

If You Build It: A Guide to the Economics of Infrastructure Investment

By Diane Whitmore Schanzenbach, Ryan Nunn, and Greg Nantz

FEBRUARY 2017

A founding principle of The Hamilton Project's economic strategy is that long-term prosperity is best achieved by fostering economic growth and broad participation in that growth. In that spirit, this paper seeks to provide an economic framework for evaluating infrastructure investments and their methods of funding and finance. Why should we invest in infrastructure, what projects should be selected, who should decide, and how should those investments be paid for are all questions that can be better answered with the help of sound economic theory and evidence.

In recent years American infrastructure investment has been insufficient to meet maintenance and expansion needs. By one important measure, annual investment has declined: net public non-defense investment at all levels of government was 1.5 percent of GDP in 1980 and only 0.6 percent in 2015 (Bureau of Economic Analysis 2016).

As net investment has declined, the average age of infrastructure continues to increase, requiring additional spending just to keep up with deterioration and to meet safety standards. For example, pipes laid for water systems dating to the late 1800s, 1920s, and post-War era have life expectancies of about 120, 100, and 75 years respectively; by one estimate, the average utility will have to spend three-and-a-half times as much on pipe replacement in 2030 as it did 30 years earlier (American Water Works Association 2001). To some extent, infrastructure aging reflects deferred maintenance that must eventually be addressed so that infrastructure will continue to function properly, facilitating economic growth. The American Society of Civil Engineers (2013) estimates that \$3.6 trillion would be required just to bring U.S. infrastructure into a state of good repair, not counting any expansion to the stock of infrastructure.¹

Because much of the nation's infrastructure generates broadly shared benefits that are not limited to those who can pay, decisions about this infrastructure are an important public policy concern and not just a matter for private firms and investors. Of course, deciding precisely which infrastructure investments should be undertaken by the public sector is an important policy question that can be informed by careful analysis.

Having determined that particular infrastructure projects are worthwhile, it is also important to consider how the projects should be financed. With a number of approaches currently under discussion, including conventional debt finance and public-private partnerships (PPPs), deciding among the alternatives requires a clear exposition of their advantages and disadvantages.

Why Should We Invest in Infrastructure?

PRODUCTIVITY GROWTH HAS DIMINISHED AND INTEREST RATES HAVE FALLEN.

In the long run, improvements in standards of living are achieved through productivity growth (Gordon 2016). As we learn to make more-effective use of labor and capital, the economy becomes more productive: we produce more with less. Unfortunately, the United States has experienced a large slowdown in productivity growth over the past dozen years (see figure 1) that amounts to about \$2.7–3.0 trillion of cumulative lost economic output (Byrne, Fernald, and Reinsdorf 2016; Syverson 2016). This slowdown has reduced growth in Americans’ living standards, increased the difficulty of alleviating poverty, and might have even weakened institutions that support U.S. democracy (Friedman 2006).

Although a number of tax, labor market, housing market, and other growth-relevant institutions could be playing a role in holding back innovation and productivity growth, substandard infrastructure could also be an important contributor. As infrastructure deteriorates, many sectors of the economy lose their ability to operate efficiently. With fewer resources devoted to infrastructure projects that will enhance future output, growth in productivity slows. Given its importance to economic growth, it is striking that public investment has slowed considerably over time; figure 2 shows that public non-defense net investment fell by more than 50 percent from 2002 to 2015.

At the same time interest rates are relatively low, and as a result the interest cost of financing infrastructure investment is low. Figure 3 shows the long-run decline in 10-year Treasury note yields, a commonly referenced benchmark interest rate. With

BOX 1.

