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The Economic and Fiscal Impacts of Hurricane Sandy in New Jersey

A MACROECONOMIC ANALYSIS

Nancy H. Mantell

Director, Rutgers Economic Advisory Service (R/ECON™)
Edward J. Bloustein School of Planning and Public Policy
Rutgers, The State University of New Jersey

Joseph J. Seneca

University Professor
Edward J. Bloustein School of Planning and Public Policy
Rutgers, The State University of New Jersey

Michael L. Lahr

Associate Research Professor
Edward J. Bloustein School of Planning and Public Policy
Rutgers, The State University of New Jersey

Will Irving

Research Associate
Edward J. Bloustein School of Planning and Public Policy
Rutgers, The State University of New Jersey

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of Planning and Public Policy

Executive Summary

This report estimates the macroeconomic and fiscal impacts of Hurricane Sandy on the economy of New Jersey using the R/ECON™ forecasting model of the state's economy. The model consists of more than 250 quarterly time-series equations and 30 employment sectors.

The analysis takes into account both the economic losses resulting from the hurricane and the offsetting positive economic impacts associated with recovery and reconstruction spending in the months and years following the storm.

However, the estimates of impacts depend upon the restoration expenditures actually being made. If the funds for these restoration and recovery expenditures are not made available, the offsetting positive impacts to the economy will not occur and the New Jersey economy will be significantly damaged. See Section 3 for estimates of the negative impacts if restoration expenditures are not made.

Based on estimated initial economic losses (not including damages to physical structures) of approximately \$11.7 billion in state gross domestic product (state GDP) and total recovery and reconstruction expenditures of approximately \$25.1 billion through 2015, the analysis finds that, following heavy losses in state GDP, employment, and income in the fourth quarter of 2012, the state economy will rebound significantly, with economic activity exceeding the baseline forecast (i.e., without the storm) for 2013–2015. Estimated *net* impacts (i.e., those that take the full recovery expenditures into account) include:

- State GDP losses of \$7.1 billion in the final quarter of 2012, followed by annual gains of \$2.5 billion (2013), \$1.7 billion (2014), and \$0.7 billion (2015) relative to baseline.
- Employment losses of 4,200 jobs in Q4 2012, followed by employment levels of 2,000, 5,600, and 4,900 above baseline in 2013, 2014, and 2015.
- Personal income \$1 billion below baseline in Q4 2012, followed by levels \$300 million or more above baseline in 2013–2015.
- A loss of approximately \$82 million in state tax revenue in Q4 2012, followed by modest gains above baseline in 2013–2015.

These estimates, while showing modest *net* positive impacts on the macroeconomic performance of the state's economy in the years following the storm, are in no way meant to imply that New Jersey has benefited, or will benefit, from the storm. The damages, both human and economic, are enormous and real. What is not yet real and accomplished is the spending of the necessary resources to fully repair and rebuild. *Only if the state obtains the resources* needed to fund the offsetting recovery and reconstruction expenditures will the substantial negative economic and fiscal impacts of the storm be neutralized over time.

Introduction

Hurricane Sandy imposed enormous damage on New Jersey, harshly and significantly affecting the lives and livelihoods of millions of people. It was a deadly, dangerous, and highly destructive storm. The individual hardships and economic losses to people, businesses, and local and state governments were extensive and severe. These impacts will continue to affect the state for some time to come, even as significant rebuilding and restoration activity occurs.

The economic pattern that typically accompanies severe natural disasters such as Hurricanes Katrina (2005), Sandy (2012), Ike (2008), Wilma (2005), and Andrew (1992) consists of large immediate losses in output, income, and employment.¹ This occurs because the immense damage to public infrastructure and the stock of private capital (housing, business structures, and inventory) severely disrupts economic activity. Subsequently, over the next several years, there is a burst of economic growth due to large expenditures on reconstruction and restoration of this capital stock, although the loss in its value is usually never fully compensated by private insurance and public restoration spending.

The purpose of this report is to estimate the macroeconomic and fiscal impacts of Hurricane Sandy on the economy of New Jersey. This is done using the R/ECON™ forecasting model of the state's economy, which consists of more than 250 quarterly time-series equations and 30 employment sectors.²

The organization of the report is as follows:

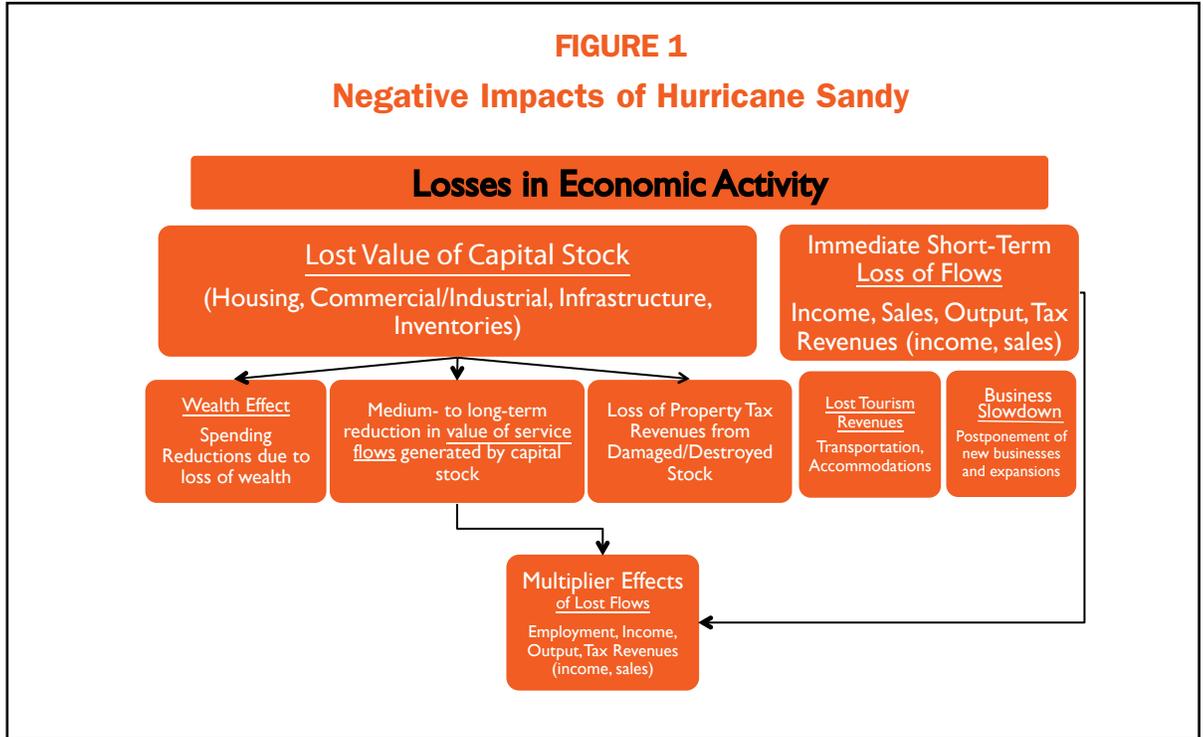
- Section 1 provides a general taxonomy of the economic and fiscal impacts of the storm.
- Section 2 describes the methodology and assumptions used to assess the duration, extent, and timing of the damages imposed on the economy by the storm. Symmetrically, it also provides estimates of the amount and timing of the repair and rebuilding expenditures that have been, and are being, made to restore the public and private capital stock of the state and to recover from the storm's damages to the operations of businesses and public entities.
- Section 3 presents the R/ECON™ model estimates of the full impacts of the storm, prior to any assumption of recovery spending.
- Section 4 presents the R/ECON™ model estimates of the *net economic and fiscal effects* from both the extensive negative impacts of the storm and the offsetting gains from increased economic activity due to the substantial rebuilding and restoration expenditures.
- Section 5 discusses several caveats to the analysis including the inevitable, but uncertain, effects of future national and international economic developments on both the U.S. and New Jersey economies.
- Section 6 provides a brief summary and conclusions.

It is most important to note that the estimates of net impacts contained in this study depend on these restoration expenditures actually being made. If the funds for these restoration and recovery expenditures are not made available, the offsetting positive impacts to the economy will not occur, and the New Jersey economy will be significantly damaged.

This analysis measures impacts on state Gross Domestic Product (state GDP), total employment, total personal income, and state tax revenues from the final quarter of 2012 through the end of 2015. *The estimated impacts represent changes to these indicators relative to a baseline forecast by the model for the New Jersey economy without the storm.*

1. Hurricane Sandy is the second most costly (in dollar damages) hurricane in U.S. history, trailing only Hurricane Katrina. The other storms listed after Katrina above are ranked in descending order of losses (in current dollars).

2. For a more detailed description of the model see appendix 1. The model was built and is maintained by Dr. Nancy H. Mantell of the Edward J. Bloustein School of Planning and Public Policy at Rutgers University. It is used routinely in economic and fiscal impact analyses of the state's economy.



SECTION 1.
Taxonomy of the Storm

It is informative to construct a general taxonomy of the economic impacts of Hurricane Sandy as a guide to how to employ the R/ECON™ model to estimate these effects. Two opposing dynamics are at play—the negative impacts from the damages of the storm that occur both immediately and over time versus the stimulus to the economy from offsetting reconstruction expenditures that begin soon after the storm and continue for several years.

Figure 1 displays the negatives. The economic losses due to the storm can be divided into *damages to the capital stock and damages to the flow of economic activity*. Capital stock losses consist of damage to, and destruction of, housing, business structures, inventories, and public facilities and infrastructure. The loss in value of these physical assets will diminish spending by owners in a manner that is symmetric to the negative wealth effect that follows from losses in financial assets.

There will also be medium- to long-term reductions in the value of the service flows from the damaged and destroyed private and public capital

stock, i.e., the contribution of the capital stock to output and income is diminished or eliminated for varying periods of time.

Further, there is a complex negative impact on property taxes as the storm’s damage reduces property values and assessments in the short term.³ Also, property tax collection rates are likely to fall as owners are unable to maintain current property tax payments. This has implications for municipal budgets and future property tax rates.

Another component of losses occurs from the immediate short-term reductions in the flow of economic activity. Sales decline (some never to be made up), employment and income decrease from fewer hours worked, output falls, and state tax revenues decrease from lower levels of economic activity. These short-term reductions in economic activity and the diminished longer-term reduction

3. The long-term implications for property taxes are complex and depend on the extent, type, and timing of the rebuilding that occurs. For example, in some shore communities, many small-lot, small-home properties may, over time, be consolidated into larger-lot, larger, and more valuable residential structures with a higher total assessment.

