The Impact of State Fiscal Policy on States' Resilience Entering the Great Recession

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Abstract

The U.S. economy entered the Great Recession in December 2007 and exited in June 2009. This national statistic obscures a wealth of state-level data shedding light on the policies and conditions that helped some states withstand that recessionary shock for a time. In this study, we used that state-level data in a parametric regression model, known as survival analysis, to estimate the effects that a state's fiscal policy had on the timing of its entry into the Great Recession. Consistent with earlier, more general, studies focusing on economic growth, we found that taxes have the potential to hasten the start of a state's recession, while expenditures could defer that event. However, not all types of taxes and expenditures were equivalent in terms of their effect on recessionary timing. Most notably, our results showed that corporate income taxes had a different timing effect than sales, property, and individual income taxes. In addition, although total expenditures tended to delay the Great Recession's onset, relatively few individual expenditure types had a statistically-significant impact on recessionary timing. Overall, our results suggest that, while taxes likely increase a state's recessionary risk and expenditures likely decrease it, that narrative is an oversimplification of the complex role played by fiscal policy in determining a state's ability to resist a negative economic shock like the Great Recession.

1 Introduction

The Great Recession was a widespread recession that, at a national level, began in December 2007 and ended in June 2009 (National Bureau of Economic Research, 2010). By the time it had run its course, the Great Recession had crippled the national economy across most geographic regions and industrial sectors. However, that recession's effects were not uniform across the nation. Each state faced its own Great Recession, and some states did a better job than others resisting its effects. For example, Brown (2017) reported that only three of the seven states of the Federal Reserve's Tenth District entered the Great Recession at approximately the same time as the nation. Of the remaining four states, two entered before the estimated national start date and two entered afterward.

The extent of the Great Recession's damage, and its duration, also undoubtedly varied among the states. In that respect, the Great Recession was a typical economic downturn. Indeed, states' economic performance during past recessions has often deviated from the nation's overall performance. Crone (2006) noted that

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only fifteen states had recessions that aligned with all four national downturns occurring from 1979 to 2006 and had no other recessions during that same period.

Exploring why some states are more successful than others at weathering economic shocks like the Great Recession is important. In particular, a better understanding of the relationship between the states' fiscal policies and their susceptibility to recessions may help state governments ward off future recessions. While economists have widely studied the general relationship between a state's fiscal policy and its economic performance, we know less about that relationship in a recessionary context. Only a few studies to date have examined how a state's fiscal policy helps, or hinders, its ability to survive a recession. Those studies largely focused on assessing how a state's policies affected the recession's severity for that state, without attempting to understand timing differences in the recession's onset among the states.

This study fills that gap by using the wealth of state-level data available from the years immediately preceding the Great Recession to uncover some of the policies and conditions that determined how well each state withstood the Great Recession's onset.[1] More specifically, we are interested in the role that state-level, fiscal-policy instruments played in hastening, or delaying, each state's entry into the Great Recession. To that end, we gathered data on the states' taxes and expenditures as a percentage of state GDP and their relative reliance on different types of taxes and expenditures as percentages of total tax revenue and total expenditures, respectively. Employing a parametric regression model known as survival analysis to estimate the effects that the states' tax and expenditures policies had on their relative recessionary risk, we found that fiscal-policy metrics played an important in role in determining the rate of entry into the Great Recession.

2 Literature Review

To develop our model of recessionary risk, we drew from two distinctly different, but related, areas of the literature.

2.1 Fiscal Policy and Economic Performance

The link between fiscal policy and economic performance has been widely addressed in the economics literature. In endogenous long-term growth models, such as that proposed by Barro (1990), the government plays an explicit role in shaping economic growth via its tax and expenditure decisions.[2] In particular, economic growth is a function of both the level of a state's taxes and whether the state spends its tax receipts on productive services and infrastructure (e.g., education, transportation) or on redistributive and consumption-oriented services (e.g., public welfare, social service administration). In this framework, although a tax increase may decrease the net return to private capital, thereby slowing down the rate of growth, using the tax receipts to fund investments in infrastructure may lead to enhanced economic performance in the future (Barro, 1990). Which effect dominates depends on, among other factors, the level of taxes. Although the positive effect of spending may outweigh the negative effect of higher taxes initially, as the tax rate increases, the relative magnitude of the effects is likely to switch, such that the negative effect dominates.

Numerous empirical studies provide support for the endogenous growth-model framework. Poot (2000), synthesizing the existing literature in this area, concluded that the link between total government expenditures as a percent of GDP and long-term growth is weakly negative. However, breaking spending down into more narrowly-defined components revealed a positive relationship between spending on education and economic growth, as well as a positive relationship between spending on infrastructure and economic growth. More recent studies reinforce the critical role played by expenditure mix in determining economic performance (e.g., Pereira, 2000; Cohen and Paul, 2004; Bania and Stone, 2008; Srithongrung and Kriz, 2014).

[1] Our study relies exclusively on data from the years immediately preceding the Great Recession in the United States. For that reason, our results and conclusions may not extend to other recessionary periods in the United States or elsewhere. We hope to extend this analysis to other recessions in future studies, so that we may determine whether common economic resilience factors exist.

[2] In exogenous long-term growth models, external factors, such as technological progress, drive economic growth (Solow, 1956). Even in this context, however, government may play role in the transitional phase before the economy reaches the steady state.

Turning to tax policy, the general consensus is that the tax rate is inversely related to measures of economic growth, although the magnitude of this relationship is less certain and depends on the type of expenditure funded by tax receipts (Poot, 2000; Bania and Stone, 2008; Srithongrung and Kriz, 2014; Arin et al., 2016; Kneller and Misch, 2017). Thus, these spending and tax studies are generally consistent with the traditional countercyclical view of fiscal policy espoused by Keynes. While many of these models focus on fiscal policy at the federal level, studies exploring the relationship between taxes, expenditures, and economic performance at the regional or state level are of particular interest here (e.g., Helms, 1985; Bania et al., 2007; Reed, 2008; Alm and Rogers, 2011; Gale et al., 2015).

For example, Berry and Kaserman (1993) explored the determinants of long-run, state-level economic development, as measured by state per-capita income. Using a longitudinal data set, they concluded that more rapid rates of growth are negatively correlated with state tax rates and positively correlated with government expenditure on higher education, as well as the percentage of state government expenditures dispersed to local governments. In fact, their analysis suggested that these fiscal-policy metrics might have greater explanatory power than the more traditional industrial composition metrics used in other studies (e.g., Connaughton and Madsen, 2009; Walden, 2012; Khatiwada, 2014; Brakman et al., 2015). This result was reinforced by Bania and Stone (2008), who compared the degree to which individual state fiscal structures affect their economic growth. Although the duration and magnitude of a fiscal policy's impact on a state depends on factors like the specific type of fiscal-policy instrument used (Srithongrung and Kriz, 2014; Crosby and Merriman, 2016) and the fiscal policies in place in surrounding states (Cohen and Paul, 2004), the combined effect of tax and spending policy, not either type of fiscal-policy instrument in isolation, explains differences in the real growth in personal income per capita. Thus, focus should remain on institutional design, or, in the words of Pjesky (2016), "[H]ow do policymakers design systems of taxation that harms [sic] us the least and how do we spend the money in a way that helps us the most?" (p. 110)

2.2 Economic Resilience

The fiscal-policy literature typically defines economic performance in terms of the growth rate of GDP, the employment (or unemployment) level, per capita disposable incomes, or wages. However, economic resilience is another important measure of economic performance. According to Martin (2012), resilience consists of four distinctly different dimensions or phases: resistance, recovery, reorientation, and renewal. In general, Martin and Sunley (2015) suggest that the manner in which a state or region moves through these phases is primarily a function of four economic subsystems: (1) the industrial structural and business subsystem (e.g., firm size and ownership, market orientation); (2) the labor market subsystem (e.g., skill set of workforce, labor mobility); (3) the financial subsystem (e.g., loan and equity market conditions); and (4) the governance subsystem (e.g., national and local economic policies, regulatory environment). These subsystems interact with expectations and norms to determine a region's or state's response to an economic shock.

