INTERNATIONAL CENTER FOR PUBLIC POLICY

International Center for Public Policy
Working Paper 23-05
January 2023

Coping with Extreme Events: On Solving Decentralized Budgetary Crises

Timothy J. Goodspeed

Georgia State University | Andrew Young School of Policy Studies

Georgia State University | Andrew Young School of Policy Studies

International Center for Public Policy
Working Paper 23-05

Coping with Extreme Events: On Solving Decentralized Budgetary Crises

Timothy J. Goodspeed

January
2023

International Center for Public Policy
Andrew Young School of Policy Studies
Georgia State University
Atlanta, Georgia 30303
United States of America

Phone: (404) 413-0235
Fax: (404) 651-4449
Email: paulbenson@gsu.edu
Website: http://icepp.gsu.edu/

International Center for Public Policy
Andrew Young School of Policy Studies

The Andrew Young School of Policy Studies was established at Georgia State University with the objective of promoting excellence in the design, implementation, and evaluation of public policy. In addition to four academic departments, including economics and public administration, the Andrew Young School houses eight leading research centers and policy programs, including the International Center for Public Policy.

The mission of the International Center for Public Policy (ICePP) at the Andrew Young School of Policy Studies is to provide academic and professional training, applied research, and technical assistance in support of sound public policy and sustainable economic growth in developing and transitional economies.

ICePP is recognized worldwide for its efforts in support of economic and public policy reforms through technical assistance and training around the world. This reputation has been built serving a diverse client base, including the World Bank, the U.S. Agency for International Development (USAID), the United Nations Development Programme (UNDP), finance ministries, government organizations, legislative bodies, and private sector institutions.

The success of ICePP reflects the breadth and depth of its in-house technical expertise. The Andrew Young School's faculty are leading experts in economics and public policy and have authored books, published in major academic and technical journals, and have extensive experience in designing and implementing technical assistance and training programs. Andrew Young School faculty have been active in policy reform in over 40 countries around the world. Our technical assistance strategy is not merely to provide technical prescriptions for policy reform, but to engage in a collaborative effort with host governments and donor agencies to identify and analyze the issues at hand, arrive at policy solutions, and implement reforms.

ICePP specializes in four broad policy areas:

- Fiscal policy (e.g., tax reforms, public expenditure reviews)
- Fiscal decentralization (e.g., reform, intergovernmental transfer systems, urban finance)
- Budgeting and fiscal management (e.g., local, performance-based, capital, and multi-year budgeting)
- Economic analysis and revenue forecasting (e.g., micro-simulation, time series forecasting)

For more information about our technical assistance activities and training programs, please visit our website at icepp.gsu.edu or contact us at paulbenson@gsu.edu.

Coping with Extreme Events: On Solving Decentralized Budgetary Crises

Timothy J. Goodspeed[1]

January 2023

Abstract

Extreme events create both macroeconomic and budgetary problems for decentralized governments. Decentralized governments are unequipped for macroeconomic stabilization policies and have very limited fiscal space. At a practical level there are three options to replace lost funding from an extreme event: decentralized governments can anticipate and save for these budgetary rainy days themselves, they can issue debt, or the central government can step in and provide aid when such extreme events occur. In this paper we examine the impact of these options on the unemployment rate. Using the 2008 financial crisis of as our extreme event and employing a difference in difference approach, we find that both grants and rainy day funds during the crisis reduced future unemployment on the margin relative to periods outside of the crisis; the same is not true of debt. We also find that grants and rainy day funds are substitutes: greater grant funding implies a somewhat smaller effect of own savings on future unemployment.

Keywords: decentralization, grants, budgetary crisis, extreme events, disasters

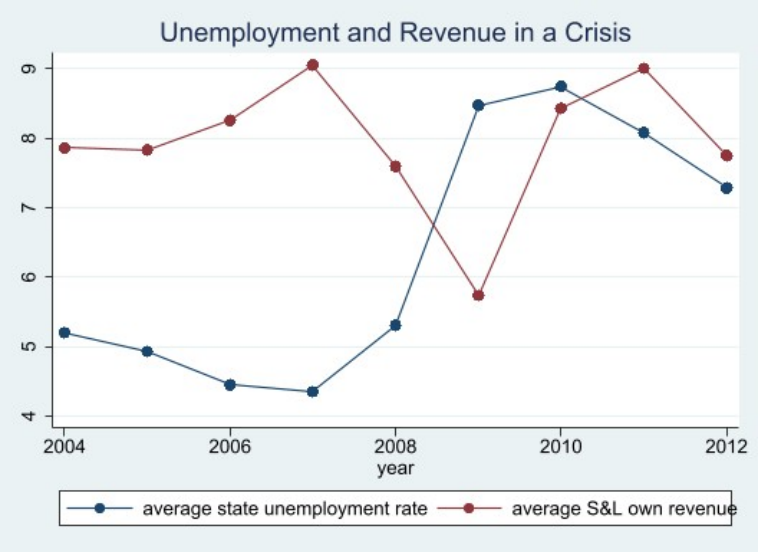
[1] Hunter College, Department of Economics, 695 Park Avenue, NY, NY, 10065 USA; email: tgoodspe@hunter.cuny.edu

I. Introduction

Extreme events often create both macroeconomic and budgetary problems for decentralized governments. Unemployment typically rises and with it expenditure needs while revenues typically fall. At the same time the fiscal space of decentralized governments is very constrained, in part by balanced budget requirements, and monetary policy is usually out of reach as decentralized governments typically do not control or print money. At a practical level there are three options to replace lost funding from an extreme event: decentralized governments can anticipate and save for these budgetary rainy days themselves, the central government can step in and provide aid when such extreme events occur, or the decentralized government can issue debt. In this paper we empirically examine the impact of these three options on US state unemployment rates using the financial crisis as our extreme event.

