UMASS DONAHUE INSTITUTE

The Economic Impacts of Sequestration on the Massachusetts Economy

Prepared on behalf of the Massachusetts Executive Office for Administration and Finance (ANF), MassDevelopment, and the Massachusetts Life Sciences Center at the request of the ANF Sequestration Task Force

Prepared by

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The objective of this analysis was to provide a highly customized economic analysis of the near-term effects of sequestration in FFYs 2013 and 2014 in Massachusetts (note that this study covers the initially anticipated budget cuts of FFY 2014, not those that result from the new budget agreement passed in December 2013 which lowered the FFY 2014 budget cuts significantly). The analysis presented in this report carefully takes into account:

- The full-range of federal spending cuts that impact Massachusetts, which are estimated to total over $1.3 billion in FFY 2013.
- The mandated spending cuts for defense and non-defense categories of government expenditures, with larger percentage cuts to non-exempt defense activities.
- Federal spending that is directed and distributed through and to state agencies, along with the myriad of grants and contracts that are obtained by public, private and non-profit organizations.
- Estimates and assumptions about how much of the mandated spending cuts actually are impacting Massachusetts in FFYs 2013 and 2014 as government agencies and organizations attempt to minimize or the delay the effects.
- Impacts, as estimated and reported, reflect lost economic activity – both directly in terms of reduced spending and dollars to Massachusetts, and indirectly in terms of the multiplier effects to the broader economy. Thus, impacts reflect both "losses" (e.g., layoffs) and economic growth or jobs not added (e.g., hiring freezes).

Massachusetts, with its reliance on federal research and defense procurement spending, has a substantial exposure to the types of federal programs that are most adversely affected by the sequestration. Although sequestration impacts all states in the US, the industrial mix of Massachusetts suggests that the cuts could result in particularly large effects related to defense contractors, health care, and life sciences research & development among other industries.[1]

In 2012, Massachusetts received $11.3 billion in Department of Defense (DoD) contracts, ranking 10th among the states. On a per capita basis, Massachusetts receives about 50 percent more defense procurement dollars than the national average. Massachusetts' advantages are even more pronounced on the research funding side. In the same year, Massachusetts attracted $2.5 billion in National Institutes of Health (NIH) grants, only surpassed by the much larger state of California, and an additional $500 million

[1] For example, see <http://www.epi.org/publication/ib363-sequestration-and-state-budgets/>

in National Science Foundation (NSF) grants. In per capita terms, Massachusetts brought in five times more NIH and three times more NSF dollars, respectively, than the national average.

Economic Impact Findings. The federal funding cuts from the sequestration are and will continue to reverberate through the Massachusetts economy and generate impacts beyond the immediate loss of federal funding. To estimate these impacts, as described further in the report, the UMass Donahue Institute (UMDI) conducted a detailed, highly customized analysis of the *direct* spending reductions due to sequestration in Massachusetts[2], and an economic impact analysis that allocated direct spending impacts to industry activity (public, non-profit and private sectors) to quantify the direct and *total* employment, labor income, value added, business output and state tax revenue effects in FFYs 2013 and 2014 This study also applies a low-medium-high range of scenarios to reflect some of the uncertainty about the actual reduction in grant and contract funding and related activity. As explained by a wide range of stakeholders, there are a number of reasons why and how the full effects are not experienced instantaneously (e.g., pre-existing multi-year contracts or grants may not have been affected, but future funding opportunities are impacted).

Key findings and estimates about the direct spending and economic impact implications of sequestration to Massachusetts include:

- The reduction in federal funding flowing to Massachusetts in FFY 2013 is estimated to be $1.3 billion, with a low-high range of $1 billion to $1.6 billion. This represents approximately a 2.3 percent reduction in all federal funding to the Commonwealth.
- The direct spending impact in FFY 2014 is estimated to increase to nearly $2.0 billion as the mandated percentage cuts increase and agencies/organizations have less room to minimize the effects of a new reality of lower federal funding.
- The largest categories of federal funding reductions were identified as: defense contractors, a wide range of non-defense research grants (e.g., National Institutes of Health), a myriad of state agency reductions, reductions in Medicare reimbursements, and military base operations.
- The cuts in federal spending due to the sequestration are having and will continue to have tangible impacts on the Massachusetts economy. Based on the economic impact analysis conducted for this study, the employment impact of the sequestration on the Commonwealth was 14,125 jobs in FFY 2013, increasing to 20,875 jobs in FFY 2014. These jobs can represent actual losses, layoffs or reductions in force as well as growth or jobs not added. For context, the state typically adds between 10,000 to 55,000 jobs per year, so any job impact over 10,000 is of significant concern.
- Based on the low-high ranges for federal funding reductions, the total jobs impact is estimated to be between 11,085 to 17,365 jobs in FFY 2013, and between 17,105 to 24,660 in FFY 2014.
- The sequestration's impact on Massachusetts' economic output is estimated to be about $2.2 billion in FFY 2013 and is expected to grow to over $3.2 billion in FFY 2014. The impact on Gross State Product is estimated to be over 0.3 percent in FFY 2013 and 0.5 percent in FFY 2014.
- The sequestration's jobs impacts on Massachusetts industries are greatest in Public Administration and Professional and Business Services, the sector that includes scientific research and engineering services – notable economic strengths in the Commonwealth.

[2] Most other studies conducted to date on the economic impacts of sequestration have applied a higher-level, more aggregate approach to changes in government spending, and for the most part have not adjusted for the multitude of ways that agencies, organizations and contractors have been able to mitigate the full near-term effects in 2013 and 2014. As a result, the findings of this study tend to provide lower impacts to employment and are difficult to compare directly to other purely macroeconomic modeling studies.

- The sequestration's output impacts on industries are most significant on Professional and Business Services and Manufacturing, a Massachusetts' industry with strong links to military procurement. Due to its capital intensity, impacts on manufacturing are better measured by output than jobs.
- While most individual government programs on a percentage basis are not largely impacted, when all of the sequestration cuts are added up, it is having a fairly significant impact. Massachusetts, during periods of economic expansion and recovery, can frequently add 40,000 to 55,000 jobs per year. In FFY 2013, the first year of the sequestration, Massachusetts growth has slowed from where it should be at this stage of the economic cycle following a steep recession. As Massachusetts and the nation strive to recover from the Great Recession, the sequestration is restraining and limiting economic growth.

Note on the December 2013 Bipartisan Budget Agreement. The values covered in this report are for the impacts initially anticipated for FFY 2014. However, the new budget agreement passed by the U.S. Congress in December 2013 lowered the FFY 2014 budget cuts significantly, offering something of a reprieve. The direct spending impact in Massachusetts, based on this new budget, declines from $2.0 billion to an estimated $1.2 billion for FFY 2014, an improvement compared to the original plan but still an expected drag to the Massachusetts economy. Based on the new budget agreement, the impacts on the Commonwealth were revised downward from the original FFY 2014 analysis. With the new agreement, the sequestration's jobs impact is now estimated at 12,607 compared to almost 21,000 in the original analysis. Similarly, the impact on Massachusetts' output and gross state product will not be as pronounced in FFY 2014 as it would have been without the agreement. The budget agreement, however, does not change the longer-term (2016 and beyond) Budget Control Act so it is a temporary fix and the longer-term concerns about sequestration are still relevant.

Although it is beyond the scope of this study, the analysis suggests that while every state will be negatively impacted by the federal budget cuts, Massachusetts will likely be hurt far more than most. This is because the state's universities and high tech companies have had disproportionate success in winning contracts over the years from agencies such as DoD, NIH and NSF that are directly affected by the sequestration. In addition, the federal grants awarded to Massachusetts universities and high tech companies have helped fuel the growth of the state's innovation economy. With a major reduction in the economic stimulus provided by these grants – a kind of "seed corn" for the innovation economy – our prospects for future economic growth are seriously threatened. Massachusetts witnessed the beginnings of serious effects from the federal spending cutbacks in FFY 2013 and the research findings indicate that they may become demonstrably worse in coming years.

Introduction

This report was prepared by the Economic and Public Policy Research (EPPR) group at the UMass Donahue Institute (UMDI) for the Massachusetts Executive Office for Administration and Finance, MassDevelopment and the Massachusetts Life Sciences Center.

Sequestration – Why It Matters to Massachusetts

The mandated federal spending cuts known as sequestration were part of a negotiated compromise to raise the federal debt ceiling in 2011. Included in the Budget Control Act of 2011, its intent was to act as a poison pill to push lawmakers to pass a compromise that would result in savings of $1.5 trillion over 10 years. That compromise never came to pass, and the sequestration was set to begin on January 2, 2013. The American Taxpayer Relief Act of 2012 delayed the budget sequestration for two months and moderated the planned cuts in federal spending. The sequestration, as enacted on March 1, 2013, reduced federal spending in the 2013 federal fiscal year (FFY) by $85 billion and by a total of $1.2 trillion over 10 years. The federal government will spend about $3.55 trillion in its 2013 fiscal year, so $85 billion amounts to about 2.4 percent of all federal spending.

While the reduction in federal spending, 2.4 percent, may seem relatively small, large parts of the federal budget are exempt from the sequester cuts including such "mandatory" programs as Medicaid, Social Security, welfare, and food stamps. Other major exemptions included the Highway Trust Fund and active (uniformed) military personnel. Due to these substantial exemptions, remaining programs must absorb the effects of the sequestration. The sequestration cuts are evenly split between defense and nondefense spending. They include cuts to discretionary defense spending (including weapons purchases and base operations, but not military personnel) and to both discretionary and nondiscretionary domestic programs – everything from research grants to education aid (often referred to as "across the board" cuts). The sequester cuts to these programs will be much deeper than the overall 2.4 percent cut in federal spending. The mandated cuts by category are shown in Table 1.

Table 1. Mandated Cuts for Non-Defense and Defense Spending, FFYs 2013 and 2014

Type and Category of Spending	Percentage Cut in FFY 2013	Percentage Cut in FFY 2014
Non-Defense Discretionary	5.0%	0.0%
Non-Defense Mandatory	5.1%	7.2%
Defense Discretionary	7.8%	0.0%
Defense Mandatory	7.9%	9.8%
Medicare	2.0%	2.0%

Sources: These reductions originate directly from the Office of Management and Budget's budget guidance reports on sequestration for FFY 2013

Massachusetts, with its reliance on federal research and defense procurement spending, has a substantial exposure to the types of federal programs that are most adversely affected by the sequestration. Although sequestration impacts all states in the US, the industrial mix of Massachusetts suggests that the cuts could

result in particularly large effects related to defense contractors, health care, and life sciences research & development among other industries.

Defense procurement and federal research cut to the core of Massachusetts' economic strengths. Although the state ranks only 14th in population size, it possesses a disproportionately large defense industry and an even larger (on a relative basis) research foundation. Defense and research are cornerstones of the state's $400 billion economy with research, in particular, helping Massachusetts to weather the recent recession better than most other states. Medical-related research, much of it funded by National Institutes of Health (NIH) grants, has fostered the development, testing, and commercialization of new drugs that have made Massachusetts the recognized world leader in life sciences, a position the state expects to strengthen going into the future.

In 2012, Massachusetts received $11.3 billion in Department of Defense contracts, ranking 10th among the states. On a per capita basis, Massachusetts receives about 50 percent more defense procurement dollars than the national average. Massachusetts' advantages are even more pronounced on the research funding side. In the same year, Massachusetts attracted $2.5 billion in NIH grants, only surpassed by the much larger state of California, and an additional $500 million in National Science Foundation (NSF) grants. In per capita terms, Massachusetts brought in five times more NIH and three times more NSF dollars, respectively, than the national average. These grants go primarily to universities and hospitals as well as to a number of the state's renowned non-profit research organizations. In sum, both defense procurement (much of that directed to aerospace, robotics, and navigation technologies) and federal research funding are key drivers for the Massachusetts innovation economy.

With an economy that is disproportionately reliant on federal research and defense spending, the sequestration represents a real threat to the long-term growth and competitiveness of Massachusetts. The sequestration does not apply to the entirety of the federal budget, but rather targets discretionary defense spending and the types of domestic spending (e.g., research) on which Massachusetts depends for jobs and growth. The sequestration has already been in effect for nine months (since March 2013) and it now appears likely to continue at least through FFY 2014. Barring an agreement in Washington, D.C. to commit to a long-term budget, the sequestration may continue indefinitely and the recent deal to end the government shutdown maintains the spending caps in future years that determine the size of sequestration spending cuts.

Due to this threat and Massachusetts' exposure to the types of cuts emphasized in the sequestration, this report seeks to lay out the ramifications of the sequestration on the Massachusetts economy. This includes quantifiable estimates of the impacts of the sequestration as well as descriptions of how the federal spending cuts reverberate through critical sectors of the Massachusetts economy, including life sciences, potentially curtailing economic opportunity and the state's long-term growth prospects. Thus, the objective of this analysis was to provide a highly customized economic analysis of the near-term effects of sequestration in FFYs 2013 and 2014 in Massachusetts. The analysis presented in this report carefully takes into account:

- The full-range of federal spending cuts that impact Massachusetts, which are estimated to total over $1.3 billion in FFY 2013.
- The mandated spending cuts for defense and non-defense categories of government expenditures, with larger percentage cuts to non-exempt defense activities (e.g., base operations, civilian employees).
- Federal spending that is directed and distributed through and to state agencies, along with the myriad of grants and contracts that are obtained by public, private and non-profit organizations.

