

# **Connecticut Coastal Community Unemployment and Economic Damage Attributable to Hurricane Sandy**

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**Contents**

Introduction ..... 3

Communities Covered..... 3

Employment Estimates ..... 4

    Employment Impacts and Multiplier ..... 8

Dollar-Value Impact ..... 8

Conclusion..... 9

Exhibit A ..... 10

## Introduction

This short analysis makes use of the Bureau of Labor Statistics' (BLS) monthly data 1990 to 2013, for Connecticut's coastal communities adversely affected by Hurricane Sandy to attain upper bound and lower bound estimates, by industry, of increased unemployment in each of the last three months of 2012. Subsequently, using the Regional Economic Modeling Inc. dynamic input-output model (REMI),<sup>1</sup> this report estimates the dollar-value of the storm's economic impact on the state over the coming years.

## Communities Covered

The three areas covered by the BLS data include:

- Bridgeport-Stamford Norwalk CT New England City and Town Area (NECTA);
- New Haven CT NECTA; and
- Norwich-New London RI-CT NECTA<sup>2</sup>

While inclusion of Norwich trespasses into Rhode Island, Norwich has the analytical advantage of capturing coastal areas and having shared impact from Sandy. The population adjustment factor is applied on Connecticut population only so that the estimates are on employment impacts for Connecticut. In December 2012, the included NECTAs contained 792.8 thousand employed out of 1,468.7 thousand covered by CT and CT-RI NECTAs compared to Connecticut's total Full time Equivalents Employed (FTEs) of 1,623.4 thousand<sup>3</sup>. Industries included in the database include manufacturing, trade transport and utilities (Ttu)– subdivided into wholesale, retail and transport and utilities – professional and business services – subset for administration and waste management – leisure and hospitality broken out as (arts, entertainment and recreation), and accommodation and food as well as other services. The information, financial services and education and health sectors are not included in this analysis for a variety of practical as well as theoretical reasons.<sup>4</sup>

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<sup>1</sup> See Exhibit A for additional information about REMI.

<sup>2</sup> For towns and cities included in NECTAs see BLS, Labor market areas, March 2011, pp. 11-16. <http://www.bls.gov/lau/lmadir.pdf> Feb. 10, 2013.

<sup>3</sup> BLS Employment Series.

<sup>4</sup> As noted, there are a number of reasons for this omission; one of the primary reasons has to do with the size of firms (large companies, as opposed to small businesses) that participate in these industries in Connecticut. Excluding these sectors helps to ensure that CCEA's estimates are more likely to error on the side of being conservative, rather than over-estimating the economic impact.

## Employment Estimates

The report uses BLS's 23-year (seasonally unadjusted) monthly data series to estimate what the expected employment for each month would had Hurricane Sandy not caused the level of damage it did. The estimating equation simply consists of a constant, monthly-dummies for each month but December, year, and a single-period lagged variable. The upper bound estimate of unemployment is the difference between the estimated expected employment and the actual results documented by the BLS. The lower bound is the portion of the previous estimate that lies beyond the 95% level of confidence for expected values – the kind of result that is driven by extraordinary events such as Hurricane Sandy over and above expectations 1/20<sup>th</sup> of the time. Total upper and lower bound estimates for all coastal communities are then extrapolated from the three communities for which the BLS produces data. Table 1 contains the upper-bound estimates for each of the three NECTAs by industry and the totals in thousands of FTEs.

