Are Regional Tax Investment Incentives a Zero-Sum Game? An Empirical Analysis of the Gulf Opportunity Zone Act of 2005

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On December 21, 2005, President Bush signed the Gulf Opportunity Zone Act of 2005, which provided tax incentives, such as bonus depreciation, to stimulate economic growth and assist the recovery and rebuilding efforts in hurricane stricken areas. This research examined whether regional tax incentives are zero-sum game, where growth in one local area comes at the expense of reduced growth in other local areas? Research results provided some tentative evidence supporting the zero-sum game theory; however, these results were not statistically significant. The conclusion is drawn, therefore, that the tax incentives provided by the Act had no significant negative impact on economic growth in the surrounding region.

INTRODUCTION

Federal tax policies often involve tax incentives intended to promote economic growth through increased capital spending by businesses. Economists often recommend increasing capital investment spending by reducing the cost of capital through tax incentives such as accelerated depreciation and the investment tax credit. Frequent use over the past 50 years suggests that Congress believes that tax incentives are an effective tool for promoting capital investment and economic growth. However, despite the continued use of tax investment incentives by policy-makers, empirical evidence concerning the effectiveness of tax incentives is inconclusive and some researchers believe that regional incentives come at the expense of surrounding regions.

On August 29, 2005, Hurricane Katrina struck land and caused significant damage in Louisiana, Mississippi, and Alabama. On September 23, 2005, Hurricane Rita made landfall along the coastlines of Texas and Louisiana, causing additional damage to the already devastated Louisiana. Hurricane Wilma made several landfalls in mid-October 2005, devastating parts of the Yucatán Peninsula and southern Florida. In response to these natural disasters, Congress developed new laws to provide disaster relief to the hurricane victims and tax recovery measures to stimulate the economic recovery of the region.

On September 26, 2005, President Bush signed the Katrina Emergency Tax Relief Act of 2005 (KETRA), which attempted to provide immediate assistance and tax relief to the victims of Hurricane Katrina. On December 21, 2005, President Bush signed the Gulf Opportunity Zone Act of 2005, otherwise known as the GO Zone Act. This Act extended the tax provisions of KETRA to the areas affected by Hurricane Rita and Hurricane Wilma and provided additional tax incentives, such as bonus depreciation and tax-exempt bond financing, to stimulate economic growth and assist the recovery and rebuilding efforts.

The GO Zone Act established zones that determined which areas were entitled to use the new tax relief policies. The Katrina GO Zone region (core disaster area) included 31 parishes in Louisiana, 49 counties in Mississippi, and 11 counties in Alabama. The Congressional Budget Office (2006) estimates that tax benefits related to the GO Zone Act will amount to about $4 billion in 2006, $3 billion in 2007, and $2 billion over the years from 2008 to 2015 (Richardson 2006). According to Richardson (2006), the major tax provisions generating these tax benefits will be the 50 percent bonus depreciation, the Section 179 expensing, and the broadening of the employee retention tax credit to all companies regardless of size. This research attempts to quantify the economic impact of the tax incentives included in the GO Zone Act on the surrounding regions, specifically examining whether these regional tax incentives create economic growth within policy coverage areas at the expense of the surrounding regions.

This research addressed the following research question: Are regional tax policy investment incentives a zero-sum game, where growth in one local area comes at the expense of reduced growth in other local areas? Research results provided some tentative evidence supporting the zero-sum game theory; however, these results were not significant at the alpha level equal to 0.05. Based on the data analysis from all statistical procedures implemented, statistically significant evidence supporting the zero-sum game theory does not exist. The conclusion is drawn, therefore, that the tax policy investment incentives provided by the Gulf Opportunity Zone Act of 2005 had no significant negative impact on economic growth in the surrounding region.

LITERATURE REVIEW & HYPOTHESIS

Tax incentives designed to spur investment are a major component of tax policy. The theory behind the use of tax incentives is that by providing businesses with accelerated tax deductions and other investment tax credits; the cost of capital needed to purchase new investments is reduced through the time value of money. The empirical debate is not centered on whether the cost of capital influences investment – even economists who are skeptical about the wisdom of using tax legislation to stimulate investment agree that the cost of capital affects investment (U.S. Congress 2007, 3). The debate is centered on the relative sensitivity of investment to changes in the cost of capital (U.S. Congress 2007, 3). The conclusions drawn by researchers examining the sensitivity of investment to changes in the cost of capital are affected by the assumptions, the methods of analysis, and the statistical techniques used by the researchers. Therefore, there are sizable bodies of research on both sides concerning the effectiveness of tax policy investment incentives. This research does not attempt to evaluate the effectiveness of tax policy investment incentives; rather it attempts to evaluate the impact that regional tax policy incentives have on the surrounding region that does not have access to the incentives provided by regional tax policies.

Brief History of Tax Investment Incentives

Historically, the primary tax policy incentives used to increase capital investment and spur economic growth have been investment tax credits, various adjustments to depreciation, and/or increased Section 179 election to expense deductions. Since the early 1900s, a depreciation deduction has been part of corporate income tax policy. The modern-day income tax began with the ratification of the 16th Amendment and the passage of the Revenue Act of 1913. Tax policies concerning depreciation have been changed many times in the past century. According to Kern (2000), the motivations for these frequent changes are attributed to: proper income measurement, raising revenue, encouraging capital formation, or ensuring a neutral tax system.