- Estimates and assumptions about how much of the mandated spending cuts actually are impacting Massachusetts in FFYs 2013 and 2014 as government agencies and organizations attempt to minimize or the delay the effects.
- Impacts, as estimated and reported, reflect lost economic activity – both directly in terms of reduced spending and dollars to Massachusetts, and indirectly in terms of the multiplier effects to the broader economy. Thus, impacts reflect both "losses" (e.g., layoffs) and economic growth or jobs not added (e.g., hiring freezes).

The general research approach was to understand and estimate:

1. The actual, enacted sequestration spending cuts and exemptions – program by program;
2. Obtain data on the most recent federal fiscal year (2012) with a complete year of data to establish a baseline of federal spending in Massachusetts across all categories of federal spending;
3. Apply the sequestration spending cuts (in percentage terms) to non-exempt categories of spending, informed by a wide range of research and interviews about the likely actual spending cut implication in FFYs 2013 and 2014;
4. Translate and categorize the estimated spending cuts into input variables for use in an economic impact model of Massachusetts; and
5. Run the impact model to generate estimates of total economic and tax revenue impacts on Massachusetts.

Of note, this study does not estimate economic impacts of sequestration in Massachusetts beyond FFY 2014, however, there is considerable debate about the likely impacts in future years. On the one hand, if sequestration-level spending cuts (i.e., mandated caps on spending) are maintained over a number of years, this could contribute to lower future deficits and debt accumulation. And in some cases, contractors and grantees that currently rely heavily on federal contracts could diversify their portfolio of work to other customers (international, private, foundations). On the other hand, the reduced funding levels are currently expected to be maintained resulting in a new, lower federal funding reality for Massachusetts and the rest of the country. As these cuts are sustained, it will result in actual dollar flows to Massachusetts that are reduced indefinitely with little to no ability to avoid the full reduction of the cuts, and this could result in not only less funding but broader spillover effects that impact our innovation economy that is so closely connected to federally-funded research (e.g., less funding for scientific research). Concerns like these are being raised by stakeholders in the Commonwealth's leading universities, life science and hospital industry associations, defense contracting and other key sectors, with even greater trepidation of the potential negative impacts five to ten years from now than in the current timeframe.

The remainder of this report provides greater detail on our estimates and assumptions about direct sequestration spending cuts, how those cuts are impacting Massachusetts, and our estimates of the total economic impacts to the Commonwealth in terms of jobs, value added (gross state product), labor income, business output (sales), and state tax revenue. It also includes a section that provides greater detail on how sequestration has and is projected to impact scientific research and defense contracting in Massachusetts, along with an Appendix of various data sources, reference materials, and sources of information.

Estimates of the Sequestration Spending Cuts in Massachusetts

This section of the report details the estimates of federal spending cuts that impact the Massachusetts economy in FFYs 2013 and 2014. First, we present estimates and assumptions about how much of the mandated sequestration cuts actually impact Massachusetts agencies, organizations and contractors during this time period, and then we translate those reduction factors into estimated dollars of funding lost due to sequestration.

Sequestration Reduction Factors

The sequestration cuts are evenly split between defense and domestic ("non-defense") programs, with half affecting "defense discretionary" spending (weapons procurement, base operations, etc.) and the rest affecting both "mandatory" (generally means regular payouts) and "discretionary" (e.g., research grants, NASA, public housing, FBI, Head Start, etc.) domestic spending. The White House's Office of Management and Budget (OMB) has prescribed the percentage cuts (reduction factors) to federal programs that are not exempt from the sequestration. Major exempt programs include Social Security, Medicaid, veterans' benefits, and food stamps. Other important exemptions were active military personnel ("uniformed") and the Highway Trust Fund, meaning that a large share of transportation funding was not included in the sequestration. Non-exempt programs must reduce their budgets according to the percentage cuts set by the OMB, with the corollary that more exemptions in some areas, results in larger percentage cuts in the non-exempt programs

For this study, the OMB cuts are shown (see Table 2) but to ensure greater accuracy of the actual economic impacts affecting Massachusetts in FFYs 2013 and 2014, UMDI estimated percentage cuts that the affected programs are more likely to have experienced. These cuts were applied to affected programs to develop an estimate of the direct spending cuts affecting Massachusetts. The reasoning and the methods applied by UMDI for making adjustments to the OMB cuts will be explained in this section.

Table 2. Office of Management and Budget, Sequestration Reduction Factors for Non-Exempt Programs, FFYs 2013 and 2014

Type and Category of Spending	Percentage Cut in FFY 2013	Percentage Cut in FFY 2014
Non-Defense Discretionary	5.0%	0.0%
Non-Defense Mandatory	5.1%	7.2%
Defense Discretionary	7.8%	0.0%
Defense Mandatory	7.9%	9.8%
Medicare	2.0%	2.0%

Sources: These reductions originate directly from the Office of Management and Budget's budget guidance reports on sequestration for FY2013 <http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy13ombjcsequestrationreport.pdf> and FY2014 <http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy14_preview_and_joint_committee_reductions_reports_05202013.pdf>

According to the OMB and shown in Table 2, the required sequestration percentage cuts for FFY 2013 would be a 5.0 percent reduction for non-defense discretionary funding, 5.1 percent reduction for non-defense mandatory funding, 7.8 percent reduction for defense discretionary funding, 7.9 percent reduction for mandatory defense funding, and 2.0 percent reduction for Medicare.[3] The American Taxpayer Relief Act (ATRA) had two effects related to sequestration. First, sequestration in FFY 2013 began on March 1 instead of January 1, which is its effective start date for fiscal years from 2014-2021. Second, the ATRA lowered the originally anticipated spending cuts in 2013 by $24 billion[4] and the sequestration percent reductions compared with future years should the sequestration continue. For FFY 2014, the OMB's required sequestration reductions were 9.8 percent for non-exempt defense mandatory funding, 7.2 percent for non-exempt non-defense mandatory funding and 2.0 percent for Medicare.[5]

Federal departments and agencies have the ability to shift funds within and between budget accounts thereby minimizing the entire impact of the sequestration reduction on their mission, programs, projects, and activities. Known as *reprogramming* and *transfer authority*, respectively, these mechanisms allow departments to exercise a degree of flexibility in how to allocate the sequestration cuts.[6] Moreover, federal contract and grant awards (e.g., Department of Defense procurement and NIH research grants) often extend beyond a single fiscal year and so even if the obligated funding amount is awarded in one fiscal year it may not be spent in whole or in part until subsequent fiscal years.[7]

For example, although the mandated cut for discretionary defense spending in FFY 2013 was 7.8 percent, actual defense activity (e.g., in procurement) in FFY 2013 is based on committed funds from previous years. The Center for Strategic Budgetary Assessments estimates the actual declines in defense spending due to the sequestration to be 4.4 percent for a combination of procurement and research, development, testing, and evaluation (RDT&E) and 6.6 percent for military operations in 2013.[8] These reduction factors were applied to the analysis to better reflect actual impacts encountered so far. Similarly, research spending in Massachusetts has not yet borne the full brunt of the sequestration due to funding commitments made in earlier years. This is not to minimize the effects of the sequestration as contracts and grants not released (or reduced) in 2013 will be more sharply felt in future years. In order to capture the insulating effects of shifting funds and observed time lags from budget authority to outlays, the UMDI research team recognizes that the economy will not immediately experience the effects of the full OMB sequestration reduction amounts and thus estimated the sequestration impacts for FFYs 2013 and 2014 based on adjusted sequestration cuts (see Table 3).

[3] Executive Office of the President - Office of Management and Budget. (2013, March 1). OMB Report to the Congress on the Joint Committee Sequestration for Fiscal Year 2013. Washington, D.C. Retrieved September 2013 , from http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy13ombjcsequestrationreport.pdf

[4] It also lowered the statutory limits in 2013 and 2014: http://www.cfr.org/united-states/crs-american-taxpayer-relief-act-2012-modifications-budget-enforcement-procedures-budget-control-act/p30034

[5] Executive Office of the President - Office of Management and Budget. (2013, May 20). OMB Sequestration Preview Report to the President and Congress for Fiscal Year 2014 and OMB Report to the Congress on the Joint Committee Reductions for Fiscal Year 2014. Washington, D.C. Retrieved September 2013, from http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy14_preview_and_joint_committee_reductions_reports_05202013.pdf

[6] Akabas, S. (n.d.). The Sequester: Mechanics and Impact. Bipartisan Policy Center. http://bipartisanpolicy.org/sites/default/files/The%20Sequester-%20Mechanics%20and%20Impact.pdf

[7] Harrison, T. (August 2012). Analysis of the FY2013 Defense Budget and Sequestration, *Center for Strategic and Budgetary Assessments*, 1-18.

[8] Center for Strategic and Budgetary Assessments, "Analysis of the FY 2013 Defense Budget and Sequestration", August 2012.

Table 3. Sequestration Reduction Factors, Low, Medium and High Estimates, FFYs 2013 and 2014

	Sequestration Reduction Factors					
		2013			2014	
Type of Reduction	Low Estimate	Medium Estimate	High Estimate	Low Estimate	Medium Estimate	High Estimate
Non-Defense Discretionary Programs	-3.0%	**-4.0%**	-5.0%	-5.0%	**-6.0%**	-7.0%
Non-Defense Mandatory Programs	-3.0%	**-4.0%**	-5.0%	-5.0%	**-6.0%**	-7.0%
Defense Contracts and Grants	-2.5%	**-4.4%**	-6.5%	-5.0%	**-7.0%**	-9.0%
Military Base Operations	-6.6%	**-6.6%**	-6.6%	-8.0%	**-8.0%**	-8.0%
Medicare	-2.0%	**-2.0%**	-2.0%	-2.0%	**-2.0%**	-2.0%
Furlough Days	-6	**-6**	-6	-6	**-10**	-14

Sources: These estimates are based upon the Office of Management and Budget's budget guidance reports on sequestration for FFY 2013 <http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy13ombjcsequestrationreport.pdf> and FFY 2014 <http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy14_preview_and_joint_committee_reductions_reports_05202013.pdf>

In order to reflect a level of uncertainty about the actual spending adjustments due to the sequestration cuts, the UMDI research team developed low, middle, and high estimates based upon informed assumptions. These were used to develop a range of possible impacts of the sequestration on Massachusetts. The middle estimate is considered to represent the effects most likely experienced by Massachusetts in FFYs 2013 and 2014. The middle estimate assumes a 4.0 percent reduction for non-defense mandatory and discretionary programs, 4.4 percent reduction for defense contracts and grants, and a 6.6 percent reduction at military bases. For 2013, our low estimate assumes that non-defense mandatory and discretionary programs will experience a reduction of 3.0 percent while military base operations and defense contracts and grants will experience a 6.6 percent and 2.5 percent reduction, respectively. The high estimate assumes a 5.0 percent reduction for non-defense mandatory and discretionary programs, which is nearly identical to the actual percentage reductions for those categories as prescribed by the OMB. This estimate also assumes that defense contracts and grants will have a 6.5 percent cut and military base operations will have a 6.6 percent cut. In 2013, federal employees affected by the sequestration were required to take unpaid time off and thus go on furlough for a number of workdays. The 2013 federal fiscal year ended on October 31 so the number of furlough days for FFY 2013 is known (six) and thus did not have to be estimated. Thus the number of furlough days applied to the analysis is six for the low, medium, and high estimates.

The reduction factors for FFY 2014 represent an escalation over those used in the analysis for FFY 2013 for two reasons. First, the estimates for 2014 incorporate the increased sequestration cuts that the OMB requires and assumes that in light of the unpredictable nature of congressional talks on the budget, discretionary spending will also have to undergo reductions in FFY 2014 (as of this writing, the OMB has not yet prescribed cuts in discretionary spending for FFY 2014 but they are now expected given the current impasse on budget negotiations). Second, the escalation in the 2014 spending cuts also reflects that some impacts of spending reductions (e.g., in defense procurement and research grants) that took place in 2013 will become tangible in 2014, and defense contractors, research organizations, and public agencies will have progressively less flexibility to absorb the sequestration cuts in 2014 (and beyond) than they did in 2013. The middle estimate (the most probable representation of the sequester cuts) assumes a 6.0 percent cut for non-defense mandatory and discretionary programs, a 7.0 percent cut for defense contracts and grants, and an 8.0 percent cut for military base operations. Our low estimate involves a 5.0 percent cut for non-defense mandatory and discretionary programs as well as defense contracts and grants. Military base operations are assumed to face an 8.0 percent cut. Similar to its 2013 counterpart, the high estimate for 2014 is closest in value to the actual percentage cuts required by the OMB. Thus non-defense mandatory and discretionary programs are assumed to have a 7.0 percent reduction, defense contracts and grants are expected to have a 9.0 percent cut and military base operations have an 8.0 percent cut in the high estimate

scenario. Since sequestration-related furloughs are not yet known for 2014, the low, middle and high estimates assume 6, 10, and 14 furlough days, respectively.

Direct Spending Impacts

By applying the reduction factors just described, federal funding was reduced in relation to the baseline funding observed in FFY 2012 for the agencies, programs, contracts, and grants affected by the sequestration. Table 4 shows the federal funding cuts associated with the middle estimate reduction factors. The spending cuts are divided into two categories, defense and non-defense, consistent with the parameters established by the sequester to apply half of the cuts to defense and half to non-defense discretionary spending. In total, the funding reductions amount to an estimated $1.32 billion in FFY 2013 and grow to an estimated $1.96 billion in FFY 2014. For context, this amounts to 2.3 percent and 3.4 percent cuts in total federal funding in Massachusetts for FFYs 2013 and 2014, respectively.

