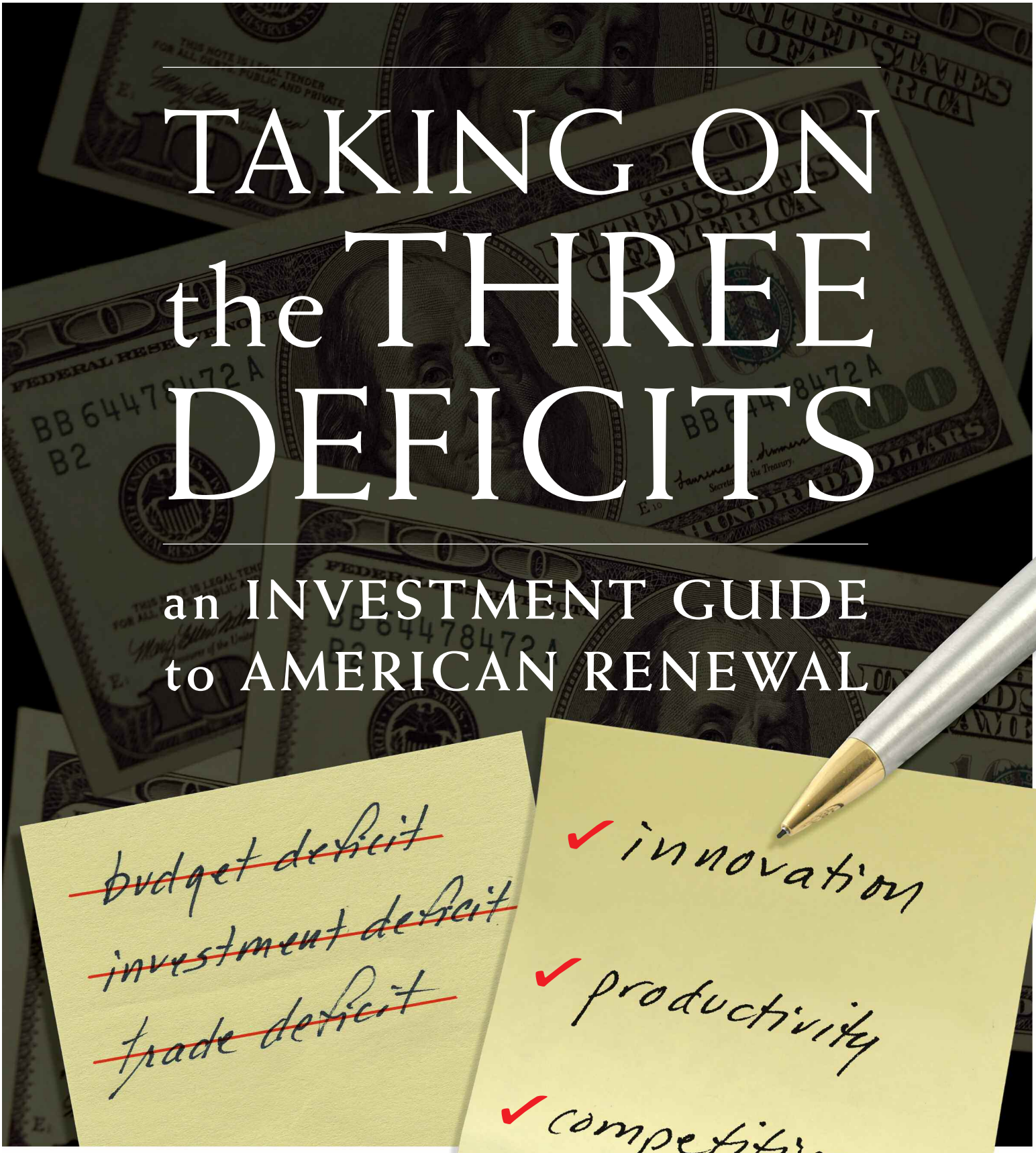
TAKING ON the THREE DEFICITS

an INVESTMENT GUIDE to AMERICAN RENEWAL



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TAKING ON the THREE DEFICITS

an INVESTMENT GUIDE to AMERICAN RENEWAL

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EXECUTIVE SUMMARY

Most policymakers in the budget debate are ignoring the trade and investment deficits, and as a result risk making all three deficits worse.

Federal policymakers are consumed by a debate over how to reduce the nation's budget deficit, which some argue is critically important to the nation's economic future. As the President's National Commission on Fiscal Responsibility and Reform noted in its final report, "America cannot be great if we go broke. Our economy will not grow and our country will not be able to compete without a plan to get this crushing debt burden off our back." Yet an oftentimes myopic focus on the budget deficit has obscured the fact that **America actually faces three deficits**—the budget deficit, the trade deficit, and the investment deficit—that, if left unchecked, could total over $41 trillion in the next 10 years. Reducing all three deficits, not just the budget deficit, is critical to future economic prosperity.

America's Three Deficits

America faces three cumulative deficits, each of which must be addressed to ensure continued economic prosperity:

The **Budget Deficit** is the difference between federal revenues and spending. The budget deficit for FY2011 stands at over $1.2 trillion, and the cumulative national debt will reach $10.4 trillion this year. The debt may rise to more than $18.3 trillion by 2021, according to Congressional Budget Office (CBO) estimates.

The **Trade Deficit** is the annual difference between U.S. exports and imports. For years, the United States has imported more than it exports, leading to large and persistent trade deficits. In 2010, the United States generated a $500 billion trade deficit. Since 1975, the United States has accumulated a total trade deficit of $8 trillion, and the cumulative trade deficit could grow to $18 trillion in 10 years. The trade deficit creates a drag on economic growth and represents a hidden tax on future generations of Americans who will have to pay it off by running trade surpluses that stem from expanded exports and/or reduced consumption of goods and services.

The **Investment Deficit** is the shortfall of investments in scientific research, education, productive infrastructure, and new technologies that are needed to maintain our current standard of living and provide a critical foundation for long-term economic prosperity. These investments drive economic growth by accelerating innovation and boosting productivity, yielding positive returns on investment for the entire economy. Yet public investment in these building blocks of national prosperity has declined for decades, leading to stagnating growth and a widening investment deficit that may increase to over $5 trillion in the next decade.

Instead of focusing solely on the budget deficit, Congress should take a more nuanced approach to budget cutting that addresses the budget deficit while simultaneously reducing the investment and trade deficits.

Overall, America's three deficits total almost $21 trillion and are projected to grow to over $41 trillion in 10 years. The budget deficit alone makes up less than half of the total combined deficit, and both future economic growth and government revenues are influenced by the magnitude of the trade and investment deficits. Thus, addressing all three growing deficits is critically important to ensuring continued economic prosperity.

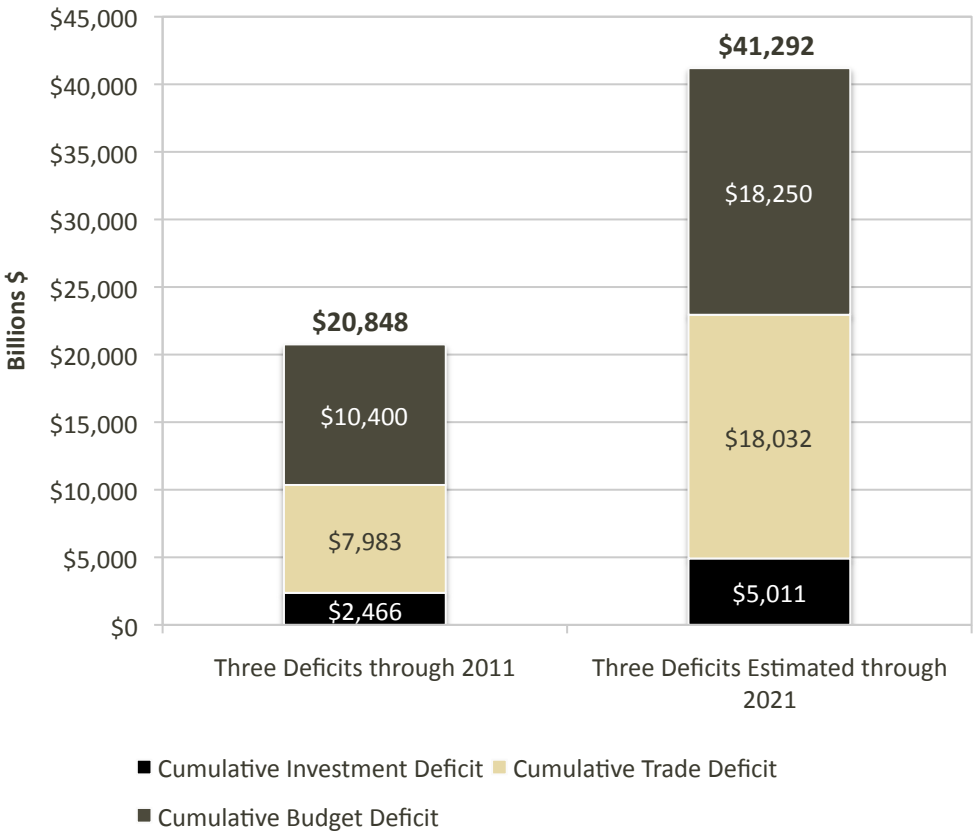

Figure 1: Estimate of America's three deficits in 2011 and 2021 projection

The Right Way and the Wrong Way to Close the Three Deficits

The Wrong Way

Most policymakers in the budget debate are ignoring the trade and investment deficits, and as a result risk making all three deficits worse. The predominant approach in Washington is to "put everything on the table" and pursue across-the-board budget cuts to reduce the level of public spending. Such a strategy makes policymakers appear bold in their approach to the national debt, but would actually be counterproductive, since it would simply transfer some financial debt to investment or trade debt. Take, for instance, the impact of a 10 percent cut in funding for research and development spending over the next 10 years. This would nominally reduce the budget deficit by $150 billion over 10 years, but would increase the investment deficit by the same amount. Moreover, it would actually increase the trade deficit as well, by slowing the pace of innovation and making U.S. exporters less competitive. In turn, both factors in turn would reduce economic growth, ultimately leading to a *higher* budget deficit (see Figure 2 below).

Increasing high-impact productive investments, including pro-growth tax expenditures, can therefore be accomplished without adding significantly to short-term debt, while generating economic returns that reduce all three deficits over the medium to long term.

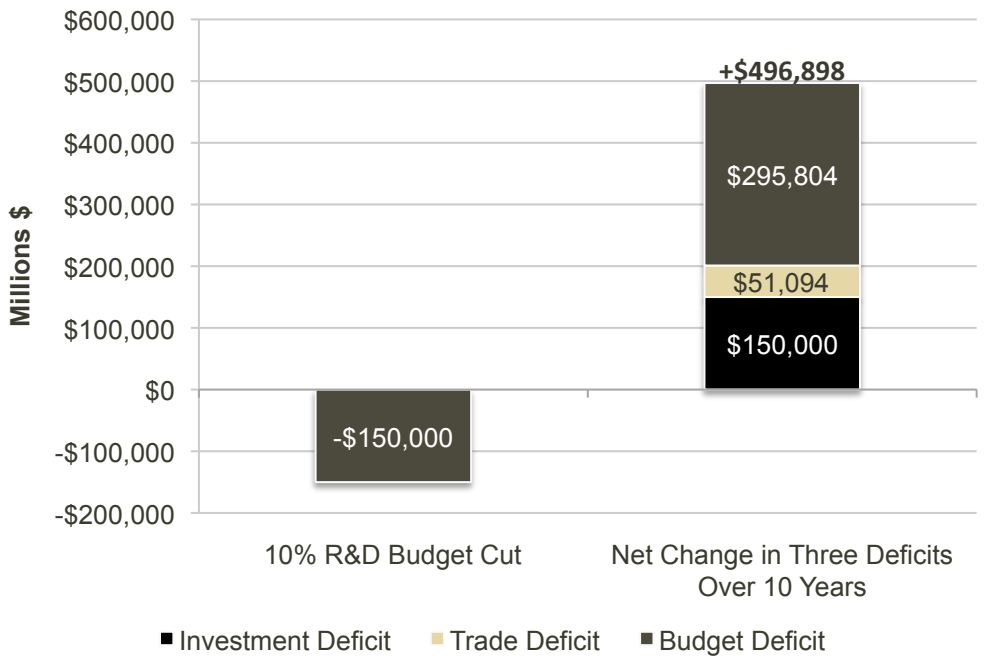

Figure 2: Estimated net impact on the three deficits of a 10 percent cut (relative to 2010 government investment level) in R&D investments portioned equally over 10 years. See Appendix A for a brief description of our estimation methodology.

