New York State Economics Association

Proceedings Of the New York State Economics Association

Volume 9

69th Annual Meeting
Farmingdale State College,
Farmingdale, New York
October 8-9, 2016

Editor: Richard Vogel

New York State Economics Association

Founded 1948

2015-2016

Published June 2017.

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The Economic Impacts of Recreational Fishing in Long Island: A Computable General Equilibrium Analysis[1]

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ABSTRACT

Recreational fishing, is an important component in Long Island's coastal economic development, and annually contributes over $0.4 billion in direct impacts to Long Island's economy. The pass-through effects linked with multi-sectors have pushed regional growth in most offshore communities. Using a computable general equilibrium (CGE) model, this study focuses on Long Island's coastal recreational fishing on both county and community levels. Three general scenarios are evaluated including; 1) a 10 percent increase in recreational fishing trips; 2) a 40 percent decrease in marine fuel prices; and 3) both shocks simultaneously. The results of the analysis show a significant positive impact on endogenous output, employment, factor income, tax, and household income as result of increasing trip demand for trips and lower factor prices. Specifically, more fishing trips lead to significant impacts on directly related sector with only moderate pass-through impacts on the regional economy. The effects of lower fuel prices tend to be relatively large in percentage terms for non-recreational fishing sectors compared with recreational fishing-related sectors. The findings also suggest that presence of geographical heteroscedasticity across the communities in the region.

INTRODUCTION

Recreational fishing is a popular leisure activity on Long Island and has become increasingly important in the past decades for many marine species (Morales-Nin, 2005; Coleman et al. 2004; (Bell 1997; McConnell, Strand, and Blake-Hedges 1995). The high value of the recreation is commonly recognized in the coastal communities, and does bring a significant number of visitors and consequently high levels of fishing and economic efforts. In some species, e.g. striped bass, porgy, efforts may be greater than those in the commercial fishing (Cowx 2002; Pitcher and Hollingworth 2002).The associated direct, indirect, and induced impacts on output, employment, and tax revenues generated from recreational fishing on Long Island are greater than those of by the commercial sectors (Pawson, et al. 2008; Cooke and Cowx 2004).

However, research on the economic, social, and ecological impacts of recreational or sports fishing has largely lagged behind similar studies on commercial fisheries (Pitcher and Hollingworth 2002). Lacking sufficient evidence to support the possible impact of recreational fishing, federal laws and agencies focused primarily on the commercial fisheries but not on recreational fishing. Possible strategies such as whether increased importance and investment in the recreational sector, and the balance between the recreational and commercial sectors remains unclear (Ihde et al. 2011; Lewin et al. 2006). The current federal system to control commercial fisheries exploitation might be inappropriate for managing recreational fishing (Commission on Saltwater Recreational Fisheries, 2014). In

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practice, the recreational fishing communities, as agencies, play significant roles to lead building and maintaining the recreational fishing in a healthy system.

Most of existing studies in evaluating the regional economic impacts of fisheries usually input-output (IO) model, assume price is fixed (Seung and Waters 2009). The advantage of this model is its can easy to estimate the economic contributions in related industries and impacts from exogenous shocks and they can be directly examined in the given economy (Miller and Blair 2009). However, a critical limitation of this model is its inability to consider the possible substitution effects in the factor market and household consumption. Another major restriction of the IO model is its lack of constraints on the supply side, such as in the labor market, and government funding (Eiswerth et al. 2005; Cicas et al. 2007; Miller and Blair 2009).

In this study, we apply a regional computable general equilibrium (CGE) model to investigate the community level effects of shocks on Long Island. This model is based on general equilibrium assumption, and determined relative prices endogenously, thereby accommodating substitution in production and consumption (Stenberg and Siriwardana 2009). Moreover, microeconomic theories and constraints in both demand and supply sides are respected in different markets. In practice, regional CGE models have been slower to develop because of a shortage of the necessary data at the local level (McGregor et al. 2010; Pouliakas et al. 2014; Andre et al. 2012). As more collected dataset are available in regions, such as the data of social accounting matrix (SAM) from IMPLAN, or some Input-Output (IO) matrix generated from community level data, CGE modeling has been more widely used at the regional level (Wu and Xiao 2014; Stenberg and Siriwardana 2009; Dyck and Sumaila 2010).

