mather:

Walton Foundation

Job Creation from Gulf Coast Wetlands Restoration

White Paper

Completed by:

Mather Economics LLC

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Abstract

The following report summarizes an analysis of the economic impact associated with wetland restoration and risk mitigation spending in the Gulf Coast Region. More specifically, the study attempts to forecast employment growth as a direct result of increased outlays appropriated for various restoration projects along the Gulf Coast. Our models suggest that increased outlays are significantly and positively correlated with total employment in the region.

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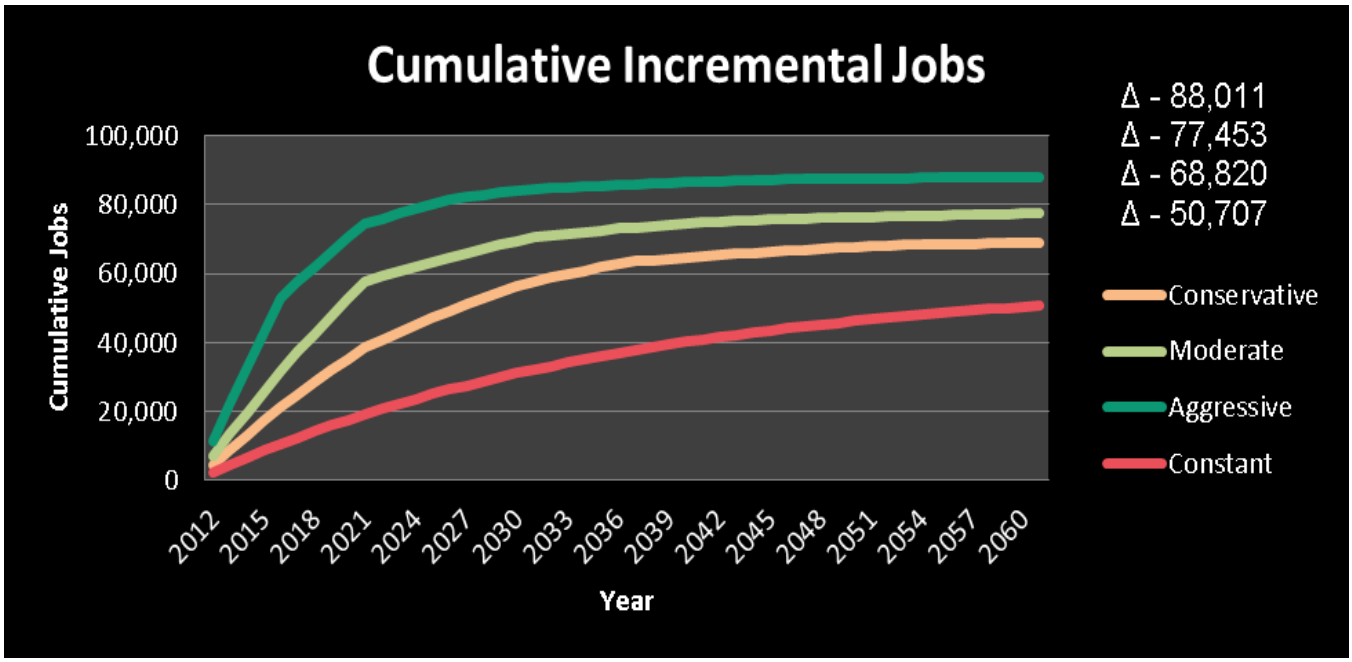
Executive Summary

- Gulf Coast restoration funding can yield robust incremental employment effects.
- Models indicate that over 50 years, $25B in restoration funding can promote the creation of as many as **88,011 incremental jobs** throughout the Gulf Coast.
- In the first ten years of restoration funding alone, 74,492 jobs could be created, for an average of 7,449 jobs created per year during the first ten years.[1]

Graph 1 - Cumulative Incremental Jobs



Econometric modeling techniques utilized in this paper suggest that Gulf Coast restoration funding will have a significant and positive impact on regional employment. [2] Four variations of the forecasting model were estimated to account for the various ways in which federal funding might affect regional employment. Each model includes a control (no federal funding) and a restoration scenario to project the incremental employment effects of restoration funding. These models indicate that, depending on the timing of the funding distributions and macroeconomic variables, the $25 billion in total restoration funding could yield as many as 88,011 incremental employment positions in the region. The graph below displays the cumulative employment effects associated with the various models specified.

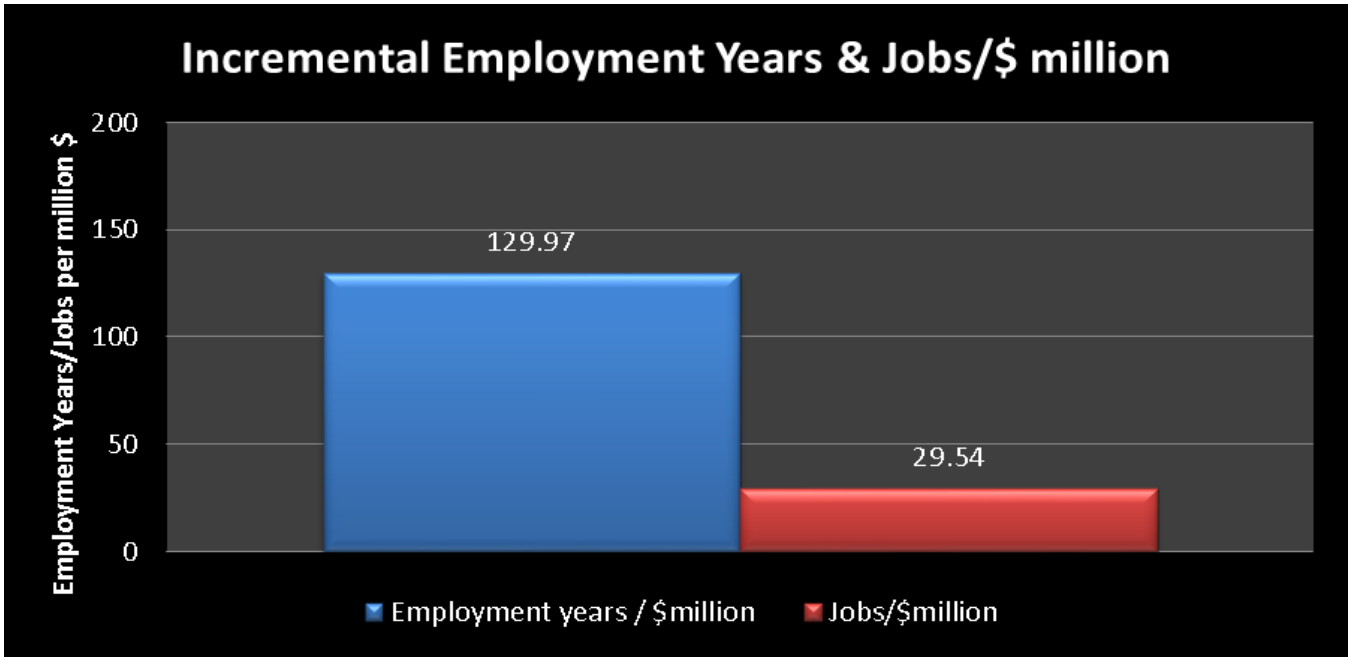
[1] Assumes fund loading associated with the "Aggressive" model.
[2] It should be noted that by "restoration spending," we imply total project spending that includes both restoration and risk mitigation outlays.

To estimate incremental jobs resulting from the restoration funding, econometric models of labor demand isolate the employment effects of federal funds entering the regional economy. The effects of overall economic activity, interest rates, wage levels, and other variables are also modeled and separated from the employment effects so that we can isolate the impact of federal funds on regional employment.

Once the employment effects of federal funds are measured, projections of incremental employment are developed using alternative funding levels by year. The number of incremental jobs created by the funding is determined by the timing of the funds as well as other macroeconomic variables. The results of several potential restoration timelines are presented in this paper, including a constant level of funding across the entire timeline of the restoration, and different levels of accelerated funding. Fund loading for the "Moderate" model, for example, assumes $1.5B in spending for years 0-10, $500M for years 10-20, $250M for years 20-30, and $125M for the remaining years in the program.