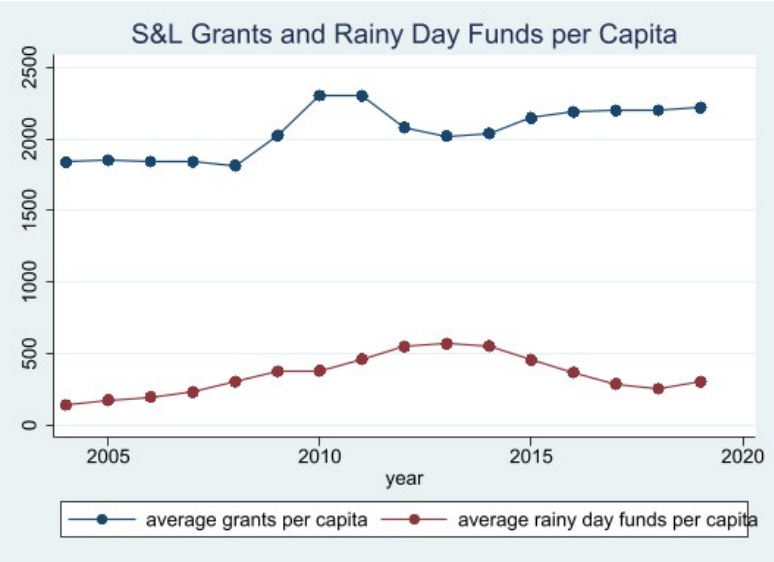
The financial crisis increased unemployment and reduced state and local government revenue in the United States. Figure 1 shows the average state and local unemployment rate and state and local revenues from 2007 to 2012. The unemployment rate rises from 2007 from the start of the financial crisis through 2010. At the same time, revenues are dropping precipitously in 2008 and 2009, and then recovering.

Figure 1



Grants from the central government accounts for part of the revenue recovery. Figure 2 shows state and local grants and rainy day funds per capita for 2004 to 2019. Grants received from the federal government increased from 2008 to 2010, maintained an elevated level in 2011, and fell back in 2012 although the level remained above the pre-crisis level. Interestingly, rainy day fund balances rose during this period.

Figure 2



The ramifications of relying on central government aid are many and depend on both past and future behavior of decentralized governments, whether and how any aid will influence future behavior, and whether grants and rainy day funds are complements (reinforcing each other in reducing unemployment) or substitutes. Past behavior is of course important since this determines whether and how much savings a decentralized government has in times of crisis. The influence of any aid on future behavior is important especially if decentralized governments perceive that aid will be forthcoming for any future extreme event. This would induce such governments to save less on their own and increase the costs to the centralized government.

In this paper we empirically examine the impact of increased central government aid, rainy day fund balances, and state and local government debt on the unemployment rate using the financial crisis as our extreme event. The paper proceeds as follows. After a brief literature review in section 2, the paper examines a simple model of rainy day funds and grants in section 3 and shows that under certain conditions more grants will induce less saving on the part of decentralized governments. Section 4 develops our difference in difference approach and describes our data. Section 5 presents the results and section 6 concludes.

II. Literature Review

This paper is connected to several strands of literature in economics. First, at a fundamental level is the question of the proper level of government to conduct macroeconomic stabilization policy. The classic view of Oates (1972) is that the stabilization function is properly done by the central level of government. This is an old debate and encompasses a number of arguments. The control of the money supply is de facto in the realm of central government activities; if it were not so states could print their own money, it would create an incentive for each state to print money for purchases rather than rely on taxation since the likely inflationary

costs would be spread across other states. Relying on fiscal policy would also have its problems since decentralized governments are small open economies buying many goods from outside the state and so would likely see smaller expenditure multipliers. In addition, given the openness of the economies of decentralized governments, macroeconomic shocks are likely to be quickly translated to other states. To the extent this is the case, there are free-rider aspects to decentralized reactions to macroeconomic stabilization policies, and regional shocks will moreover tend to become national shocks.

Whether decentralization per se is helpful or hurtful in macroeconomic stability is a complex issue. First one has to define what is meant by macroeconomic stability, and here authors have different interpretations. The classic view detailed above is essentially a comparison of the effects of a purely central government Keynesian fiscal policy and a purely subnational government fiscal policy; simply stated, the pure subnational government multiplier is expected to be smaller than the pure central government multiplier. Since countries with a decentralized structure of government usually have a number grants to both encourage (e.g. through matching grants) and fund government programs (e.g. lump-sum grants) that are administered (often with accompanying rules – conditional grants - and regulations) by subnational governments, central government programs aimed at stabilization will often involve subnational governments to a large degree. The grant funding of such programs thus becomes quite relevant, and this grant funding can be nondiscretionary (e.g. determined through a formula) or discretionary. Thus the large literature encompassing the effects of grant funding on state and local government behavior becomes relevant. This literature is voluminous; see for instance the review by . It is however related to the literature on the flypaper effect where the empirical finding is that "money sticks where it hits," that is, a dollar of grant funding leads to

more expenditure than a dollar of own revenue (see for instance Hines and Thaler, 1995, for a review). It is also related to the literature on soft budget constraints at the decentralized level (see e.g. Goodspeed, 2017, for a survey) where the idea is that decentralized governments anticipate additional central government funding and spend more or accumulate more debt in anticipation of such aid.

