Beyond the Congressional Budget Office: The Additional Economic Effects of Immediately Opening Federal Lands to Oil and Gas Leasing

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Executive Summary

While headlines have reported a boom in US oil and gas production, that boom has been related almost exclusively to exploration and development on private and state lands and waters. Even that limited expansion has had profound effects. Opening up Federal resources — in addition to private and state resources — to exploration and development can accelerate all of those trends. But recent administrations have yet to follow through on promises to allow access to Federal resources, instead proposing to levy increased taxes on oil and gas production.

The Congressional Budget Office (CBO), at the request of the House Budget Committee, recently released an analysis of lease revenues that could be expected to arise from a proposal to open Federal lands and waters to oil and gas leasing (the "CBO Assessment"). Specifically, the proposal aims to open areas that are statutorily or as a matter of administration policy prohibited from leasing. The issue has repeatedly been a hot-button political and economic issue in the last several years, most recently at the beginning of the Obama administration and then again as Republican challengers in the 2012 election placed opening the lands and waters at the center of their energy policy.

But while the Administration cannot shy away from exploring the fiscal benefits of opening Federal lands, the CBO study was restricted to analyzing just one component of those benefits: lease revenues. This paper highlights the larger economic effects, including economic growth, wages, jobs, and both federal and state and local tax revenues, of opening Federal lands and waters to oil and gas leasing, relying solely upon the CBO natural resource and oil and gas price estimates to show these broader economic effects in order to maintain direct comparability with their analysis. This paper also seeks to "complete" the CBO Assessment by taking measurements of output, jobs, wages and tax revenues into consideration.

The findings of this paper demonstrate that opening federal land that is currently closed-off because of statutory or administrative action would lead to broad-based economic stimulus, including increasing GDP, employment, and wages. Specifically:

GDP increase:

- $127 billion annually for the next seven years.
- $450 billion annually in the next thirty years.
- $14.4 trillion cumulative increase in economic activity over the next thirty-seven years.
    - These estimates include "spill-over" effects, or gains that extend from one location to another location. For example, increased oil production in the Gulf of Mexico might lead to more automobile purchases that would increase economic activity in Michigan. Spillover effects would add an estimated $69 billion annually in the next seven years and $250 billion over thirty years.

Jobs increase:

- 552,000 jobs annually over the next seven years.
- Almost 2 million jobs annually over the next thirty years.
    - Jobs gains would be felt in high-wage, high-skill employment like health care, education, professional fields, and the arts.

Wage increase:

- $32 billion increase in annual wages over the next seven years.
- $115 billion annually between seven and thirty years.
- $3.7 trillion cumulative increase over thirty-seven years.

Increase in tax revenue:

- $2.7 trillion increase in federal tax revenues over thirty-seven years.
- $1.1 trillion in state and local tax revenues over thirty-seven years.
- $24 billion annual federal tax revenue over the next seven years, $86 billion annually thereafter.
- $10.3 billion annual state and local tax revenue over the next seven years, $35.5 billion annually thereafter.

The present analysis illustrates the considerable economic value ignored by the CBO in its analysis, even accepting the CBO's resources estimates which rely upon aged geologic survey data and only tangentially take into account modern deep water and horizontal drilling technology.

The present analysis illustrates the considerable economic value ignored by the CBO in its analysis, even accepting the CBO's resources estimates which rely upon aged geologic survey data and only tangentially take into account modern deep water and horizontal drilling technology. In addition to the lease revenues established by the CBO, Federal taxes from the increased output could raise as much as $24 billion annually in the short-run, and would continue to produce $86 billion annually in the long-run. The federal benefits, when incorporating the CBO's estimates on leasing revenues, could be as great as $36 billion annually for the next 7 years, and $99 billion annually in the long-run. Per this analysis, opening Federal lands and waters to oil and gas leasing will generate Federal tax revenue far exceeding revenue sought through levying new taxes on exising oil and gas production.

According to the findings of this paper, the effects of the proposal on the larger economy would also be substantial. Output would increase by $127 billion annually over the next 7 years (about 1% of current GDP), and $450 billion annually after that (about 3.2% of current GDP). *This exceeds many estimates for current annualized GDP growth throughout the entire economy.* Over 500 thousand jobs could be created for the next 7 years with almost 2 million jobs after that, aiding economic recovery for workers facing historically high unemployment rates. Wages would increase by $32 billion annually in the short run, with long run annual effects of $115 billion. The economic impulses created by opening Federal lands and waters to oil and gas extraction could therefore help significantly to spur economic growth — and help break the economy out of its sluggish post-recessionary malaise. Importantly, those benefits would be realized without any increase in direct government spending. Rather, increased output would refill national, state, and local government coffers — currently depleted by the current economic crises — without additional government outlays.

Even those findings, however, are conservative, because of Congressional constraints on CBO analyses, the CBO's use of price data that is not generally accepted, and flawed methodologies. More specifically, the CBO Assessment analyzes only production from Federal tracts where (1) leasing is *statutorily* prohibited — for example the Arctic National Wildlife Refuge (ANWR), and (2) onshore and offshore areas that are restricted from oil and natural gas leasing based on the policies of the current administration — including sections of the Outer Continental Shelf (OCS). Areas with less stringent restrictions are left out of the analysis.

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Gas and oil prices are a crucial component of the analysis. Yet gas and oil prices used in the CBO Assessment lie below those used in other independent analyses like that of the World Energy Outlook. For instance, the 2020 oil price used by CBO is $106.9 per bbl (in 2011 prices), while that used by the World Energy Outlook current policy scenario (in 2011 prices) is $128.3. The 2020 World Energy Outlook current policy scenario price for natural gas runs about $5.7, the same as that used by the CBO. The CBO revenue estimates are, therefore, lower than other contemporary studies. Using the CBO's lower oil price and resource estimates necessarily decreases the estimates of expected economic activity, making the estimates in this paper conservative.

Reserve estimates have historically increased over time in areas that have been assessed geologically with each new generation of survey and drilling technology. No geologic assessments have been allowed on the Federal lands and waters subject to the CBO Assessment since the 1970s, when assessment technology was rudimentary by today's standards. Those early geologic assessments did not explore depths or take into account modern drilling technology like hydraulic fracturing that could result in substantial additional resources. Until those geologic assessments are updated, the existing available estimates are properly treated as an extremely conservative lower bound.

Perhaps the most important gains from the proposal, particularly through the lens of the CBO's Assessment, are in state and federal tax revenues. These revenues are substantially larger than the CBO's estimates for bonus payments, royalties, and leasing receipts, and bring the total fiscal revenues expected from opening up Federal lands and waters over the period 2012 – 2022 from roughly zero (because the CBO does not recognize the short-run investment phase of oil and gas projects) to up to $517 billion. Then from 2023-2035, revenues will increase from the roughly $25 to $50 billion predicted by the CBO to well over a trillion when considering effects on the broader economy.

This paper illustrates that Congress has chosen to evaluate only one small piece of the economic effect of opening federal tracts to oil and gas leasing. By ignoring the investment phase, the CBO — upon the instruction of Congress — substantially underestimates the economic effects of current policy choices. Moreover, by focusing on lease revenue and ignoring the potential for increased tax revenue, Congress has doubly downplayed the fiscal effects of such a policy. By failing yet again to analyze jobs, wages, and output, Congress ignores the crucial economic reality that freeing resources can help our economy grow beyond the recent recession and its continuing drag upon economic growth.

As Congress again turns its attention to the means through which our ongoing budget crises – from the debt limit to budget sequesters to the simple act of funding our government beyond the current continuing resolution – there will no doubt be renewed efforts to address revenue concerns by punitively taxing the oil and gas industry in pursuit of modest revenue gains. As this analysis notes, though, the revenue potential inherent to expanding access to resources found on Federal lands and waters is orders of magnitude greater than that which is measured by the CBO.

Using the CBO's lower oil price and resource estimates necessarily decreases the estimates of expected economic activity, making the estimates in this paper conservative.

I. Introduction

The Congressional Budget Office (CBO), at the request of the House Budget Committee, recently released an analysis of a proposal to open Federal Lands to oil and gas leasing (the "CBO Assessment").[1] Specifically, the proposal aims to open lands that are statutorily or as a matter of administration policy prohibited from leasing. The issue has repeatedly been a hot-button political and economic issue in the last several years, most recently at the beginning of the Obama administration and then again as Republican challengers in the 2012 election placed opening the lands at the center of their energy policy.[2]

While headlines have reported a boom in US oil and gas production, that boom has been related exclusively to exploration and development on private and state lands. Even that limited expansion has had profound effects that, "*will be felt well beyond North America — and the energy sector*"[3] Even without opening up Federal lands, it is expected that *"by around 2020, the United States is projected to become the largest global oil producer …. The result is a continued fall in US oil imports, to the extent that North America becomes a net oil exporter around 2030. This accelerates the switch in direction of international oil trade towards Asia, putting a focus on the security of the strategic routes that bring Middle East oil to Asian markets. The United States, which currently imports around 20% of its total energy needs, becomes all but self-sufficient in net terms — a dramatic reversal of the trend seen in most other energy-importing countries."*[4]

Opening up Federal lands — in addition to private and state lands — to exploration and development can accelerate all of those trends. But recent administrations have yet to follow through on promises to allow access to Federal resources.

Still, the Obama administration continues to explore its options, if only in a piecemeal fashion. For instance, the CBO was recently asked to look at direct lease revenues expected to be received from such activities — specifically those from bonus payments and royalties paid by private companies to develop onshore and offshore oil and gas on federal lands. But if Federal Lands are opened to exploration and development, they will drive much more economic activity than mere lease revenues and bonus bids.

This paper highlights the larger economic effects, including economic growth, wages, jobs, and both federal and state and local tax revenues, of opening Federal Lands to oil and gas leasing. I rely solely upon the CBO natural resource and oil and gas price estimates to show these broader economic effects in order to maintain direct comparability with their analysis. I merely seek to "complete" the CBO study by taking measurements of output, jobs, wages and tax revenues into consideration.

Even without opening up Federal lands, it is expected that "by around 2020, the United States is projected to become the largest global oil producer ….

While, I emphasize in what follows the consistent application by CBO (at the behest of Congress) of outdated resource estimates and assumptions, I do not attempt to answer the ultimate question of "how much is out there," a question that has dogged the industry for decades now since exploration has been prohibited on Federal Lands. I treat such topics only to the extent necessary to show that the CBO resource estimates used in their analysis lie at the "extremely conservative" end of the spectrum.[5]

Lastly, unlike lease revenues, economic activity from opening Federal lands would affect regions throughout the United States, even areas without direct claims to lease revenues or close proximity to drilling sites. Moreover, those economic benefits are generated on both a short- and long-term basis. For purposes of my analysis, short-run effects are those during the first years of the investment, the pre-production phase;[6] Long-run effects are represented as expected annual effects during the production phase.[7] A summary of those estimated short- and long-run economic effects are listed in Table 1.