Table 4. Sequestration Direct Impact Summary (Medium Estimate), FFYs 2013 and 2014

Category of Federal Funding	FFY 2013	FFY 2014
Non-Defense	**-$711**	**-$1,025**
Federal Grants to State Agencies	-$124	-$189
Non-Defense Discretionary Programs	-$117	-$177
Non-Defense Mandatory Programs	-$7	-$12
Medicare Reimbursed to Hospitals and Doctors	-$165	-$202
Non-Defense Federal Contracts and Grants	-$346	-$519
Contracts	-$71	-$106
Grants	-$275	-$413
Non-Defense Civilian Employee Wages	-$26	-$46
Emergency Unemployment Compensation	-$50	-$69
Defense	**-$604**	**-$934**
Defense Procurement Contracts	-$497	-$791
Defense Grants (e.g. for Research)	-$11	-$17
Military Base Operations	-$74	-$90
Defense Civilian Employee Wages	-$22	-$36
TOTAL	**-$1,315**	**-$1,959**
Massachusetts Federal Funding, 2012 Total	$57,837	$57,837
Share of Federal Funding Lost to Sequestration	-2.30%	-3.40%

Source: UMDI analysis based on data from the Schedule of Expenditures of Federal Awards (SEFA), Federal Funds Information for States (FFIS), USA Spending, Bloomberg Government, the U.S. Office of Personnel Management, and data collected from individual Massachusetts military installations. Dollars reported in Millions of 2013 USD.

The non-defense federal funding cuts from the sequestration are estimated for the following categories of spending:

- **Federal grants to state agencies.** The federal government provides funding directly to the Commonwealth of Massachusetts that is then distributed to support government initiatives throughout the state. This includes funding for child nutrition programs, vocational training, adult education, early childhood education, public housing, home weatherization, public housing, substance abuse, workforce training, and emergency management among others. The cuts in these programs were estimated to be $124 million in FFY 2013 and then growing to $189 million in FFY 2014. With these cuts, Massachusetts must reduce important public investments in its people and infrastructure.

- **Medicare reimbursements.** The Medicare cuts represent reductions in reimbursements to hospitals and doctors of $165 million in 2013 and $202 million in 2014.

- **Non-defense federal contracts and grants.** Massachusetts is a significant recipient of contracts and grants from the federal government to support research as well as for numerous other types of work (engineering, planning, environmental protection, etc.). Table 5 shows federal funding for Massachusetts by programs such as the National Institutes of Health (NIH) that feeds into the state's scientific infrastructure and innovation economy. NIH funding cuts are estimated to be over $100 million in FFY 2013 and grow to $153 million in FFY 2014. The funding cuts for other critical programs, including the National Science Foundation, will also contribute to an erosion of basic research in Massachusetts, the foundation on which scientific breakthroughs are developed and new industries are born. UMDI conducted interviews with a range of organizations (MIT, Brandeis University, MassBio, Mass Life Sciences Center, etc.) to confirm and refine this analysis.

- **Non-defense civilian employee wages.** Due to furloughs, federal employees in Massachusetts affected by the sequester experienced 6 workdays without pay in FFY 2013.[9] This is expected to be followed by an estimated 10 workdays without pay in FFY 2014 (this excludes any effects of the October 1 to October 16, 2013 federal government shutdown). The lost wages for federal employees in Massachusetts is estimated to be $26 million in FFY 2013 and $46 million in FFY 2014.

- **Emergency Unemployment Compensation (EUC).** The regular unemployment insurance program that is administered at the state level and paid for with state taxes on employers is exempt from the sequester. However, Emergency Unemployment Compensation, an extension of the regular program enacted in 2008 to combat the recession by extending unemployment insurance to the long-term unemployed is not exempt. The sequester reduced benefits for the EUC by 12.8 percent in 2013 to be followed by a 7.2 percent cut in 2014.[10] For Massachusetts' 46,000 (as of mid-July 2013) recipients of EUC, this results in total payment reductions of $50 million and $69 million, respectively, in 2013 and 2014, a direct loss in income and consumer purchasing power.

[9] U.S. Office of Personnel Management, Federal Human Resources Data, http://www.fedscope.opm.gov/

[10] National Employment Law Project, "State Implementation of the Sequester Cuts to Federal Emergency Unemployment Compensation Programs", July 2013. The Massachusetts Executive Office of Labor and Workforce Development shows a reduction in the percentage cut for the EUC beginning in FFY 2014 (October 2013), http://www.mass.gov/lwd/unemployment-insur/.

Table 5. Non-Defense Contracts and Grants – Value of Contracts and Grants (2012) and Estimated Funding Reductions for Leading Agencies, FFYs 2013 and 2014

Agency	Value of Contracts and Grants	Estimated Funding Reduction	
		FFY 2013	FFY 2014
National Institutes of Health (NIH)	$2,547	-$102	-$153
National Science Foundation (NSF)	$463	-$19	-$28
National Aeronautics and Space Administration (NASA)	$232	-$9	-$14
Department of Energy (DOE)	$217	-$9	-$14
National Oceanic and Atmospheric Administration (NOAA)	$60	-$2	-$4
Other Agencies	$5,756	-$205	-$306

Source: UMDI retrieved data from USA Spending in October 2013
Note: Dollars reported in Millions of 2013 USD.

By mandate, the Department of Defense (DoD) must absorb half of the cuts in federal spending due to the sequestration. The cuts affecting the Department of Homeland Security, often grouped with the DoD, are included by mandate within the non-defense federal funding category. With the exception of payroll for men and women in uniform (military personnel), almost all other aspects of the DoD's operations must absorb some portion of the sequestration cuts. With its exposure to significant DoD procurement contracts, Massachusetts stands among the more vulnerable states to the defense cutbacks that comprise half of the sequestration. The defense-related federal funding cuts from the sequestration are estimated for the following categories of spending:

- **Defense procurement contracts.** DoD contracts in Massachusetts were valued at $11.3 billion in FFY 2012, equaling about 3 percent of the Massachusetts economy. Massachusetts is home to many defense contractors with particular concentrations in missiles, navigation systems, aircraft engines, robotics, communications networks, and engineering services. For these reasons, the federal spending reductions to defense contracts represent, by far, the single largest category affected by the sequester in Massachusetts even after applying a percent reduction (4.4%) that is significantly below the mandated total defense cuts. The cuts are an estimated $497 million for FFY 2013 and estimated to rise to $791 million in FFY 2014. The decline in the value of procurement contracts due to the sequester will likely continue to grow in future years as both FFY 2013 and, to a lesser extent, FFY 2014 are somewhat insulated by existing procurement contracts signed in earlier years. A question mark for Massachusetts is whether its defense-industrial mix emphasizing advanced military technologies will help the state weather the sequestration cuts more successfully than competing states. Based on survey efforts to obtain feedback to date from defense contractors, it is clear that some small to medium sized defense contractors are feeling the effects of sequestration but a relatively low response rate to the survey suggests that many firms have not yet felt the impacts.

- **Defense grants.** Similar to the significant grants Massachusetts receives in the non-defense category for health and other scientific research, Massachusetts universities, laboratories, and research institutions also receive grants from the Department of Defense to support research. The cuts in these types of grants are estimated to be $11 million in FFY 2013, growing to $17 million in FFY 2014.

- **Military base operations.** Massachusetts' six military installations are each affected by the federal spending cuts of the sequestration. Each installation must decide what operations (e.g., travel, construction, purchases, flyovers, etc.) are to be cut in order to meet lower budget thresholds. With annual operations of Massachusetts military installations costing over $1.1 billion, the sequestration cuts for FFY 2013 and FFY 2014 are estimated at $75 million and $92 million, respectively.

- **Defense civilian employee wages.** The sequestration affects civilian personnel only and does not apply to military personnel in uniform. In Massachusetts, this includes large numbers of workers at the Natick Soldier Systems Center as well as civilian employees working at the state's military bases. The Pentagon put its civilian employees on 6 days of furlough in FFY 2013. This is expected to be followed by an estimated 10 workdays without pay in FFY 2014 (this excludes any effects of the October 1 to October 16, 2013 federal government shutdown). Based on input obtained from the state's military bases, the lost wages for military civilian employees in Massachusetts is estimated to be $22 million in FFY 2013 and $36 million in FFY 2014.

The dollar-based estimates presented regarding the sequestration funding cuts, thus far, represent a "medium" estimate representing the likely cuts Massachusetts will experience in both FFY 2013 and FFY 2014. It is possible that these cuts may not be as substantial as initially thought depending on how agencies adjust to the funding cuts and how well Massachusetts contractors fare in the competition for federal dollars. Using the range of reduction factors discussed above, different estimates of the direct impacts of the sequestration in Massachusetts were developed. Based on these estimates, the funding reduction in FFY 2013 may be as low as $1 billion or potentially as high as $1.6 billion (see Table 6). Overall impacts will escalate in FFY 2014, perhaps reaching a level as high as $2.3 billion. On the other hand, they could be as low as $1.6 billion, especially if Massachusetts is awarded higher than expected contract procurements.

Table 6. Sequestration Direct Impact Summary, FFYs 2013 and 2014, Low, Medium, and High Estimates

	Sequestration - Funding Reductions					
	FFY 2013			FFY 2014		
	Low Estimate	**MEDIUM Estimate**	High Estimate	Low Estimate	**MEDIUM Estimate**	High Estimate
TOTAL Funding Impact	-$1,007	**-$1,315**	-$1,645	-$1,579	**-$1,959**	-$2,346
Share of MA Federal Funding Lost to Sequestration	-1.7%	**-2.3%**	-2.8%	-2.7%	**-3.4%**	-4.1%

Source: UMDI analysis based on data retrieved from USA Spending in October 2013
Note: Dollars reported in Millions of 2013 USD.

Economic Impacts of Sequestration

Economic Impact Analysis Approach

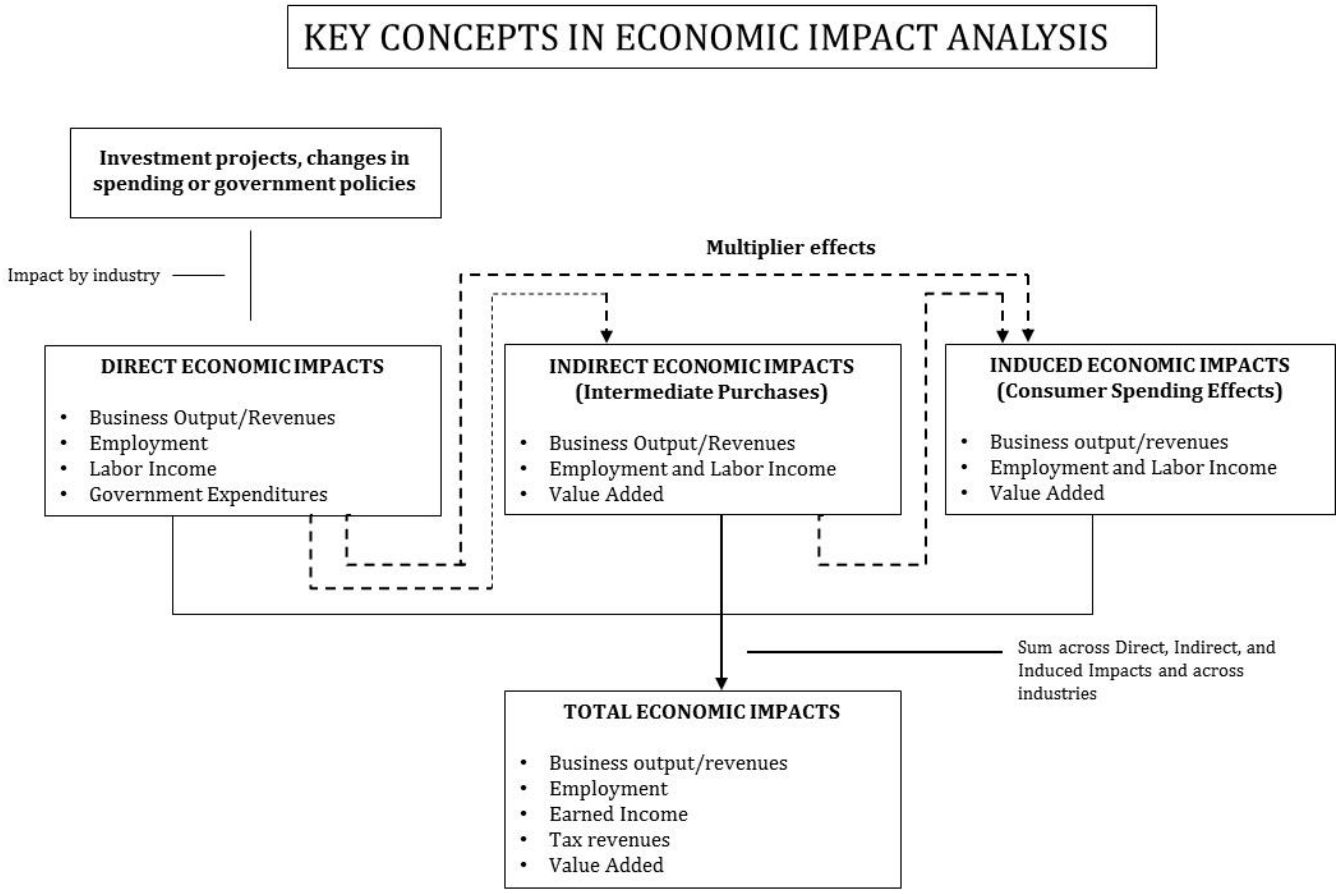
The federal funding cuts from the sequestration, detailed in the previous section, will reverberate through the Massachusetts economy and generate impacts beyond the immediate loss of federal funding. This section of the study provides estimates of the overall economic impacts of the sequestration on Massachusetts. The economic impacts presented in this section, as estimated and reported, reflect changes in economic activity – both directly in terms of reduced spending and dollars to Massachusetts, and indirectly in terms of the multiplier effects to the broader economy. Thus, the economic impacts reflect a combination of "losses" (e.g., layoffs) and economic growth or jobs not added (e.g., hiring freezes).