Comparatively few studies using the CGE framework have been applied to fisheries. Houston et al. (1997) use a static CGE model to estimate the regional economic impacts associated with different policies for reducing groundfish harvest in coastal Oregon. Similarly, Floros, et al. (2003) develop a standard CGE model for Italian fisheries. Waters and Seung (2010) evaluate the effects of supply-side and demand-side shocks for Alaska fisheries by applying a CGE model. Dyck and Sumaila (2010) use this model in a global fishery, which detects the economic impact of ocean fish populations. Very few studies use CGE modeling specifically focused on recreational fishing. Instead, recreational/sports fishing is usually estimated as a part of recreation activities, tourism, or marine ecosystem. For example, Finnoff and Tschirhart (2008) generate a CGE model to evaluate the marine ecosystem by integrating the dynamic economic and ecological system in a general equilibrium model. Both commercial fishing and recreational fishing sectors are treated as import sectors of ecosystem estimating in the model.

In this study, by applying a regional computable general equilibrium (CGE) model, we analyze three general scenarios including 1) a 10% increasing recreational fishing trips, 2) 40% decreasing in marine fuel prices. 3) Both shocks simultaneously. The hypothesis of an increase in recreational fishing trips is based on recent trends in the region. The second scenario reflects fuel and energy market prices since 2014. The marine fuel price change would be expected to have significant impacts on Long Island's recreational fishing since boat fishing (owner, rental or charter boat) is prevalent in this area. The primary SAM data are generated from IMPLAN (2014 data) and disaggregated sectors related to recreational fishing, such as food and beverage stores, general and consumer goods rental, and reservation services. This can effectively avoid the overestimation in the IO model (Leung and Pooley 2001).

RECREATIONAL FISHING IN LONG ISLAND

Recreational fishing on Long Island has been thriving since 1998, and the proportion of recreational and sports fishing increased continuously over the last two decades. Recreational fishing generated $316 million dollars in expenditures in Long Island as a whole in 2012 (NMSF 2014) and led to economic impacts estimated at $381 million in total output, close to $242 million in value added, $151 million in income, and total employment of 2,959 people. It peaked in 2007 when recreational fishing in the state contributed up to 1 billion in outputs, almost 6,000 people employed, and $0.5 billion of value added.

Table 1. Economic Impacts of Recreational Fishing Expenditures (millions of dollars), New York, 2012

	2006	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
Employment Impacts (1,000)	5.37	6.49	5.77	4.57	4.46	3.09	2.96
Output Impacts	812.27	979.19	875.45	680.46	667.85	398.88	381.30
Value Added Impacts	424.07	511.31	457.20	358.11	350.16	254.73	241.95
Income Impacts				231.73	227.22	160.03	151.10

Note: Output impacts reflect total dollar sales generated from marine recreational fishing expenditures. Value-added impacts represents the contribution marine recreational fishing makes to gross domestic product. Income impacts represent wages, salaries, benefits, and proprietary income generated from marine recreational fishing. Date source: NOAA Interactive Fisheries Economic Impacts. https://www.st.nmfs.noaa.gov/apex/f?p=160:7:0::NO

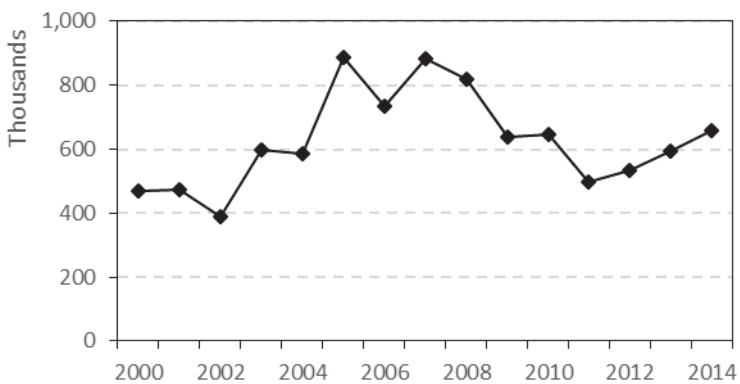

Figure 1 Estimated Coastal Recreational Fishing Trips, Long Island, 2000-2014

Average annually coastal recreational fishing participation by anglers in the Long Island has exceeded over 600,000 trips in recent years. While activity fell between 2008 and 2010, it recovered in 2011 and by 2014 reached it 2004 level. Average trip expenditures by residents on for-hire fishing trips were estimated as $157.83, $59 on private boat trips, and $19.91 for shore trips, compared with $116.37, $38.83, and $44.68 for Non-resident respectively. Total angler expenditures on recreational fishing in Long Island were estimated at $330.3 million in 2011. Trip expenditures were $205.9 million and expenditures on durable goods were $124.4 million. Recreational fishing also generated $78 million tax revenue, including 40.4 in local tax and 37.4 in federal tax. 70% of the total come from business and households.

