because of Hurricane Betsy in 1965 that followed the Great Flood of 1951, Hurricane Carla in 1962, and various flooding disasters that occurred in years prior (King 2005). Hurricane Betsy was the first natural disaster to result in over a billion dollars in damages, and there was not a flood insurance program in place at the time. Homeowners who were affected could apply for disaster loans, but there was no guarantee of federal support (Holladay 2010).

Overall, the NFIP was created in response to the trend of development in flood-prone areas, the increasing damages caused by floods, and rising cost of taxpayer funded disaster relief for flood victims (Jenkins 2004). The program's main functions are underwriting and providing affordable flood insurance, and leading floodplain management. Coverage is available to consumers with a federally insured mortgage in communities that have implemented floodplain management strategies (King, 2011). Communities that have a greater than 1% chance of flood occurrence in a given year are eligible to participate in this program and must implement floodplain management strategies. The purchase of flood insurance is then mandatory in these eligible communities (Department of the Treasury, 2013). Federal flood insurance is currently offered to homeowner, renters, and business owners in over 20,000 participating communities that adopt and enforce floodplain management regulations which conform to NFIP standards (King 2005). Due to the high subsidies on older structures, additional federal funding programs, and continued coverage of repetitive loss properties, the NFIP could be encouraging floodplain development and increasing the presence of moral hazard (Platt 1976, Starbuck 2016).

The NFIP involves a partnership among FEMA specialists, insurance agents and claims adjusters, private insurance companies, floodplain managers, and other public officials, lenders, and real estate agents. The federal government assumes liability for the insurance coverage, sets the insurance rates, coverage limitations, and eligibility requirements. FEMA additionally designates special flood hazard areas with the issuance of flood insurance rate maps (FIRMs), and provides grant funding for mitigation planning activities. The private insurance sector sells insurance, adjusts and pays claims, and performs planning studies. The states coordinate the program and provide assistance to local participating communities. Lastly, local communities adopt, administer, and enforce the floodplain development regulations set by FEMA (King 2005).

The NFIP is one of the nation's largest domestic liabilities as it does not operate on the traditional insurance definition of fiscal solvency. Rather, it operates under a statutory mandate that premiums on pre-FIRM structures must be reasonable and be subsidized if necessary. The subsidy is provided via discounted premium rates from full actuarial rates. NFIP has established a methodology consisting of a target level of premium income is at least sufficient to cover expenses and losses relative to the calculated average historical loss year in order to make up the subsidized premium shortfall. The premium level generated to cover the average historical loss year must accommodate all of the NFIP business, including that which is highly subsidized. The NFIP has authority to borrow up to $1.5 billion from the U.S. Treasury to cover losses in the situatuion that premium and investment income are inadequate, but borrowed funds must be repaid with interest (King 2005).

Due to the severity of Hurricane Katrina and the subsequent demand on the NFIP it now has a deficit of over $20 billion. The way the program is currently structured it will seemingly never be able to pay back this debt. Congress has set statutory limits on the insurance rates so the program in unable to build reserve funds that would cover demand during years with catastrophic events (Holladay 2010). The NFIP also does not increase rates for properties that have been flooded more than one time (Cleetus 2014).

The Congressional Research Service (CRS) which provides policy and legal analysis to committees and Members of both the House and Senate as well as the General Accounting Office (GAO) which provides auditing and evaluation services for Congress has published reports on the status and challenges of the program. A majority of these assessment reports identify many of challenges and shortfalls of the NFIP that affect financial solvency, which include premium discounts/subsidies, repetitive loss properties, participation rates, flood hazard mapping, and investment in risk reduction (moral hazard problem) (Jenkin 2004, King 2005, King 2011, Hayes 2011, King 2013).

The main issue with repetitive loss properties (RLP) is that the vast majority of them are older, and as a result were "grandfathered" into the NFIP when the program was created. These properties have been repaired multiple times with subsidized flood insurance claim payments and policyholders pay much less than the full actuarial risk rates (King 2011, King 2005).

Repetitive Loss Properties (RLPs) and Severe Repetitive Loss Properties (SRLs)

A Repetitive Loss Property (RLPs) is defined by FEMA as a one that has two or more claim payments of over $1,000 each, in any ten year period (FEMA, 2012). A Severe Repetitive Loss Property (SRLP) is defined as one that has received four or more claim payments of over $5,000 each, two of which that have occurred in any ten year period, or at least two payments with the cumulative amount exceeding the market value of the property.

Repetitive loss properties account for a disproportionate amount of annual NFIP claims. About 1 percent of the insured properties are considered to be repetitive loss, yet about 38 percent of all program claim payment value have been the result of these properties, costing the NFIP nearly $5 billion since 1978 (Jenkeins 2004).

As expected, these properties are mainly concentrated in high-risk coastal and river area. Approximately 43% of insured RLPs, and 59% of insured SRLs are located in Florida, Louisiana, and Texas (Jenkins 2004). On average the addition of new RLPs are outpacing FEMA mitigation efforts by a factor of 10 to 1. Over the past two decades, the number of insured properties annually incurring second flood losses has increased by 68% and it is estimated that it would cost approximately $1.8 billion to mitigate through acquisition the current population of severe repetitive loss properties. FEMA estimates that 90% of RLPs were built prior to 1975, or before the adoption of FIRMs that properly reflect the probability of flooding in special flood hazard areas (Skinner 2009).

Bunning - Bereuter - Blumenauer Flood Insurance Reform Act of 2004 (FIRA 2004)

Enacted on June 30, 2004, FIRA 2004's goal was to reduce or eliminate future losses to properties in the NFIP. The centerpiece of the act revolved around reducing repetitive loss properties and associated claims. The act doubled the authorization for the Flood Mitigation Assistance grant program, which had been primarily used for RLPs as well as created grant programs specifically for RLPs and SRLs (FEMA 2014).

The purpose of the Repetitive Flood Claims Grant Program (RFC Program) was to "help states and communities reduce flood damages to insured properties that have had one or more claims to the National Flood Insurance Program" (FEMA 2009). This program was authorized $10 million a year from 2006 – 2010 and does not require any local cost share in contrast to the other FEMA grant mitigation programs (Robinson 2008). States and local governments (applicants and sub-applicants, respectively) may apply to receive different amounts of money based on their needs and amounts are awarded on a competitive basis. RFC funds are available to retrofit individual properties insured under the NFIP that have had one or more claim payments.

The purpose of the Severe Repetitive Loss Grant Program (SRL Program) was to "reduce or eliminate claims under the NFIP through project activities that will result in the greatest savings to the NFIP in the shortest period of time". This grant program authorized $40 million in 2006 and 2007, and $80 million in 2008 and 2009 (FEMA 2009). SRL funds can be applied to residential structures insured under the NFIP that are qualified as a severe repetitive loss structure. The SRL Program targeted 17 states, each of which contains at least 51 SRLs. These states include Connecticut, Massachusetts, New Jersey, New York, Pennsylvania, Virginia, Alabama, Florida, Kentucky, Mississippi, North Carolina, Illinois, Louisiana, Oklahoma, Texas, Missouri, and California. This targeted group is allocated 90% of the SRL Program fund based on SRLs and need. The remaining 10% is set-aside for all states and awarded on a competitive application basis (FEMA 2009).

Mitigation projects that are eligible under the RFC and SRL Programs include property acquisition, structure demolition for purposes of open space, property structure relocation, structure elevation, and dry floodproofing of historic residential structures. The RFC Program can additionally provide dry floodproofing of non-residential structures, and the SRL Program can additionally complete localized flood reduction projects and mitigation reconstruction (Robinson 2008).

The additional mitigation funding added in FIRA 2004 should, in theory, decrease the total value of claims paid by the NFIP, thus reducing their costs from these repetitive properties. Note that although the above amounts were authorized for each program, the Administration's budget request for FY2006 did not include funding and legislation to appropriate the funds was pending. FEMA officials noted the holdup was due to the delay in receiving Congressional funding, which seemingly was approved for 2007, and the challenge of developing rules and guidance (King 2006). According to the data, payouts from these funds did not begin until 2008, possibly due to the application process.

The mitigation process occurs when FEMA has awarded the grant to the state and the state awards the subgrant to the local government. A formal offer of mitigation is extended from the local government to the property owner, who has been made aware that his/her property is repetitive loss property with these funds available through communication and application of the local government (often the Office of Community Development) (FEMA 2008).

Other FEMA Mitigation Grant Programs

Hazard Mitigation Grant Program (HMGP) - This mitigation fund, considered a "disaster fund", was authorized under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) signed into law November 23, 1988. It is activated immediately after a presidential disaster declaration, and provides funds on a sliding scale formula based on a percentage of the total federal assistance for a disaster for long-term mitigation measures to reduce vulnerability to natural hazards (Robinson 2008).

Pre-Disaster Mitigation (PDM and LPDM) - This mitigation fund authorized Congress by the Disaster Mitigation Act of 2000 in order to amend the Stafford Act. This fund is designed to assist States, U.S. Territories, Federally-recognized tribes, and local communities in implementing a sustained pre-disaster natural hazard mitigation program. The goal is "to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding in future disasters" (FEMA 2016a). This grant program has both a competitive fund as well as a legislative aspect. The competitive fund is given on a competitive basis and encourages planning and mitigation measures before disaster strikes so that overall risks to people and property are reduced while also limiting the need for federal funding following the declaration of catastrophic event. The Legislative Pre-Disaster Mitigation (LPDM) differs from the competitive PDM fund in that it is based on state appropriations (McCarthy and Keegan 2009). Based on FEMA data, PDM funds were first administered in 2001 and LPDM funds were first granted in 2008.