TABLE 1
Post-Sandy Initial Unemployment Claims

POST-SANDY INITIAL CLAIMS		
Filed Week Ended	Reflecting Week Ended	Claims
November 10, 2012	November 3, 2012	46,129
November 17, 2012	November 10, 2012	45,631
November 24, 2012	November 17, 2012	21,665
December 1, 2012	November 24, 2012	23,856
December 8, 2012	December 1, 2012	19,887
COMPARED WITH PRE-SANDY 4-WEEK AVERAGE		
Pre-Sandy 4-Week Average		10,925
Five-Week Excess over Pre-Sandy Average		102,543
COMPARED WITH SAME WEEKS, PRIOR YEAR		
Filed Week Ended	Reflecting Week Ended	Claims
November 12, 2011	November 5, 2011	12,145
November 19, 2011	November 12, 2011	12,017
November 26, 2011	November 19, 2011	10,506
December 3, 2011	November 26, 2011	10,603
December 10, 2011	December 3, 2011	13,671
TOTAL OVER SAME WEEKS, PRIOR YEAR		98,226

Source: U.S. Department of Labor, Employment and Training Administration.

in service flows of destroyed or damaged capital stock have further negative multiplier effects on the economy.

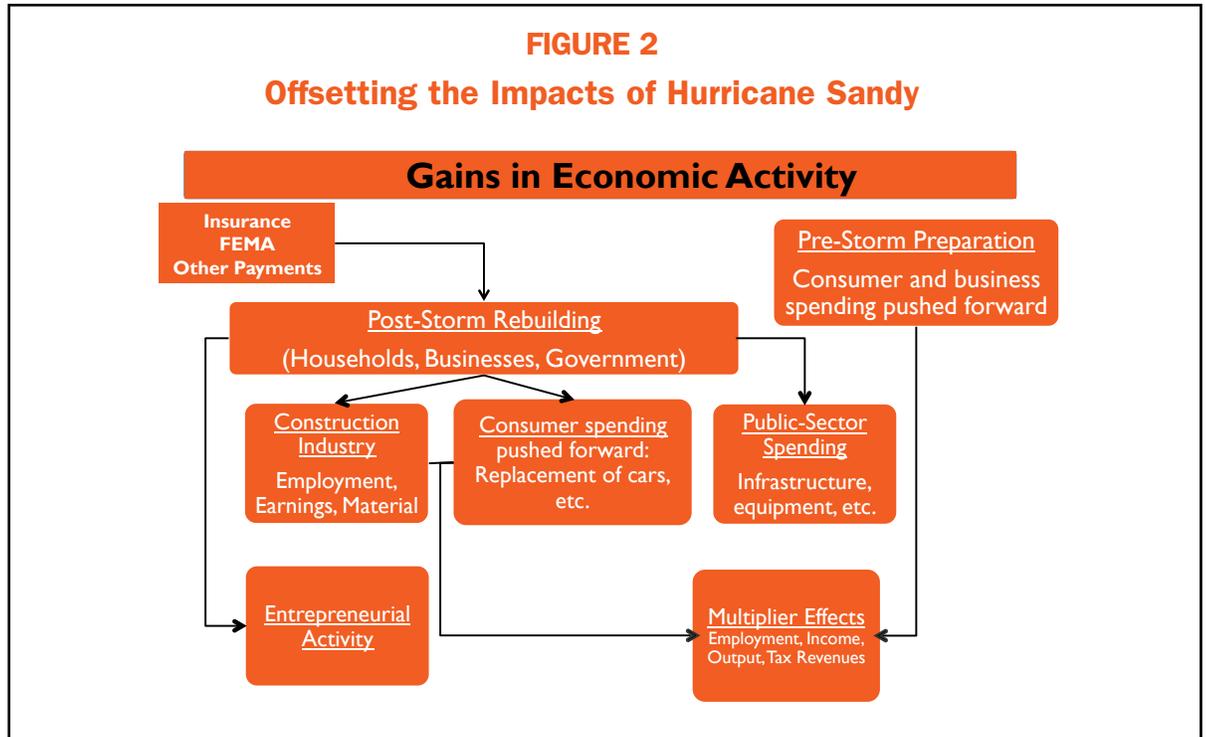
These impacts will appear, with a relatively short lag, in such data series as total personal income, unemployment insurance claims, retail sales, and income, sales, and property tax revenues. As an example, table 1 lists initial unemployment claims for New Jersey in the five weeks immediately after the storm. When compared with either the four-week pre-storm average, or the same five weeks in 2011, initial unemployment claims were approximately 100,000 higher during the month following the storm. The lost income, spending, and output as a result of this unemployment echoes throughout the economy with further negative impacts, as described above.

Offsetting these damages are the positive economic effects of the response to the storm's damages as portrayed in figure 2. These consist of

pre-storm purchases by households preparing for the hurricane and the marshaling by businesses of materials and personnel in advance of the hurricane. To some extent these purchases displace purchases of other goods and services that would have been made had there been no storm, or represent purchases moved forward in time with no net increase in spending.

The major offsetting impact occurs from the extensive post-storm expenditures by households, businesses, and governments on cleaning up, rebuilding, restoration, repair, and renewal of the damaged private and public capital stock. These expenditures are funded by private insurance, FEMA, and other existing or new federal and state aid programs.