Table 2. Economic Impacts of Recreational Fishing Expenditures (millions of dollars), Long Island, 2011

TRIP IMPACTS BY FISHING MODE:	EXPENDITURES
FOR-HIRE	66.3
PRIVATE BOAT	115.7
SHORE	23.9
TOTAL DURABLE EQUIPMENT	124.4
TOTAL STATE TRIP AND DURABLE EQUIPMENT	330.3

Specifically, trip-related expenditures can be divided as tackle, fuel, food & drink, lodge, boat and boat rent, and related recreation activities. Boat (purchase and repair) and boat rent are the largest expenditure on recreational fishing, which accounts for over 30% of spending. Spending on recreation activities (e.g. Charter fees, crew tips and parking fees) is taken over 20% of expenditures. The proportion of spending in Lodge is less than 1% indicating a limited number of overnight trips. Geographically, Montauk and Port Jefferson are the two largest recreational fishing locations in our selected communities which attracted over 50 thousand fishing trips, and related spending is over 2.5 million dollars.

Table 3. Estimate Total Spending and Trips on Recreational Fishing (Thousand dollars) in Selected Communities, Long Island, 2014

	Mastic Beach	Long Beach-Jones beach	Mattituck	Montauk	Port Jefferson	Long Island
Tackle	212	115	93.4	536.6	555.3	67,900
Gas	116.8	63.4	51.4	295.6	306	37,413
Food & Drink	112.7	61.2	49.7	285.3	295.3	36,105
Lodge	1.4	0.8	0.6	3.6	3.7	456
Boat	326.3	177.1	143.7	825.9	854.7	104,518
Recreation	176.2	95.6	77.6	445.9	461.4	56,424
Total Trips	20,496	11,126	9,030	51,891	53,697	656,649

MODELS

Model specification

The model structure follows closely regional thee CGE model developed by Washington State University (Waters, et al. 1997; Julia-Wise et al. 2002). The model is based on classical economic theory. Particular specifications for this model follow IFPRI's standard computable general equilibrium equations (Lofgren, Harris, and Robinson 2002) (Figure 2). We assume all economic agents including consumers, producers, and institutions, are optimizing their behavior in the economy and traces the impact of shocks through effects on output, prices, sales, employment, income, revenues. The model simulates economic impacts in which quantities and prices adjust and feedback to clear both product and factor markets in response to shocks.

Producers are assumed to maximize profits by optimally allocating the output between the Long Island market and exports (including the rest of the U.S (RUS) and the rest of the world (ROW) using a constant elasticity of transformation (CET) aggregation function. The production function is specified in two-level nested structure. At the top level, a composite of value added and a composite of intermediate inputs are substituted in a Leontief function. At the bottom level, primary factors (Labor, Capital, and other inputs) are assumed to substitute through a Leontief-CES composite value added function under (Winchester et al., 2006). Intermediate is determined by fixed-shares through Leontief function at top level. The Leontief production function ensures "weak separability" between primary factors (labor and capital) and intermediate factors (Holland et al. 2006). The factors demand functions are derived from the first-order conditions of profit maximization taking into account the value-added or prices.

The domestic supply is derived from an Armington CES function, which is used to distribute locally produced goods and imported goods for both firms and households. This model allows for imperfect substitution between state produced goods and goods from import market. Local goods (produced in the Long Island) and imported goods are allowed for substitution firstly, then domestic imports (RUS) and foreign imports (ROW) are allowed to substitute each other. The export supply function is derived as a constant elasticity of transformation (CET) function. The value of exports is specified as a function of the ratio of local level and international export prices (Holland et al. 2006). The regional export is a function of the price of exports to rest of the U.S. and foreign sources. The price of a foreign produced commodity is a function of the world price and the foreign exchange rate. We also assume the foreign exchange rates are fixed.