Flood Mitigation Assistance (FMA) - The FMA grant program was created as part of the National Flood Insurance Reform Act of 1994 with the goal of reducing or eliminating claims under the NFIP. An allocation is provided to each state based on the total number of NFIP insurance policies and the total number of repetitive loss properties within the state, as a priority of program was to reduce the number of repetitive losses to insured structures. It is given on a competitive basis process with consideration of determined allocation. Fund payments were first made in 1997 based on FEMA data (Robinson 2008, FEMA 2016b).

Literature Review

Literature on the presence of moral hazard is abundant; however, most research and exploration is done in only two insurance markets: the automobile industry and healthcare market (Lee 2013, Dionne et al. 2005, Winkleman 2004, Chiappori Durand and Geoffard 1998). In my research, Hudson, Botzen, Czajkowski, and Kreibich (2017) were the first to publish a peer-reviewed academic paper regarding moral hazard and flood insurance market in the United States. Hudson, Botzen, et al. studied the relationship between disaster risk reduction and insurance coverage to assess the presence of moral hazard for two different natural disaster events, using econometric probit models on survey data prior to catastrophic events in Germany and the United States. The results showed that there was no significant negative relationship between insurance coverage and risk reduction, i.e. individuals with insurance did not significantly reduce mitigation efforts based on their analysis. Thus, it was concluded moral hazard is absent in both countries, but was noted that adverse risk selection may be present.

Prior to that, McGee (2014) with the sponsorship of O'Hara, in an honor undergraduate thesis, tests the effect of the Flood Insurance Reform Acts of 1994 and 2004 on NFIP policies in force, the number of claims the program pays, and the value of these claims. Using US aggregate data, McGee conducted multivariate regression models with policies in force, number of claims, and value of claims as the dependent variables. McGee finds evidence to suggest that the FIRA 1994 was associated with an increase in the number of claims paid by the NFIP and that the FIRA 2004 and its grant programs were successful in reducing the value of claims paid by the NFIP and the number of policies in force, respectively. It is then concluded that, when taken together, that the FIRA 1994 did not reduce the moral hazard problem, while FIRA 2004 and the associated grants did reduce the moral hazard problem.

However, McGee (2014) only uses dummy variables and interaction terms to capture to effect of FIRA 1994, FIRA 2004, and the grant programs. Additionally, the centerpiece of FIRA 2004 were the grant programs which began providing fund payments in 2008 according to the FEMA payments. It is unclear from her analysis what drives the 2004 Act significance, as the grant programs were the centerpiece of FIRA 2004. From my research, I would mainly contribute her significant finding for FIRA 2004 to be possibly due to the doubling of Congressional funding to the Flood Mitigation Assistance (FMA) program, among other smaller changes to the NFIP and its structure. Furthermore, the grant programs interaction term is represented for years 2006 and on. Although these funds received congressional appropriations in 2006, the FEMA data on these funds displays that the first project paid for from this fund was approved in 2008.

Moreover, Kevin T. Starbuck wrote a Naval Postgraduate School masters thesis, titled "Moral Hazard: How the National Flood Insurance Program Is Limiting Risk Reduction" in December 2016. His thesis consists of a case study analysis that is described as "a qualitative exploratory theory-building analysis of how the NFIP has contributed to limiting risk reduction behavior and given rise to a moral hazard.” He finds that aspects of the NFIP limit risk reduction, specifically and stating that “NFIP policies that support continued coverage of repetitive loss” are key drivers of this problem, as they “impact the sustainability and resilience of the program.” He notes that his findings have “important consequences for the broader domain of evaluating the unintended consequences of federal involvement in providing disaster assistance.” Further he concludes that “while there is an imperative for the government to provide assistance in time of crisis, it is important to evaluate the how that assistance may change behavior; policies designed to limit risk may be actually prolong or increase risk.”

I build on McGee’s 2014 work, given additional data received from FEMA on RLP and SRLP claim values by state, as well as mitigation grant program funds paid by FEMA for each state. I am able to evaluate the effect that an increase in mitigation grant funds paid had on the RLP claim values. By doing so, I am able to suggest what these outcomes mean in terms of an indication of the moral hazard presence among these properties. My analysis adds a quantitative component to Starbuck’s statements regarding federal assistance and policies that may change behavior, and unintendedly increase risk. Indications of moral hazard at the policyholder level should to be considered in conjunction with Starbuck’s (2016) analysis as well as additional research regarding moral hazard theory and access to federal funding as described by R.O. King in CRS reports on the NFIP.

Methodology and Data

In order to test the effectiveness of the SRL and RFC Program and assess the potential impact on the presence of moral hazard, I use the value of repetitive loss insurance claims paid and the value of residential severe repetitive loss insurance claims paid as my dependent variables. If these NFIP mitigation grant programs provide incentives for policyholders of these properties to mitigate less or to maintain (or increase) the value of their property, these policies are further encouraging risky behavior which accentuates the moral hazard problem. Furthermore, if these policies encourage less people to migrate away from these dangerous floodplain areas or encourage more people to move to these areas, the moral hazard issue is exacerbated.

All variables have one value for each state per year for time $t = 1996 - 2013$. In determining the effect of these programs, I control for additional grant mitigation funding, property damages caused by natural disasters, and the number of county-declared flood related disasters (since the NFIP only provides flood insurance and pays claims for flood damage). These independent variables used for my regression analysis models include those utilized by McGee (2014). Since the different grant mitigation funds began funding states in different years, zero values were added before funding began and for states that did not receive any funding. For additional information see the Data Appendix.

Figure 1 is a graph of the value of RL claims paid by the NFIP from 1995 to 2013. The extreme spike in 2005 is mainly due to Hurricane Katrina, while the spikes in 2008 and 2012 are partly due to Hurricane Ike and Hurricane Sandy, respectively. Figure 2 is a graph of the value of SRL claims paid by the NFIP from 1995 to 2013. The trend seen is nearly identical to that of the value of RL claims paid. The amount, however, differs by being approximately one fifth of the value of RL claims paid. Figure 3 shows the fluctuations in the number of county-declared flood related events over time. Figure 4 displays the amount of property damage due to natural disasters over the time horizon studied.