The Right Way

Instead of focusing solely on the budget deficit, Congress should take a more nuanced approach to budget cutting that addresses the budget deficit while simultaneously reducing the investment and trade deficits. The only way to do this is to *increase* targeted investments that spur innovation, productivity, and competitiveness while cutting budgets elsewhere. Increasing these productive public investments will close the investment deficit, boost U.S. competitiveness and exports, and generate higher economic growth, which is the single best way to close the budget deficit.[1] The CBO estimates that an increase of just 0.1 percent in the GDP growth rate could reduce the budget deficit by as much as $310 billion cumulatively over the next decade.[2] For example, an increase in the real rate of GDP growth from the CBO projection of 2.8 percent over the next decade to 4 percent—the U.S. growth rate from 1993 to 2000—would, all else equal, cut the cumulative budget deficit in half, or by $6.8 trillion, over the next decade. Indeed, gaining control over the nation's debt without an increase in economic growth and therefore tax revenues will be extremely difficult, if not impossible.

Productive Investment vs. Consumptive Spending

The challenge, then, is to identify those programs that spur innovation, productivity, and competitiveness, and therefore drive economic growth and competitiveness. In particular, policymakers should distinguish between **productive investments**—expenditures that expand the productive capacity of the country, drive economic growth, and increase future incomes—and **consumptive spending**—government expenditures that finance present consumption of goods and services.

The key difference between programs should really be whether a program is considered consumptive spending or productive investment, not whether the expenditure is mandatory or not.

This critical distinction is often lost on both sides of today's budget negotiations. Many on the left do not distinguish between the two, either because they are unconcerned about the budget deficit or because they believe spending and investment have the same economic impact. Many on the right paint all federal investments as "spending" that should be cut, even though investments like scientific research yield large returns for both society and the federal treasury that other spending, including subsidies to farmers and oil companies, do not.[3] There is a similar lack of clarity on tax policy, with some on the left opposed to more tax cuts for businesses and some on the right in favor of any and all tax cuts, regardless of merit. The truth is that some tax expenditures, like the ethanol tax credit, are wasteful and do not increase productivity or growth, while tax incentives, like the R&D tax credit, encourage activities that foster growth, innovation, and job creation.[4]

Furthermore, policymakers from both the left and right limit their framing of the federal budget to either discretionary or non-discretionary programs. The fact is, the entire federal budget consists of government expenditures. The key difference between programs should really be whether a program is considered consumptive spending or productive investment, not whether the expenditure is mandatory or not. Breaking from this old framing would create a more robust and effective budget policy debate.

Productive public investments will help reduce the three deficits and should be strengthened, while consumptive spending will likely add to the three deficits and could more justifiably be cut. Some consumptive spending programs may still be important, but each should be judged on their own merits. In general, targeted cuts could be made to consumptive spending to reduce the budget deficit without exacerbating the other two deficits. Meanwhile, agencies, programs, and policies with some connection to productive investments—e.g., R&D, education, and infrastructure programs and policies—collectively take up a relatively small portion of the budget picture—likely less than 10 percent of all expenditures. Increasing high-impact productive investments, including pro-growth tax expenditures, can therefore be accomplished without adding significantly to short-term debt, while generating economic returns that reduce all three deficits over the medium to long term.

To distinguish between investment and spending, policymakers should consider three criteria:

1. **Innovation**. Does the program or policy help spur innovation to create new products, processes, technologies, or knowledge that in turn adds value or creates new industries?
2. **Productivity**. Does the program or policy increase the productivity of organizations and the economy as a whole?
3. **Competitiveness**. Does the program or policy help close the trade deficit by making U.S. firms more globally competitive, thereby increasing exports or reducing imports?

By using these three metrics as a guide, policymakers can make better budget decisions that spur economic growth and simultaneously close all three deficits, even as they cut spending elsewhere in the budget. By increasing productive public investments to spur innovation, productivity, and competitiveness, America can begin closing its three deficits and once again become the most competitive and innovative nation in the world.

AMERICA'S THREE DEFICITS: BUDGET, TRADE, AND INVESTMENT

America actually faces three deficits—budget, trade, and investment—that if left unchecked could total over $41 trillion in the next ten years. Reducing all three deficits, not just the budget deficit, is critical to future economic prosperity.

In this section, we detail each of the three deficits—budget, trade, and investment—and explain why each is a significant drag on long-run economic performance. Then, we explain how the three deficits are interrelated and describe the wrong and right ways to approach the challenge of closing all three deficits.

The Budget Deficit

In the last ten years, the United States budget situation has shifted from surpluses in the late 1990s to sizable deficits throughout the last decade. In 2001, the nonpartisan CBO projected that the government would erase overall debt by 2006 and that it would see a cumulative *surplus* of $2.3 trillion by 2011. Instead, the United States' total outstanding debt is projected to reach $10.4 trillion this year—a negative shift of $12.7 trillion from expectations at the start of the decade and the largest debt as a percentage of GDP since 1950.[5]

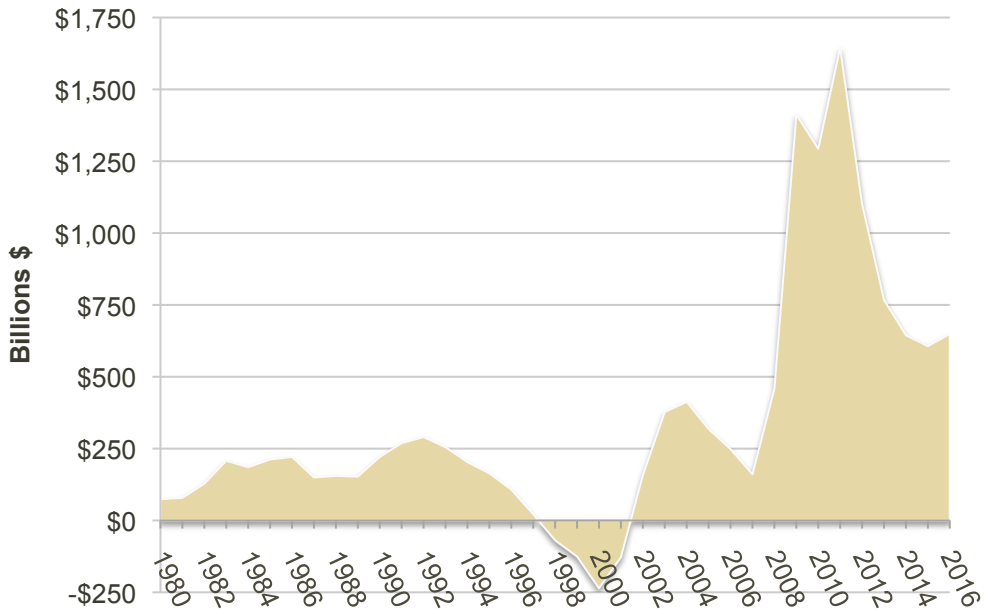

Figure 3: U.S. federal budget deficit 1980-2016.[6] Years 2011-2016 are Office of Management and Budget (OMB) estimates assuming current policies and policy expiration.

America's national debt and its projected growth in the coming decades put future economic expansion at risk. The debt will have to be paid back to creditors with increasingly large interest payments. Significant deficits today will also require significant tax increases or dramatic spending cuts in the future, reducing future consumption as well

as the resources needed to make growth-enhancing investments. Persistent budget deficits can generate a strong feedback effect that can be destructive to the economy. As the national debt increases, the government's ability and willingness to make productive public investments decreases, reducing economic growth and thus tax revenues. This, in turn, further exacerbates our budget deficit. Such a negative cycle can also erode business confidence in the economy, reducing domestic private sector investment.[7] Over time, a large and persistent budget deficit will lead to economic disarray.

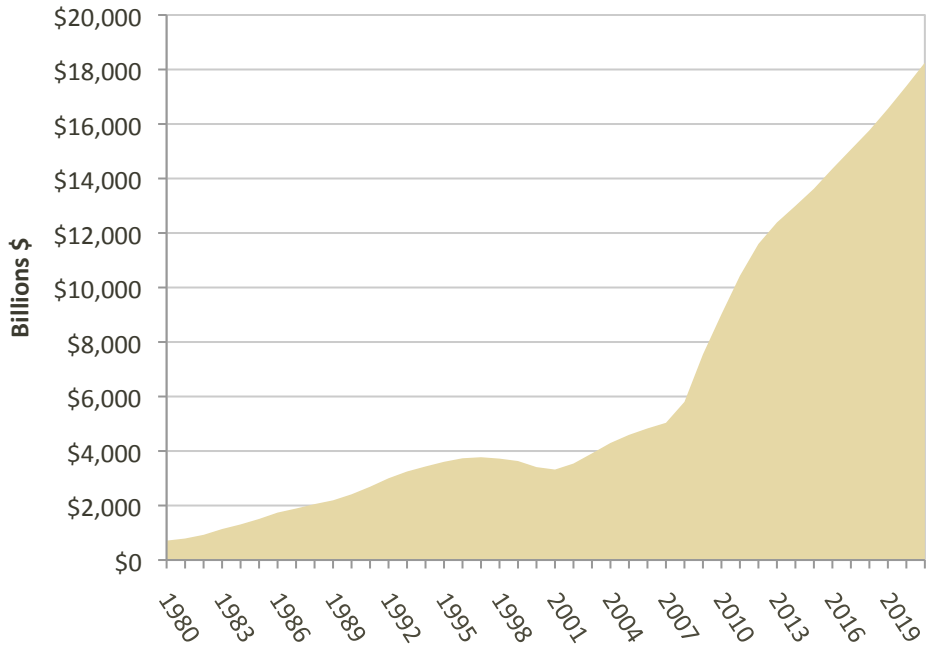

Figure 4: Cumulative U.S. national debt 1980-2021.[8] Years 2011-2021 are CBO estimates assuming current policies and policy expiration.

The Trade Deficit

U.S. trade performance—the balance between imports and exports—has fared no better than the budget deficit in recent years. During the prior decade, the United States added $5.5 trillion to the deficit in traded goods and services, bringing the cumulative deficit since the nation last recorded a trade surplus in 1975 to $8 trillion. The accumulated trade deficit is worsening considerably every year. In 2006, the annual current account deficit reached a record $760 billion, or more than five percent of GDP.[9] After falling during the economic downturn, the trade deficit has recently returned to near pre-recession levels (Figure 5).

Why are large trade deficits undesirable? The United States has borrowed massive amounts of overseas capital to finance its persistent trade deficit—an amount equivalent to $49,000 for every American household.

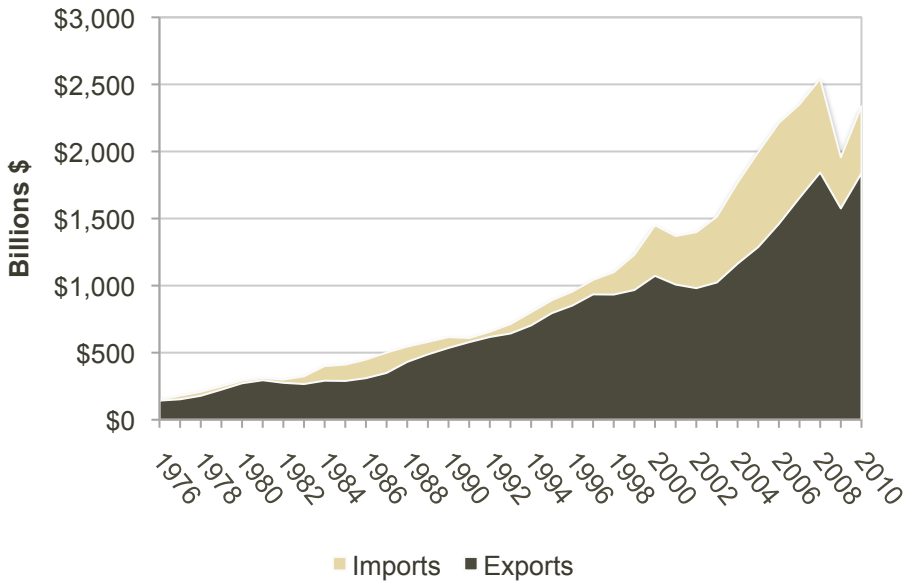

Figure 5: U.S. export and import receipts of goods and services, 1976-2010.[10]

Petroleum imports continue to account for roughly half of the trade imbalance, while the traditional U.S. trade surplus in agricultural products is nearing zero. The deficit in manufactured goods has become a key component of America's trade imbalance in recent years: in seven of the past 10 years, the United States deficit in manufactured goods exceeded $400 billion. The United States even records a trade deficit in advanced technology products, widely assumed to be America's comparative advantage, and ran a record $81 billion deficit in the category in 2010.[11] This deficit is a result of a "hollowing out" of the domestic economy, as reduced capital investment and faltering international competitiveness has weakened our domestic manufacturing base.[12] The United States does maintain a trade surplus in services, but it is equal to only 17 percent of the trade deficit in goods and is not nearly large enough to reduce the overall trade deficit without a corresponding expansion of exports in manufacturing sectors.