TABLE 1: **ANNUAL IMPACT OF OPENING RESTRICTED DRILLING AREAS**
($ BILLIONS ANNUALLY, UNLESS OTHERWISE SPECIFIED)

	SHORT-RUN	LONG-RUN
AVG. PROCEEDS FROM		
FEDERAL OIL AND GAS LEASING (CBO)	$11.7	$13.5
ANNUAL FEDERAL TAX REVENUES FROM		
INCREASED OFFSHORE ACTIVITY	$24.1	$85.5
TOTAL FEDERAL REVENUES	**$35.8**	**$99.0**
OUTPUT	$126.9	$449.9
WAGES	$32.4	$114.8
EMPLOYMENT (THOUSANDS OF JOBS)	552	1,957
STATE & LOCAL TAX REVENUES	$10.3	$35.5

SOURCE: CBO, POTENTIAL BUDGETARY EFFECTS OF IMMEDIATELY OPENING MOST FEDERAL LANDS TO OIL AND GAS LEASING, AUG. 2012, AT TABLE 1. CBO LONG-RUN IS THE AVERAGE OF THEIR 11 YEARS OF ESTIMATES.
NOTE: SHORT-RUN EFFECTS ARE THOSE PROVIDED ANNUALLY DURING THE FIRST YEARS OF THE INVESTMENT (PRE-PRODUCTION) PHASE -ESTIMATED TO BE 7 YEARS; LONG-RUN EFFECTS ARE THOSE PROVIDED ANNUALLY DURING THE PRODUCTION PHASE - ESTIMATED TO BE 30 YEARS. MY ANALYSIS ONLY INCLUDES AREAS DESIGNATED AS TEMPORARILY UNAVAILABLE BY THE CBO.

The present analysis illustrates the considerable economic value ignored by the CBO in its analysis even accepting the CBO's resources estimates, which rely upon aged geologic survey data and only tangentially take into account modern deep water and horizontal drilling technology. In addition to the lease revenues established by the CBO, Federal taxes from the increased output could raise as much as $24 billion annually in the short-run, and would continue to produce $86 billion annually in the long-run. The federal benefits, when incorporating the CBO's estimates on leasing revenues, could be as great as $36 billion annually for the next 7 years, and $99 billion annually in the long-run.

The effects on the larger economy would also be substantial. Output would increase by $127 billion annually over the next 7 years (about 1% of current GDP), and $450 billion annually after that (about 3.2% of current GDP). This exceeds many estimates for current annualized GDP growth throughout the entire economy.[8] Over 500 thousand jobs could be created for the next 7 years with 2 million jobs after that, aiding economic recovery for workers facing historically high unemployment rates.[9] Wages would increase by $32 billion annually in the short run, with long run effects of $115 billion. The economic impulses created by opening Federal lands to oil and gas extraction could therefore help significantly spur economic growth — and help break the economy out of its sluggish post-recessionary malaise. Importantly, those benefits would be realized without any increase in direct government spending. Rather, increased output would refill national, state, and local government coffers — currently depleted by the current economic crises — without additional government outlays.

The remainder of this paper outlines my analysis in further detail. Section II describes the impetus for the current proposal to open Federal lands to oil and gas extraction. Section III then analyzes the CBO's Assessment of that proposal. Section IV describes the data and assumptions used in my analysis. Section V calculates the broader economic effects of opening federal lands to oil and gas leasing using the CBO resource estimates and assumptions regarding oil and gas prices.

II. The Impetus for the Current Proposal Analyzed in the CBO Assessment

Energy independence has long been a goal of the United States, especially when dependency on foreign oil subjects the U.S. economy to significant volatility as a result of global political struggles. In 2006, the U.S. Minerals Management Service (MMS) reported to Congress that "much of the growth in the Nation's energy demand will have to be met by OCS…if further increases of imported supplies are to be avoided."[10] MMS also estimated that if opened in 2006, "OCS oil production [alone] could account for as much as 40 percent of domestic oil production by 2010."[11] Furthermore, the MMS indicated that the OCS natural gas resources would become an essential source of energy as imports from other countries—particularly Canada—decline.[12]

Moreover, in a climate of slow economic growth, the OCS and ANWR represent attractive sources economic activity from increased oil and gas production. Similar to fiscal alternatives presently under consideration, oil and gas development would provide a long-run economic stimulus to the U.S. economy because the incremental output, employment, and wages provided by oil and gas development would be spread over many years. Unlike fiscal policies, however, stimulus from opening Federal lands to oil and gas extraction would not require higher deficits or taxes to support that long-term growth.

The CBO Assessment findings are, nonetheless, limited by its instructions from Congress. The scope of the Congressional Budget Office is limited to providing objective, impartial analysis, and the CBO makes no recommendations to Congress. In this case, the report "…was requested by the Chairman of the House Committee on the Budget, who asked CBO to describe its baseline projections and to estimate the budgetary impact in the years following 2022 of legislation authorizing oil and gas leasing in all federal areas where it is currently restricted." The CBO report does not stray beyond this narrow scope.

The CBO report, therefore, analyzes only production from Federal lands where (1) leasing is statutorily prohibited – for example the Arctic National Wildlife Refuge (ANWR), and (2) onshore and offshore areas that are restricted from oil and natural gas leasing based on the policies of the current administration – including sections of the Outer Continental Shelf (OCS).[13]

The CBO estimates that opening ANWR to development would generate about $5 billion in additional Federal lease and bid receipts over the next 10 years – mostly in the form of bonus payments.[14] Additionally, the CBO estimates royalty revenues, based on estimates of potential and probable oil prices, to be between $25 billion and $50 billion (in 2010 dollars) during the 2023–2035 period, or roughly $2 billion to $4 billion a year.[15] Outside ANWR, mainly in sections of the OCS, the CBO estimates that proceeds from bonus payments will be about $2 billion a year from 2013-2022.[16] The CBO does not estimate royalty payments for the 2022-2035 period outside of ANWR because of a perceived lack of information.[17] This serves to significantly lower their estimations.

Additionally, the CBO estimates royalty revenues, based on estimates of potential and probable oil prices, to be between $25 billion and $50 billion (in 2010 dollars) during the 2023–2035 period, or roughly $2 billion to $4 billion a year.

In aggregate, the CBO states that it expects that federal and state governments would only receive around $7 billion total in the first 10 years of the proposed opening of federal lands to exploration. Longer term, the CBO believes it can only be certain that $2 to $4 billion of additional revenues will be generated between 2023 to 2025 from the current proposal.

Perhaps the most important, and controversial, part of the CBO Assessment is the limitation of their analysis to government revenues directly derived from leasing. While royalty and lease revenues are important components of the economic effects of drilling activity and deserve dedicated study, the economic effects of expanding access to oil and gas resources can be expected to be far broader than just the leasing and royalty payments.

The CBO — by instruction from Congress — overlooks the broader benefits of opening Federal lands to oil and gas extraction for both the larger economy and federal and state tax revenues. As the analysis presented later in this paper shows, the effects of increased output in an industry such as oil and gas exploration will have pervasive effects throughout the economy. The present analysis fills that gap left by the CBO to fill in the total economic effects as policymakers consider the implications, yet again, of opening Federal lands to oil and gas extraction.

III. Analysis of the CBO Assessment

The CBO Assessment measures the relationship between the quantity of oil and gas reserves to be extracted, the price of those resources, and the rates at which bonus bids, leases and royalties would be expected to accrue given those assumptions. The CBO therefore notes that the "budgetary effects of increasing the oil and gas industry's access to federal lands would depend on the quantity, characteristics, and market value of the untapped resources in the designated areas,"[18] and caveats their analysis by stating that the estimates are uncertain because "they depend both on the amount of oil that might be produced and on future oil prices."[19]

I show below that the CBO Assessment utilizes resource estimates, price paths, and bid assumptions that systematically understate the economic effects of opening up Federal lands. While I present evidence of such conservatism here, I analyze later only the CBO input estimates without adjusting them upward in order to maintain strict adherence to the CBO methodology. Even using the CBO parameters, opening Federal lands is likely to create significant growth in output, jobs, wages, and tax revenues not discussed by the CBO.

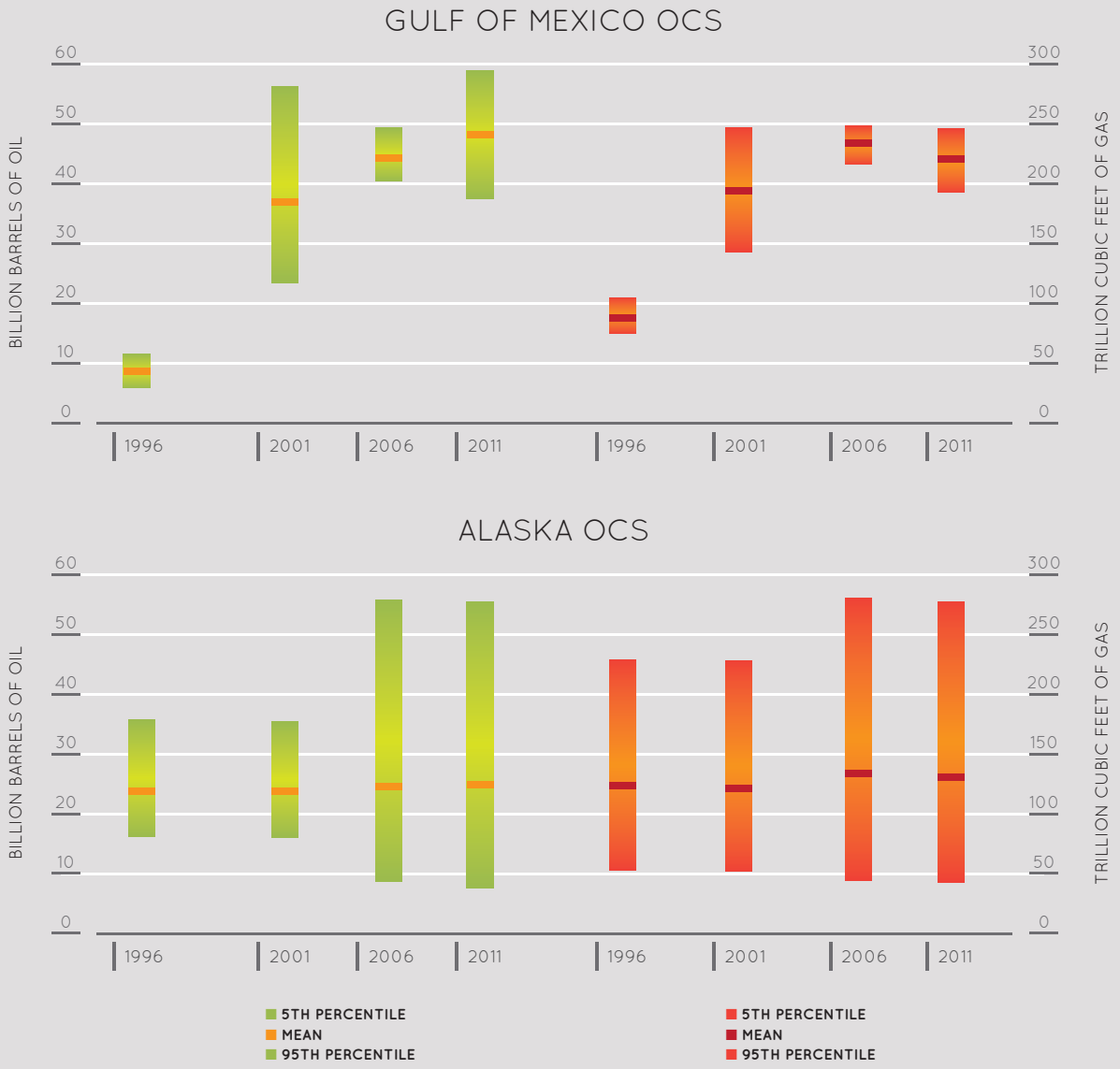
A. The CBO Assessment relies crucially upon oil and gas price estimates that are lower than those used by other agencies

Gas and oil prices used in the CBO Assessment lie below those used in other independent analyses like that of the World Energy Outlook. For instance, the 2020 oil price used by CBO is $106.9 per bbl (in 2011 prices)[20], while that used by the World Energy Outlook current policy scenario (in 2011 prices) is $128.3. The 2020 World Energy Outlook current policy scenario price for natural gas[21] runs about $5.7, the same as that used by the CBO.[22] The CBO estimates are, therefore, lower than other contemporary studies. Using lower prices will decrease my estimates of expected economic activity, rendering my estimates conservative. Nonetheless, I rely solely upon the CBO prices for purposes of my analysis.

