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## 2011 UPDATE


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### ABSTRACT

This study focuses on the employment effects of military spending versus alternative domestic spending priorities, in particular investments in clean energy, health care and education. We first present some simple alternative spending scenarios, namely devoting $1 billion to the military versus the same amount of money spent on clean energy, health care, and education, as well as for tax cuts which produce increased levels of personal consumption. Our conclusion in assessing such relative employment impacts is straightforward: $1 billion spent on each of the domestic spending priorities will create substantially more jobs within the U.S. economy than would the same $1 billion spent on the military. We then examine the pay level of jobs created through these alternative spending priorities and assess the overall welfare impacts of the alternative employment outcomes. We show that investments in clean energy, health care and education create a much larger number of jobs across all pay ranges, including mid-range jobs (paying between $32,000 and $64,000) and high-paying jobs (paying over $64,000). Channeling funds into clean energy, health care and education in an effective way will therefore create significantly greater opportunities for decent employment throughout the U.S. economy than spending the same amount of funds with the military.

## 1. INTRODUCTION

This paper examines the employment effects of military spending versus channeling equivalent amounts of funding into education, health care, clean energy, and personal consumption within the U.S. economy. Specifically, we consider the impact of devoting a given amount of money — for example, $1 billion — to the military versus spending the same amount of money for these four non-military alternatives.

Since mid-2011, the impact of military spending on job creation has been discussed prominently in the United States, as one component of the broader debate on how to reduce the federal government's fiscal deficit. The figures we present here aim to help clarify that debate.[1] Our key finding is that spending on the military is a poor source of job creation relative to spending on the green economy, health care, education, or even personal household consumption.

The U.S. government spent $689 billion on the military in 2010.[2] This amounts to about $2,200 for every resident of the country. The level of military spending has risen dramatically since 2001, with the increases beginning even before September 11, 2001. In constant dollar terms (after controlling for inflation), military spending rose at an average rate of 5.3 percent per year from 2001 – 2010, i.e. through the full eight years of the Bush presidency and the first two years under President Obama. By contrast, the overall U.S. economy grew at an average annual rate of 1.6 percent over this past decade. As a share of GDP, the military budget rose from 3.0 to 4.7 percent between 2001- 2010. At the current size of the economy, a difference between a military budget at 4.7 rather than 3.0 percent of GDP amounts to $250 billion.

The largest increases in the military budget over 2001 – 2010 were associated with the Afghanistan and Iraq wars. These two wars cost $165.3 billion in fiscal year 2010 and $1.1 trillion over the decade 2001-2010, according to the Congressional Research Service.[3] Subtracting this $165 billion from the 2010 Pentagon budget would itself have brought down U.S. military spending from 4.7 to 3.6 percent of GDP. The Obama administration has committed to withdrawing all troops from Iraq by the end of 2011 and the majority from Afghanistan as well by the end of 2012. It is therefore appropriate now to anticipate significant reductions in military spending in the coming years as a share of overall U.S. economic activity.

In August 2011, the U.S. Congress passed legislation to create a "supercommittee," the purpose of which was to try to find common ground between Democrats and Republicans for achieving long-term reductions in the government's fiscal deficit. Part of the arrangement in establishing the supercommittee was that the military budget would automatically be cut by nearly $500 billion over 10 years—i.e. $50 billion per year—beginning in 2013 if the committee failed to reach an agreement by its stipulated November 23, 2011 deadline. Medicare and other domestic programs would also face nearly $500 billion in cuts starting in 2013. Given that the supercommittee did fail to reach an agreement, the federal government is now scheduled to proceed with all of these budget cuts. Still, it remains unclear whether any of these cuts will in fact be enacted, since Congress can always reverse previous legislative decisions.

Whatever may result from the ongoing Congressional debates on deficit reduction, a major claim that emerged around the supercommittee's deliberations was that large cuts in the military budget would produce severe negative impacts on jobs in the U.S. economy. The Pentagon itself offered the position that military cuts in the range of $1 trillion over the next decade — i.e. twice the level that would occur under the Congressional supercommittee's arrangement — would add 1 percentage point to the U.S. unemployment rate. Other analysts have made similar claims.[4]

[1] At the same time, we are not entering here into the broader debate around the U.S. fiscal deficit and debt. See Pollin (2011) on this broader set of issues.

[2] This and related figures on the U.S. federal government budget are obtained from the U.S. Office and Management and Budget Historical Tables.