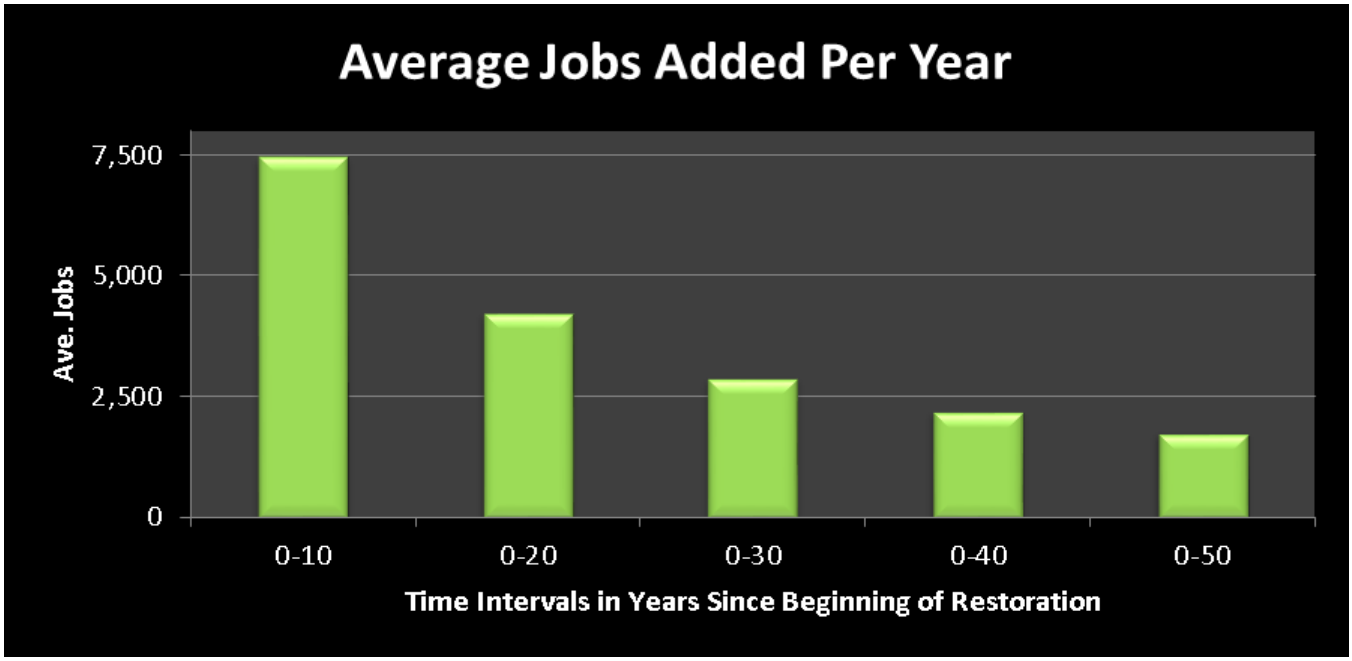
The results of our analysis suggest that, for the moderate case, the number of incremental employment years per million dollars of funding is 129, which is equivalent to 29 jobs per million at an average employment duration per job of 4.4 years.

Graph 2 – Incremental Employment Years & Jobs/$ Million, Moderate Model



As can be observed in the graph below, average incremental positions added from the influx of restoration funding is in the several thousands annually, and average employment effects are especially large in the first decade of restoration funding, due to weighting the allocation of funds to the early stages of the program.

Graph 3 – Average Jobs Added Per Year, Moderate Model



The incremental employment forecasts conducted in this study are largely consistent with other studies that have been performed in recent years by various institutions. The analysis presented here, along with commensurate studies, show that restoration funding can result in significant and positive employment effects in addition to environmental benefits.

Introduction

Value of coastal wetlands

The Gulf Coast provides a host of environmental benefits to the region and nation. Including over five million acres of wetlands, the Gulf Coast possesses half of all the wetlands in the entire United States. The Gulf Coast provides habitats for thousands of species, provides storm surge protection for coastal residences and businesses, supports abundant recreational and commercial fishing activities, attracts billions of dollars in tourism, and supports one of the largest oil and gas operations in the United States.[3] Louisiana, as the epicenter of Gulf Coast activity, both environmentally and economically, is especially important. Approximately 40 percent of the coastal wetlands of the lower forty-eight states are located in the state of Louisiana, and these areas provide a plethora of environmental and economic benefits to the state, region, and country.[4]

When larger storms hit the coast, wetlands provide a buffer between storm surges and the highly populated inland areas of the coastline. Additionally, in periods of high rainfall, wetland areas provide flood mitigation services by absorbing excess water. Wetland areas also help to purify water through filtering contaminants and pollutants.[5]

Coastal wetlands in the state also offer numerous benefits relating to wildlife habitats. The coastal areas of Louisiana are heavily concentrated with thousands of indigenous species of aquatic, land, and bird life.[6] Louisiana's commercial and recreational fishing industries provide 25-35 percent of the nation's aggregate catch, and the state leads the nation in crab and oyster harvesting. This abundance in aquatic life is due largely to the coastal wetlands, which provide an ideal environment for fish and shellfish nurseries.[7]

Economically, the Louisiana wetlands have a significant impact on the productivity and safety of oil and gas operations in the region. In the late 1990s, the state accounted for 18 percent of all oil production and 24 percent of all natural gas production throughout the entire United States. The coastal wetlands of Louisiana provide essential wave and storm protection

[3] "The Gulf of Mexico's Ecosystem." Gulfsource, 2012. pg. 1
[4] "Coastal Wetlands Planning, Protection, and Restoration Act." United States Geological Survey, 2012. pg. 1
[5] ibid, pg. 1
[6] ibid., pg. 1
[7] "The Cost of Doing Nothing." *Water Marks*. Louisiana Coastal Wetlands Conservation and Restoration Task Force, Summer 1999. pg. 8

for oil and gas infrastructure, which is ubiquitous along the coast. For example, Port Fourchon, the economic epicenter of offshore drilling operations along the Gulf Coast, is highly vulnerable to tropical storms and hurricanes. The wetland areas surrounding the port provide invaluable flood and erosion protection from these storms. Furthermore, more than 20,000 miles of oil and gas pipeline run throughout the state of Louisiana and its coast. The coastal wetlands provide the pipelines with a barrier to the volatile weather conditions prevalent in the region. Certain stretches of these pipelines also use wetlands as anchor points, so the erosion of these areas could have a negative impact on pipeline safety in the future.[8]

Threatening this ecological and economic productivity is the rapid loss of wetland area occurring throughout the Gulf region, and especially in the state of Louisiana. From 1950 to 2000, more than one thousand miles of coastal wetlands have vanished at the rate of 25 to 35 miles per year.[9] A variety of sources contribute to this loss of wetland area: hurricanes, dredging, levee and dam building, and the construction of logistics networks for ships and oil and gas pipelines.[10] As discussed, these wetlands and barrier islands provide a habitat to thousands of species, serve as anchor points for thousands of miles of pipeline originating from offshore drilling facilities, and deliver storm surge protection to logistical operations and residential communities throughout the region.

Economic Impact

This significant loss of valuable land along the Gulf coast has led to a large response on the part of the federal and state governments to help restore these areas. These restoration projects have and will continue to have a positive impact environmentally, but the funding associated with these restoration projects also have substantial economic impacts. As we will see, restoration funding can yield significant and positive impacts economically, especially on state and regional employment.

The purpose of the analysis presented here is to estimate the employment effects resulting from the increase in federal funding as part of a $25 billion Gulf Coast wetlands restoration project that will take place over the duration of 50 years. Employment in the Gulf Region will be forecasted using various time-series econometric modeling techniques using

[8] ibid., pg. 4-8.
[9] ibid., pg. 3.
[10] "Coastal Restoration Spending in Louisiana," Louisiana Workforce Commission, September, 2011. pg. 1

data on employment, federal outlays, and macroeconomic data. As part of this paper, we will: present a summary of findings, examine existing literature on the issue, outline the data used for the analysis, discuss the modeling methodology, explain the results of models used, outline some additional economic benefits outside of the scope of this project, and provide concluding remarks.