B. The CBO Assessment relies crucially upon estimates of oil and gas reserves that are known to be understated

Reserve estimates have historically increased over time in areas that have been assessed geologically with each new generation of survey and drilling technology. No geologic assessments have been allowed on the Federal lands subject to the CBO Assessment since the 1970s, when assessment technology was rudimentary by today's standards.[23] Those early geologic assessments did not explore depths or take into account modern drilling technology like fracking that could result in substantial additional resources. Until those geologic assessments are updated, the existing available estimates are properly treated as an extremely conservative lower bound.

FIGURE 2: **MMS 2011 RESERVE ESTIMATES CHANGE IN GEOLOGIC ASSESSMENT RESULTS OVER TIME**



The CBO uses Federal data from the Minerals Management Service to estimate oil and gas resources in various coastal and onshore regions. The CBO estimates *unavailable undiscovered* oil and gas resources on Federal lands to be about 30% (51 billion BOE) of the totally currently *available* undiscovered resources (175 billion BOE).[24]

The double qualifier of "unavailable undiscovered" resources hides a key problem with analyzing economic benefits of opening such lands, whether those are related to lease revenues, taxes, or broader economic benefits. The concept of "availability" relates not just to extraction, but also exploration. The "unavailable" areas have not been open to survey and exploration for some thirty years now. Survey and exploration technology can only be used to explore those regions once the Federal government grants access to them. Thus, the areas evaluated in the CBO Assessment have not been explored with new survey technologies, nor have they been explored with the capabilities of horizontal drilling, deep water drilling,

and fracking in mind. The MMS, itself, states that changes to resource estimates are driven by "subsequent production, discoveries, data acquisitions, and application of new or improved exploration and production changes."[25]

Thus, there is a "chicken-and-egg" problem in using the existing resource estimates in determining whether or not to open new lands to exploration. New data is obtained as the lands are opened to exploration, but exploration has been blocked by reasoning that there are insufficient discovered (or even undiscovered) resources. For example, the MMS states that for Alaska estimates have not changed because "there has been no significant new geologic data gathered in the region and none of the leases acquired since the previous assessment have been tested."[26] If the region was tested more thoroughly, estimates of available reserves could rise substantially. As a result, many of the areas at stake in the current proposal remain a black box because of the legislation blocking exploration.

Data reflecting changes in MMS geologic assessments over time has often been used to show this point, which is acknowledged in the CBO Assessment. Figure 2 from the CBO Assessment compares the trends of geologic assessments for the western Gulf of Mexico — where exploration is allowed — and Alaska — where exploration is prohibited. During the past fifteen years, the mean estimate of barrels of oil in the Gulf roughly quintupled and the mean estimate of natural gas in the Gulf nearly trebled, while estimates in the state of Alaska have remained static because there is little or no new data from exploration.

Similar comparisons — made across time for specific geographic areas — emphasize the role of technology in increased resource estimates. For instance, in 1995 the U.S. Geological Survey ("USGS") estimated that the Bakken formation held 151 million barrels of technically recoverable oil. But in 2008, after the impact of hydraulic fracturing and direction drilling were included in the USGS's assessment, the estimate of recoverable oil in the Bakken jumped 25 fold.[27] Similarly, in 2002, the USGS estimated the Marcellus shale area held about two trillion cubic feet of natural gas and 0.01 billion barrels of natural gas liquids. By 2011, however, the USGS estimated the area held 84 trillion cubic feet of natural gas and 3.4 billion barrels of liquids. Within a span of 9 years, technology increased estimated natural gas supplies in the Marcellus 42-fold, and liquids 340-fold.[28]

To the extent that "unavailable undiscovered" resource estimates occasionally increase, they do so at a significantly lower rate than those in areas available for exploration. For instance, in August, 2012 the U.S. Geological Survey revised its estimate of current U.S. reserves, showing that 32 billion of barrels of oil and 291 trillion cubic feet of natural gas (or about 10 percent of known reserves) could be added to current proven reserves from existing reservoirs, *excluding* resources on Federal lands prohibited from drilling.[29] In its 2006 geologic assessment of oil and natural gas reserves in the OCS areas in which drilling has been *prohibited*, the MMS stated that undiscovered technically recoverable oil and gas resources had probably increased 15% over the 2001 assessment.[30] Yet in its 2011 assessment, the increase was only 5% over the 2006 assessment.[31] Since there has been no new assessment of areas in which drilling has been prohibited, the basis of the slowdown is purely speculative.

Within a span of 9 years, technology increased estimated natural gas supplies in the Marcellus 42-fold, and liquids 340-fold.

Ultimately, those suppressed resource estimates lead to lower production growth from Federal Lands than from elsewhere. Over the period 2010-2011, Federal onshore production showed a slight uptick of 4 million barrels per year, with another 6 million barrels per year coming from Indian lands, for a total 10 million barrels per year increase, or 27,400 barrels per day. Over the same period, North Dakota added 109,000 barrels per day. Thus North Dakota, with only 44.45 million acres, increased production onshore 4 times as fast in 2011 in *absolute* terms as the federal government, with 757 million acres of onshore subsurface mineral estate. In other words, while the government's onshore lands are 17 times as large as North Dakota, they generated increased production of only ¼ of North Dakota. Acre for acre, therefore, North Dakota increased production roughly *68 times* the rate of the Federal government onshore in 2011.[32]

It is clear, therefore, that resource estimates in areas in which exploration is allowed are rising faster than those in areas in which exploration is prohibited.

Nonetheless, I do not adjust resource estimates for these understatements in my economic modeling below. Still, even relying upon the CBO's understated resource estimates shows there is vast economic potential to be had from opening up Federal lands.

C. Lease revenues and bonus bids have also historically been underestimated

Estimates of leasing revenue suggest that the CBO is underestimating bonus and royalty payments, too. Over the 60 years from 1954 to 2004, the U.S. federal government has collected more than $156 billion in lease and levy payments for OCS oil and natural gas production.[33] The CBO Assessment confirms many third-party estimates of such revenue. For example, in a 2009 study, I estimated that in the long-run, increased OCS development (not including ANWR and other onshore) could result in some $14.3 billion in royalty revenue per year.[34]

The CBO Assessment suggests that ANWR may contribute another $2 billion - $4 billion a year to the OCS revenues, which is in line with similar studies. For instance, a 2011 study by Northern Economics, an economic consultancy based in Alaska, estimated that Federal Leasing Revenues from the combined Beaufort and Chukchi OCS development alone would be between $96 billion and $171 billion between 2008 and 2057, or roughly $2.0 billion - $3.5 billion per year.[35] Additionally, a 2008 CRS Report estimated that the total royalties from ANWR would be between $15 billion to $92 billion, in total.[36]

Of course, those estimates leave out bonus bids that also contribute to Federal coffers. In 2006, the U.S Department of the Interior said that it would generate $7 billion in one year from leasing ANWR lands.[37] The CBO, in a 2010 letter to Senator Ted Stevens, states that at $50 per barrel the bonus bids on ANWR might be more than $10 billion.[38]

Bonus bids have historically been grossly underestimated. For example, in 2008, the federal government originally estimated that leasing an area in Alaska's Chukchi Sea would generate only $67 million; instead it generated a record $2.66 billion.[39] There were 667 bids in the region, with outlays of $2.1 billion from Shell, and $506 million from ConocoPhillips.[40] The reason for the sudden uptick in bidding was attributed to high oil prices that were approaching $90.[41] The CBO Assessment uses prices well over $100 after 2017 in its analysis, suggesting that similar bid revenues would result if additional federal lands are made available.[42]

Tying it all together, Shell paid $2.2 billion for its leases in Alaska. It is unlikely that Shell, who had $31 billion in earnings last year, would spend such a large sum of money on the region if the potential was not great. Production, once it begins, will reflect the economic benefits of resources in the region. But jobs and economic growth begin long before production. Shell will have to spend an additional $2.3 billion on equipment and personnel before it can drill a single well. In total, it is estimated that by the time Shell begins producing any oil in Alaska it will have spent $7 billion in up-front investment costs.[43] In the next section, I estimate the magnitude of those short-term (during the pre-production phase) and long-term (during the production phase) economic benefits. Together, those promise significant economic growth.

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IV. Data and Assumptions

The oil and gas industry has long been a foundation of the U.S economy and an important source of federal revenues. Hundreds of both large and small companies in the U.S. oil and gas industry create close to 9.2 million jobs "not just in exploring, producing, refining, transporting, and marketing oil and natural gas, but also through the purchases of other goods and services that support the industry's operations."[44] In 2006, the U.S. oil and natural gas industry paid approximately $90 billion in taxes and $28 billion in U.S. federal, state and local taxes.[45] Clearly, therefore, expanding oil and gas activity would generate jobs, wages, and tax revenues throughout our economy.

While it is sometimes argued that those jobs, wages, and tax revenues will only develop slowly over time, substantial economic activity takes place well before new oil and gas fields begin production. As cited previously, Shell is expected to sink more than $7 billion into development necessary for drilling in its recently-acquired leases in Alaska.[46] Shell's experience is by no means unique. Since the early 2000s, large-scale projects have required considerable up-front investment. For instance, Chevron's 2002 "Tahiti" project in the Gulf of Mexico — which involves fields lying 100 miles off the U.S. coast at a depth of 4,000 feet — found "an estimated 400 million to 500 million barrels of recoverable resources."[47] Chevron estimated that it would take seven years to build the necessary infrastructure required to begin production at Tahiti.[48] The field was estimated to require an investment of about "$4.7 billion [in current dollars] — before realizing $1 of return on … investment."[49]

Such investment has spillover effects for other industries that support the U.S. energy market and employees in that sector. In my previous study on the economic effects of opening the OCS planning areas, I addressed how offshore drilling alone contributes to substantial economic growth for onshore and offshore communities.[50] Drilling projects, whether offshore or onshore, have two distinct phases: (1) the initial exploration and development of offshore facilities and (2) the extraction of reserves.[51] Both phases support numerous local and national industries, such as steelmaking, machinery production, shipbuilding, and food and support services. To maintain strict adherence with the CBO analysis, I ignore the effects of investments in new refining capacity and infrastructure, which again biases the estimates downward. The analysis therefore considers only the "short-term" economic effects that flow from exploration and development and the "long-term" effects that flow from production.