**Table 1: Upper Bound of FTEs Impacted in 2012Q3 by NECTA by Industry (1000's FTEs)**

	Trade transportation & utilities (ttus)	Wholesale	Retail	Transportation & utilities	Professional and business services	Administration and Waste management	Hospitality % Leisure	Art, entertainment and recreation	Accommodation and food	Other Services	Manufacturing	Total	Total Less Manufacturing
<b>Bridgeport-Stamford Norwalk</b>													
Oct	-0.805	0.109	-0.781	-0.127	-0.427	-0.203	-0.166	-0.265	0.192	-0.028	0.179	-1.246	-1.426
Nov.	-1.466	-0.125	-1.141	-0.197	0.017	0.237	-0.202	-0.002	-0.099	0.054	-0.110	-1.708	-1.597
Dec.	-0.192	-0.001	-0.151	-0.047	-0.192	0.114	-1.399	-0.439	-0.860	-0.011	0.148	-1.646	-1.794
<b>New Haven</b>													
Oct	0.416	0.083	0.482	-0.155	0.260	0.278	0.863	-0.181	0.990	-0.018	-0.439	1.082	1.521
Nov.	-0.527	-0.138	-0.288	-0.112	-0.386	-0.141	-0.422	-0.209	-0.294	0.051	-0.153	-1.436	-1.284
Dec.	-0.316	-0.060	-0.178	-0.091	-0.386	-0.063	-0.024	0.561	-0.658	-0.113	-0.033	-0.871	-0.838
<b>Norwich-New London</b>													
Oct	-0.185	0.019	0.027	-0.156	-0.003	0.000	-0.464	-0.325	-0.129	-0.007	0.016	-0.643	-0.659
Nov.	-0.198	0.004	-0.163	0.032	-0.033	0.000	-0.290	-0.519	0.246	-0.020	0.043	-0.497	-0.540
Dec.	-0.098	-0.022	-0.066	0.067	-0.107	0.000	-0.231	-0.261	0.069	-0.024	-0.060	-0.521	-0.460
<b>Totals</b>													
Oct	-0.574	0.212	-0.272	-0.438	-0.170	0.075	0.233	-0.771	1.054	-0.053	-0.243	-0.807	-0.565
Nov.	-2.191	-0.259	-1.592	-0.276	-0.402	0.096	-0.914	-0.731	-0.146	0.085	-0.220	-3.641	-3.422
Dec.	-0.605	-0.083	-0.395	-0.071	-0.685	0.051	-1.654	-0.140	-1.449	-0.149	0.055	-3.038	-3.093
<b>Adjusted totals</b>													
Oct	-0.635	0.234	-0.301	-0.485	-0.188	0.083	0.258	-0.853	1.165	-0.059	-0.268	-0.893	-0.624
Nov.	-2.422	-0.287	-1.760	-0.305	-0.444	0.106	-1.010	-0.808	-0.161	0.094	-0.243	-4.025	-3.782
Dec.	-0.669	-0.091	-0.436	-0.079	-0.757	0.056	-1.828	-0.155	-1.602	-0.164	0.061	-3.357	-3.419

Given Sandy arrived late in October, adverse employment impacts totaling 4,025 FTEs arise in November before somewhat subsiding in December to 3,357. Ttu was particularly hard hit in November with a drop in 2,422 with the retail subsector suffering the most loss at 1,760. In the same month, hospitality and leisure also lost in excess of 1,000 FTE midst a deteriorating decline to 1,828 in December, concentrated in its accommodation and food industry.

The available evidence suggest that of the 39 total metrics, 10 indicate declines beyond the 95% level of confidence, some by a considerable amount as shown in Table 3. Of the outliers, one occurred in October, leaving nine of the 26 total observations in November and December attributable to Sandy' wrath.

The Federal Emergency Management Agency's (FEMA's) declaration covers damages from October 28 until November 8. Ttu in November dropped by in excess of 1,000 FTEs. The concentration of these cells in over a quarter of the possible cells when the odds are for obtaining slightly less than two of them indicated the severity of the Sandy in lowering employment. As indicated in the previous table, employment grew in some industries so that the sum of the impacts is less than the sum of the declining parts appearing in Table 2. This table strengthens the conclusion that the really severely impacted industries have been ttu , especially retail, and hospitality and leisure concentrated in arts, entertainment and recreation in the earlier months and accommodation and food in December.