Figure 1

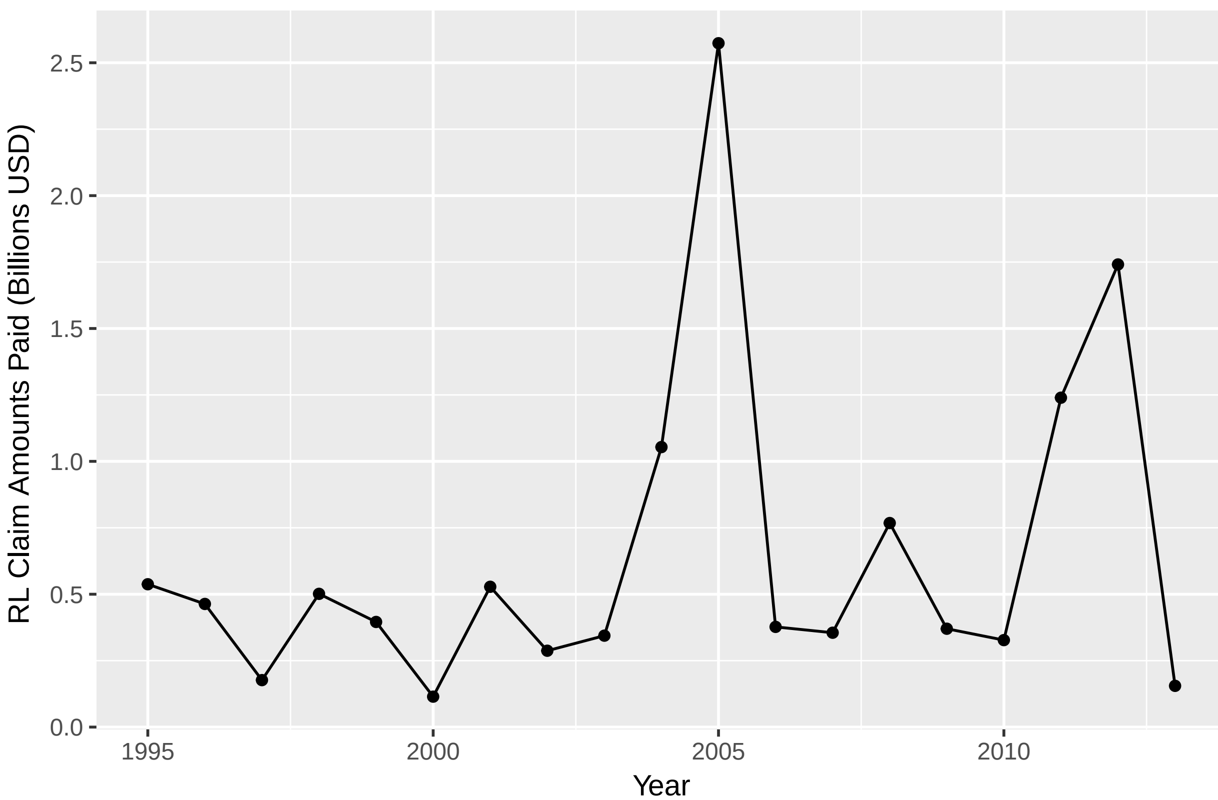


Figure 2

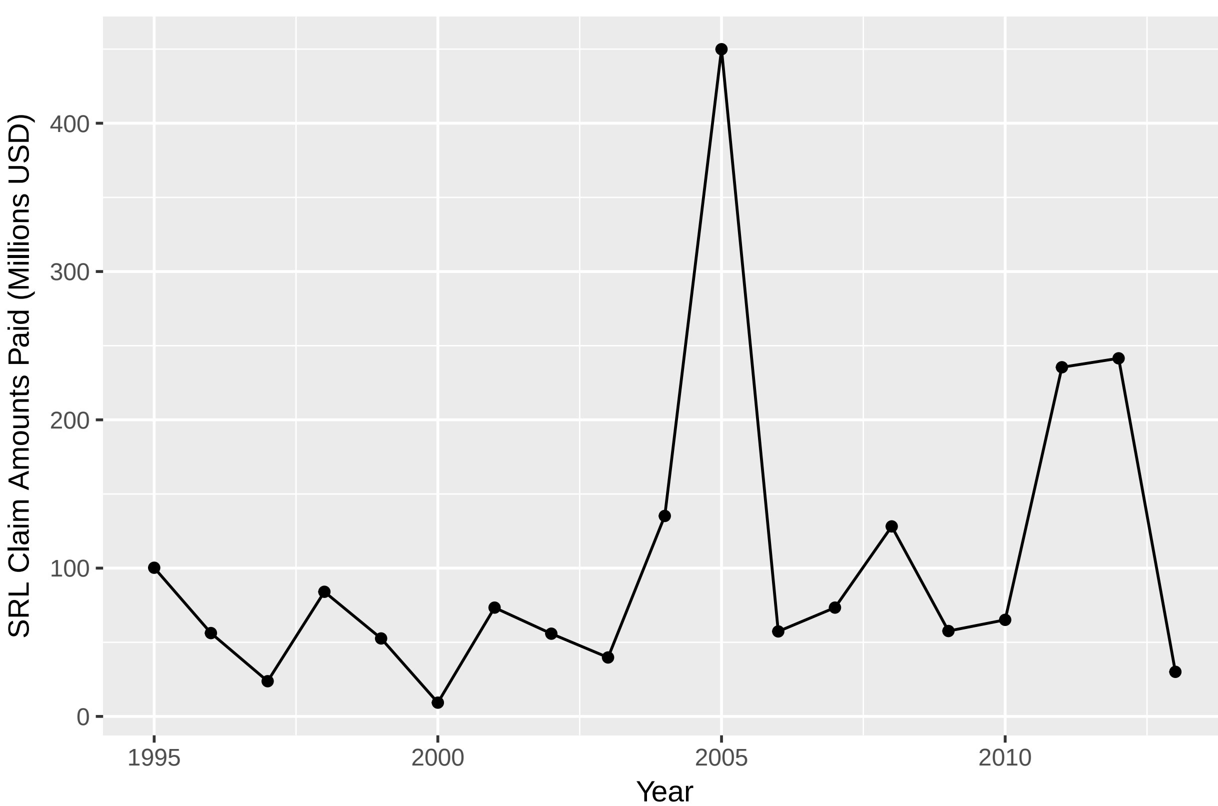


Figure 3

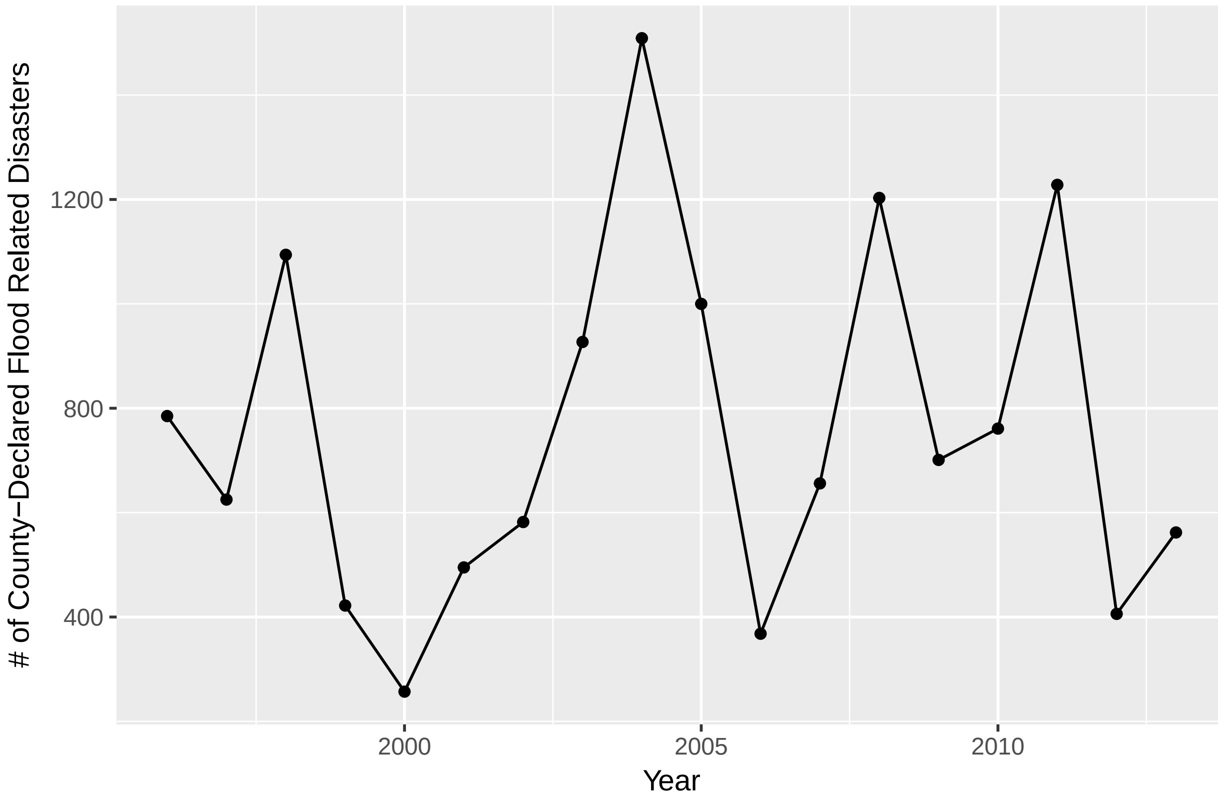
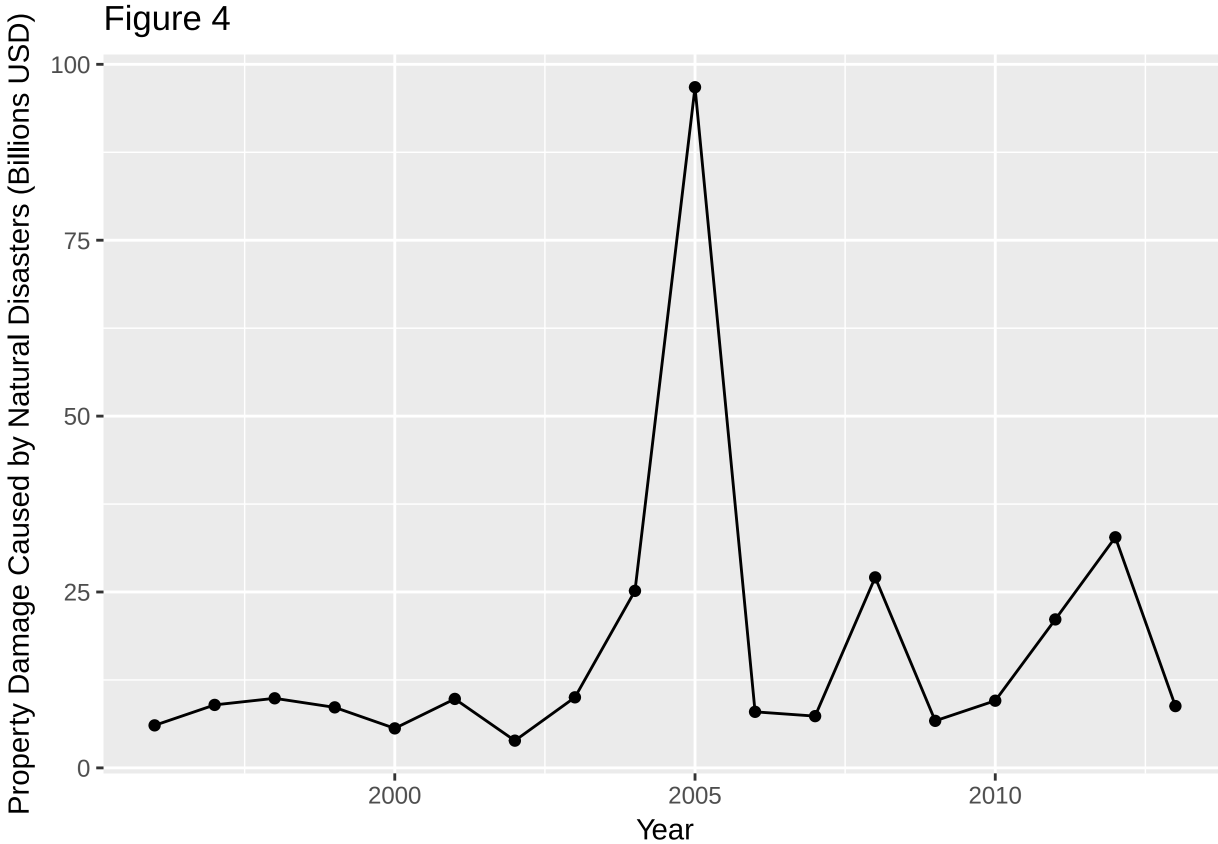


Figure 4



Moreover, since the Target Group states received preferred allocation of the SRL Program, in analyzing the effect of the SRL program, I limit my dataset to only the Targeted Group states. Observe the difference in allocations of the grant mitigation funds (excluding HMGP due to the difference in scale) between the Targeted Group and Non-targeted Group below in Figure 5. The total amount granted from the FEMA mitigation programs can also be seen in Figure 6 and Figure 7 in the Graph Appendix.