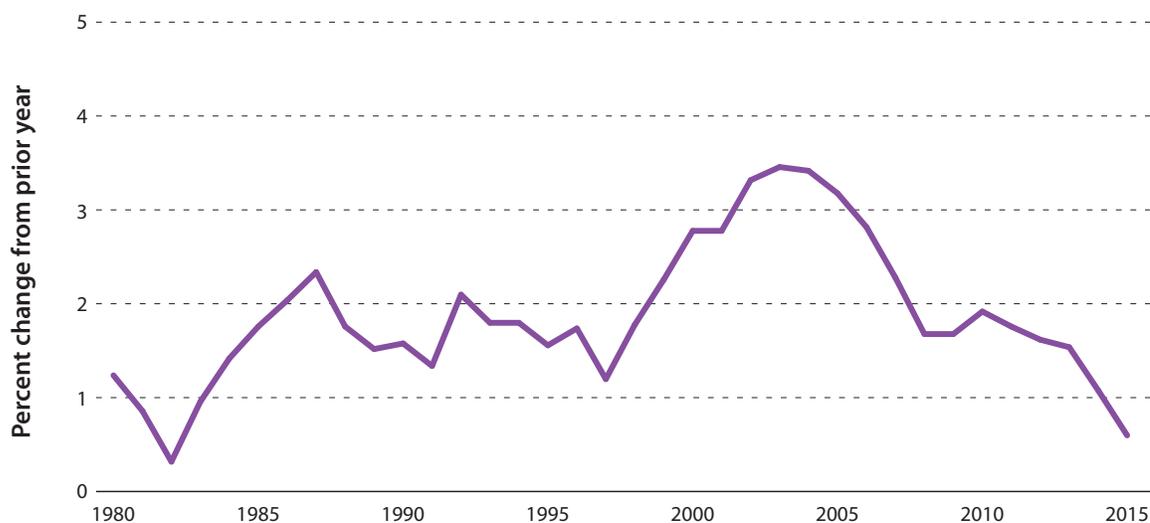
What factors determine the economic returns to spending on infrastructure?

One way to approach infrastructure spending decisions is in terms of how they affect economic activity, both locally—e.g., by increasing a port’s capacity to move goods, or by reducing traffic congestion—and nationally—e.g., by stimulating demand for new parts built elsewhere.

The following variables determine the returns to infrastructure spending:

- The magnitude of the economic returns to successful projects
- The share of infrastructure spending that goes to less productive projects—for example, projects that are selected for political rather than economic reasons
- The rate at which new infrastructure will depreciate
- The share of spending that simply replaces previously planned infrastructure investments by state and local governments
- The federal government’s interest rate on borrowing
- The stimulus effects on the economy, if applicable

FIGURE 1.
Change in Labor Productivity, 1980–2015



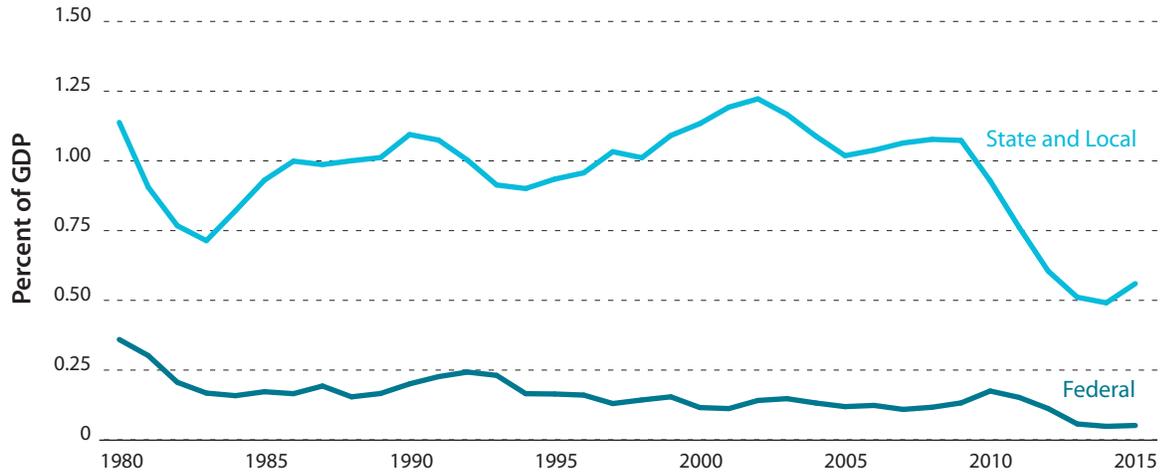
Source: Bureau of Labor Statistics 2016; authors’ calculations.
Note: Values are shown as a trailing, five-year moving average.

this low cost of borrowing, capital-intensive investment of all kinds becomes more appealing to both the public and private sectors, all other things being equal. Infrastructure investments that once appeared to be cost-prohibitive can now be justified economically, as explained in box 2, and could help reverse the downward trend in productivity growth.