Why are large trade deficits undesirable? The United States has borrowed massive amounts of overseas capital to finance its persistent trade deficit—an amount equivalent to $49,000 for every American household.[13] But this borrowing cannot continue forever and, in fact, represents a "hidden tax" on future generations of Americans who will have to pay off the trade deficit with a future increase in the production of goods and services or a reduction in consumption and living standards.[14] To put it another way, Americans currently consume on average 5 percent more than they produce (the trade deficit averaged 5 percent of GDP before the recession). So in the future, Americans may need to consume 5 percent *less* than they produce if actions are not taken now to boost U.S. competitiveness in traded sectors and address the growing trade deficit.

If such large trade deficits persist, the value of the U.S. dollar will eventually fall relative to foreign currencies as investors sell dollars in favor of other traded currencies, particularly if the growth of emerging economies continues at a quick pace. A declining dollar makes it more expensive for U.S. consumers to purchase imported goods and services, which can easily lead to reduced consumption and falling living standards. On the flip side, the

declining dollar will make U.S. producers more competitive internationally and will help boost exports, something that ultimately helps rebalance the global economy.

But a declining dollar should not be relied on to completely reverse the trade deficit. To close the trade deficit without reducing consumption and living standards, the United States must invest in manufacturing, research, technology, and infrastructure. These investments are critical to increase productivity, make domestic firms more competitive, and support economic leadership in new technology industries—something other nations are doing with significantly positive results. If we fail to make investments that strengthen our domestic manufacturing and technology base, we will miss out on the economic opportunity presented by high-value export industries, even as we face more expensive imports from abroad. That would be a recipe for long-term economic decline.

If federal R&D investment had been sustained at the post-war, 1960-1980, average share of GDP, these investments would be approaching $230 billion annually today, rather than current levels of roughly $150 billion.

The Investment Deficit

The decline in U.S. investments in innovation, education, and productive infrastructure also presents a mounting challenge to American economic prosperity. From 1980 through the Great Recession, the United States' total investment in **research and development** (R&D)—a central driver of innovation—declined as a share of GDP and has only increased in the last two years due to stimulus investments that will soon expire.[15] Federal R&D investment as a share of GDP averaged 1.52 percent per year from 1960-1980, as the United States led the world in the development of game-changing new innovations in aerospace, semiconductors, computing, information technology, and other 20th century drivers of American economic prosperity. Yet total federal R&D investments fell to an average of less than 1 percent per year from 1981–2011 (see Figure 6).

If federal R&D investment had been sustained at the post-war, 1960-1980, average share of GDP, these investments would be approaching $230 billion annually today, rather than current levels of roughly $150 billion.[16] Since 1980, the United States has accrued a nearly $1.5 trillion cumulative R&D investment deficit (see Figure 7 below). And if current R&D investments continue with no change, that R&D investment deficit will grow to $2.6 trillion by 2021.

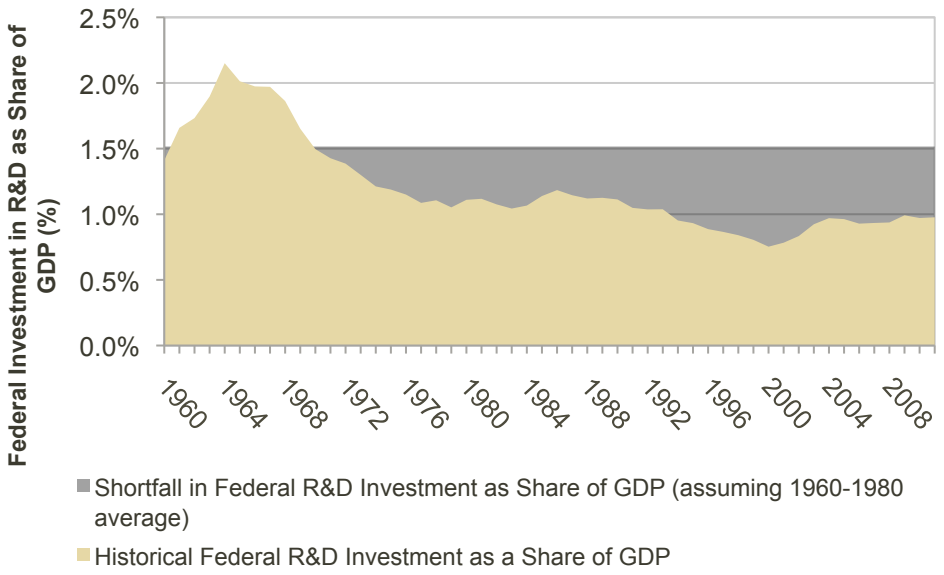

Figure 6: Estimate of shortfall in federal investments in R&D. Nominal historical federal investments in R&D as a share of GDP from 1960-2011 is shaded tan. Shortfall in R&D investments, shaded in gray, is estimated as the difference of actual federal investments from the average investments in R&D from 1960-1980 (1.52 percent). In the interest of simplicity, we ignore the 1976-1977 transition quarter.

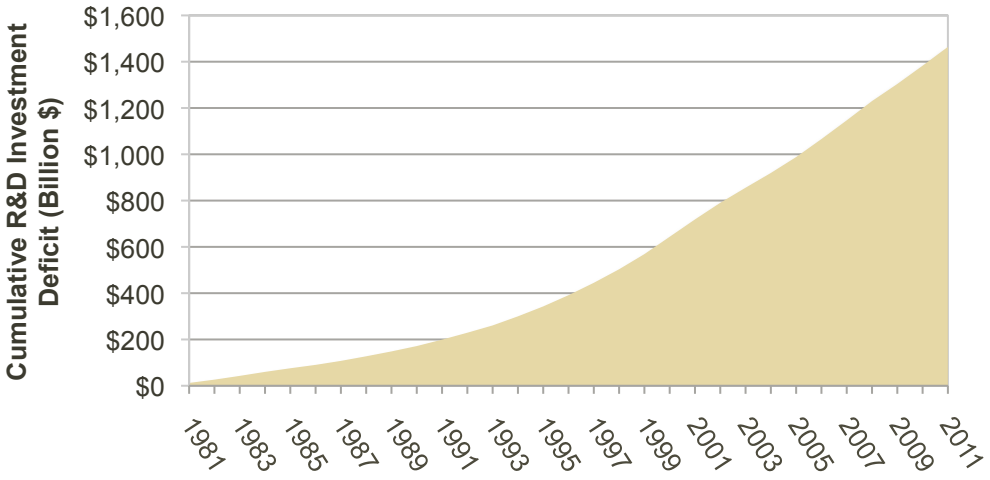

Figure 7: Growth in the cumulative shortfall in public R&D investments from 1980-2011. Annual deficits calculated relative to an average investment of 1.52 percent of GDP, consistent with average national investments sustained from 1960-1980 (see Figure 6).

Investments in **education** are much tougher to analyze because investments are made through local, state, and federal governments as well as the private sector. But according to the National Center for Education Statistics, total local, state, and federal funding for elementary and secondary education per pupil has grown at a lower rate since 1980, indicating a decline in investment. From 1961 through 1986, total investment per pupil grew 3.8 percent annually, but declined to 1.9 percent from 1986 through 2007. If total investments per pupil continued growing at 3.8 percent annually, America would be investing almost $6,000 more per student.[17]

If current average investment as a share of GDP continues through 2021, the education investment deficit will increase to over $1 trillion.

Furthermore, total federal investments in education—including federal grants to state and local governments as well as direct federal outlays—have declined over the past three decades (Figure 8). If federal investments in education continued at the same share of GDP sustained from 1967-1980, or 0.88 percent, cumulative federal investments in education since 1980 would have totaled $618 billion more than actual investments over this period.[18] And if the current average investment as a share of GDP continues through 2021, the education investment deficit will increase to over $1 trillion.

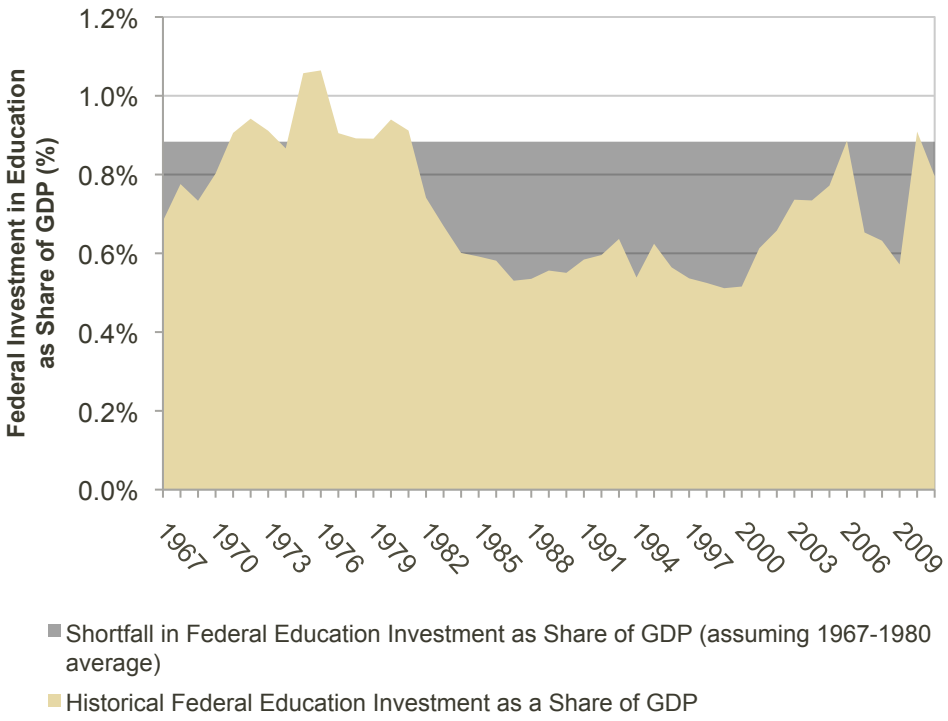

Figure 8: Estimate of shortfall in federal investment in education. Nominal historical federal investment in education as a share of GDP from 1967-2011 is shaded tan. The shortfall in education investment, shaded in gray, is estimated as the difference of actual federal investment from the average investment in education from 1967-1980 (0.88 percent of GDP). In the interest of simplicity, we ignore the 1976-1977 transition quarter.

The need to maintain and improve our nation's **infrastructure**, including energy, transportation, and water, represents another mounting investment deficit. The American Society of Civil Engineers estimates that the states and federal government must invest $1.1 trillion over the next five years to simply bring the nation's infrastructure up to "good condition."[19] In addition, the National Surface Transportation Infrastructure Financing Commission calculated in 2008 that the federal government must invest on average $96 billion more per year to maintain and improve U.S. infrastructure in addition to what is already being invested through the Highway Trust Fund. So from 2008, the first year of the report's analysis, through 2021, the federal government must invest at least $1.25 trillion more in infrastructure improvements. As the report states, this growing infrastructure investment deficit means our "safety, economic competitiveness, and quality of life are at risk."[20]

All told, shortfalls in R&D, education, and infrastructure investment create a total investment deficit of over $2.4 trillion in 2011, and could more than double to at least $5 trillion by 2021.

All told, shortfalls in R&D, education, and infrastructure investment create a total investment deficit of over $2.4 trillion in 2011. Assuming current public investments in R&D and education as a share of GDP are sustained and assuming no revenue changes to the Highway Trust Fund or infrastructure investments, the total investment deficit is estimated to more than double to at least $5 trillion by 2021. These significant national deficits in R&D, education, and infrastructure, are a major reason why the United States is now ranked second to last out of 44 countries and regions in making progress on innovation and competitiveness.[21]

Furthermore, as the shortfall in R&D, education, and infrastructure investments—the investment deficit—worsens, so too does our economic performance. Investment in R&D, for example, is an important driver of productivity, which spurs economic growth, as illustrated in the following example.