Although all four dimensions of resilience are critical in understanding the manner in which a state's or region's economy responds to a recessionary shock, of particular relevance to our study are models addressing a state's resistance to such disturbances. In this context, resistance encompasses the timing of the reaction to the recessionary shock and the depth of that reaction. Numerous studies have examined how the depth of reaction to a recessionary shock has varied among regions (Hassink, 2010; Martin et al., 2016) or states (Connaughton and Madsen, 2012; Walden, 2012). In these studies, the variable of interest was typically the employment rate, with "high resistance" being denoted by a relatively small decrease in the employment rate over the course of the recession and "low resistance" being denoted by a relatively large decrease in the employment rate over the course of the recession. Although these models presented empirical evidence that regions and states differ in terms of their depth of reaction to a recessionary shock, they largely did not explain the source of those differences or address differences in the timing of the recession (Connaughton and Madsen, 1985; Martin, 2012; Fingleton et al., 2012; Pereira, 2014; Han and Goetz, 2015). According to Han and Goetz (2015), examining the causes and consequences of these various patterns represents a fruitful area for additional study.

Several studies have explored the relationship between economic resistance and the industrial structural and business subsystem. Those studies suggested that differences in regional responses to a recessionary shock were at least partially the result of differences in industrial composition and diversity (Deller and Watson,

2016), but that that relationship was not consistent over time or over regions (Martin et al., 2016). Several of these studies incorporated elements of the labor market subsystem, including the impact of housing prices and in-migration (Walden, 2012), education and poverty (Connaughton and Madsen, 2012), and urbanization (Brakman et al., 2015) on unemployment.

Most closely related to our study are models focusing on the role of the governance subsystem in explaining why some regions experience severe declines in economic performance and others seem more insulated from recessionary shocks. In this context, one area of interest has been the impact of such a shock on state tax revenues and expenditures (Dye, 2004; Campbell and Sances, 2013; Chernick et al., 2014; Seegert, 2015), as well the effect of balanced-budget rules on a state's fiscal response (Hong, 2015). However, only a few studies to date have addressed the role played by fiscal-policy instruments in determining economic resistance. Connaughton and Madsen (2009) examined each state's contribution to the overall U.S. Okun gap (i.e., the loss between actual GDP and potential GDP over the full course of a recession) from 2001 to 2005 and the factors affecting that contribution, including the state and local tax burden index. Walden (2012) considered the degree to which the state and local tax revenue, as a percentage of personal income, affected the unemployment rate during the Great Recession. Although neither study found evidence of a statistically-significant relationship between taxes and economic resistance, that outcome may have been a result of their use of an aggregate tax measure and choice of econometric model.

In general, economic resistance encompasses both the timing of a state's reaction to a recessionary shock and the depth of the reaction. Although the previously summarized literature focuses on factors that determine the severity of reaction to a recessionary shock, little attention has been paid to differences in the timing of recessions across states. The current study fills that gap by drawing on the discipline's understanding of economic growth and economic resilience. Building on the work of Iqbal and Silvia (2016), who utilized an ordered-probit framework to predict the probability of a recession based on broad metrics of economic performance, we developed a model that more closely links the timing of a recession to the components of the economic subsystems that determine economic resilience. Our study is similar to that of Lewin et al. (2018) in that we adopted a survival analysis model to estimate recessionary risk,[3] controlling for elements of the industrial landscape and labor force. However, motivated by the resilience model proposed by Martin and Sunley (2015) and the economic growth literature, we also incorporated tax and expenditure fiscal-policy metrics.

3 Method

3.1 Data

The period for our study is from 2004 to 2009, which begins several years before the first state in our data set entered the Great Recession and ends with the last state's entry. At a national level, a committee of the National Bureau of Economic Research (NBER) sets dates for the beginning and end of recessionary/expansionary periods.[4] At the state level, however, there are no official dates for turning points in the business cycle. Furthermore, consistent monthly state-level indicators of economic performance are not widely available.[5] For example, gross state product is published quarterly, with a lag of approximately six months. Given the importance of monitoring multiple monthly performance indicators when defining the

[3]As explained in more detail under Model Specification, survival analysis is a regression modeling technique where the dependent variable is the time until an event of interest occurs. Here, as in Lewin et al. (2018), the event of interest is the Great Recession's onset for the relevant geographic unit (e.g., a state). While applying survival analysis to economic downturns is relatively new, researchers have employed these statistical methods to study a wide variety of phenomena, including the literal survival of women suffering from eating disorders (Keel et al., 2003), unemployment duration (e.g., Lancaster, 1979), and the duration of golf tourists' visits to the Algarve region in southern Portugal (Barros et al., 2010).

[4]In common parlance, a national recession occurs when GDP declines for at least two consecutive quarters. The NBER, however, does not exclusively rely on GDP when identifying recessionary periods. Instead, it defines a national recession as a substantial decline in economic activity at the national level that lasts for more than a few months. Accordingly, the NBER considers a variety of monthly indicators when reaching a decision regarding the timing of recessionary/expansionary periods (National Bureau of Economic Research, 2010). For additional discussion, see Zarnowitz (1992).

[5]Given that the NBER dates turning points in the national business cycle in terms of months, and that multiple national recessions have been less than a year in length, defining state business cycles using monthly indicators is a natural extension of previously established methodology (Crone and Clayton-Matthews, 2005).

precise timing of recessions, as emphasized by the NBER at the national level, identifying economic turning points at the state level has historically been problematic.

To address that deficiency, the Federal Reserve Bank of Philadelphia constructed and made available the monthly coincident index (Crone and Clayton-Matthews, 2005), which is a state-level measure of economic performance. Like the NBER's methodology for national recessions, this coincident index combines data on several monthly performance indicators to summarize current economic conditions in a single state-level statistic (Crone, 2006). Those performance indicators are nonfarm payroll employment, average hours worked in manufacturing by production workers, the unemployment rate, and wage and salary disbursements deflated by the consumer price index (U.S. city average).[6]

Table 1: Entry into Great Recession by State

States	Month & Year
Montana, Rhode Island	March 2007
Illinois, Michigan, Nevada, Tennessee	June 2007
Alabama, Hawaii	July 2007
Connecticut	August 2007
Arizona, California, Delaware	October 2007
Florida	December 2007
Louisiana, Massachusetts	January 2008
Maryland, Ohio	February 2008
Georgia, Indiana, Iowa, Kentucky, Maine, Minnesota, Mississippi, New York, South Carolina	March 2008
Idaho, Missouri, Oklahoma, Washington	April 2008
Kansas, New Jersey, New Mexico, Oregon, West Virginia	May 2008
Pennsylvania, South Dakota, Vermont, Virginia	June 2008
Colorado, North Dakota, Utah, Wyoming	August 2008
Arkansas, New Hampshire, Wisconsin	September 2008
Nebraska	November 2008
Alaska, Texas	January 2009

Although the trend for each state's index is consistent with that state's long-term GDP growth, the index itself typically exhibits greater volatility than comparable national metrics. We followed the criteria established by the Federal Reserve Bank of Philadelphia to address this volatility by defining recessionary entry as the month in which (1) the cumulative decline in the states coincidence index is at least 0.5%, which is the smallest decline in the national index for any recession in the last quarter century, and (2) the period from that index's peak to its trough is at least 3 months (Crone, 2006). Based on these criteria, the first state entered the Great Recession in March 2007 and the last state entered in January 2009 (see Table 1 for the full list of entry dates). The mean date of entry was March 2008.

We grouped our explanatory variables into three broad, state-level categories: (1) industry- and population-related variables;[7] (2) tax-related variables; and (3) expenditure-related variables.[8] In the model itself, we

[6]As noted by Crone (2006), "A complete set of state indexes is available only from 1979 because some data series needed to construct the indexes are not available before then. For consistency, each state's index is constructed from the same set of variables" (p. 11). Thus, using the general coincident index instead of some other measure of economic performance more tailored to the Great Recession, such as one tied to the housing crisis, allows us to more easily extend our model to other recessionary periods.

[7]Although a clear link existed between the housing industry crisis and the Great Recession, the deterioration of household balance sheets was not the primary cause of the economic decline (Bernanke, 2018). That fact, coupled with our desire to create a generalizable model, caused us to omit this potential explanatory variable from our analysis.