Proposed Funding

This report utilizes $25 billion in Gulf Coast restoration funding, which stems from the potential funds to be received from the RESTORE Act, as a basis for employment forecasting. The bill would create a Gulf Coast Restoration Trust Fund, of which it would receive 80 percent of any penalties paid as a part of the Clean Water Act. These penalties would be paid by the responsible parties of the Deepwater Horizon oil spill, and the Restoration Trust Fund would support restoration projects along the Gulf Coast to help promote a safer and more sustainable coastline.[11]

[11] "An Overview of the RESTORE Act," Environmental Law Institute, March, 2012. pg. 1

Summary of Findings

Our models indicate that federal spending is positively correlated with regional employment levels. After applying the coefficients of the models estimated in this project to levels of federal outlays, gross domestic product, consumer prices, wages, and federal funds rates, we conclude that the influx of additional restoration funds will have a significant and positive impact on regional employment over the course of the fifty years presented in this study.

Four variations of the forecasting model were estimated, each with a control and restoration model built within. All of the variations specified use total employment as the primary basis of estimation. The primary difference between the specifications is the loading of restoration funds throughout the timeline of the project. The "Constant" model uses a consistent loading of funds, which means the same amount of funding is applied every year for the duration of the project. The "Conservative," "Moderate," and "Aggressive" models use a progressively front loaded funding schedule. That is, larger funding is applied earlier in the process the more aggressive the model becomes. We suspect these four model variations are conservative and robust estimations of forecasted employment, as they reflect the substitution effects within sectors of the economy. For the remainder of the paper, we will focus primarily on the results of the "Moderate" model.

The table below displays a summary of the four model variations estimated for this project.[12]

[12] Graph 6 and Table 4 display the allocation of funds for the four models specified.

Table 1 - Model Results Summary

Summary of Model Results				
	Constant	Conservative	Moderate	Aggressive
Total Incremental Jobs	50,707	68,820	77,453	88,011
Jobs/million $	15.33	24.55	29.54	35.59
Average Jobs Added Years 0-10	1,923	3,846	5,770	7,449
Average Jobs Added Years 0-20	1,609	2,894	3,532	4,226
Average Jobs Added Years 0-30	1,363	2,169	2,500	2,890
Average Jobs Added Years 0-40	1,169	1,700	1,912	2,190
Average Jobs Added Years 0-50	1,014	1,376	1,549	1,760

Comparing the results of the control and restoration models, under conservative macroeconomic assumptions, we project a significant increase in incremental employment positions due to restoration funding in the Gulf Coast region. Specifically, the "Moderate" model forecasts 77,453 *incremental* positions created over a fifty-year period from 2012-2062, for an average yearly increase of 1,549 jobs.

A more accurate metric of the employment effects and the cost per unit of employment is "employment-years," which reflects the change in employment over the time period of restoration investments. For our "Moderate" model, we find that the $25 billion in total funding will generate approximately 3.25 million additional employment years, which translates into a "cost per employment year" of roughly $7,700.

In 2010, the Bureau of Labor Statistics (BLS) estimated the median number of years that wage and salary workers had been with their current employer was 4.4 in the United States.[13] Using this figure, we can estimate the number of jobs created per million dollars of investment. By dividing the $25B total investment by one million, dividing total incremental job years by the resulting quotient, and finally dividing that quotient by employment tenure, we arrive at a "jobs per million" metric. Those results are shown in the summary table above. An example of how we arrived at this metric for the "Moderate" model is presented below.

1.) 25,000,000,000/1,000,000 = 25,000

2.) (3,249,262/25,000) = 129.97

3.) (129.97/4.4) = 29.54 jobs per million

[13] "Employee Tenure Summary," Bureau of Labor Statistics, 2010. pg. 1

Literature Review

Fiscal Multiplier

Numerous academic studies have been conducted regarding the impact of federal spending on economic activity. As a part of gross domestic product, the value of all goods and services produced in the economy, government spending does have an impact on output. There is, however, significant disagreement over exactly how substantial an impact federal outlays have on the economy. The government spending multiplier, a measure of how output changes proportionally to changes in government spending, has been a central tenant of macroeconomic research. Barro (1981) estimated the fiscal multiplier to be 0.8, implying that a 1 percent increase in government spending results in a 0.8 percent increase in national output.[14] In a similar study, Ramey (2008) estimated the multiplier to be 1.2.[15] Various other studies have pointed to a fiscal multiplier between zero and one; thus, we can assume from these studies that government spending has a positive (albeit widely ranging in degree depending on the particular study) impact on the economy.

Restoration and Employment

In addition, numerous studies regarding the economic impact of restoration funding on specific areas of the country exist. For example, Shropshire and Wagner (2009) estimated that 31.53 jobs are created for every $1 million spent on restoration projects in the state of Montana.[16] Mosely and Nielson-Pinkus (2010) estimated that a total of 23.8 jobs are created for every $1 million spent on restoration projects in the state of Oregon. These jobs were the cumulative sum of direct, indirect, and induced sources. For clarification, those terms are defined as:

> **Direct Effects** are those created by the planning and implementation of the restoration projects.
> **Indirect Effects** are those associated with the demand for materials, supplies, equipment, and other services needed to implement projects.

[14] Barro, Robert "Output effects of government purchases," *Journal of Political Economy*, 89(6): 1115, 1981
[15] Ramey, Valerie "Can Government Purchases Stimulate the Economy?" forthcoming, *Journal of Economic Literature*, 2011. pg. 4
[16] Shropshire, Robin and Barbara Wagner , "An Estimation of Montana's Restoration Economy." Montana Department of Labor and Industry. 17 Sept., 2009. pg. 6

> **Induced Effects** are those produced when people employed in the direct and indirect sectors spend their incomes on goods and services.[17]

A 2011 study conducted by the Louisiana Workforce Commission (one in which most closely relates to the analysis performed in this paper) analyzed the economic impact associated with restoration funding in the state of Louisiana. In 2010, $618 million were spent on coastal restoration projects in the state of Louisiana, and the Louisiana Workforce Commission estimated that a total of 8,900 jobs were created as a result of the restoration funding, with 4,880 of them being direct jobs and an additional 4,020 being indirect jobs.[18]

From the studies cited above, it seems that there is a clear association between restoration funding and job creation. The scope of this project will be to forecast the marginal impact of restoration funding on Gulf Coast regional employment over a 50-year time period.

[17]Nielsen-Pincus, Max and Cassandra Mosele, "Economic and Employment Impacts of Forest and Watershed Restoration in Oregon." University of Oregon: Institute for a Sustainable Environment," Spring 2010. pg. 4-7
[18] "Coastal Restoration Spending in Louisiana," pg. 4

Data

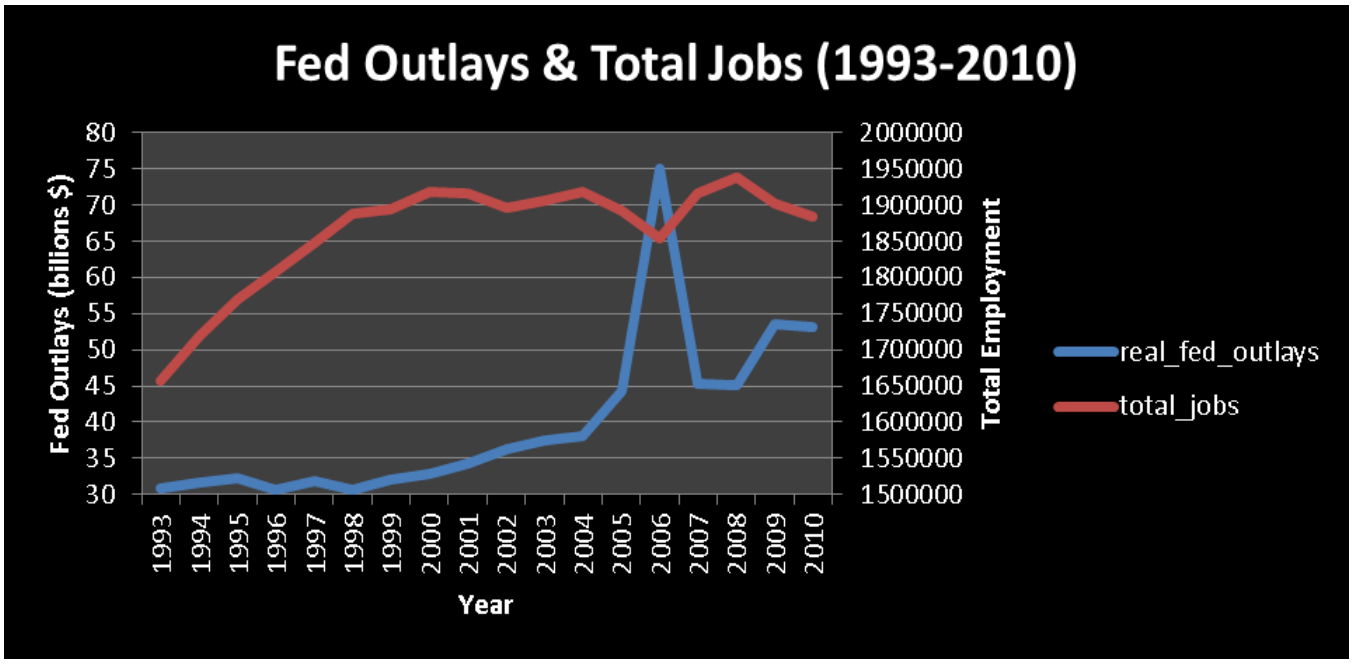
The data set used for this analysis was compiled from a variety of sources. Employment and wage data were obtained from the Bureau of Labor statistics and the Louisiana Workforce Commission.[19][20] Federal outlay data was obtained from the United States Census[21], national consumer pricing information (CPI) was obtained from the Budget Office of the Seattle Municipal Government[22], federal funds rate information was obtained from the St. Louis Federal Reserve Bank[23], and returns on the Dow Jones Industrial Average were obtained from Econ Stats.[24] Our models utilized data from 1980 onward from all of the sources above, with the exception of federal outlay data, which was available from 1993 onward only.