INFRASTRUCTURE DEFICITS HAVE BECOME LARGE.

Indeed, the potential for infrastructure improvements to enhance long-run growth appears to be substantial. Pervasive deficits in the quality of infrastructure have been widely documented (U.S. Department of Transportation 2016a; U.S. Environmental Protection Agency 2013). Figure 4 breaks out investment needs

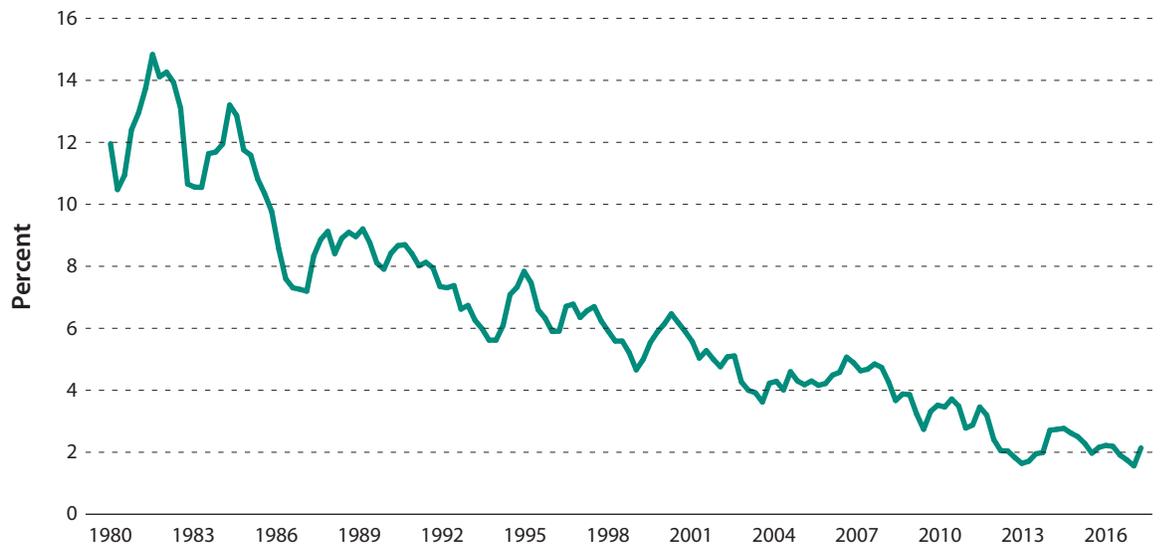
FIGURE 2.
Public Non-Defense Net Investment: Federal vs. State and Local, 1980–2015



Source: Bureau of Economic Analysis 2016.



FIGURE 3.
Ten-Year Treasury Note Yields, 1980–2016



Source: Federal Reserve Bank of St. Louis n.d.



BOX 2.

Investment Should Increase When Interest Rates Are Low

Investors decide whether to spend their money on a new project by comparing its risk and expected return to the guaranteed rate of return on government bonds. When that guaranteed rate of return—often simply called the “interest rate”—is high, holders of capital have an attractive outside alternative to the new project. Rather than commit to the investment, they can simply earn the high interest rate by purchasing government bonds. By contrast, when interest rates are low, buying government bonds is less tempting. This reflects an abundance of funds relative to all the investment opportunities that exist throughout the economy.

Consequently, the same potential investment may yield a positive net return when interest rates are low that it would not were interest rates high.² The box table shows how this would work for a hypothetical project that returns \$120 in seven years in exchange for an initial investment of \$100.

Real Interest rate	Net present value	Is investment justified?
1%	\$11.93	Yes
2%	\$4.47	Yes
3%	-\$2.43	No
5%	-\$14.72	No
10%	-\$38.42	No

Note: Assumes \$120 in benefits after seven years, initial costs of \$100, and no inflation.

by type of infrastructure, with blue bars on the left depicting funded infrastructure, and green bars on the right showing the investment requirements that remain unfunded, using estimates from the American Society of Civil Engineers (2013).