Some studies examining panel data across countries, such as Lago-Peñas, Martinez-Vazquez,and Sacchi (2020), interpret macroeconomic stabilization in terms of government debt and find that in some cases greater decentralization is associated with lower general government deficits. This is found to depend however on the vertical fiscal imbalance (VFI - roughly the degree to which subnational governments rely on grant rather than own-source finance), with a high VFI undermining the improvement of government debt; borrowing rules and the strictness of other fiscal rules are also found to matter. This is consistent with other work such as Eyraud and Lusinyan (2013) who find that a higher VFI worsens the general government balance, something predicted by the soft budget constraint literature. Some other studies using international data, such as Baskaran (2010), Neyapti (2019), and Bartolini, Sacchi, Salotti, and Santolini (2018) find the level of debt improves with decentralization. Baskaran in particular cites a competition effect at the subnational level as potentially countering detrimental incentives such as the free-rider/common pool problem or the soft budget constraint. On the other hand, other studies such as Pettersson-Lidbom (2010), Baskaran (2012), Sorribas-Navarro (2011), and Buettner and Wildasin (2006) find support for soft budget constraint behavior and so are not so sanguine about decentralization and government debt when the VFI is high.

A second literature examines decentralization and the Great Recession. In the US, this has mainly been related to the impact of the 2009 American Recovery and Reinvestment Act

(ARRA) – the major US fiscal stimulus bill - on US states. Inman (2010) finds that ARRA funds, which were intended to aid states in fiscal distress and to provide an economic stimulus, were not distributed to achieve macroeconomic stabilization (i.e. there was a large political element). Wilson (2012) studies the impact of the ARRA on state and local employment and finds that it increased employment although the cost per job is quite high. Carlino and Inman (2013) examine the effect of state deficits on employment growth during the 1973-2009 period and find that deficits increased employment growth (albeit only in the short-run) as well as having spillover effects on neighboring states. However, the cost per job is again very high and higher than a state's marginal benefit.

A number of studies examine decentralization and the Great Recession in an international context. de Mello (2020) examines a large set of advanced and emerging-market/developing economies and finds that the crisis was associated with an increase in the subnational shares of general government spending and revenue, greater indebtedness was associated with greater subnational authority, and greater spending was associated with weaker subnational authority. Goodspeed (2020) examines EU countries and finds that greater decentralization lowered social protection expenditures and a greater vertical fiscal imbalance and greater subnational deficits resulted in more spending on things other than social protection. Similarly, Beremendi and Rogers (2020) attribute their results to the weaker redistributive mechanisms in fiscally decentralized nations. Rodríguez-Pose and Ketterer (2020) examine regional quality of governance indicators in the EU and find that improvements in quality of government are one of the most powerful drivers of regional development in Europe.

A third literature concerns the rainy day funds of US states. This literature is relatively limited but Knight and Levinson (1999) examine the relation between rainy day funds and total

balances (general funds plus rainy day funds) and find a positive relationship which they interpret as higher savings. Moreover, they indicate the recent nature of these funds: while most states have such a fund now, 27 states adopted rainy day funds between 1984 and 1997. There is also some evidence that such funds are inadequate. For instance, Zhao (2014) finds that in 21 of 25 years, rainy day funds were less than that needed for stabilized revenues, and Sobel and Holcombe (1996) find they were inadequate for the 1990-91 recession. Gonzalez and Paqueo (2003) find that rainy day funds are ineffective in reducing the volatility of non-social sector expenditures but are effective in reducing the volatility of social sector expenditures.

Finally, some recent papers have investigated the effects of an alternative shock, the Covid-19 shock, on state tax revenues. Our data does not allow an examination of this period, but notable papers that have examined certain aspects of that shock include Clemens and Veuger (2020) who assess the effect on states income and sales tax revenues and find shortfalls in sales tax revenues of 11.5 percent; Chernick, Copeland and Reschovsky (2020) who examine the effect on city revenues and find shortfalls and find predicted shortfalls of 5.5 to 9 percent with substantial variation among cities; and Gordon, Dadayan, and Rueben (2020) who describe the fall in revenue and central government aid for state and local governments in the US. Finally, Green and Lalouche (2021) find a causal link between lower revenues caused by the pandemic (particularly sales tax revenues) and increased unemployment in the state and local government sector. Moreover, they find that the Cares Act aid significantly attenuated the rise in state and local government unemployment. State rainy day funds are also found to help decrease the sensitivity to the revenue shock.

III. The Relationship Between Rainy Day Funds and Grants

How are decentralized government savings through rainy day funds affected by the alternative source of funding through central government grants? To get at this question theoretically, we start with a model of decentralized savings based on Goodspeed (2016).

Suppose a decentralized government has certain income $\bar{Y}$ in period 1 and uncertain income in period 2 resulting from an extreme event. The government can anticipate future spending needs by saving some of its period 1 certain income $\bar{Y}$ leaving it with Y = $\bar{Y}$ - S period 1 income. This saving constitutes a rainy-day fund, which can be used as a fiscal policy lever to combat a recession in period 2. Suppose that the uncertain income in period 2 can be high, Y_H, with probability P or low, Y_L, with probability (1 – P), but the savings can mitigate the damage of the business cycle shock. Using the savings in this way as a fiscal policy tool is modeled by making P a function of S. Note that the probability here is not the probability of the shock but rather the probability of the outcome of the shock – that of attaining a certain level of income in the presence of the uncertainty, or the severity of the shock. It is for this reason that the probability that P is viewed as a function of the fiscal policy tool, S, rather than being exogenous.