A major shift occurred concerning depreciation tax policy with the enactment of the Internal Revenue Code of 1954. For the first time, Congress, rather than the Treasury, determined allowable methods for calculating the depreciation deduction, and this represented the first time that Congress considered using tax depreciation as an economic incentive for stimulating investment (Kern 2000). The Revenue Act of 1962 introduced the investment tax credit (ITC) for the first time. This investment tax credit was equal to seven percent of the cost of a qualifying asset in the year of acquisition. Unlike a deduction, a credit is a dollar-for-dollar reduction of a taxpayer's tax liability. The investment tax credit represented a landmark

in terms of tax incentives for investment. President Kennedy advocated enacting the credit to stimulate capital formation, and he believed that higher levels of capital formation would raise productivity, keep people employed, and alleviate a serious balance of payments problem (House of Representatives 1962, 31). Congress echoed his sentiments by stating that the objective of the credit was "to encourage modernization and expansion of the Nation's productive facilities and thereby improve the economic potential of the country, with resultant increase in job opportunities and betterment of our competitive position in the world economy" (Committee on Finance 1962, 11).

The Revenue Act of 1971 introduced the Class Life Asset Depreciation Range System (ADR), which replaced the previous depreciation procedures with new guidelines. The investment tax credit and new depreciation guidelines enacted in 1971 were designed to be "large enough to stimulate the economy and yet not so large that they create a new wave of inflationary pressure" (Committee on Finance 1971, 71). The Economic Recovery Tax Act of 1981 (ERTA) introduced the Accelerated Cost Recovery System (ACRS) and modified the investment tax credit. This new ACRS system classified depreciable assets into one of four recovery classes (3-year, 5-year, 10-year, and 15-year) and was drastically different from previous depreciation methods.

The next major tax legislation was the Tax Reform Act of 1986, which included major shifts in depreciation policy and repealed the investment tax credit. The Act modified ACRS, resulting in the creation of the Modified Accelerated Cost Recovery System (MACRS). MACRS lengthened the useful lives of certain assets, expanded the number of property classes, and added the half-year convention to simplify calculations in the first and last year of a property's recoverable life. MACRS was designed to "provide for more neutral depreciation treatment across diverse assets" (Joint Committee on Taxation 1986, 10).

The Job Creation and Worker Assistance Act of 2002 was an economic stimulus bill that was enacted in part due to the terrorist attacks of September 11, 2001. After these tragedies, Congress needed to promote capital investments that would foster business expansion and generate employment opportunities (Committee Report 2003). The Act allowed an additional first-year depreciation deduction equal to 30 percent of the adjusted basis of qualified property, subject to the general rules regarding whether an item is deductible. This additional first-year depreciation deduction is also commonly referred to as "bonus depreciation" or "partial expensing" throughout the literature. This bonus depreciation incentive was the first major change in investment tax policy since the Tax Reform Act of 1986.

The Growth Tax Relief Reconciliation Act of 2003 provided additional tax investment incentives for businesses to spur economic growth. The Act increased the first-year depreciation deduction enacted by the Job Creation and Worker Assistance Act of 2002 from 30 percent to 50 percent on qualified property. The Act also increased the Section 179 expense deduction allowance through January 1, 2005, basically doubling the base amount of $100,000 for qualifying property. In 2005, Congress passed the Gulf Opportunity Zone Act of 2005 that extended these accelerated bonus depreciation deductions and Section 179 deduction incentives, in addition to other tax credits, for certain regions of the United States devastated by hurricanes.

The Economic Stimulus Act of 2008 was signed into law during February 2008, with the intended purpose of mitigating the economic recession. The Act provided recovery rebates for individuals and tax incentives for business investment. It contained two primary business investment incentives, an increased Section 179 expense deduction, and a bonus depreciation incentive. In early 2009, Congress passed the American Recovery and Reinvestment Act of 2009, as a direct response to the economic crisis then facing the United States; it was intended to spur economic activity and investment in long-term growth. According to Section 3 of the Act, this legislation was meant to accomplish the following: (1) preserve and create jobs and promote economic recovery, (2) assist those most impacted by the recession, (3) provide investments needed to increase economic efficiency by spurring technological advances in science and health, (4) increase investment in transportation, environmental protection, and other infrastructure that will provide long-term economic benefits, and (5) stabilize State and local government budgets, in order to minimize and avoid reductions in essential services and counterproductive state and local tax increases (House of Representatives 2009). The Act extends by one year the 50 percent bonus

depreciation deduction available for qualified property and the increased Section 179 expense amount enacted by the Economic Stimulus Act of 2008. Additional policies were passed in 2010 and 2011 to extend certain tax policy incentives.