**Table 2: Lower Bound of FTEs Impacted in 2012Q3 by NECTA by Industry (1000's FTEs)<sup>5</sup>**

	Trade transportation & utilities (ttus)	Retail	Administration and Waste management	Hospitality % Leisure	Art, enertainment and recreation	Accommodation and food	Total	Total Less Manufacturing
<b>Bridgeport-Stamford Norwalk</b>								
Oct	-0.056	-0.157						
Nov.	-0.718	-0.516						
Dec.				-0.736	-0.055	-0.416		-0.081
<b>New Haven</b>								
Oct								
Nov.				-0.025			-0.233	-0.228
Dec.						-0.2766		
<b>Norwich-New London</b>								
Oct			-0.132	-0.110				-0.066
Nov.				-0.304				
Dec.				-0.046				
<b>Totals</b>								
Oct					-0.174			
Nov.	-0.961	-0.641			-0.134		-0.714	-0.869
Dec.				-0.670		-0.711	-0.11	-0.541
<b>Adjusted totals</b>								
Oct					-0.193			
Nov.	-1.063	-0.708			-0.148		-0.789	-0.961
Dec.				-0.741		-0.711	-0.121	-0.598

Before CCEA was able to calculate the total dollar-value of likely economic impact from Sandy, one further adjustment to the data was required. The BLS operates with full-time equivalents of employment whereas both REMI and FEMMA use jobs in their employment series. In the former a FTE

<sup>5</sup> Industries for which Bridgeport-Stamford, Norwalk, and Norwich-New London did not have any values are not shown here in the interest of space.

may be comprised of one or more employees inclusive of part-time and fulltime employees. By industry the ratio of fulltime to part-time employees differs. For that reason, transforming FTEs to jobs needs to be carried out industry by industry. The job equivalents of the FTEs for each of the last three months of 2012 for the upper and lower bound estimates of the direct job impacts from Sandy appear in Table 3.

**Table 3: Upper and Lower Bound of Jobs Impacted in 2012Q3 by NECTA by Industry (1000's Jobs)**

Bound	Trade transportation & utilities (ttus)	Wholesale	Retail	Transportation & utilities	Professional and business services	Administration and Waste management	Hospitality % Leisure	Art, entertainment and recreation	Accommodation and food	Other Services	Manufacturing	Total	Total Less Manufacturing
<b>Upper</b>													
Oct	-0.803	0.334	-0.375	-0.561	-0.175	0.136	0.327	-1.786	1.262	-0.097	-0.398	-1.120	-0.756
Nov.	-3.063	-0.409	-2.191	-0.353	-0.414	0.174	-1.280	-1.692	-0.174	0.155	-0.361	-5.047	-4.581
Dec.	-0.846	-0.130	-0.543	-0.091	-0.706	0.092	-2.316	-0.325	-1.735	-0.270	0.091	-4.210	-4.141
<b>Lower</b>													
Oct								-0.404					
Nov.	-1.344		-0.881					-0.310				-0.989	-1.164
Dec.							-0.939		-0.851			-0.152	-0.724

The adjusted areas of coverage correspond to areas designated by FEMMA for the bulk of its relief effort in coastal counties and lands occupied by the Mashantucket Pequot. While FEMMA’s assistance to individuals is independent of the businesses employing them its assistance to business is in conjunction with the U.S. Small Business Administration (SBA), that the latter’s definition of small business becomes material.

The SBA’s loan criterion is based on either revenues or employment or both for “Small,” with the numbers differ among industries classified according to their North American Industrial Classification System (NAICS) code.<sup>6</sup> For example, to qualify as a small business for Federal government contracting, a non-manufacturer must have 500 or fewer employees, be primarily in the wholesale or retail trade, and supply the product of a US small manufacturer, if the contract is set aside for a small business.<sup>7</sup>

Based on the sum of full-time and part-time employees averaged over the previous 12 months, employment must be under 100 to 1,500 depending on the firm’s NAICS. For example, natural resource companies subject to employment bounds are classified as small if they have 500 or fewer employees. Wholesalers are generally required to have a maximum of 100 employees. In contrast, air transportation and pipeline companies are classified as small as long as they have no more than 1,500 employees. In all these instances, limits on the maximum dollar of sale also vary among NAICS.