Current State Employment Statistics

Taking Louisiana as a case study, over the course of 2011, the state of Louisiana possessed an average of 1,900,735 seasonally adjusted employment positions, compared to annual averages of 1,924,499 and 1,926,301 in 2009 and 2010, respectively. Total employment has fluctuated in a tight range and has been relatively flat since the late 1990s. Prior to 1999, year-over-year employment growth was consistently strong. The impact of Hurricane Katrina caused a regional employment contraction in 2005 and 2006, and a large increase in federal outlays to the state took place during these years. The 2008 United States recession also contributed to a significant contraction in state employment through 2009, where employment has largely stabilized since. The following graph displays total employment and federal outlays to the state from 1993 to 2011.

[19] "Local Area Unemployment Statistics," Bureau of Labor Statistics, 2012. pg. 1
[20] "Current Employment Statistics (CES) Data," Louisiana Workforce Commission. 2012. pg. 1
[21] "Consolidated Federal Funds Report," U.S. Census Burea, 2012. pg. 1
[22] "Historical Consumer Price Information,." Seattle City Budget Office, 2012. pg. 1
[23] "Effective Federal Funds Rate," Federal Reserve Bank of St. Louis, 2012. pg. 1
[24] "Equity Index Data." EconStats, 2012. pg. 1

Graph 4 - Federal Outlays in Louisiana by Year and Total Employment (Jobs)

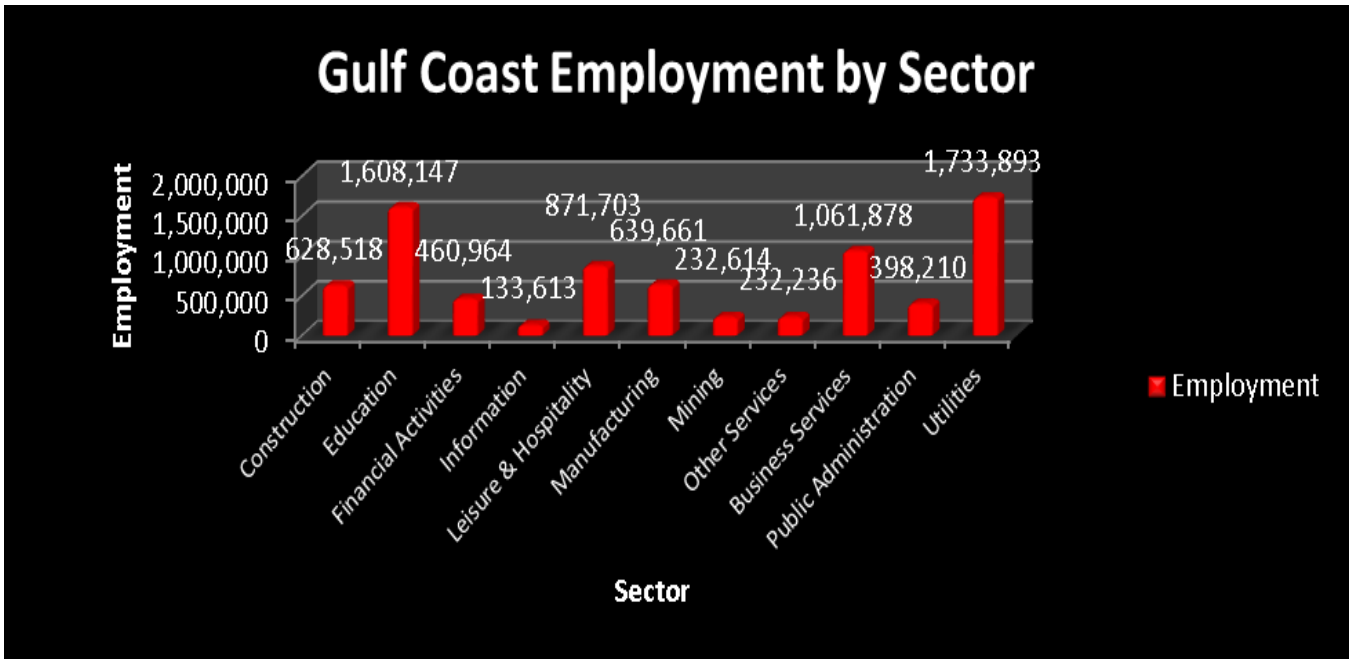


Gulf Region Employment by Sector

In the aggregate, the education/healthcare, leisure/hospitality, business services, and transportation/utilities sectors make up the largest share of employment in the Gulf Coast region. While these services account for a large portion of the total employment in the economy, construction and manufacturing positions are also prevalent, providing more than 600 thousand jobs each. The following graph displays total employment represented by each sector in the Gulf Coast economy. [25]

[25] "The Gulf of Mexico at a Glance: A Second Glance," National Oceanic and Atmospheric Administration, 2011. pg. 14.

Graph 5 - Employment Shares by Sector



Model

Modeling Methodology

The marginal impact of increased federal funding on regional employment was derived in two primary steps. Initially, time-series econometric models were designed and implemented to measure the correlation between various macroeconomic variables. More specifically, the analysis was used to measure how an incremental change in the level of federal funds appropriated to the region was correlated with levels of employment throughout the region. The models control for the influence of other variables expected to have an impact on employment, such as U.S. gross domestic product (GDP), the Dow Jones Industrial Average (DJIA), consumer prices (CPI), average wages, and the U.S. federal funds rate. Additionally, a variable to control for the effects of Katrina was implemented in early versions of the models, but it was eventually dropped due to its statistical insignificance. By controlling for the levels of these macroeconomic variables, the impact of federal funds on regional employment can be isolated and measured. The model was specified as follows:

$$\ln Y = \alpha + l.2\ln(\beta_1 X_1) + \ln(\beta_2 X_1) + \ln(\beta_3 X_3) + \ln(\beta_4 X_4) + \ln(\beta_5 X_5)$$

$$\ln(\text{Total Employment}) = \alpha + \beta 1 l.2\ln(\text{Fed. Outlays}) + \beta_2 \ln(\text{DJIA}) + \beta_3 \ln(\text{Int. Rates}) + \beta_4 \ln(\text{Wages}) + \beta_5 \ln(\text{GDP})$$

Secondly, the coefficients (elasticities) obtained from these models were applied to levels of the macroeconomic variables listed above to forecast employment. A control model was used, which implemented forecasted levels of federal outlays *without* the additional federal funds, to measure employment growth due to natural macroeconomic factors. After this was completed, a restoration model was estimated, which implemented forecasted levels of federal outlays with the addition of real restoration outlays added every year for fifty years. *The total employment difference between these two models every year is assumed to be the incremental jobs added due solely to restoration funding*.