Factors supply commonly referred to factor market in this model. The capital of factors of production is typically assumed to be fixed within a given period, while labor is assumed mobile across sectors. Firms could move their capital from one industry to another in response to different rental rates in the economy (Alavalapati et al. 1998). Unemployment is possible, and labor supply is assumed perfectly elastic. The rental rates for capital inputs are endogenously determined. Input factor supplies are considered exogenously in the model. Equilibrium in these markets requires factor prices to adjust to ensure that demand equals supply. However, due to imperfect labor markets, there is unemployment; therefore, market clearing for labor is relaxed to allow for unemployment in labor supply. Aggregate demand for each commodity comprises household consumption spending (consumption, investment and intermediate) on domestic and imported goods. Equilibrium in the commodities market requires that demand for commodities equal supply.

Final demand (households, government, and investment) and intermediate demand are composited by mixed commodities from both local-produced and imported. The optimal locally produced commodities and imported commodities are derived using a constant elasticity of substitution (CES) aggregation function (Armington function) to form a composite commodity. Intermediate demand is derived from the Leontief function at the top level of production.

Households are disaggregated into nine categories following IMPLAN and are assumed to maximize utility subject to a budget constraint. Household demand is derived using a linear expenditure function (Stone-Geary utility function) (Stone 1954; Zhang et al. 2005). Income is generated as a result of households supplying factors of production, import tariff revenues transferred to them by their domestic governments, and transfers of other property and labor income from outside of the local economy (Decaluwe, et al, 2010). Household disposable income is computed net of household residential property taxes and federal income taxes. Household savings are modeled as a constant proportion of household disposable incomes (after-tax income). Total saving is the sum of household savings and foreign savings.

The government account was divided into two accounts: federal, and state and local combined. We treat the State, and local government expenditures as endogenous and driven by state and local tax revenues. Expenditures are a function of the total state and local tax revenue plus intergovernmental transfers. State and local tax revenues are generated from the payroll tax, household direct taxes (residential property taxes), and indirect business taxes (business and occupation tax, sales tax, and business property tax).

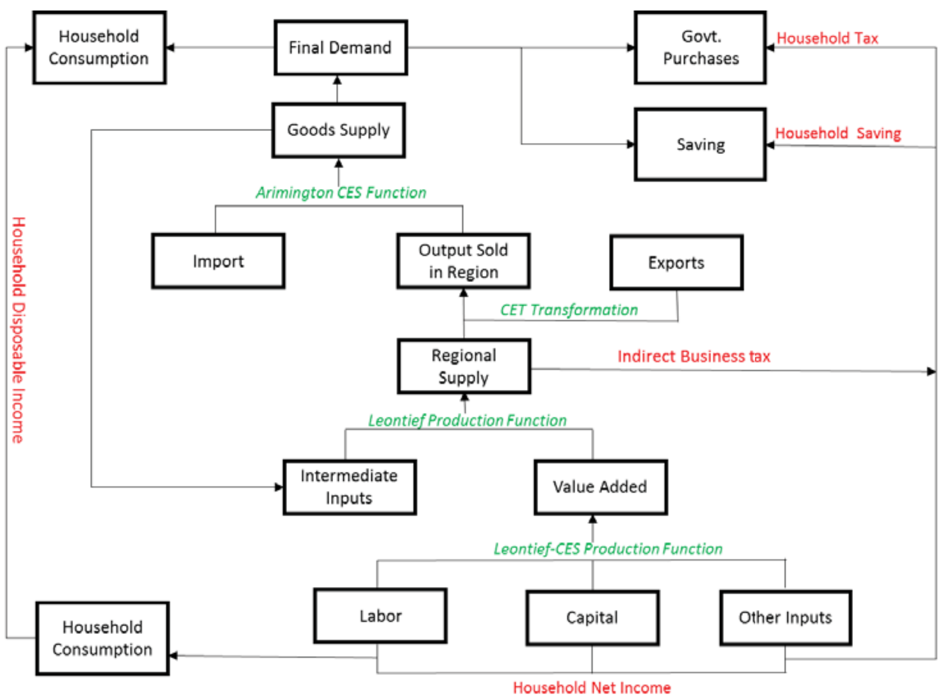

Figure 2. The Structure of Long Island CGE Model

The Prices block is defined as relative to the prices of all factors, goods, and services, including import price, export price, demand price, activity price, and input price. To make them comparable, all the prices are treated as endogenous "weights" that help to solve the conditions of commodity and factor market balance with representing the relative valuations in each industry and market (Waters and Seung 2010).