Empirical Studies of the Impact of Tax Policy Incentives on Capital Investments

Prior to the 1967 article, "Tax Policy and Investment Behavior" by Hall and Jorgenson, very little empirical research concerning the impact of tax policy incentives had been performed. Hall and Jorgenson examined the effects of accelerated depreciation methods adopted in 1954 and the investment tax credit of 1962. They also investigated the depreciation guidelines of 1962 and considered the hypothetical effects of adoption of first-year write-off in 1954 as an alternative to accelerated depreciation. Based on their research findings, Hall and Jorgenson (1967) concluded that the effects of accelerated depreciation were very substantial, especially for investment in structures, and that the depreciation guidelines of 1954 were significant with respect to investments in equipment. Hall and Jorgenson (1967) also concluded that the effects of the investment tax credit of 1962 were dramatic and left no doubt about the impact of tax policy on determining investment behavior. Their overall conclusions were "that tax policy is highly effective in changing the level and timing of investment expenditures" and "that tax policy has had important effects on the composition of investment" (Hall and Jorgenson 1967, 392).

Since Hall and Jorgenson, dozens of studies have been performed on the economic impact of tax policy incentives. Numerous studies have found evidence supporting the effectiveness of tax policy investment incentives. Auerbach and Hassett (1992) concluded that tax policy changes affect the level and pattern of investment significantly. While other studies have found evidence concluding tax incentives are not effective. Chirinko (1986) concluded that investment behavior may respond to tax policy incentives, but that significant supporting empirical evidence has yet to be generated. Clark's (1993) study indicated that changes in the investment tax credit had only minimal and delayed effects on investment and that an investment tax credit is unlikely to have socially beneficial effects.

While studies concerning tax policy incentives are numerous, very few studies have examined the impact that regional tax incentives could potentially have on the surrounding region. Bartik (1994) noted that success in one area could cause negative results in other areas, explaining that job growth in one local area will, in part (not necessarily totally), come at the expense of reduced job growth in other local areas. Liard-Muriente (2007) also noted that regional development policies could be described as a zero-sum game, with local job reshuffling as the outcome. After all, if one area accomplishes growth, it may be at the expense of another area. Therefore, when examining economic growth, researchers should consider the impact of surrounding regions. Therefore, hypothesis one, stated in the null form, is:

> *H1: The tax policy investment incentives provided by the Gulf Opportunity Zone Act of 2005 have no impact on economic growth in the surrounding region.*

METHODOLOGY

The purpose of the research is to examine whether regional tax policy investment incentives create economic growth within policy coverage areas at the expense of the surrounding regions. This research utilizes multiple regression procedures with a matched sample panel data set from 2002 through 2008 to determine whether tax policy investment incentives at the regional level are a zero-sum game. In general, counties are the smallest geographical regions for which significant amounts of data are available, and to date very little empirical research has been performed on the effectiveness of tax investment incentives using real-world economic data at the county level. The research studies in the following paragraphs examined economic growth and/or capital investments and were based at the regional or county level. These research studies provided the foundation for selecting variables at the county level used to measure economic growth in this research study.

The econometric forecasting model developed by Chang (1979) included numerous variables, such as: lagged manufacturing investment, output by the manufacturing sector, output by the construction sector, employment, population, wage income, personal income, retail sales, and a time variable, just to name a few. The econometric forecasting model developed by Chang proved to be quite accurate in predicting local variables such as population, total employment, and personal income. Carlino and Mills (1987) explored the determinants of population and employment densities by analyzing numerous variables, such as: total population density, total employment density, and manufacturing employment density, along with other variables, including taxes per capita, median family income, median education levels, and interstate highway density to determine factors contributing to economic growth.

Monchuk et al. (2007) made note of popular measures of economic growth at the county level, including population, employment, and per capita income growth. Carruthers and Mulligan (2008) examined the rate of change over time in population density, employment density, and average annual wage to measure economic growth. Deller (2008) included the following historical measures of economic growth as variables: per capita income, employment, population, unemployment rate, education, local taxes, and percentage of population employed by state and local government. Steinnes and Fisher (1974) used numerous variables in their model including the following: manufacturing employment, non-manufacturing employment, median income, race, college faculty, property tax rate, and other factors. Helms (1985) included variables such as population density, education, highways, wages, and multiple types of taxes in his research. Courant (1994) urged researchers to "don't just count jobs" when measuring economic development, and that variables such as average growth rate of state product, employment growth, changes in per capita income, value of business building permits, and other factors should be considered when explaining economic growth.

Based on the relevant literature, this research was analyzed with the following dependent variables at the county level: annual industry earnings, manufacturing industry earnings, construction industry earnings, per capita income, personal income, average wages per job, median household income, total employment for all industries, total manufacturing employment, and total construction employment. Additional control variables were also included in the analysis, such as population density, federal government expenditures, unemployment rate, and a state variable.

Research Design

This research examined the percentage change in each of these variables individually at the county level and attempted to determine if any increases in the affected core disaster area are offset by decreases in the surrounding counties. The year-over-year percentage changes for each dependent variable were analyzed individually with OLS regression procedures on an annual basis for the period covering 2003 through 2008 and were also be analyzed individually for the GO Zone timeframe (2006-2008) and for the two-year period preceding Hurricane Katrina (2003-2004). The year 2005 was not included in either combined sample due to the fact that it overlapped both groups.