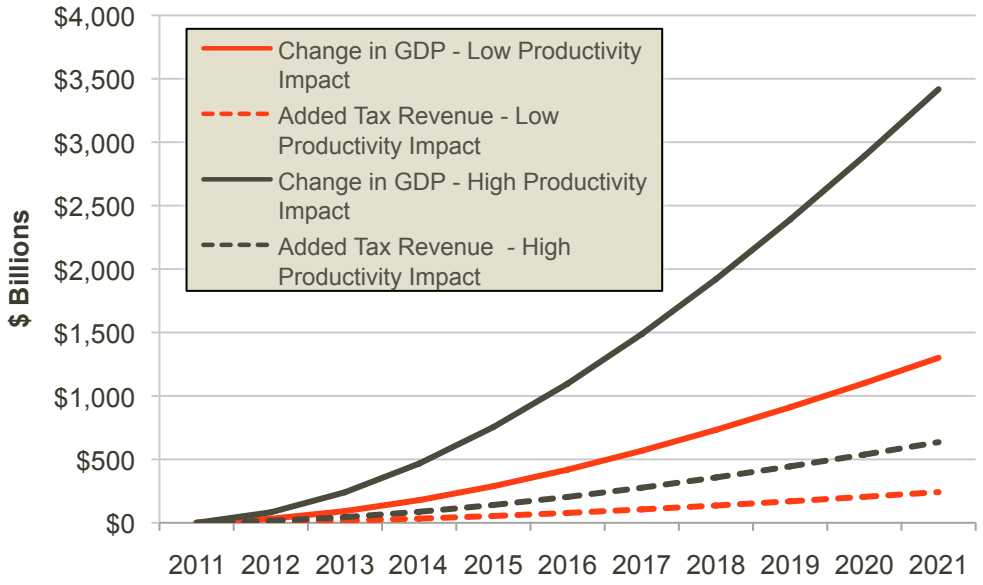

Figure 9: Estimates of cumulative GDP and tax revenue growth (in net present value) as a result of a 1 percent increase (one-time investment) in U.S. R&D stock of $35 billion. Dark lines represent a high productivity impact case (1 percent increase in R&D stock increases productivity by 0.61 percent). Red lines represent a low productivity impact case (1 percent increase in R&D stock increases productivity by 0.23 percent).[22]

Economy-wide studies of the impacts of increased R&D on productivity yield diverse results depending on the character of the economy. Credible estimates indicate that a one percent increase in the R&D stock[23] results in a 0.23 percent to 0.61 percent corresponding increase in economic productivity.[24] Using either the low or high end of that range, we estimate that a one-time, 1 percent increase in the national R&D stock, or an increase of roughly $35 billion, could yield significant long-term productivity gains, economic growth, and increased federal revenues, illustrated in Figure 9 above. As we can see, the federal government breaks even on their initial investment within a few years regardless of which estimate of R&D impact on productivity is used (see Appendix A for a brief summary of the methodology for these calculations). Thus, in the long run, federal investment in R&D could significantly reduce the budget deficit in addition to generating significant wealth and job creation.[25]

CLOSING THE THREE DEFICITS: SPURRING ECONOMIC GROWTH THROUGH TARGETED PUBLIC INVESTMENTS

Not only has much of the debate largely ignored America's two other deficits, it has narrowly focused on cutting a small slice of the federal budget that contains the vast majority of the programs vital to sustained economic growth and competitiveness.

The fact that America faces three deficits makes the budget debate more complicated than the simple math of revenues and expenditures would suggest. The budget, trade, and investment deficits are all interrelated, and decisions aimed at closing any particular deficit often have an impact on the other two. For instance, the decision to cut federal spending will close the budget deficit in the short term, but could either increase or decrease the trade and investment deficits, depending on what type of spending Congress decides to cut and/or increase. To simultaneously close all three deficits, policymakers need to take a more nuanced approach to the budget debate that reflects this reality. If they don't, their decisions will at best have a negligible impact on the three deficits. At worst, they will harm the future prosperity of the economy.

Putting the Current Budget Deficit Debate in Perspective

Specifically, much attention has been paid to the need to reduce non-defense discretionary spending. But entitlements like Social Security, Medicare, and Medicaid, all of which fall outside the discretionary budget, are by far the largest drivers of government outlays and thus, the budget deficit (Figure 10). Defense spending also plays a large role, accounting for half of all discretionary spending. In FY2010, these four spending areas made up 61.5 percent of the $3.5 trillion federal budget. By contrast, non-defense discretionary spending accounted for just 18.8 percent of the budget. Yet the most recent budget deal passed into law would cut this small share of the budget by over $900 billion over 10 years, while leaving larger portions of the budget initially untouched (unless the Supercommittee come up with an additional $1.2 trillion in cuts of its choosing, further significant cuts to the defense budget are set to occur).

Unfortunately, the discretionary budget includes most of America's key investments in innovation, productivity, and competitiveness. The American Association for the Advancement Science (AAAS) has estimated that non-defense R&D, a key source of innovation investment, accounts for 9 percent of the discretionary budget and slightly less than 2 percent of the total budget. Education and worker training likewise take up less than 4 percent of the total FY2010 budget. And infrastructure, including both transportation and water infrastructure, has historically accounted for similarly small budgetary levels—about 4 percent of the FY2010 budget—with some programs supported by dedicated revenue streams such as the gas tax. Within this framework,

agencies and programs with some connection to productive investments and innovation collectively take up a relatively small portion of the budget picture—likely less than 10 percent of all expenditures (Figure 11).

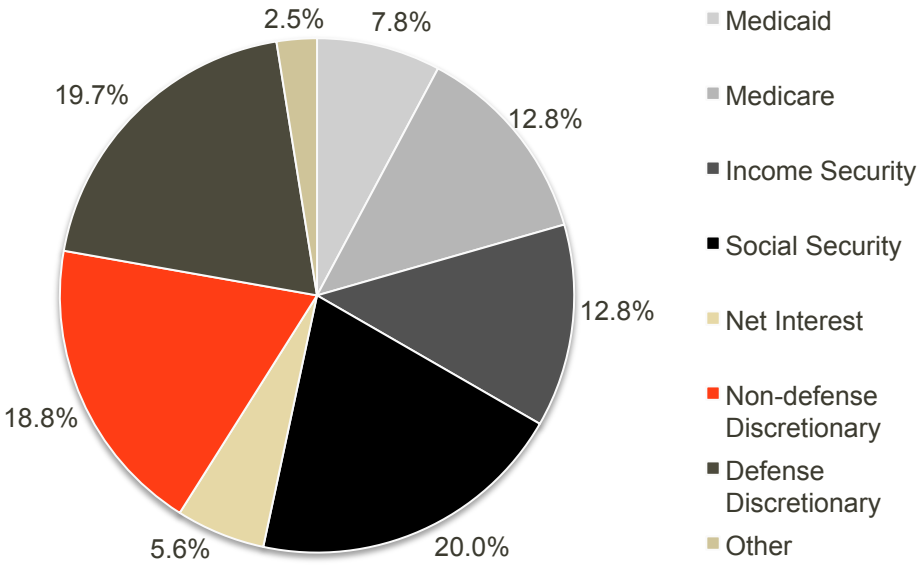

Figure 10: Share of 2010 federal budget by major budget category. The "other" spending category includes veterans support, government employee retirement plans, and the children's healthcare program[26]

Thus, while many policymakers rail against excess discretionary spending, the fact is that the discretionary budget, and in particular the key productive investments within the discretionary budget, make up a relatively small part of the budget deficit challenge. This has three important implications for the budget debate and crafting effective strategies to close the three deficits. First, focusing on cuts to these investments alone will make little headway in reducing the budget deficit. At only 18.8 percent of the federal budget, even if all discretionary programs were eliminated, the United States would still need to do much more to address the budget deficit. Second, the small size of productive investments indicates just how significant the investment deficit really is. As described above, the investment deficit is nearly $2.4 trillion through 2011 and projected to more than double to $4.9 trillion in the next 10 years. Deep, across-the-board cuts to the discretionary budget will only add to the investment deficit challenge. And third, notwithstanding their relatively small size, many of the productive public investment programs that fall within the federal discretionary budget are vital to economic growth and competitiveness and are therefore inextricably tied to all three deficits. Cutting these key investments now will only send America backwards.

National policymakers must recognize that America faces three interrelated deficits, not just one, and acknowledge that a focus on blanket, "across-the-board" budget cutting can exacerbate America's three deficits and negatively impact the United States' economic future.

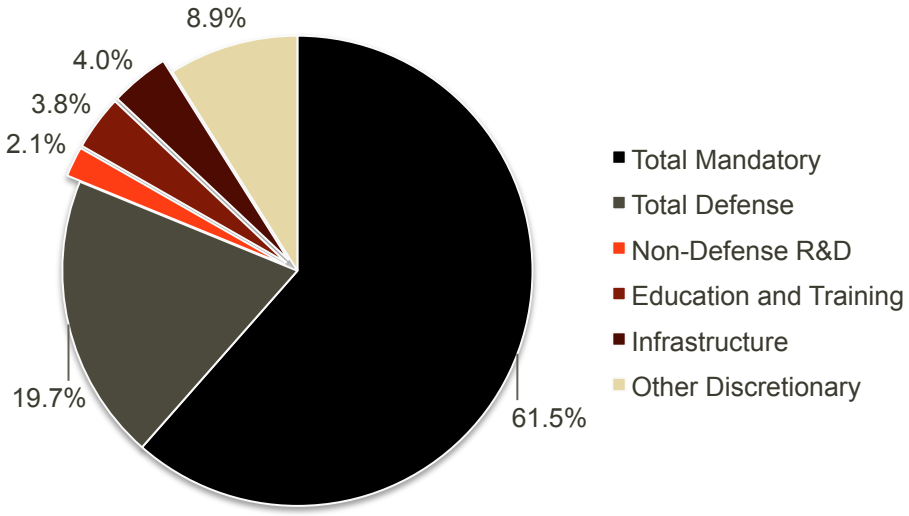

Figure 11: 2010 Federal budget organized by select major outlay type.[27]

National policymakers must recognize that America faces three interrelated deficits, not just one, and acknowledge that a focus on blanket, "across-the-board" budget cutting can exacerbate America's three deficits and negatively impact the United States' economic future. The current approach by policymakers not only fails to improve the three deficits, but can also make all three, and the economy in general, worse.

Cutting Productive Public Investments: The Wrong Way to Close the Three Deficits

The predominant budget strategy in Washington, as described above, simply transfers some fiscal debt to greater investment or trade debt, by cutting productive investments that would otherwise help boost exports or grow the economy (while doing little to reduce the budget deficit). As a result, the debt is still passed on to our children and is not actually reduced.

This dynamic can perhaps best be understood through the following analogy: Imagine the United States is a private firm. This firm is challenged by excessive debt commitments, owing money all over town, and is losing money due to reduced sales. However, this firm also owns an R&D lab that is one of the best in the world. The company *could* sell the lab, freeing up extra short-term cash flow that allows it to pay off some of its debts. But this decision comes with a price: by selling its lab, it loses its capacity for innovation. As a result, it is no longer capable of creating the next smart phone or transformative energy technology. This would cost the company dearly in the form of future revenues and would reduce the company's ability to re-invest back into its business and compete in the global economy.

The United States faces a similar situation with respect to its budget deficit. While an across-the-board reduction in federal spending will reduce the budget deficit in the short term, it would increase the investment and trade deficits, reduce economic growth, and

therefore actually increase the budget deficit in the medium to long term. As discussed above, investments in research programs would boost tax revenue (reducing the budget deficit all else equal) and boost economic growth by 0.2 to 0.6 percent for every 1 percent increase in R&D stock. Thus, from an economic growth perspective, R&D is one of the most cost-effective activities government can invest in, both directly through labs and grants and indirectly through corporate tax incentives for private industry.

In reality, cutting programs that support productivity, competiveness, and innovation capacity, particularly in traded advanced manufacturing sectors, clearly puts U.S. industries at a competitive disadvantage in the global market.

Cutting R&D investment in order to reduce the budget deficit not only stifles productivity and growth, it also is a counterproductive strategy to tame the national debt itself. Here's an example: what would happen if policymakers cut cumulative R&D budgets over the next 10 years by 10 percent? In the short term, this would amount to a budget cut of roughly $15 billion in the first year compared to 2010 total public R&D investments and $150 billion reduction in budgets over 10 years. But assuming even a low impact change in productivity, policymakers can expect reduced productivity and economic output to add to the cumulative budget deficit by nearly double the amount cut from the R&D budget (Figure 12).