[8]Given the complex economic system studied here, these categories, and the explanatory variables they encompass, are not comprehensive. For example, many economists and political scientists have studied the connections between a government's political ideology, its economic policy-making, and the resulting economic outcomes (Potrafke, 2018). Alm and Rogers (2011) considered a number of political ideology variables in their exploration of the effects that fiscal policies had on a state's economic growth and found that having a Republican governor in the preceding year was associated with lower rates of economic growth. Others investigators found stronger economic performance under Democratic governors using different economic metrics (e.g., Leigh, 2008; Chang et al., 2009). However, in a study that focused on governors having a business background, Neumeier (2018) found that party affiliation had no statistically-significant effect on income growth or unemployment. Overall, Potrafke (2018) concluded that, while "early studies suggest that leftwing/Democratic US state governments oversaw more expansionary fiscal policies than rightwing/Republican governments," in the end "[t]he evidence . . . is mixed" (pp. 194-195). Of course, the political ideology of the state government also affects the tax-related and expenditure-related variables incorporated in our study (Reed, 2006). For these reasons, and because political ideology is difficult to accurately measure among states and within a state having divided government (Potrafke, 2018), we did not include political ideology in our data set.

Table 2: Descriptive Statistics - Base Model

Explanatory Variable	Mean	Std. Dev.	Min	Max
Population between 20 years old and 64 years old, inclusive (%)	59.72	1.31	55.92	63.00
White (%)	81.61	12.28	25.59	96.91
Population density (residents/square mile)	190.68	256.39	1.13	1,197.10
Population 25 years and over with bachelors degree or more (%)	26.69	4.70	15.30	39.00
Gini index	44.62	2.01	38.44	50.30
Employed in firms with 1-99 employees (%)	39.10	7.67	29.29	80.80
Employed in firms with 100-999 employees (%)	19.52	2.53	5.85	24.23
Manufacturing employment (%)	12.41	4.73	0.00	24.07
Mining employment (%)	1.99	2.11	0.00	14.14
Construction employment (%)	6.50	1.69	0.00	12.69
Education and health employment (%)	15.70	3.06	7.76	25.18
Finance employment (%)	6.93	1.42	4.81	13.06
Information employment (%)	2.52	0.70	0.00	5.15
Leisure employment (%)	12.45	3.35	8.72	32.40
Professional employment (%)	13.83	2.93	7.91	22.84
Other services employment (%)	3.70	0.69	0.00	6.07

used two-year lagged values to account for the delay in effect typically associated with changes in fiscal policy and general economic conditions.[9] The industry and population-related variables are consistent with those most commonly used in previous economic resistance studies focusing on the depth of the response to recessionary shocks. As such, they comprised our base model (see Table 2 for variable definitions and descriptive statistics).[10] Data on age, race, education, population density and the Gini index came from the Population Division of the U.S. Census Bureau.[11] Our employment data pertaining to firm size was from the Business Dynamics Statistics (U.S. Census Bureau, 2015), while the Quarterly Census of Employment and Wages was the source for employment data pertaining to the industrial sector (U.S. Bureau of Labor Statistics, 2018).

Table 3: Descriptive Statistics - Tax and Spending Burden Models

Explanatory Variable	Mean	Std. Dev.	Min	Max
Sales tax receipts / GDP (%)	3.05	0.99	0.64	5.35
Individual income tax receipts / GDP (%)	1.76	0.97	0.00	4.17
Corporate income tax receipts / GDP (%)	0.31	0.25	0.00	2.34
Property tax receipts / GDP (%)	2.63	0.91	0.85	5.24
Higher education expenditures / GDP (%)	1.69	0.48	0.81	2.92
K-12 education expenditures / GDP (%)	3.83	0.56	2.56	5.59
Public welfare expenditures / GDP (%)	2.95	0.87	1.31	5.69
Hospital & health-related expenditures / GDP (%)	1.38	0.66	0.27	3.84
Highway-related expenditures / GDP (%)	1.27	0.47	0.51	3.38
Police & correctional expenditures / GDP (%)	1.01	0.19	0.62	1.67
Total tax receipts / GDP (%)	8.62	1.25	5.46	18.11
Total expenditures / GDP (%)	19.51	2.95	12.65	31.57

We obtained the data pertaining to tax receipts by category and expenditures by function from the Annual Surveys of State and Local Government Finance (U.S. Census Bureau, 2018b). This information, combined with state-level GDP from U.S. Bureau of Economic Analysis (2018), allowed us to consider both

[9]Fiscal-policy time lags have three components: Recognition lag, response/implementation lag, and impact lag (Hubbard et al., 2014). For our study, only impact lag is relevant because our explanatory fiscal-policy variables are the result of implemented policies. Economists typically estimate the impact lag between a fiscal policy's implementation and its effect on the economy at "several months to several years" (Hubbard et al., 2014, p. 488). Because of that uncertainty, and the wide range of explanatory fiscal-policy variables used, we tested whether our results were sensitive to this two-year lag assumption by comparing them to the results we obtained using a one-year lag or a three-year lag. We did not find significant differences.

[10]Throughout our study, we increased variables having ranges from zero to one (e.g., the Gini index) by a factor of 100 to facilitate model estimation.

[11]The source for data on age, race, and population density was the Intercensal Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2010 (U.S. Census Bureau, 2011). Given changes in survey reporting during our sample timeframe, we drew data on education from two different U.S. Census Bureau sources: (1) Statistical Abstract of the U.S. 2000-2006 (U.S. Census Bureau, 2018c) and (2) American Community Surveys (U.S. Census Bureau, 2018a). Similarly, we drew data on the Gini index from two different U.S. Census Bureau sources: (1) Hisnanick and Rogers (2007) and (2) American Community Survey 1-Year Estimates 2006-2009 (U.S. Census Bureau, 2018a).

the tax and spending burden and the tax and spending mix in our analysis (see Tables 3 and 4 for variable definitions and descriptive statistics of the variables used in our tax and spending burden models and tax and spending mix models, respectively).

Table 4: Descriptive Statistics - Tax and Spending Mix Models

Explanatory Variable	Mean	Std. Dev.	Min	Max
Sales tax receipts / Total tax receipts (%)	35.69	12.21	5.62	62.71
Individual income tax receipts / Total tax receipts (%)	20.22	10.89	0.00	44.40
Corporate income tax receipts / Total tax receipts (%)	3.55	2.67	0.00	22.42
Property tax receipts / Total tax receipts (%)	30.42	9.29	10.64	64.71
Higher education expenditures / Total expenditures (%)	8.68	2.12	4.03	13.73
K-12 education expenditures / Total expenditures (%)	19.78	2.37	14.61	27.61
Public welfare expenditures / Total expenditures (%)	14.98	3.14	8.02	23.95
Hospital & health-related expenditures / Total expenditures (%)	7.02	2.88	1.52	15.11
Highway-related expenditures / Total expenditures (%)	6.48	2.06	2.72	13.57
Police & correctional expenditures / Total expenditures (%)	5.25	1.00	3.18	8.75
Total tax receipts / Total expenditures (%)	44.81	6.56	21.81	79.19
Total expenditures / Total tax receipts (%)	228.05	34.81	126.28	458.47

Our categorization of tax receipts and expenditures was not exhaustive.[12] Instead, we focused our attention on those categories of tax receipts and expenditures that represented the largest share of total taxes and spending. Thus, we included only sales, income (individual and corporate), and property taxes in our analysis. Those taxes collectively accounted for approximately 90% of total tax receipts. Similarly, the education, public welfare, health, highway, and police and correction-related spending included in our model collectively accounted for approximately 70% of total spending.