The economic impacts of the federal spending cuts were estimated specifically for Massachusetts at the state level. To conduct this analysis, the Minnesota IMPLAN Group's input-output model has been used to estimate the direct, indirect and induced effects of the sequestration, in terms of employment, labor income, business sales (output), value added, and state revenue. The results are generated and reported in terms of the following:

- **Job impacts** represent a change in average annual jobs for the year indicated (compared to a scenario where sequestration cuts are not implemented).
- **Labor income** consists of total employee compensation (wage and salary payments, as well as health and life insurance benefits, retirement payments and any other non-cash compensation) and proprietary income (payments received by self-employed individuals as income).
- **Value added** represents total business sales (output) minus the cost of purchasing intermediate products and is roughly equivalent to gross state/domestic product (commonly referred to as GSP or GDP).
- **Output** is a broader measure that consists of total business or industry sales.
- **State revenue** is the estimated impact on state tax collections attributable to the sequestration. It is primarily comprised of impacts on sales tax and personal income tax revenues.

The total economic impact of the sequestration as estimated by the IMPLAN model is the sum of direct, indirect, and induced impacts. **Direct impacts** are only those associated specifically with the entities (e.g., government agencies) or industries (e.g., an aerospace company that lost a defense contract) that experienced the actual funding reduction from the sequestration. **Indirect impacts** are generated when material, equipment or other intermediate purchases are made (or not made) to support the direct activity (e.g., support to the government agency or a supplier to the aerospace company). **Induced impacts** are generated by changes in local consumer spending activity resulting from the economic changes shown in the direct and indirect impacts, primarily due to reduced labor income. In other words, lower economic activity from the sequestration as evidenced by the direct and indirect impacts will translate to fewer dollars available to consumers for spending. The economic impact analysis includes estimates of the direct, indirect and induced impacts of the project. The economic impact methodology described above is visually presented in Figure 1 below.

Figure 1. Economic Impact Analysis Methodology



Economic Impacts of Sequestration – Summary Results

Table 7 illustrates the economic impacts of sequestration estimated for the Massachusetts economy in FFY 2013 and 2014 associated with the "medium" scenario loss of federal funding shown earlier in this study. It also includes the estimated impacts for FFY 2014 based on the new budget agreement passed in December 2013. The agreement lowered the sequestration cuts significantly from what had been initially anticipated for FFY 2014. By applying the spending reductions for FFYs 2013 and 2014 (original and the revised based on the budget deal) to the IMPLAN model, the direct, indirect, induced, and total economic impacts of the sequestration on Massachusetts are estimated. Based on the IMPLAN economic simulations, the FFY 2013 total impacts include a reduction of: 14,125 jobs, $984 million in household income, $1.4 billion in value added (akin to gross state product), and $2.2 billion in output. Based on the larger reduction in spending initially expected for FFY 2014 prior to the new budget agreement, the economic impacts increase to an estimated 20,875 jobs, $1.5 billion in household income, $2.1 billion in valued added, and $3.3 billion in output. The lower federal funding from the sequestration also has an impact on state tax revenues, primarily sales and income taxes, in Massachusetts. We estimate the state tax revenue impacts in Massachusetts to be $63 million in FFY 2013 and $93 million in FFY 2014 ($57 million with the new budget agreement). The December 2013 budget agreement offers a modest reprieve for FFY 2014, with economic impacts slightly lower than those shown for FFY 2013 (see table below). It does not,

however, change the longer-term (2016 and beyond) Budget Control Act and is thus only a temporary fix. Should the sequestration continue, the impacts will grow and become more reflective of the original impacts shown for FFY 2014.

Table 7. Summary of Economic Impacts, FFYs 2013 and 2014

Impact Type	FFY 2013	FFY 2014	Dec. Budget Agreement
Direct Effects			
Employment	-7,495	-11,016	-6,168
Labor Income	-$606	-$886	-$501
Total Value Added	-$764	-$1,127	-$624
Output	-$1,211	-$1,802	-$1,003
Indirect Effects			
Employment	-2,065	-3,094	-1,774
Labor Income	-$140	-$211	-$120
Total Value Added	-$223	-$335	-$192
Output	-$343	-$515	-$294
Induced Effects			
Employment	-4,565	-6,764	-4,665
Labor Income	-$238	-$353	-$243
Total Value Added	-$424	-$628	-$433
Output	-$651	-$964	-$665
TOTAL EFFECTS			
Employment	**-14,125**	**-20,875**	**-12,607**
Labor Income	**-$984**	**-$1,450**	**-$864**
Total Value Added	**-$1,411**	**-$2,090**	**-$1,250**
Output	**-$2,205**	**-$3,281**	**-$1,961**
State Tax Revenues	**-$63**	**-$93**	**-$57**
Massachusetts GDP (2012)	$403,823	$403,823	$403,823
Value-Added Effect as a Share of MA GDP	**-0.35%**	**-0.52%**	**-0.31%**

Source: Results are from simulations run in IMPLAN in October 2013. All dollar amounts are in millions of USD

The economic impacts of the sequestration amount to 0.35 percent of the Massachusetts gross state product in FFY 2013 (measured as the value-added impact divided by the state's GSP). As the effects of the sequestration intensify going into 2014, the impacts will approach an estimated 0.5 percent of GSP. The sequestration effectively applies a break on U.S. and Massachusetts economic growth and is very likely preventing a more robust recovery from the recession. For context, these estimates of job impacts and reduced GSP are significant but are substantially lower than earlier studies of sequestration impacts that estimated over 44,000 jobs impacted.[11] We believe that these customized, Massachusetts-specific impacts are more accurate based on a significantly refined understanding of how sequestration is actually reducing economic activity in the Commonwealth, rather than using high-level, aggregate cuts and assumptions. Still, these impacts provide evidence that sequestration is affecting the potential growth in the state. For example, an annual reduction in jobs due to sequestration of 14,000 to 21,000 represents a significant

[11] "The Economic Impact of Sequestration Budget Cuts to DOD and Non-DOD Agencies as Modified by the American Taxpayer Relief Act of 2012," Dr. Stephen Fuller, George Mason University, March 14, 2013.

share of typical statewide job growth in Massachusetts as statewide job growth has ranged from approximately 9,500 to 52,000 over the past ten years (excepting years of job losses).

The estimated multiplier effects through the IMPLAN model are between 1.8 to 1.9 for employment and output. This means that the total economic impact is just under twice as large as the direct impact with multiplier effects estimated to result in an 80-90 percent larger reduction in economic activity beyond the direct effects of spending with the majority of this due to induced effects (less consumer spending). This multiplier effect is well within industry standards, as it tends to be a bit lower for pure public expenditures and higher for private sector impacts (and sequestration ends up impacting both).

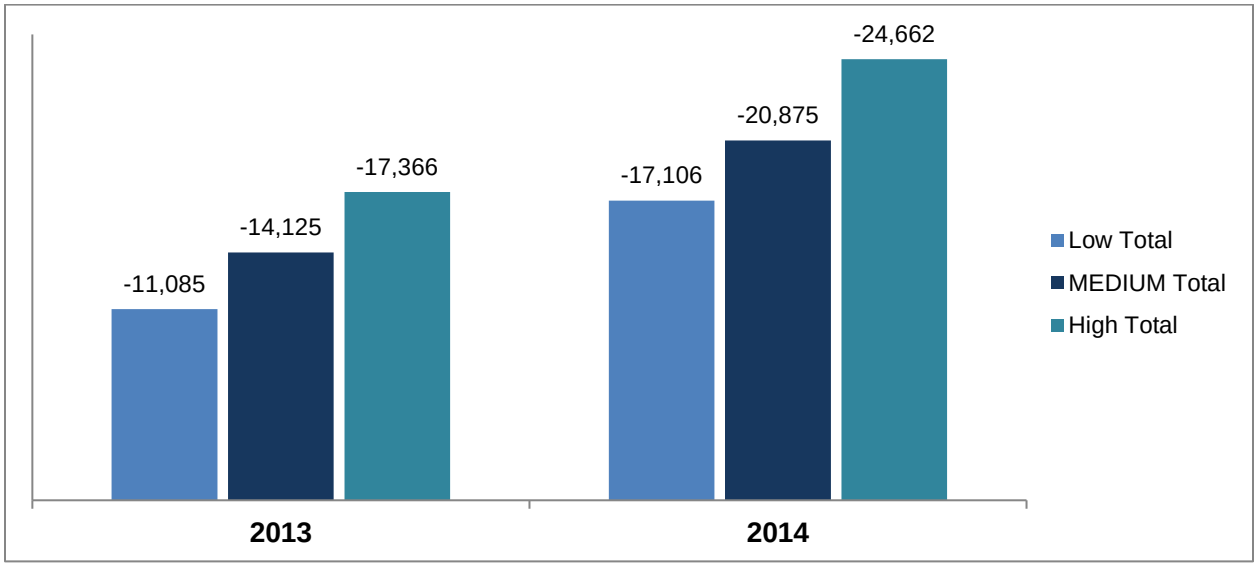
Due to the uncertainties involved in estimating the sequestration's effects on Massachusetts, UMDI, as discussed in prior sections of the study, developed ranges for the funding reductions to test what the ultimate economic impacts of the sequestration may be on the Massachusetts economy. As can be seen in Table 8 and Figure 2 (below), the sequestration will have significant economic impacts on the state, regardless of whether the funding reductions come in lower or higher than currently anticipated. The low range for FFY 2013 still represents a job impact of 11,085 jobs and a 0.27 percent impact on Massachusetts GSP (i.e., value-added). From this low estimate, potential impacts rise progressively. The high scenario for FFY 2014, which is entirely plausible if contractors see major declines in government procurement orders and the effects of reduced research grants begin to snowball, would mean a job impact 24,662 jobs and a reduction of $2.5 billion in GSP (i.e., the change in value-added).

Table 8. Summary of Economic Impacts - Low, Medium, and High Estimates

Economic Impacts of Sequestration						
Impact - Type	**Low (2013)**	**MEDIUM (2013)**	**High (2013)**	**Low (2014)**	**MEDIUM (2014)**	**High (2014)**
TOTAL EFFECTS						
Employment	-11,085	**-14,125**	-17,366	-17,106	**-20,875**	-24,662
Labor Income	-$765	**-$984**	-$1,218	-$1,187	**-$1,450**	-$1,714
Total Value Added	-$1,088	**-$1,411**	-$1,758	-$1,700	**-$2,090**	-$2,481
Output	-$1,668	**-$2,205**	-$2,783	-$2,647	**-$3,281**	-$3,918
State Tax Revenues	-$49	**-$63**	-$78	-$76	**-$93**	-$111
Massachusetts GDP (2012)	$403,823	**$403,823**	$403,823	$403,823	**$403,823**	$403,823
Value Added Effect as a Share of MA GDP (2012)	-0.27%	**-0.35%**	-0.44%	-0.42%	**-0.52%**	-0.61%

Source: Results are from simulations run by UMDI in IMPLAN in December 2013
Note: All dollar amounts are in millions of USD

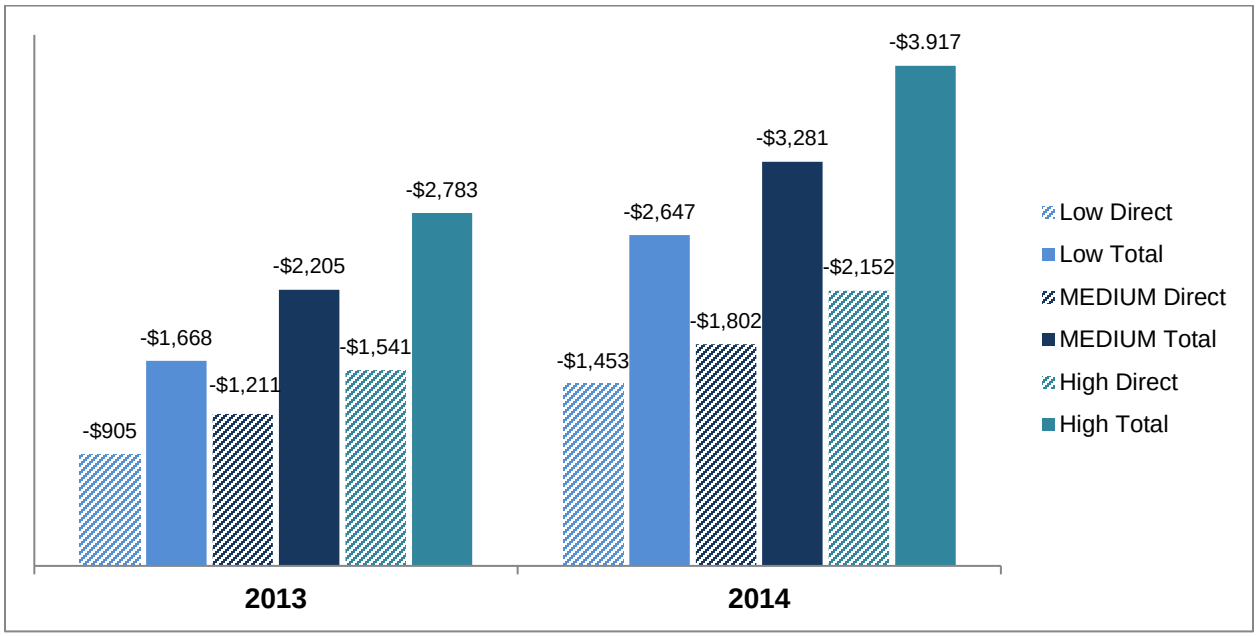
Figure 2. Total Employment Impacts, Low to High Ranges for FFYs 2013 and 2014



Source: Results from simulations run in IMPLAN in October 2013
Note: All values denote total numbers of jobs that would have been in the economy if sequestration had not taken place.