The models implemented in this forecast incorporate assumptions on levels of macroeconomic variables in the future. The table below displays a summary of the macroeconomic assumptions made for the purpose of this project

Table 2 – Model Assumptions[26]

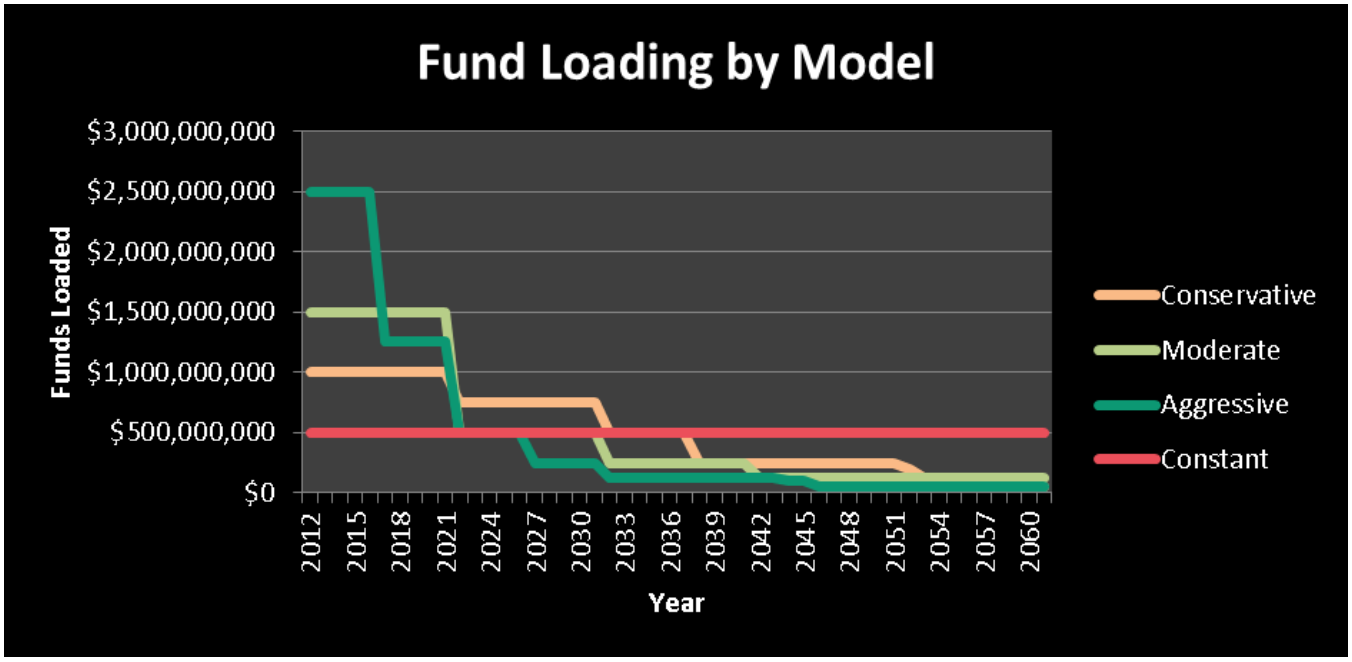
*Assumptions
2.5% annual growth in real fed outlays
2% annual growth in DJIA
2% annual growth in real US GDP
2% annual federal funds rate
1.5% annual inflation rate
$500M annual restoration funding
flat real wage growth

Since these macroeconomic indicators have an effect on the level of total employment, altering these assumptions has an effect on the total employment forecasted throughout the models. However, it is imperative to note that altering these macroeconomic assumptions *does not have a significant impact on the number of incremental jobs added between the control and restoration models*. That is to say, for example, if we assume that annual GDP growth will be 3 percent year-over-year rather than 2 percent, on average, this change may add 10,000 extra jobs to the regional economy over the course of 50 years. However, this change to the assumption would add 10,000 jobs to both the control and restoration models; thus, the incremental jobs added would remain largely unchanged.

Fund loading specifications are based upon various assumed levels of aggressiveness and are developed to represent different scenarios of logical funding timelines. Clearly, a fifty year time table allows for substantial flexibility in fund loading across years of the project. These four specifications are simply used to represent four separate scenarios that could reflect possible implementation strategies for the restoration funds. The graph below displays the fund loading schedules associated with the four model variations specified for this project. The more front-loaded restoration funds are allocated, the more aggressive the model is deemed to be. The goal with front-loaded funding is to diminish the negative effects of increasing price levels throughout the economy. As price levels rise year-over-year, the value of restoration funds are eroded, which implies weakened incremental employment effects. The more that restoration funds are allocated and spent earlier in the project, the smaller the effect of inflation on restoration funding.

[26] $500 million annual funding assumption associated with "Constant" model.

Graph 6 - Fund Loading by Model



Results

Incremental Employment

Our models indicate that the employment benefits associated with Gulf Coast wetlands restoration funding are positive and significant. The "Moderate" forecasting specification estimated for this project predicts a total of 77,453 incremental employment positions created over a period of 50 years in the Gulf Coast Region as a direct result of the proposed $25 billion in restoration funding. The table below displays a subset of elasticity measurements from the "Moderate" specification estimated.

Table 3 - Regression Coefficients

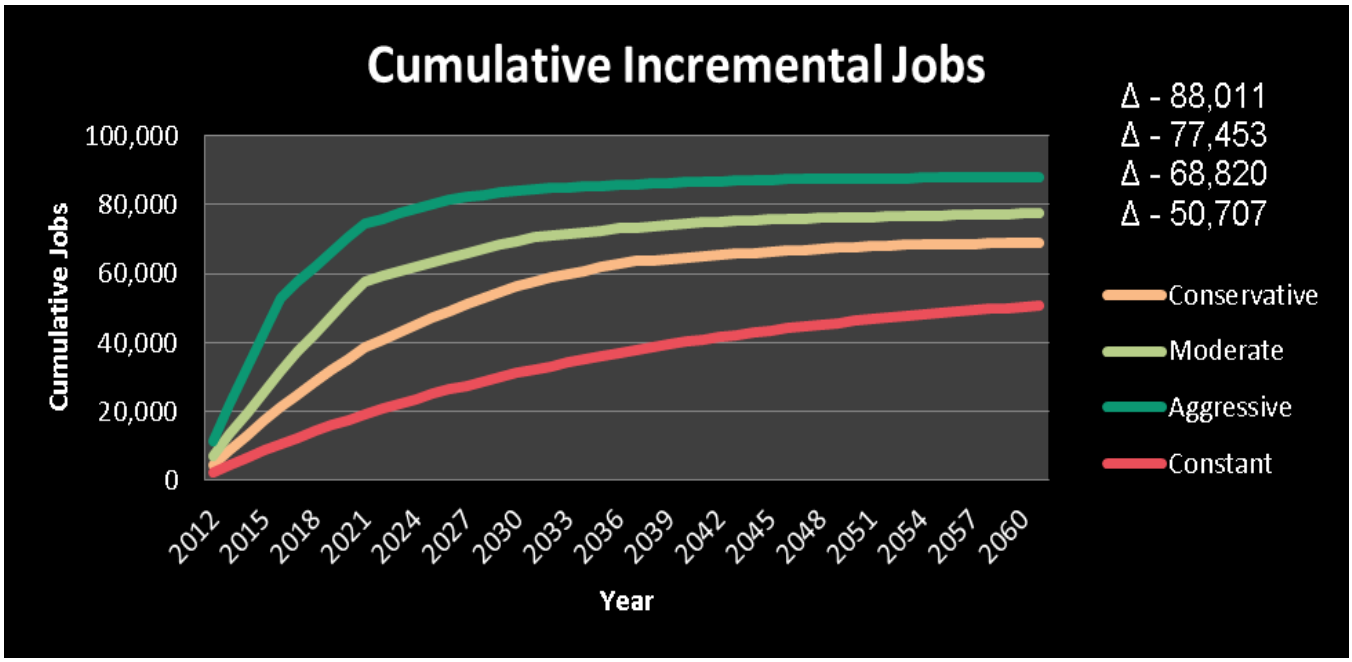
	Total Employment	Transportation	Manufacturing	Construction
Real Fed. Outlays	0.139**	0.137**	0.163**	0.216*
	(4.59)	(3.60)	(3.52)	(2.34)
DJIA	0.0744*	0.0674	0.149**	0.248*
	(2.94)	(2.12)	(3.84)	(3.21)
Inflation Rate	-0.0566*	-0.0664*	-0.0360	-0.0523
	(-2.99)	(-2.80)	(-1.24)	(-0.91)
Fed. Funds Rate	0.00688	0.0186*	0.0321**	0.0279
	(1.14)	(2.45)	(3.46)	(1.51)
Ave. Wage	-0.916**	-0.891*	-0.00982	0.359
	(-4.30)	(-3.34)	(-0.03)	(0.55)
Real U.S. GDP	0.171*	0.129	-0.547**	-0.217
	(2.38)	(1.43)	(-4.98)	(-0.99)

The table above displays the sensitivity of Gulf Coast employment to changes in levels of federal funds appropriated to the region, along with other macroeconomic variables. For example, as real federal outlays to region, which adjusts federal outlays for changes in the price of goods and services in the economy, increase by 1 percent, total state employment increases by 0.139 percent, on average, assuming all other variables remain constant.