3.2 Model Specification

To estimate the factors that contribute to economic resistance, we employed a parametric regression model utilizing time-to-event data. This general approach is known as survival analysis, because our model is typically used to evaluate the time to the occurrence of an undesirable event (e.g., a patient's death).[13] The survival function represents the probability of observing a survival time greater than some stated value t. Focusing our attention on the Great Recession, our time period of interest was January 2004 to December 2009, with each month representing a distinct period, such that $t = 1$ denotes January 2004, $t = 2$ denotes February 2004, etc. Assuming an exponential regression model,[14] the survival function takes the following form:

$$S(t, \boldsymbol{x}, \boldsymbol{\beta}) = \exp\left(- \frac{t}{e^{\boldsymbol{x'\beta}}} \right) \tag{1}$$

where $\boldsymbol{x}$ denotes a vector of lagged state-level industry and population-related variables, tax-related variables, and expenditure-related variables that affected economic resistance to the recession; $\boldsymbol{x'}$ is the transpose of $\boldsymbol{x}$; and $\boldsymbol{\beta}$ denotes a vector of coefficients to be estimated. The ratio of the probability density function of

[12] Our categorization also excludes federal government tax receipts and expenditures. As the national economy faltered, the federal government attempted to stave off the economic downturn (e.g., by lowering interest rates). Because the federal government's actions affected all the states simultaneously, however, state-level recessionary timing differences should not be affected by these efforts.

[13] The general term "survival analysis" encompasses a range of nonparametric, semiparametric, and parametric models that share the goal of analyzing the covariates affecting the time until an event of interest occurs. The most widely known survival analysis technique is the Cox proportional hazards model, which is a semiparametric model that makes no assumptions about the shape of the baseline hazard function (i.e., the hazard function when the covariates do not affect it). In contrast, a parametric survival analysis model attempts to derive an equation predicting survival times that "simultaneously: (1) . . . describes the basic underlying distribution of survival time (error component), and (2) . . . characterizes how that distribution changes as a function of covariates (systematic component)" (Hosmer et al., 2008, p. 68).

[14] We chose an exponential regression model because, as Table 1 demonstrates, the states were increasingly likely to enter the Great Recession with increasing time. Presumably, the economic conditions in the first states to enter that recession created a snowball effect that increased the likelihood other states would follow. Consistent with that snowball effect, in an exponential regression model the likelihood of survival varies exponentially with $-t$.

the time variable and the survival function is the hazard function. In short, the hazard function represents the unconditional probability of experiencing the event at time t, scaled by the fraction of those who have survived until time t. Under the exponential model assumptions, the hazard function takes the form:

$$h(t, \boldsymbol{x}, \boldsymbol{\beta}) = e^{-\boldsymbol{x'\beta}}. \tag{2}$$

In other words, the hazard function is time independent and depends only on the model coefficients and covariate values (Hosmer et al., 2008).[15] From the hazard function we derived hazard ratios, which estimated the effect of a one unit increase in the explanatory variable on the rate of entry into the recession. In an exponential regression model, the hazard ratio for covariate x_i is:

$$HR(x_i) = e^{-\beta_i}. \tag{4}$$

Thus, the estimated coefficient, $\hat{B}_i$, allows us to model the effect of covariate x_i on the rate of entry into the recession. If $\hat{B}_i < 0$, then $\widehat{HR}(x_i) > 1$ and an increase in the value of the covariate accelerated the rate of entry into the recession. In contrast, if $\hat{B}_i > 0$ and $\widehat{HR}(x_i) < 1$, then an increase in the value of the covariate decelerated the rate of entry into the recession.

4 Results

Tables 5 and 6 show the estimated hazard ratios and p-values for two analytically distinct fiscal-policy modeling approaches. Table 5's tax and spending burden models normalize each state's tax and expenditure variables by converting them into a percentage of the state's GDP. The tax and spending mix models shown in Table 6 normalize each state's tax variables using the state's total tax receipts and its expenditure variables by using the state's total expenditures. In each table, the Base Model column gives the hazard ratios for our state-level demographic and industry variables prior to the inclusion of any fiscal-policy variables.[16]

The Tax Model adds state-level tax variables and an overall state-level expenditure variable to the Base Model.[17] Similarly, the Spending Model adds state-level expenditure variables and an overall state-level tax variable to the Base Model. Finally, the Comprehensive Model includes the Base Model and all tax and expenditure variables (other than the overall tax and expenditure variables). Although we have not provided standard errors for the hazard ratios in Tables 5 and 6, they are available upon request.

The Comprehensive Models shown in Tables 5 and 6 have numerous statistically-significant hazard ratios for our tax and expenditure variables (i.e., hazard ratios that are not equal to one). Accordingly, we ran hypothesis tests to ascertain whether those variables with hazard ratios not equal to one were statistically different from each other. Table 7 reports the results of those hypothesis tests for the comprehensive tax and spending burden model from Table 5, and Table 8 reports results for the comprehensive tax and spending mix model from Table 6. We did not run hypothesis tests comparing the tax and expenditure variables because all statistically-significant tax variables had hazard ratios greater than one and all statistically-significant expenditure variables had hazard ratios less than one.

[15] We used maximum likelihood estimation to estimate time-to-event regression models with right-censored data. For an exponential regression model, the log likelihood function can be written as:

$$L(\boldsymbol{\beta}) = \sum_{i=1}^{n} c_i z_i - e^{z_i} \tag{3}$$

where $z_i = y_i - \boldsymbol{x_i'\beta}$, c_i is a censoring indicator, $y_i = \ln(t_i)$, and $\boldsymbol{x}$ is a vector of the observable covariates.

[16] Although the state-level demographic and industry variables generally match those commonly incorporated in previous economic growth models in the literature, we tested numerous specific forms of these variables, as well as combinations of them, to determine our final base model. For example, in the context of market structure and firm size, we examined the percentage of firms of different sizes and the percentage of workers employed at firms of different sizes, selecting the latter for inclusion in our final base model due to its superior predictive power. Similar testing resulted in the specific measures of population size, race, and human capital incorporated in our analysis.

[17] We initially included other tax-related variables as covariates in our model, including states' tax rates, the number of tax brackets, and the progressivity of individual and corporate income tax. The inclusion of these other tax-related variables did not significantly affect the nature of our results. Moreover, they generally had little variation and lacked statistical significance. For those reasons, we omitted them from our final models.

Table 5: Hazard Ratios - Tax and Spending Burden Models

	Base Model	Tax Model	Spending Model	Comprehensive Model
Explanatory Variable		*Hazard Ratio*		
Population between 20 years old and 64 years old, inclusive (%)	1.620***	1.719**	1.480***	1.560**
	(<0.001)	(0.029)	(0.001)	(0.042)
White (%)	1.014	1.019	1.010	1.039
	(0.334)	(0.286)	(0.724)	(0.144)
Population density (residents/square mile)	1.000	1.000	0.999	1.000
	(0.522)	(0.925)	(0.646)	(0.736)
Population 25 years and over with bachelors degree or more (%)	0.934	0.948	0.911	0.931
	(0.111)	(0.212)	(0.125)	(0.247)
Gini index	1.256***	1.330***	1.440***	1.350***
	(0.001)	(0.004)	(<0.001)	(0.005)
Employed in firms with 1-99 employees (%)	1.105***	1.204***	1.118**	1.184***
	(0.004)	(<0.001)	(0.021)	(0.001)
Employed in firms with 100-999 employees (%)	1.211*	1.467***	1.220	1.529***
	(0.056)	(0.003)	(0.159)	(0.003)
Manufacturing employment (%)	1.130	1.232	1.252*	1.245
	(0.116)	(0.129)	(0.091)	(0.130)
Mining employment (%)	1.110	1.313	1.178	1.308
	(0.348)	(0.124)	(0.297)	(0.263)
Construction employment (%)	1.241	1.181	1.242	1.235
	(0.170)	(0.390)	(0.232)	(0.301)
Education and health employment (%)	1.130	0.951	1.170	1.058
	(0.247)	(0.722)	(0.372)	(0.670)
Finance employment (%)	1.373***	1.643**	1.420**	1.665**
	(0.009)	(0.011)	(0.019)	(0.014)
Information employment (%)	0.478***	0.468*	0.477**	0.460
	(0.009)	(0.076)	(0.038)	(0.157)
Leisure employment (%)	1.046	1.087	1.118	1.180*
	(0.495)	(0.357)	(0.263)	(0.074)
Professional employment (%)	1.378***	1.450**	1.662***	1.790***
	(<0.001)	(0.018)	(0.003)	(<0.001)
Other services employment (%)	0.887	0.806	0.839	0.710
	(0.589)	(0.532)	(0.588)	(0.493)
Sales tax receipts / GDP (%)		2.427**		2.523**
		(0.022)		(0.015)
Individual income tax receipts / GDP (%)		1.472*		1.618**
		(0.097)		(0.041)
Corporate income tax receipts / GDP (%)		1.043***		1.049***
		(<0.001)		(<0.001)
Property tax receipts / GDP (%)		1.254		2.041**
		(0.254)		(0.024)
Higher education expenditures / GDP (%)			1.361	1.981
			(0.646)	(0.257)
K-12 education expenditures / GDP (%)			0.438*	0.315*
			(0.089)	(0.060)
Public welfare expenditures / GDP (%)			0.484**	0.509**
			(0.018)	(0.026)
Hospital & health-related expenditures / GDP (%)			0.958	1.791
			(0.922)	(0.262)
Highway-related expenditures / GDP (%)			2.770	1.422
			(0.357)	(0.562)
Police & correctional expenditures / GDP (%)			0.077***	0.038***
			(0.009)	(0.008)
Total tax receipts / GDP (%)			2.338***	
			(<0.001)	
Total expenditures / GDP (%)		0.717***		
		(<0.001)		