Based on the 2009 census results for employment by establishment/firms, CCEA has derived the percentage of employment in each of the industries of interest that takes place at various sized

<sup>6</sup> U.S. Small Business Administration, Table for Small Business Standards, <http://www.sba.gov/content/small-business-size-standards> (Feb 21, 2013)

<sup>7</sup> U.S. Small Business Administration, Guide to Size Standards, <http://www.sba.gov/content/guide-size-standards> (Feb. 21, 2013)

establishments. These data tend to be confidential at the county level so statewide data are used as a proxy with the results appearing in Table 4. The results clearly vary among industries with smaller establishments concentrated in other services, accommodations and food, and retail and larger establishments in manufacturing, utilities, and administration and waste management.

**Table 4: Percentage of CT Jobs by Size of Establishment/Firm Employment by Industry 92009)**

Establishments/firms Employment Limits	Trade transportation & utilities (ttus)	Wholesale	Retail	Transportation & utilities	Professional and business services	Administration and Waste management	Hospitality % Leisure	Art, entertainment and recreation	Accommodation and food	Other Services	Manufacturing
Less than 50	47.84	42.00	53.54	32.91	50.16	33.71	58.97	49.40	60.77	81.23	24.51
Less than 100	62.09	56.42	66.59	52.31	62.31	45.66	76.42	72.49	77.16	88.76	39.10
Less than 500	93.79	84.16	99.36	86.77	81.41	76.68	85.94	92.86	84.64	97.64	71.00
less than 1000	96.63	89.97	99.36	96.91	81.41	76.68	85.94	92.86	84.64	97.64	80.66

Note: The conversion factor is 2011 jobs by industry in REMI's base case divided by the BLS employment for the same industry for Connecticut Counties of Fairfield, New Haven and New London aggregated among the counties.

The SBA criteria for "small" differ among industries so that its percentage of employees whose employers are eligible for assistance also differs among industries. Those criteria are summarized in Table 5. SBA's criterion for the vast majority of manufacturers is 500 or fewer employees. Where employment criteria do not pertain there small is defined by annual firm revenues. As noted in Table 5, for many industries these criteria are parsimonious.

**Table 5: Small Business Assistance Criteria for Eligibility and Percentage of Impacted Employees at Eligible Establishments/Firms**

FEMMA Maxima for Small Business Eligibility	Trade transportation & utilities (ttus)	Wholesale	Retail	Transportation & utilities	Professional and business services	Administration and Waste management	Hospitality % Leisure	Art, entertainment and recreation	Accommodation and food	Other Services	Manufacturing
Employment		100	50								500-1500
Revenues (Millions \$)	\$7-\$35.5		\$7-\$35.5	\$7-\$35.5	\$7-\$35.5	\$7-\$35.5	\$7-35.5	\$7	\$7-35.5	\$7-35.5	39.10
% Impacted Employees at Eligible Locales		56.42	53.54								71.00

Source: Derived from US Bureau of the Census, American Fact Finder

[http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=BP\\_2009\\_00A3&prodType=table](http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=BP_2009_00A3&prodType=table) (Feb. 22, 2013)

Unfortunately there are no parallel breakouts for firm revenues by establishment/firm size that correspond to the employment breakout of establishments/firms by size so that the data on which to base the share of the adversely impacted employees is sparse. Yet from the available evidence, CCEA would expect FEMMA assistance via employers to approximately half of those whose employment has been interrupted by Sandy. Adverse employment impacts by industry are then expected to continue over the next two years with half being redressed in 2013 and remaining during 2014. There are uncertainties about whether or not eligible establishments/ firms will apply to rebuild as well as the capacity of those who do not apply to rebuild as well as the related timing of each firm undertaking rebuilding efforts so that even the evidence above is open to wide interpretations.