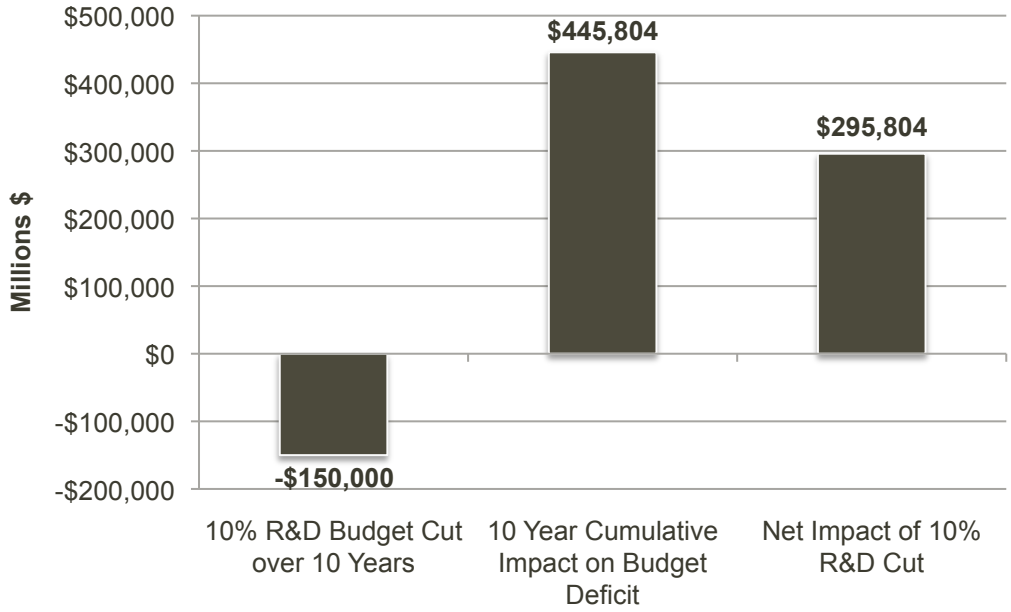

Figure 12: Analysis of a 10 year, 10 percent cut in government R&D investment and its net impact on the budget deficit. Assumes that for every 1 percent change in R&D stock, productivity changes by 0.23 percent

The same holds for cutting public investments in infrastructure, such as transportation, electricity, and communications systems, that support economic productivity and growth. One definitive study estimates that increasing traditional infrastructure investments in projects such as roads, transmission lines, and bridges by 1 percent increases productivity by 0.23 percent.[28] Other econometrics literature is mixed on the productivity impact of investment in infrastructure, but the literature does suggest that specific infrastructure investments have high rates of return and should be targeted.[29] For instance, greater access to better telecommunications infrastructure leads to more efficient means of communication for businesses and consumers, lowering transaction costs, improving productivity, and thus spurring economic growth.[30] And greater access to smarter

electricity and transportation infrastructure compared to traditional transmission lines and roads could significantly boost productivity.[31] Thus, cutting investments, especially in next generation infrastructure, in an effort to reduce the budget deficit not only stifles future growth, but also makes the United States less competitive.

Closing the budget deficit on the backs of the investment and trade deficits is simply poor economic policy and will do little to solve the three deficits challenge.

Similarly, across-the-board attempts to close the budget deficit could also harm the trade deficit. For instance, Congress could close the budget deficit by axing funding for the International Trade Administration (ITA), which provides export assistance, business promotion, and trade agreement enforcement services. Yet cutting this funding would put domestic firms at a disadvantage compared to their global competitors. Congress could also reduce the budget deficit by cutting programs like the Manufacturing Extension Partnership at the National Institutes of Standards and Technology (NIST), which helps boost domestic manufacturers' competitiveness by helping them adopt cutting-edge technologies. This, too, would reduce the competitiveness of U.S. manufacturing firms and raise future trade deficits. And cuts to R&D and infrastructure put U.S. businesses and domestic industries at a significant disadvantage in terms of innovation capacity. National governments that invest at the frontier of technological innovation and new technology industries often gain first-mover advantages and therefore export advantage for their domestic firms.

Most economic analyses fail to distinguish between spending and investment when evaluating the impact of fiscal decisions on the trade deficit. For example, a recent International Monetary Fund (IMF) report finds that a 1 percent decrease in a country's federal budget as a share of GDP decreases the overall trade deficit by 0.4 percent to 0.6 percent as a share of GDP, by reducing domestic consumption and imports.[32] But the IMF's model assumes that cutting government consumption produces the same midterm economic effect as cutting government investment and ignores the fact that not all budget cuts are created equal. It is true that reducing federal spending can reduce the trade deficit to the extent that it decreases imports. But if those cuts are concentrated on export assistance programs or investments in innovation in emerging traded sectors, for example, the resulting decrease in U.S. competitiveness would more than offset this temporary reduction in the trade deficit over the long term.

In reality, cutting programs that support productivity, competiveness, and innovation capacity, particularly in traded advanced manufacturing sectors, puts U.S. industries at a competitive disadvantage in the global market. Conversely, a review of the econometrics literature calculates that a 1 percent decrease in export costs—through productivity increases or currency devaluation—*increases* exports by an average of 1.31 percent.[33] Cutting productivity-enhancing government programs will therefore reduce the opportunity to expand exports and enhance American competitiveness, exacerbating the national trade deficit.

Let's return again to the example where we cut cumulative R&D investments over the next 10 years by 10 percent or $150 billion over 10 years. Such a strategy would make the United States less competitive by reducing exports by over $50 billion; leading to a potential 10 percent increase in the current annual trade deficit (a short description of the analysis methodology can be found in Appendix A). In addition, cutting R&D investment would increase the investment and budget deficits. Overall, a 10 percent cut in government investment in R&D over the next decade would actually increase America's three deficits by almost $500 billion, or over three times the amount of the original

budget cut (Figure 13). There is the potential for significant additional negative impacts to the trade deficit depending on the *type* of R&D budget cuts pursued.

$1 trillion in targeted investments and $2 trillion in targeted cuts would reduce America's three deficits by $4.15 trillion, or 10 percent, in ten years.

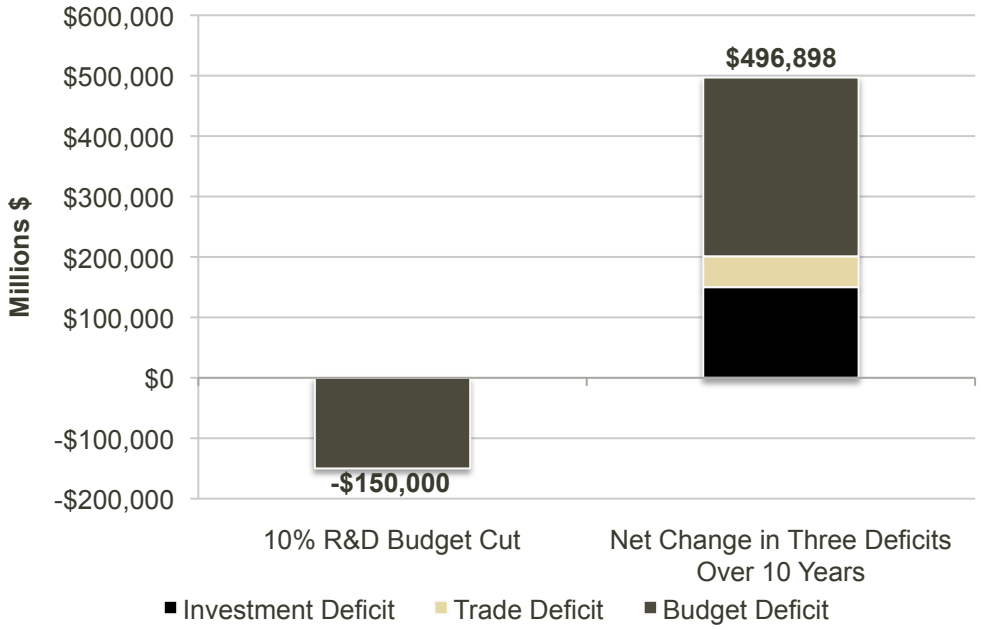

Figure 13: Estimated impact of a 10 percent cut (relative to 2010 government investment level) in R&D investments portioned equally over 10 years on the three deficits

In short, everything should *not* be on the table in the budget debate. If Congress cuts productive investments in areas like R&D, education, and infrastructure, it will increase the already large investment deficit, and actually reduce economic growth relative to where it would be otherwise. Cutting programs that promote exports or enhance the technological capabilities of our entrepreneurial manufacturing firms will lead to a reduction in exports, also harming economic growth. Closing the budget deficit on the backs of the investment and trade deficits is simply poor economic policy and will do little to solve the three deficits challenge. Fortunately, there is a better way forward.

Investing in Innovation, Productivity & Competitiveness: The Right Way to Close the Three Deficits

Let's return to the analogy of our private firm: Instead of selling its R&D lab, the company could reduce costs by cutting costs elsewhere that don't put future growth at risk, such as cutting dividend payments to shareholders or reducing 401(k) matches to employees. By maintaining and strengthening its innovative capacity, it would be able to develop a series of new products that allow it to capture market share from its competitors, increase its export capacity abroad, and significantly increase sales revenues. Increased revenues would help the firm pay off its debts, boost dividends, and increase employee benefits in the long term, all as a result of the high returns to investment in innovation.

But how would this more strategic approach look from a three deficits perspective? In short, this would include Congress taking a more positive sum approach and doing what

a competitive company would do: cut the fat and make investments to boost future competitiveness and growth.

Take the following example: over 10 years, Congress directly cuts the budget deficit through $2 trillion in nonproductive or counterproductive federal spending cuts and entitlement reforms while boosting targeted investments in innovation and research by $200 billion and infrastructure by $800 billion. In simple terms, this equals $1 trillion in net budget cuts over 10 years.

The benefits of this strategy are far greater than the immediate budget deficit impacts alone, however. Because Congress took care to increase investments in programs that boost innovation, growth, and global competitiveness while making deep cuts elsewhere, $1 trillion in targeted investments and $2 trillion in targeted cuts would reduce America's three deficits by $4.15 trillion, or 10 percent, in 10 years (Figure 14).

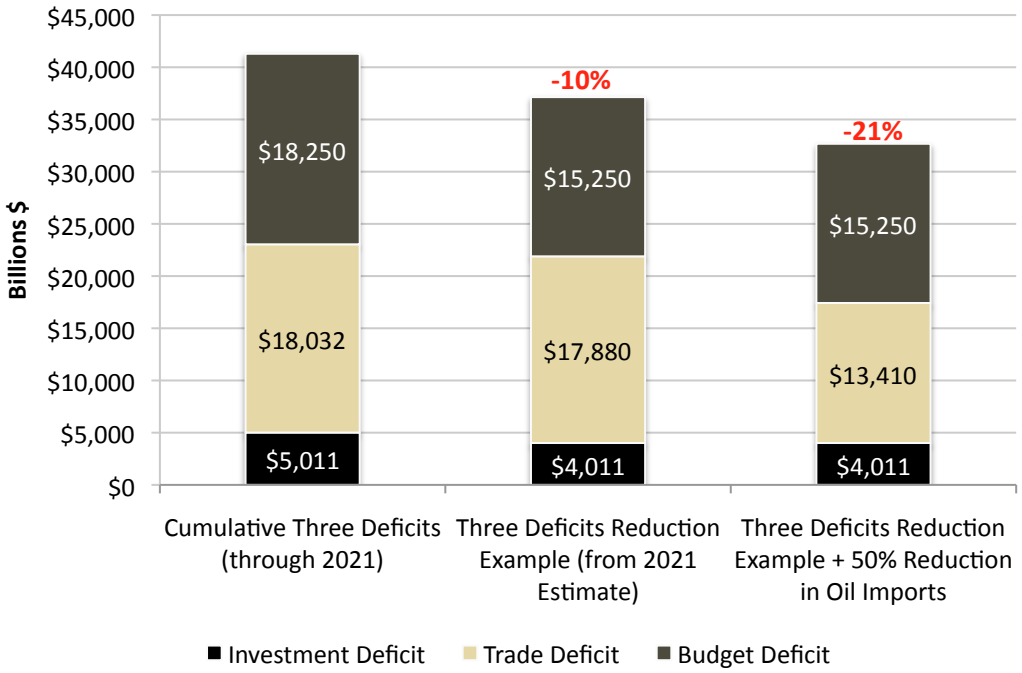

Figure 14: The net impact of theoretical, targeted investments and spending cuts on the cumulative three deficits. This investment-focused three deficits reduction strategy makes $2 trillion in targeted cuts to unproductive or counterproductive spending and $1 trillion in investments in R&D and next generation infrastructure. Investments and cuts are equally spread out over 10 years

The impact of these investments on the three deficits could be even larger if they target key issues exacerbating the United States trade deficit, as well. For instance, if Congress boosts targeted investments in developing breakthrough clean energy technologies, such as advanced, cheap, and energy dense batteries for electrified vehicles, further reductions in the trade deficit could be achieved by reducing U.S. oil imports. In 2010, oil imports accounted for 50 percent of the trade deficit. So, innovation investments in clean technology development that results in a 50 percent reduction in oil imports could reduce the three deficits by an additional 10 percent relative to the same investment example without clean technology development. In other words, if coupled with targeted

investments in innovation, productivity, and competitiveness, a net $1 trillion budget cut, or just 2.4 percent of the estimated cumulative three deficits in 10 years, the ultimate impact on America's three deficits would be multiplied—resulting in at least a $8.6 trillion reduction in the combined deficits, or 21 percent compared to our 2021 three deficits estimate (Figure 14).[34]

The point should be clear: a more strategic approach to budget cutting could have a much larger impact on America's three deficits than across-the-board budget cuts discussed in current policy debates.

We should also be clear, however, that reducing America's budget deficit to near-zero cannot be accomplished through just discretionary budget cuts or targeted investments alone. The above example would represent a good first step. Reducing the cumulative budget deficit further requires attending to the lion's share of government spending, such as reducing entitlement spending, as well as creating more revenue without harming the international competitiveness of U.S. businesses.