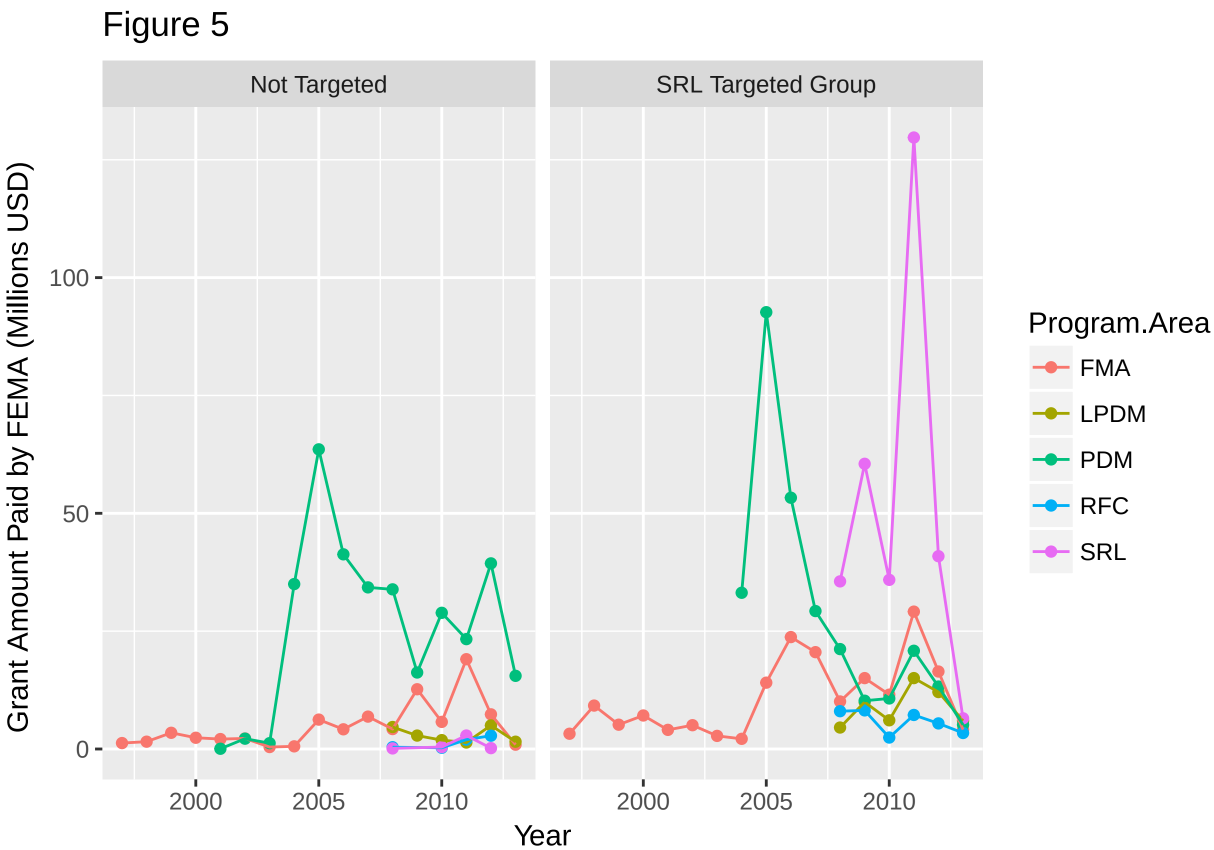


Figure 5 shows that the majority of the funds from the SRL Program is granted to the Targeted Group, which is expected since this group is targeted based on the number of severe repetitive loss properties it has. Note that the Targeted Group consists of only 17 states, while the Non-targeted Group is the remaining 33 states. So, although the FMA and PDM funds are approximately evenly distributed between both groups, the average state in the Targeted Group received more since the group is nearly half the size.

However, since the RFC Program is available to all states on a competitive annual basis, I use all US states dataset as well as the limited Targeted Group dataset in analyzing the effect; it is expected that a greater effect would be seen in the limited Targeted Group dataset given these states have the most severe repetitive loss properties, and this group has a majority of the value of both RLP claims and SRL claims, which can be seen in Figure 8 and Figure 9 in the Graph Appendix. Additionally, the allocation of the property damage from natural disasters, number of county-declared flood related disasters, and amount of money granted from the HMGP between the Targeted Group and Non-targeted Group can also been seen in Figures 10, 11, and 12 in the Graph Appendix. The Targeted Group is clearly more vulnerable to flood catastrophes and property damages associated with natural disasters.

Furthermore, summary statistics on variables for the US and limited Targeted Group are provided in Table 1 and Table 2, respectively. Since the different grant program began at different times, statistics are not representative of when they were available for funding for states, rather they are representative of the time horizon used (1996 to 2013).

Due to the skewness and number of zero values for the SRL and RL claim values, mitigation grant programs, and property damage of natural disasters, I used an inverse sine hyperbolic transformation. The normalization of this data can be seen in the Data Appendix.

Model Specification

My model assesses the impact the SRL and RFC grant programs have on value of RLP and SRL claims. I run the following regression model with time and state fixed effects. Lags on the mitigation funding are used since mitigation project effects are expected to take time to complete. Base year log of HMGP is excluded from the models due to collinearity with the log of property damages caused by natural disasters. The dependent variables used are the inverse sine hyperbolic transformation of the value of RLP claims paid and the inverse sine hyperbolic transformation of the value of SRL claims paid. The empirical specification for my underlying model is as follows:

$$ClaimValue_{it} = \alpha_i + \beta_1 NaturalDisasters + \beta_2 MitigationFunding + \eta_t + \gamma_{it} + \epsilon_{it},$$

where

- ClaimValue
  - lSRL__Flood__Claims is the inverse sine hyperbolic transformation of t value of SRL flood insurance claims paid by the NFIP
  - lRLP__Flood__Claims is the inverse sine hyperbolic transformation of t value of RLP flood insurance claims paid by the NFIP
- NaturalDisasters
  - ldamages is the inverse sine hyperbolic transformation of t value property damages caused by natural disasters.
  - FloodDisasterCount is the number of county-declared flood related disasters
- Mitigation Funding
  - lFMA is the inverse sine hyperbolic transformation of t value of funding provided by FEMA from the FMA program
  - lPDM is the inverse sine hyperbolic transformation of t value of funding provided by FEMA from the PDM program
  - lLPDM is the inverse sine hyperbolic transformation of t value of funding provided by FEMA from the LPDM program
  - lRFC is the inverse sine hyperbolic transformation of t value of funding provided by FEMA from the RFC program
  - lSRL is the inverse sine hyperbolic transformation of t value of funding provided by FEMA from the SRL program
  - laglFMAx is the lag of lFMA by x year(s), i.e. the inverse sine hyperbolic transformation of the (t-x) t value of funding provided by FEMA from the FMA program
  - laglPDMx is the lag of lPDM by x year(s)
  - laglLPDMx is the lag of lLPDM by x year(s)
  - laglRFCx is the lag of lRFC by x year(s)
  - laglSRLx is the lag of lSRL by x year(s)
  - laglHMGPx is the lag of lHMGP by x years(s)

Note that since both independent and dependent variables are transformed using the inverse sine hyperbolic transformation, the variables were not adjusted for inflation.

5. Results

Tables 3 and 4 shows the results from the model regression using three lags on the mitigation funding grant programs for log of SRL Claims and log of RL Claims as the dependent variables. Results are shown for both the entire United States (Table 3) and the Targeted Group only (Table 4). I found that the value of property damages caused by natural disasters (ldamages) and the number of county-declared flood related events (FloodDisasterCount) in a given year for a state are important predictors for the value of SRL and RLP claims as these variables are significant across all model variations ran. Additionally, for all states, I found that an increase in the amount of money granted from the FMA fund and LPDM fund are associated with a decrease in the value of RLP claims paid three years later and two years later, respectively. Similarly, in the Targeted Group, an increase in the amount of money granted from the FMA fund and HMGP fund are associated with a decrease in the value of RLP claims paid three years later and two years later, respectively. The same effect of the HMGP is seen on the value of SRL claims for the Targeted Group only.

More importantly, I found that an increase in the amount of money granted from the RFC Program is associated with an increase in the value of RLP and SRL claims paid the following year. Additionally, in all states, it seems as though the PDM Program the has the same short run positive effect on RLP claim value, suggesting moral hazard presence may also be driven by this mitigation fund program. As expected the SRL Program does not show significance in models with all US states. However, limiting my data to the Targeted Group, I found that an increase in the amount of money granted from the SRL Program is associated with an increase in the value of RLP claims paid the following year.