As shown in Figure 3, there is a similar relationship for output (revenue) impacts in FFYs 2013 and 2014, with this graph showing greater detail in terms of the *direct* and *total* effects (when including multiplier effects) for each low, medium and high scenario. For example, total output impacts range from $1.7 billion in the low scenario to $2.8 billion in the high scenario in FFY 2013 and from $2.7 billion to $3.9 billion in FFY 2014.

Figure 3. Direct and Total Output Impacts, Low to High Ranges FFYs 2013 and 2014



Source: Results are from simulations run in IMPLAN in October 2013
Note: All values denote millions of USD that would have been in the economy had sequestration not taken place.

Industry Impacts

Based on Massachusetts' unique industrial mix and the pathways that sequestration is affecting public and private sector activity and servicers, we found that the top five industry super-sectors that will experience the greatest employment impacts in FFYs 2013 and 2014 due to the federal spending cuts include: Professional and Business Services; Public Administration; Education and Health Services; Trade, Transportation and Utilities; and Leisure and Hospitality. Professional and Business Services include the engineering, design, environmental, and scientific research services that are all Massachusetts strengths—and industries that are impacted by reductions in defense and research (e.g., NIH and NSF) spending. The employment impacts in the table represent jobs that would have been in the economy had the sequestration cuts not been in effect. For FFY 2013, the employment impacts include 3,661 jobs in Professional and Business Services, 2,745 jobs in Public Administration, 2,521 jobs in Education and Health Services (primarily universities and hospitals), 1,594 jobs in Trade, Transportation and Utilities, and 950 jobs in Leisure and Hospitality. Impacts to manufacturing are also significant, largely based of defense contractor activity, with employment impacts estimated to be over 800 in FFY 2013 and approach 1,300 jobs in FFY 2014. In FFY 2014, we expect these impacts to rise from FFY 2013 due to the increase in the sequestration-related federal spending cuts. Employment impacts for FFY 2014 include 5,548 jobs for Professional and Business Services, 4,042 jobs in Public Administration, 3,455 jobs in Education and Health Services, 2,384 jobs in Trade, Transportation and Utilities, and 1,418 jobs in Leisure and Hospitality. The total employment impacts from the sequestration in FFYs 2013 and 2014 are 14,125 and 20,875, respectively.

Table 9. Employment Impacts on Massachusetts Industries due to the Sequestration, FFYs 2013 and 2014

Industry Supersector	FFY 2013 Employment Impact	FFY 2014 Employment Impact
Natural Resources & Mining	-$35	-$53
Trade, Transportation and Utilities	-$1,594	-$2,384
Construction	-$262	-$403
Manufacturing	-$822	-$1,290
Information	-$214	-$325
Financial Activities	-$820	-$1,212
Professional and Business Services	-$3,661	-$5,548
Education and Health Services	-$2,521	-$3,455
Leisure and Hospitality	-$950	-$1,418
Other Services (Excluding Public Administration)	-$500	-$745
Public Administration	-$2,745	-$4,042
Totals	**-$14,125**	**-$20,875**

Source: Results from simulations run in IMPLAN in December 2013
Note: All values denote total numbers of jobs that would have been in the economy if sequestration had not taken place.

Manufacturing ranks only 6th highest in employment impacts from the sequestration among Massachusetts' major sectors in both FFYs 2013 and 2014 which may seem low given the impacts of reduced defense procurement (much of it in manufacturing) on the industry. However, as can be seen in Table 10, Manufacturing ranks second in output impacts associated with the sequestration. Manufacturing in Massachusetts is extremely capital-intensive rather than labor-intensive, meaning that a single employee produces a very high value of output due to the application of sophisticated production processes and the

use of advanced machinery. For this reason, the sequestration's effects on the Massachusetts manufacturing sector is better illustrated through the output impact figure than the jobs impact.

Table 10. Output Impacts on Massachusetts Industries due to the Sequestration, FFYs 2013 and 2014

Industry Supersector	FFY 2013 Output Impact	FFY 2014 Output Impact
Natural Resources & Mining	-$15	-$23
Trade, Transportation and Utilities	-$197	-$296
Construction	-$30	-$47
Manufacturing	-$364	-$571
Information	-$91	-$138
Financial Activities	-$220	-$326
Professional and Business Services	-$570	-$868
Education and Health Services	-$310	-$417
Leisure and Hospitality	-$61	-$91
Other Services (Excluding Public Administration)	-$42	-$63
Public Administration	-$224	-$322
Imputed Rental Activity for Owner-Occupied Dwellings	-$76	-$118
Totals	**-$2,201**	**-$3,281**

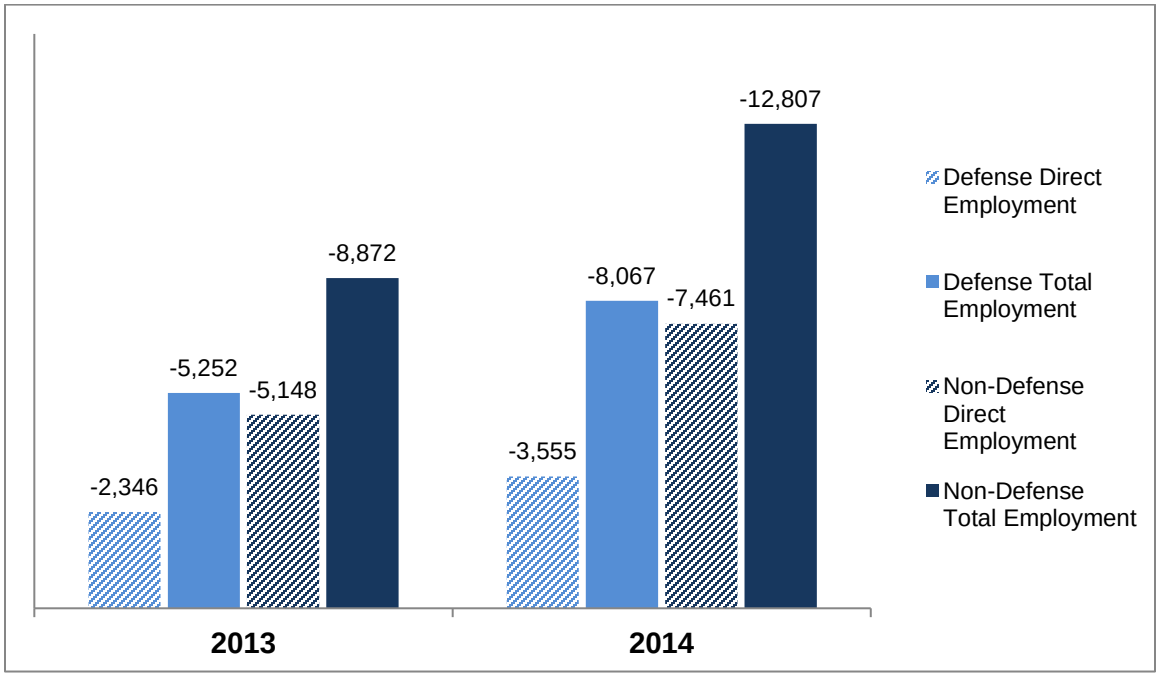
Source: Results are from simulations run in IMPLAN in December 2013
Note: All values denote millions of USD that would have been in the economy had sequestration not taken place.

The industries with the greatest output impacts due to the sequestration in FFYs 2013 and 2014 include: Professional and Business Services; Manufacturing; Public Administration; Education and Health Services; and Financial Activities. For FFY 2013, output impacts include a $570 million impacts for Professional and Business Services, $364 million for Manufacturing, $310 million for Education and Health Services, and $224 million for Public Administration. These impacts are estimated to increase in FFY 2014 as the sequestration's effects escalate. In FFY 2014, the output impact on Professional and Business Services is projected to be $868 million, Manufacturing $571 million, Education and Health Services $417 million, and Public Administration $322 million. The total estimated output impacts on Massachusetts from the sequestration are $2.2 billion and $3.3 billion in FFYs 2013 and 2014, respectively.

Industry Impacts for Non-Defense and Defense Spending Cuts

As shown in Figure 4, there are considerable economic impacts attributed to both the defense and non-defense sector funding reductions. Direct employment impacts in FFY 2013 attributed to defense spending reductions are over 2,300 jobs with a total impact of about 5,250 jobs lost or not added. The totals related to non-defense spending are even larger, covering a much broader swath of the economy with a direct job impact of 5,148 and a total employment impact in FFY 2013 of 8,872. Consistent with the overall study findings, these impacts are expected to increase considerably in FFY 2014. The most likely reason for the relatively smaller defense economic impacts is the research-based estimate of procurement (contracts) experiencing a 4.4 percent reduction in FFY 2013 with larger impacts expected in future years.

Figure 4. Direct and Total Employment Impacts for Defense, Non-Defense Total, FFYs 2013 and 2014



Source: Results from simulations run in IMPLAN in December 2013
Note: All values denote total numbers of jobs that would have been in the economy if sequestration had not taken place.

To further understand the specific impacts of sequestration on the state economy, we explored the distribution of impacts (in terms of employment and output) across all of the industry supersectors in Massachusetts attributable to the specific defense- and non-defense-related federal spending cuts (see Tables 11 through 14). Public Administration (government) is the most affected industry from the non-defense funding changes of the sequestration as nearly every government agency as well as the programs they manage is affected in some manner by the cuts. Professional and Business Services, the sector that includes scientific research, engineering, consulting, and environmental services also absorbs a substantial impact from the non-defense spending reductions. These industries are also relative Massachusetts economic strengths, having grown with support from the state's universities, research institutions, and highly educated workforce. Cuts to a range of education programs and Medicare contribute to the relatively high economic impacts, in terms of both jobs and output, to the Massachusetts education and healthcare sector.

Table 11. Non-Defense Sequestration Impacts on Industries by Employment in FFYs 2013 and 2014

Industry Supersector	FFY 2013 Non-Defense Employment Impact	FFY 2014 Non-Defense Employment Impact
Natural Resources & Mining	-26	-40
Trade, Transportation and Utilities	-902	-1,312
Construction	-167	-255
Manufacturing	-137	-207
Information	-108	-159
Financial Activities	-517	-742
Professional and Business Services	-1762	-2,577
Education and Health Services	-1972	-2,606
Leisure and Hospitality	-587	-859
Other Services (Excluding Public Administration)	-304	-444
Public Administration	-2390	-3,605
Totals	**-8,872**	**-12,807**

Source: Results are from simulations run in IMPLAN in December 2013
Note: All values denote total numbers of jobs that would have been in the economy if sequestration had not taken place.

Table 12. Non-Defense Sequestration Impacts on Industries by Output in FFYs 2013 and 2014

Industry Supersector	FFY 2013 Non-Defense Output Impact	FFY 2014 Non-Defense Output Impact
Natural Resources & Mining	-$11	-$17
Trade, Transportation and Utilities	-$110	-$161
Construction	-$19	-$29
Manufacturing	-$55	-$83
Information	-$44	-$65
Financial Activities	-$136	-$195
Professional and Business Services	-$266	-$390
Education and Health Services	-$252	-$328
Leisure and Hospitality	-$38	-$55
Other Services (Excluding Public Administration)	-$25	-$36
Public Administration	-$175	-$261
Imputed Rental Activity for Owner-Occupied Dwellings	-$49	-$71
Totals	**-$1,179**	**-$1,693**

Source: Results are from simulations run in IMPLAN in December 2013
Note: All values denote millions of USD that would have been in the economy had sequestration not taken place.

The industry sectors that will be most affected by the decline in defense dollars directed to Massachusetts are understandably different than those most impacted by cuts to non-defense spending. The sequestration will have the greatest output impacts on the Manufacturing sector, with an estimated $309 million impact in FFY 2013 and a $488 million impact in FFY 2014. Due to its capital intensity, significant output impacts in Manufacturing do not necessarily translate into significant employment impacts although manufacturing does endure the second highest job impacts among the major sectors in conjunction with the sequestration-related cuts to defense spending. Professional and Business Services follows manufacturing in output impact but is first among the major sectors in job impacts due to the sequestration. The Department of Defense relies on private-sector contractors for a vast array of technical, management, legal, scientific, research and development, engineering, accounting, and computer services.