Table 1 provides an accounting of how much money is being spent by the federal, state, and local governments on various types of infrastructure. State and local expenditures account for roughly three quarters of total spending, though the federal share of investment is larger in some areas, such as aviation. Water infrastructure spending is a large component of the expenditures, exceeded only by highway

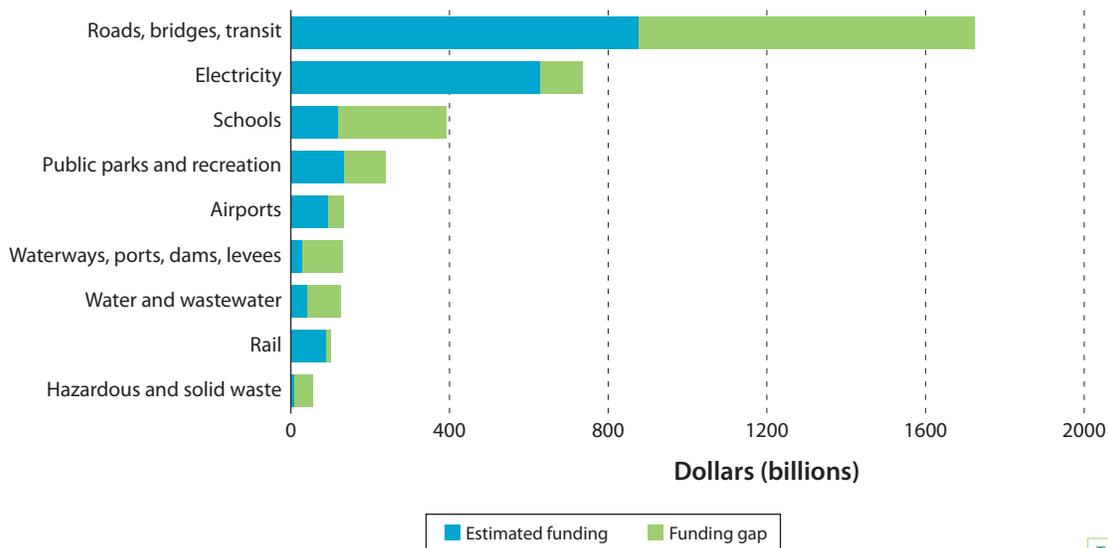
spending. Importantly, a majority of public spending—57 percent—is dedicated to operating and maintaining existing infrastructure (Congressional Budget Office 2015).

INFRASTRUCTURE INVESTMENTS CAN INCREASE PRODUCTIVITY, THOUGH THE EFFECTS VARY.

There is a relatively small body of literature investigating the relationship between public investments and long-run productivity growth. Work by Aschauer (1989) and Munnell (1990) finds a strong positive relationship between public

FIGURE 4.

Infrastructure Needs, Funded and Unfunded, 2013–2020



Source: American Society of Civil Engineers 2013 via Center on Budget and Policy Priorities 2016.

BOX 3.

Infrastructure as Stimulus

In addition to the role of infrastructure investment in promoting long-run productivity growth, additional infrastructure spending can serve as a tool for minimizing the damage and duration of recessions. A 2016 Hamilton Project policy proposal by Alan Blinder explains how fiscal policy can be used to fight recessions and summarizes the economic research on the efficacy of fiscal policy for this purpose. Blinder finds a central role for automatic fiscal stimulus—including infrastructure spending—particularly when long and severe recessions strike, and above all when targeted to backlogs of deferred maintenance. Fiscal multipliers—a measure of the macroeconomic impact of stimulus—are especially large at such times (Auerbach and Gorodnichenko 2013). Notably, with unemployment relatively low as of early 2017, this particular argument for infrastructure investment is not currently compelling.

capital expenditures and productivity. However, the research cannot conclusively determine whether public investments are the driving cause of increased productivity; it could be, for example, that during periods of brisk technological progress both productivity growth and public capital expenditures rise, and that the correlation is spurious.