The research question was analyzed with a matched sample panel data set using annual data from 2002 through 2008. The data set consists of the 91 counties and parishes included in the GO Zone core disaster area and 91 non-GO Zone counties and parishes surrounding the affected region for a total sample of 182 counties. The 91 counties and parishes included in the GO Zone core disaster area include 49 counties in Mississippi, 31 parishes in Louisiana, and 11 counties in Alabama. Mississippi is comprised of 82 counties, and Louisiana has 64 parishes. The 91 non-GO Zone counties selected to create the matched sample for this research include the remaining 33 non-GO Zone counties in Mississippi, the remaining 33 non-GO zone parishes in Louisiana, and 25 non-GO Zone counties in Alabama. The 25 non-GO Zone Alabama counties were selected first based on proximity to the GO Zone core disaster area, and then matched on population from 2002. The models are as follows:

$$\%\Delta AIE_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta MIE_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta CIE_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta PCI_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta PEI_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta TEI_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta MEJ_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta CEJ_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta MHI_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$
$$\%\Delta AWJ_t = \beta_0 + \beta_1 GOZ_t + \beta_2 PDE_t + \beta_3 FGE_t + \beta_4 UNR_t + \beta_5 STA_t + \varepsilon_t$$

where, for a given county or parish at a time period *t*:

GOZ	=	GO Zone county (1=yes, 0=no);
%ΔAIE	=	percentage change in annual industry earnings;
%ΔMIE	=	percentage change in manufacturing industry earnings;
%ΔCIE	=	percentage change in construction industry earnings;
%ΔPCI	=	percentage change in per capita income;
%ΔPEI	=	percentage change in personal income;
%ΔTEI	=	percentage change in total employment for all industries;
%ΔMEJ	=	percentage change in total manufacturing employment;
%ΔCEJ	=	percentage change in total construction employment;
%ΔMHI	=	percentage change in the median household income;
%ΔAWJ	=	percentage change in the average wages per job;
PDE	=	population density;
FGE	=	total federal government expenditures by county;
UNR	=	civilian labor force unemployment rate by county;
STA	=	state identification control variable;

The primary sources of information are the United States Census Bureau, the Bureau of Economic Analysis, and the Bureau of Labor Statistics. Annual industry earnings represent net earnings by place of work (the sum of wage and salary disbursements, supplements to wages and salaries, and proprietors' income) less contributions for government social insurance, plus an adjustment to convert earnings by place of work to a place-of-residence basis. Personal income is the income received by all persons from all sources and is measured before the deduction of personal income taxes. Per capita personal income is calculated as the personal income of residents of a given area divided by the resident population of the area. In computing per capita personal income, the Bureau of Economic Analysis uses the Census Bureau's annual midyear population estimates.

The independent variable, GO Zone county (1=yes, 0=no), was created based on information obtained from IRS Publication 4492, for GO Zone and non-GO Zone counties in the sample. Population density is calculated by dividing total population by total square miles for each county or parish. Federal government expenditures encompass the total dollar amount of federal government expenditures by county. The unemployment control variable is comprised of the county/parish civilian labor force unemployment rate from the Bureau of Labor Statistics.

In addition, the research question was analyzed with binary logistic regression utilizing certain economic indicators implemented in the previous model; however this model considered all of the variables simultaneously to determine whether statistically significant differences existed between GO Zone counties and non-GO Zone counties. This model analyzes the two-year period (2003-2004) preceding Hurricane Katrina to determine whether differences existed between GO Zone counties and

non-GO Zone counties prior to the hurricanes and also analyzes the three-year GO Zone timeframe (2006-2008) to determine whether differences existed between GO Zone counties and non-GO Zone counties after the hurricanes. The model is as follows:

$$GOZ_t = \beta_0 + \beta_1 \Delta MIE_t + \beta_2 \Delta CIE_t + \beta_3 \Delta PEI_t + \beta_4 \Delta MEJ_t + \beta_5 \Delta CEJ_t + \beta_6 \Delta MHI_t + \beta_7 \Delta AWJ_t + \beta_8 PDE_t + \beta_9 FGE_t + \beta_{10} UNR_t + \beta_{11} STA_t + \varepsilon_t$$

where, for a given county/parish at a time period *t*:

GOZ	=	GO Zone county (1=yes, 0=no);
ΔMIE	=	change in total manufacturing earnings;
ΔCIE	=	change in total construction earnings;
ΔPEI	=	change in personal income;
ΔMEJ	=	change in total manufacturing employment;
ΔCEJ	=	change in total construction employment;
ΔMHI	=	change in the median household income;
ΔAWJ	=	change in the average wages per job;
PDE	=	population density;
FGE	=	total federal government expenditures by county;
UNR	=	civilian labor force unemployment rate by county;
STA	=	state identification control variable;

RESULTS

The Sample

The dataset consists of 1,274 observations for each variable. To account for inflation during the sample time period, all dollar amounts are converted to constant 2008 dollars using the Gross Domestic Product (GDP) price deflator. Table 1 provides descriptive statistics for the dependent variables over the full sample.