Table 13. Defense Sequestration Impacts on Industries by Employment in FFYs 2013 and 2014

Industry Supersector	FFY 2013 Defense Employment Impact	FFY 2014 Defense Employment Impact
Natural Resources & Mining	-9	-13
Trade, Transportation and Utilities	-692	-1,072
Construction	-95	-148
Manufacturing	-685	-1,083
Information	-107	-165
Financial Activities	-303	-470
Professional and Business Services	-1,899	-2,970
Education and Health Services	-550	-849
Leisure and Hospitality	-363	-559
Other Services (Excluding Public Administration)	-195	-302
Public Administration	-355	-437
Totals	**-5,252**	**-8,068**

Source: Results are from simulations run in IMPLAN in December 2013
Note: All values denote total numbers of jobs that would have been in the economy if sequestration had not taken place.

Table 14. Defense Sequestration Impacts on Industries by Output in FFYs 2013 and 2014

Industry Supersector	FFY 2013 Defense Output Impact	FFY 2014 Defense Output Impact
Natural Resources & Mining	-$4	-$6
Trade, Transportation and Utilities	-$87	-$135
Construction	-$11	-$17
Manufacturing	-$309	-$488
Information	-$47	-$73
Financial Activities	-$84	-$131
Professional and Business Services	-$305	-$478
Education and Health Services	-$57	-$89
Leisure and Hospitality	-$23	-$36
Other Services (Excluding Public Administration)	-$18	-$27
Public Administration	-$49	-$61
Imputed Rental Activity for Owner-Occupied Dwellings	-$31	-$48
Totals	**-$1,026**	**-$1,589**

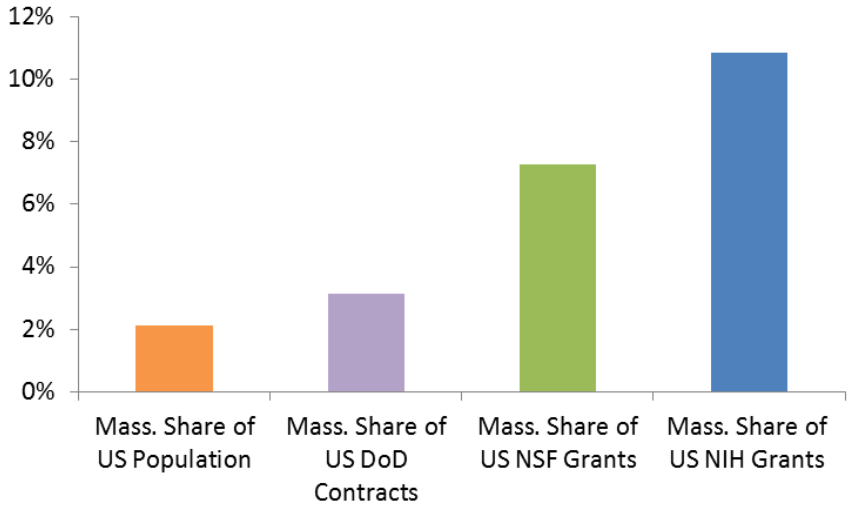
Source: Results are from simulations run in IMPLAN in December 2013
Note: All values denote millions of USD that would have been in the economy had sequestration not taken place.

Impacts of Scientific Research and Defense Contracting in Massachusetts

Massachusetts, along with the other 49 states and the District of Columbia, receives a flow of federal funds to support a wide range of crucial public programs to support education, nutrition, infrastructure, healthcare, public safety, transportation, environmental quality, and disaster relief, among many others. All states and their residents are impacted by the reduced support to these programs brought on by the sequestration. While Massachusetts, its communities, and its people benefit from the programs and services provided through federal funding and are duly concerned about the effects of budget cuts, what sets Massachusetts apart from other states and heightens concern about the sequestration are cuts to research funding and spending on defense contractors, two lynchpins of the Massachusetts economy.

Few states are as vulnerable to the combination of federal research and defense spending cuts than Massachusetts. Both act as catalysts for growth by encouraging innovation, commercializing technologies, and spinning-off new companies, or, in some instances, entirely new industries. In FFY 2012, Massachusetts received $11.3 billion in Department of Defense contracts, ranking 10th among the states. On a per capita basis, Massachusetts receives about 50 percent more defense procurement dollars than the national average. Massachusetts' advantages are even more pronounced on the research funding side. In FFY 2012, Massachusetts attracted $2.5 billion in National Institutes of Health (NIH) grants, only surpassed by the much larger state of California, and an additional $500 million in National Science Foundation (NSF) grants. In per capita terms, Massachusetts brought in five times more NIH and three times more NSF dollars, respectively, than the national average. Half of the top 18 NIH hospitals, based on funding, are located in Massachusetts. Relative to the Commonwealth's 2.1 percent share of the U.S. population in FFY 2012, the state is receiving far greater shares of total U.S. DoD contracts, NSF grants, and NIH grants (see Figure 5). The sequestration strikes at the essence of the Massachusetts innovation economy, taking away the seed corn on which the Commonwealth's economy develops and grows.

Figure 5. Massachusetts' Share of U.S. Population, Department of Defense (DoD) Contracts, National Science Foundation (NSF) Grants, and National Institutes of Health (NIH) Grants, FFY 2012



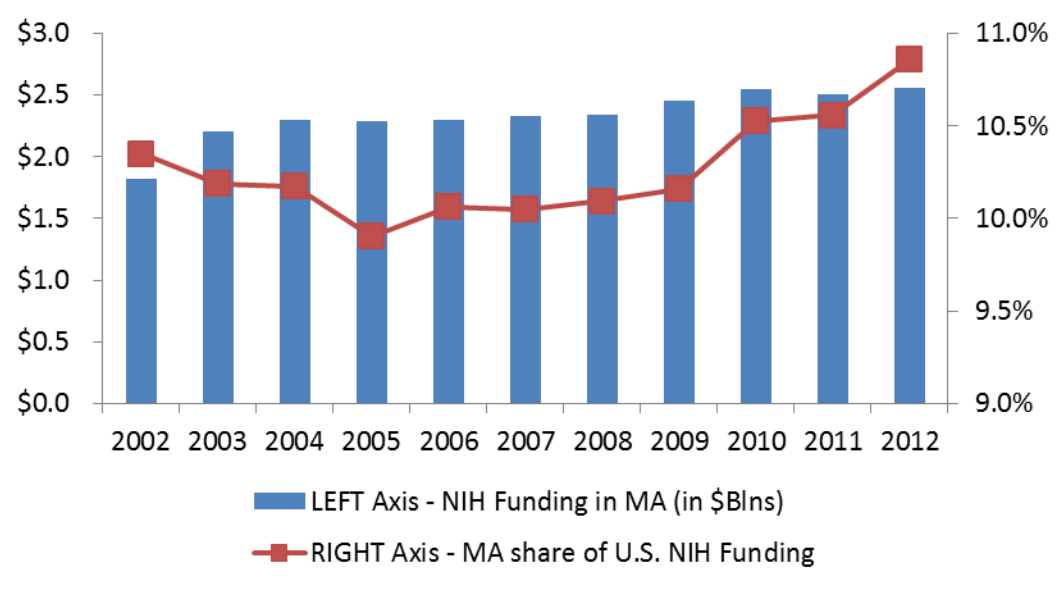
Sources: Data retrieved from USA Spending in November 2013 and U.S. Census Bureau

This section of the study explains in detail how the sequestration cuts reverberate through the Massachusetts economy, focusing on the longer-term ramifications of the reductions in federal research funding and defense spending, as informed by a combination of data and informant interviews.

Federal Research Grants

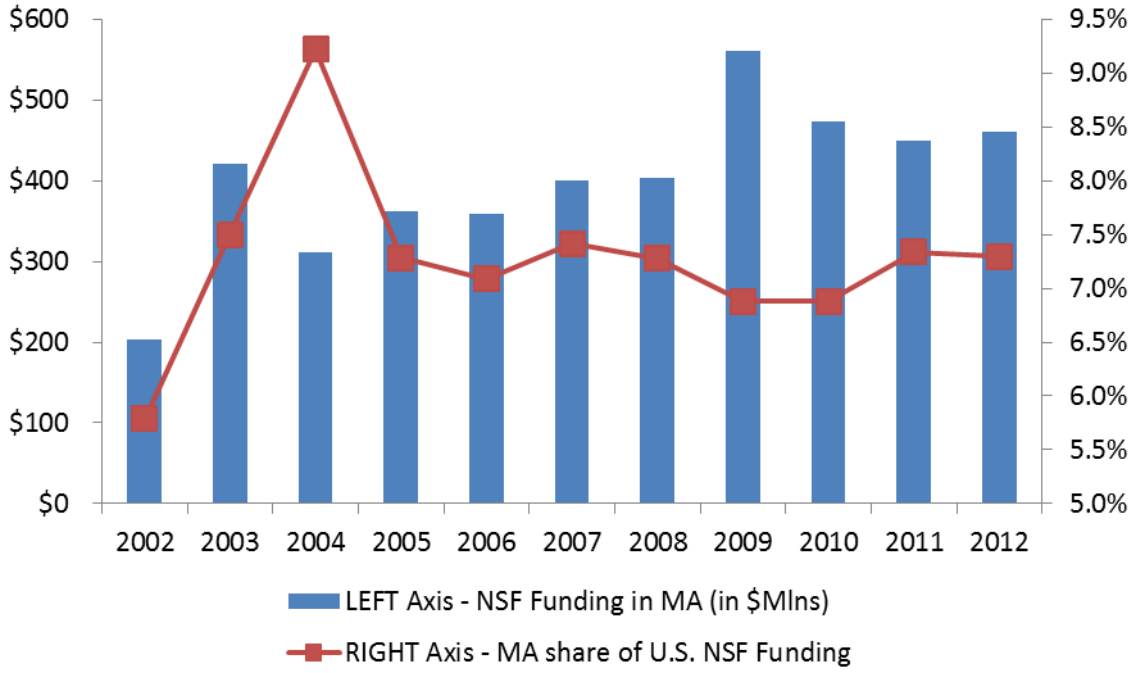
The federal research dollars awarded to Massachusetts universities, hospitals, businesses, and institutions are a key component of the dynamic that makes the Commonwealth a leading state for technology and innovation. Competitive research grants provided by NIH, NSF, NASA, the Department of Energy, and others underpin a fertile research environment in Massachusetts that is globally preeminent. The state's disproportionately high shares of research funding, patents, and venture capital attest to the quality of the research taking place in Massachusetts and its ability to transform innovations into commercially viable products. Figures 6 and 7 illustrate NIH and NSF funding levels in Massachusetts during the FFYs 2002 to 2012 period and the state's share of the U.S. total. The grants are competitive and Massachusetts has earned a track record in winning an outsize share of these federally funded research grants.

Figure 6. Total Massachusetts NIH Grants and Share of U.S., FFYs 2002-2012



Source: Data retrieved from the National Institutes of Health website in November 2013

Figure 7. Total Massachusetts NSF Grants and Share of U.S., FFYs 2002-2012



Source: Data retrieved from USA Spending in November 2013

While Massachusetts' leadership in advanced technology research is diverse, allowing the state to excel in many industries, the emergence of life sciences and its particular vulnerability to the sequestration cuts to NIH research funding raises alarms about the ongoing competitiveness of the industry in Massachusetts, and by translation, in the United States. Life sciences is a global industry and, today, Massachusetts is at the forefront of U.S. strength in the industry. Massachusetts is continuing to benefit from the expansion of its own, home-grown, life sciences companies as well as the consolidation of major national and international companies' research operations into the state. However, any lessening of Massachusetts' capabilities to carry-out medical research, exactly what the sequestration is doing by cutting NIH research grants, will also undermine future U.S. potential within the globally-competitive life sciences industry.

Interviews conducted with the Massachusetts Life Sciences Center, Brandeis University, MIT, and the Massachusetts Biotechnology Council as well as information provided by the University of Massachusetts[12] revealed how reduced federal funding is likely to erode the Commonwealth's research foundations by forcing a series of adaptations by universities, hospitals, and students that will ultimately result in scaled-back research outcomes. Lower levels of research, in turn, can do long-term damage to the Massachusetts innovation economy, including the life sciences industry. Key observations concerning the effects of the sequestration on Massachusetts research and industry from these interviews include:

- **Timing of sequestration impacts.** At this point, it is too early to know the exact effects of reduced NIH and NSF funding, but there are significant fears. Today, the full effects are not being immediately felt but there have been some adjustments, such as cutting back on personnel (e.g., not hiring post doctorate jobs in laboratories). There is a recognized potential, however, for great effects. "The sequestration is not a cliff, but a slowly moving train wreck."

[12] University of Massachusetts response to the American Association of State Colleges and Universities "Institution Sequestration Impact Survey," 2013; and the UMass President's Office "FY 2012 Annual R&D Expenditures Report," August 2013.

Unless policies change, the mild effects we see now will turn into huge problems in the years to come as funding cycles end.

- **Delays in securing grant dollars.** NIH and NSF authorize and fund projects in cycles and gaps are developing in funding which are causing breaks in the continuity of research projects. There are many "non-decisions" (nor timelines offered) on proposals submitted in the past year, leaving researchers uncertain about how, when, and if to move forward. A standard NIH grant is for four years, requiring a straightforward annual renewal. Now, existing projects are facing cuts in coming years due to the sequestration forcing adjustments such as reductions in salaries and workforce. At the end of the four year funding cycle, fewer research projects are being granted continuations for an additional four years. If faculty are unable to secure other funding, years of research are lost and cannot proceed to latter stages of development that may yield benefits for industry and society.