[3] Belasco (2011) Table 1. Stiglitz and Bilmes (2008, 2010) estimate the overall costs of the Iraq war alone as over $3 trillion, including the costs over time of diagnosing, treating, and compensating disabled veterans.

[4] Phil Stewart, "Pentagon Cuts Could Worsen Unemployment: Pentagon," Reuters, September 15, 2011 (http://www.reuters.com/article/

Whether any of these particular forecasts of employment effects are accurate, it is certainly true that the Pentagon is a major employer in the U.S. economy, so that cuts to the Pentagon budget, considered on their own, could not help but produce large reductions in employment. In fact, the approximately $690 billion Pentagon budget for 2010 provided the funding for nearly 6 million jobs, both within the military itself and in all the civilian industries connected to the military.[5] In addition, because of the high demand for technologically advanced equipment in the military, a good proportion of the jobs created by the military budget are well-paying and professionally challenging.

However, in terms of assessing the employment effects of military spending on the economy, the most important question is not the absolute number of jobs that are created by spending, for example, $1 billion. It is rather whether spending $1 billion on the military creates a greater or lesser number of jobs *relative to spending the same $1 billion on alternative public purposes*, such as education, health care or the green economy, or having consumers spend that amount of money in any way they choose.

As we show, in comparison to these alternative uses of funds, spending on the military is a relatively poor source of job creation. Indeed, our research finds that $1 billion in spending on the military will generate about 11,200 jobs. By contrast, the employment effects of spending in alternative areas will be 15,100 for household consumption, 16,800 for the green economy, 17,200 for health care, and 26,700 for education. That is, investments in the green economy, health care and education will produce between about 50–140 percent more jobs than if the same amount of money were spent by the Pentagon.

We do also find that jobs created by military spending provide relatively high average wages and benefits in comparison with these other sectors of the economy. This is especially because, on average, jobs associated with the military provide far more generous benefits than can be obtained in other sectors of the U.S. economy. Nevertheless, because spending on clean energy, health care, and education produces substantially more jobs overall per $1 billion in spending, it also creates more good jobs. This includes jobs paying within a mid-range, which we define as between $32,000 - $64,000 per year, as well as high-paying jobs, i.e. those paying over $64,000.

This study is an updated version of two previous reports that we published, including a more detailed presentation in 2007 and an initial updated analysis in 2009 (see Pollin and Garrett-Peltier 2007, 2009). For this version, we have updated all the employment estimates, using the most recent figures from the U.S. Department of Commerce, Bureau of Labor Statistics and other sources. All sources are described in the appendix. The basic findings of this paper have not changed relative to our previous paper, though some of the detailed results do vary.

In the next section of the paper, we explain why employment creation varies by sectors within the U.S. economy and briefly describe our methodology for estimating relative employment effects. We present our estimates on employment creation in Section 3. Section 4 then provides figures on differences in compensation levels between sectors. We offer some brief concluding observations in Section 5.

## 2. WHY EMPLOYMENT CREATION VARIES BY SECTOR

The basic tool we use for estimating the net overall employment effects of alternative government spending priorities in the United States is the input-output model of the U.S. economy, produced every five years and updated annually by the Department of Commerce. The input-output analytic framework was first developed in the 1930s by Nobel Laureate economist Wassily Leontief, with many subsequent refinements by Leontief and others. An input-output

2011/09 /16/us-usa-defense-spending-idUSTRE78F09720110916). We are unaware of the underlying research though which these Pentagon results were derived. One widely cited separate study by Stephen Fuller of George Mason (2011) found that 1 million jobs would be lost through a $45 billion cut in Pentagon spending to purchase military equipment.

[5] We are not including here the generation of jobs through 'induced' or multiplier effects. We cover this topic in the next section of the paper.

model traces through all of the factors—i.e. inputs—that go into producing a given output. For example, we can observe through the input-output model of the U.S. economy how many and what types of workers, how much and what types of equipment, and how much energy — all *inputs* — are needed to produce a military fighter airplane, tank or warship — i.e. the *outputs*. We can also observe what the equivalent requirements would be to keep an existing elementary school or hospital functioning or to build a new school or hospital. Similarly, we can use the input-output model to estimate the employment and other requirements for investing in clean energy activities. These would include energy efficiency projects such as building retrofits, public transportation and upgrading the electrical grid system; and renewable energy projects such as expanding the capacity to produce wind, solar, and geothermal energy on a cost-effective basis.