TABLE 1

Descriptive Statistics – Dependent Variables						
Variable	N	Range	Min.	Max.	Mean	Std. Dev.
Median Household Income	1274	51675	20624	72299	35290	7796.20
Personal Income	1274	28714	35	28749	1840.52	3306.14
Average Wages Per Job	1274	33724	22365	56089	31785	5860.44
Per Capita Income	1274	52903	16732	69635	27347	5248.70
Housing Unit Estimates	1274	309740	883	310623	24901.58	37628.92
Total Employment	1274	482014	664	482678	31424.42	57599.35
Construction Employment*	1196	31286	31	31317	2341.49	4252.28
Manufacturing Employment*	1210	32869	10	32879	2975.78	3994.22
Total Industry Earnings	1274	26256	14.39	26270.24	1342.09	2892.56
Construction Earnings*	1195	2119	.36	2119.75	104.84	242.86
Manufacturing Earnings*	1203	2176	0	2176.24	179.83	276.28

Based on the dataset of 1,274 observations for the years 2002-2008.

Note: Median Household Income, Per Capita Income, and Average Wages Per Job are in dollars. Personal Income and Earnings information are in millions of dollars.

All dollar amounts are converted to constant 2008 dollars using the Gross Domestic Product (GDP) price deflator.

*Data were missing for a few counties in the Construction and Manufacturing Industries.

All of the independent variables exhibit some level of significant correlation with the dependent variables, indicating that relevant variables have been utilized in this research. The independent variables used in this research were tested for collinearity and multicollinearity. The results indicate that no significant collinearity or multicollinearity existed between the independent variables used in this research.

Data Analysis

The research question was tested by comparing GO Zone counties to non-GO Zone counties pre- and post-Katrina, and was also be tested by comparing GO Zone counties to GO Zone counties and comparing non-GO Zone counties to non-GO Zone counties pre- and post-Katrina. Since the data analysis in this research study utilized standard multiple regression equations, the models were tested for violations of the regression assumptions. The analysis indicated no violations of the regression assumptions required for appropriate multiple regression models and no transformations were necessary to proceed with the interpretation of the results. The data were also analyzed for serial correlation and no variables exhibited serial correlation.

Table 2 provides results for the primary variable of interest (GO Zone) and the overall model. The results reported in Table 2 compare the annual percentage change values for GO Zone counties versus non-GO Zone counties pre- and post-Katrina. Each overall model analyzed was statistically significant below the alpha level of 0.05, except for pre-Katrina construction industry earnings, personal income, average wages per job, and post-Katrina median household income. Based on the multiple regression procedures, eight of the ten dependent variables tested showed statistically significant differences, at the

alpha level equal to 0.05, between GO Zone and non-GO Zone counties post-Katrina, and these differences did not exist during the pre-Katrina time period (2003-2004). These variables were personal income, with a post-Katrina p-value of 0.011, construction employment, with a post-Katrina p-value of 0.014, construction net earnings, with a post-Katrina p-value of 0.018, average wages per job, with a post-Katrina p-value of 0.001, total industry net earnings, with a post-Katrina p-value of 0.003, manufacturing employment, with a post-Katrina p-value of 0.033, manufacturing net earnings, with a post-Katrina p-value of 0.003, and total employment, with a post-Katrina p-value of 0.001.

TABLE 2

Summary Table Comparing GO Zone to Non-GO Zone Counties Pre- and Post-Katrina using Annual Percentage Change Values and Multiple Regression

	Pre-Katrina			**Post-Katrina**		
Variables	Beta	t - statistic	P-value	Beta	t - statistic	P-value
Personal Income (DV)						
Overall Model			0.263			0.000
Go Zone	-.093	-1.691	**0.092**	.110	2.545	**0.011**
Average Wages Per Job (DV)						
Overall Model			0.055			0.000
Go Zone	-.035	-.640	**0.523**	.141	3.226	**0.001**
Per Capita Income (DV)						
Overall Model			0.001			0.000
Go Zone	-.090	-1.657	**0.098**	.066	1.518	**0.130**
Median Household Inc. (DV)						
Overall Model			0.000			0.078
Go Zone	-.126	-2.448	**0.015**	.037	.832	**0.406**
Manufacturing Employment (DV)						
Overall Model			0.000			0.000
Go Zone	.028	.498	**0.619**	.094	2.136	**0.033**
Total Industry Earnings (DV)						
Overall Model			0.012			0.000
Go Zone	-.082	-1.502	**0.134**	.129	3.037	**0.003**
Construction Earnings (DV)						
Overall Model			0.486			0.002
Go Zone	-.056	-.979	**0.328**	.111	2.381	**0.018**
Manufacturing Earnings (DV)						
Overall Model			0.029			0.000
Go Zone	-.015	-.258	**0.797**	.130	2.944	**0.003**
Total Employment (DV)						
Overall Model			0.000			0.000
Go Zone	-.027	-.533	**0.595**	.134	3.329	**0.001**
Construction Employment (DV)						
Overall Model			0.043			0.002
Go Zone	-.058	-1.013	**0.312**	.115	2.459	**0.014**

Pre-Katrina is comprised of years 2003 and 2004; Post-Katrina is comprised of years 2006, 2007, and 2008.
All dependent variables represent average annual percentage change by county for each variable.
Data Sources: Regional Economic Information System, Bureau of Economic Analysis and U.S. Census Bureau.
An analysis of variance (ANOVA) was calculated to determine the overall significance of each model.