- **Lower win rate for grants.** The hit rate for winning grants among faculty has been cut in half. To compensate, faculty are writing more grant applications, taking more work time and increasing workloads. Now, it is not uncommon to submit 8 to 10 applications before receiving funding.

- **Universities have sunk significant investments into laboratories.** Large-scale investments over the past years were built in anticipation of a continued flow of federal research dollars. Institutions build based on expected revenue streams and are accustomed to economic cycles that include peaks and troughs. However, if the sequestration represents the "new norm", universities will need to change their behaviors. Research labs will need to become smaller, reducing workforce at multiple levels. Technicians, post-doctorate fellows, and graduate students would all be affected, hindering the paths for careers in life sciences and other advanced industries.

- **Junior professors will have a more difficult time obtaining tenure.** Promotion to tenure is traditionally based on a professor's ability to win grants and funding. Senior, tenured professors with long-developed track records for research have higher hit rates in winning grants than younger, junior professors. With reduced funding due to the sequestration, there is likelihood that newer faculty will confront even more barriers in earning sufficient grants for tenure as scarcer federal research funds increasingly go to more senior professors. Even more senior faculty are seeing their grants not renewed or are having to go through multiple review cycles to secure funding. If more junior professors cannot win grants early it will also make it more difficult for them to win grants later in their careers as early grants often produce the data needed to win new grants in future years. The sequestration, in effect, could break this cycle of innovation and thus limit the range and scope of innovation taking place in Massachusetts and the U.S.

- **Pursuing STEM (science, technology, engineering, and mathematics) degrees may become less compelling**. Economic competition is global. The U.S. and individual states, including Massachusetts, emphasize the importance of STEM education for competitive reasons as well as to create more opportunities for individuals. Massachusetts and its universities are extraordinarily successful at pulling students into the sciences but the sequestration undermines STEM efforts by providing fewer opportunities for graduate and under graduate students to participate in lab work. Faculty have been told to proceed cautiously and lower graduate admissions unless explicit funding has been identified. Students cannot be encouraged to pursue STEM degrees when professors are telling them there is no money for

them to conduct research. Talented students that would have otherwise pursued STEM degrees and stayed in academia may increasingly go into non-STEM fields and to Wall Street to pursue careers. The innovation pipeline, however, begins in academia and these are the same people who help supply the Massachusetts life science industry and high tech sectors with the talent they need to compete globally.

- **Institutions are looking to diversify their funding sources due to the sequestration.** According to MassBIO, about half of the research funding to Massachusetts hospitals is sourced from the NIH. With the sequestration budget cuts, hospitals are looking to engage industry more quickly and at earlier stages of research, secure private donations for research, and dedicate more of their own funds to sustain medical research.

- **Big, private investments in life sciences and bio-tech companies are largely unaffected by the sequestration, today, but that is not guaranteed into the future.** Major national, international, and Massachusetts-based life sciences companies are proceeding with major investments. However, these companies developed or located in Massachusetts due to the state's unique ecosystem that supports their growth. Massachusetts offers a very successful recipe for the life sciences industry but industry leaders are very concerned that reduced NIH funding will undermine this eco-system. Global competition is heating up for talented biotech workers (e.g., China is actively trying to recruit back expats to develop biotech there) and if the NIH funding losses become systemic, Massachusetts (and the U.S.) could begin losing talent to other parts of the world. Investor uncertainty from the NIH cuts may also further reduce resources available to develop life sciences in Massachusetts. Ultimately, the sequestration will not affect life science companies' current 5-year investment plans in Massachusetts but could affect future investment decisions if the federal research funding cuts become permanent.

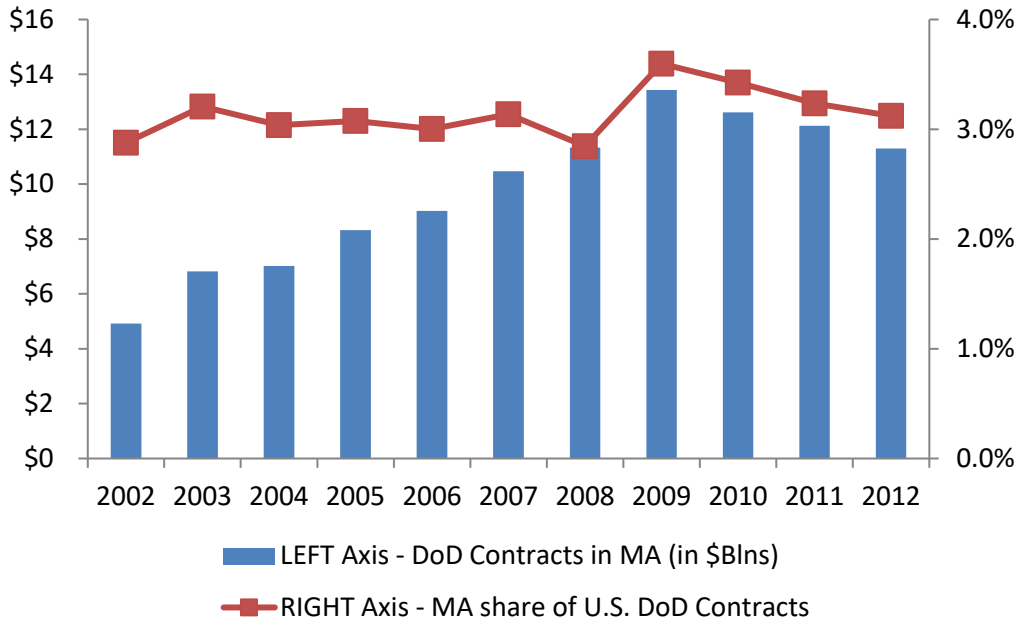
- **Fusion program ends at MIT.** A long-running experiment, the Alcator C-Mod project that explores nuclear fusion as a possible energy source, will be shut down at MIT due to the sequestration cut that came on top of already diminished federal funding. Physicists, technicians, and engineers will face layoffs due to the program cut and the U.S. will be left with only two similar initiatives at Princeton and in San Diego. With a progressed, competitive fusion program located in France, there is worry about the U.S. losing its preeminence and its technical expertise in the area. Fusion may offer a viable energy alternative within 20 years but technical progress will slow with fewer federal research dollars, representing both a lost opportunity as well as a strategic long-term concern for the United States. MIT is the largest producer of fusion PhDs in the country but applications have gone down with the cuts. MIT is now putting the Alcator C-Mod project into "cold" shutdown, meaning it could be revived if funding is restored.

The budget stalemate and the sequestration cuts are creating an air of uncertainty among Massachusetts' research institutions and the industries that depend on them. The interviews underscore that research capacity lost today through reductions in federal spending are likely to have a cascading effect in the future. Massachusetts will remain a relative leader in research, innovation, and in advanced industries like life sciences but the scope and breadth of the state's (and the country's) capabilities to bring invention forward will be effectively undermined by the sequestration. The possible erosion of the state's competitiveness, including opportunities lost to other nations like China and France, would have palpable effects on future economic conditions in Massachusetts. The exact extent of these effects will begin to become more visible in coming years should the sequestration cuts remain.

Defense Spending

Defense procurement is a key component of the Massachusetts economy. In FFY 2012, Massachusetts received $11.3 billion in Department of Defense contracts, ranking 10th among the states. On a per capita basis, Massachusetts receives about 50 percent more defense procurement dollars than the national average. Massachusetts procurement contracts increased dramatically in the 2000s (see Figure 8) as U.S defense spending rose to support wars in Iraq and Afghanistan and to address terrorism threats. Although it can fluctuate on a year to year basis, Massachusetts generally receives 3.0 to 3.5 percent of total U.S. defense procurement spending annually.

Figure 8. Total Massachusetts Department of Defense Contracts and Share of U.S., FFYs 2002-2012



Source: Data retrieved from USA Spending in November 2013

The Department of Defense must absorb half of the sequestration cuts with the other half going to domestic programs. In FFY 2013, this translated to a 7.8 percent mandated reduction in defense spending. Without a budget agreement, the scale of these cuts is expected to be similar in FFY 2014. The actual impacts of the sequestration, however, were limited in Massachusetts in FFY 2013 as the state's leading military contractors continued to have substantial work from contracts signed in earlier years. Raytheon, the largest defense contractor in Massachusetts (see Table 15), reported that through 2013, the U.S. military budget cuts required under sequestration were not hitting the defense industry as quickly as initially expected.[13] Raytheon is planning for continued federal sequestration cuts in 2014 but is expecting large-scale contracts, both domestic and international, to buttress potential effects from the sequestration. General Electric's Lynn facility, a manufacturer of aircraft and helicopter engines and one of the state's largest military contractors, has remaining contracts for engine orders to get it through 2013. However, sequestration's prolonged impact could be felt in future engine and spare part orders, affecting

[13] Reuters, "Raytheon reports higher than expected earnings, raises forecast," October 24, 2013.

procurement levels in 2014 and beyond.[14] As an example of identified impacts, a Northampton manufacturer of sensors used in submarines and surface ships, L-3 KEO, announced layoffs of 19 employees in late 2013 in part because of declining defense spending and the impact of the sequestration.[15] Due to the military's changing priorities and the high levels of competition for procurement contracts, it remains to be seen how well the Massachusetts defense industry fares in future years. The Commonwealth's strengths in higher technology military applications and less exposure to programs like the F-35 fighter jet (a program expected to face cuts) may help its relative performance in winning military contracts but continued sequestration cuts in defense are so substantial that Massachusetts and its contractors will likely experience tangible reductions in military contracts in the future.

Table 15. Top 5 Recipients of Defense Contract Awards in Massachusetts, FFY 2012

Recipient	Defense Contract Awards
Raytheon Company	$3,790.9
General Electric Company	$1,492.2
General Dynamics Corporation	$1,264.5
Massachusetts Institute of Technology	$961.7
Stark Draper Laboratory, Inc.	$325.1
Top 5 Total (in USD)	$7,834.4
MA Total Defense Contract Awards	**$11,298.8**
Top 5 Total (Share of Total Defense Contract Awards)	69.3%

Source: Data retrieved from USA Spending in September 2013
Note: All dollar amounts are in millions of current USD.

A survey of government contractors conducted as part of this study underscored the current level of concern that manufacturers, in particular, have regarding prospects for federal military procurement in Massachusetts. Key findings from the survey include: (1) a very low response rate to the survey indicated that the current effects of the sequestration are likely quite limited and not yet widespread among Massachusetts contractors. The impetus to respond to the survey would be reduced if the sequestration is not an active concern; and (2) among the handful of companies that did respond as being affected by the sequestration, there was tangible evidence of impacts to small-to-medium sized subcontractors and suppliers. In the face of the sequestration, larger companies can more easily shift resources whereas smaller firms, with lower margins and fewer contracts have less flexibility in adapting to sequestration-driven declines in military orders. Even if the sequestration is having limited current effects, it is contributing to economic uncertainty and is making some companies reluctant to invest. Although hopeful for future defense orders, companies are uncertain about what the future may bring.

[14] The Daily Item, "GE stable for '13 in face of sequestration," February 23, 2013.
[15] The Republican, "Northampton Company L-3 KEO announces the elimination of 19 positions," November 22, 2013.

Appendix A: Key Elements of the Methodological Approach

This section of the report details key elements of the methodological approach that the research team employed in the collection, organization and analysis of data on the economic impacts of sequestration on the Massachusetts economy in FFYs 2013 and 2014. First, we explain our data collection process of federal non-defense and defense funding in Massachusetts. This is followed by a description of how furlough impacts were estimated based from employment and wage data for defense and non-defense employees. Then we discuss how we transformed these estimates into inputs in the IMPLAN input-output modeling software and how IMPLAN generated an estimate of the total economic effects (including multiplier effects) of the sequestration.

Data Collection

Federal Non-defense and Defense Funding: Contracts and Grants

The UMDI research team derived all data on federal funding for Massachusetts from several public and proprietary sources.

With assistance from the Massachusetts Executive Office of Administration and Finance (ANF), data on specific program funding were retrieved from the publicly available Schedule of Expenditures of Federal Awards (SEFA) for Massachusetts and the subscription-based Federal Funds Information for States (FFIS) data sets.

FFIS' database includes most, although not all, federal grant-in-aid and formula grant programs, so the research team used the SEFA data to establish a complete set of formula grant spending that flows to and through Massachusetts. As explained below, some federal funds go directly to the state while others are released directly to non-government contractors who then perform their work in the state. Programs were categorized using the Catalogue of Federal Domestic Assistance (CFDA) codes and cross-referenced from both sources to avoid duplications.

The CFDA codes were also used to distinguish exempt from non-exempt programs, the status of which has been confirmed by Congressional Research Service (CRS) reports on sequestration and from the FFIS and ANF.