However, not all damages are likely to be covered by these payments, and the ultimate increase in the value of the capital stock post-storm is likely



to be less than the losses to it. The U.S. Bureau of Economic Analysis measures disaster losses as capital consumption charges in the investment and savings tables of the National Income and Product Accounts.⁴ The expenditures on restoring the capital stock will appear, over time, as investment in GDP but are not distinguished as replacement spending.

Construction industries and related service industries (e.g., engineering, design, real estate, and finance) will benefit broadly. Consumer spending caused by the need to prematurely replace items (e.g., vehicles) due to ravages of the storm will also be accelerated, and public-sector spending on infrastructure restoration will be significant. These expenditures will occur over a mid-to-longer period of time lasting from months to several years.

The expenditure flows, both in anticipation of the pending storm and, more substantively, post-storm will have positive additional multiplier impacts.

Also, and less tangible, is the possible boost to entrepreneurial confidence that these substantial recovery efforts may create in the region, creating a “Can do, we will recover, keep the economy rolling” attitude.

On balance, therefore, a set of positive effects from rebuilding and like activities is juxtaposed over a set of negative effects of the storm itself. The offsetting effects are more likely to appear in standard measures of increases in economic flows over a substantial period of time and dominate the negative effects in these same series from the storm’s damages. The time sequence of the negative and offsetting impacts will interact, with likely net negative effects in the immediate aftermath of the storm followed by net positive impacts subsequently for a considerable period. However, the uncompensated losses in wealth, as payments to owners fall short of damages, will be less visibly borne by those affected.⁵

4. See table 5.1 in the National Income and Product Accounts:
<http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1>

5. These losses will not appear directly in the conventional measures of flows (quarterly or annually) of economic activity although they will affect these through the negative wealth effect described previously.

SECTION 2.

Assumptions and Methodology

The taxonomy described above provides general guidance for estimating the economic and fiscal impacts of the storm with the R/ECON™ model.

The first specific step in this process is to make key assessments as to the negative effects of the storm and integrate those into the model for the purpose of simulating the extent and time path of the losses to the state's economy. Accordingly, we assume:

- There was a *loss of one week's output for two-thirds of the state's GDP*: Half the loss was restored in week two, and the other half in week three. Full output was restored by week four. Based on a real state GDP estimate in Q4 2012 of \$433.8 billion at an annual rate, a loss of one week's output for two-thirds of this number is \$5.56 billion, with subsequent losses of \$2.78 billion and \$1.39 billion in the next two weeks, for a total loss of \$9.72 billion over the three weeks. In current dollars this loss is \$11.66 billion in the fourth quarter of 2012. This loss includes the reduction of residential energy usage to zero for two-thirds of the state for 10 days.
- Payroll employees continued to be paid, but *contract, hourly, and self-employed workers were not paid* during the storm and its immediate aftermath. Thus, the income and employment losses were substantially less than the output loss.
- *User-tax losses* (sales, gas, and alcohol) *occurred immediately during the storm period*, but ended as people returned to work in early November 2012.
- The state's *tourism industry will have losses of \$950 million in Q3 2013*. These losses represent approximately 2.5 percent of the estimated \$38 billion annual tourism industry of the state. The losses will occur primarily in Monmouth and Ocean Counties.

Offsetting these negative impacts are the substantial response, repair, and reconstruction expenditures that began during the storm and will continue for several years to come. This analysis uses the \$29.4 billion estimate of damages of the storm prepared by the New Jersey Governor's

Office as a basis for the amount of expenditures by category of damage.⁶ These amounts are integrated, with adjustments, into the R/ECON™ model. *It is estimated that \$25.099 billion in repair and restoration expenditures of various types will occur over the period from Q4 2012 through Q3 2015.*

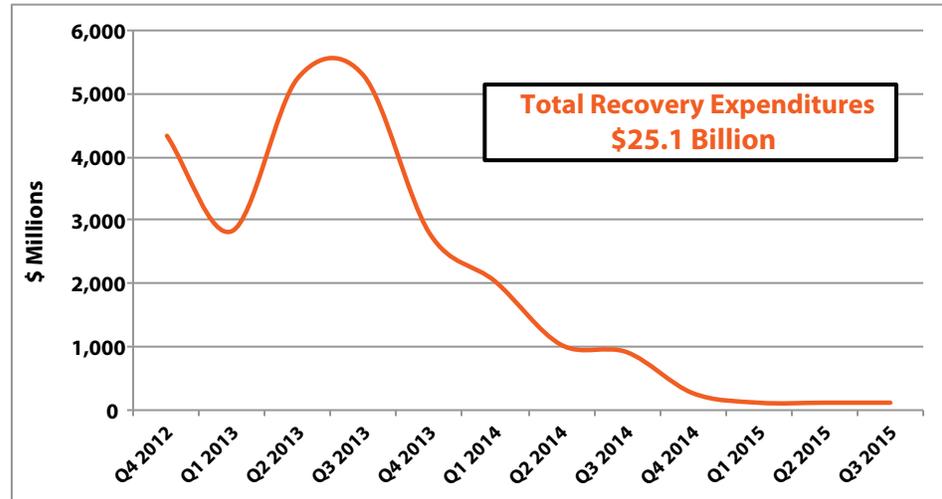
Figure 3 provides the distribution of these public and private expenditures by calendar quarter. The source of funds is a combination of resources from private insurance, FEMA, other federal assistance, and the State of New Jersey. These expenditures are entered in the appropriate sectors of the R/ECON™ model in the quarterly sequence given in table A in appendix 2 in order to simulate the impacts on the economy of the expenditures in response to the storm.