Additional statistical procedures were performed on the full dataset examining the interaction between GO Zone versus non-GO Zone counties pre- and post-Katrina; essentially testing whether the pre-Katrina and post-Katrina regression coefficients reported in Table 2 for the GO Zone variable in each model were statistically different. Based on these multiple regression procedures, three of the dependent variables showed a statistically significant change at the alpha level equal to 0.05 when comparing the GO Zone variable regression coefficient from the pre-Katrina time period to the coefficient from the post-Katrina time period, after controlling for the independent variables included in each model. These variables were construction employment, with p-value of 0.039, average wages per job, with a p-value of 0.028, and total employment, with a p-value of 0.033. These results verify previously reported statistical differences concerning these variables.

These significant differences in the construction industry were not unexpected and can be explained by the physical property damage caused by Hurricane Katrina. The significant differences in annual percentage change values in the remaining dependent variables could provide support for the theory that regional tax incentives are a zero-sum game, but additional procedures need to be performed before such conclusions can be drawn. Evidence in support of the zero-sum game theory will exist if additional statistical tests show that the annual percentage change in GO Zone counties post-Katrina (2006-2008) were significantly greater than the annual percentage change pre-Katrina (2003-2004), and if statistical tests also show that the annual percentage change in non-GO Zone counties post-Katrina were significantly smaller than the annual percentage change in non-GO Zone counties pre-Katrina.

GO Zone versus GO Zone, Non-GO Zone versus Non-GO Zone Pre- and Post-Katrina

Additional tests were performed comparing GO Zone counties to GO Zone counties pre- and post-Katrina and non-GO Zone counties to non-GO Zone counties pre- and post-Katrina. Table 3 reports the results from these multiple regression tests. An alternate version of the GO Zone independent variable was created and named Katrina to identify pre-Katrina versus post-Katrina time periods. These statistical tests were performed to determine if statistically significant increases in the annual percentage changes in values existed in GO Zone counties post-Katrina when compared to GO Zone counties pre-Katrina, if statistically significant decreases in annual percentage change values existed in non-GO Zone counties post-Katrina when compared to non- GO Zone counties pre-Katrina. Significant results would provide support for the theory that regional tax incentives are a zero-sum game.

The results reported in Table 3 compare GO Zone counties to GO Zone counties pre- and post-Katrina and non-GO Zone counties to non-GO Zone counties pre- and post-Katrina. Each overall model analyzed was statistically significant below the alpha level of 0.05, except for pre-Katrina construction industry earnings, and post-Katrina personal income, median household income, and construction employment. Based on the multiple regression procedures, four of the dependent variables showed a statistically significant change, at the alpha level equal to 0.05, when comparing the GO Zone counties for the pre-Katrina time period (2003-2004) to the post-Katrina time period (2006-2008), after controlling for the independent variables included in each model. These variables were construction employment, with a p-value of 0.020, total employment, with a p-value of 0.036, total industry net earnings, with a p-value of 0.008, and manufacturing industry net earnings, with a p-value of 0.008. Based on the standardized coefficients, these differences pointed to significant increases in the annual percentage change in each variable, except for annual industry net earnings, which showed smaller values post-Katrina compared to the pre-Katrina timeframe. Only two of the dependent variables produced a statistically significant change, at the alpha level equal to 0.05, when comparing the non-GO Zone counties for the pre-Katrina time period (2003-2004) to the post-Katrina time period (2006-2008), after controlling for the independent variables included in each model. These variables were construction employment, with a p-value of 0.026, and construction industry net earnings, with a p-value of 0.004. Three of the four primary variables of interest (average wages per job, manufacturing employment, and manufacturing earnings) showed larger percentage changes post-Katrina in GO Zone counties and smaller percentage changes post-Katrina in non-GO Zone counties, providing support for the zero-sum game theory. These results,

however, were not significant at the alpha level equal to 0.05, eliminating the possibility of drawing conclusions supporting the zero-sum game theory.