To estimate the overall employment effects of any given spending target, such as a fighter bomber airplane or a school, we have to consider three factors within the overall input-output model:

**1. Direct effects:** the jobs created by producing the fighter bomber or school;

**2. Indirect effects:** the jobs associated with industries that supply intermediate goods for building a fighter bomber, school, or any other direct spending target. These would include the steel, glass, tire, and electronic industries for building an airplane; and concrete, glass, and trucking industries for building a school.

**3. Induced effects:** the expansion of employment that results when people who are paid to build a fighter bomber or school spend the money they have earned on other products in the economy.

How could one spending target create more jobs for a given amount of expenditure than another? As a matter of simple arithmetic, there are only three possibilities, which we can illustrate by comparing the situation for educational versus military spending:

**1. Labor Intensity.** When proportionally more money of a given overall amount of funds is spent on hiring people, as opposed to spending on machinery, buildings, energy, land, and other inputs, then spending this given amount of overall funds will create more jobs. The average labor intensity of the education-related industries — i.e. number of jobs created per dollar of spending, as opposed to the amount spent on machinery, buildings, energy, land and other inputs — is higher than the labor intensity of military-related industries.

**2. Domestic content.** If we are considering job creation within the U.S. economy, when a higher proportion of a given amount of funds is spent within the U.S. as opposed to spending on imports or activities in other countries, the given amount of money will, again, create more jobs. The overall level of spending within the U.S. economy — as opposed to the rest of the world — is higher for education than the military. For example, we roughly estimate that U.S. military personnel spend only 43 percent of their income on domestic goods and services (including import purchases in this calculation) while the U.S. civilian population, on average, spends 78 percent of their income on domestic products.

**3. Compensation per worker.** If there is $1 million total to spend in a given year, and one employee earns $1 million per year, then that obviously means that only one job is created through spending $1 million. However, if the average pay is $50,000 per year, then the same $1 million will generate 20 jobs at $50,000 per person. Thus, if the average pay for all of the industries associated with education — including direct, indirect, and induced effects — is lower than the average pay for the military-related industries, then more jobs will be created through spending a given amount of money in education as opposed to the military.

## 3. EMPLOYMENT ESTIMATES

We present in Table 1 and Figure 1 our estimates of the effects of spending $1 billion on alternative sectors within the U.S. economy, including military spending, clean energy, health care, and education. We also include figures for tax cuts that then get

translated dollar-for-dollar into increased levels of household consumption. We include this category of tax cuts/household consumption since it is the most straightforward alternative use of funds now devoted to the military — i.e. the money freed up from a reduction in military spending goes back directly to taxpayers for them to use as they see fit.[6] Our estimates are derived from the 2009 U.S. input-output model, along with other data sources on national income and employment within the United States. We describe our data sources and techniques for estimation in depth in the Appendix.

We wish to stress here that our figures are, of course, *estimates*. We are confident in their reliability as estimates, but we cannot claim that they are accurate down to the level of every detail. There are two basic reasons for this. First, one faces a wide range of technical challenges in developing empirical estimates of matters such as those we are posing here. No model will adequately capture the full range of influences that, in the real world, produce economic outcomes, such as job creation. At the same time, of all the unavoidably imperfect approaches available for us to use, we are confident in the reliability of our own methods.[7] In addition to the strictly methodological issues in play, all researchers, including ourselves, are working with data sources that are subject to changes over time. Still, we are again confident that, in terms of the data that are available to us at the time of writing, the figures we are reporting are as reliable as possible.

The first two columns of Table 1 report direct and indirect job creation estimates for each of our five spending targets: military spending, household consumption, clean energy, health care, and educational services. We then summarize these direct and indirect effects in column 3. Column 4 then reports our estimates for induced job creation for each of the spending targets. Column 5 then adds together direct, indirect, and induced job creation. Finally, in column 6, we present the overall job creation figures for each spending target relative to military spending.

Considering overall job creation, we see from Table 1 that military spending creates about 11,200 from $1 billion in spending. By a significant amount, this is the fewest number of jobs of any of the alternative uses of funds that we present. Thus, household consumption generates about 15,100 jobs, 35 percent more than military spending. Clean energy generates about 16,800 jobs (50 percent more than military), and health care generates about 17,200 jobs (54 percent more than the military). Spending on education is the largest source of job creation by a substantial amount, generating about 26,700 jobs overall through $1 billion in spending, which is 138 percent more than the number of jobs that are generated through $1 billion in military spending.