All significant results seen below hold for the given model with a single lag or two lags, rather than three lags; verification of this can be seen in the Table models 5 and 6.

6. Discussion

The findings that additional funding to a given state in a year from the RFC and SRL Program increase the value of RL and SRL claims paid the following year back the hypothesis that these programs increase the presence of moral hazard in the NFIP. Additionally, mitigation funding from FEMA programs is associated with a decrease in the value of RL and SRL claims paid two and three years later. This negative association implies that these programs are successful (to an extent) in reducing the vulnerability of RL and SRL properties in the short run as they are shown to hold significance in lowering the value of claims paid from these properties holding all else constant in the model.

Effect of RFC Program and SRL Program

Controlling for state difference, two-way time trends, property damages caused by natural disasters, the number of county-declared flood related disasters, and other FEMA mitigation efforts, I find that additional money granted from the RFC Program is associated with an increase in the value of RLP and SRL claims paid the following year. This result holds when utilizing all US state data as well as the dataset limited to the Targeted Group. For targeted states only, a similar effect is seen with the SRL Program on the value of RL claims as an increase in the amount of money granted from the SRL Program is associated with an increase in the value of RLP claims paid the following year. Given this result and the fact that the SRL claim values are included in RLP claim values for a given state in a year, the effect of the SRL Program on the following year SRL claims paid is expected to hold significance. However, although the effect has the same positive trend and is greater (as expected), statistical significance does not hold as the p-value on laglSRL1 is 0.14 in Table 4.

This positive association between the one year lag of these program funds and the corresponding value of claims paid by the NFIP provides evidence that the Flood Insurance Reform Act of 2004 was not effective in reducing vulnerability of living in floodplains in the short run, and may have accentuated the moral hazard problem. This relationship, and the consistency seen in my models and analysis, indicates moral hazard may indeed have been an unintended consequence of the 2004 Act. Moral hazard could have presented itself in a few different ways. The first is the possibility that policyholders mitigate less causing greater repetitive loss claim value after they are aware that these grants will provide the funds to mitigate. The other would be that repetitive loss properties are increasing at a faster rate and/or decreasing at a slower rate as result of these available funds for mitigation.

Moreover, a significant negative association is seen in the laglSRL3 variable on the change in value of RLP claims for the Targeted Group. This suggests that the funds paid by the SRL Program to a state one year is associated with a decrease in the value of RLP claims three years later. This indicates that the SRL Program is may be success at mitigating risks across a three or more year horizon; however, the significance does not hold for the change in value of SRL claims paid and the SRL Program is only utilized for SRL properties.

Effect of Other FEMA Mitigation Grant Programs

I find that the lag of some other FEMA Mitigation Grant Progams for two or three years is associated with a decrease in the value of RLP and/or SRL claims for either the US or soley the Targeted Group. These significant variables suggests that these mitigation programs are successful at reducing the vulnerability of the corresponding properties on a short time horizon.

Furthermore, I find that, when analyzing the Targeted Group only, an increase in funds paid by the LPDM Program to a given state in a year assessed by the model is associated with a decrease in the value of SRL claims paid by that state in that same year. This suggests that the mitigation efforts supported by the LPDM Program may have worked quickly and effectively, and ultimately reduced the vulnerability of SRL properties in the short, short run.

7. Conclusion

Although the financial issues and the outstanding debt of NFIP is often attributed to policymakers' failures to structure the program for catastrophic losses, the moral hazard issue associated with repetitive loss claim and subsidized insurance coverage is an element that undoubtedly limits risk reduction by policyholders and contributes to the NFIP's fiscal problems. The NFIP enacted FIRA 2004 with the ultimate goal of reducing or eliminating repetitive loss claims with the RFC Program and the SRL Program. As shown in my results, some grant mitigation funds are associated with a decrease in the repetitive loss claim value in the short run; however, the RFC Program and SRL Program was shown to increase the value of repetitive loss claim value the following year. Therefore, this is evidence that policy designed to reduce risk, can potentially increase risk, exacerbating the moral hazard issue in the NFIP.

The results of my analysis are limited since my study is only focused on the value of repetitive loss claims paid by the NFIP. In order to get a full grasp of the moral hazard issue without analyzing individual actions or tendencies, a further analysis on the number of current, new, and mitigated repetitive loss properties as well as the number of repetitive property claims paid is needed. Changes were also made to the NFIP through the Biggert-Waters Flood Insurance Reform Act of 2012, which consolidated many of the FEMA mitigation grant programs. With additional changes being made as the NFIP faces financial struggles, the presence of moral hazard and the consequences on these policies will be interesting to investigate.