We assume inflation erodes the value of restoration funds over time, so the marginal impact of the restoration funding is relatively larger earlier in the process rather than later in the process. Therefore, federal funding contributes more to real federal outlays—and therefore incremental jobs—the younger the program is.

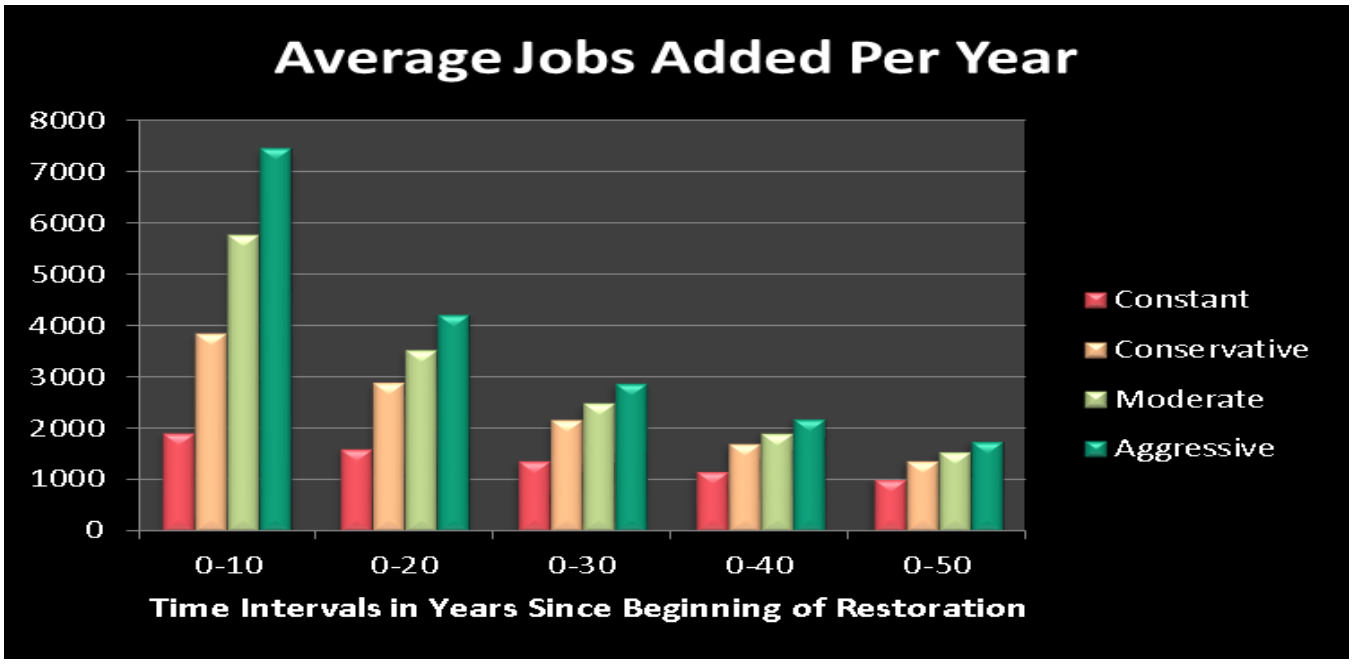
The graph below shows cumulative incremental employment for the four model variations specified. The slope of these lines is due to three primary factors. Firstly, restoration funding is front-loaded in the "Conservative," "Moderate," and "Aggressive" specifications. That is, larger amounts of funding are applied in the first stages (years) of the project versus later years in the project; thus, the slopes for these three models will be steeper in the early part of the project. Thus, the impact of funding on incremental jobs added will be amplified early in the process where funding is largest. Alternatively, the "Constant" specification applies a continuous funding load over the course of 50 years, which leads to a more consistent slope over time. Secondly, inflation erodes the nominal value of restoration funding as time passes. In other words, a billion dollars of restoration funding today is not the same as a billion dollars of restoration funding in 2060. The value of money diminishes as the price level throughout the economy increases over time. Our models take this inflation effect into account; thus, restoration funding has a relatively smaller effect the later in the process the funds are applied. Thirdly, the law of diminishing returns states that as more and more inputs are applied to a process, the marginal impact of those additional inputs diminishes over time. These three factors combined account for the flattening slope of the incremental jobs lines below.

Graph 7 - Cumulative Incremental Jobs



The graph below breaks down the cumulative jobs figure above into averages over several time intervals. As you can see, average incremental employment is larger earlier in the process due to inflation effects and fund loading allocations. Over the course of fifty years, we see overall average incremental employment effects per year of 1,014, 1,376, 1,549, and 1,760 for the "Constant," "Conservative," "Moderate," and "Aggressive" model specifications, respectively.

Graph 8 – Average Jobs Added Per year

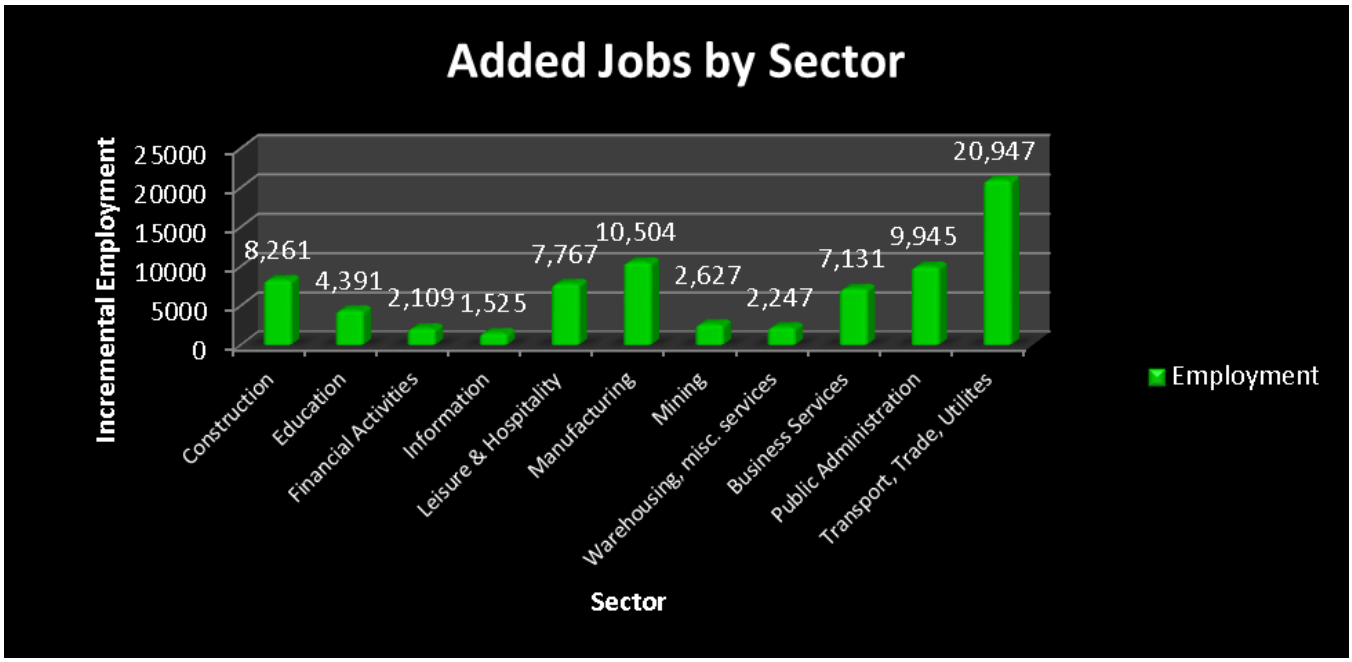


Incremental Jobs by Sector

The breakdown of incremental jobs by sector reveals job growth across all sectors of the Gulf Coast economy. Our model suggests that additional restoration funding promotes the strongest employment growth across the transportation/utilities, government, leisure/hospitality, business services, construction, retail trade, and manufacturing sectors. These finding suggest that while restoration funding has a substantial impact on positions in sectors directly related to restoration projects (transportation, construction, manufacturing, etc.), significant job growth is also created in sectors indirectly related to restoration projects. This promotes the idea that directly created jobs generate demand for goods and services, which promote the creation of secondary or "indirect" employment throughout the regional economy. The graph below displays forecasted total jobs added by sector after 50 years of restoration funding.[27]