That said spurring economic growth through targeted investments while ensuring that we do not exacerbate the budget deficit through cuts in government investments will make closing the budget deficit far easier while helping secure long term U.S. competiveness and economic growth. In fact, reigning in the national debt will likely prove impossible without adopting a more responsible "three deficits" approach to budget priorities.

DISTINGUISHING BETWEEN CONSUMPTIVE SPENDING AND PRODUCTIVE INVESTMENT: A GUIDE FOR POLICYMAKERS

Productive public investments are a key policy tool necessary to close the three deficits plaguing America. The challenge, then, is to distinguish between those programs and policies that spur innovation, productivity, competitiveness, and therefore economic growth and those that do not.

In particular, **productive investment** includes expenditures that expand the productive capacity of the country, drive economic growth, and increase incomes, consumption, and economic opportunities in the future. In the words of Nobel Prize-winning economist Michael Spence, "investment is an expenditure whose purpose is to increase the tangible and intangible asset base of the economy. Those expanded assets increase the output of the economy and the productivity of labor."[35]

Consumptive spending, by contrast, can be thought of as government expenditures on goods and services that finance present consumption, as opposed to longer-term investment. This category would include things like non-R&D defense spending, funding for judicial and administrative systems, or subsidies to mature industries. Some consumptive spending takes the form of transfer payments, which shift resources from one group to another, either in the short term or long term. These spending programs include entitlement programs like Social Security and Medicare, which pool payroll tax revenues from the population at large and fund present and future retirees and elderly medical costs.

To be clear, the distinction between productive investment and consumptive spending does not mean that the latter is not important or useful. Indeed, programs like unemployment insurance (a transfer payment) can be critical to safeguarding citizens' livelihoods, particularly during a deep economic recession. But these programs do not directly expand the country's asset base or otherwise drive innovation, productivity, and competitiveness and thus should not be in the same category as those programs that do.

We therefore counsel **a three-step process to establish effective and responsible budget priorities**:

1. Distinguish between programs and policies that classify as productive investments on the one hand and consumptive spending on the other.
2. Make targeted increases to high-impact, productive public investments to drive economic growth and reduce all three deficits.
3. Closely examine and assess all consumptive spending on its own merits to identify policies or programs that can be reduced or eliminated to reduce the budget deficit without impacting the trade and investment deficits.

This section provides a framework for the first stage in this process, aiding policymakers in evaluating programs to determine whether each are productive public investments that should be safeguarded and even expanded because of their impact on economic growth, or consumptive spending that warrants further close examination to identify opportunities for effective budget savings.

In particular, to differentiate between consumptive spending and productive investments, policymakers should use three criteria:

1. **Innovation**. Does the program or policy help spur innovation to create new products, processes, technologies, or knowledge that in turn adds value or creates new industries?
2. **Productivity**. Does the program or policy increase the productivity of organizations and the economy as a whole?
3. **Competitiveness**. Does the program or policy help close the trade deficit by making U.S. firms more globally competitive, thereby increasing exports, or reducing imports?

Two illustrative program examples are given below, one each for productive investment and consumptive spending. Additional program examples can be found in Appendix B.

Oil and Gas Subsidies: Consumptive Spending

Several provisions in the tax code are intended to promote oil and gas exploration and production and investment in related capital goods. For example, oil and gas firms may expense or amortize expenditures for wages, supplies, and services associated with drilling and may claim a deduction on capital investments due to resource depletion. Firms may also claim a 6 percent income tax deduction for oil and gas production. These and other expenditures can add up to several billion dollars per year.[36]

1. *Does the program help spur innovation that leads to something new that adds value?*

No. Subsidies for the extractive oil and gas industries are inherently meant to promote activities that have been undertaken for, literally, over a century, and have little direct bearing on innovation to create new technologies or products. Oil and gas firms may benefit from other more general tax expenditures like the research and experimentation tax credit, which applies across the entire economy, but subsidies targeted specifically at these extractive industries are not intended to drive innovation.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

No. These subsidies are allocated based on the quantity of energy resources produced or the quantity of investment, and have no explicit preference for investments that enhance the productive capacity of extractive firms over an earlier baseline. In fact, it's possible that tax expenditures, by providing a buffer to shield private firms from the pressures of competition, can actually reduce the incentive to boost productivity. For instance, the depletion allowance allows firms to claim a deduction based on the depletion of the resources they have tapped in order to recover their capital investment costs. Shielding firms from the need to recover full capital costs dampens the incentive for firms to reduce

those initial capital investments and extract resources more efficiently through better methods or new technologies, which would boost productivity.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Oil and gas subsidies may help reduce exports by reducing the cost of domestic production relative to imports. As mentioned above, oil imports are one of the major drivers of the deficit in traded goods and services. By providing incentives for marginal oil and gas production, these tax expenditures can help to reduce the trade deficit, though they cannot provide sufficient incentive for domestic production to significantly reduce domestic oil imports.

Advanced Research Projects Agency-Energy (ARPA-E): Productive Investment

ARPA-E is an energy technology program within the Department of Energy that funds small groups of researchers, engineers, and entrepreneurs focused on breakthroughs in clean energy technology. It is modeled after the Defense Advanced Research Projects Agency (DARPA), which is responsible for many breakthrough innovations including stealth-fighter technology and the Internet.

1. *Does the program help spur innovation that leads to something new that adds value?*

Yes. ARPA-E plays a critical role in clean energy innovation by expanding knowledge about clean energy technologies as well as targeting high-risk, high-reward technologies that would create significant social and economic value. It does this in at least three different ways.

First, ARPA-E invests in targeted, high-risk research projects aimed at key technology barriers that can enable the development of game-changing, next-generation clean energy technologies. For example, the Electrofuels program seeks unique methods for utilizing metabolic engineering and synthetic biological approaches for the efficient conversion of carbon dioxide to liquid transportation fuels. Any one of its programs, if successful, would lead to new technologies with significant social and economic returns.

Second, ARPA-E fills weaknesses in the innovation ecosystem by bridging the gap between basic research and the demonstration of new technologies. Energy sector investments in early stage projects are limited, as most investors view these types of projects as too risky and prefer to target later stage, mature technologies. ARPA-E fills the resulting technological "valley-of-death" by investing in early-stage R&D projects that also bring basic and applied research together under the same roof.

Third, ARPA-E enhances the innovation capabilities of the energy sector by facilitating collaboration and coordination among universities, businesses, and government labs. ARPA-E program managers hold workshops with leading public and private sector thinkers on particular clean energy technology issues to hone in on those that would spur the greatest technological innovation. Research teams are also collaborative and often include federal labs, universities, and businesses working together.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

Yes. ARPA-E increases economic productivity both directly and indirectly. Directly, ARPA-E invests in innovative technologies that would drive energy efficiency for utilities, consumers, and industry. For example, ARPA-E is investing in power electronics and smart-grid technologies that would revolutionize electricity delivery and provide more reliable energy to consumers and businesses. It would also enable consumers to have more control over their energy use through smarter electronics and appliances, boosting energy efficiency across the grid.

Indirectly, ARPA-E boosts productivity through investments in projects that could potentially have significant spillovers. For instance, its Electrofuels program aims to create new biotechnologies and microorganisms that can convert sunlight into energy with 10 times the efficiency of photosynthesis. If successful, not only would the breakthroughs impact the biofuel industry, but it would also provide benefits to farmers by making their farmland more productive.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Yes. ARPA-E helps close the trade deficit by helping create new businesses that offer innovative and affordable clean energy technologies. These new businesses would have first-mover advantages in the global clean energy economy, boosting U.S. exports. Some of the breakthrough technologies funded by ARPA-E could also reduce the consumption of foreign oil, which reduces imports as well.

CONCLUSION

For the last year, Washington policymakers have been rightfully engaged in a debate over the budget deficit. But a frequently myopic focus on the budget deficit alone has obscured the fact that America actually faces three deficits—budget, investment, and trade—all interrelated, and each critical to the nation's future economic prosperity.

To make economic matters worse, the current budget deficit debate threatens to exacerbate all three deficits by indiscriminately slashing federal programs vital to innovation, growth, and competitiveness. Put simply, cutting the budget deficit on the back of the trade and investment deficits would be akin to taking one step forward, but two steps back. Such indiscriminate policy would be a route to both fiscal and economic ruin. As this report demonstrates, in some cases, blunt and deep budget cuts can actually increase America's three deficits by at least three times the level of the initial cuts. This fact demands a more nuanced debate over budget priorities, and it highlights the economic folly of blind, "across-the-board" budget cuts.

This paper aims to generate a more informed discussion about how the United States can find a more sustainable fiscal path while reducing its large and persistent trade and investment deficits. To simultaneously reduce all three deficits, the government must make targeted, growth-enhancing investments to spur innovation, productivity, and competitiveness, even as it cuts spending elsewhere. In service of this goal, we provide a straightforward rubric to help policymakers differentiate between productive government investment and consumptive (and often counterproductive) government spending. As this paper demonstrates, by increasing productive public investments while making targeted cuts to consumptive spending, America can close its three deficits and once again become the most competitive and innovative country in the world.

APPENDIX A: BRIEF SUMMARY OF THREE DEFICITS ESTIMATION METHODOLOGY

The figures and data provided in this report are simple estimates of the cumulative investment, trade, and budget deficits and an analysis of specific interactions among all three. Relevant economics and policy literature is used to approximate each of the three deficits, their interactive feedbacks, and the impact each has on economic growth. To be clear, this analysis is not an econometrics model. It does not estimate total economic effects, but instead aims to compare broadly the relative magnitude of changes in government investments on the three deficits. Also, it does not calculate all economic impacts. For example, it does not calculate the impact policy changes would have on net interest payments on the national debt. The estimates and comparisons made are strictly illustrative. With that said, the following sections explain the methodologies used to calculate each deficit.

The Cumulative Budget Deficit

The most recently available CBO analysis of the United States economy is used to estimate the cumulative budget deficit in 2011 and 2021.[37]

The Cumulative Trade Deficit

We estimate the cumulative trade deficit through 2011 using data from the Census Bureau and the Bureau of Economic Analysis.[38] The cumulative trade deficit is calculated as the sum of the annual trade deficits since 1975, the first year the United States ran a current account deficit. In order to project the cumulative trade deficit from 2011-2021, we use CBO GDP estimates and assume that the trade deficit averages 5 percent of GDP—the level it reached prior to the economic recession.

The Cumulative Investment Deficit

A growing economics literature points to investments in education, R&D, and infrastructure as the building blocks of innovation, and thus, productivity and economic growth.

The annual federal infrastructure deficit is assumed to be $96 billion, as calculated by the National Surface Transportation Infrastructure Financing Commission. Thus, the 2011 cumulative infrastructure deficit is assumed to be $384 billion, or the annual shortfall summed from 2008 (the starting point of the Commissions analysis) through 2011. The 2021 cumulative infrastructure deficit is calculated from 2008 through 2021, or $1.344 trillion.

Investments in R&D declined as a share of GDP since 1980 to 0.98 percent from the 1960-1980 average of 1.52 percent of GDP. We calculate the cumulative R&D investment deficit as the sum of the difference between expected R&D investments if government investments continued at 1.52 percent from actual government investments over that period.[39]

Federal investments in education declined as a share of GDP since 1980 to 0.64 percent from the 1967-1980 average of 0.88 percent of GDP. We calculate the cumulative

education investment deficit as the sum of the difference between expected education investments if government investments continued at 0.88 percent from actual government investments over that period.[40]

Feedback Effects among Three Deficits

For the example describing the impact of a mix of budget cuts, R&D investments, and infrastructure investments, the following methodology was used.

There is a large literature on the impacts of increasing or decreasing investments in infrastructure and R&D on productivity. We can reasonably estimate the economic and three deficit impacts of different federal budget policy decisions through the use of established elasticities.

First, we assume that increasing R&D and infrastructure investments boosts productivity. In both cases we use conservative estimates. Based on Coe and Helpman,[41] we estimate that for every 1 percent change in the stock of R&D, productivity changes by 0.23 percent. We estimated the U.S. R&D stock based on Coe and Helpman's findings that the GDP/R&D stock ratio is 4.39 and the annual depreciation rate for R&D is 5 percent. So, based on the most recent 2011 GDP estimate of $15.184 trillion, U.S. R&D stock is estimated at $3.459 trillion.

For infrastructure investments, we assume a more conservative estimate than that found in the literature, particularly from Aschauer,[42] and estimate that for every 1 percent increase in the stock of infrastructure, productivity increases by 0.1 percent. We estimated the U.S. infrastructure stock based on Bureau of Economic Analysis data reporting that the public infrastructure stock is roughly $9.5 trillion and its annual depreciation rate is 1.52 percent.