TABLE 3

Summary Table Comparing GO Zone Counties to GO Zone Counties and non-GO Zone Counties to non-GO Zone Counties Pre- and Post-Katrina using Annual Percentage Change Values and Multiple Regression

	GO Zone			Non-GO Zone		
Variables	Beta	t - statistic	P-value	Beta	t - statistic	P-value
Personal Income (DV)						
Overall Model			0.000			0.091
Katrina (Pre-K vs. Post-K)	-.153	-1.251	**0.212**	-.226	-1.757	**0.080**
Average Wages Per Job (DV)						
Overall Model			0.000			0.001
Katrina (Pre-K vs. Post-K)	.218	1.759	**0.079**	-.214	-1.775	**0.077**
Per Capita Income (DV)						
Overall Model			0.000			0.002
Katrina (Pre-K vs. Post-K)	.102	.833	**0.405**	-.240	-1.886	**0.060**
Median Household Inc. (DV)						
Overall Model			0.000			0.203
Katrina (Pre-K vs. Post-K)	.089	.724	**0.469**	.076	.589	**0.556**
Manufacturing Employment (DV)						
Overall Model			0.002			0.000
Katrina (Pre-K vs. Post-K)	.251	1.952	**0.052**	-.154	-1.231	**0.219**
Total Industry Earnings (DV)						
Overall Model			0.000			0.000
Katrina (Pre-K vs. Post-K)	-.328	-2.647	**0.008**	-.036	-.290	**0.772**
Construction Earnings (DV)						
Overall Model			0.369			0.000
Katrina (Pre-K vs. Post-K)	.187	1.412	**0.159**	.377	2.873	**0.004**
Manufacturing Earnings (DV)						
Overall Model			0.001			0.000
Katrina (Pre-K vs. Post-K)	.389	3.037	**0.003**	-.200	-1.569	**0.118**
Total Employment (DV)						
Overall Model			0.000			0.000
Katrina (Pre-K vs. Post-K)	.244	2.105	**0.036**	.049	.439	**0.661**
Construction Employment (DV)						
Overall Model			0.015			0.070
Katrina (Pre-K vs. Post-K)	.306	2.337	**0.020**	.299	2.227	**0.026**

Pre-Katrina is comprised of years 2003 and 2004; Post-Katrina is comprised of years 2006, 2007, and 2008.
All dependent variables represent average annual percentage change by county for each variable.
Data Sources: Regional Economic Information System, Bureau of Economic Analysis and U.S. Census Bureau.
The Katrina independent variable is used to identify pre- and post-Katrina time periods.
An analysis of variance (ANOVA) was calculated to determine the overall significance of each model.

Logistic Regression Procedures

Results from the binary logistic regression data analysis comparing Go Zone counties to non-GO Zone counties post-Katrina produced similar findings to previously analyzed multiple regression models; however, the data do not fit the model. The recommended test for overall fit of a binary logistic regression model is the Hosmer and Lemeshow test, also called the chi-square test (Hair et al. 2006). The Hosmer and Lemeshow test is used to assess the goodness of fit of a model and allows for any number of explanatory variables, which may be continuous or categorical. A finding of non-significance (p-value greater than 0.05) allows the researcher to conclude that the model adequately fits the data. In this case, the Hosmer and Lemeshow test performed on the binary logistic model comparing Go Zone counties to non-GO Zone counties post-Katrina shows a p-value of 0.000. This significant p-value indicates that the overall model is not a good fit for the data at an acceptable level. The Hosmer and Lemeshow test performed on the binary logistic model comparing non-Go Zone counties to non-GO Zone counties post-Katrina shows a p-value of 0.050, indicating a poor overall model fit for this model as well. Based on these significant findings, the binary logistic models were not used to draw conclusions in this research study.

Based on the multiple regression data analysis from all of the models tested, statistically significant evidence supporting the rejection of the hypothesis (H1) did not exist. The null hypothesis, therefore, was not rejected and the conclusion was drawn that the tax policy investment incentives provided by the Gulf Opportunity Zone Act of 2005 had no significant impact on economic growth in the surrounding region.

Sensitivity Analysis

A sensitivity analysis was performed in an attempt to eliminate the potential impact on research findings caused by Hurricane Katrina storm damage and to verify previously reported results. A subset of the full dataset was created and tested with multiple regression procedures. The subset sample consisted of GO Zone and non-GO Zone counties from Mississippi. The sample dataset consisted of the 20 most northern GO Zone counties in Mississippi and the 20 most southern non-GO Zone counties in the same state. The impact of Hurricane Katrina should be minimized by selecting the northern GO Zone counties where storm damage was minimal when compared to counties along the coastline. This sample dataset was analyzed using the same multiple regression models previously examined. As before, the models were tested for violations of the multiple regression assumptions and the analysis indicated no violations of the assumptions required for appropriate multiple regression models and no transformations were necessary to proceed with the interpretation of the results.

Additional multiple regression procedures were run as a sensitivity analysis. The results (table not shown) compare the annual percentage changes for GO Zone counties to non-GO Zone counties pre- and post-Katrina. Based on the multiple regression procedures, no statistically significant results existed, at the alpha level equal to 0.05 that showed any differences between GO Zone and non-GO Zone counties pre-Katrina or post-Katrina. Additional statistical procedures were performed on the dataset examining the interaction between GO Zone versus non-GO Zone counties pre- and post-Katrina; essentially testing whether the pre-Katrina and post-Katrina regression coefficients for the GO Zone variable in each model were statistically different. Based on these multiple regression procedures, none of the dependent variables showed a statistically significant change at the alpha level equal to 0.05 when comparing the GO Zone variable regression coefficient from the pre-Katrina time period to the coefficient from the post-Katrina time period, after controlling for the independent variables included in each model.