We further assume that the impact of S as a stabilization tool is helpful in reducing the severity of the shock but is subject to diminishing returns. Mathematically, we assume that the first derivative of P(S) is positive, $P'(S) > 0$, goes to infinity as S goes to zero, $P'(0) \rightarrow \infty$, and the second derivative is negative, $P''(S) < 0$. Utility in period 1 is denoted v(Y) and in period 2 is $P(S)u(Y_H) + (1-P(S))u(Y_L)$. Thus saving in the rainy day fund in period 1 which is used as a fiscal policy tool in period 2 increases the expected income of the state in period 2. Note that the government sector is active in its use of S and the (possibly unobserved) way that S is spent

matters. We do not explicitly model this political aspect except through the properties of the function P(S).

From an ex-ante viewpoint, the government's optimization problem for rainy day fund savings is

$$(1) \qquad \underset{S}{\text{Max}}\; v(\bar{Y} - S) + P(S)u\,(Y_H\,) + (1 - P(S))u(Y_L\,)$$

The first order condition is

$$(2) \qquad \frac{\partial P}{\partial S}\left[u(Y_H\,) - u(Y_L)\;\right] = \frac{\partial v}{\partial Y}$$

The government balances the marginal benefit and cost of saving. The cost, on the right hand side, is the loss in current spending power resulting from saving. The marginal benefit on the left hand side results from the fact that increasing saving today allows for an expansionary fiscal policy should a recession occur in the uncertain future and so increases the probability of a high-income outcome and decreases the probability of a low-income outcome.

We introduce grants by allowing cross-state transfers in period 2, but states governments retain some power over fiscal policy and can also save in a rainy-day fund for use in period 2 as before. Thus we allow for both self-insurance over time and for cross-state insurance in period 2. The model is most easily described by considering the case of two decentralized governments. The model set-up is the same as before except that there are now two states and cross-state transfers. Thus, each of the two states has certain income in period 1 and uncertain income in period 2 as before. Each can be hit by a shock, the consequences of which will depend on prior rainy-day fund savings (and transfers going to or coming from the other state as described below). The savings in a state's rainy-day fund can be used as a fiscal policy lever to combat a

recession in period 2, increasing the ex-ante probability of a high income outcome and decreasing the ex-ante probability of a low-income outcome. The shocks that hit each state are independent and identically distributed (i.i.d.). The joint possibilities for income in the union are:

i. (Y_H, Y^*_H) with probability P(S)P(S*)

ii. (Y_H, Y^*_L) with probability P(S)(1-P(S*))

iii. (Y_L, Y^*_H) with probability (1-P(S))P(S*)

iv. (Y_L, Y^*_L) with probability (1-P(S))(1-P(S*))

where the asterisk differentiates the two states; we will however assume symmetry across the two countries to simplify.

To model the cross-state transfers we assume that the state government that ends up in the low-income state receives a direct transfer from the state government that ends up in the high-income state. We call this transfer T. A first question is what happens to each state's ex-ante rainy-day fund contributions when we introduce such a transfer. The problem of a state becomes:

$$\begin{aligned} &\underset{S}{\text{Max}}\, v(\overline{Y} - S) + \\ &+ P(S)P(S^*)u\,(Y_H\ ) \\ &+ P(S)(1 - P(S^*)u(Y_H\ - T) \\ &+ (1 - P(S))P(S^*)\,u(Y_L\ + T) \\ &+ (1 - P(S))(1 - P(S^*))\,u(Y_L\ ) \end{aligned} \tag{2}$$

and the first-order condition is:

$$\frac{\partial P}{\partial S} P(S^*)\left[u(Y_H\ ) - u(Y_L\ + T)\right] - \frac{\partial P}{\partial S}(1 - P(S^*))\left[u(Y_L\ ) - u(Y_H\ - T)\right] = \frac{\partial v}{\partial S} \tag{3}$$

Once again saving for precautionary reasons in a rainy-day fund has a cost: the state diverts money that could be used today to an uncertain future. This cost, the fall in utility in the present is shown on the right hand side of the first order condition.

The left hand side indicates the marginal benefit of saving the rainy-day fund. This is different once grants are included. In fact, the marginal benefit of savings is lower than before so contributions to a rainy-day fund will be lower. As the grant is introduced, saving in a rainy-day fund makes it more likely for a state to be a payer and less likely to be a receiver of a cross-state transfer, thus reducing the marginal benefit of rainy-day savings.

This is the moral hazard cost of the transfer and implies that rainy day fund savings are lower with transfers than without.[1] Secondly, the savings level of the rainy day fund will depend negatively on the size of the transfer T. To show this note that as the transfer T rises, the first bracketed term of the marginal benefit of savings given by falls and the second (negative) bracketed term rises. Thus the marginal benefit of savings falls leading to a lower contribution to the rainy-day fund as the transfer rises.

To summarize, a system of grants leads to lower contributions to a state's rainy-day fund, and the larger is the grant the lower will be states' contributions to their own rainy-day funds. Moving to the Nash equilibrium, each state's reaction function is lower when grants rise, so the Nash equilibrium level of savings is lower as well.

[1] Since there are two players in our simple characterization of transfers, we need to think about the Nash equilibrium in this game. But given the assumed symmetry, each state will have identical reaction functions. One can show that the reaction functions are downward sloping, that a Nash equilibrium exists, and (given symmetry) that the level of savings of each member will be identical. Each state will save less than they would without transfers in equilibrium.

IV. Empirical Framework and Data

We turn next to an empirical examination of counter-cyclical fiscal policies in US States. As mentioned above, the extreme event negatively affects both the expenditure and revenue sides of the budget. Counter-cyclical fiscal policy thus emanates from one of three sources: increased debt, increased grants from the central government, or the use of previous savings accumulated in rainy day funds. How do these three fiscal policy tools compare in their effect in countering the impact of an extreme event?