In both cases, we calculated the annual change in productivity and compound growth in GDP due to the investment. So the change in productivity in year 1 is calculated as:

$$\frac{Total\ Increase\ in\ R\&D\ Stock}{R\&D\ Stock} \times Elasticity$$

Where, for example, the elasticity is 0.23 percent for R&D investments. The change in productivity then annually depreciates by 5 percent. For every percent change in productivity we assume an equal change in GDP, compounded, so:

$$Annual\ \Delta\ in\ GDP = GDP + (Annual\ \Delta\ in\ Productivity \times\ GDP)$$

We assume GDP in 2011 to be $15.184 trillion, or the most recently published estimate, to be the base case. The difference between the annual compound changes in GDP from the base case is the annual change in GDP.

We then calculate the annual change in GDP in net present value, assuming a 2 percent discount rate. From here we assume that the ratio of federal revenues/GDP is 18.6 percent, or the pre-recession ratio. So, the change in federal tax revenue in net present value is:

$$Change\ in\ GDP\ in\ NPV \times 0.186$$

The sum of the annual change in federal tax revenue is the cumulative impact on the budget deficit. Further, to calculate the impact of changes in investment stretching over more than one year, the above calculations are repeated, but lagged accordingly.

Similar calculations were used to estimate the impact of investments on the trade deficit, but the above calculations were repeated for both R&D and infrastructure investments to single out the impact of each on the trade deficit. We assume the most recent U.S. exports data—$1.8 trillion—to be the base case.

The economics literature produces a wide range of elasticities describing the change in exports resulting from a change in export costs caused by numerous external policies and forcing mechanisms including currency devaluation and productivity change. Hooper and Marquez[43] calculated that the median of the relevant literature is a 1.31 percent change in exports for every 1 percent change in export costs. Considering the range of elasticities, we chose a more conservative 1 percent change in exports for every 1 percent change in export costs. In other words, we assume that for every 1 percent change in productivity, tradable businesses reduce costs by 1 percent, thus exports increase by 1 percent. So a change in public investments directly impacts the cumulative trade deficit.

APPENDIX B: INVESTMENT OR SPENDING? ILLUSTRATIVE EXAMPLES OF SELECT FEDERAL PROGRAMS

Agriculture Commodity Crop Subsidies: Consumptive Spending

The United States provides direct government subsidies for a number of commodity crops. In 2010 subsidies totaled over $20 billion including significant subsidies for corn ($3.5 billion), cotton ($835 million), wheat ($1.7 billion), rice ($406 million), and soybeans ($1.5 billion).[44] Most recently, as part of the Farm Bills in 2002 and 2008, farmers can receive direct payment subsidies from at least 36 individual U.S. Department of Agriculture (USDA) programs totaling over $16 billion annually (pre-recession).[45] The original intention of these subsidy programs was to provide farmers direct payments when commodity prices were low or in times of disaster, thus helping to sustain the vital U.S. agriculture sector through periodic downturns and insulate farmers from economic ruin.

1. *Does the program help spur innovation that leads to something new that adds value?*

No. Commodity crop subsidies do not spur or encourage innovation. The lion's share of subsidies goes to large farming corporations. Without an effective ceiling on payments, in a time of high commodity crop prices these unwarranted subsidies represent nothing but a windfall profit. The subsidies do not incentivize new production methods or the development of new technologies, but are strictly provided based on crop acreage. Similar to the National Flood Insurance Program (see below), the USDA also does not enforce strict restrictions so that many farms and farmers not technically eligible for subsidies still receive benefits.[46] And because of significant subsidies, oftentimes as much as two-thirds the costs of premiums for crop insurance (a significant commodity crop subsidy), farmers face little risk and see no incentive to innovate or increase production efficiency.[47] In fact, the Government Accountability Office (GAO) found cases of farmers deliberately allowing their crops to fail in order to collect subsidies through crop insurance or direct payments—the opposite of spurring innovation.[48]

2. *Does the program increase the productivity of private firms or the economy as a whole?*

No. Crop subsidies do not increase the productivity of private firms or the U.S. economy. Subsidies are keyed to acreage under cultivation, so the larger the farm, the larger the subsidy up to a legislated limit which is based on total farm revenue and not on yield performance (the productivity of the farm). Thus, it provides farmers no incentive to increase productivity through the use of new technologies or methods. In fact, beginning in 2002, additional crop insurance policies were created to offer revenue guarantees based on historical revenues and yields. The insurance theoretically provides a disincentive to increase productivity because government subsidized crop insurance guarantees a base level of revenue.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Crop subsidies do boost U.S. exports and competitiveness in the global agriculture market, but at the price of substantial distortion to international agricultural markets that are particularly disadvantageous to developing countries. By artificially reducing costs to U.S. farmers, commodity crop exports, like corn, increase. As a result, the United States continues to have a trade surplus in agriculture. But because this competitiveness is artificially based on subsidies, the United States is trading a short-term export boost for long-term export limitations. In other words, if other nations increase agriculture productivity through non-artificial, non-subsidy means such as better technologies and methods below that of America's subsidized cost, we lose ground and have to either increase subsidies (thus the budget deficit) or spur agricultural innovation to catch-up. While these subsidies do boost short-term competitiveness, their long-term impact is relatively hollow and could exacerbate the three deficits.

National Flood Insurance Program: Consumptive Spending

The National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency (FEMA), provides insurance to homeowners and businesses in flood-prone regions of the country. In exchange for providing insurance, communities must adopt and enforce floodplain management ordinances and building standards to decrease flood damage and promote water resource conservation. Originally, the program was meant to pay for itself by collecting premiums from flood insurance policies, but due to increased disaster losses and Congress authorizing lower subsidized insurance rates, the program requires additional funding to remain solvent.

1. *Does the program help spur innovation that leads to something new that adds value?*

No. The NFIP does not help spur innovation. Instead NFIP acts as an incentive for homeowners to live in high flood-risk regions as it is essentially required to accept all applicants for insurance and is not allowed to deny coverage for high-risk properties.[49] And in many cases, NFIP is required to offer a subsidized rate below typical market rates not equivalent to the properties overall risk. Ultimately, the program shifts economic development to flood-prone areas instead of spurring new, additional development that may add to overall growth.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

No. NFIP does not increase the productivity of private firms or the U.S. economy. Publically offered flood insurance simply subsidizes homeownership and businesses, often those already existing in flood-prone regions. In fact, by incentivizing development in areas at high-risk for flood damage, overall productivity could decrease due to businesses taking on damage or temporarily shutting down due to flooding.

The insurance program does offer the potential for businesses and homeowners to deploy flood mitigation strategies and technologies as part of the required floodplain management ordinance. This could reduce flood disaster costs for businesses, but a recent GAO report found that more often than not, local communities do not enforce these ordinances.[50]

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

No. NFIP does not boost the competitiveness of U.S. firms as it does not boost productivity or innovation nor does it help industries boost their exports. It theoretically does provide insured businesses with lower costs for purchasing flood insurance compared to purchasing higher premium private insurance (or in many cases in which private insurance do not offer flood insurance, none at all) that could potentially be invested back into the business, but because most insurance plans cover homeowners, this impact is not likely to be a significant boon to business competitiveness.

The Research & Experimentation Tax Credit (R&D Tax Credit): Productive Investment

The Research & Experimentation Tax Credit was established in 1981 to incentivize firms to increase their research activities. The credit, which has been extended several times but never made permanent, is made up of four provisions: 1) a standard 20 percent credit for increasing investments in R&D; 2) an alternative simplified credit of 14 percent for all R&D investments above 50 percent of the average of the three previous years; 3) a 20 percent credit for basic research payments made to qualified institutions for pre-commercial R&D; 4) a 20 percent flat credit for businesses collaborating in energy research consortium.

1. *Does the program help spur innovation that leads to something new that adds value?*

Yes. The R&D tax credit plays a critical role in spurring innovation by boosting private sector investment in R&D. R&D is the principle way industry creates knowledge that can be commercialized into economically valuable products and services; the R&D tax credit is the principle way the federal government incentivizes private-sector R&D activities. Nearly all scholarly studies conducted in the last 20 years have found that the credit is an effective tool for spurring increased business R&D by an additional $1 to $2 for every $1 in forgone tax revenue.

But while the R&D tax credit does significantly boost private sector R&D investment, it is still limited compared to its potential impact. Businesses investing in R&D in collaboration with a university receive only 65 percent of eligible tax credit if the research is commercially oriented. Thus, the R&D credit incentivizes more early stage R&D and has a limited impact on research that supports bridging the gap between new ideas in the lab and demonstrating new technologies. The R&D credit also provides a lower rate for research conducted between a business and non-energy related research consortia therefore acting as a disincentive for collaborative research—an increasingly important characteristic of research in the new economy.[51]

2. *Does the program increase the productivity of private firms or the economy as a whole?*

Yes. The R&D tax credit increases productivity for the economy as a whole, but does so indirectly through boosting private sector R&D investments. Research performed by the private sector can lead to new products and services that directly impact business productivity.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Yes. The R&D tax credit does facilitate increased exports, by boosting private sector investments in innovative products and services, which could boost exports and impact the trade deficit. Only R&D performed in the United States is eligible for the R&D tax credit, so new products and services created through this research is developed domestically. Therefore this domestic research results in increased export opportunities for industries and businesses with domestic supply chains.

Economic Development Administration's Regional Innovation Clusters Program: Productive Investment

The role of the Economic Development Administration's (EDA) cluster program is to identify and support existing regional innovation clusters (RICs) (not create new ones), convene relevant stakeholders, create a cluster support framework, disseminate information, and provide targeted capital investments to spur cluster growth.[52] RICs are geographic concentrations of firms and industries that do business with each other and have common needs for talent, technology, and infrastructure. A RIC includes an active network of public, private, and non-profit organizations that leverage a region's unique competitive strengths and capabilities to create jobs and broad economic prosperity.

1. *Does the program help spur innovation that leads to something new that adds value?*

Yes. RICs play a central role in spurring innovation by creating an open environment of knowledge creation and exchange. By linking and aligning regional assets, institutions, and services, RICs help expand the knowledge base of the region as a whole. The RIC program accelerates innovation by providing information and connecting institutions and actors to needed resources that can help drive entrepreneurship and growth. For example, the EDA-RIC is developing a national research and information center to geographically map clusters across the country to more efficiently facilitate business linkages to these networks. The RIC supported Regional Innovation Acceleration Network (RIAN) connects organizations across the country to share best practices aimed at business creation, business support, technology commercialization, and financial investments. In addition, other activities include cluster initiative planning, asset mapping, transformative technology development (such as through the i6 Challenge program) and implementation feasibility studies, all of which help businesses gain access to new knowledge, technologies, and financing. These program activities compare to more traditional infrastructure building typically done through EDA. In this sense, the RIC program transcends more traditional—some may say less productive—investments in economic development by supporting more advanced regional economic development efforts.

As a result, the scholarly literature identifies RICs as a promising way that both the public and private sectors can overcome challenges to technology commercialization. Clusters create cost and innovation advantages for participants by giving them access to high-caliber human capital and R&D collaboration. One of the criteria to be selected for competitive grants under the RIC program is an applicant's ability to demonstrate a focus on advancing commercialization of federal and private research. By bringing public and

private entities together to focus on commercialization and growth, a RIC helps regions acquire the resources necessary to develop, demonstrate, and scale-up new products and services.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

RICs do not necessarily directly increase productivity, but instead aim to accelerate innovation in general, which can indirectly boost productivity. By increasing access to skilled workers and technical expertise, RICs enable businesses to more rapidly spur the adoption of new innovations. And because RICs make available specialized infrastructure, skills, and scientific knowledge—such as through federal labs and universities—which businesses may not normally have access to, the barriers to new technology development are reduced. As such, by accelerating the innovation process, productivity-enhancing technology becomes more readily available.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Similar to boosting productivity, RICs do not directly close the trade deficit, but instead provide the groundwork for new businesses and industries to deploy new technologies to market that increase exports. Because the RICs program is within EDA, it does receive support from the Trade and Investment Program, which promotes U.S. exports. For instance, the program supported a Cleantech Trade and Investment Mission in 2010 that showcased U.S. clean energy technologies, clusters, and businesses at international events. As a result, the program facilitated hundreds of linkages between clean energy businesses and potential foreign investors and customers that are the first step in building international business relationships and potential export partners.[53]

Integrative Graduate Education and Research Traineeship Program (IGERT): Productive Investment

The National Science Foundation's (NSF) IGERT program provides grants for universities to create new, interdisciplinary science, technology, engineering, and mathematics (STEM) graduate-level programs. These unique programs develop new curriculum and courses, emphasize expertise in more than one discipline, and insist on internships, co-ops, out-of-university research, and collaborative studies. Since its inception, NSF has made IGERT its flagship education and training program and countries like Canada and Germany have implemented similar initiatives.[54]

1. *Does the program help spur innovation that leads to something new that adds value?*

Yes. IGERT spurs innovation by supporting education/training and research—two important building blocks of innovation. IGERT programs focus on emerging science and engineering fields, including nanotechnology and clean energy, to prepare a new wave of professionals proficient in those disciplines. In total, IGERT has directly funded nearly 6,000 doctorate-level students. This includes funding their research, tuition, and the development of multidisciplinary curricula.