In this CGE model, different institutions are assumed to operate in various ways and will depend on how the linkages of the macroeconomic system are specified which will impact the "model closure" (Julia-Wise, et al. 2002). Given the situation of the local economy operates in the study area, a Keynesian type of closure best represented Long Island's economy in this study. The Keynesian closure assumes that labor supply was mobile across sectors while capital was assumed fixed in the region but mobile between sectors. Factor prices are institutionally fixed, thus the labor market clears adjusting the level of employment in the region. Investment is fixed and exogenous, and the model balances saving-investment accounts through endogenous saving flows. The regional supply of labor is assumed to be perfectly elastic, but it might vary in the long run. The local supply of capital is considered to be perfectly inelastic in the short term.

Model calibration

The model was calibrated to Long Island in both County level and community level (Zip code level) using 2014 symmetric Social Accounting Matrix (SAM) tables produced by IMPLAN. 536 IMPLAN industry sectors were aggregated into 15 production sectors. Because of the limitations and inaccuracies associated with using unrevised IMPLAN data for the recreational fishing, we also collect some data from U.S. Fishing Angler Expenditures Survey, 2011 and NOAA's Marine Recreational Information Program (MRIP). Angler Expenditures Survey is a nationwide expenditure survey of marine anglers every five years conducted by NOAA Fisheries; Survey results are used to assess the spending of marine recreational fishing, as well as how marine recreational fishing contributes to the economies of coastal communities and the nation's economy. MRIP is a program conducted by NOAA and reports marine recreational catch and effort through survey and report system. We use those datasets to isolate the economic impacts of recreational fishing from the IMPLAN's sectors.

The Long Island SAM used for the CGE model disaggregate the Long Island's economy into nine general sectors, including Agriculture, Construction, Utilities, Wholesale and Retail Trade, Mining and Quarrying, Processed Food, Manufacturing, Services, and Miscellaneous. Sectors related to the recreational fishing are isolated into six industries as Tackle and Supplies, Retail Food and Beverage Stores, Boat and Boat Rent, Lodge, Recreation Amusement, and Transportation. Overall, the Long Island SAM include a total of 15 aggregated production sectors producing 15 commodities; 3 value-added sectors (labor, capital, and indirect business taxes); 2 government sectors (combined state and local government and federal government); 9 household categories (classified by income level); a savings-investment account; and two accounts for imports and exports to the RUS and ROW.

Some specific parameter values for the model equations needed to be calibrated in the CGE model. Parameters, such as elasticities of substitution (e.g. elasticity of substitution for production, elasticity of substitution between row imports and RUS imports, etc.), transformation (e.g. elasticity of transformation between ROW and RUS for exports etc.), and some demand elasticities (e.g. demand elasticity for capital and labor) are specified based on previous research (Bilgic et al. 2002). Other parameters, such as share parameters (e.g. Armington composite shares) and shift parameters (e.g. CET composite transformation parameter) are determined by solving the given equations by substituting the value of SAM with the base-year data and the exogenous parameters.

SIMULATIONS AND RESULTS

Simulations

We use the CGE model to run three simulations in this study. The first scenario estimates the impact from an increase in the demand for recreational fishing. The reason we select this situation is because we find the recreational fishing in the Long Island has recovered since 2010, and it still has the potential to reach peaks last seen between 2005 and 2008 from efficient marketing and favorable policies and related facilities investment. Thus, we estimate the impact from a 10% increasing recreational fishing trips. Direct impacts are assumed to raise the consumption in related sectors as Table 3.

The second scenario is evaluates the impacts of a steep decrease in fuel prices, which simulates the situation that has occurred since 2014 in which the average marine fuel price fell by 40%. We assume the fuel prices might significantly affect Long Island's recreational fishing industries since fuel is a significant cost factor for the boating community including recreational fishing vessels (head boat or Charter boat). We assumed a 40% reduction in the exogenous fuel price for the marine boat in this case.

The third scenario evaluates the combined impacts of both scenarios simultaneously. Expected results are that output, employment, and tax will show significant growth in the related sectors, corresponding to lower prices.

We use the latest version of GAMS (General Algebraic Modeling System) to solve the CGE model. This solution algorithm can solve both linear and nonlinear programming problems. A solver called the mixed complementarity problem (MCP) is employed to deal with the system model. The model is calibrated using 2014 as the benchmark year. An aggregated model including both Nassau and Suffolk Counties (Long Island) is estimated first. And then we will calculate the impacts of the scenarios for five coastal communities (Figure 2), including Mastic Beach (11967; 11951), Long Beach-Jones Beach (11561; 1558; 11572; 11510), Mattituck (11952), Montauk (11954), and Port Jefferson (11777; 11766).