### **Employment Impacts and Multiplier**

Average direct employment impacts for the months of November and December were utilized as direct bases for upper bound direct employment impacts with a sixth of those values occurring in 2012 i.e. over the two months, 75% in 2013, representing gradual recovery during the year and 25% in 2014, indicative of ongoing gradual recovery until full recovery is reached at the end of 2014. The sum of the direct job-years lost over the 26 months is 5,256. Direct job losses result in a decrease in demand and net out migration of 2,374 that reverberate throughout CT further exacerbating the unemployment situation so that in total, inclusive of the indirect and induced impacts a total of 7,550 job-years are expected to be lost resulting in a jobs multiplier effect of 1.45. The vast majority of the job losses 7,103 are expected to be in the private sector with the remainder being in government due to its curtailed sources of revenues from the unemployed attributable to Sandy.

### **Dollar-Value Impact**

REMI measures the dollar value impacts of these reductions in gross output (shipments) and real gross state product (RGSP) in chained 2005 dollars and current dollars for personal income and personal disposable income with the differences beaten these last two measures being the adverse impacts on government revenues. The loss in output over the 26 months is expected to \$699 million and in RGDP \$444 million in 2005 dollars. Over the same period even taking unemployment benefits into consideration, losses in current dollar personal income will amount to \$379 million of which \$301 million will reduce disposable income, the funds households have left to spend after taking taxes into account. These results imply that government tax revenues will be curtailed by \$78 million in current dollars.



## Conclusion

The purpose of this study was to evaluate the likely economic impacts on small businesses resulting from Hurricane Sandy's destructive collision with the Connecticut coast. As noted in the brief section on the structure of the Connecticut economy, about half of its private sector jobs appear to fall under FEMA's definition of small businesses. This approach does not assess the reconstruction costs faced by Connecticut small business, but does quantify the total impacts of the lost jobs in aggregate and for small businesses in the state.

By using dynamic regression analysis and data from the BLS, CCEA was able to determine the number of private sector job-years that can be expected to be lost (and attributable to) Sandy from November 2012-December 2014 will reach 7,103 jobs of which roughly half or 3,551 job losses can be expected to be in small businesses. Further, REMI yielded estimates of the negative financial impacts in real dollars for gross output of small businesses \$350 million and RGDP of \$222 million. In current dollar terms the impacts will trim personal incomes from small businesses by \$190 million, disposable incomes by \$150 million and government revenues by \$39 million over the 26 months.

To the extent that employment was extended in the immediate wake of Sandy, to assist in cleaning-up sites that were damaged severely enough to require temporary or permanent closure, use of that data as a proxy for the small business employment impacts may underestimate negative impacts. Alternatively, recuperation may occur more quickly than envisaged in the assumptions above and other sectors, not included here such as construction may experience increasing employment over and above what occurred in the base case.

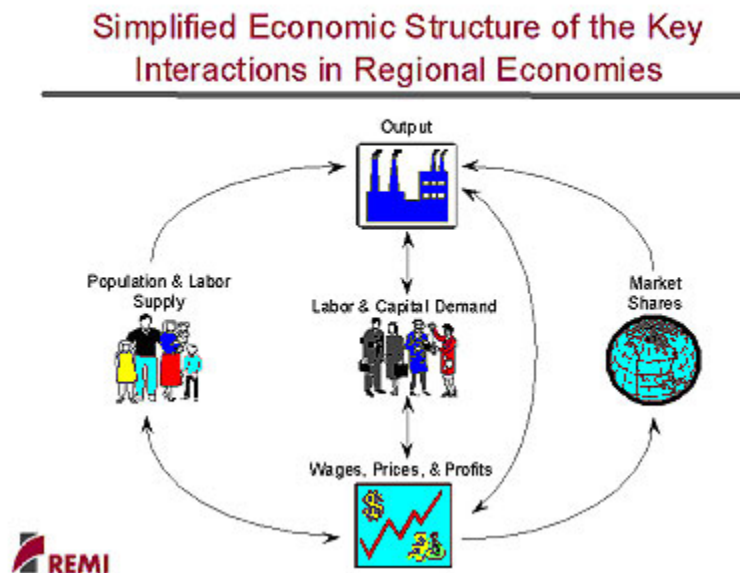
The lower bound case involving a loss of less than a sixth of the upper bound direct jobs losses would result in relatively small impacts.