Note that expenditures are at a fairly high level in the immediate aftermath of the storm, as we assume significant outlays in the short term on emergency response, cleanup and repair for utilities and other critical infrastructure, as well as business spending on repair and inventory replacement, individual spending on homeowner repairs, outlays for short-term housing and other immediate needs, and public facilities (e.g., parks). The spending slows as construction projects are delayed through the winter months at the beginning of 2013, then picks up again in the second and third quarters as homeowners and businesses in the shore communities accelerate their repairs in preparation for the summer tourism season. Table A in appendix 2 provides a detailed description of these expenditures by category and gives the assumed timing of the spending for each category of expenditure.

It is most important to note that the estimates of impacts presented in the following section depend on these expenditures actually being made. If the funds for these restoration and related expenditures are not made available, the offsetting positive impacts to the economy will be significantly diminished. Further, any significant

6. See, "Christie Administration Releases Total Hurricane Damage Assessment of \$36.9 Billion" (Governor's Office, State of New Jersey, November 28, 2012). The \$36.9 billion total includes \$29.4 billion in damages from the storm and \$7.4 billion in future mitigation and prevention costs. However, the present analysis assumes that no expenditures will be made in this latter category.

FIGURE 3
Time Path of Repair and Recovery Expenditures, Q4 2012–Q3 2015



differences between the assumed (figure 3) and actual time paths of post-storm recovery spending will affect the timing of the economic impacts of the recovery.

SECTION 3. Economic and Fiscal Losses without Recovery Spending

The critical contribution of the restoration spending is manifested by using the R/ECON™ model to first simulate the impacts of the storm on the state's economy *assuming no rebuilding expenditures are made*. This assumption is clearly an extreme scenario, but it establishes a benchmark for comparisons of what the performance of the economy would be with and without significant reconstruction. The impacts of the storm are then compared with a baseline forecast for the state's economy.⁷

Table 2 provides these estimates. The largest negative impact occurs in Q4 2012. State GDP is nearly \$12 billion lower than in the baseline forecast. In addition, there are 7,300 fewer jobs and over \$1.1 billion less in personal income.⁸ These losses also result

7. The Baseline Scenario is from the October 2012 R/ECON™ forecast.

8. As the note to table 2 indicates, these are comparisons of Q4 estimates without reconstruction to the Q4 baseline estimates.

in reductions in state tax revenues of more than \$108 million.⁹ The negative impacts persist into the following three years with further, albeit smaller, declines in those years. State GDP is over \$2.8 billion below baseline in 2013 and over \$550 million below baseline in 2014. Even three years out from Hurricane Sandy, in 2015, state GDP is lower by \$325 million compared with the baseline forecast.¹⁰ Employment and personal income losses also continue, resulting in further losses in tax revenue. These continuing losses reflect—and the authors believe conservatively—the decline in the output and income of the damaged private and public capital stock and the negative wealth effect, as discussed in Section 2, on the taxonomy of the storm.

9. State tax revenues are estimated using historical relationships between total personal income and revenues from the gross income, sales, gasoline, alcohol, and cigarette taxes. Similarly, business tax revenues are estimated from historical relationships between state GDP and revenues from the corporate business tax and the corporate business tax for financial institutions. We also include actual year-over-year losses in casino tax revenues in Q4 2012 due to the closure of the casinos for a week during the storm, as reported by the State of New Jersey Department of Law and Safety, Division of Gaming Enforcement.

10. Again, as noted in table 2, these differences are annual average estimates with no reconstruction, compared with annual average baseline estimates.

TABLE 2
Economic and Fiscal Impacts of Hurricane Sandy without Reconstruction
— Damages Relative to Baseline Scenario —

Year ^a	State Gross Domestic Product (State GDP) (\$ millions)	Workplace Employment (thousands)	Personal Income (\$ millions)	State Tax Revenues (\$ millions)
Q4 2012	-11,879.0	-7.3	-1,186.2	-108.5
2013	-2,802.8	-8.8	-290.3	-24.3
2014	-554.5	-2.3	-7.5	-2.6
2015	-325.2	-0.9	-32.0	-2.7

Note: a. The differential between the baseline scenario and the alternative scenario that includes the impacts of the hurricane is shown for the fourth quarter of 2012. For subsequent years, the differential is between the averages of the four quarters of each year in the baseline and alternative scenarios.

Source: R/ECON™ model estimates, Rutgers, The State University of New Jersey. January 2013.

SECTION 4.

Net Economic and Fiscal Impacts

Given the amount and timing of both the negative damages and the offsetting positive expenditures assigned by sector in the R/ECON™ model, forecasts of the *net* impact on major New Jersey economic indicators were then estimated. These results appear in table 3 and are expressed as the change in each indicator in the given calendar year compared with the baseline (no storm) forecast of the R/ECON™ model. Thus, table 3 provides the impact estimates assuming all restoration expenses are made in the amount and order given in appendix 2.

The general pattern is as expected. Initially, in Q4 2012, the damages inflicted by the storm result in net negative effects on state GDP, employment, income, and tax revenues, though these losses are tempered by the spending on large-scale cleanup and repair efforts in Sandy's immediate aftermath. These losses are then offset (and, in fact, exceeded) by the net positive effects of expenditures for the ongoing rebuilding effort in the subsequent three years (2013–2015). It is also worth noting that while the highest full-year's expenditures occur in 2013 (figure 3), the positive impacts of these expenditures are somewhat muted by reductions in tourism spending in the summer of that year.