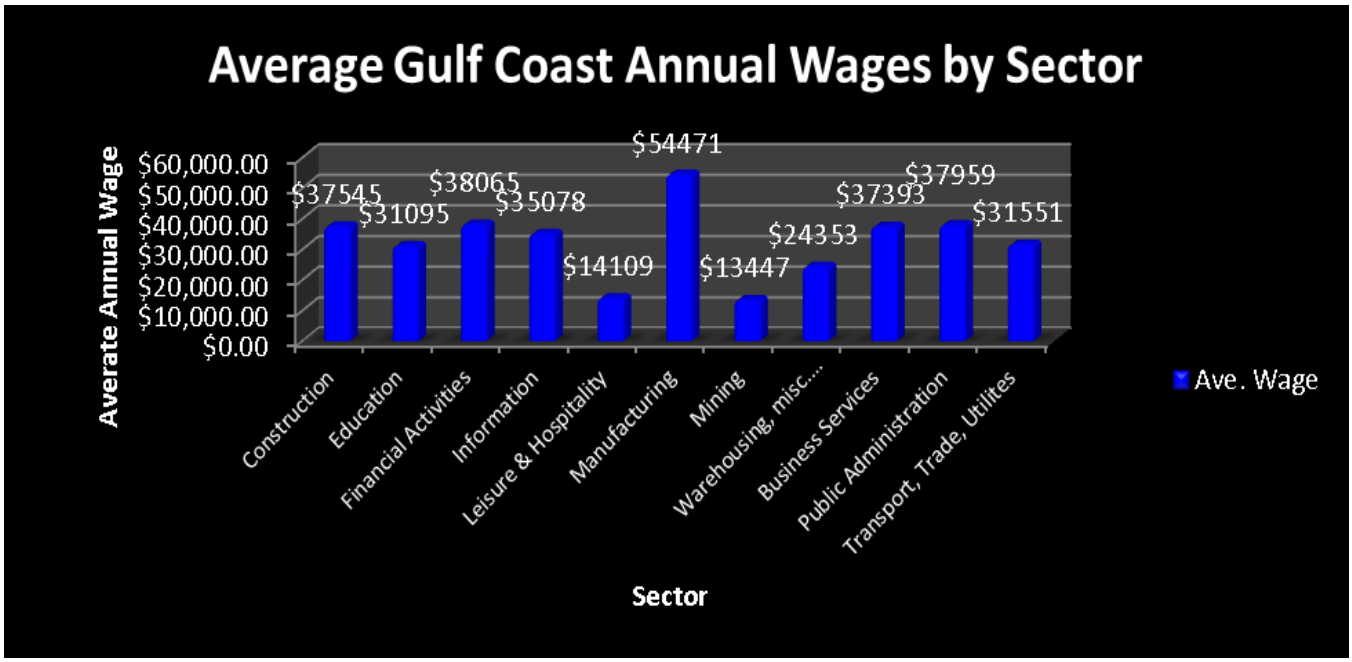
[27] Manufacturing sector includes durable and non-durable goods.

Graph 9 - Total Jobs Added by Sector, Moderate Model



The following graph displays average annual wage information by sector within the Gulf Coast Region as of 2008. Employment created by restoration funding will generate jobs with a wide range of wages, providing balance to the economy through primary and secondary employment effects.[28]

Graph 10 – Average Wages by Sector

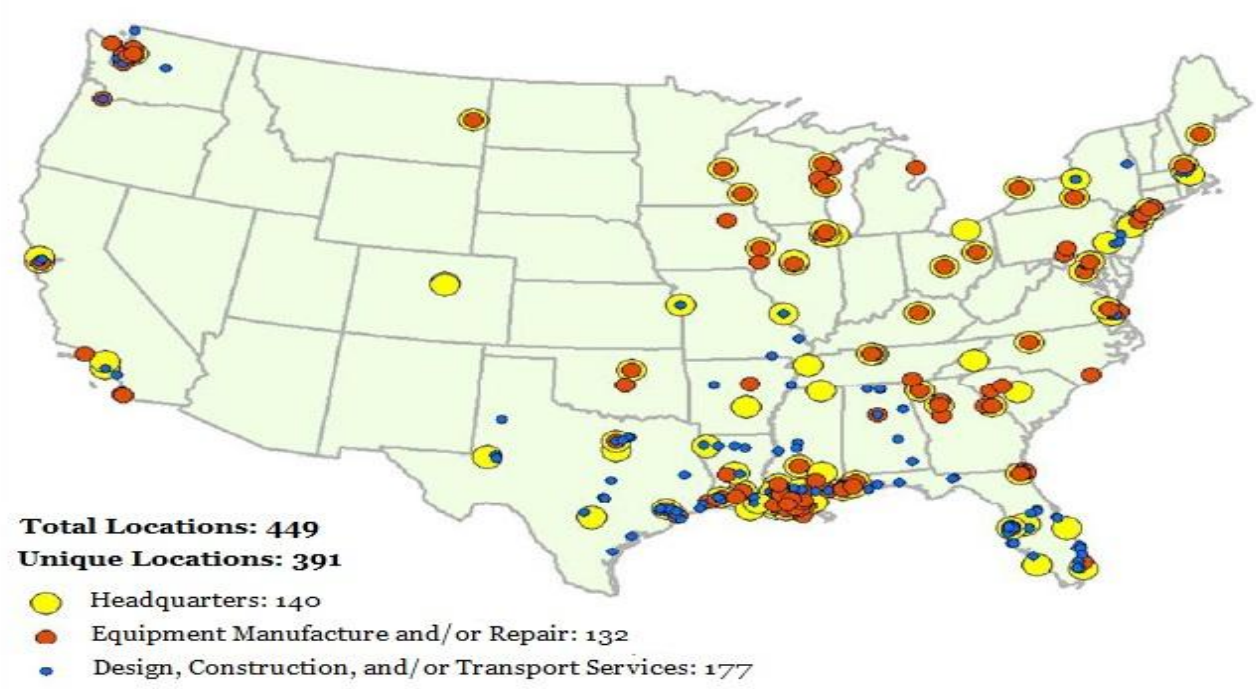


[28] "The Gulf of Mexico at a Glance: A Second Glance," National Oceanic and Atmospheric Administration, 2011. pg. 14.

Ancillary Benefits of Restoration Funding

The scope of this study is specific in the sense that only regional employment effects are being forecasted and measured. It is important to note that various other ancillary economic benefits can be realized through the funding outlined in this project. As an example, the graph below is the result of a Duke University study in 2011, which shows the geographical distribution of companies participating in dredging, machinery manufacturing, site design, and other industries related to restoration efforts in the Gulf Coast region.[29]