These overall job creation figures are summarized again in Figure 1 (page 6). The large disparities in the job-generating capacity of our four domestic spending categories relative to military spending emerge sharply in this figure.

**TABLE 1. EMPLOYMENT CREATION THROUGH SPENDING $1 BILLION FOR ALTERNATIVE SECTORS OF THE U.S. ECONOMY, 2009**

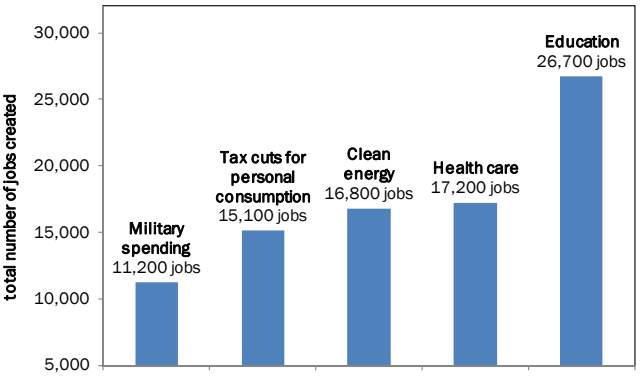
| | (1) Direct Jobs | (2) Indirect Jobs | (3) Direct + Indirect Jobs (= columns 1+2) | (4) Induced Jobs | (5) Total Job Creation (= columns 3+4) | (6) Total Job Creation Relative to Defense Spending |
|---|---|---|---|---|---|---|
| Military | 6,800 | 1,800 | 8,600 | 2,600 | 11,200 | – |
| Tax cuts for personal consumption | 7,300 | 3,500 | 10,800 | 4,300 | 15,100 | +34.8% |
| Clean energy | 7,900 | 4,100 | 12,000 | 4,800 | 16,800 | +50.0% |
| Health care | 8,400 | 3,900 | 12,300 | 4,900 | 17,200 | +53.6% |
| Education | 15,300 | 3,800 | 19,100 | 7,600 | 26,700 | +138.4% |

*Sources: See Appendix*

[6] At the same time, we recognize that households do not spend all of the additional income they receive from tax cuts, but rather either increase savings or pay off debts with a significant share of this additional income. This was certainly the case over the 2008-09 recession, in which the expansionary impacts of tax cuts resulting from the American Recovery and Reinvestment Act stimulus program were substantially weaker than other components of the stimulus, such as direct government spending (see Congressional Budget Office 2011 and Pollin 2011 for further discussion). For our discussion here, we are presenting the most favorable employment effects from tax cuts—i.e. through a scenario where all tax cuts translate dollar-for-dollar into additional household spending.

[7] See Pollin, Heintz, and Garrett-Peltier (2009) for an extended discussion of related methodological issues.

FIGURE 1. JOB CREATION IN THE U.S. THROUGH $1 BILLION IN SPENDING




## 4. COMPENSATION LEVELS

As mentioned above, one way in which a given amount of spending will create a different number of jobs overall is through variations in compensation levels — e.g. spending $1 million in a year could create a total of one job or 20 jobs, depending on whether average compensation is $1 million or $50,000 per year. If the only way that more jobs are created through non-military as opposed to military spending activities is by paying much lower wages and benefits, we then need to question whether the net job impact of an alternative use of funds is superior to spending on the military.

Thus, in Table 2, we present figures on average wages, benefits, and total compensation for the various sectors we have been considering. These figures incorporate all jobs created through spending in the different sectors, including direct, indirect and induced jobs. In the first column of the table, we report on average wages in each of the sectors, and the second column shows the average wage in the four domestic spending areas relative to military spending. As we see, average wages generated by military spending, at $58,096 per year, are higher than any of the other four sectors. The average wage in the health care, education and clean energy sectors are nearly identical at around 50,000 per year, around 14 percent below that for the military.[8] Average wages for personal consumption spending are somewhat lower, at around $47,000 per year, 19 percent below the average for the military.