More-recent work finds that productivity gains associated with public investment are smaller and vary by economic sector and region (Chandra and Thompson 2000; Gramlich 1993; see U.S. Department of the Treasury and Council of Economic Advisers [2010] for a discussion). In particular, industries with a clear connection to new infrastructure—for instance, vehicle-intensive industries and road building—experience greater productivity gains (Fernald 1999). Comparing a number of countries over the second half of the twentieth century, Canning and Pedroni (2004) find that infrastructure investment resulted in increases in long-run growth, especially investments in telecommunications, power generation, and road building. However, one study of the transportation sector found that new roads built between 1983 and 2003 have not generated benefits that exceed their

costs (Duranton and Turner 2012); importantly, the paper does not speak to the value of spending on maintenance and repair. Pereira (2001) observes that public investment can increase long-run private investment, but finds that the largest induced private investments occurred for electric and gas facilities, mass transit, and airfields; private investments resulting from spending on highways and streets were much smaller.

What Projects Should Be Selected?

Choosing among many possible investments is quite challenging, as is quantifying all the relevant costs and benefits. Here, we discuss some considerations that are important for public infrastructure project selection.

First, **is there a role for government?** Or, in other words, can the private sector successfully deliver the project, or is there a market failure that can only be mitigated by a public investment response? Market failures often occur when the link between an individual’s use of a good and payment for it is severed. For instance, flood control provided by a levee or dam has benefits that are widely shared by local residents and businesses. But once a levee is built, it protects the entire community; no one can be excluded from the flood protection. If funding for the levee were collected on a strictly voluntary basis, some potential beneficiaries would quite rationally refuse to pay for the service. Assuming that other community members were still willing to fund the levee, those who refused to pay would save their money but still gain the flood protection offered by the levee. With some community members unwilling to pay, the private market would be unable to collect enough resources for the optimal levee. The market would supply insufficient flood control, perhaps by building a less effective levee, or perhaps by not building one at all. In this example, not being able to exclude nonparticipants from enjoying the benefit necessitates public investment.

Second, **do the investment’s expected benefits exceed its costs?** Every potential investment is different, but research and experience support two general principles that serve as helpful guidance.

FIX IT FIRST.

The United States has gained tremendously from investments such as the interstate highway system, the electrical grid, and water and wastewater systems. The benefits of each type of infrastructure,

TABLE 1.

Government Spending on Infrastructure

All values reported in billions of dollars

	Highways	Mass Transit and Rail	Aviation	Water
Federal	\$46.3	\$15.5	\$16.0	\$18.4
State and Local	\$118.3	\$52.9	\$20.0	\$128.5

Source: Congressional Budget Office 2015.

Note: Water infrastructure includes spending on water transportation (\$9.8 billion), water resources (e.g., dams, levees, reservoirs, and watersheds; \$28.2 billion), and water utilities (e.g., supply and wastewater systems; \$108.9 billion). Estimates are for 2014.



developed over a span of many decades, are large by comparison to their costs. What is less clear is whether the marginal benefit—the return from an additional dollar of spending on new infrastructure—is still larger than the cost.

One implication is that repair and maintenance often have higher returns than new construction. About one third of the nation's major urban roads were rated in substandard or poor condition in 2016, generating large costs for motorists (TRIP 2016). A 2016 Congressional Budget Office report suggests that spending on highways could be allocated more effectively by increasing spending on repairs and decreasing spending on system expansion.

The notion that the returns to repair and maintenance exceed those for new construction underlies the “Fix It First” approach, prioritizing rehabilitation over new projects (Kahn and Levinson 2011). Conducting early and regular maintenance yields large cost savings relative to fixing or replacing roads only after they have become badly damaged (AASHTO and TRIP 2009).

Furthermore, the tendency of transportation authorities to select lowest-bidder firms that use suboptimal construction techniques

might lower initial construction costs but will increase the future cost of maintenance. More-advanced construction techniques and materials—such as thicker pavement and tack coats applied before paving—cost more upfront, but because they are more durable can save money over the long run. When making design decisions, it is important to count all costs, including expected maintenance and repair over subsequent decades (Winston 2013).

COUNT NON-PECUNIARY BENEFITS.