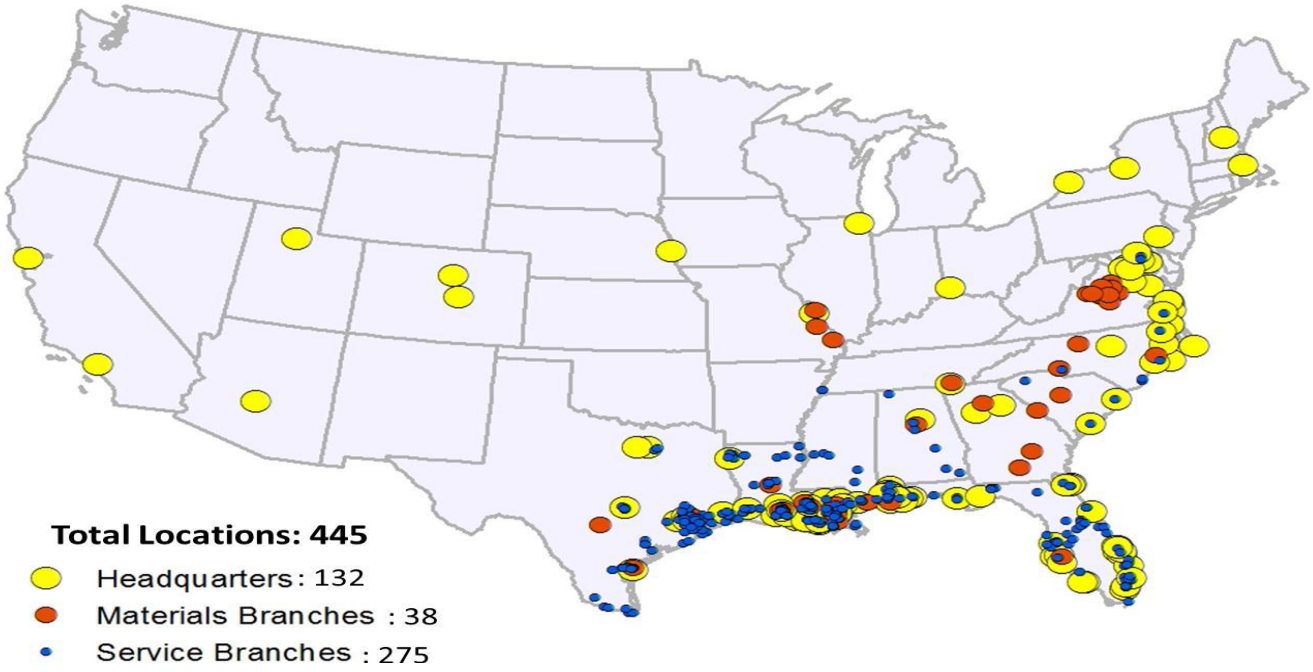
Graph 11 - Restoration Supply Chain Employment



Clearly, Gulf Coast restoration funding has a significant impact on production and employment, not only in the Gulf Coast, but also nationwide. Additionally, looking at oyster reef restoration alone, hundreds of firms around the country are associated with this particular type of Gulf Coast restoration. The graph below displays the location of firms around the country that are associated with Gulf Coast oyster reef restoration.[30]

[29] Gary Gereffi, Marcy Lowe, and Sawn Stokes, "Restoring the Gulf Coast." Duke University, Center for Globalization, Governance, and Competitiveness, 5 December, 2011. pg. 30.
[30] Gary Gereffi, Marcy Lowe, Sawn Stokes, and Susan Wunderink, "Restoring Gulf Oyster Reefs." Duke University, Center for Globalization, Governance, and Competitiveness, forthcoming. pg. 37.

Graph 12 – Location of Firms associated with Gulf Coast Oyster Reef Restoration



As can be seen in the graphics above, Gulf Coast restoration projects have an effect on firms nationwide, and the proposed restoration funding that is the focus of this paper could have positive and significant output and employment effects for these firms, which could further contribute to ancillary employment effects around the country.

Restoration funds flow through the economy creating both direct and indirect employment. Investment in the region will create direct employment through the immediate utilization of manpower and capital needed to perform the restoration projects, and the spending and investment resulting from these direct effects will create demand for ancillary goods and services throughout the economy. Thus, the funds allocated for Gulf Coast restoration projects will have a widespread and positive impact on state, regional, and national output and employment.

Conclusions

The employment forecast presented in this paper is to be utilized as a tool for judging the efficacy of federal funding on the non-environmental impacts of Gulf Coast restoration projects. We have seen that the large influx of federal funds into the region can have substantial employment effects throughout the region. Our analysis indicates that over the duration of 50 years (proposed project timeline), the Gulf Coast Region will add a total of 77,453 jobs throughout the economy, which is an average of 1,549 incremental jobs added per year due solely to restoration funding.[31] As discussed, due to the long time frame of this project, even a low and steady rate of annualized inflation erodes the real value of the annual restoration funding over time; thus, the incremental employment effects forecasted in this model are larger earlier in the project timeline.

Our employment estimates are slightly more conservative than some previous studies relating restoration funding and employment. This effect could be due to a variety of influences, including the fact that the analysis presented in this paper projects over a significantly larger time frame. Previous studies have focused on the employment effects over only a one year time period, and the inflation impact presented above, along with the influence of diminishing marginal returns, may contribute to the more conservative job estimate. With that said, however, our forecast still projects a substantial increase in employment due to restoration funding in the Gulf Coast.

[31] Assumes "Moderate" model specification

Appendix

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Supporting Documents

Table 4 - Fund Loading by Model

	Fund Loading			
	Conservative	**Moderate**	**Aggressive**	**Constant**
2012	$1,000,000,000	$1,500,000,000	$2,500,000,000	$500,000,000
2013	$1,000,000,000	$1,500,000,000	$2,500,000,000	$500,000,000
2014	$1,000,000,000	$1,500,000,000	$2,500,000,000	$500,000,000
2015	$1,000,000,000	$1,500,000,000	$2,500,000,000	$500,000,000
2016	$1,000,000,000	$1,500,000,000	$2,500,000,000	$500,000,000
2017	$1,000,000,000	$1,500,000,000	$1,250,000,000	$500,000,000
2018	$1,000,000,000	$1,500,000,000	$1,250,000,000	$500,000,000
2019	$1,000,000,000	$1,500,000,000	$1,250,000,000	$500,000,000
2020	$1,000,000,000	$1,500,000,000	$1,250,000,000	$500,000,000
2021	$1,000,000,000	$1,500,000,000	$1,250,000,000	$500,000,000
2022	$750,000,000	$500,000,000	$500,000,000	$500,000,000
2023	$750,000,000	$500,000,000	$500,000,000	$500,000,000
2024	$750,000,000	$500,000,000	$500,000,000	$500,000,000
2025	$750,000,000	$500,000,000	$500,000,000	$500,000,000
2026	$750,000,000	$500,000,000	$500,000,000	$500,000,000
2027	$750,000,000	$500,000,000	$250,000,000	$500,000,000
2028	$750,000,000	$500,000,000	$250,000,000	$500,000,000
2029	$750,000,000	$500,000,000	$250,000,000	$500,000,000
2030	$750,000,000	$500,000,000	$250,000,000	$500,000,000
2031	$750,000,000	$500,000,000	$250,000,000	$500,000,000
2032	$500,000,000	$250,000,000	$125,000,000	$500,000,000
2033	$500,000,000	$250,000,000	$125,000,000	$500,000,000
2034	$500,000,000	$250,000,000	$125,000,000	$500,000,000
2035	$500,000,000	$250,000,000	$125,000,000	$500,000,000
2036	$500,000,000	$250,000,000	$125,000,000	$500,000,000
2037	$500,000,000	$250,000,000	$125,000,000	$500,000,000
2038	$250,000,000	$250,000,000	$125,000,000	$500,000,000
2039	$250,000,000	$250,000,000	$125,000,000	$500,000,000
2040	$250,000,000	$250,000,000	$125,000,000	$500,000,000
2041	$250,000,000	$250,000,000	$125,000,000	$500,000,000
2042	$250,000,000	$125,000,000	$125,000,000	$500,000,000
2043	$250,000,000	$125,000,000	$125,000,000	$500,000,000
2044	$250,000,000	$125,000,000	$125,000,000	$500,000,000
2045	$250,000,000	$125,000,000	$75,000,000	$500,000,000
2046	$250,000,000	$125,000,000	$50,000,000	$500,000,000
2047	$250,000,000	$125,000,000	$50,000,000	$500,000,000
2048	$250,000,000	$125,000,000	$50,000,000	$500,000,000

2049	$250,000,000	$125,000,000	$50,000,000	$500,000,000
2050	$250,000,000	$125,000,000	$50,000,000	$500,000,000
2051	$250,000,000	$125,000,000	$50,000,000	$500,000,000
2052	$250,000,000	$125,000,000	$50,000,000	$500,000,000
2053	$125,000,000	$125,000,000	$50,000,000	$500,000,000
2054	$125,000,000	$125,000,000	$50,000,000	$500,000,000
2055	$125,000,000	$125,000,000	$50,000,000	$500,000,000
2056	$125,000,000	$125,000,000	$50,000,000	$500,000,000
2057	$50,000,000	$125,000,000	$50,000,000	$500,000,000
2058	$50,000,000	$125,000,000	$50,000,000	$500,000,000
2059	$50,000,000	$125,000,000	$50,000,000	$500,000,000
2060	$50,000,000	$125,000,000	$50,000,000	$500,000,000
2061	$50,000,000	$125,000,000	$50,000,000	$500,000,000