TABLE 2. AVERAGE WAGES, BENEFITS AND TOTAL COMPENSATION FOR ALTERNATIVE SECTORS OF U.S. ECONOMY, 2009: TOTAL JOB CREATION: DIRECT, INDIRECT, AND INDUCED JOBS

| | (1) Average Wages | (2) Average Wages relative to Military | (3) Average Benefits | (4) Average Total Compensation (= columns 1+3) | (5) Average Total Compensation Relative to Military |
|---|---|---|---|---|---|
| Military | $58,096 | -- | $32,679 | $90,776 | -- |
| Tax cuts for personal consumption | $47,021 | -19.1% | $15,704 | $62,725 | -30.9% |
| Clean energy | $49,966 | -14.0% | $22,274 | $71,340 | -21.4% |
| Health care | $50,121 | -13.7% | $18,857 | $68,978 | -24.0% |
| Education | $49,972 | -14.0% | $21,375 | $72,246 | -20.4% |

*Sources: See Appendix*

These differentials widen substantially when we then factor in benefits provided within each sector. These figures are shown in column 3 of the table. Here we see that the benefits provided by military spending are far greater than the other sectors. Thus, military sector benefits average nearly $33,000, with the next highest being clean energy at about $22,300.

The much higher level of benefits for the military means that, when we consider overall compensation — including wages plus benefits — spending on the military does come out significantly higher than other sectors. We see this in columns 4 and 5 of Table 2. Average overall compensation for jobs generated by military spending, at $90,776 is 20 percent higher than education, and 31 percent higher than personal consumption.

### Higher Average Wages vs. Total Numbers of Decent Jobs

Given these results for overall compensation, it is important to weigh the benefits of more jobs through non-military spending versus higher average com-

[8] The compensation figure that we report here for education includes both public and private school systems. Compensation is substantially higher within the public school system. Considered separately, public school compensation, including both wages and benefits, averages about $69,000.

pensation within the military. The first point to note is that the main factor driving the higher overall compensation figure for the military is benefits, not wages. This result connects up to an important theme in the longstanding debate in the United States about the availability and affordability of high-quality health care coverage: that military personnel receive generally excellent health coverage through government-run programs. This level of government-based support for military personnel stands in sharp contrast to the much poorer coverage provided in other sectors of the U.S. economy.

That said, the benefits from higher average compensation levels must be weighed against the much larger number of jobs generated by spending on clean energy, health care, and education. We present figures relevant for making such relative assessments in Table 3 and Figure 2. In this table and figure, we break down the overall number of jobs generated by spending in each sector into three separate pay categories: the proportions of a) low-paying jobs, which we define as paying less than $32,000 per year in annual wages; b) mid-range jobs, which are jobs paying between $32,000 - $64,000 in annual wages; and c) high-paying jobs, i.e. those paying more than $64,000 per year.

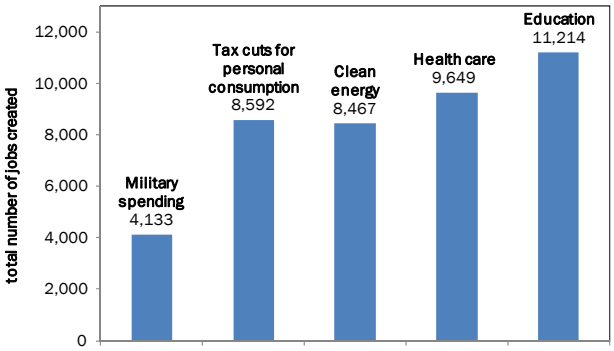
**TABLE 3. DISTRIBUTION OF JOBS BY WAGE LEVELS IN ALTERNATIVE U.S. ECONOMIC SECTORS: JOBS CREATED THROUGH $1 BILLION IN SPENDING WITHIN EACH SECTOR**

| | Total Jobs Created | Jobs with Wages below $32,000 | Jobs with Wages between $32,000 - $64,000 | Jobs with Wages above $64,000 |
|---|---|---|---|---|
| Military | 11,200 | 4,133 *(36.9% of military)* | 4,715 *(42.1% of military)* | 2,352 *(21.0% of military)* |
| Tax cuts for personal consumption | 15,100 | 8,592 *(56.9% of personal consumption)* | 4,590 *(30.4% of personal consumption)* | 1,918 *(12.7% of personal consumption)* |
| Clean energy | 16,800 | 8,467 *(50.4% of clean energy)* | 5,998 *(35.7% of clean energy)* | 2,335 *(13.9% of clean energy)* |
| Health care | 17,200 | 9,649 *(56.1% of healthcare)* | 5,315 *(30.9% of healthcare)* | 2,236 *(13.0% of healthcare)* |
| Education | 26,700 | 11,214 *(42.0% of education)* | 10,867 *(40.7% of education)* | 4,619 *(17.3% of education)* |