Notes: Robust standard errors; p-values in parentheses; *** p<0.01; ** p<0.05; * p<0.1

Table 6: Hazard Ratios - Tax and Spending Mix Models

	Base Model	Tax Model	Spending Model	Comprehensive Model
Explanatory Variable		*Hazard Ratio*		
Population between 20 years old and 64 years old, inclusive (%)	1.620***	1.517	1.488***	1.914***
	(<0.001)	(0.135)	(0.001)	(0.005)
White (%)	1.014	1.024	1.010	1.042*
	(0.334)	(0.193)	(0.678)	(0.077)
Population density (residents/square mile)	1.000	1.000	0.999	1.001
	(0.522)	(0.791)	(0.664)	(0.232)
Population 25 years and over with bachelors degree or more (%)	0.934	0.960	0.904	0.961
	(0.111)	(0.418)	(0.104)	(0.463)
Gini index	1.256***	1.463***	1.391***	1.279**
	(0.001)	(0.005)	(<0.001)	(0.012)
Employed in firms with 1-99 employees (%)	1.105***	1.207***	1.121**	1.149***
	(0.004)	(<0.001)	(0.012)	(0.005)
Employed in firms with 100-999 employees (%)	1.211*	1.452***	1.223	1.383***
	(0.056)	(0.001)	(0.146)	(0.006)
Manufacturing employment (%)	1.130	1.214	1.219	1.177
	(0.116)	(0.171)	(0.100)	(0.197)
Mining employment (%)	1.110	1.064	1.180	1.375
	(0.348)	(0.748)	(0.318)	(0.152)
Construction employment (%)	1.241	1.142	1.198	1.213
	(0.170)	(0.515)	(0.401)	(0.327)
Education and health employment (%)	1.130	0.906	1.148	1.102
	(0.247)	(0.521)	(0.442)	(0.451)
Finance employment (%)	1.373***	1.393	1.366***	2.071***
	(0.009)	(0.130)	(0.009)	(<0.001)
Information employment (%)	0.478***	0.514	0.490**	0.330**
	(0.009)	(0.138)	(0.049)	(0.019)
Leisure employment (%)	1.046	1.057	1.104	1.210**
	(0.495)	(0.555)	(0.306)	(0.028)
Professional employment (%)	1.378***	1.377*	1.662***	1.698***
	(<0.001)	(0.061)	(0.002)	(<0.001)
Other services employment (%)	0.887	0.870	0.844	1.058
	(0.589)	(0.693)	(0.651)	(0.885)
Sales tax receipts / Total tax receipts (%)		1.013		1.130***
		(0.756)		(0.002)
Individual income tax receipts / Total tax receipts (%)		0.968		1.091**
		(0.300)		(0.021)
Corporate income tax receipts / Total tax receipts (%)		1.334***		1.463***
		(<0.001)		(<0.001)
Property tax receipts / Total tax receipts (%)		0.946**		1.094**
		(0.046)		(0.040)
Higher education expenditures / Total expenditures (%)			1.043	1.232*
			(0.739)	(0.051)
K-12 education expenditures / Total expenditures (%)			0.856	1.027
			(0.102)	(0.776)
Public welfare expenditures / Total expenditures (%)			0.923	0.990
			(0.326)	(0.888)
Hospital & health-related expenditures / Total expenditures (%)			1.000	1.156
			(0.999)	(0.179)
Highway-related expenditures / Total expenditures (%)			1.227	1.195
			(0.172)	(0.131)
Police & correctional expenditures / Total expenditures (%)			0.611**	0.725
			(0.039)	(0.156)
Total tax receipts / Total expenditures (%)			1.152***	
			(<0.001)	
Total expenditures / Total tax receipts (%)		0.0269***		
		(<0.001)		

Notes: Robust standard errors; p-values in parentheses; *** p<0.01; ** p<0.05; * p<0.1

Table 7: Hazard Ratio Hypothesis Tests - Tax and Spending Burden Comprehensive Model

	Receipts / GDP (%)			Expenditures / GDP (%)	
Hazard Ratios	Sales tax	Property tax	Individual income tax	K-12 education	Public welfare
Receipts / GDP (%)					
Property tax	0.662				
Individual income tax	0.351	0.559			
Corporate income tax	0.019**	0.035**	0.063*		
Expenditures / GDP (%)					
Public welfare				0.532	
Police & correctional				0.204	0.037**

Notes: *** p<0.01; ** p<0.05; * p<0.1

As noted above, the hazard ratios in Tables 5 and 6 indicate the risk that a state will succumb to the Great Recession in the next time period, given the state has held off the recession prior to the start of that period. A statistically-significant hazard ratio greater than one indicates that, all else equal, an increase in the independent variable will likely accelerate the state's entry into the Great Recession. For example, in Table 5's Base Model the hazard ratio for the percentage of a state's population between the ages 20 and 64, inclusive, is 1.620. That result means that a one percentage point increase in this population group will increase the risk that the state will enter the recession in the next time period by 62%.

Table 8: Hazard Ratio Hypothesis Tests - Tax and Spending Mix Comprehensive Model

	Receipts / Total tax receipts (%)		
Hazard Ratios	Sales tax	Property tax	Individual income tax
Receipts / Total tax receipts (%)			
Property tax	0.290		
Individual income tax	0.178	0.919	
Corporate income tax	<0.001***	<0.001***	<0.001***

Notes: *** p<0.01; ** p<0.05; * p<0.1

On the other hand, a statistically-significant hazard ratio less than one indicates that, all else equal, an increase in the independent variable likely slows down entry into the Great Recession. Therefore, the 0.478 hazard ratio shown in the Base Model for the percentage of a state's employees working in the information sector indicates that a one percentage point increase in this population will reduce the state's risk of entering the Great Recession in the next time period by 52.2%. Thus, hazard ratios that are less than one signal that the attribute in question strengthens a state's economic resistance to the Great Recession, while ratios greater than one indicate greater susceptibility.

5 Discussion

Although we are primarily interested in fiscal-policy effects, we prepared the Base Model using state-level demographic and industry variables to determine whether our approach yielded results that are consistent with earlier studies examining economic resistance to recessions.[18] We found that increasing the level of income inequality in a state, as measured by the state's Gini index, by one point increased the likelihood that the state would enter the Great Recession in the next month by 25.6%. That result is consistent with Lewin et al.'s (2018) finding that metropolitan areas with higher income inequality were less able to resist

[18] As noted above, our results and conclusions may not extend to other recessionary periods in the United States, or elsewhere, because we rely exclusively on data from the years immediately preceding the Great Recession in the United States. Nevertheless, on the assumption that some common economic resilience factors exist, we expected our results to align with prior work on other recessions.

the Great Recession. Similarly, our results showing that a state's population age distribution, its share of workers employed in small firms, and the distribution of its workers among industrial sectors affected the state's ability to resist the Great Recession are generally consistent with prior studies (Deller and Watson, 2016; Martin et al., 2016).