Thus, state GDP is \$7.1 billion (current dollars) lower in Q4 2012 relative to baseline. This decrease is significantly less than the \$11.9 billion in storm damages to output assumed for Q4 2012, as noted in Section 3. The significant reduction in the loss in output (\$4.8 billion) is attributable to the positive impacts of the rebuilding expenditures (estimated at \$4.3 billion in Q4 2012) and their subsequent multiplier effects that simultaneously occur in Q4 2012. Net positive increases in state GDP relative to baseline occur in each of the next three years as the offsetting gains from the restoration expenditures outweigh any lingering negative impacts of the storm. These increases in state GDP decline in magnitude over time: \$2.46 billion in 2013, \$1.69 billion in 2014, and \$0.71 billion in 2015.

Total payroll employment follows a similar pattern, with *net* losses of 4,200 jobs in Q4 2012 followed by gains in the next three years.¹¹ The largest employment increase occurs in 2014, with

11. The large-scale job losses associated with Hurricane Sandy reflected in the new unemployment claims in table 1 may be significantly offset by jobs created in construction and related industries participating in the immediate cleanup and repair efforts following the storm. Also, many of those involved in these initial claims returned to work in a few weeks as business operations resumed.

TABLE 3
Net Economic and Fiscal Impacts of Hurricane Sandy
— Damages Relative to Baseline Scenario —

Year ^a	State Gross Domestic Product (State GDP) (\$ millions)	Workplace Employment (thousands)	Personal Income (\$ millions)	State Tax Revenues (\$ millions)
Q4 2012	-7,053.9	-4.2	-1,031.2	-82.2
2013	2,455.3	2.0	302.8	22.7
2014	1,693.6	5.6	483.9	26.1
2015	712.3	4.9	440.5	20.5

Note: a. The differential between the baseline scenario and the alternative scenario that includes the impacts of the hurricane is shown for the fourth quarter of 2012. For subsequent years, the differential is between the averages of the four quarters of each year in the baseline and alternative scenarios.

Source: R/ECON™ model estimates, Rutgers, The State University of New Jersey. January 2013.

an employment level 5,600 jobs greater than in the baseline scenario due to the restoration work. Total personal income mirrors the employment pattern, with a net negative effect in Q4 2012 and a peak positive effect in 2014.

The result is a net tax revenue loss of \$82.2 million in Q4 2012, followed by positive differentials in the next three years of \$22.7 million (2013), \$26.1 million (2014), and \$20.5 million (2015).

The conclusion drawn from table 3 is that the storm's impacts on the state's economy over the period are relatively modest. The changes in table 3 are small given the size of the state's economy. *However, it is vital to repeat that these are net estimates.* They are the balance after the state's economy sustained very sizeable damages (\$29.4 billion by the Governor's Office estimate) and then, according to the assumptions of this analysis, had a nearly equivalent amount of expenditures to aid those immediately affected and to repair capital damages and restore business and public-sector operations.

Thus, the critical component is the provision of sufficient resources for the recovery expenditures.

This report's estimates indicate that the New Jersey economy will be significantly weakened if the restoration spending of \$25.1 billion does not occur—i.e., if the federal government and other sources do not provide these resources for the recovery.

Importantly, in no way does this analysis suggest that the storm was a small event for the economy of New Jersey even if the final economic outcome is that of the net effects estimated in table 3 (i.e., the outcome after the full \$25.1 billion of recovery expenditures is made). Hurricane Sandy has had profound and deep negative impacts on the state and its people. These effects continue in many forms.

The key point of this analysis is that the damages of the storm are real and have already been sustained. What has not yet been actualized is the acquisition of the full resources that are needed to provide the offsetting expenditures. *Only with the realization of these resources and their expenditure will the substantial negative economic and fiscal impacts of the storm be, as the analysis reported in table 3 indicates, neutralized over time.*

SECTION 5.

Caveats

The results in tables 2 and 3 were derived from a set of reasonable assumptions based on the best currently available data about damages and restoration spending. These assumptions and estimates were then applied in the large-scale, detailed, carefully constructed, and routinely updated R/ECON™ forecasting model of the New Jersey economy. They represent the authors' best estimates of the gross and net impacts of Hurricane Sandy over a four-year period in terms of several important macroeconomic activity measures of the state's economy. However, like all economic forecasts, the estimates are subject to uncertainties and exogenous influences. These caveats are discussed below.

First, there is uncertainty with respect to the baseline forecast, which depends on key long-term national factors such as population growth, changes in technology, productivity, and prices. Any systematic changes to these core drivers of the national economic forecast are likely to affect all states, including New Jersey. Thus, the baseline forecast, which is used to measure the impacts of the storm, could itself change, and change significantly over the next several years. Global and/or national economic crises (or beneficial shocks) that are now unapparent can occur quickly, with extensive impacts on the New Jersey economy.