GO Zone versus GO Zone, Non-GO Zone versus Non-GO Zone Pre- and Post-Katrina

Additional procedures compared GO Zone counties with GO Zone counties pre- and post-Katrina and non-GO Zone counties with non-GO Zone counties pre- and post-Katrina for the sensitivity sample dataset. Based on the additional multiple regression procedures, only one of the dependent variables showed a statistically significant change, at the alpha level equal to 0.05, when comparing the GO Zone counties for the pre-Katrina time period (2003-2004) to the post-Katrina time period (2006-2008), after controlling for the independent variables included in each model. That variable was per capita income,

with a p-value of 0.003; however, based on the sign of the standardized coefficient, the annual change in per capita income in the GO Zone counties decreased post-Katrina. Results from the multiple regression procedures performed on annual percentage change values in this sensitivity analysis provided no statistical evidence supporting the rejection of the null hypothesis (H1).

CONCLUSIONS AND LIMITATIONS

The Gulf Opportunity Zone Act of 2005 implemented temporary regional tax investment incentives after Hurricane Katrina devastated the Gulf Coast. This research evaluated the economic impact on the surrounding regions of tax policy investment incentives provided by the Gulf Opportunity Zone Act of 2005. This research examined whether regional tax policy investment incentives create economic growth within policy coverage areas at the expense of the surrounding regions, essentially a zero-sum game. Overall, the results do not indicate that the tax incentives provided by the GO Zone Act has had a statistically significant negative impact on the surrounding region. The null hypothesis, therefore, is supported and the conclusion is drawn that the tax policy investment incentives provided by the Gulf Opportunity Zone Act of 2005 have had no significant impact on economic growth in the surrounding region.

Limitations of the Study

As with all forms of research, some limitations are inherent in archival empirical research. Archival empirical data for the affected region make this study possible but also limit the ability to generalize these results to other regions. In addition, empirical research utilizing real-world data can be prone to internal validity issues that exist due to lack of environmental controls and other possible causal factors. The purpose of this research is to determine whether tax policy investment incentives have a negative impact on surrounding regions. Therefore, explanation and generalization are not the primary factors of this research study.

The time limitation of the study and the temporary nature of the tax policy investment incentives impose additional limitations on any findings. The short-term nature of these regional tax policy investment incentives restricts the data and limits the time available to identify a statistically significant impact. Also, these temporary investment incentives may have shifted capital investment spending forward in time, which would indicate a temporary change with no significant long-term impact on economic growth. Future studies covering tax policy investment incentives could help to clarify some of these temporary and time-related limitations.

Although the models used in this research were capable of explaining a large portion of the variation in the dependent variables, any missing and unexplained variables can contribute omitted variable bias to this study. Unfortunately, some of these omitted variables are intangible and could not be measured. The physical property damage and population out-migration caused by Hurricane Katrina also created potential limitations on any findings. Hurricane Katrina was the worst natural disaster in our nation's history in terms of geographic scope, the severity of its destruction, and the number of persons displaced from their homes (GAO 2010). These extraneous factors make drawing conclusions difficult in the counties and parishes most severely damaged by Hurricane Katrina.

Contributions of the Study

Multiple researchers have stated that regional tax incentives are potentially a zero-sum game. This research provides evidence of the impact that regional tax policy investment incentives have on the surrounding areas, helping to determine whether regionally tailored tax incentives have a significant impact on the intended beneficiaries or are simply a zero-sum game that shifts spending from one geographic location to another. This research minimizes issues addressed by prior empirical research and estimated the impact of regional tax incentives on surrounding regions.

Most prior empirical research studies in this area have been cross-sectional studies based on industry-, firm-, or asset-level data and not typically tested at the regional level. Steinnes (1984) examined regional

economic development and concluded that the use of pooled-time-series-cross-sectional data provides more accurate results when compared to research that only examines cross-sectional data for one time period. According to Wooldridge (2009), utilizing pooled cross sections from different years is an effective way of analyzing the effects of government policy. This research addressed these issues by utilizing a matched sample panel data set at the county level.

The GO Zone Act provides an opportunity for researching the effectiveness of tax-policy incentives on capital investment and economic growth at the county level over a finite period of time covering 2006 through 2008. According to Richardson (2006), Hurricanes Katrina and Rita may provide the ultimate test for tax policy in the United States. The Katrina Emergency Tax Relief Act of 2005 (KETRA) and, especially, the Gulf Opportunity Zone Act of 2005 give economists an opportunity to evaluate the effectiveness of tax policy (Richardson 2006).

Suggestions for Future Research

Regional tax investment incentives provide opportunities for future research. Very little empirical research has been performed on the effectiveness of tax investment incentives using real-world economic data. Additional research could be performed on the incentives provided by the GO Zone Act after additional time has passed to determine its potential long-term effects. The current study provides a foundation for future research by identifying significant independent control variables that explain a large portion of the variation in key economic indicators. If possible, research could be performed on regional tax incentives not created in response to a natural disaster of some type, eliminating potential extraneous factors. Future research on regional tax incentives could also be performed on a micro level, examining very specific North American Industry Classification System (NAICS) codes within specific industries.

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