## Exhibit A

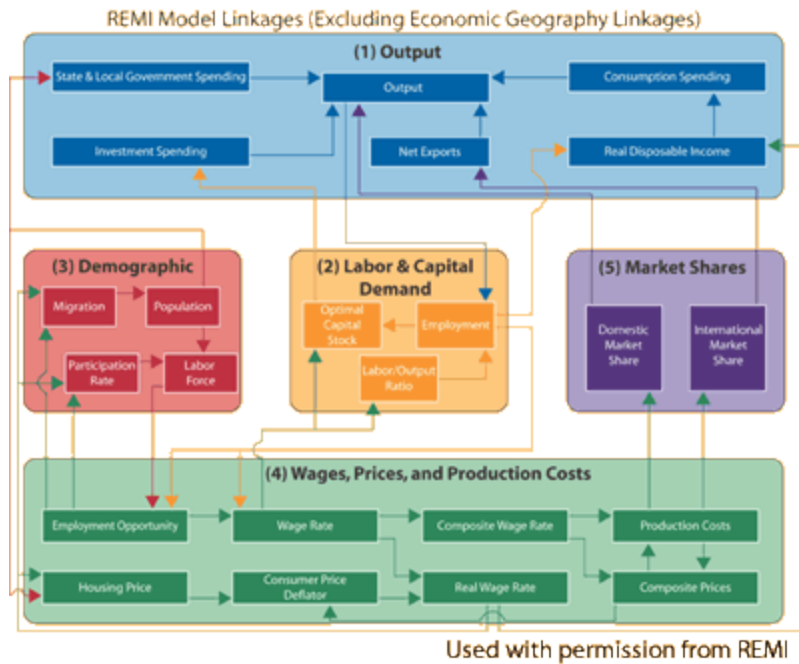
REMI is a multi-sector, dynamic, economic impact model of Connecticut and its eight counties. REMI measures total economic changes over time by comparing a baseline forecast (or no action), to an alternative forecast via changing certain variables such as industry employment or sales.

The REMI model includes all of the major inter-industry linkages among 466 private industries, aggregated into 66 industrial sectors. With the addition of farming and three public sectors (state and local government, civilian federal government and military), there are 70 sectors represented in the model for each of Connecticut's eight counties.

Because the variables in the REMI model are inter-related, a change in any one variable affects many others. For example, if wages rise in one sector, the relative costs of producing a certain output (or outputs) change, and could potentially cause the producer to substitute capital for labor. The change in the capital-labor ratio potentially impacts demand for inputs, which affects employment, wages, and other variables. And so on. Such "chain-reactions" propagate in time across all sectors in the model.



The REMI model is based on a nationwide input-output (I/O) model – an approach that was originally developed by Nobel Laureate Wassily Leontief – that the U.S. Department of Commerce (DoC) further developed, and continues to maintain. I/O models focus on the inter-relationships between industries and provide information about how changes in specific variables – whether economic variables such as employment or prices in a certain industry, or other variables (such as population) – affect markets. REMI' CT model scales the U.S. I/O table according to annual regional relationships, current conditions, scale, and rates of innovation by industry, allowing the relationships to adapt dynamically at reasonable rates to incorporate those changing conditions both historically and into the future.



The modeling approach we employed for this project was to measure the employment and job impacts of Hurricane Sandy and allow REMI to monetize those values (industry outputs and wages and salaries) as well as assessing the counterfactual of the base case; that is the total adverse impacts from Sandy inclusive of direct, indirect and induced impacts. Put slightly differently, to model the economic impact via the counterfactual, the modeler, using the structure provided by the REMI program, “removes” certain benefits (in our case, the adverse impact of Sandy’s wrath). Then, by considering the difference between the “before” and “after” value (of the economic variables of interests), we can calculate the total (economic) consequences for the region/state.