We consulted numerous secondary sources, and our findings build upon the research of the following institutes and academic researchers:

- Several CRS reports provided us with context about how the sequestration reduction percentages would operate across various mandatory[16] and discretionary[17] programs. One CRS report in particular examined the "special rules" of the sequestration cuts and explained how portions of

[16] Levit, D. A. (2012, March 23). Mandatory Spending since 1962. Congressional Research Service. Retrieved September 2013, from http://www.fas.org/sgp/crs/misc/RL33074.pdf

[17] Austin, D. A. (n.d.). Trends in Discretionary Spending. Congressional Research Service. Retrieved September 2013, from http://www.fas.org/sgp/crs/misc/RL34424.pdf

certain programs or agency budget accounts were either exempt or subject to both the mandatory and discretionary reduction rate – for example community and migrant health centers.[18]

- Reports from the Center on Budget and Policy Priorities provided us with a detailed dissection of the structure of federal non-defense discretionary spending[19] and the shares of federal tax dollars that are disseminated to those budget categories.[20]
- Richard Kogan's report for the Center on Budget and Policy Priorities described how sequestration would occur and produced estimates of potential impacts on the federal level.[21] These estimates were considered when we established our own range of estimates.
- Our range of estimates for the economic impacts on Massachusetts also considers the work of Stephen Fuller, whose March 2013 report employs IMPLAN to estimate the effects of sequestration on the federal level.[22]
- We also relied on the breadth of research in which the UMass Donahue Institute has an expertise – profiling the defense industry sector of Massachusetts.[23]

The mandated level of sequestration percentage reductions depended upon three major criteria:

1) whether the program, project or activity was exempt or non-exempt from sequestration;
2) whether the program, project or activity was funded from mandatory or discretionary appropriations; and
3) whether those funds were allocated to defense or non-defense functions.

Thus throughout our data collection process, we organized and classified our data so that their contribution to the total sequestration impacts could be appropriately and accurately measured. We sorted the full set of programs into non-defense mandatory, non-defense discretionary and exempt categories (which were excluded from the analysis). Table 16 shows examples of the major federal programs that are subject to sequestration including the State Energy Program and Crime Victims Fund Program, among many others. The federal programs that are exempt from sequestration including Pell Grants, the Children's Health Insurance Program (CHIP), Temporary Assistance for Needy Families (TANF), the Supplemental Nutrition Assistance Program (SNAP, better known as "food stamps"), and Medicaid are listed in Table 17.

[18] Spars, K. (2013, June 13). Budget "Sequestration" and Selected Program Exemptions and Special Rules. Congressional Research Service. Retrieved September 2013, from http://www.fas.org/sgp/crs/misc/R42050.pdf

[19] Center on Budget and Policy Priorities. (2013, June 14). Policy Basics: Non-Defense Discretionary Programs. Retrieved September 2013, from http://www.cbpp.org/files/PolicyBasics-NDD.pdf

[20] Center on Budget and Policy Priorities. (2013, April 22). Policy Basics: Where Do Our Federal Tax Dollars Go? Retrieved September 2013, from http://www.cbpp.org/files/4-14-08tax.pdf

[21] Kogan, R. (2013, March 22). Sequestration by the Numbers. Center on Budget and Policy Priorities. Retrieved September 2013, from http://www.cbpp.org/cms/?fa=view&id=3937

[22] Fuller, S. (2013, March). The Economic Impact of Sequestration Budget Cuts to DOD and Non-DOD Agencies as Modified by the American Taxpayer Relief Act of 2012. George Mason University. Retrieved September 2013, from http://cra.gmu.edu/pdfs/Sequestration_Update.pdf

[23] For more information, please consult the following reports: UMass Donahue Institute. (November 2012). The New England Defense Industry: Current Profile and Economic Significance, Massachusetts Summary. Hadley, MA: UMass Donahue Institute; <http://www.massbenchmarks.org/publications/studies/pdf/MA_Defense%20Industry_11_8.pdf>. UMass Donahue Institute. (October 2011). New England Defense Contracting Trends, 2006-2010. Hadley, MA: UMass Donahue Institute. <http://www.defensetech.net/articles/news/NE%20Defense%20Data%20Memo_10_6_11%20(3).pdf>; UMass Donahue Institute. (August 2012). An Economic Contribution Analysis and Overview of Massachusetts Military Installations. Hadley, MA: UMass Donahue Institute. <http://www.massdevelopment.com/wp-content/uploads/2012/08/Military_Installation_Report_Final.pdf>.

The FFIS and SEFA sources contain only information about *formula* grants; therefore we collected data from USA Spending and interviews with key informants at major research universities in Massachusetts to obtain complete and accurate data on *competitive* and *research* grants. These types of grants do not typically flow through the state and local governments and are instead awarded to research facilities and universities. In addition to providing a more comprehensive set of all state grants, these interviews provided useful context for the impacts of sequestration on the significant life sciences field in Massachusetts. For instance, our team conducted interviews with the contacts at the Massachusetts Life Sciences Center, Brandeis University, the Massachusetts Institute of Technology, Small Business Administration, and the Massachusetts Biotechnology Council (MassBIO) in order to obtain actual impacts of sequestration on research grant funding. Similarly, we interviewed contacts at the Massachusetts Hospital Association for actual impacts of sequestration on research grants and Medicare funds. All non-defense grant data were supplemented by and combined with data on primary grant awards pulled from USA Spending.

Table 16. Examples of Federal Programs Subject to Sequestration and a Summary of Impacts

Department of Agency	Program, Project or Activity	Summary of Impacts
Department of Agriculture	Supplemental Feeding Program for Women, Infants and Children	Fewer infants and children would have access to nutritious foods and fewer mothers would have access to breastfeeding and nutritional programs for newborns
Department of Commerce	Public Safety Interoperable Communications Grant Program	Fewer first responders in Massachusetts would have the ability to communicate efficiently during a catastrophic event
Department of Education	Federal Work Study Program for College Students	Fewer Massachusetts students would have the access to financial resources that could allow them to attend college
Department of Energy	State Energy Program	Massachusetts would have fewer funds available to invest in the research, development and implementation of energy-efficient goods and services
Environmental Protection Agency	Clean Water State Revolving Fund Program	Massachusetts would have limited ability to protect people and wetlands from the effects of water pollution
Department of Health and Human Services	Child Care and Development Program	Fewer low-income parents in Massachusetts would have access to child-care resources needed for them to be able to work or attend classes or training
Department of Homeland Security	State Homeland Security Grant Program	Massachusetts would have fewer resources to prevent, respond to and recover from acts of terrorism and natural disasters
Department of Housing and Urban Development	HOME Investment Partnership Program	Less affordable housing would be available for low-income families
Department of the Interior	Boating Safety	Massachusetts would have limited ability to educate the public about boating safety and ensure the safety of residents and tourists from boating accidents
Department of Justice	Crime Victims Fund Program	Fewer victims of violent crimes in Massachusetts would be able to afford resultant legal fees and requisite support services
Department of Labor	Dislocated Worker Grant Program	Fewer unemployed residents (including veterans) in Massachusetts would have access to job training, career counseling, outreach, job search, and placement services
Department of Transportation	Pipeline Safety	Massachusetts would have reduced resources and capability to protect people, the environment and property from the risks associated with the transportation of hazardous materials

Source: Data retrieved from federal program and agency websites in November 2013

Table 17. Examples of Federal Programs Exempt from Sequestration

Department of Agency	Program, Project or Activity
Department of Agriculture	School Breakfast and Lunch Programs
	Special Milk
	Supplemental Nutrition Assistance (Food Stamps)
	Emergency Food Assistance Program (TEFAP)
	Fresh Fruit and Vegetable Program
Department of Education	Pell Grants
Department of Health & Human Services	Vaccines for Children
	Temporary Assistance for Needy Families (TANF)
	Children's Health Insurance Program (CHIP)
	Foster Care
	Adoption Assistance
	Child Support Enforcement
	Medicaid
Department of Transportation	Highway Safety Improvement Program
	Safe Routes to School
	Metropolitan Planning
	Job Access and Reverse Commute
	Railway Highway Crossings
	Airport Improvement Program
Department of Veterans' Affairs	Veterans' Medical Care
	Veterans' State Nursing Home Care
	Veterans' State Domiciliary Care

The research team collected data on non-defense and defense contracts and grants from USA Spending and Bloomberg Government. As a proprietary data consultant, Bloomberg Government played a key role in our study by providing us with the most current data on federal grants and contracts and access to their experts on the federal budget in general and military spending in particular.[24] Since half of the sequestration reductions affect defense spending and Massachusetts is a leading state for military procurement, we anticipated that sequestration would incur a sizeable impact on the state's numerous government contractors, who produce various research and development, cyber-security, testing, software, engineering, and manufactured goods (e.g., missiles and aircraft engines) and services for the Department of Defense.

[24] More information about Bloomberg Government can be found at <http://about.bgov.com/>.

We collected data on the impacts of sequestration on Emergency Unemployment Compensation in FFYs 2013 and 2014 from electronic correspondences with the Federal Reserve Bank of Boston and the National Employment Law Project's July 2013 report on sequestration.[25] We also gathered information on the impacts that sequestration would have on small businesses and entrepreneurs in Massachusetts from our interviews with the Small Business Administration.

Federal Non-defense and Defense Employee Wages and Furloughs

Data on defense and non-defense federal employment and employee wages were obtained from the U.S. Office of Personnel Management's web-based FedScope tool. This source afforded us current figures (as of March 2013) and distributions of employment and wages across all federal agencies and departments that have employees in Massachusetts. Employment and wage data for military installations in Massachusetts were collected through electronic correspondences and compiled by the Office of the Governor's Military Task Force in September 2013.

The furlough data (i.e., the number of furlough days affecting different government agencies) for FFY 2013 were collected from Bloomberg Government and publicly available news sources that recorded actual furlough numbers in real time. Furlough estimates for FFY 2014 were based upon calculations that utilized both the data from FedScope and the Governor's Office.

Inputs for Economic Impact Analysis and the IMPLAN Model

After completing an estimate of the direct funding cuts in Massachusetts resulting from the sequestration, the research team translated the cuts into variables that could be used as inputs for MIG Inc.'s IMPLAN economic model. The different categories of federal spending cuts were translated into IMPLAN inputs in the following manner:

- All non-defense funds that pass through the state were disaggregated into State Education Institution Spending, State Non-Education Institution Spending, and Capital Investments.
- The reductions in Medicare were translated into impacts experienced by Hospitals and Offices of Physicians, as this is the subset of institutions and businesses that will feel the full impact of the 2.0 percent cut in Medicare payments.
- Non-defense contracts and grants were divided into State Education Institution Spending, State Non-Education Institution Spending, and industry sales.
- Defense Contracts were entered into IMPLAN as a change in industry sales. We based our allocations on findings from the UMDI 2012 study on the Massachusetts defense industry.[26]
- Defense funds allocated for research and development appear in the model as a change in sales for the Scientific Research industry.
- Defense funds allocated for base operations, operations and maintenance, and military construction were entered into the model as a change in Federal Defense Institution Spending.
- The impacts of furloughs on federal employee wages – for both defense and non-defense departments – were converted into changes in Employee Compensation/Labor Income.
- Similarly, the sequestration reductions to Emergency Unemployment Compensation were also converted to changes in Employee Compensation/Labor Income.

[25] National Employment Law Project (NELP). (2013, July). State Implementation of the Sequester Cuts to Federal Emergency Unemployment Compensation (EUC) Program. Retrieved from http://nelp.3cdn.net/6320ece2f3fe1f26f3_9em6bhlqt.pdf

[26] UMass Donahue Institute. (November 2012). The New England Defense Industry: Current Profile and Economic Significance, Massachusetts Summary. Hadley, MA: UMass Donahue Institute; <http://www.massbenchmarks.org/publications/studies/pdf/MA_Defense%20Industry_11_8.pdf>.

IMPLAN's economic impacts of the federal spending cuts were estimated specifically for Massachusetts at the state level. The economic impact results generated by IMPLAN are reported in terms of the following:

- **Job impacts** represent a change in average annual jobs for the year indicated (compared to a scenario where sequestration cuts are not implemented).
- **Labor income** consists of total employee compensation (wage and salary payments, as well as health and life insurance benefits, retirement payments and any other non-cash compensation) and proprietary income (payments received by self-employed individuals as income).
- **Value added** represents total business sales (output) minus the cost of purchasing intermediate products and is roughly equivalent to gross state/domestic product (commonly referred to as GSP or GDP).
- **Output** is a broader measure that consists of total business or industry sales.
- **State revenue** is the estimated impact on state tax collections attributable to the sequestration. It is primarily comprised of impacts on sales tax and personal income tax revenues.

About Us

The UMass Donahue Institute (UMDI) is the public service outreach and economic development unit of the University of Massachusetts President's Office. Established in 1971, the UMDI coordinates multi-campus initiatives that link UMass, other public and private higher education, and other external resources with the needs of government agencies, corporations, and nonprofit organizations. UMDI provides significant economic and public policy analysis, organizational development, training, education, financial management education, research, and evaluation to federal and state agencies, nonprofits, industry associations, and corporations. UMDI draws on its unique position within higher education to serve as a bridge between theory, innovation, and real-world applications.

The Economic and Public Policy Research (EPPR) group is a leading provider of applied research, helping clients make more informed decisions about strategic economic and public policy issues. EPPR produces in-depth economic impact and industry studies that help clients build credibility, gain visibility, educate constituents, plan economic development initiatives, and prioritize investments. EPPR is known for providing unbiased economic analysis on state-level economic policy issues in Massachusetts and beyond, and has completed a number of economic studies on manufacturing, technology, defense industries, life sciences, telecommunications, health care, and transportation. Their trademark publication is called *MassBenchmarks*, an economic journal that presents timely information concerning the performance of and prospects for the Massachusetts economy, including economic analyses of key industries that make up the economic base of the state.

For more information, visit www.donahue.umassp.edu and www.massbenchmarks.org.