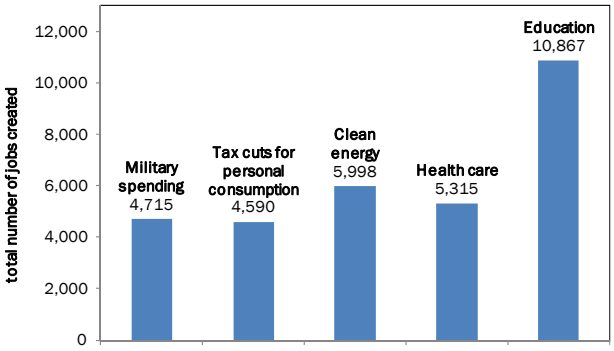
*Sources: See Appendix*

**FIGURE 2. DISTRIBUTION OF JOBS BY WAGE RANGES IN ALTERNATIVE SECTORS: DIRECT, INDIRECT, AND INDUCED JOBS CREATED THROUGH $1 BILLION IN SPENDING**

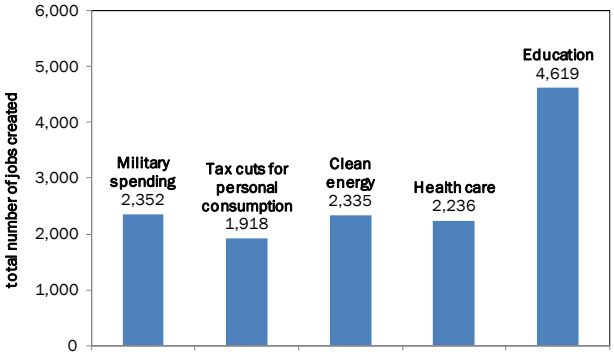
a) Number of jobs with wages below $32,000/year




b) Number of jobs with wages between $32,000 and $64,000/year




c) Number of jobs with wages above $64,000/year



For these pay distribution figures, we were able to obtain relevant data on wages only, not benefits as well. This then means that the distributional breakdowns that we are able to observe do not take account of the much greater advantage for military employment in terms of benefits.

Nevertheless, working with data on the distribution of wages alone, a basic result still emerges clearly. This is that, for the most part, spending on clean energy, health care, and education generates more jobs of all kinds: low, mid-range, and high-paying jobs. This is for the straightforward reason that spending within the non-military sectors creates significantly more jobs overall, even if the average pay in these domestic sectors is lower. For example, let us compare spending $1 billion on clean energy with military spending. With clean energy, we estimate that almost 6,000 jobs are within our mid-range of $32,000 - $64,000 and another roughly 2,300 pay over $64,000. This totals to about 8,300 jobs at either the mid-range or high pay levels. Military spending, by contrast, generates about 4,700 mid-range jobs and another roughly 2,350 high-paying jobs. This totals to 7,050 mid-range or high-paying jobs with the military, i.e. 15 percent fewer such jobs than would be generated through $1 billion in spending on clean energy.

The contrast is far more dramatic with education, where spending $1 billion will generate about 15,500 jobs that pay either in the mid-range or high end of wages. This is about 120 percent higher than what results through military spending.

Again, these differences would be less dramatic if we were able to take account of benefits as well as wages. But this factor would not change the basic result we are observing: that spending on clean energy, health care, and education will all create many more jobs overall, at all pay levels, than spending on the military. Even spending on personal consumption generates roughly the same number of both mid-range and high-paying jobs as military spending, even while the average wage is 19 percent lower for jobs generated by personal consumption relative to the military.

## 5. CONCLUSIONS

As of 2010, the U.S. government operated with a military budget of nearly $690 billion. This is a 67 percent increase (in real dollars) relative to the level of spending in 2001. It amounted to 4.7 percent of GDP in 2010. An expenditure level of this magnitude will necessarily have a major impact on establishing the country's policy priorities and overall economic trajectory.

We have shown the overall employment effects — including direct, indirect, and induced job creation — of spending on the military in contrast with four alternative domestic spending categories: clean energy, health care, education, and increasing household consumption through tax cuts. Specifically, we have shown that spending on all of these alternatives to military spending create substantially more jobs per $1 billion in expenditures relative to military spending.