To calibrate the short- and long-term relevant to oil field development, I follow the method of my 2009 study and use detailed data from Chevron's Tahiti project, which is presented as a typical large-scale project for which data is available. I assume that the initial phase of investment will last 7 years and the life of an oil field after that (the long-term effect) lasts 30 years[52] and annualize my estimates based on these assumptions.

During the short-term exploration and development phase, I apply the approximate exploration and development expenditure to the multipliers to find the economic effects. The Tahiti field was estimated to hold between 400 million and 500 million barrels of oil and oil equivalents (primarily natural gas) and expected to require an initial fixed investment of $4.7 billion. Using the mid-point resource estimate of 450 million barrels of oil equivalent, up-front development costs in Tahiti amounted to approximately $10.44 per expected barrel of oil and $1.86 per 1,000 cubic feet of natural gas resources. These costs are be spread over 7 years, resulting in average up-front development expenditures equal to $1.49 per barrel of oil and $0.27 per 1,000 cubic feet of natural gas.[53]

During the long-term production phase, I apply the output value to the multiplier to determine the economic effect for the next 30 years.

I use CBO estimates to determine the likely value of reserves and the amount of reserves to be applied across each period. The CBO estimates for the amount of oil and natural gas reserves are expressed in barrel of oil equivalent (BOE). In order to put gas estimates into dollar equivalents, I first convert them from BOE

In 2006, the U.S. oil and natural gas industry paid approximately $90 billion in taxes and $28 billion in U.S. federal, state and local taxes. Clearly, therefore, expanding oil and gas activity would generate jobs, wages, and tax revenues throughout our economy.

back to thousands of cubic feet based on the 0.178 conversion ratio provided by the CBO.[54]

The CBO estimates reserves at the regional level, but multipliers are provided at the state level. I want to allocate reserves to states, therefore, in order to compute not only Federal tax revenues, but also state and local tax revenues. For the OCS resources, I use the method of my 2009 study and allocate the CBO's reserve estimates to the adjoining coastal states in the given region based on share of coastline (see Table A1). ANWR resources are allocated to Alaska. For other onshore resources, I leave aside state estimates and measure economic activity and tax revenues only at the aggregate U.S. level.

I apply the prices provided by the CBO in Table A1, averaging $5.1 for gas at the Henry hub in dollars per thousand cubic feet and $101.34 per barrel for oil, to convert the reserve estimates to dollar equivalents.[55] Applying the prices to the allocated CBO reserve estimates yields the expected dollar output. Table A2 shows how reserves and their value are allocated across the U.S.

I use the statistical approach known as "input-output" analysis to measure how economic activities with respect to opening federal lands to oil and gas leases will spillover throughout the economy. The U.S. Department of Commerce has refined this approach, pioneered by Nobel Prize laureate Wassily Leontief,[56] into the modern Regional Input-Output Modelling System II, or "RIMS II."[57] The model is premised on the idea that when a company produces $1 more in output, that increase in industrial activity will ripple throughout the economy. This is the same style of analysis routinely used by the CBO and others for policy analysis.

Three RIMS II "final demand multipliers" are applied to changes in output and investment used in the CBO Assessment. The first of these, the BEA output multiplier, measures the total increase in economic activity—including the effect on all other industries—resulting from $1 of new industrial activity in a particular geographic region.[58] The second, the BEA earnings multiplier, measures the increase in wages resulting from $1 of new industrial activity.[59] The third, the BEA employment multiplier, measures the increase in employment (in full-time equivalent jobs) associated with a $1,000,000 increase in industrial activity.[60] Each BEA multiplier measures the changes that are expected to occur within one year.[61] I use 2010 multipliers for the state-level analyses, but 2006 multipliers at the national level, due to data availability.[62]

The BEA multipliers are based on *actual* changes in output, wages, and employment that have historically resulted from changes in economic activity.[63] Since each state has a different industry base, the effect associated with additional oil and gas extraction varies by state. For example, in Delaware an extra $1,000,000 of oil and gas extraction translates into $1,495,300 of additional annual output, $279,800 in additional annual wage income, and approximately 6 additional full-time jobs for the year. In Texas, however, the same $1,000,000 translates into $1,837,300 in additional output, $389,000 in additional wage income, and approximately 7.6 additional full-time jobs.

If a state does not have any expenditures for a particular industry—such as oil and gas extraction—the BEA calculates a multiplier of zero.[64] To circumvent this limitation, the present analysis estimates a RIMS II multiplier for each state with a BEA value of zero (states with no prior oil and gas exploration and drilling industry) by applying the simple average multiplier for all other states with valid BEA multipliers.[65] This approach is not meant to be definitive; rather, it is an attempt to roughly estimate the effect that the industry would have on states that do not presently have any oil and gas extraction activity. This treatment is applied to three states: Georgia, Maine, and New Hampshire. The final demand multipliers used for the analysis are presented Appendix Table A3.

In the following section, I apply these multipliers to their respective economic values (the value of the economic activities at their source) to determine the state-by-state (where available) and overall effect of increased offshore oil and natural gas production on the U.S. economy.

V. Opening ANWR and the OCS to Leasing Will Create Substantial Gains in Wages, Employment, and Will Have Profound Effects on Communities throughout the Nation

The substantial economic gains estimated in this study showcase the potential benefits of opening federal lands to oil and gas leasing. The following sections present the results from the analysis. Section A explains the effect of the proposal on both regional and national economic output; Section B quantifies the effects on employment; Section C explains the expected increase in wages as a result of the proposal; and Section D describes the expected increases in state, local and federal tax revenue.

It is important to note that the BEA makes clear that while the RIMS II model estimates economic effects of projects, the figures calculated with the model do not have a direct analog with respect to GDP, historical wages, or employment data.[66] Instead, the estimates shown represent a reasonable approach to assessing the economic impact of different development proposals and, because they do not take into account the impact of increased government spending of tax and lease revenues produced by the increased activity, the effects can be considered conservative.

A. Opening up oil and natural gas resources on Federal lands can generate $14.4 trillon in economic activity

The broadest measure of the incremental effect of the proposal is the effect on total economic output. The gain in total output from opening federal lands to oil and gas leases, could exceed $127 billion annually for the next 7 years, and $450 billion annually in the long-run.

The predicted regional increase in economic output based on the estimated output increase is presented in Table 2.[67] State-level estimates are available in Table A6.

It is important to note that the multipliers in this table only provide the increase in output that *is generated at the same location as the increase in production*. These state and regional estimates, therefore, do not consider "spill-over" effects, or gains that extend from one location to another location. Since the U.S. economy is integrated, gains in one region can be felt throughout the country. For example, oil and natural gas produced in the Gulf of Mexico could be used as an input in the Midwest.

Additionally, the non-ANWR onshore resources estimated by the CBO are not allocated to specific states or regions and are therefore not included in the state/regional analysis. Comparing the total U.S. results to the sum of each state's estimates suggest that there will be over $69 billion in annual additional and spill-over output from the Assessment values in the short-run, and $250 billion in the long-run.

Overall, therefore, the gain in total output from opening federal lands to oil and gas leases is likely to exceed $127 billion annually for the next 7 years, and $450 billion annually in the long-run.

B. Opening up oil and natural gas resources on Federal lands can generate up to 2.5 million jobs

The economic output above is created on the basis of additional jobs. I estimate that the CBO Assessment would also result in a gain of 552 thousand jobs[68] over the next 7 years, and over 1.9 million jobs in the long-run after that. Moreover, those job gains are not only in the energy sector but across the whole economy.

1. Total job creation analysis

Using the RIMS II final-demand employment multipliers (denominated in job-years per $1 million change in final demand), Table 3 yields the expected

TABLE 2: **INCREASED OUTPUT FROM OPENING FEDERAL LANDS**
($ MILLIONS ANNUALLY)

REGION	SHORT-RUN	LONG-RUN
ATLANTIC OCS	$7,588	$32,647
EASTERN GULF	$7,122	$25,915
PACIFIC OCS	$24,727	$83,301
ANWR	$17,747	$57,611
TOTAL FROM REGIONAL ANALYSIS	**$57,184**	**$199,474**
NOTE: NON-ANWR/SPILLOVER EFFECTS	$69,725	$250,388
TOTAL U.S. (ONSHORE & OFFSHORE)	**$126,909**	**$449,861**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

average annual effects on employment.[69] Table A6 reports state-level details.

As before, the state-level RIMS II multipliers do not account for increases in employment in one state resulting from higher production elsewhere, as well as non-ANWR onshore production the CBO did not allocate to states or regions. As a result, such jobs are omitted from the regional totals. Comparing the nationwide employment effects to the sum of the state employment effects yields the additional (non-ANWR) and spill-over (jobs created outside the states where resource constraints are lifted) effects of more than 318 thousand jobs over the next 7 years, and 1.1 million after that, for the subsequent 30 years of production.

TABLE 3: **INCREASED EMPLOYMENT FROM OPENING FEDERAL LANDS**

REGION	SHORT-RUN	LONG-RUN
ATLANTIC OCS	38,442	165,391
EASTERN GULF	32,333	117,647
PACIFIC OCS	101,417	341,662
ANWR	61,314	199,044
TOTAL FROM REGIONAL ANALYSIS	**233,507**	**823,745**
NOTE: NON-ANWR/SPILLOVER EFFECTS	318,661	1,133,560
TOTAL U.S. (ONSHORE & OFFSHORE)	**552,168**	**1,957,305**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

TABLE 4: **INCREASED EMPLOYMENT FROM OPENING FEDERAL LANDS, BY SECTOR**

	SHORT-RUN	LONG-RUN
MINING	109,541	388,296
HEALTH CARE AND SOCIAL ASSISTANCE	58,201	206,307
RETAIL TRADE	54,728	193,998
ACCOMMODATION AND FOOD SERVICES	37,811	134,030
REAL ESTATE AND RENTAL AND LEASING	37,530	133,034
PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES	34,778	123,281
MANUFACTURING	32,430	114,955
ADMINISTRATIVE AND WASTE MANAGEMENT SERVICES	32,361	114,711
FINANCE AND INSURANCE	29,270	103,755
OTHER SERVICES	27,950	99,076
TRANSPORTATION AND WAREHOUSING	19,584	69,421
WHOLESALE TRADE	16,175	57,337
EDUCATIONAL SERVICES	14,701	52,112
ARTS, ENTERTAINMENT, AND RECREATION	11,139	39,484
INFORMATION	9,527	33,771
MANAGEMENT OF COMPANIES AND ENTERPRISES	8,901	31,553
AGRICULTURE, FORESTRY, FISHING, AND HUNTING	8,477	30,050
CONSTRUCTION	3,531	12,516
HOUSEHOLDS	3,271	11,595
UTILITIES	2,258	8,006
TOTAL	**552,163**	**1,957,286**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

2. Evaluation of the types of jobs created by opening up Federal lands

The multiplier data can also be used to analyze the types of jobs created as a result of opening up oil and natural gas resources on Federal lands. While there will undoubtedly be job creation in the energy sector, many additional jobs will be generated in ancillary industries that support the oil and gas industry as well as seemingly-unrelated industries located in regions where oil and gas industry earnings make up a substantial share of local economic activity.