Typically, costs are predominantly monetary. Benefits, by contrast, are often difficult to put into dollar terms. For instance, lead abatement in housing, transportation, and water infrastructure confers health benefits that may in turn improve test scores (Aizer et al. 2016) and lower crime (Reyes 2007). Precisely quantifying these benefits is challenging. In such situations, it can be useful to calculate how large the unknown benefits would have to be—given the costs, quantifiable benefits, and interest rate—to justify the investment. Policy makers and stakeholders can then decide whether it is plausible that benefits exceed the threshold.

Who Should Decide?

The application of cost-benefit analysis is vital to selecting and implementing sound projects, but equally important is having decisions made by the appropriate policy maker. Two types of choices are particularly important: the assignment of responsibility for funding and implementation to a given level of government, and the degree to which investment decisions are insulated from political pressure.

There are advantages and disadvantages to vesting the various levels of government—local, state, or federal—with the authority to design, construct, finance, operate, and maintain infrastructure development. On the one hand, local and state governments might be better equipped than the federal government to gauge which infrastructure projects would be most valuable in their jurisdictions. Given how variable the returns are for different potential projects, having reliable information about costs and benefits is crucial.

On the other hand, these governments can have special difficulty funding necessary investments, perhaps because local economic downturns make it difficult for them to find the resources to engage in infrastructure spending when it is most needed. In addition, to the extent that a potential investment has spillover benefits to neighboring jurisdictions, local or state governments will not have the appropriate incentive to fully invest because they do not consider the benefit to the neighboring area. By contrast, national policy makers might have easier access to financing and a perspective that incorporates benefits and costs across jurisdictions.

Moreover, some infrastructure is characterized by economies of scale in planning and implementation. When a local or state government lacks the scope to pursue a large-scale project, there can be a role for the federal government.

BOX 4.

What Is a Public-Private Partnership?

Borrowing from Engel, Fischer and Galetovic (2011), this paper defines a PPP as “an agreement by which the government contracts a private company to build or improve infrastructure works and to subsequently maintain and operate them for an extended period (for example, 30 years) in exchange for a stream of revenues during the life of the contract” (p. 2).

PPPs take on a variety of forms. In some cases, only two phases—design and construction, for example—are bundled in a contract with a single firm. At the other end of the spectrum are PPPs for which a single firm takes responsibility for all phases: design, construction, finance, operation, and maintenance (U.S. Department of the Treasury 2016). In return, firms typically receive revenues from future user fees or from the government (termed “availability payments”).

Although it is routine in the United States for infrastructure projects to be implemented by private contractors paid with public funds, PPPs are relatively rare and have so far met with limited success (Engel, Fischer, Galetovic 2011). A 2011 Hamilton Project policy proposal estimates that the United Kingdom, despite having a much smaller economy, financed \$50 billion of PPP projects from 1990 to 2006, compared to only \$10 billion in the United States over the same period. However, the popularity of PPPs in the United Kingdom owes considerably to their utility for bypassing public debt limits, as opposed to an increased appreciation for the social benefits of PPPs (Engel, Fischer, and Galetovic 2011).

ASSIGN RESPONSIBILITY FOR INFRASTRUCTURE APPROPRIATELY.

Given these considerations, how best to assign responsibility for infrastructure investment? One commonly utilized approach has been for the federal government to fund and/or finance investments in part or in full, sharing with states and municipalities the power to select and implement particular projects. An example of this approach is the Transportation Investment Generating Economic Recovery (TIGER) competitive grant process—now in its eighth round since initiated in 2009—which requires a cost-benefit analysis of potential projects.

TIGER grants are issued when the U.S. Department of Transportation solicits and selects proposals for transportation investments that are submitted by state and local governments, transit agencies, port authorities (for non-dredging projects), and others. Combinations of agencies can apply jointly, which helps to accommodate projects that have benefits that spill across government boundaries (U.S. Department of Transportation 2016b).

Another possibility entails a more limited role for the federal government, restricted to financing support rather than project selection. For more than a century, interest payments on most debt issued by state and local governments have been exempt from federal income taxation (Driessen 2016). This exemption amounts to a general subsidy for state-and-local debt-financed expenditures, including infrastructure investment, but it is limited in one important respect: many investors (e.g., pension funds) are not required to pay federal taxes on their investment income. Consequently, these investors do not benefit from the tax-exempt status of state and local bonds, limiting the market for such debt.