More specifically, we found that increases in a state's working-age population percentage tended to accelerate the state's entry into the Great Recession. While this result may seem counterintuitive, our study focuses on relative economic performance changes in the face of the Great Recession, not on absolute economic performance or aggregate workforce productivity. Therefore, a state with a greater percentage of its population in the labor pool may have faced a greater risk of an economic performance decline when the Great Recession loomed because a greater share of its population had their primary source of income—their jobs—exposed. We also found that increases in the percentage of its workers employed in firms with less than one thousand employees tended to accelerate the state's entry into the Great Recession. In other words, a state relying more on small and medium-sized businesses for employment opportunities was more vulnerable to the Great Recession than states having more concentrated employment markets, perhaps because the former's smaller firms lacked the "deep pockets" of their larger counterparts. Turning to industry structure, the percentage of a state's workers employed in the finance and professional sectors positively correlated with the state's rate of entry into the Great Recession. Given the key role played by the financial crisis in the Great Recession, this result was not surprising.

In contrast, increases in the percentage of a state's workers employed in the information sector strengthened the state's economic resistance to that recession. The information sector includes firms involved in the production, distribution, transmission, and processing of information, cultural products, and other data or communications.[19] In light of this sector's central role in most people's day-to-day lives, the demand for its services may be largely independent of overall economic conditions. Thus, greater reliance on the information sector may have partially protected states from the Great Recession's onset.

Other factors, such as the percentage of the state's population that was white, its population density, and the percentage of the population holding a bachelor's degree, did not yield statistically-significant hazard ratios. Collectively, these results, which were robust and consistent across almost all variations of the tax and spending burden models and tax and spending mix models displayed in Tables 5 and 6, allowed us to recognize and control for the role of key non-fiscal-policy factors in our model of recessionary risk.

Earlier studies of fiscal policy and economic growth imply that a state's fiscal policy should affect its economic resistance to recessions. However, only a few studies have directly probed the relationship between a state's fiscal-policy instruments and its economic resistance. Those studies used aggregate tax measures to focus on the interplay between state tax policies and the severity of the states' responses to the recession, but did not find any statistically-significant effects. Our work differs from earlier studies in that (1) we focused on economic resistance's timing component instead of its response component, (2) we used tax data that delineated by type of tax instead of relying on aggregate measures, and (3) we employed a survival analysis model that was well-suited for examining economic resistance's timing component. We found numerous statistically-significant tax and expenditure effects.

We first turn to our tax and spending burden models in Table 5, which consider the effect of state taxes and expenditures as a percentage of the state's GDP. On the tax side, our independent variables measure the burden that the state imposes on its annual income through taxation of that income. Thus, "Individual income tax receipts / GDP (%)" measures the percentage of the state's GDP that the state and its local governments harvest using individual income taxes. Although we report the results of three different tax and spending burden models, our discussion concentrates on the Comprehensive Model because the three models are largely consistent.

The hazard ratios for the Comprehensive Model in Table 5 suggest that a state's tax and spending burden had a strong impact on the timing of the state's entry into the Great Recession. For each major type of tax included in our model—sales tax, individual income tax, corporate income tax, and property tax—an increase in the state's use of that tax to harvest a portion of its GDP tended to accelerate the state's entry

[19] "The main components of this sector are the publishing industries . . .; the motion picture and sound recording industries; the broadcasting industries . . .; the telecommunications industries; Web search portals, data processing industries, and the information services industries" (U.S. Bureau of Labor Statistics, n.d.).

into the Great Recession. Those results are statistically-significant and are consistent with existing work showing an inverse relationship between taxes and economic growth at the federal and state levels (Poot, 2000; Bania and Stone, 2008; Srithongrung and Kriz, 2014; Arin et al., 2016; Kneller and Misch, 2017). Although the hazard ratios for sales tax (2.523), property tax (2.041), and individual income tax (1.618) are large and statistically different from corporate income tax's hazard ratio (1.049), the hypothesis tests in Table 7 indicate that they are not statistically different from each other. Therefore, the most we can say is that the taxes included in our model weakened the states' ability to resist the onset of the Great Recession, and that a state's reliance on corporate income tax to collect a portion of its annual GDP in the years preceding that recession did the least amount of damage to its economic resistance.

Our tax and spending burden models' expenditure results in Table 5 are also consistent with prior studies showing a positive relationship between certain types of government expenditures and economic growth (Poot, 2000; Pereira, 2000; Cohen and Paul, 2004; Bania and Stone, 2008; Srithongrung and Kriz, 2014). The Tax Model's hazard ratio for total expenditures as a percentage of state GDP was 0.717 and statistically-significant, indicating that overall state and local government expenditures had a strong deferral effect on entry into the Great Recession. Turning to the Comprehensive Model, we found that a state dedicating a larger percentage of its GDP to K-12 education, public welfare, and police & correctional expenditures had a lower risk of entering the Great Recession than states that spent less in those areas. These results are, at least partially, consistent with prior studies indicating that government spending on education and infrastructure positively correlated with long-term economic growth (Poot, 2000; Berry and Kaserman, 1993). While we could not distinguish between the hazard ratios for K-12 education (0.315) and public welfare (0.509), or between K-12 education and police & correctional expenditures (0.038), as shown in Table 7 we were able to establish that police & correctional expenditures had a greater strengthening effect on the states' ability to resist the Great Recession than public welfare expenditures. Thus, we found that a state and local government's overall expenditure level leading up to the Great Recession contributed to its ability to resist that recession, and that, to a lesser extent, the specific nature of its expenditures mattered as well.

Although we cannot definitively establish why the states' K-12 education, public welfare, and police & correctional expenditures improved their ability to resist the Great Recession's onset two years later, we offer two explanatory observations here. First, the primary recipients of a state's payments in these areas (e.g., elementary school teachers, welfare recipients, and law enforcement personnel) might have been more inclined to spend those funds than the recipients of other expenditure categories included in the model (e.g., physicians receiving hospital & health-related expenditures or professors receiving higher education expenditures). That greater propensity to spend could have positively affected the states' short-term economic outlook and helped stave off the Great Recession two years later. Second, the nature of the expenditures might help explain why police & correctional expenditures were more effective than public welfare expenditures at strengthening the states' resistance. While public welfare payments may not create economic growth beyond the spending effects already discussed, police & correctional expenditures may indirectly supporting a state's economy. For example, short-term public safety improvements may increase consumer confidence, and increased law enforcement activity may preferentially advantage legal economic activity, which state GDP measures, over illegal economic activity, which it ignores. Taken together, these two observations support the expenditure results in our tax and spending burden models.

The tax and spending mix models in Table 6 considered the effect of a state's relative reliance on different types of taxes and expenditures in the years prior to the Great Recession. In that table, the independent tax variables are the percentages of the states' total tax receipts for each type of tax. Similarly, the independent expenditure variables are the percentages of the states' total expenditures for each type of expenditure. Consistent with our discussion of the tax and spending burden models above we reported the results of three different tax and spending mix models, but focus our discussion on the Comprehensive Model because our results were largely consistent across the three models.

The hazard ratios for the Comprehensive Model in Table 6 suggest that a state's relative reliance on different types of taxes affected the state's ability to resist the Great Recession. While increased reliance of each of the four tax types in our model increased the likelihood that the state in question would fall into the Great Recession in the next month, our analysis shows that the taxes' relative impacts were not equal. Specifically, the hazard ratio for corporate income taxes (1.463) was statistically different from the hazard ratios for sales taxes (1.130), property taxes (1.094), and individual income taxes (1.091). Unfortunately,

the hypothesis tests in Table 8 show that our model could not separate the latter three taxes' impacts. Thus, we can say with confidence that, while no tax we studied fortified a state's ability to resist the Great Recession, greater reliance on corporate income taxes in the state's tax mix likely accelerated its entry into that recession.