To find evidence on this question we analyze the effect of each of these sources of fiscal policy on unemployment in US States. Our approach is a difference in difference methodology that is captured in the following basic regression equation:

$$U_{st} = b_0 + b_1 X_{st} + b_2 C_{t'} * X_{st} + D_s + D_t + u_{st}$$

where U is the unemployment rate in State s at time t, X is the fiscal variable of interest (grants, rainy day funds, or debt) in state s at time t, C is a dummy variable that defines the period of crisis during time t', D_s are state dummies, D_t are time dummies, and u is a random error term.

We will consider as our extreme event the financial crisis period which we will define as 2007-2010. Unfortunately, state and local data are available only with a significant lag and therefore data limitations do not allow us to test anything for the Covid epidemic.

An additional variation on the difference in difference methodology will test whether rainy day funds and grants are substitutes or complements. That is, do additional grant funds tend to dampen the use and effectiveness of rainy day funds as noted in the previous section. This variation is captured in the following additional regression equation:

$$U_{st} = b_0 + b_1 X_{st} + b_2 C_{t'} * X^1_{st} + b_3 C_{t'} * X^2_{st} + b_4 C_{t'} * X^1_{st} * X^2_{st} + D_s + D_t + u_{st}$$

Here we are interested in the sign of the coefficient b_4 as well as b_2 and b_3 as before.

The data spans the years 1977 to 2019 with some exceptions. Fiscal variables will be measured in real per capita terms where real values are calculated as the nominal value divided by the personal consumption expenditures (PCE) price index for that year. State and local finance data is downloaded from the Office of Tax Policy and comes from the state and local government finances of the Census Bureau. Unfortunately, Census did not collect this information for 2001 and 2003 due to budgetary constraints; these two years have been dropped from the sample.

An important fiscal variable is intergovernmental revenue which we will refer to as grants. As noted in the US Census Bureau (2006) Classification Manual, this variable "comprises monies from other governments, including grants, shared taxes, and contingent loans and advances for support of particular functions or for general financial support; any significant and identifiable amounts received as reimbursement for performance of governmental services for other governments; and any other form of revenue representing the sharing by other governments in the financing of activities administered by the receiving government." Importantly it also excludes social insurance revenues such as unemployment insurance which are treated as insurance trust revenue.

State population figures are taken from the Census Bureau. State rainy day balances are drawn from the Fiscal Survey of States of the National Association of State Budget Officers. As noted above, a limited number of states had rainy day funds in the early years of the sample. State unemployment rates are downloaded from FRED.

We use a difference in difference approach to identify causality in the effects of our fiscal variables on unemployment. Here it is important to note the control group. All states are hit by the financial crisis so there is no contemporaneous control group. Rather the control group is the time period outside of the crisis period. I include both time and state fixed effects, thus controlling for common effects on unemployment across states in any year as well as time invariant factors unique to a state over the time period. (Since I include time fixed effects I cannot also include a separate crisis dummy but I can include its interaction as noted in the regression specification.) Thus the interpretation of the coefficient on our fiscal variables is the average effect of the fiscal variable on unemployment within a state during the crisis period relative to the average effect within a state outside of the crisis period.

It is also likely that any effect of our fiscal variables happens in the future rather than immediately; moreover, endogeneity could be an issue for a contemporaneous specification since it may be difficult to disentangle the effect of the fiscal variable on unemployment from the reverse effect. We therefore offer in the results two variations for the time period of unemployment: a two year lead for the unemployment rate and a 4 year lead for the unemployment rate.[2]

Finally, we offer results for three time variations of the sample: the full sample (1977-2019), the sample since 1990, and the sample since 2000. We do this for several reasons. First, we do this in part to vary the comparison group; over the different control periods there are different business cycle episodes which could result in different impacts of the fiscal variables on unemployment. Secondly, we vary the sample years because rainy day funds for states did not

[2] I also ran a contemporaneous specification; the results from the contemporaneous specification are excluded to save on space. For the most part they are consistent with the results presented but are the least preferred due to the aforementioned endogeneity issues.

become prevalent until after 2000, thus for the pre-2000 period there are many zero states. And finally grants also vary considerably over our full sample, and incorporate various changes in the structure of the US grants system.

V. Results

As noted above, we will examine how three potential state counter-cyclical policy tools impacted state unemployment during an extreme event, the financial crisis. The three fiscal policy tools we examine are debt, grants from the central government, and previous savings accumulated in rainy day funds.

We will present several variations. Tables 1 and 2 present results for the full sample from 1977 to 2019. The dependent variable for Table 1 is the log of a state's unemployment rate two years in the future as the dependent variable. Table 2 presents the results using the log of a state's unemployment rate four years in the future as the dependent variable. Each specification includes a full set of year and state fixed effects.

We will also present specifications for two other sample periods. This essentially varies the control group. Tables 3 and 4 will present results using the years 1990 to 2019 and Tables 5 and 6 will present results for 2000 to 2019. One reason to use the period from 1990 is that the 1990s saw a significant reform of the grant system so could potentially offer a better control group. Likewise, rainy day funds became most popular in the 1990s so the period since 2000 is also potentially a better control group.

For all sample periods used as the control, the first three columns of each table examine the impact of each fiscal variable in isolation. The first column of each table includes grants per capita and an interaction of the crisis period with grants per capita. The crisis period is defined as

2007-2010 (a separate variable for this dummy is of course not included since the year dummies are included). The second column of each table includes rainy day funds per capita and an interaction of this with the crisis period. The third column of each table includes debt per capita and an interaction of this with the crisis period.

The fourth column of each table examines the interaction of rainy day funds and grants. This column includes grants per capita, rainy day funds per capita, and interaction of each with the crisis period, and an interaction of both with the crisis period. It is this last interaction that will tell us whether grants and rainy day funds are substitutes or complements.