For this analysis, the gains are broken down using specific RIMS II multipliers for each industry, as described in Section IV. Those multipliers determine which industries will stand to gain the most from the proposal. Table 4 reports the expected employment gains nationally, by industry.

The results in Table 4 show that communities around the country would realize job gains associated with increased offshore oil and gas production. These effects flow from the increase in high-wage, high-skills employment associated with the expansion. For example, a new offshore facility in Florida may induce the development of onshore support facilities such as shipyards and refineries in Virginia, or even inland, in Tennessee. Employees in these new industries, in turn, would increase community demand for health care,

TABLE 5: **WAGE GAINS FROM OPENING FEDERAL LANDS**
($ MILLIONS ANNUALLY)

REGION	SHORT-RUN	LONG-RUN
ATLANTIC OCS	$1,555	$6,689
EASTERN GULF	$1,430	$5,204
PACIFIC OCS	$5,129	$17,281
ANWR	$3,258	$10,578
TOTAL FROM REGIONAL ANALYSIS	**$11,373**	**$39,752**
NOTE: NON-ANWR/SPILLOVER EFFECTS	**$21,014**	**$75,053**
TOTAL U.S. (ONSHORE & OFFSHORE)	**$32,387**	**$114,805**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE

education, and other community services that are available to *all* residents (whether they are employed by the offshore industry or not), as well as tax revenues to fund those expansions.

It is interesting to note that more than one-third of jobs created in the short-run (37 percent) occur in professional fields such as health care; real estate; professional, scientific, and technical services; finance; education; the arts; information; and management.[70] Manufacturing, which includes food and textile manufacturing, also benefits, with 6% of the total employment gains. In both the short-run and long-run, less than 20% of the jobs created are in the mining sector, which includes oil and gas production and refining.

C. Opening up oil and natural gas resources on Federal lands can generate $3.7 trillion of wages

The jobs created by opening up oil and natural gas resources on Federal lands will also cause substantial wage gains for American workers. To estimate wage increases, I apply the RIMS II's final demand earnings (wage) multipliers to the final demand estimates. Table 5 and Table A6 present the results. The caveats regarding non-ANWR and spill-over effects remain true for this wage analysis, with additional effects of another $21 billion in the short-run and $75 billion in the long-run. The proposal will result in well over $32 billion in annual wages paid to employees over the next 7 years, and $115 billion annually after that.

D. Opening up oil and natural gas resources on Federal lands can generate $2.7 trillion in Federal tax revenues and $1.1 trillion in State and Local tax revenues

The economic gains presented in this study will translate into higher tax collections and increases in public revenues for both state and local, and federal governments. The present analysis applies a broad measure of the total tax revenues (from all sources) that both state and local and federal governments will gain from the proposed opening of federal lands to oil and gas leases. The analysis estimates that Federa-l tax revenues can be expected to increase by $24 billion annually in the short-run, and $86 billion annually in the long-run, while state and local government tax revenues can be expected to increase by $10.3 billion annually in the short-run, and $35.5 billion annually in the long-run.[71]

I follow the approach outlined by the Federal Reserve Bank of Boston to determine annual state and local tax burdens as a share of GSP (see Table A5).[72] For each state and the District of Columbia, the state and local tax burden can be calculated by dividing annual

TABLE 6: **ANNUAL GAINED TAX REVENUES BY STATE FROM THE PROPOSAL**
($ MILLIONS ANNUALLY)

	SHORT-RUN	LONG-RUN
STATE & LOCAL TAXES (INDIVIDUAL)	$5,869	$19,757
MAINE	$45	$195
NEW HAMPSHIRE	$1	$5
MASSACHUSETTS	$45	$192
RHODE ISLAND	$9	$39
CONNECTICUT	$15	$66
NEW YORK	$28	$121
NEW JERSEY	$35	$151
DELAWARE	$5	$24
MARYLAND	$7	$31
VIRGINIA	$20	$87
NORTH CAROLINA	$65	$281
SOUTH CAROLINA	$40	$172
GEORGIA	$19	$80
FLORIDA	$241	$948
CALIFORNIA	$1,111	$3,744
OREGON	$238	$802
WASHINGTON	$159	$534
ALASKA	$3,784	$12,286
STATE & LOCAL TAXES (W/SPILLOVER AND NON-ANWR EFFECTS)	**$10,247**	**$35,493**
FEDERAL TAXES	**$24,113**	**$85,474**

SOURCE: BUREAU OF ECONOMIC ANALYSIS; DEPARTMENT OF COMMERCE; U.S. CENSUS BUREAU; BUREAU OF ECONOMIC ANALYSIS

state and local tax revenue by annual GSP. Data for state and local tax revenues are released by the U.S. Census Bureau annually with a lag. As such, the state and local tax burden calculations are based on the most recent available fiscal year, 2011.[73] Those data produce the *average* state and local tax burden in 2011 in each state. The effective tax burdens are applied to the estimated increase in output as a result of the proposal. Table 6 presents the estimated gains in tax revenues per year, by state.

As before, the gains in tax revenues present the same caveats regarding non-ANWR and "spill-over" revenues.[74] The estimates thus represent a lower bound on potential state and local tax revenues gained as a result of the opening protected federal lands to oil and gas leasing. In order to account for the aggregate spillover and non-ANWR revenues, I use the weighted average of tax rates, based upon GSP of the individual states.[75] Accounting for spillover and non-ANWR activities, state and local taxes amount to $10.3 billion annually in the short-run and $35.5 billion annually in the long-run.

Applying a 19 percent tax rate to the increased national output as a result of the proposal yields Federal tax revenues of nearly $24 billion annually in the short-run and $86 billion annually in the long-run that are completely ignored by the CBO.

An effective Federal income tax rate on the national output can be applied to estimate Federal tax revenues. Tax rates as a percentage of GDP historically have hovered at around 19% regardless of U.S tax policy.[76] Applying a 19 percent tax rate to the increased national output as a result of the proposal yields Federal tax revenues of nearly $24 billion annually in the short-run and $86 billion annually in the long-run. To put some color around these estimates, in FY 2011 the federal government collected approximately $2.3 trillion in tax revenue. Hence, the proposal would result in a 3% increase in federal tax revenues annually for the next 7 years, without a single change to federal tax policies. Moreover, the tax revenues derived above ignore royalties shared between the state and Federal governments, as well as lease revenues directly derived from Federal permits.

VI. Summary and Conclusions

The CBO's analysis of the proposed opening of restricted federal lands fails to consider the key follow-on effects outside of oil and gas leasing revenues. The present paper aims to fill in this data gap, and the resulting analysis indicates that there are expansive economic effects from the proposal. Most notably in the form of increased output, job creation in industries outside of the energy sector, wage increases — and perhaps most importantly to the present analysis increased state and federal tax revenues.

Opening federal lands to oil and gas leasing can be expected generate short-run benefits amounting to $126 billion in annual economic output to the nation, $32 billion in annual wages, and over 552 thousand jobs. In the long-term, such changes can be expected to generate an additional $450 billion in annual output, $115 billion in annual wages, and nearly 2 million jobs. Many of the job increases will occur in fields such as healthcare and manufacturing. High-income, high skill fields like science and technology and finance also benefit with growth from opening Federal lands.

Perhaps the most important gains from the proposal, particularly through the lens of the CBO's Assessment, are in state and federal tax revenues. Increased output and economic growth, lead to a larger pie upon which to assess taxes. The result is a gain of $10.3 billion annually in state and local tax revenues in the short run, followed by nearly $35.5 billion annually in the long-run. Federal revenues will grow similarly, with short-term revenues increasing nearly $24 billion annually in the short-run and almost $86 billion annually in the long-run. These revenues are substantially larger than the CBO's estimates for bonus payments, royalties, and leasing receipts, and bring the total Federal revenues expected from opening up Federal lands over the period 2012 – 2022 from roughly zero (because the CBO does not recognize the short-run investment phase of oil and gas projects)[77] to up to $517 billion. Then from 2023-2035, revenues will increase from the roughly $25 to $50 billion predicted by the CBO[78] to well over a trillion when considering effects on the broader economy.

Again, Congress has chosen to evaluate only one piece of the economic effect of opening federal lands to oil and gas leasing. By ignoring the investment phase, the CBO — upon the instruction of Congress — substantially underestimates the economic effects of current policy choices. Moreover, by focusing on lease revenue and ignoring tax revenue, Congress has doubly downplayed the fiscal effects of such a policy. Finally, by failing yet again to analyze jobs, wages, and output, Congress ignores the crucial economic reality that freeing resources can help our economy grow beyond the recent recession and its continuing drag upon economic growth.

VII. Appendix

TABLE A1: **BOE BY REGION (BASED ON FIGURE 1 OF CBO REPORT)**
(VALUES IN BILLIONS)

	TOTAL BOE	OIL BOE	MCF
ALLOWABLE			
CENTRAL AND WESTERN GULF OCS	78	42	202
ALASKA OCS	28	28	0
ONSHORE	18	1	95
TEMPORARILY UNAVAILABLE			
EASTERN GULF OCS	8	6	11
ATLANTIC OCS	9	3	33
PACIFIC OCS	12	10	11
ONSHORE	10	5	28
UNAVAILABLE			
ANWR	8	8	0
ONSHORE	4	2	11

SOURCE: SOURCE: FIGURE 1 OF CBO REPORT
NOTES: 1,000 CUBIC FEET OF NATURAL GAS (1 MCF)=0.178 BOE

TABLE A2: **VALUE OF RESERVES AND INVESTMENT BY REGION & STATE**
(VALUES IN BILLIONS)

REGION	STATE	LENGTH OF COASTLINE	% OF REGIONAL COASTLINE	OIL BOE BILLIONS OF BOE	GAS MCF	VALUE OF RESERVES ($BILLIONS)
ATLANTIC	MAINE	228	11%	0.32	3.48	$50.2
ATLANTIC	NEW HAMPSHIRE	13	1%	0.02	0.20	$2.9
ATLANTIC	MASSACHUSETTS	192	9%	0.27	2.93	$42.2
ATLANTIC	RHODE ISLAND	40	2%	0.06	0.61	$8.8
ATLANTIC	CONNECTICUT	96	4%	0.13	1.46	$21.1
ATLANTIC	NEW YORK	127	6%	0.18	1.94	$27.9
ATLANTIC	NEW JERSEY	130	6%	0.18	1.98	$28.6
ATLANTIC	DELAWARE	28	1%	0.04	0.43	$6.2
ATLANTIC	MARYLAND	31	1%	0.04	0.47	$6.8
ATLANTIC	VIRGINIA	112	5%	0.16	1.71	$24.6
ATLANTIC	NORTH CAROLINA	301	14%	0.42	4.59	$66.2
ATLANTIC	SOUTH CAROLINA	187	9%	0.26	2.85	$41.1
ATLANTIC	GEORGIA	100	5%	0.14	1.52	$22.0
ATLANTIC	FLORIDA	580	27%	0.80	8.84	$127.6
EASTERN GULF	FLORIDA	770	100%	6.00	11.00	$361.4
PACIFIC	CALIFORNIA	840	65%	6.50	7.15	$695.6
PACIFIC	OREGON	296	23%	2.29	2.52	$245.1
PACIFIC	WASHINGTON	157	12%	1.21	1.34	$130.0
ANWR	ALASKA	-	100%	8.00	0.00	$810.7
UNITED STATES ONSHORE & OFFSHORE				34.00	95.00	$3,933.4

SOURCE: FIGURE 1 & TABLE 1 CBO ASSESSMENT.