Before turning to our analysis of the states' expenditure mixes, our corporate income tax results deserve a little more scrutiny. In our tax and spending burden models, we found that a state's reliance on corporate income tax to collect a portion of its annual GDP in the years preceding the Great Recession did the least amount of damage to its economic resistance, when compared to the other tax options. Here, our tax and spending mix models indicate that a state's greater reliance on corporate income taxes in its tax mix likely accelerated its entry into that recession. Although the two sets of models examine different aspects of the states' fiscal policies,[20] these potentially contradictory results are interesting and may warrant further study. We provide here one possible explanation involving tax volatility and our model's two-year lag between the fiscal-policy measures we used as independent variables and our dependent variable, the Great Recession's onset.

In general, corporate income tax receipts are more volatile than other types of state taxes because their tax base is more volatile than the tax bases of the other taxes (e.g., property and sales taxes, which have relatively stable tax bases like property values and consumption) (Stark, 2010). Thus, when a state's economy begins to slow, its corporate income receipts as a share of state GDP are more likely to drop quickly compared to its other tax receipts. That quicker drop, which would have the effect of leaving more of the state's GDP with its taxpayers over the next two years, could help stabilize the private sector's contribution to the state's economy heading into the recession. While that stabilizing effect was not strong enough to fully offset the tax's overall accelerating effect (as seen in the other, more stable, taxes), it may have reduced the strength of that effect in our tax and spending burden models. In contrast, turning to the tax and spending mix models, the corporate income tax's greater volatility would have different consequences. Due to that volatility, states relying heavily on corporate income tax receipts (as a percentage of their total tax receipts) are more likely to experience rapidly decreasing tax receipts in the succeeding two years as economic growth begins to slow. That revenue contraction may cause the government to reduce its expenditures if it is subject to a balanced-budget requirement and has an insufficient rainy day fund, further weakening the state's economy and pushing it toward recession. In effect, the reduced corporate income tax receipts destabilize the public sector and hasten the recession's onset.

Returning to our analysis of the tax and spending mix models in Table 6, the hazard ratio for total expenditures, represented as a percentage of total tax receipts in that table's Tax Model, was 0.0269 and statistically significant. That result suggests that increasing expenditures while holding total taxes constant (e.g., increasing deficit spending or spending down the state's rainy day fund) greatly reduced a state's likelihood of falling into the Great Recession. Given the well-established positive effect of government spending on economic growth, that finding is not surprising and is consistent with traditional countercyclical fiscal policy. However, the Comprehensive Model in Table 6 shows that, unlike the states' tax mixes, their expenditure mixes had little or no effect on the timing of their entry into the recession. While that result may seem to contradict the literature's support for the proposition that spending on education and infrastructure spurs long-term economic growth, our tax and spending mix results reflect the states' relative expenditure priorities, not their actual expenditures on those priorities. Thus, a state may prioritize infrastructure spending without actually spending much on it. Indeed, only higher education spending as a percentage of total expenditures had a statistically-significant hazard ratio, and its 1.232 hazard ratio suggests that states spending a larger proportion of their total expenditures on higher education are more likely to enter a recession sooner than other states. Nevertheless, the amount a state spends when facing a possible recession appears to matter more than how it chooses to spend that amount.

Overall, our results demonstrate that a state's fiscal policy can affect its susceptibility to recessions. Entering into the Great Recession, states harvesting a larger portion of their GDP through taxes made themselves more vulnerable to that recession's onset. In contrast, states with higher expenditures in the

[20]To demonstrate this difference, it is possible for a state to have low corporate income tax receipts as a percentage of its GDP (i.e., a low corporate income tax burden) while having high corporate income tax receipts as a percentage of its total tax receipts (i.e., a high corporate income tax mix) by relying heavily on corporate income taxes and not collecting much tax. A high-tax state that does not use the corporate income tax would achieve the opposite pairing.

years leading into the Great Recession did a better job resisting it. At that level, our results are consistent with the discipline's general theories on fiscal policy and economic growth and with the countercyclical fiscal policy championed by Keynes and his disciples.

6 Conclusion

We set out to examine the role that state-level fiscal-policy instruments played in hastening, or delaying, each state's entry into the Great Recession. Our results complement the findings reported in previous studies, which focused on the role of these instruments in the more general context of economic growth. Similar to endogenous-growth models, we found that taxes have the potential to increase future recessionary risk, while expenditures somewhat insulated states from that risk. However, not all types of taxes and expenditures were equivalent in terms of their effect on recessionary risk. Moreover, this effect varied depending on the fiscal-policy modeling approach we used to examine their impact.

When we focused on the size of a state's taxes and expenditures relative to that state's GDP (i.e., a burden approach), we found that an increase in the state's use of a sales tax, individual income tax, corporate income tax, and property tax tended to accelerate the state's entry into the Great Recession. However, the state's reliance on a corporate income tax did the least amount of damage to its economic resistance. On the expenditure side, a state dedicating a larger percentage of its GDP to K-12 education, public welfare, and police & correctional activities had a lower risk of entering the Great Recession than a state that spent less in those areas.

By changing frameworks to consider a state's relative reliance on each tax and expenditure in its overall portfolio of taxes and expenditures (i.e., a mix approach), we found that no tax studied strengthened a state's ability to resist the Great Recession, but that greater reliance on corporate income taxes in the state's tax mix likely accelerated its entry into that recession. A state's expenditure mix, however, had little or no effect on its susceptibility to the Great Recession. Overall, our results suggest that, while taxes likely increase recessionary risk and expenditures likely decrease recessionary risk, that narrative is an oversimplification of the complex role played by fiscal policy in determining a state's ability to resist a negative economic shock like the Great Recession.

It is important to note that we based our economic resistance analysis solely on the recessionary risk of states entering into the Great Recession. However, not all recessionary periods are equivalent in terms of impetus or general economic conditions. Thus, the results of our study may not generalize to other recessionary periods in the United States or elsewhere. Furthermore, our findings may not extend to the ensuing periods of economic recovery. Accordingly, we anticipate pursuing two lines of further study. First, examining the states' resistance to other recessions may shed additional light on the policies and conditions that improve a state's economic resistance. Second, using our state-level data to study other aspects of economic resilience—recovery, reorientation, and renewal—during the Great Recession may uncover important fiscal-policy effects in those areas, too.

References

Alm, J. and Rogers, J. (2011). Do state fiscal policies affect state economic growth? *Public Finance Review*, 39:483–526.

Arin, K. P., Helles, P. H., Koyuncu, M., and Reich, O. F. M. (2016). Should we care about the composition of tax-based stimulus packages? *Contemporary Economic Policy*, 34:430–445.

Bania, N., Gray, J. A., and Stone, J. A. (2007). Growth, taxes, and government expenditures: Growth hills for U.S. states. *National Tax Journal*, 60:193–204.

Bania, N. and Stone, J. A. (2008). Ranking state fiscal structures using theory and evidence. *Journal of Policy Analysis and Management*, 27:751–770.

Barro, R. J. (1990). Government spending in a simple model of endogeneous growth. *Journal of Political Economy*, 98:S103–S125.

Barros, C. P., Butler, R., and Correia, A. (2010). The length of stay of golf tourism: A survival analysis. *Tourism Management*, 31:13–21.

Bernanke, B. (2018). The real effects of the financial crisis. *Brookings Papers on Economic Activity*, 20.

Berry, D. M. and Kaserman, D. L. (1993). A diffusion model of long-run state economic development. *Atlantic Economic Journal*, 21(4):39–54.

Brakman, S., Garresten, H., and van Marrewijk, C. (2015). Regional resilience across Europe: on urbanization and the initial impact of the Great Recession. *Cambridge Journal of Regions, Economy, and Society*, 8:225–240.

Brown, J. P. (2017). Identifying state-level recessions. *Economic Review*, 102(1):85–108.

Campbell, A. L. and Sances, M. W. (2013). State fiscal policy during the Great Recession: Budgetary impacts and policy responses. *The Annals of the American Academy of Political and Social Science*, 650:252–273.

Chang, C., Kim, Y., and Ying, Y. (2009). Economics and politics in the United States: a state-level investigation. *Journal of Economic Policy Reform*, 12:343–354.

Chernick, H., Reimers, C., and Tennant, J. (2014). Tax structure and revenue instability: the Great Recession and the states. *IZA Journal of Labor Policy*, 3:1–22. https://doi.org/10.1186/2193-9004-3-3.