Table 1 uses the full sample and the log of unemployment two years in the future as the dependent variable which should help with any endogeneity issue from a contemporaneous specification. Column 1 indicates a slightly negative impact of grants per capita on unemployment outside of the crisis period but a larger and more significant negative impact of grants on unemployment during the crisis period. Column 2 indicates rainy day funds significantly lowered future unemployment during the crisis period but not outside of it. Column 3 indicates that more debt did not help in lowering future unemployment, indeed it is associated with higher future unemployment and this relationship is accentuated during the crisis period. The final column includes both rainy day funds and grants. The results from this column indicates that both rainy day funds and grants lowered unemployment during the crisis period, but the interaction term indicates they also act as substitutes. That is, the effect of rainy day funds on unemployment is lessened the higher are grants. This is consistent with the results of the theoretical model outlined above.

Table 1. Log of Unemployment Rate t+2, Full Sample

Variables	(1) lunemploy_lead2	(2) lunemploy_lead2	(3) lunemploy_lead2	(4) lunemploy_lead2
Grants per capita	-2.97e-05*			-2.72e-05
	(1.70e-05)			(1.76e-05)
Grants*Crisis	-0.000156***			-0.000153***
	(2.04e-05)			(2.35e-05)
Rainy day per cap		-4.73e-06		-4.04e-06
		(4.16e-06)		(4.22e-06)
Rainy*Crisis		-3.09e-05***		-0.000154**
		(8.20e-06)		(7.40e-05)
Debt per capita			1.27e-05***	
			(2.11e-06)	
Debt*Crisis			8.33e-06*	
			(4.62e-06)	
Grants*rainy*crisis				3.53e-08**
				(1.68e-08)
Constant	1.693***	1.665***	1.618***	1.691***
	(0.0280)	(0.0231)	(0.0243)	(0.0283)
Observations	1,950	1,949	1,950	1,949
R-squared	0.717	0.707	0.711	0.718
Number of stateid	50	50	50	50
Fixed State Effects	Y	Y	Y	Y
Fixed Year Effects	Y	Y	Y	Y

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2 uses the full sample and the log of unemployment four years in the future as the dependent variable which both strengthens the case for exogeneity and provides evidence on the fiscal impact further in the future. These results largely support the results of Table 2 with somewhat stronger statistical significance on debt. Subnational debt appears to increase (worsen) rather than lessen unemployment four years in the future.

Table 2. Log of Unemployment Rate t+4, Full Sample

Variables	(1) lunemploy_lead4	(2) lunemploy_lead4	(3) lunemploy_lead4	(4) lunemploy_lead4
Grants per capita	-4.42e-05**			-5.15e-05***
	(1.84e-05)			(1.90e-05)
Grants*Crisis	-0.000112***			-0.000107***
	(2.09e-05)			(2.41e-05)
Rainy day per cap		3.23e-06		5.40e-06
		(4.21e-06)		(4.29e-06)
Rainy*Crisis		-2.62e-05***		-0.000164**
		(8.25e-06)		(7.43e-05)
Debt per capita			1.09e-05***	
			(2.19e-06)	
Debt*Crisis			1.46e-05***	
			(4.63e-06)	
Grants*rainy*crisis				3.70e-08**
				(1.69e-08)
Constant	1.989***	1.947***	1.907***	1.996***
	(0.0288)	(0.0231)	(0.0243)	(0.0292)
Observations	1,850	1,849	1,850	1,849
R-squared	0.723	0.716	0.720	0.724
Number of stateid	50	50	50	50
Fixed State Effects	Y	Y	Y	Y
Fixed Year Effects	Y	Y	Y	Y

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Tables 3 and 4 repeat Tables 1 and 2 using as a sample 1990 to 2019 rather than starting with 1977. This essentially changes the control group since the control is the impact of the fiscal variable outside of the crisis period. One reason that this control group is interesting is that there were structural changes in grants that took place during the 1990s. With this control group, the differences during the crisis period become stronger. Qualitatively, the results are similar and they are statistically stronger, with a higher R^2, greater significance for interactions, and less significance for the fiscal variables outside of the crisis period.

Table 3. Log of Unemployment Rate t+2, 1990-2019 Sample

Variables	(1) lunemploy_lead2	(2) lunemploy_lead2	(3) lunemploy_lead2	(4) lunemploy_lead2
Grants per capita	-2.67e-05			-2.36e-05
	(1.77e-05)			(1.82e-05)
Grants*Crisis	-0.000152***			-0.000148***
	(1.74e-05)			(2.00e-05)
Rainy day per cap		-5.01e-06		-5.47e-06
		(3.91e-06)		(3.91e-06)
Rainy*Crisis		-3.09e-05***		-0.000157**
		(7.05e-06)		(6.29e-05)
Debt per capita			6.36e-06*	
			(3.42e-06)	
Debt*Crisis			1.75e-07	
			(4.16e-06)	
Grants*rainy*crisis				3.58e-08**
				(1.43e-08)
Constant	1.910***	1.886***	1.848***	1.907***
	(0.0252)	(0.0198)	(0.0283)	(0.0255)
Observations	1,300	1,300	1,300	1,300
R-squared	0.779	0.766	0.762	0.780
Number of stateid	50	50	50	50
Fixed State Effects	Y	Y	Y	Y
Fixed Year Effects	Y	Y	Y	Y

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4. Log of Unemployment Rate t+4, 1990-2019 Sample