Graph Appendix

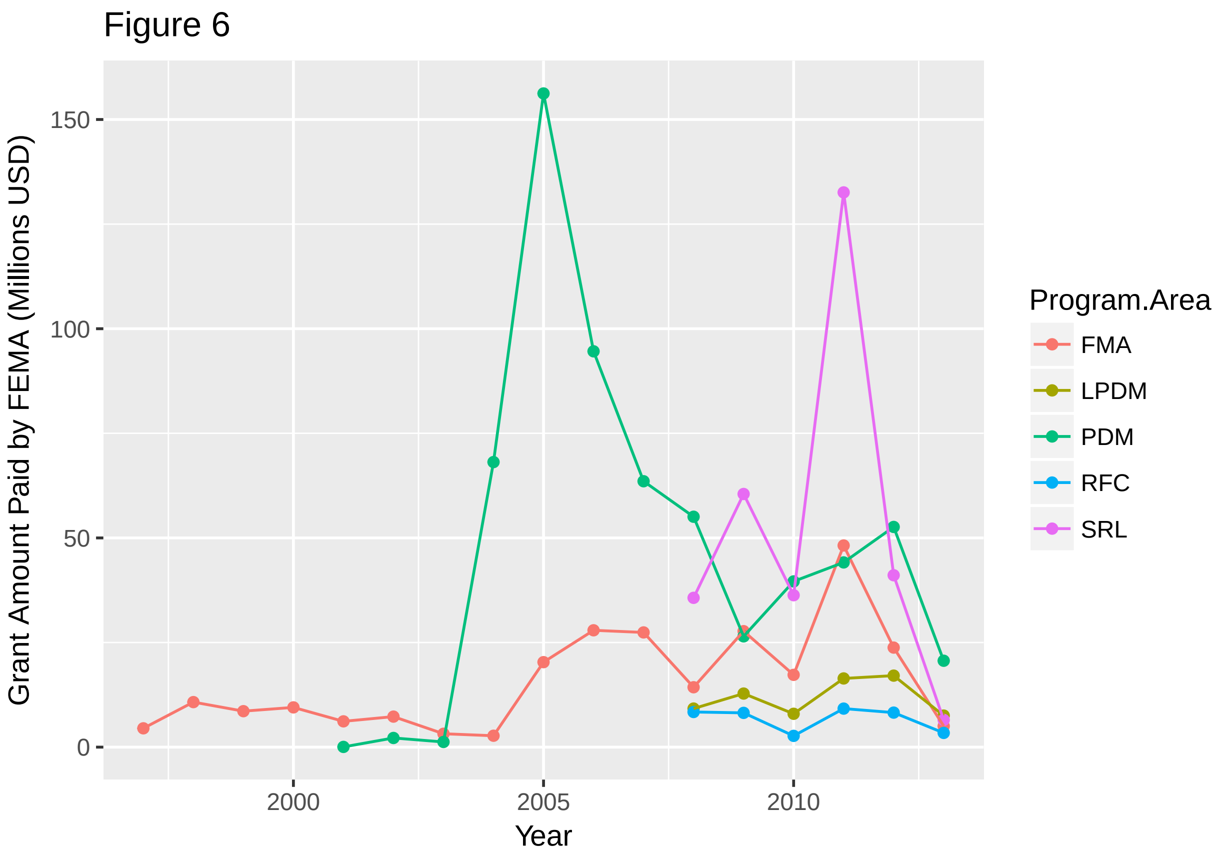


Figure 7

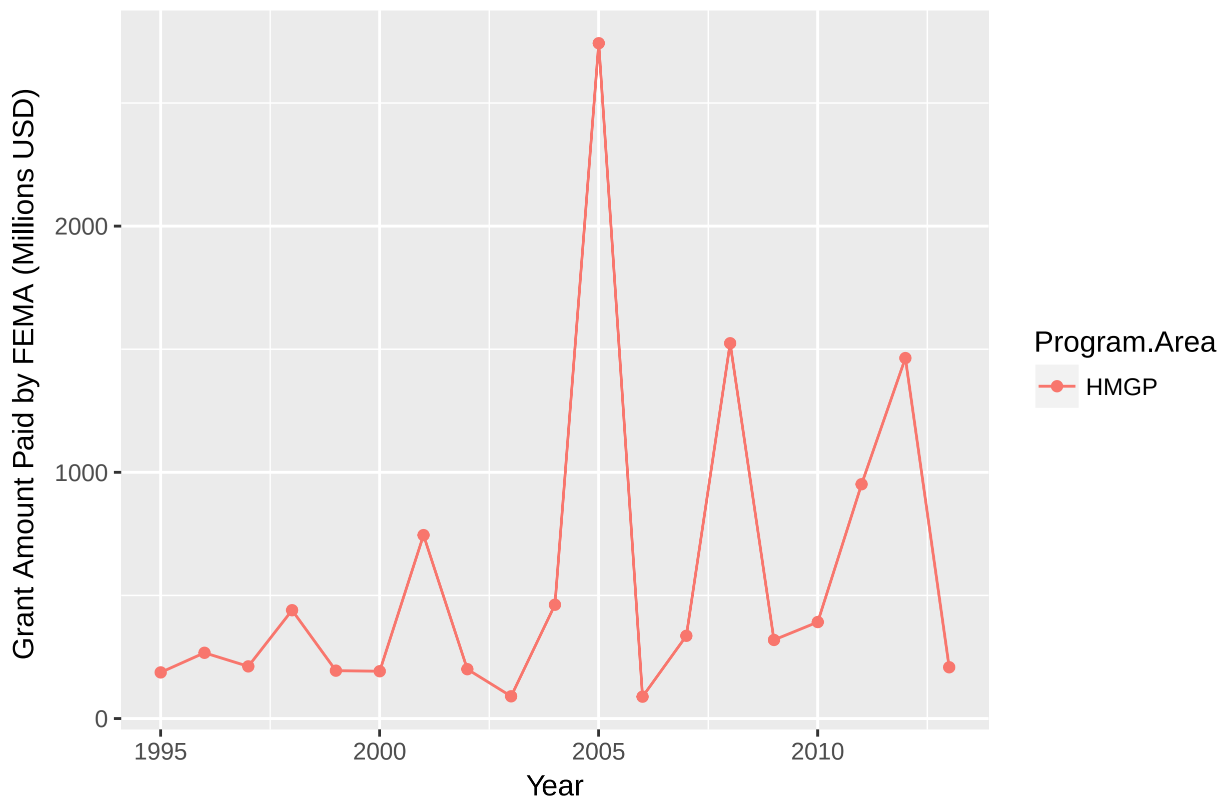


Figure 8

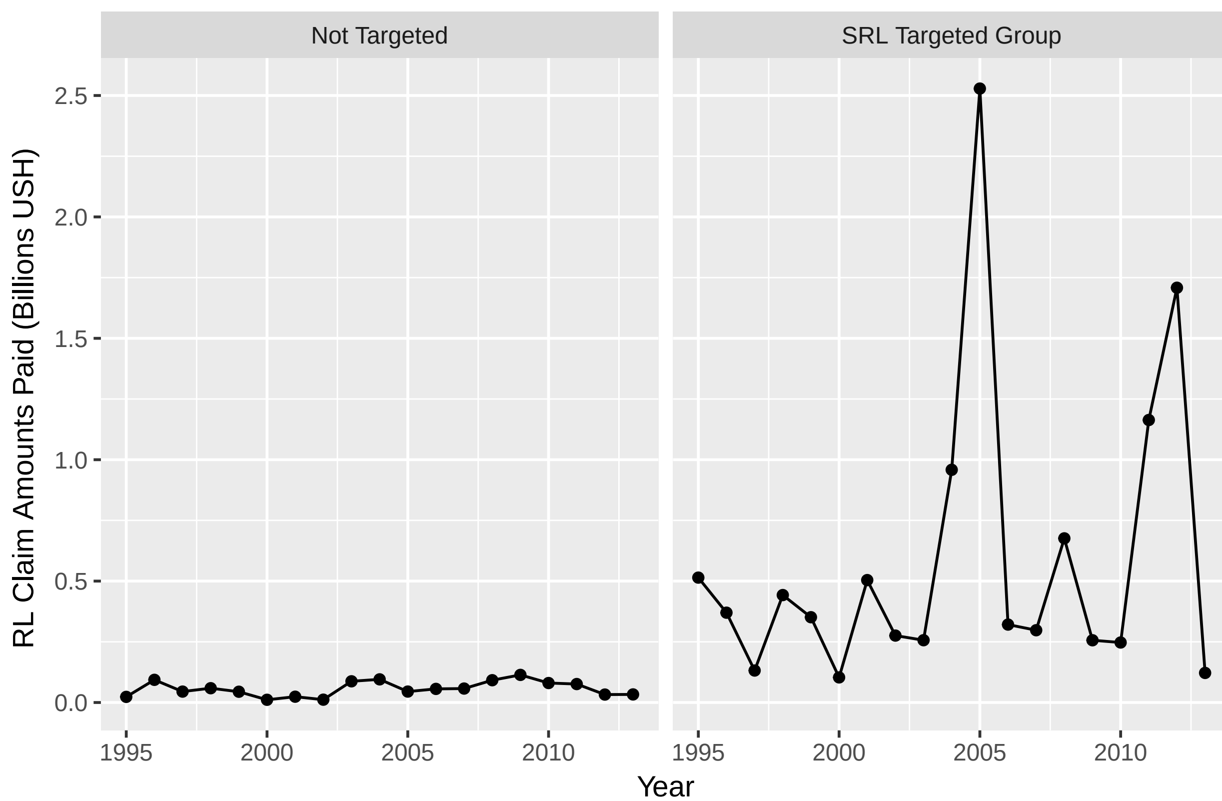


Figure 9

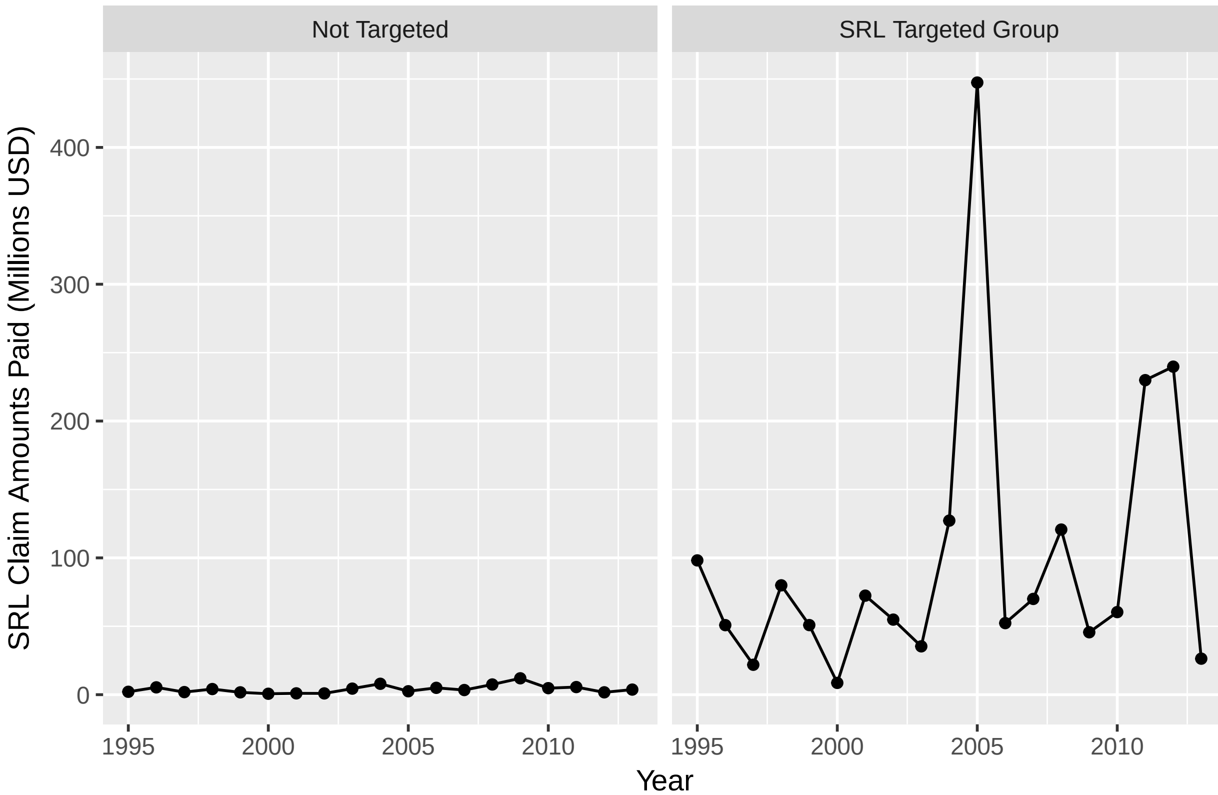


Figure 10

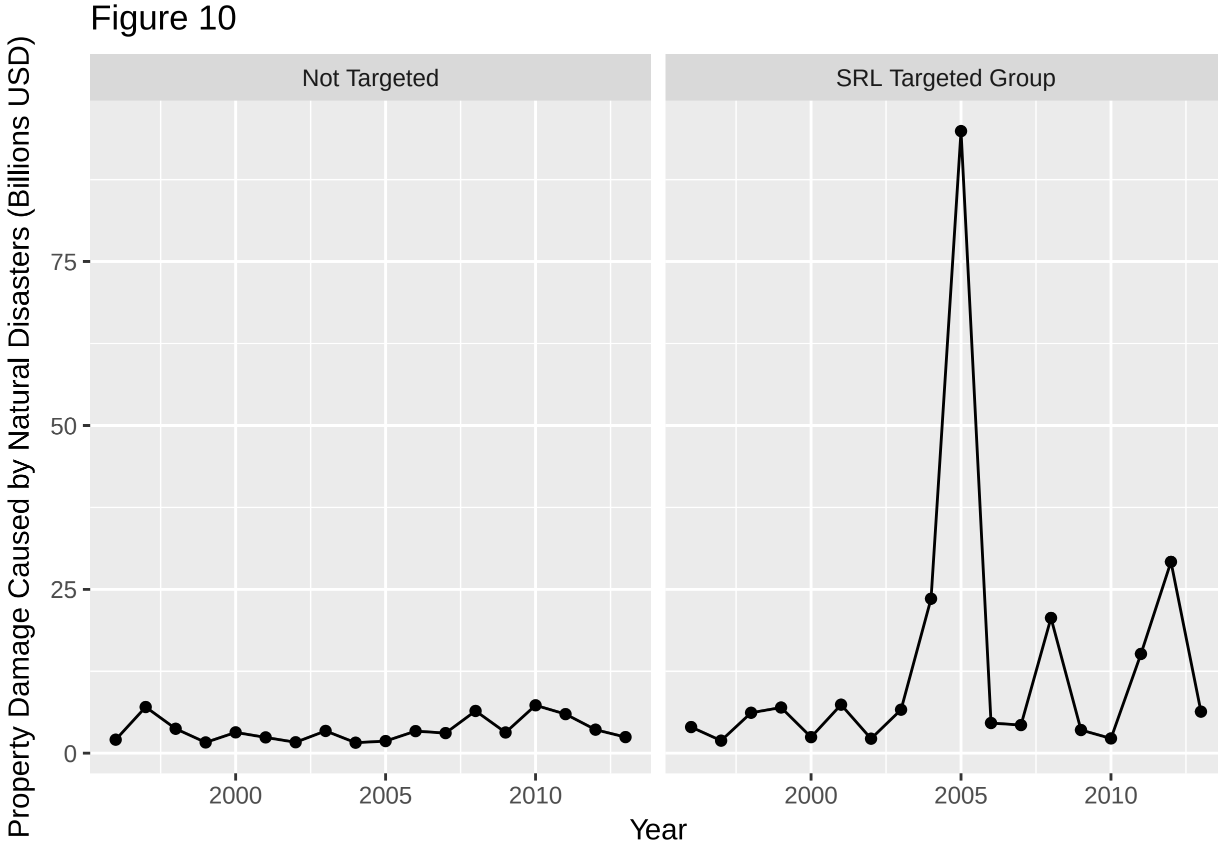


Figure 11

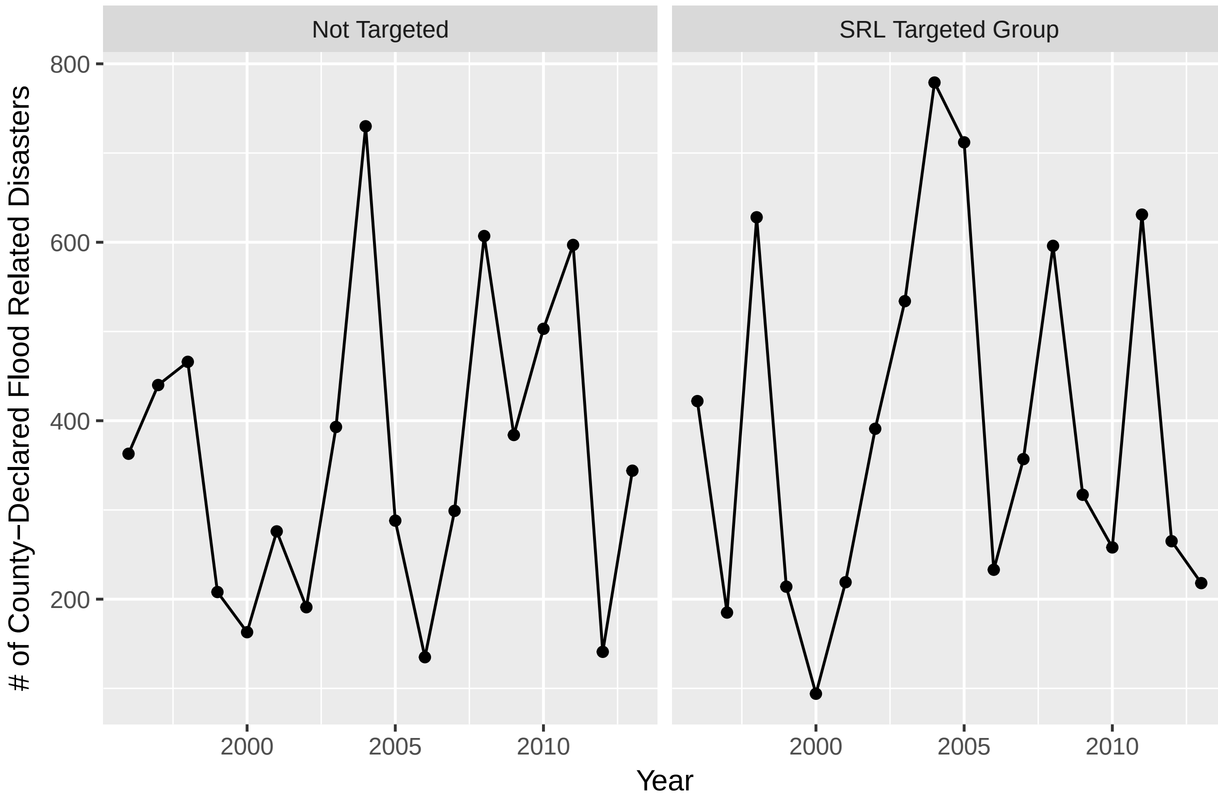
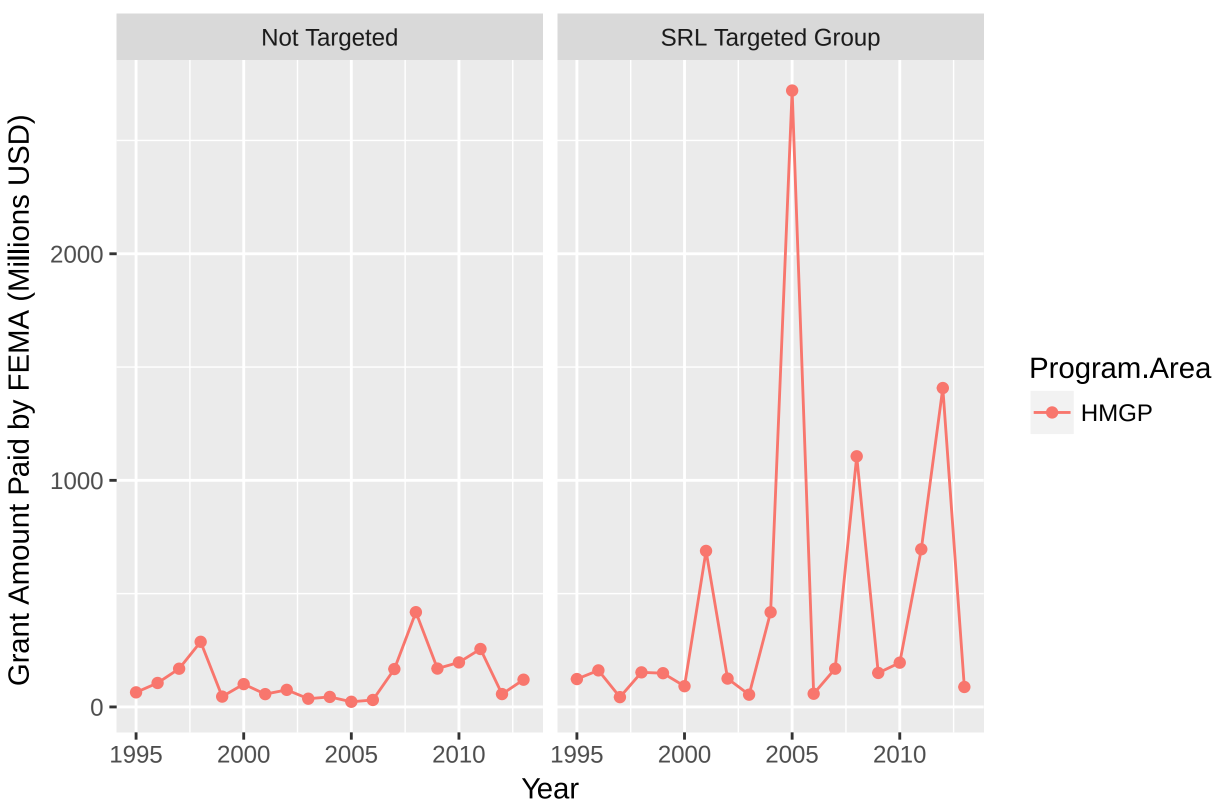


Figure 12



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List of Tables

Table 1: Descriptive Statistics of Variables (1996-2013), all reported in Million USD, except FloodDisasterCount

Statistic	N	Mean	St. Dev.	Min	Max
FMAm	900	0.293	1.128	0.000	12.527
HMGPm	900	11.593	81.968	0.000	1,922.635
PDMm	900	0.678	2.001	0.000	26.495
RFCm	900	0.045	0.334	0.000	5.250
SRLm	900	0.347	3.030	0.000	48.702
SRL_Flood_Claimsm	900	2.074	12.874	0.000	310.827
RLP.Flood.Claims.Paidm	900	12.968	72.410	0.000	1,573.258
FloodDisastersCount	900	15.090	28.951	0	302
Property_Damage_mmUSD	900	340.020	2,338.066	0.000	52,777.000

Table 2: Descriptive Statistics of Variables - Target Group (1996-2013), all reported in Million USD, except FloodDisasterCount