Cohen, J. P. and Paul, C. J. M. (2004). Public infrastructure investment, interstate spatial spillovers, and manufacturing costs. *The Review of Economics and Statistics*, 86:551–560.

Connaughton, J. E. and Madsen, R. A. (1985). State and regional impact of the 1981-1982 recession. *Growth and Change*, 16(3):1–10.

Connaughton, J. E. and Madsen, R. A. (2009). Regional implications of the 2001 recession. *The Annals of Regional Science*, 43:491–507.

Connaughton, J. E. and Madsen, R. A. (2012). U.S. state and regional impact of the 2008-2009 recession. *Journal of Regional Analysis & Policy*, 42:177–187.

Crone, T. M. (2006). What a new set of indexes tell us about state and national business cycles. *Business Review, Federal Reserve Bank of Philadelphia*, (Q1):11–24.

Crone, T. M. and Clayton-Matthews, A. (2005). Consistent economic indexes for the 50 states. *The Review of Economics and Statistics*, 87:593–603.

Crosby, A. W. and Merriman, D. F. (2016). What happened to Illinois' economy following the January 2011 tax increases? A Midwestern comparison. *Journal of Regional Analysis & Policy*, 46:39–51.

Deller, S. and Watson, P. (2016). Did regional economic diversity influence the effects of the Great Recession? *Economic Inquiry*, 54:1824–1838.

Dye, R. F. (2004). State revenue cyclicality. *National Tax Journal*, 57:133–145.

Fingleton, B., Garretson, H., and Martin, R. (2012). Recessionary shocks and regional employment: Evidence on the resilience of U.K. regions. *Journal of Regional Science*, 52:109–133.

Gale, W. G., Krupkin, A., and Rueben, K. (2015). The relationship between taxes and growth at the state level: New evidence. *National Tax Journal*, 68:919–942.

Han, Y. and Goetz, S. (2015). The economic resilience of U.S. counties during the Great Recession. *The Review of Regional Studies*, 45:131–149.

Hassink, R. (2010). Regional resilience: a promising concept to explain differences in regional economic adaptability? *Cambridge Journal of Regions, Economy, and Society*, 3:45–58.

Helms, L. J. (1985). The effect of state and local taxes on economic growth: A time series-cross section approach. *The Review of Economics and Statistics*, 67:574–582.

Hisnanick, J. J. and Rogers, A. L. (2007). Household income inequality measures based on the ACS Data: 2000-2005. Technical report, Housing and Household Economic Statistics Division, US Census Bureau, Washington, DC. Retrieved from https://www.census.gov/library/working-papers/2007/demo/ACS-inequality-report-2000-2005_v2.html.

Hong, S. (2015). Fiscal rules in recessions: Evidence from the American states. *Public Finance Review*, 43:505–528.

Hosmer, D., Lemeshow, S., and May, S. (2008). *Applied Survival Analysis: Regression Modeling of Time-to-Event Data*. John Wiley & Sons, Inc., Hoboken, NJ.

Hubbard, R. G., O'Brien, A. P., and Rafferty, M. (2014). *Macroeconomics*. Pearson Education, Inc., Upper Saddle River, NJ, 2nd edition.

Iqbal, A. and Silvia, J. (2016). Is predicting recessions enough? *Business Economics*, 51:248–259.

Keel, P. K., Dorer, D. J., Eddy, K. T., Franko, D., Charatan, D. L., and Herzog, D. B. (2003). Predictors of mortality in eating disorders. *Archives of General Psychiatry*, 60:179–183.

Khatiwada, L. K. (2014). Modeling and explaining county-level prosperity in the U.S. *Journal of Regional Analysis & Policy*, 44:143–156.

Kneller, R. and Misch, F. (2017). A survey on the output effects of tax reform from a policy perspective. *Contemporary Economic Policy*, 35:165–192.

Lancaster, T. (1979). Econometric methods for the duration of unemployment. *Econometrica*, 47:939–956.

Leigh, A. (2008). Estimating the impact of gubernatorial partisanship on policy settings and economic outcomes: A regression discontinuity approach. *European Journal of Political Economy*, 24:256–268.

Lewin, P. A., Watson, P., and Brown, A. (2018). Surviving the Great Recession: The influence of income inequality in U.S. urban counties. *Regional Studies*, 52:781–792.

Martin, R. (2012). Regional economic resilience, hysteresis and recessionary shocks. *Journal of Economic Geography*, 12:1–32.

Martin, R. and Sunley, P. (2015). On the notion of regional economic resilience: conceptualization and explanation. *Journal of Economic Geography*, 15:1–42.

Martin, R., Sunley, P., Gardiner, B., and Tyler, P. (2016). How regions react to recessions: resilience and the role of economic structure. *Regional Studies*, 50:561–585.

National Bureau of Economic Research (2010). Business Cycle Dating Committee, National Bureau of Economic Research. Report. Retrieved from http://www.nber.org/cycles/sept2010.html.

Neumeier, F. (2018). Do businessmen make good governors? *Economic Inquiry*, 56:2116–2136.

Pereira, A. M. (2000). Is all public capital created equal? *The Review of Economics and Statistics*, 82:513–518.

Pereira, R. M. (2014). Okun's law, asymmetries and regional spillovers: Evidence from Virginia metropolitan statistical areas and the District of Columbia. *The Annals of Regional Science*, 52:583–595.

Pjesky, R. J. (2016). The impact of state corporate tax rate changes on state economic performance. *Southwestern Economic Review*, 43:103–115.

Poot, J. (2000). A synthesis of empirical research on the impact of government on long-run growth. *Growth and Change*, 31:516–546.

Potrafke, N. (2018). Government ideology and economic policy-making in the United States-a survey. *Public Choice*, 174:145–207.

Reed, W. R. (2006). Democrats, republicans, and taxes: Evidence that political parties matter. *Journal of Public Economics*, 90:725–750.

Reed, W. R. (2008). The robust relationship between taxes and U.S. state income growth. *National Tax Journal*, 61:57–80.

Seegert, N. (2015). The performance of state tax portfolios during and after the Great Recession. *National Tax Journal*, 68:901–918.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70:65–94.

Srithongrung, A. and Kriz, K. A. (2014). The impact of subnational fiscal policies on economic growth: A dynamic analysis approach. *Journal of Policy Analysis and Management*, 33:912–928.

Stark, K. J. (2010). The federal role in state tax reform. *Virginia Tax Review*, 30:407–444.

U.S. Bureau of Economic Analysis (2018). Gross domestic product by state. Data file. Retrieved from https://www.bea.gov/data/gdp/gdp-state.

U.S. Bureau of Labor Statistics (2018). Quarterly census of employment and wages. Data file. Retrieved from https://www.bls.gov/cew/datatoc.htm.

U.S. Bureau of Labor Statistics (n.d.). Information: NAICS 51. Date file. Retrieved January 18, 2019, from https://www.bls.gov/iag/tgs/iag51.htm.

U.S. Census Bureau (2011). Intercensal estimates of the resident population for the United States, regions, states, and Puerto Rico: April 1, 2000 to July 1, 2010. Data file. Retrieved from https://www.census.gov/data/tables/time-series/demo/popest/intercensal-2000-2010-state.html.

U.S. Census Bureau (2015). Business dynamics statistics. Data file. Retrieved from https://www.census.gov/ces/dataproducts/bds/data_firm.html.

U.S. Census Bureau (2018a). American community survey. Data file. Retrieved from https://www.census.gov/programs-surveys/acs/data.html.

U.S. Census Bureau (2018b). Annual surveys of state and local government finances. Data file. Retrieved from https://www.census.gov/programs-surveys/gov-finances/data/datasets.html.

U.S. Census Bureau (2018c). Statistical abstracts of the United States. Data file. Retrieved from https://www.census.gov/library/publications/time-series/statistical_abstracts.html.

Walden, M. L. (2012). Explaining differences in state unemployment rates during the Great Recession. *Journal of Regional Analysis & Policy*, 42:251–257.

Zarnowitz, V. (1992). *Business cycles: Theory, history, indicators, and forecasting.* University of Chicago Press, Chicago, IL.