It is true that jobs generated by military spending provide higher average levels of compensation. This is primarily the result of substantially more generous benefits provided for employees associated with the military industries than those working in other sectors of the U.S. economy. But even despite these large differences in benefits for employees in the military sector, it is still the case, as we show, that spending on clean energy, health care, and education all create a much larger number of jobs that pay wages greater than $32,000 per year. Spending in these sectors all generate a much larger number of mid-range jobs, paying between $32,000 and $64,000, as well as high-paying jobs that pay over $64,000.

Overall then, as we concluded in the previous two versions of this study, there is a great deal at stake as policymakers and voters establish public policy spending priorities. By addressing social needs in the areas of clean energy, health care and education, we would also create many more job opportunities overall as well as a substantially larger number of good jobs.

# APPENDIX

## Estimating Employment

*Direct and Indirect Jobs*

The employment effects reported in this paper were estimated using IMPLAN 3.0 software and data from the Minnesota IMPLAN Group, Inc. IMPLAN is an input-output model which uses data from the U.S. Department of Commerce as well as other public sources. The data set we used in this paper is the 2009 U.S. national data set, the most recent available as of November 2011. An input-output model traces linkages between all industries in the economy as well as institutional sources of final demand (such as households and government). The model is described in detail in the technical appendix of Pollin et al (2009).

As a general point, we emphasize that our estimates are not based on a forecasting model in the way this term is generally understood—i.e. as an exercise that attempts to predict the future growth path of the U.S. economy. Rather, our employment estimates are figures generated directly from data from the Commerce Department's surveys of businesses within the United States, and organized systematically within their input-output model. Within the given structure of the current U.S. economy, these figures provide the most accurate evidence available as to what happens within private and public enterprises when they produce the economies' goods and services—i.e. how many workers do they hire, and what are the materials they purchase? Our methodology is to work within this detailed survey evidence and data set, and to pose simple questions within it.

There are certainly weaknesses with our use of the input-output model. The most important are that it is a) a static model; and b) a linear model. But these deficiencies need to be considered in the context of alternative approaches that, in our view, operate with even more deficiencies, certainly within a short-run framework (for further discussion, see Pollin et al 2009).

Beyond these relatively abstract analytic considerations, we do also have strong on-the-ground evidence that our method of estimating job effects is effective, at least on a short-run basis. In considering work we conducted over 2009-10 for the U.S. Department of Energy, we utilized this same approach to estimate the job-generating effects of the environmental programs within the overall ARRA. Because we made these estimates while the ARRA was actually being implemented, we were able later to observe closely how accurately our estimates had been relative to the reported figures on actual job creation coming back to the DOE from around the country, in particular with respect to various building retrofitting initiatives advanced in various parts of the country. These data from the field demonstrated that our model was highly robust. Specifically, working with the most recent data that were available, we found that for every 100 jobs we had predicted would be created by spending on the building retrofit programs in the ARRA, 97 jobs were actually created.[9]

Of course, other modeling approaches can yield useful findings. For example, specifically with respect to the impact of military spending on overall U.S. economic performance, Auerbach and Gorodnichenko (2011) use a Vector Autoregression model to conclude that the multiplier effects of military spending is greater than other forms of spending within the U.S. economy. However, we are unable to establish relative employment effects of military versus non-military spending from this exercise, since it does not incorporate employment/output ratios from military versus non-military spending.

In this report, we analyze the employment effects of the following types of spending: federal defense, personal consumption (by households), healthcare, education, and clean energy. Of these categories, federal defense, personal consumption, and healthcare are defined within the I-O model. For the education category, we combine public and private education sub-sectors (4 in all: primary and secondary, colleges and universities, public sector, and other) and provide a weighted average of the employment effects in these four sub-sectors, where the weights are based on actual output levels in 2009. Similarly, the healthcare category is comprised of five healthcare industries (doctors' offices, clinics and labs, home health care, hospitals, and nursing and residential care). We use the current (2009) output levels for each of the industries as weights for the healthcare spending category here. For a description of how we create the "clean energy" category, please refer to the technical appendix (pp. 50-52) of Pollin et al (2009).

*Induced Jobs*

Induced employment effects are the jobs that are created when workers in the direct and indirect industries spend their earnings. We estimate that for all sectors other than defense spending, the induced effect is approximately 40% of the combined direct and indirect effects. See pages 33-34 of Pollin et al (2009)[10] for a discussion of induced effects. For the defense sector, induced effects will be lower than for other sectors, since military personnel spend a lower percentage of their income on domestic goods and services than do other types of workers. In Pollin et al (2007) we estimate that military personnel spend 43% of their income on U.S. goods and services, while the rest of the U.S. workforce spends 78%.[11]

[9] We describe this result in a working paper prepared for the International Labor Office, Heintz, Pollin, and Wicks-Lim (2011).