A list of recent similar events that have occurred in the space of a just a decade suggests that this is not a remote possibility: terrorist attacks in 2001, the abrupt end of the technology boom, the wild ride of a housing boom and its subsequent free-fall bust, extensive financial-sector abuses and the Great Recession, public debt crises in the European Union, and the sweeping and still unfolding effects of new technologies for oil and gas extraction from shale. Thus, the baseline forecast, inevitably and always, rests on an uncertain and changing foundation.¹²

Second, there are additional uncertainties that accompany national economic policy actions or inactions that are more immediate. The complex and interrelated influences of federal and state tax policy decisions are an

12. This reality of significant changes in major underlying conditions leads to frequent updating of baseline forecasts in macroeconomic model analyses.

example. The long-playing fiscal gridlock in Washington, D.C., despite a last-hour agreement on taxes, will continue to unfold in 2013, with substantive potential effects on the national and state economies.

One aspect, regardless of when and how the many complex remaining federal fiscal issues with respect to expenditures and tax reform are resolved, may already have occurred, with important fiscal implications for New Jersey (and many other states). Namely, the inaction in nearly all of 2012 on the specifics of federal tax policy for 2013 may have significantly affected financial decisions. Large amounts of capital gains, dividends, bonuses, and other discretionary income may have been purposefully taken by taxpayers in 2012. New Jersey gross income tax revenues, which are highly sensitive to such income, may be increased for 2012 as a result, only to experience a relative decline in 2013. Thus, the state fiscal impact estimates from Hurricane Sandy calculated in this study may be obscured in the actual tax collections for both 2012 and 2013 as these strategic financial decisions play out over the next two years.

A third source of uncertainty lies in the estimates of the reconstruction expenditures of this analysis. Obviously, actual spending amounts that exceed or fall short of the assumptions contained here would affect the estimates of table 3. While the direction of the change in impacts is intuitive—e.g., lower-than-assumed levels of expenditures would result in lower gains in GDP, employment, income, and state taxes—the relation is not linear.¹³ In addition, changes in the assumed time sequence of spending would also affect the estimates.

Finally, the authors' assumptions about the storm damage to the economy affect the impacts reported in tables 2 and 3. While these were made with careful deliberation so as not to exaggerate or understate the storm's effects, alternative assumptions would produce different impacts.

13. For example, a 25 percent lower amount of actual spending on restoration compared with this study's assumed level of spending would not necessarily lead to 25 percent lower economic impacts. This is due to the complex interactions and interdependencies in the R/ECON™ model. The impacts could exceed, equal, or be less than 25 percent.

SECTION 6. Summary and Conclusion

This report estimates that Hurricane Sandy inflicted substantial damages on the New Jersey economy. These damages are concentrated in the final quarter of 2012, but their effects continue into 2013 and beyond. However, the sizable flow of restoration expenditures reduces the net damages in 2012 and leads to net increases in economic activity in subsequent years. There is a considerable boost to employment throughout the entire period, and state taxes rebound after experiencing an initial decline at the end of 2012.

While the estimated impacts are carefully and objectively made using the detailed R/ECON™ forecasting model, they are subject to a number of uncertainties. These include changes to the baseline forecast, complex strategic tax decisions caused by uncertain federal fiscal policy, and the level and timing of the study's assumptions about both damages and restoration expenditures.

The estimates show a net positive impact on macroeconomic variables of the state's economy in 2013, 2014, and 2015, following heavy losses to the state economy in the final quarter of 2012. However, in no way do the study's findings imply that New Jersey will benefit from the storm. The death and destruction it inflicted on the state

created enormous pain, trauma, and loss for so many. Moreover, some expenses incurred by households in the wake of the storm are unlikely to be reimbursed by sources outside of the state. This means a lesser amount of private, in-state funds is likely to be available for investment or spending in New Jersey. Wise and effective prevention and adaptation policies are vital to ensure that the deadly and disruptive effects of such natural events, with all their attendant human costs, are minimized in the future.

Finally, as noted previously, this analysis estimates that the storm will, in the end, have relatively modest *net* impacts on the macroeconomic performance of the state's economy. This conclusion is critically dependent on having the full resources estimated (\$25.1 billion) to repair the storm's extensive damages allocated. Without those resources, the state's economy will have been significantly weakened and undermined. ■

The authors thank David Rosen and Charles Steindel for insightful comments on an earlier draft of this report and Arlene Pashman for impeccable editorial and production support. The views expressed here are those of the authors.

Appendix 1

R/ECON™ Forecasting Model

This quarterly model forecasts New Jersey's economy for each of the state's labor market areas for up to 20 years into the future. It is a quarterly structural econometric time-series model that consists of more than 250 equations that estimate, among other things:

- State gross domestic product (state GDP), employment, prices, and wage rates for major industries
- Personal income and its components
- Inflation
- Population, labor force, and unemployment
- Housing and commercial building permits
- Motor vehicle registrations
- Local and state tax revenues
- Energy prices and energy consumption

The model forecasts are used by several state-based clients, among them PSE&G and the Department of Treasury, State of New Jersey. Semiannual forecast conferences take place at the Edward J. Bloustein School of Planning and Public Policy at New Brunswick's Civic Square Building in April and October.

Appendix 2

Distribution of Post-Sandy Recovery Expenditures, by Category

Table A provides a detailed description of recovery expenditures by category and gives the assumed timing of the spending for each category of expenditure.

The first column gives the general category of damage/expenditure.

The second column lists the authors' assessment of the nature of each of the several categories of damages/expenditure.

The third column is the study's estimate of the amount of restoration expenditures that will occur by category and the percentage that this represents of the Governor's Office estimate of damages in that category.