Variables	(1) lunemploy_lead4	(2) lunemploy_lead4	(3) lunemploy_lead4	(4) lunemploy_lead4
Grants per capita	-5.94e-06			-1.33e-05
	(1.95e-05)			(2.01e-05)
Grants*Crisis	-0.000118***			-0.000113***
	(1.82e-05)			(2.09e-05)
Rainy day per cap		4.30e-06		3.71e-06
		(3.96e-06)		(4.02e-06)
Rainy*Crisis		-2.59e-05***		-0.000159**
		(7.15e-06)		(6.42e-05)
Debt per capita			6.44e-06*	
			(3.64e-06)	
Debt*Crisis			6.88e-06	
			(4.20e-06)	
Grants*rainy*crisis				3.58e-08**
				(1.46e-08)
Constant	1.689***	1.684***	1.646***	1.696***
	(0.0266)	(0.0199)	(0.0292)	(0.0269)
Observations	1,200	1,200	1,200	1,200
R-squared	0.774	0.767	0.765	0.776
Number of stateid	50	50	50	50
Fixed State Effects	Y	Y	Y	Y
Fixed Year Effects	Y	Y	Y	Y

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Tables 5 and 6 repeat the analysis using as a sample 2000 to 2019. The results again largely mimic the longer samples, with a higher R^2. One notable difference is in the debt per capita variable. It is found to decrease unemployment four years ahead outside of the crisis period, but is found to increase the unemployment rate four years ahead during the crisis period. The latter result is consistent with the Table 2 results for the full sample period, while the former result is opposite in sign to the corresponding full sample results. The reason for this is that the control group is different in the two tables. For the two decades between 2000 and 2019, debt

was rather effective in reducing future unemployment and debt in the crisis period does rather poorly in comparison. But for the approximately four decades of the full sample, debt was not effective in reducing future unemployment (hence the difference) and debt in the crisis period was even less effective.

Table 5. Log of Unemployment Rate t+2, 2000-2019 Sample

Variables	(1) lunemploy_lead2	(2) lunemploy_lead2	(3) lunemploy_lead2	(4) lunemploy_lead2
Grants per capita	7.05e-06			2.39e-06
	(2.14e-05)			(2.14e-05)
Grants*Crisis	-0.000132***			-0.000123***
	(1.59e-05)			(1.82e-05)
Rainy day per cap		-2.36e-06		-6.83e-06
		(4.73e-06)		(4.62e-06)
Rainy*Crisis		-3.05e-05***		-0.000163***
		(6.40e-06)		(5.71e-05)
Debt per capita			4.80e-07	
			(6.91e-06)	
Debt*Crisis			1.51e-06	
			(4.00e-06)	
Grants*rainy*crisis				3.57e-08***
				(1.29e-08)
Constant	1.619***	1.630***	1.626***	1.627***
	(0.0347)	(0.0178)	(0.0472)	(0.0346)
Observations	800	800	800	800
R-squared	0.852	0.842	0.837	0.854
Number of stateid	50	50	50	50
Fixed State Effects	Y	Y	Y	Y
Fixed Year Effects	Y	Y	Y	Y

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Log of Unemployment Rate t+4, 2000-2019 Sample

Variables	(1) lunemploy_lead4	(2) lunemploy_lead4	(3) lunemploy_lead4	(4) lunemploy_lead4
Grants per capita	8.40e-05***			7.46e-05***
	(2.34e-05)			(2.34e-05)
Grants*Crisis	-9.46e-05***			-8.48e-05***
	(1.63e-05)			(1.85e-05)
Rainy day per cap		1.91e-05***		1.54e-05***
		(4.73e-06)		(4.70e-06)
Rainy*Crisis		-1.99e-05***		-0.000109*
		(6.37e-06)		(5.69e-05)
Debt per capita			-1.33e-05*	
			(7.72e-06)	
Debt*Crisis			8.75e-06**	
			(4.01e-06)	
Grants*rainy*crisis				2.41e-08*
				(1.29e-08)
Constant	1.345***	1.460***	1.547***	1.355***
	(0.0371)	(0.0174)	(0.0518)	(0.0369)
Observations	700	700	700	700
R-squared	0.868	0.865	0.861	0.871
Number of stateid	50	50	50	50
Fixed State Effects	Y	Y	Y	Y
Fixed Year Effects	Y	Y	Y	Y

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

VI. Conclusion

Extreme events often create both macroeconomic and budgetary problems for decentralized governments. Unemployment typically rises and with it expenditure needs while revenues typically fall. At the same time the fiscal space of decentralized governments is very constrained, in part by balanced budget requirements, and monetary policy is usually out of reach as decentralized governments typically do not control or print money.

What is a decentralized government to do? At a practical level there are three options to replace lost funding and improve macroeconomic outcomes from an extreme event:

decentralized governments can anticipate and save for these budgetary rainy days themselves, they can issue debt, or the central government can step in and provide aid when such extreme events occur.

In this paper we examine the impact of these options on the unemployment rate. Using the financial crisis as our extreme event and employing a difference in difference approach, we find that both higher grants and higher rainy day fund balances during the crisis reduced future unemployment on the margin relative to periods outside of the crisis. Increased debt does not provide the same benefits; indeed, it may increase future unemployment. We also find that grants and rainy day funds are substitutes in their effect on unemployment: greater grant funding implies a somewhat smaller effect of own savings on future unemployment.

References

Bartolini, D., Sacchi, A., Salotti, S., & Santolini, R. (2018). Fiscal decentralisation in times of financial crises. CESifo Economic Studies, 64(3), 456–488. doi:10.1093/cesifo/ifx008

Baskaran, T. (2010). On the link between fiscal decentralization and public debt in OECD countries. Public Choice, 145(3), 351–378. doi:10.1007/s11127-009-9570-4.