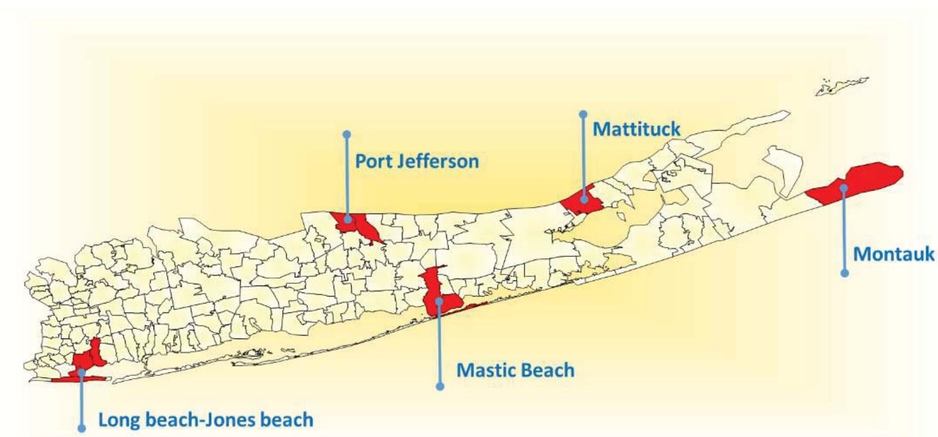

Figure 3. Distribution of Study Aare in The Long Island

Simulation Results

Simulation results from three scenarios in the whole Long Island are presented from Table 4 to Table 7. The impacts from the simulations are reported as a change from the 2014 baseline values for commodity price, industry output, employment, household income, and government's revenue, and GDP. Table 4 indicated the change from baseline values of commodities price under the three scenarios in Long Island. The commodity prices represent the changes in relative valuations of goods and services at the new equilibrium compared with the baseline (Gavazza, et al. 2014).The initial values of all prices are assumed to be 1 in the baseline of equilibrium. Commodities' price increased slightly as more fishing trips for most of the recreational fishing related sectors, while those impacts are tiny in the nine general sectors (less than 0.01%). Prices in the sector of the boat and boat rent are relatively sensitive to the increasing demand, which increased by 1.21%. Lower fuel price obviously is favorable to most sectors. Composite prices of goods and services in the sectors of transportation, construction, and mining and quarrying are significantly reduced by 4.3%, 1.5%, and 1.3%. It is surprising that the price of the boat and boat rent fell only 0.13%, which implies that the expenditure share of fuel might be not very high for the fishing boat related sector and the substitution rate for other commodities is small. Results from combined scenarios are moderated by adding up the positive impact from increased demand and negative impacts from the reduction of fuel price. Recreational fishing related sectors are more affected in trips growth, while changed in the fuel price have wide influences on the general sectors.

Table 4. Change from Baseline Values of Commodities Price under Scenarios in Long Island, 2014

Sectors	Increase Trips	Decrease Fuel Price	Combined
Tackle and Supplies	0.89%	-0.06%	0.82%
Retail Food and Beverage Stores	0.19%	-0.14%	0.05%
Lodge	0.00%	-0.01%	-0.01%
Boat and Boat Rent	1.21%	-0.30%	0.46%
Recreation Amusement	0.36%	-0.13%	0.22%
Transportation	0.00%	-4.26%	-4.26%
Agriculture	0.00%	-0.05%	-0.05%
Construction	0.01%	-1.52%	-1.51%
Utilities	0.01%	-0.12%	-0.11%
Wholesale and Retail Trade	0.00%	-0.05%	-0.05%
Mining and Quarrying	0.00%	-1.31%	-1.30%
Processed Food	0.00%	-0.02%	-0.02%
Manufacturing	0.00%	-0.02%	-0.02%
Services	0.01%	-0.05%	-0.04%
Miscellaneous	0.00%	-0.06%	-0.06%

Table 5 listed the change from baseline values of output under the three scenarios in Long Island. As the number of fishing trips increased, significant impacts resulted in tackle and supplies, boat and boat rent and recreation amusement, of 8.6%, 5.8%, and 4.1% respectively. The impacts are more significant in the sectors of transportation (+31%), Mining and Quarrying (+6.9%), and Boat and Boat Rent (+3%) due to the 40% of the reduction in fuel price. We can imply that the demands are relatively elastic in those three sectors. Revenues in those sectors expand as a result of favorable prices. The impacts of a reduction in fuel price bring a small change in the value of the output of industries in Tackle and Supplies, Retail Food and Beverage Stores, and Recreation Amusement. The induced effects from transportation and other sectors were negligible.