A work-around for this limitation—and a deeper subsidy for state and local bonds—was developed in the form of the Build America Bonds (BABs) program, which provided subsidized taxable debt that was attractive to a wider range of investors. These bonds were available for issuance only in 2009–10, although there have been proposals to reintroduce the program as a means of promoting infrastructure investment (Altman, Klein, and Krueger 2015).

INSULATE DECISIONS FROM POLITICAL PRESSURE WHERE POSSIBLE.

Careful cost-benefit analysis is more likely to be implemented when decisions about infrastructure investments are free from undue political pressure. For instance, if project selection depends primarily on whether a particular location is represented by a relatively influential member of Congress, infrastructure spending is unlikely to flow to places with the greatest need or where the economic benefits to investment are the greatest. Some argue that this occurred during the earmark era (Frankel 2013), when members of Congress would request funding or financing on behalf of particular entities or localities, directly benefitting their constituents (Kirk, Mallet, and Peterman 2017).

The removal of earmarks in 2011 by party and committee rules has removed some of the politics of infrastructure decision making. However, soft earmarking—when a project is named

BOX 5.

Safeguarding the Integrity of Government Contracting

Whether PPPs are used or not, the federal, state, and local governments must interact with private contractors in order to install infrastructure. Consequently, policy makers should recognize the importance of maintaining impartiality in how contracts are awarded and administered, thereby protecting the taxpayer. To maintain these standards, governments impose restrictions and disclosure requirements on the process that selects contractors.

One direct means of protecting contracting integrity is to limit the ability of legislators and government officials to receive government contracts. At the federal level, executive branch employees are barred from a range of contracting activities during and after federal employment (Maskell 2014). Many states impose their own restrictions. For example, Alabama prevents legislators, their families, and associated businesses from entering into any noncompetitive contracts at the state or municipal levels (National Conference of State Legislatures 2013).

Competitive bidding is another useful tool to safeguard the integrity of government contracting. In addition to helping find the lowest-cost supplier, competitive bidding is typically complemented by transparency requirements: for instance, the Commonwealth of Virginia often uses a process in which bids are “publicly opened and read aloud . . . [and] evaluated based upon the requirements set forth” (Commonwealth of Virginia 1998).

Additionally, transparency initiatives can be implemented, further improving oversight of government contracting. One notable example was signed into law by President George W. Bush in 2006, providing for a public Web site (USASpending.gov) that would contain detailed information about entities—including contractors—receiving government funds (U.S. Department of the Treasury n.d.). The searchable Web site currently displays contract amounts and timing, as well as information about the contractors (including their identities) and the process that resulted in the contract awards.

a priority for funding consideration—still occurs, by avoiding the ban on specifying a particular amount of tax dollars for project funding. Members may also appeal directly to the U.S. Department of Transportation or state and local agencies in support of specific projects (Kirk, Mallet, and Peterman 2017).

Nonetheless, much of current spending—including 92 percent of highway spending through FY2020—is allocated by formula (Kirk, Mallet, and Peterman 2017), which may reduce political influence on the project selection process. However, formula funding itself is not free from bias. For example, past U.S. Department of Transportation rules have been constructed to, for example, favor older transit systems over newer ones in the allocation of funding

(Kirk, Mallet, and Peterman 2017). Formulas for the highway trust fund were written to favor small and rural states—e.g., Rhode Island or Montana—over larger states like Texas and California (U.S. Government Accountability Office [GAO] 2010). As a result, funds are not necessarily directed to where the best projects are located.

Moreover, the current approach to infrastructure decision making appears to systematically disadvantage investments that are relatively productive—like airports, transit, and the electrical grid—in favor of investments in roads, which are likely less productive (Pereira 2001) but provide direct benefits to constituents (Kirk, Mallet, and Peterman 2017).