The final column gives the distribution of these expenditures by calendar quarter.

TABLE A
Distribution of Post-Sandy Recovery Expenditures

Damage/ Expenditure Category	Nature of Expenditure	Amount of Expenditure (\$ millions)	Percentage of Damages Covered (%)	Distribution of Expenditures (%)
Government Response and Repair	Immediate evacuation and policing	529.4	100	100% in Q4 2012
Individual Assistance	Immediate assistance for food and shelter	702.7	100	100% in Q4 2012
Housing	Loss of home and property	3,690.9	75	11% in Q4 2012 11% in Q1 2013 17% in Q2 2013 29% in Q3 2013 14% in Q4 2013 8% in Q1 2014 5% in Q2 2014 5% in Q3 2014
Business	Loss of office, inventory, and other property	6,239.3	75	11% in Q4 2012 11% in Q1 2013 17% in Q2 2013 29% in Q3 2013 14% in Q4 2013 8% in Q1 2014 5% in Q2 2014 5% in Q3 2014
Health	Emergency health care	291.8	100	100% in Q4 2012
Schools	Property damage	2.6	100	50% in Q4 2012 50% in Q1 2013
Transit, Roads, and Bridges	Cleanup, Repair, Rebuilding	1,351.0	100	11% in Q4 2012 4% in Q1 2013 4% in Q2 2013 19% in Q3 2013 16% in Q4 2013 11% in Q1 2014 10% in Q2 2014 5% in Q3 2014 5% in Q4 2014 5% in Q1 2015 5% in Q2 2015 5% in Q3 2015
Parks and Environment	Cleanup, Repair, Rebuilding	5,526.5	100	7% in Q4 2012 18% in Q1 2013 42% in Q2 2013 18% in Q3 2013 7% in Q4 2013 8% in Q1 2014
Water, Waste, and Sewer	Cleanup, Repair, Rebuilding	3,012.7	100	11% in Q4 2012 4% in Q1 2013 13% in Q2 2013 19% in Q3 2013 16% in Q4 2013 12% in Q1 2014 10% in Q2 2014 10% in Q3 2014 5% in Q4 2014
Government Operating Revenue	Loss in revenues	—	0	—

TABLE A (CONTINUED)
Distribution of Post-Sandy Recovery Expenditures

Damage/ Expenditure Category	Nature of Expenditure	Amount of Expenditure (\$ millions)	Percentage of Damages Covered (%)	Distribution of Expenditures (%)
Other Local Government Revenues and Road	Loss in revenues and need for road repair	641.6	87	18% in Q4 2012 18% in Q1 2013 42% in Q2 2013 7% in Q3 2013 7% in Q4 2013 8% in Q1 2014
Other Local Education	Loss in revenues	—	0	—
Atlantic City/Casino Reinvestment Development Authority (CRDA)	Cleanup, Repair, Rebuilding	312.7	100	18% in Q4 2012 18% in Q1 2013 42% in Q2 2013 7% in Q3 2013 7% in Q4 2013 8% in Q1 2014
Port Authority of New York and New Jersey	Cleanup, Repair, Rebuilding	1,000.0	100	11% in Q4 2012 4% in Q1 2013 4% in Q2 2013 19% in Q3 2013 16% in Q4 2013 11% in Q1 2014 10% in Q2 2014 5% in Q3 2014 5% in Q4 2014 5% in Q1 2015 5% in Q2 2015 5% in Q3 2015
Utilities — Gas and Electric	Cleanup, Repair, Rebuilding	1,797.3	100	35% in Q4 2012 18% in Q1 2013 21% in Q2 2013 15% in Q3 2013 7% in Q4 2013 4% in Q1 2014
TOTAL EXPENDITURES ALLOCATED		\$25,098.5		

Source: R/ECON™ model estimates, Rutgers, The State University of New Jersey. January 2013.

The **Edward J. Bloustein School of Planning and Public Policy** is one of the nation's key centers for the theory and practice of planning and public policy scholarship and analysis. The school was established in 1992 by the Rutgers University Board of Governors to provide a focus for all of Rutgers' initiatives and programs of instruction, research, and service in planning and public policy. The Bloustein School was ranked No. 3 in the United States in the latest survey of the nation's top graduate programs in urban planning by Planetizen, a Los Angeles-based planning and development network.

A Bloustein School Twentieth Anniversary Celebration

March 2012 marked the twentieth anniversary of the establishment of the Edward J. Bloustein School of Planning and Public Policy. A series of events from fall 2011 through spring 2012 commemorated this achievement. Festivities included presentations on Bloustein School faculty and staff research, several major lectures, and a two-day symposium on healthy cities, health policy, transportation security, and international planning. Events highlighted the best of the school's work in urban planning, public policy, and public health. They began in September 2011 with the construction of the Rutgers and NJIT completely solar-powered ENJOY house on the Washington Mall in the District of Columbia as part of the U.S. Department of Energy's Solar Decathlon and culminated in a two-day symposium on April 26 and 27, 2012.

For additional information about the Bloustein School, its academic programs, upcoming events, and affiliated research centers, visit the school's website: <http://www.policy.rutgers.edu>. ■

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Edited by

James W. Hughes, Dean
Edward J. Bloustein School of Planning and Public Policy
and
Joseph J. Seneca, University Professor
Rutgers, The State University of New Jersey