In addition, a central characteristic of IGERT programs is the vital basic research they conduct. The programs bring together numerous departments, academics, students, and disciplines to address cross-cutting problems. For example, Cornell University brought together biology and engineering faculty and students to study and create new, sustainable materials of the future. Project researchers created fibers that can generate electricity when stressed or put into motion, opening up the possibility of new "intelligent" materials that can be used for energy harvesting and medical monitoring sensors.[55] The successes of these cross-cutting research projects potentially enable the development of innovative new technologies.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

Yes. IGERT boosts productivity by increasing the education of graduate students across a number of disciplines as well as training students in subjects important to emerging science and technology sectors. This education provides a pool of well-skilled workers for growing industries. Specifically, IGERT has invested in numerous programs in high-impact disciplines like genomics, nanotechnology, materials science, and biotechnology.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

IGERT doesn't directly close the trade deficit, but it does help boost U.S. competitiveness by creating a more educated workforce. In particular, IGERT often funds disciplines at the forefront of emerging industries that could be the next "wave of innovation," similar to the IT sector since the 1990s. By training scientists and engineers in emerging sectors, the United States will have a competitive advantage over other countries, increasing the likelihood of attracting greater private sector investment in new industries. Furthermore, IGERT program curriculums aim to continue past their initial NSF funding and help to create a long-term academic network that continues to educate students in vital areas of study.

Manufacturing Extension Partnership: Productive Investment

The Manufacturing Extension Partnership (MEP) works with small and medium-sized manufacturers to help them increase productivity, boost sales, and create and retain jobs. MEP's technical experts work one-on-one in hands-on, direct engagements with U.S. SME manufacturers to help them innovate, improve operational efficiency, and implement lean, green, and sustainable manufacturing methods. In 2010 alone, MEP served 34,299 manufacturers. It has completed over 430,000 engagements in its lifespan.[56] MEP generates high returns from federal investment, with each dollar invested generating $32 in returns; this translates into $3.6 billion in new sales annually for America's SME manufacturers.[57] With 1,400 technical experts, located across all fifty states, the MEP is well positioned to get on SME shop floors and help them to improve their organizations.

1. *Does the program help spur innovation that leads to something new that adds value?*

MEP does not directly perform research into new technologies. But one of the five focus areas of MEP is "Technology Acceleration" which has the goal of leveraging new technology to allow SMEs to adopt new products and processes. In this capacity MEP acts

as the connecter between SMEs and their unmet technology needs, searching outside normal channels to find innovative solutions. Specifically the technology scouting program allows MEP to search for new technologies to bring directly to SMEs to help them create new products and enter new markets. For example, the MEP helped Lehighton Electronics identify a new market to enter, and connected them with technology suppliers to help them gain market entry.[58]

2. *Does the program increase productivity of private firms or the economy as a whole?*

Yes. MEP technical experts help SMEs implement lean operations, by going directly to shop floors around the country. One of MEP's five focus areas is "Continuous Improvement" with the stated intention of "increasing productivity, and freeing up capacity for growth." Specifically, MEP offers the Lean Product Development program to SMEs to help them reduce time to market, use fewer resources, and cut waste out of the process.[59] The primary goal of this program is to apply the waste elimination philosophy of lean operations into product development. Firms utilizing this program have reported up to a 50 percent reduction in launch schedule, improvements in gross margin, and enhanced customer satisfaction.[60]

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Yes. As part of its duties, MEP works with exporting SMEs. By empowering them to become more productive and less wasteful, and by increasing their technological capacity MEP helps SMEs to become more effective exporters. In addition to its general duties, MEP has implemented an ExporTech program, which aids SMEs in entering global markets. SMEs working with the ExporTech program develop an export strategy in small workshops. Technical experts then vet these strategies and help the SME connect with organizations that assist them in implementing their strategy. This program works with other organizations such as the U.S. Export Import Bank and the U.S. Export Assistance Centers to provide a strong network of support for exporting SMEs.[61] For example, after completing the ExportTech course, Wilco Machine & Fab, an energy industry equipment manufacturer in Oklahoma, expanded their export business from 8 percent of revenues in 2008 to 51 percent of revenues in mid-2009.[62]

Agricultural Research and Development: Productive Investment

Three of 10 people on the planet today rely on others to grow their food and 900 million remain chronically food insecure. By 2050 the global demand for agricultural production is expected to double. Half of the global population will live in cities and need to be fed through market channels. In the next 50 years we will need to produce more food than we have in the last 10,000 years.[63] Meeting these demands will require substantial increases in agricultural productivity.

Governments across the world have been slow to adopt policies that adequately reflect the climbing pressure on global food supply. Public investments in agricultural research and development have, at best, been flat and more often dropping decade after decade, leading to dangerous gaps in the innovation necessary to enhance crop yields. Without renewed investment in agricultural innovation, the widespread food insecurity the original Green

Revolution helped reduce may return, and the food riots and price spikes of 2007 and 2008 may become more commonplace. To address these deficiencies, Nobel Peace Prize winner and longtime agricultural researcher Dr. Norman E. Borlaug (and many others) have called for a "Second Green Revolution."[64]

Innovations in agriculture span a wide range of technologies: new techniques for weed control that help reduce topsoil loss (contour plowing), improved planting/harvesting equipment, irrigation techniques, new approaches to pest and disease control, and seed/variety improvement.

1. *Does the program help spur innovation that leads to something new that adds value?*

Yes. Numerous studies document that few investments have more consistently and reliably produced returns as high as those in agricultural research.[65] While the benchmark return on U.S. government securities has historically been 3–4 percent, the median return from investments in agricultural research in the United States has been 45 percent.[66] This means that for every dollar spent on agriculture research, the returns to society were worth $10. These have come in the form of new seeds that produce higher yields on the same or fewer inputs, new farming equipment that enables precision applications of fertilizer, quality, productivity and efficiency gains in food processing, and other concrete products and techniques. These have had widespread ripple effects throughout the food value chain and society at large.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

Yes—both. Returns from agricultural research benefit farms large and small, companies all along the food chain from field to fork, and the communities in which these activities are located. Benefits are shared widely throughout the food industry, in all its various manifestations, consumers who benefit from lower food prices and higher quality foods, companies who ship commodities and processed foods around the world, and all their customers. Few sectors have impacts that are farther reaching.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Yes. U.S. agricultural exports have been one of the few reliable sources of trade surplus over the past several decades.[67] The United States is widely seen to enjoy a competitive advantage vis-à-vis most of the rest of the world due to the agricultural productivity superiority directly resulting from a strong research base. In recent decades, however, public sector research funding has not kept pace, leading to innovation deficits particularly with crops that are not major commodities, the most attractive targets for private sector R&D. The historical record provides few, if any examples of higher return on investment than those achieved through expenditures on agricultural research.

Energy Frontier Research Centers (EFRCs): Productive Investment

Energy Frontier Research Centers bring together small groups of researchers focused on breakthroughs in science that can unlock game changing new energy innovations. EFRCs are mainly led by university teams, but they can also involve national labs or private industry. The purpose is to conduct fundamental research on one or several energy-related "grand challenges" identified by the scientific community, where such research would benefit from a dedicated and concerted effort beyond the scale of supporting one or two principal investigators. EFRCs are defined by their multidisciplinary composition and collaborative nature, sparking new approaches to scientific problems and improve opportunities for breakthrough discovery.

1. *Does the program help spur innovation that leads to something new that adds value?*

Yes. Innovation of new products and processes is the EFRC program's primary goal. The centers pursue use-inspired basic research to expand fundamental knowledge in key energy-relevant fields, which in turn will accelerate the creation of new energy technologies. With 46 individual centers based at labs and universities in 35 states tackling a wide range of technical challenges, research areas are literally all over the map, and could yield dividends for several clean technologies down the road. For example, some centers are pursuing advances in molecular science and nanotechnology to improve solar cell efficiency; others are developing advanced materials to more effectively remove CO_2 from smokestacks and advancing knowledge of geologic formations at the molecular level for improved carbon sequestration.

The importance of basic research to innovation that drives new products and industries should not be underestimated. Economist Edwin Mansfield has found that academic research has been a major contributing factor to 23 percent of new products and 18 percent of new processes introduced over the past few decades.[68] Mansfield has also found the social rate of return of academic research to be at least 40 percent.[69] In the energy realm, scientific advancements have formed the basis for new technologies since the days of Edison.

It is also important to note that, with some exceptions, basic research of the kind performed by the EFRCs is generally unattractive to modern industry in most fields, especially in energy. The rewards for research are often unclear, and not quickly or easily captured even if they are realized. As a result, private firms tend to focus more on applied research, if at all, with faster returns and less uncertainty of success. This leaves a hole that public agencies can fill. For example, the federal government accounted for huge portions of funding for academic computer science research in the early decades of the field's development.[70] Similarly, EFRCs are pursuing work that the private sector won't do at a large enough scale to meet our energy challenges.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

No. The EFRCs do not produce work intended to directly increase firm productivity in the near term as other programs might. The EFRC program's science work can lead to new products or processes that firms will be able to adopt down the road and thus

increase their productivity, but the EFRC role essentially stops after the initial knowledge gains are made.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Yes. The EFRCs contribute to an improved trade balance in one very important way: by laying the groundwork for reducing or eliminating oil imports. In 2010, the United States ran a deficit of traded goods and services of almost exactly $500 billion. Of this, net imports of petroleum accounted for $265 billion. The idea that domestic production can make up for this imbalance is largely a myth, and the only real solution is to develop viable alternatives to petroleum-based fuel, including biofuels and electric vehicles.

Several EFRCs are contributing to this effort in several ways. Some research teams are developing novel catalysts that convert biomass to fuel more efficiently, while others are developing methods that can improve catalysis, in general. Still others are pursuing science to increase the efficiency of photosynthesis and thus make plants more energy rich. On the storage front, EFRCs are seeking fundamental materials science breakthroughs at the nanoscale to develop improved vehicle batteries and fuel cell systems.

USDA Rural Utilities Service: Productive Investment

The Rural Utilities Service (RUS), part of the USDA's Rural Development Bureau, addresses shortfalls in rural infrastructure investment through public-private partnerships, providing loans and assistance in water, energy, and communications infrastructure. The program also has initiatives dealing with broadband-related technical training, distance learning, and telemedicine.

1. *Does the program help spur innovation that leads to something new that adds value?*

No. The RUS is more of an enabler of innovation by others than a driver of innovation itself, by expanding access to digital technologies and training local personnel with how to use them, and by marginally expanding the market for clean energy technologies. It does not perform high-risk research or other functions typically associated with driving innovation directly, however.

2. *Does the program increase the productivity of private firms or the economy as a whole?*

Yes. The program undoubtedly helps to boost domestic productivity, particularly through its efforts to provide rural digital telecommunications access. ICT, of which broadband Internet is a central component, added a full 1.18 percent to GDP growth and accounted for two-thirds of the growth in total factor productivity during the second half of the 1990s.[71] Further, broadband-enabled Internet business solutions are expected to add a total of 0.43 percentage points to U.S. productivity growth through 2011.[72] Many of these gains are most obvious in urban areas, but rural businesses also benefit from expanded market opportunities through e-commerce, and from improved access to business-to-business transactions. And farmers can also benefit from broadband access, as an information resource for markets, prices, and improved methods, and as a way to reduce input costs by finding suppliers beyond their traditional local areas.[73] Broadband

is thus central to productivity gains and job growth, and expanding rural broadband access is central to the RUS's mission. Through Recovery Act funding of the Broadband Initiatives Program, the RUS provided grants and loans for over 300 rural projects, mostly "last-mile" projects, connecting seven million Americans and 360,000 businesses with broadband Internet or satellite access.[74]

Beyond access to broadband Internet, RUS also helps to boost productivity in other ways. A trained workforce is a key component for boosting worker and thus firm productivity, as multiple studies have shown.[75] One European study found that a 1 percent increase in training days boosts worker productivity by 3 percent.[76] RUS provides training assistance to local organizations in the areas of water and broadband infrastructure, and provides grants to clinics, hospitals, and other entities for distance learning in telemedicine, which offers the potential to allow health-care professionals to provide high-quality treatment in sparsely populated areas more efficiently and effectively.

3. *Does the program help close the trade deficit by making U.S. firms more globally competitive, increase exports, or reduce imports?*

Although most of the RUS's work deals in non-traded sectors like water infrastructure and local health care provision, which have little impact in imports and exports, connecting agricultural communities with broadband access can help expand agricultural exports. Generally, broadband access boosts productivity, which in turn boosts international competitiveness. Given the business gains available to farmers mentioned above, improved broadband access can provide some farms with opportunities for positive marginal productivity gains.

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