NOTES: RESERVES FROM TABLE A1 ARE ALLOCATED TO STATES BASED ON SHARE OF COASTLINE. ONSHORE IS CAPTURED ONLY IN THE TOTAL U.S. THEN THESE RESERVES ARE CONVERTED TO $ VALUES BY MULTIPLYING THEM BY THE CBO ESTIMATE FOR MCF PRICE – $5.10 (BASED ON AVERAGE PRICE ESTIMATES FOR 2012-2022) AND OIL PRICE – 101.34 (BASED ON AVERAGE PRICE ESTIMATES FOR 2012-2022); INVESTMENT COSTS ARE ESTIMATED BY MULTIPLYING RESERVE ESTIMATES BY THE ESTIMATED $ OF INVESTMENT PER MCF FROM THE TAHITI PROJECT – $1.86/7=.02 AND $10.44/7=$1.49.

TABLE A3: **RIMS II 2010 OIL AND GAS EXTRACTION MULTIPLIERS**

STATE	OUTPUT	EARNINGS	EMPLOYMENT
ALABAMA	1.5147	0.274000	8.9373
ALASKA	1.4874	0.273100	5.1389
CALIFORNIA	1.6915	0.359000	6.7674
CONNECTICUT	1.0000	0.300532	7.3216
DELAWARE	1.4953	0.279800	6.0210
FLORIDA	1.5008	0.301400	6.8132
GEORGIA	1.5599	0.305800	7.3216
ILLINOIS	1.6634	0.335700	9.7864
LOUISIANA	1.6453	0.318000	6.9802
MAINE	1.0000	0.300532	7.3216
MARYLAND	1.4906	0.290200	9.0325
MASSACHUSETTS	1.5289	0.287400	8.3572
MISSISSIPPI	1.5075	0.266900	7.7226
NEW HAMPSHIRE	1.0000	0.300532	7.3216
NEW JERSEY	1.5788	0.293700	8.5829
NEW YORK	1.4379	0.226500	6.4359
NORTH CAROLINA	1.5252	0.293500	6.5902
OREGON	1.5020	0.291200	6.4913
RHODE ISLAND	1.4834	0.290300	6.1671
SOUTH CAROLINA	1.5182	0.309600	7.1937
PENNSYLVANIA	1.7305	0.360100	8.5332
TEXAS	1.8373	0.389000	7.6448
VIRGINIA	1.5280	0.294300	9.1455
WASHINGTON	1.5281	0.312100	6.5555
UNITED STATES*	2.3938	0.610900	10.4152

SOURCE: SOURCE: FIGURE 1 OF CBO REPORT

NOTES: 1,000 CUBIC FEET OF NATURAL GAS (1 MCF)=0.178 BOE

* THIS DATA IS FROM 2006 FOR OIL AND GAS EXTRACTION BECAUSE THE BEA HAS CEASED PRODUCING NATIONWIDE MULTIPLIERS. THE MULTIPLIER SHOULD NONETHELESS BE RELATIVELY STABLE OVER TIME.

TABLE A4: **RIMS II OIL & GAS EXTRACTION EMPLOYMENT MULTIPLIERS, BY INDUSTRY**

INDUSTRY	EXTRACTION MULTIPLIER
MINING	2.0662
HEALTH CARE AND SOCIAL ASSISTANCE	1.0978
RETAIL TRADE	1.0323
ACCOMMODATION AND FOOD SERVICES	0.7132
REAL ESTATE AND RENTAL AND LEASING	0.7079
PROFESSIONAL, SCIENTIFIC, AND TECHNICAL SERVICES	0.6560
MANUFACTURING	0.6117
ADMINISTRATIVE AND WASTE MANAGEMENT SERVICES	0.6104
FINANCE AND INSURANCE	0.5521
OTHER SERVICES	0.5272
TRANSPORTATION AND WAREHOUSING	0.3694
WHOLESALE TRADE	0.3051
EDUCATIONAL SERVICES	0.2773
ARTS, ENTERTAINMENT, AND RECREATION	0.2101
INFORMATION	0.1797
MANAGEMENT OF COMPANIES AND ENTERPRISES	0.1679
AGRICULTURE, FORESTRY, FISHING, AND HUNTING	0.1599
CONSTRUCTION	0.0666
HOUSEHOLDS	0.0617
UTILITIES	0.0426
TOTAL	**10.4151**

SOURCE: BUREAU OF ECONOMIC ANALYSIS;
NOTES: THIS DATA IS OF 2006 BECAUSE THE BEA STOPPED PRODUCING U.S. LEVEL INDUSTRY EMPLOYMENT DATA. THE MULTIPLIERS HOWEVER ARE RELATIVELY STABLE OVER TIME.

TABLE A5: 2011 STATE TAX BURDEN

STATE	STATE AND LOCAL TAXES ($2011)	GROSS STATE PRODUCT ($ 2011)	TAX BURDEN (ESTIMATED)
ALABAMA	8,635,527,000	150,330,000,000	5.7%
ALASKA	9,532,624,000	44,702,000,000	21.3%
ARIZONA	12,247,616,000	227,098,000,000	5.4%
ARKANSAS	7,635,370,000	91,496,000,000	8.3%
CALIFORNIA	115,565,925,000	1,735,360,000,000	6.7%
COLORADO	9,589,681,000	234,308,000,000	4.1%
CONNECTICUT	13,177,045,000	201,386,000,000	6.5%
DELAWARE	3,079,166,000	57,293,000,000	5.4%
FLORIDA	34,120,038,000	661,091,000,000	5.2%
GEORGIA	17,850,125,000	365,809,000,000	4.9%
HAWAII	5,102,871,000	57,977,000,000	8.8%
IDAHO	3,529,196,000	51,463,000,000	6.9%
ILLINOIS	29,619,110,000	582,094,000,000	5.1%
INDIANA	15,246,515,000	240,933,000,000	6.3%
IOWA	6,653,147,000	128,597,000,000	5.2%
KANSAS	7,165,501,000	113,367,000,000	6.3%
KENTUCKY	10,112,843,000	141,266,000,000	7.2%
LOUISIANA	10,697,358,000	205,877,000,000	5.2%
MAINE	3,653,983,000	44,821,000,000	8.2%
MARYLAND	16,897,413,000	264,373,000,000	6.4%
MASSACHUSETTS	21,722,664,000	348,577,000,000	6.2%
MICHIGAN	25,292,388,000	337,427,000,000	7.5%
MINNESOTA	18,296,318,000	244,912,000,000	7.5%
MISSISSIPPI	6,626,204,000	84,272,000,000	7.9%
MISSOURI	10,941,653,000	216,099,000,000	5.1%
MONTANA	2,548,268,000	31,983,000,000	8.0%
NEBRASKA	4,143,035,000	79,889,000,000	5.2%
NEVADA	6,041,767,000	112,503,000,000	5.4%
NEW HAMPSHIRE	2,166,334,000	56,572,000,000	3.8%
NEW JERSEY	29,940,234,000	426,765,000,000	7.0%
NEW MEXICO	5,136,455,000	70,497,000,000	7.3%
NEW YORK	64,164,437,000	1,016,350,000,000	6.3%
NORTH CAROLINA	22,392,452,000	385,092,000,000	5.8%
NORTH DAKOTA	2,600,821,000	34,262,000,000	7.6%

— CONTINUED ON NEXT PAGE —

TABLE A5: 2011 STATE TAX BURDEN (CONTINUED)

STATE	STATE AND LOCAL TAXES ($2011)	GROSS STATE PRODUCT ($ 2011)	TAX BURDEN (ESTIMATED)
OHIO	27,480,438,000	418,881,000,000	6.6%
OKLAHOMA	8,814,218,000	134,146,000,000	6.6%
OREGON	8,493,308,000	186,228,000,000	4.6%
PENNSYLVANIA	31,716,660,000	500,443,000,000	6.3%
RHODE ISLAND	2,729,507,000	43,663,000,000	6.3%
SOUTH CAROLINA	8,253,067,000	143,278,000,000	5.8%
SOUTH DAKOTA	1,348,017,000	34,443,000,000	3.9%
TENNESSEE	11,223,774,000	233,997,000,000	4.8%
TEXAS	44,919,866,000	1,149,908,000,000	3.9%
UTAH	5,798,868,000	108,329,000,000	5.4%
VERMONT	2,366,479,000	22,968,000,000	10.3%
VIRGINIA	18,093,846,000	375,747,000,000	4.8%
WASHINGTON	17,489,540,000	310,906,000,000	5.6%
WEST VIRGINIA	4,947,847,000	55,765,000,000	8.9%
WISCONSIN	15,009,179,000	221,741,000,000	6.8%
WYOMING	2,487,141,000	31,542,000,000	7.9%
WASHINGTON D.C.	5,390,557,000	91,643,000,000	5.9%
WTD AVG. (GSP)	778,686,396,000	13,108,469,000,000	5.9%

SOURCE: U.S. CENSUS BUREAU, BUREAU OF ECONOMIC ANALYSIS

TABLE A6: **STATE LEVEL RESULTS**
($ MILLIONS ANNUALLY, EXCEPT FOR EMPLOYMENT)

	OUTPUT		EMPLOYMENT		WAGES		LOCAL & STATE TAXES	
STATE	SHORT	LONG	SHORT	LONG	SHORT	LONG	SHORT	LONG
MAINE	$557	$2,396	4,078	17,544	$167	$720	$45	$195
NEW HAMPSHIRE	$32	$137	233	1,000	$10	$41	$1	$5
MASSACHUSETTS	$717	$3,085	3,920	16,863	$135	$580	$45	$192
RHODE ISLAND	$145	$624	603	2,593	$28	$122	$9	$39
CONNECTICUT	$235	$1,009	1,717	7,387	$70	$303	$15	$66
NEW YORK	$446	$1,919	1,997	8,590	$70	$302	$28	$121
NEW JERSEY	$501	$2,157	2,726	11,726	$93	$401	$35	$151
DELAWARE	$102	$440	412	1,772	$19	$82	$5	$24
MARYLAND	$113	$486	684	2,943	$22	$95	$7	$31
VIRGINIA	$418	$1,799	2,502	10,765	$81	$346	$20	$87
NORTH CAROLINA	$1,121	$4,825	4,846	20,847	$216	$928	$65	$281
SOUTH CAROLINA	$694	$2,984	3,286	14,138	$141	$608	$40	$172
GEORGIA	$381	$1,639	1,788	7,695	$75	$321	$19	$80
FLORIDA	$2,126	$9,148	9,653	41,530	$427	$1,837	$110	$472
FLORIDA	$7,122	$25,915	32,333	117,647	$1,430	$5,204	$368	$1,338
CALIFORNIA	$16,687	$56,218	66,763	224,917	$3,542	$11,932	$1,111	$3,744
OREGON	$5,222	$17,591	22,566	76,023	$1,012	$3,410	$238	$802
WASHINGTON	$2,818	$9,492	12,088	40,722	$575	$1,939	$159	$534
ALASKA	$17,747	$57,611	61,314	199,044	$3,258	$10,578	$3,784	$12,286
TOTAL FROM REGIONAL ANALYSIS	**$57,184**	**$199,474**	**233,507**	**823,745**	**$11,373**	**$39,752**	**$6,105**	**$20,619**
NOTE: NON-ANWR/ SPILLOVER EFFECTS	**$69,725**	**$250,388**	**318,661**	**1,133,560**	**$21,014**	**$75,053**	**$4,142**	**$14,874**
TOTAL U.S. (ONSHORE & OFFSHORE)	**$126,909**	**$449,861**	**552,168**	**1,957,305**	**$32,387**	**$114,805**	**$10,247**	**$35,493**