Statistic	N	Mean	St. Dev.	Min	Max
FMAm	306	0.600	1.621	0.000	11.229
HMGPm	306	27.690	137.830	0.000	1,922.635
PDMm	306	0.947	2.976	0.000	26.495
RFCm	306	0.113	0.550	0.000	5.250
SRLm	306	1.010	5.136	0.000	48.702
SRL_Flood_Claimsm	306	5.864	21.596	0.000	310.827
RLP.Flood.Claims.Paidm	306	35.014	121.168	0.036	1,573.258
FloodDisastersCount	306	23.049	39.195	0	302
Property_Damage_mmUSD	306	791.349	3,953.544	0.100	52,777.000

Table 3: Regression using 3 Lags - US

	Dependent variable:	
	lRLP_Flood_Claims	lSRL_Flood_Claims
	(1)	(2)
lFMA	0.002 (0.018)	−0.012 (0.030)
laglFMA1	−0.021 (0.017)	−0.028 (0.029)
laglFMA2	−0.010 (0.017)	−0.020 (0.028)
laglFMA3	−0.032* (0.017)	−0.045 (0.029)
laglHMGP1	0.003 (0.013)	−0.004 (0.023)
laglHMGP2	0.012 (0.013)	−0.004 (0.023)
laglHMGP3	0.010 (0.013)	−0.022 (0.023)
lLPDM	−0.012 (0.026)	−0.021 (0.044)
laglLPDM1	0.040 (0.029)	0.012 (0.048)
laglLPDM2	−0.062** (0.031)	−0.045 (0.053)
laglLPDM3	0.019 (0.035)	0.041 (0.058)
lPDM	−0.021 (0.019)	−0.025 (0.033)
laglPDM1	0.043** (0.020)	0.005 (0.034)
laglPDM2	−0.017 (0.022)	−0.059 (0.036)
laglPDM3	−0.010 (0.023)	−0.003 (0.038)
lRFC	−0.050 (0.038)	−0.082 (0.064)
laglRFC1	0.079** (0.039)	0.116* (0.067)
laglRFC2	−0.017 (0.047)	0.030 (0.079)
laglRFC3	0.011 (0.056)	−0.073 (0.095)
lSRL	0.005 (0.032)	0.057 (0.055)
laglSRL1	0.019 (0.034)	−0.011 (0.058)
laglSRL2	−0.020 (0.038)	−0.043 (0.065)
laglSRL3	−0.011 (0.044)	0.055 (0.075)
FloodDisastersCount	0.023*** (0.004)	0.039*** (0.007)
ldamages	0.413*** (0.069)	0.383*** (0.117)
Observations	750	750
R^2	0.181	0.125
Adjusted R^2	0.072	0.008
F Statistic (df = 25; 661)	5.830***	3.777***
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 4: Regression using 3 Lags - TG

	Dependent variable:	
	lRLP_Flood_Claims	lSRL_Flood_Claims
	(1)	(2)
lFMA	−0.008 (0.017)	−0.016 (0.035)
laglFMA1	0.003 (0.016)	−0.008 (0.034)
laglFMA2	0.002 (0.016)	−0.011 (0.033)
laglFMA3	−0.027* (0.016)	−0.035 (0.034)
laglHMGP1	0.018 (0.013)	−0.003 (0.028)
laglHMGP2	−0.029** (0.014)	−0.061** (0.029)
laglHMGP3	−0.011 (0.013)	−0.038 (0.028)
lLPDM	−0.028 (0.024)	−0.099** (0.050)
laglLPDM1	0.031 (0.026)	0.050 (0.055)
laglLPDM2	−0.041 (0.027)	−0.062 (0.057)
laglLPDM3	−0.015 (0.032)	0.011 (0.067)
lPDM	−0.004 (0.020)	−0.017 (0.041)
laglPDM1	0.012 (0.020)	0.036 (0.042)
laglPDM2	0.030 (0.022)	0.028 (0.046)
laglPDM3	0.011 (0.025)	−0.034 (0.052)
lRFC	−0.009 (0.028)	−0.005 (0.059)
laglRFC1	0.051* (0.029)	0.058 (0.060)
laglRFC2	0.005 (0.034)	0.028 (0.072)
laglRFC3	−0.027 (0.038)	−0.097 (0.081)
lSRL	−0.033 (0.023)	−0.006 (0.048)
laglSRL1	0.050** (0.024)	0.074 (0.051)
laglSRL2	0.001 (0.027)	−0.004 (0.056)
laglSRL3	−0.061** (0.029)	−0.034 (0.061)
FloodDisastersCount	0.013*** (0.003)	0.019*** (0.006)
ldamages	0.442*** (0.066)	0.366*** (0.139)
Observations	255	255
R^2	0.483	0.249
Adjusted R^2	0.340	0.041
F Statistic (df = 25; 199)	7.442***	2.638***
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 5: Regression using 1 and 2 Lags - US

	Dependent variable:			
	lRLP_Flood_Claims		lSRL_Flood_Claims	
	(1)	(2)	(3)	(4)
lFMA	0.008 (0.016)	0.016 (0.015)	−0.015 (0.028)	−0.013 (0.026)
laglFMA1	−0.022 (0.016)	−0.023 (0.015)	−0.035 (0.027)	−0.036 (0.026)
laglFMA2	−0.015 (0.016)		−0.030 (0.027)	
laglHMGP1	0.002 (0.012)	0.004 (0.012)	−0.002 (0.021)	−0.002 (0.020)
laglHMGP2	0.009 (0.013)		−0.002 (0.021)	
lLPDM	−0.008 (0.025)	−0.017 (0.025)	−0.015 (0.043)	−0.030 (0.042)
laglLPDM1	0.034 (0.027)	0.020 (0.026)	0.018 (0.046)	0.008 (0.044)
laglLPDM2	-0.054^{*} (0.030)		−0.036 (0.050)	
lPDM	−0.020 (0.019)	−0.021 (0.018)	−0.016 (0.031)	−0.015 (0.031)
laglPDM1	0.042^{**} (0.020)	0.033^{*} (0.019)	0.005 (0.033)	−0.009 (0.032)
laglPDM2	−0.022 (0.021)		−0.056 (0.035)	
lRFC	−0.058 (0.037)	−0.050 (0.036)	−0.078 (0.062)	−0.074 (0.061)
laglRFC1	0.073^{*} (0.038)	0.066^{*} (0.037)	0.114^{*} (0.065)	0.115^{*} (0.062)
laglRFC2	−0.013 (0.044)		0.023 (0.075)	
lSRL	0.004 (0.031)	−0.008 (0.030)	0.057 (0.053)	0.041 (0.051)
laglSRL1	0.021 (0.033)	0.016 (0.031)	−0.007 (0.055)	−0.015 (0.052)
laglSRL2	−0.019 (0.037)		−0.034 (0.063)	
FloodDisastersCount	0.020^{***} (0.003)	0.021^{***} (0.003)	0.033^{***} (0.006)	0.033^{***} (0.006)
ldamages	0.420^{***} (0.064)	0.404^{***} (0.061)	0.431^{***} (0.109)	0.450^{***} (0.104)
Observations	800	850	800	850
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 6: Regression using 1 and 2 Lags - US

	Dependent variable:			
	lRLP_Flood_Claims		lSRL_Flood_Claims	
	(1)	(2)	(3)	(4)
lFMA	−0.002 (0.016)	−0.003 (0.015)	−0.012 (0.032)	−0.013 (0.029)
laglFMA1	−0.0004 (0.015)	−0.001 (0.015)	−0.009 (0.031)	−0.013 (0.030)
laglFMA2	−0.002 (0.016)		−0.022 (0.032)	
laglHMGP1	0.019 (0.013)	0.017 (0.012)	−0.001 (0.025)	−0.002 (0.024)
laglHMGP2	−0.030** (0.013)		−0.063** (0.026)	
lLPDM	−0.028 (0.023)	−0.028 (0.023)	−0.099** (0.047)	−0.099** (0.045)
laglLPDM1	0.028 (0.025)	0.027 (0.025)	0.063 (0.052)	0.060 (0.049)
laglLPDM2	−0.043 (0.027)		−0.075 (0.054)	
lPDM	0.001 (0.019)	−0.001 (0.019)	−0.0002 (0.039)	−0.004 (0.038)
laglPDM1	0.011 (0.020)	0.018 (0.020)	0.037 (0.041)	0.046 (0.039)
laglPDM2	0.035 (0.022)		0.041 (0.044)	
lRFC	−0.021 (0.027)	−0.006 (0.027)	−0.019 (0.055)	0.005 (0.053)
laglRFC1	0.062** (0.029)	0.050* (0.027)	0.078 (0.058)	0.063 (0.054)
laglRFC2	−0.017 (0.031)		−0.014 (0.063)	
lSRL	−0.032 (0.023)	−0.027 (0.022)	−0.008 (0.046)	0.004 (0.044)
laglSRL1	0.045* (0.024)	0.037 (0.024)	0.064 (0.049)	0.051 (0.047)
laglSRL2	−0.007 (0.026)		−0.004 (0.053)	
FloodDisastersCount	0.011*** (0.003)	0.012*** (0.003)	0.016*** (0.005)	0.018*** (0.005)
ldamages	0.466*** (0.062)	0.472*** (0.060)	0.383*** (0.125)	0.402*** (0.120)
Observations	272	289	272	289
Note:				*p<0.1; **p<0.05; ***p<0.01