Table 5. Value of output (sales) Changes from Baseline Values under Scenarios in County Level, Long Island

Sectors	Increase Trips	Decrease Fuel Price	Combined
Tackle and Supplies	8.61%	0.22%	8.83%
Retail Food and Beverage Stores	1.89%	0.04%	1.93%
Lodge	0.00%	2.18%	2.19%
Boat and Boat Rent	5.78%	2.99%	8.78%
Recreation Amusement	4.10%	0.87%	4.96%
Transportation	0.03%	31.00%	31.04%
Agriculture	0.01%	1.09%	1.10%
Construction	0.06%	-0.69%	-0.64%
Utilities	0.05%	1.25%	1.30%
Wholesale and Retail Trade	0.02%	0.54%	0.56%
Mining and Quarrying	0.05%	6.86%	6.91%
Processed Food	0.01%	1.16%	1.16%
Manufacturing	0.01%	1.60%	1.61%
Services	0.04%	0.40%	0.44%
Miscellaneous	0.09%	0.83%	0.92%

Table 6 provided the changes from baseline values of employment under the three scenarios in Long Island. A greater number of trips led to increased employment in the fishing related sectors. Employment in the labor-intensive industries such as tackle and supplies, boat and boat rent, and recreation amusement increased by 11%, 9%, and 5% respectively. Price declines in fuel are associated with more employment in boat and boat rent, recreation, amusement, and mining and quarrying. The Lodge sector showed almost no change in price, output, and employment as the trips 'changed. This suggests that there are a limited number of overnight fishing trips. Fishing visitors prefer short fishing tours or most of the fishing participators are residents on the Island. This result is consistent with the tourism survey in the Long Island.

The macro-impacts of the simulations are reported in Table 7. Regional GDP is expecting increased by 0.14%, 1.07% and 1.21% in the three scenarios respectively. Government revenues are affected much more significantly by the decline of fuel price than increased fishing trips, which was 0.8% vs. 0.1% in the federal government and 0.1% vs. 0.07%. Household income changes were varied respecting the two shocks. Fishing trips generated more impact skewed to higher income level groups, while lower fuel price benefits appeared to have a greater impact on the Middle-High level income group.

Table 6. Employment Changes from Baseline Values under Scenarios in County Level, Long Island

Sectors	Increase Trips	Decrease Fuel Price	Combined
Tackle and Supplies	10.88%	0.39%	11.29%
Retail Food and Beverage Stores	2.30%	0.25%	2.54%
Lodge	0.01%	3.83%	3.84%
Boat and Boat Rent	8.77%	5.05%	13.93%
Recreation Amusement	5.25%	1.40%	6.66%
Transportation	0.04%	6.20%	6.20%
Agriculture	0.02%	3.41%	3.43%
Construction	0.09%	1.50%	1.58%
Utilities	0.07%	2.48%	2.55%
Wholesale and Retail Trade	0.03%	0.93%	0.96%
Mining and Quarrying	0.08%	16.91%	17.00%
Processed Food	0.01%	1.69%	1.69%
Manufacturing	0.01%	3.00%	3.01%
Services	0.06%	0.86%	0.93%
Miscellaneous	0.11%	1.08%	1.19%

Table 7. Changes from Baseline Values of Governments Revenue, GDP, Household Income under Scenarios in County Level, Long Island

Sectors	Increase Trips	Decrease Fuel Price	Combined
Federal government revenue	0.11%	0.76%	0.87%
State government revenue	0.07%	0.10%	0.16%
GDP	0.14%	1.07%	1.21%
Gross Household Income			
<$10,000	0.01%	0.08%	0.09%
$10,000–$15,000	0.02%	0.13%	0.15%
$15,000–$25,000	0.03%	0.25%	0.28%
$25,000–$35,000	0.05%	0.38%	0.43%
$35,000–$50,000	0.07%	0.54%	0.62%
$50,000–$75,000	0.09%	0.69%	0.78%
$75,000–$100,000	0.10%	0.75%	0.85%
$100,000–$150,000	0.11%	0.78%	0.89%
> $150,000	0.10%	0.75%	0.85%