Endnotes

1. Congressional Budget Office, Potential Budgetary Effects of Immediately Opening Most Federal Lands to Oil and Gas Leasing, Congressional Budget Office, Aug. 2012 [hereinafter the *"CBO Assessment"*] http://cbo.gov/sites/default/files/cbofiles/attachments/08-09-12_Oil-and-Gas_Leasing.pdf.
2. Richard Harris, "Romney's Energy Plan Doubles Down on Fossil Fuels," NPR, Aug. 23, 2012, available at http://www.npr.org/2012/08/23/159926765/romney-energy-plan-touts-oil-gas-coal-production (last accessed on 10/9/2012).
3. World Energy Outlook 2012, OECD/International Energy Agency, November 2012, at 23-4 [hereinafter *World Energy Outlook*].
4. *Id.*
5. For example, while the CBO seems to indicate that 70% of resources are on Federal Lands that are open for leasing, a BLM inventory study required by the 2005 energy law says about 62% of the resource (onshore) is not open. (http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS__REALTY__AND_RESOURCE_PROTECTION_/energy/0.Par.4483.File.dat/EPCA2008LOfront.pdf) page xxix). Similarly, DOI does similar things for OCS, with Secretary Salazar saying his proposed 5 year plan which includes no areas where the moratorium was lifted in 2008 and is the smallest number of sales since the OCSLA, contains "75% of the undiscovered resource." (http://www.ogj.com/articles/2011/11/salazar-unveils-new-proposed-5-year-ocs-leasing-program.html).
6. The initial investment phase is estimated to be 7 years, as estimated by Chevron in a recent project. See, Statement of Peter J. Robertson, Vice Chairman, Chevron Corp., Prepared for the House Select Committee on Energy Independence and Global Warming, Apr. 1, 2008 [hereinafter *Chevron Testimony*] ("In 2002, we used leading-edge technology to drill in 4,000 feet of water and found an estimated 400 million to 500 million barrels of recoverable resources. It will take seven years to build the infrastructure required to produce the oil and gas more than a 100 miles offshore.").
7. Estimated to last for the life of the oil field – typically 30 years based on a recent Chevron estimate; See, , *Chevron Testimony*, *supra*, at 6 ("Once in production, Tahiti is expected to produce for up to 30 years.").
8. The current U.S. GDP is approximately $15 trillion, so $380 billion/15 trillion=2.5%. See Michael Dolgow, The Last Years of America's Historic GDP Reign, Bloomberg Businessweek, Jul. 17, 2012, available at http://www.businessweek.com/articles/2012-07-17/the-last-years-of-americas-historic-gdp-reign (last accessed on 10/9/2012); Currently GDP is growing at approximately 1.7%, see Bureau of Economic Analysis, GDP and the Economy: Second Estimates for the Second Quarter of 2012, Sept. 2012, available at http://www.bea.gov/scb/pdf/2012/09%20September/0912_gdpecon.pdf (last accessed on 10/9/2012).
9. The unemployment rate has remained around 8-9% for the past several years; Bureau of Labor Statistics, Labor force statistics from the current population survey, available at http://data.bls.gov/timeseries/LNS14000000 (last accessed on 10/9/2012).
10. U.S. Department of the Interior, Minerals Management Service, Report to Congress: Comprehensive Inventory of U.S. OCS Oil and Natural Gas Reserves, Feb. 2006 *[hereinafter MMS Report to Congress]* at 5 ("Much of the growth of the Nation's energy demand will have to be met by OCS production, especially from new frontier areas in the GOM [Gulf of Mexico], if further increases of imported supplies are to be avoided."). Note that the Congressional and Presidential moratoria were still in effect at this time, precluding the MMS from discussing new OCS production in OCS areas other than the Gulf of Mexico.
11. *Id.* at 6 ("The OCS oil production could account for as much as 40 percent of domestic oil production by 2010.").
12. *Id.* at 5 ("In the past, any difference between the growth in demand and the growth in domestic production was predominately met by imports of natural gas from Canada. However, Canada's future production will likely not support increased U.S. import requirements. Most additional supplies will need to come from Alaskan natural gas (if a pipeline is built), coalbed methane, the OCS, or from imports of LNG. Much of the growth in the Nation's energy demand will have to be met by OCS production, especially in new frontier areas in the GOM [Gulf of Mexico], if further increases of imported supplies are to be avoided."). As noted above, the Congressional and Presidential moratoria were still in effect at this time, precluding the MMS from discussing new OCS production in OCS areas other than the Gulf of Mexico.
13. *CBO Assessment, supra*, at 1.
14. Bonus payments are payments from a private firm for the right to explore and develop the area. See *CBO Assessment, supra*, at 1 ("CBO expects that opening ANWR to development would yield about $5 billion in additional receipts over the next 10 years, primarily in the form of bonus payments made by private firms for the opportunity to explore for and develop resources in particular areas.").
15. *Id.* at 1 ("According to estimates of potential resources by the Department of Energy's Energy Information Administration (EIA) and taking into account a range of probable oil prices, gross royalties from leasing in ANWR would probably total between $25 billion and $50 billion (in 2010 dollars) during the 2023–2035 period, or roughly $2 billion to $4 billion a year. (By comparison, CBO estimates that under current law, gross receipts from all federal oil and gas leasing activities in 2022 will be about $12 billion, in 2010 dollars.")).
16. *Id.* at 2 ("Specifically, with expanded leasing, CBO estimates that additional gross proceeds from federal oil and gas leases on public lands—principally in certain sections of the OCS off the Atlantic and Pacific coasts and in the eastern Gulf of Mexico and in onshore areas where leasing is now restricted—would total about $2 billion over the 2013–2022 period.").

17. *Id.* at 2 ("The long-term budgetary consequences of opening other federal lands to leasing are less clear, however. Much of the near-term development enabled by the proposal (beyond that in ANWR) would occur under current law, albeit at a later time. CBO does not have enough information to predict with specificity what would occur after 2022 either under current law or under the proposal.").
18. *Id.* at 2.
19. *Id*. at 1.
20. Id. at 5.
21. The World Energy Outlook quotes gas prices in terms of weighted averages expressed on a gross calorific-value basis, per millions of BTUs, while the CBO quotes prices in terms of thousands of cubic feet (McF). The heat content of natural gas lies between 900 Btu/McF and 1100 Btu/McF. A single McF of gas produced in the U.S. in 1995 was equal to approximately 1,028,000 BTU, so that the conversion factor to divide the reported IER price is 1,000,000/1,028,000=0.97371 (see U.S. Department of Energy, Annual Energy Review 1995, Energy Information Administration Report DOE/EIA-0384(95) Washington, D.C.: U.S. DOE, 1996).
22. Price at the Henry hub in dollars per thousand cubic feet. (*CBO Assessment* at 5.)
23. The only known exception is the case in which ANWR was subjected to 2 dimensional seismic analysis in the early 1980's as part of the Legislative EIS required by a 1980 law and a well was drilled on Inupiat Eskimo lands, but the results of those analyses remain confidential.
24. This can be calculated by simply reorganizing Figure 1 of the *CBO Assessment*. The CBO's figure is slightly misleading because they break apart temporarily unavailable resources and indefinitely unavailable resources. The two are distinguished only by whether there exists presently statutory authority to open such lands. For existence, there exists no such authority to open up ANWR, but there does exist authority to open up the OCS.
25. Bureau of Ocean Energy Management, Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2011, Nov. 2011, available at http://www.boem.gov/uploadedFiles/2011_National_Assessment_Factsheet.pdf (last accessed on 10/9/2012) [hereinafter *MMS 2011*].
26. *Id.* at 5.
27. U.S. Geological Survey, 3 to 4.3 Billion Barrels of Technically Recoverable Oil Assessed in North Dakota and Montana's Bakken Formation—25 Times More Than 1995 Estimate, Apr. 10, 2008, http://www.usgs.gov/newsroom/article.asp?ID=1911.
28. US Geological Survey, USGS Releases New Assessment of Gas Resources in the Marcellus Shale, Appalachian Basin, http://www.usgs.gov/newsroom/article.asp?ID=2893&from=rss_home.
29. Press Release, USGS Releases Oil and Gas Reserve Growth Estimates, USGS, Aug. 14, 2012, available a http://www.doi.gov/news/pressreleases/USGS-Releases-US-Oil-and-Gas-Reserve-Growth-Estimates.cfm (last accessed on 10/9/2012).
30. Minerals Management Service, Assessment of Undiscovered Technically Recoverable Oil and Gas Resources on the Nation's Outer Continental Shelf, 2006, MMS, Feb. 2006, available at http://www.boemre.gov/revaldiv/PDFs/2006NationalAssessmentBrochure.pdf (last accessed on 10/9/2012).
31 . *MMS 2011, supra*.
32. See https://www.dmr.nd.gov/oilgas/stats/annualprod.pdf for statistics on North Dakota. See also http://www.instituteforenergyresearch.org/2012/09/24/u-s-oil-production-up-but-on-whose-lands-2/ for a more general discussion of the lag in resource production from Federal lands.
33. *MMS Report to Congress, supra* at 4 ("From the time OCS leasing began in 1954 through 2004, the DOI [Department of the Interior] has regulated production of more than 15 Bbo and 165 Tcf of natural gas from OCS leases offshore California, Alaska, and in the GOM. During this time, more than $156 billion in bonus bid, rental and royalty payments has been collected from OCS oil and gas activity.").
34. Joseph R. Mason, *The Economic Contribution of Increased Offshore Oil Exploration and Production to Regional and National Economies*, American Energy Alliance, Feb. 2009. Available at http://www.americanenergyalliance.org/images/aea_offshore_updated_final.pdf?phpMyAdmin=fa972a975ccbf0bd709c38b1080539f5 [hereinafter *Mason 2009*] at 22.
35. Northern Economics, Potential National-Level Benefits of Alaska OCS Development, Feb. 2011, available at http://www.northerneconomics.com/pdfs/ShellOCS/National%20Effects%20Report%20FINAL.pdf (last accessed on 10/9/2012/
36. Congressional Research Service, Possible Federal Revenue from oil Development of ANWR and Nearby Areas, Jun. 2008, available at http://www.policyarchive.org/handle/10207/bitstreams/19129.pdf (last accessed on 10/9/2012).
37. Rose Ragsdale, White House says ANWR lease revenue could triple, Petroleum News, Feb. 12, 2006, available at http://www.anwr.com/archives/white_house_says_anwr_lease_revenue_could_triple.php (last accessed on 10/9/2012).
38. Letter to Senator Ted Stevens from the Congressional Budget Office, Dec. 7, 2005, available at http://www.cbo.gov/publication/17536 (last accessed on 10/9/2012), ("In your letter of December 5, 2005, you asked for estimates of potential bonus bids for leases to develop the coastal plain of the Arctic National Wildlife Refuge (ANWR) under certain conditions.