[10] Pollin, Robert, Jeannette Wicks-Lim, and Heidi Garrett-Peltier, (2009).

[11] Pollin and Garrett-Peltier (2007).

This reduces the induced employment created through wages and salaries, since fewer dollars are spent within the U.S. and thus create fewer domestic jobs. Since the economy-wide induced effect of 0.4 results from 78% domestic spending, the military domestic spending of 43% creates an induced effect of approximately 0.2. To adjust for this, we weight the induced effect by the portion of total defense spending going to military salaries versus other salaries. Of $1 million spent on defense (economy-wide), $570,563 is for compensation of employees. Of that, $302,191 is military pay and $268,372 is non-military. So the weighted average induced effects would be 0.4*(268,372/570,563) + 0.2*(302,191/570,563) = 0.3. Thus, we use 0.3 for defense spending induced effects, and 0.4 for the induced effects for all other sectors.

In this updated study, we find modest differences in employment levels per $1 billion in expenditure (the employment/output ratio) relative to our previous two studies. These differences can result from either 1) changes in the patterns of production and employment within any given industry; 2) changes by statistical agencies in their methods for collecting and presenting data; or 3) changes in our own calculating methods. For the case of the health care industry in particular, the main reason for the change from 19,600 jobs per $1 billion in our 2009 study versus the 17,200 jobs in this current report was a small change in our own methodology. Our current methodology provides a more accurate approach to weighting the various sub-sectors within the overall health care industry in establishing the overall industry employment/output figure.

## Wages and Benefits

*Wages*

The wages presented in this reported are estimated by using the I-O model combined with wage, salary, and benefit data from the U.S. Bureau of Economic Analysis and the Bureau of Labor Statistics. First, we estimate the employment impacts resulting from each spending strategy by using the I-O model. These employment impacts are distributed across the 440 industries of the model. We calculate the share of new employment in each of those industries, and then aggregate them to a 65-industry level so that the results are compatible with other data sources. At this level of detail, we can match our I-O industries with BEA data on wages and salaries by full-time equivalent employee.[12] We then calculate the weighted average wage for each spending strategy by multiplying each industry's average wage by its share of new employment, and summing the results.

$$\sum_{i=1}^{n} w_i \, s_i$$

where $w_i$ is the average wage in industry *i* and s is the share of new employment in industry *i*.

*Benefits*

In order to estimate benefits in addition to wages, we use data from the U.S. Bureau of Labor Statistics. The BLS conducts an employer-based survey entitled "Employer Cost for Employer Compensation" and reports the percentage of total compensation going to wages and salaries versus benefits for various industries. For each spending category, we apply these industry-specific ratios to the vectors of employment shares by industry that we calculated as above. Thus we calculate a weighted average benefits to total compensation ratio for each spending category and then can calculate the total compensation figure for each spending category. This total compensation therefore accounts for the distribution of new employment created through the I-O model, as well as the average dollar value of both wages and benefits received by workers in those industries.

*Wage Distribution*

For civilian employment, we map our input-output employment results onto the Bureau of Labor Statistics' Current Population Survey data. The full details of this procedure are explained in Pollin, Wicks-Lim, and Garrett-Peltier (2009) (see footnote 2, page 35). In brief, we use the I-O model to calculate shares of employment in each industry and use these shares to weight the worker data in the CPS. The CPS data set gives us information on occupations, wages, and credentials that we then use to calculate wage distributions for each spending category.

The CPS, however, does not contain data on active military personnel. For this employment category, we use data from the Department of Defense's 2009 Green Book, which lists the number of people at each pay grade and years of service category, as well as the average wage for each of these. Using these two tables we calculate the distribution of pay for active duty military. Since the "defense" spending category in this paper includes both active military personnel as well as civilian personnel, contractors, and civilian workers in indirect and induced industries, we calculate a weighted average wage distribution, where the weights are the percentages of active military personnel and other defense-related workers.

[12] BEA, Table 6.6D. "Wage and Salary Accruals Per Full-Time Equivalent Employee by Industry," available from http://www.bea.gov/national/.

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A full list of the authors' related publications **can be found here.**