The three scenarios were also analyzed for five selected areas of Long Island.[2] Five off-shore regions (two on the North Shore and three on the South Shore) are selected to compare the variability across the community. In general, Impacts result from more trips on the fishing related sectors are much larger than those from falling in fuel price; Fluctuations in the North Shore (Port Jefferson and Mattituck) are more significant than those in South Shore (Long beach-Jones beach and Mastic Beach). Montauk, an area well-known for tourism and recreational fishing in the region showed the most significant changes arising from the shocks. For example, with respect to the two simulated shocks GDP increased by 0.51% and 1.84% respectively.

Sectors such as tackle and supplies, boat and boat rent, and recreation amusement are much more sensitive in output and employment but more stable in price with respect to the increased trips. This result occurs primarily as a result of the general equilibrium model in which available substitutes are hard to find for those sectors and elasticities of supply and demand are relatively larger. The macro indexes including federal government revenue, state government revenue, GDP, and gross household income varied slightly as the extra 10% fishing trips due to subtle changes in the proportions from related industries (less than 0.1% in most regions).

CONCLUSIONS

In this study, we have applied the CGE model to examine the effects of shocks in fishing trips and marine fishing price. The endogenous impacts on commodity price, outputs, employment, income distribution and government revenue are measured in both county level and community level. As expect, an increase in the number of trips leads to the commodities' price rising, at least in the short run. But those changes are insignificant because the consumers' expenditure shares in the recreational fishing are small. Effects on output and jobs were generally positive but lower than expected changes. This is chiefly due to substitution effects in both production and consumptions. Impacts due to pass-through in GDP, income, and government revenue were much more moderate. The increase of recreational fishing's share in GDP may be a result of the stagnation of other industries and/or their replacement/ousting by recreational fishing. It is interesting to note that the impact on household income is considerably smaller than that of GDP, implying that recreational fishing primarily stimulates high value added activities, mainly in the service industries.

Impacts from lower fuel prices tended to be relatively large in percentage terms for non-recreational fishing sectors compared with recreational fishing related industries because the average share of revenues expended for fuel by the recreational fishing related industries is lower than for most non-recreational fishing-related industries. Thus, the combined impacts of both shocks are dominated by the effects of the trip increase in recreational fishing-related industries, but dominated by the effects of reduced fuel price in non-recreational fishing-related industries.

The overall GDP changes from the combined shocks are 1.21% in this region. More benefits are absorbed by the higher-income groups. This is chiefly due to the fact that mean household income is higher on Long Island than in many other areas of the country, averaging almost $90 thousand. High-and medium-income households benefit the most from the government channel effects, except in the case when the government directs the revenue from trips expansion. The lowest-income households are not the main beneficiaries, and their income benefits more from the earnings and price channel effects of trips expansion.

The community-level analysis shows apparent heteroscedasticity in both geography and across industries. Impacts on the North Shore of Long Island are usually higher than those on the South Shore. Some regions such as Port Jefferson and Montauk are driven more from marine based activities such as recreational fishing and the induced impacts on other sectors might increase the regional GDP, government revenue and household income by 6%, 4%, and 3% respectively in the combined scenarios. Sectors such as tackle and supplies, boat and boat rent, and recreation amusement are much more sensitive in output and employment but more stable in price respecting to the increased trips.

Recreational fishing generates output, employment, and income in related industries and leads to pass through to the whole economy, including a positive balance of payments, stimulates the supplying sectors, and leads to a generally increased level of economic activity. Our finding indicated this sector is relatively sensitive to more labor-intensive industries; policy makers should give due consideration to the overall economic development when deciding on tourism development strategy. Some fishery-dependent regions and communities could be paid more attention from some favorable policy.

ENDNOTES

1. This presentation is a resulting product from project R/CHD-8, entitled Leveraging Long Island's Coastal Heritage for the Future: Integration and Diversification of Long Island's Coastal Industries funded under award 67209 from the National Sea Grant College Program of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration, to the Research Foundation of State University of New York on behalf of New York Sea Grant. The statements, findings, conclusions, views, and recommendations are those of the author(s) and do not necessarily reflect the views of any of those organizations.

2. Due to space constraints, the full tables of these results are not included here, but are available upon request.

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