Specifically, you asked us to take into account recent projections by the U.S. Geological Survey (USGS) of economically recoverable oil in that area. You also asked us to assume that prospective bidders for ANWR leases would assume that long-term oil prices would be roughly $50 per barrel in 2010 (equivalent to about $45 per barrel in 2005 dollars). Under your assumptions, potential bonus bids might total at least $10 billion—roughly double CBO's official estimate. (Federal receipts net of payments to Alaska would be one half of the bonus bids.).

39. Robert Dillion, "Shell Spends Big at Record Alaska Lease Sale," Oil Daily, Feb. 2008.
40. *Id.*
41. *Id.*
42. According to the prices presented in Table 1 of the CBO Report, prices will remain permanently over $100 after 2017 and will increase to $113.50 by 2022. See *CBO Assessment*, *supra*, Table 1 at 5.
43. Jon Birger, Why Shell is betting billions to drill for oil in Alaska, CNNMoney, May 24, 2012, available at http://features.blogs.fortune.cnn.com/2012/05/24/oil-shell-alaska-drilling (last accessed on 10/9/2012) ("Before sinking a single well, Shell will have already invested $4.5 billion in its Alaska project — $2.3 billion assembling the necessary equipment and personnel on top of the $2.2 billion for the leases. The wells Shell will begin drilling in July are exploratory, not producing. So assuming Shell does find oil, it would be another seven to 10 years before it's able to drill producing wells, install permanent platforms, and build the offshore and onshore pipelines required to get Arctic oil to consumers in the lower 48. By then, the up-front investment for Shell, which reported $31 billion in profits for 2011, will probably have topped $7 billion.").
44. *America's oil and natural gas industry supports over 9 million jobs.* American Petroleum Institute, Apr. 5, 2010 (available at http://www.api.org/aboutoilgas/).
45. *See Energy and the Economy*, Energy Tomorrow (available at http://www.energytomorrow.org/Energy_and_the_Economy.aspx).
46. Jon Birger, Why Shell is betting billions to drill for oil in Alaska, CNNMoney, May 24, 2012, available at http://features.blogs.fortune.cnn.com/2012/05/24/oil-shell-alaska-drilling (last accessed on 10/9/2012)
47. Statement of Peter J. Robertson, Vice Chairman, Chevron Corp., Prepared for the House Select Committee on Energy Independence and Global Warming, Apr. 1, 2008 [hereinafter *Chevron Testimony*], at 6 ("In 2002, we used leading-edge technology to drill in 4,000 feet of water and found an estimated 400 million to 500 million barrels of recoverable resources. It will take seven years to build the infrastructure required to produce the oil and gas more than a 100 miles offshore.").
48. *Id.*
49. *Id.* ("When Tahiti finally comes on line, we will have invested $4.7 billion — before realizing $1 of return on our investment.").
50. *See Mason 2009*, *supra*.
51. My previous study, Mason 2009, supra., also investigated refinery developments that would be necessary to process the increased production. A later study discussed additional infrastructure that is necessary to move domestically-produced and refined products to final markets. See Mason, Joseph R. *The Perverse Dynamics of Long-term Low Interest Rates: Evidence from Oil Prices*, Small Business and Entrepreneurship Council, May 2012, available at http://www.sbecouncil.org/uploads/SBEC%20Mason%20Monetary%20Policy%20Final%20Paper.pdf
52. The initial investment phase is estimated to be 7 years, as estimated by Chevron in a recent project. ("In 2002, we used leading-edge technology to drill in 4,000 feet of water and found an estimated 400 million to 500 million barrels of recoverable resources. It will take seven years to build the infrastructure required to produce the oil and gas more than a 100 miles offshore."); *Chevron Testimony*, *supra*, at 6 ("Once in production, Tahiti is expected to produce for up to 30 years.").
53. $10.44 per barrel of oil / 7 years = $1.49 per barrel of oil per year, and $1.86 per 1,000 cf / 7 years = $0.27 per 1,000 cf per year.
54. *CBO Assessment, supra*, Figure 1 at 5.
55. *Id.*, Table 1 at 7.
56. Wassily W. Leontief, *Input-Output Economics*, 2nd edition, 1986.
57. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II)*, Bureau of Economic Analysis, U.S. Department of Commerce, 3rd edition, 1997, 1.
58. *See id.* at 3 ("In this [final demand output multiplier] table, each column entry indicates the change in output in each row industry that results from a $1 change in final demand in the column industry. The impact on each row industry is calculated by multiplying the final-demand change in the column industry by the multiplier for each row.").
59. *Id.*
60. *See id.* at 4 ("In the final-demand employment multiplier table, each column entry indicates the change in employment in each row industry that results from a $1 million change in final demand in the column industry. The impact on each row industry is calculated by multiplying the final-demand change in the column industry by the multiplier for each row.").
61. *Id.* at 8 ("RIMS II, like all I-O models, is a 'static equilibrium' model, so impacts calculated with RIMS II have no specific time dimension. However, because the model is based on annual data, it is customary to assume that the impacts occur in 1 year."). Jobs, as well as dollar amounts of economic activity and wages, are also reported on an annual basis. While it is natural to sum the annual dollar amount of wages and economic activity over years to a cumulative effect, jobs do not naturally lend themselves to the same

interpretation. It may help the reader to interpret the resulting jobs numbers as "job-years" or divide the number of jobs by the number of years to establish the number of jobs created for the life of the project. I use the job-years concept below in reporting my results — the standard method for reporting results of RIMS II analysis — and leave it to the reader to interpret the numbers appropriately.

62. RIMS II state-level multipliers were updated from 2006 to 2010 on the BEA site after the November 2012 elections. The national-level multipliers were still not updated as of the date of this report.
63. *See* U.S Department of Commerce, Bureau of Economic Development, Brief Description: RIMS II Methodology, *available at* http://www.bea.gov/bea/regional/rims/brfdesc.cfm ("RIMS II uses BEA's benchmark and annual I-O tables for the nation. Since a particular region may not contain all the industries found at the national level, some direct input requirements cannot be supplied by that region's industries. Input requirements that are not produced in a study region are identified using BEA's regional economic accounts." Note that in both cases multiplier estimates as based on government-maintained industry data.).
64. *RIMS II Handbook, supra* note 45, at 18 ("The impact estimation is complicated by the treatment of the industry in RIMS II; inasmuch as this industry does not yet exist in the economic area, the column entries in the final-demand multiplier table for the industries from which the glass-container industry purchases inputs are zero." Note that this discussion is limited to an example applying final-demand multipliers to a glass-container plant, but that it clearly applies to both direct and final-demand multipliers for all industries.).
65. The BEA suggests that a "bill-of-goods" approach — in which survey data about probable wage and production expenditures from firms can be established for such an industry in a region in which there is no production — can be applied to predict changes in output in such situations (*Id.*). That approach requires, however, very specific data for each and every project in each state and lengthy surveys with potentially affected business owners. Because specific bill-of-goods data is not available for future oil and gas projects on Federal lands, a bill-of-goods approach cannot be applied here.
66. See, for instance, Ambargis, Zoë O., "RIMS II: Regional Input-Output Modeling System," Presentation at the BEA/PNREAP/University of Nevada Regional Economic Workshop, Reno, NV, September 2009.
67. Additional detail is provided in Appendix Table A3.
68. A job is defined by the BEA method in terms of "full time person years of employment." (Lynch, Timothy, "Analyzing the Economic Impact of Transportation Projects using RIMS II, IMPLAN and REMI," Florida State University Institute for Science and Public Affairs, October 2000.) According to Zoë O. Ambargis of the BEA, a common mistake is to confuse FTE impacts and employment statistics. By the BEA method, two employees reduced to half time, for instance, constitute one job. (*See*, for instance, Ambargis, Zoë O., "RIMS II: Regional Input-Output Modeling System," Presentation at the BEA/PNREAP/University of Nevada Regional Economic Workshop, Reno, NV, September 2009.) .
69. The employment impact estimates from BEA's RIMS II multipliers are simply one employed position at a firm, as measured by BEA. They are not full-time equivalents. The BEA data does not distinguish between full-time and part time jobs. Thus, the employment figures represent merely an estimate of how reported company payrolls are likely to change in response to changes in demand. Nonetheless, a common mistake in interpreting the RIMS II models is to confuse BEA "jobs" with Full-Time Equivalent (FTE) job impacts and employment statistics. See, for instance, Zoë O. Ambargis. "RIMS II: Regional Input-Output Modeling System," BEA/PNREAP/University of Nevada Regional Economic Workshop, Reno, NV, September 2009.
70. For a full listing of the jobs see *U.S. Census Bureau's 2007 NAICS Codes and Titles*, (available at http://www.census.gov/naics/2007/NAICOD07.HTM).
71. Note that this analysis is conservative because it does not consider the state and local taxes produced from "spill-over" effects. These tax revenues cannot be accurately measured because spill-over output cannot be attributed to particular states. Because spill-over output is significant, however, my estimate significantly understates the total incremental state and local taxes that would be produced *annually*.
72. Matthew Nagowski, *Measures of State and Local Tax Burden*, New England Public Policy Center, Federal Reserve Bank of Boston, Jul. 13, 2006, (available at http://www.bos.frb.org/economic/neppc/memos/2006/nagowski071306.pdf).
73. U.S. Census Bureau, Federal State and Local Governments, State and Local Government Finances (available at http://www.census.gov/govs).
74. It is impossible to quantify these benefits because state and local taxes differ from state to state and because the BEA does not provide a means to allocate the spill-over revenues to particular states. To be conservative, the analysis estimates only the revenues that can be accurately assigned and measured.
75. Using the weighted average by increased output generates nearly identical results.
76. W. Kurt Hauser, There's no escaping Hauser's law, the WSJ, Nov. 2010, available at http://online.wsj.com/article/SB10001424052748703514904575602943209741952.html?KEYWORDS=hauser (last accessed on 10/9/2012).
77. *CBO Assessment*, *supra*, at 6, ("If legislation was enacted in 2013 to open ANWR leasing, no production would be likely to occur for 10 years and production would likely not peak before 2032.").
78. *Id.*, ("Assuming that oil prices over the 2023-2025 period might range from under $100 per barrel to over $150 per barrel (in 2010 dollars)…CBO estimates that the government's gross receipts might total between $25 billion and $50 billion…"

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