Baskaran, T. (2012), "Soft budget constraints and strategic interactions in subnational borrowing: Evidence from the German States, 1975-2005", Journal of Urban Economics, 71(1): 114-127.

Beramendi, Pablo and Melissa Rogers (2020) Fiscal decentralization and the distributive incidence of the Great Recession, Regional Studies, 54:7, 881-896, DOI: 10.1080/00343404.2019.1652895

Buettner, T. and Wildasin, D. E. (2006), "The dynamics of municipal fiscal adjustment", Journal of Public Economics, 90(6-7): 1115-1132.

Carlino, G., and R. P. Inman. 2013. "Local Deficits and Local Jobs: Can US States

Stabilize Their Own Economies?" Journal of Monetary Economics 60 (July): 517–30.

Chernick, Howard, David Copeland, and Andrew Reschovsky. 2020. The Fiscal Effects of the COVID-19 Pandemic on Cities: An Initial Assessment , National Tax Journal, 73:3, pp. 699-732.

Clemens, Jeffrey and Stan Veuger. 2020). Implications of the COVID-19 Pandemic for State Government Tax Revenues, National Tax Journal, 73:3, pp. 619-644.

de Mello, Luiz and João Tovar Jalles (2020) The global crisis and intergovernmental relations: centralization versus decentralization 10 years on, Regional Studies, 54:7, 942-957, DOI: 10.1080/00343404.2019.1645326

Eyraud, Luc and Lusine Lusinyan. 2013. "Vertical fiscal imbalances and fiscal performance in advanced economies." Journal of Monetary Economics 60 (July): 571-87.

Gonzales, C., Paqueo, V. 2003. Social sector expenditures and rainy-day funds, World Bank Policy Research Working Paper 3131.

Gordon, Tracy, Lucy Dadayan, and Kim Rueben (2020), State and Local Government Finances in the COVID-19 Era , National Tax Journal, 73:3, pp. 733-758.

Goodspeed, Timothy J. 2016. "Absorbing Shocks: National Rainy-Day Funds and Cross-Country Transfers in a Fiscal Union," FinanzArchiv: Public Finance Analysis, Mohr Siebeck, Tübingen, vol. 72(4), pages 407-420, December.

Goodspeed, Timothy J. 2017. "Bailouts and Soft Budget Constraints in Decentralized Government: A Synthesis and Survey of an Alternative View of Intergovernmental Grant Policy," Hacienda Pública Española, IEF, vol. 221(2), pages 113-134, June.

Goodspeed, Timothy J. 2020. Decentralization and intra-country transfers in the Great Recession: the case of the European Union, Regional Studies, 54:7, 931-941, DOI: 10.1080/00343404.2019.1666207

Green, Daniel and Erik Loualiche. 2021. “State and local government employment in the COVID-19 crisis.” Journal of Public Economics. Volume 193. 104321.

Hines and Richard Thaler. 1995. “The Flypaper Effect.” Journal of Economic Perspectives vol. 9, no. 4, (pp. 217-226).

Inman, Robert P. 2010. “States in Fiscal Distress.” Regional Economic Development, Federal

Reserve Bank of St. Louis 6 (1): 65–80.

Knight, B., and Levinson, A. (1999), Rainy Day Funds and State Government Savings,National Tax Journal 52, 459–472.

Lago, Manuel E., Santiago Lago-Penas, and Jorge Martinez-Vazquez, 2022. "On the Effects of Intergovernmental Grants: A Survey," International Center for Public Policy Working Paper Series, at AYSPS, GSU paper2203, International Center for Public Policy, Andrew Young School of Policy Studies, Georgia State University.

Lago-Peñas, Santiago, Jorge Martinez-Vazquez, and Agnese Sacchi. 2020. Fiscal stability during the Great Recession: putting decentralization design to the test, Regional Studies, 54:7, 919-930, DOI: 10.1080/00343404.2019.1637836

National Association of State Budget Officers. Fiscal Survey of States (various issues) and State Rainy Day Fund Balances Historical Data Set, 1988-2022.

Neyapti, B. (2010). Fiscal decentralization and deficits: International evidence. European Journal of Political Economy, 26(2), 155–166. doi:10.1016/j.ejpoleco.2010.01.001

Oates, Wallace E. 1972. Fiscal Federalism. Harcourt Brace Jovanovich, Inc.

Pettersson-Lidbom, P. (2010), “Dynamic Commitment and the Soft Budget Constraint: An Empirical Test”, American Economic Journal: Economic Policy, 2(3): 154-79.

Rodríguez-Pose, Andrés and Tobias Ketterer 2020. Institutional change and the development of lagging regions in Europe, Regional Studies, 54:7, 974-986, DOI: 10.1080/00343404.2019.1608356

Sobel, R.S. and R.G. Holcombe, “The Impact of State Rainy Day Funds in Easing State Fiscal Crises During the 1990–1991 Recession,” Public Budgeting & Finance, 1996, 16 (3), 28–48.

Sorribas-Navarro, P. (2011), “Bailouts in a fiscal federal system: Evidence from Spain”, European Journal of Political Economy, 27(1): 154-170.

U.S. Bureau of the Census. 2006. Government Finance and Employment Classification Manual Covering the activities of the Federal, state, and local governments.

Wilson, Daniel. 2012. “Fiscal Spending Jobs Multipliers: Evidence from the 2009 American Recovery and Reinvestment Act.” American Economic Journal: Economic Policy 4 (August): 251–82.

Zhao, B. (2014), Saving for a Rainy Day: Estimating the Appropriate Size of U.S. State Budget Stabilization Funds, Federal Reserve of Boston Working Paper 14-12.