One option that would further insulate infrastructure investments from the political process is an infrastructure bank. Broadly speaking, its mission would be to provide public loans for infrastructure projects, typically as a supplement to larger quantities of private capital (Galston and Davis 2012; Kahn and Levinson 2011). Infrastructure banks already exist in a majority of the states (though often in a fairly limited role) and in the European Union. In the formulation suggested by Galston and Davis (2012), a national infrastructure bank would be set up as a government-owned corporation (similar to the structure used for the Federal Deposit Insurance Corporation, for example), with a governing board selected by Congress and the president. The bank's staff would in principle evaluate project proposals and make loan decisions impartially, using cost-benefit analysis.

How Should Infrastructure Investments Be Paid for?

No one approach to paying for infrastructure is clearly superior under all circumstances. Each method has its advantages and disadvantages, both political and economic.

IMPLEMENT USER FEES WHEN POSSIBLE; OTHERWISE, FUND WITH TAXES.

Funds for any infrastructure project ultimately come from taxation, user fees, or a mixture of the two. This simple, fundamental point can sometimes be obscured by the complexity of the financing arrangements surrounding a project.

In many cases, governments pay for their projects using only tax revenues. Infrastructure ranging from storm levees to public K–12 schools is typically implemented through this funding approach.

This reliance on tax revenue has advantages in some circumstances. When it is infeasible to charge individual users and other beneficiaries in proportion to the benefit they derive, or when it is itself a policy goal that access to the infrastructure be provided at no cost to the user, tax revenue is the preferable funding source. However, one notable disadvantage of tax revenue as a source for funding is that it can lead to a poor selection among potential projects. When taxes are the funding source, investment is not necessarily deterred by the possibility of weak future returns. When the new infrastructure is not required to pay for itself, there is no so-called market test to filter out unproductive projects. In other political environments, policy

BOX 6.

The Role of Repatriation

At first blush, international corporate tax reform would appear to have little or nothing to do with infrastructure investment. However, the U.S. tax code—and expectations of a future tax holiday—have led many firms to hold earnings abroad, where they temporarily remain untaxed by the U.S. government. When these earnings are eventually returned to the United States in a process called repatriation, substantial tax revenues will be generated.

Members of Congress have called for combining corporate tax reform with an infrastructure package, by using the taxes collected on repatriated assets either to shore up the highway trust fund, to fund the creation of a national infrastructure bank, or to otherwise pay for infrastructure investment (Delaney 2015).

Revenues from repatriation have important limitations as a source of funds for infrastructure. First, the repatriation of funds that are currently held abroad is a one-time activity; after corporate tax reform and the initial spike in revenues, subsequent infrastructure needs would have to be funded in some other way. Second, a poorly designed policy change, like a repatriation tax holiday, would actually lose tax revenue over the long run (Joint Committee on Taxation 2014). A tax holiday would undermine the current international tax system: the U.S. Treasury would receive less revenue from the repatriated funds than it was owed, and firms would be even more likely to hold future profits abroad so as to exploit—or precipitate—the next tax holiday. However, as part of a well-designed corporate tax reform, revenues from repatriated funds could be a useful complement to other infrastructure funding mechanisms.

makers might actually forgo productive projects when budgets are tight and available tax revenue is scarce.

In addition, it is costly to raise tax revenue. Taxpayers tend to adjust their behavior in order to avoid taxation, which leads to distortions in economic activity. All else equal, user fees should be utilized in preference to taxes.

Some projects can be paid for with user fees, which are payments made by those who access the infrastructure, typically in proportion to the extent of their use. The classic example of infrastructure user fees is the toll road, but many other projects—ports, airports, and water treatment plants, among others—are funded at least in part with user fees.³

The deployment of user fees can have social benefits. User fees are useful when they reduce congestion or mitigate environmental damage, as when they reduce water consumption in times of drought. As described in a Hamilton Project policy proposal by Engel, Fischer, and Galetovic (2011), user fees can also act as a filter that distinguishes between projects that are socially valuable and those that are not: if fees from a new project are

sufficient to pay for the costs of construction and operation, the investment is worth pursuing. However, the inverse is not always true, as illustrated by the following common scenario in which it is logistically difficult or impossible to collect user fees. For example, an investment that reduces the air pollution generated by a city bus system will yield real benefits that many individuals would be willing to pay to obtain, but collecting user fees is infeasible because nonpaying individuals cannot be prevented from enjoying the benefits of the investment. Finally, there are instances in which it would be impossible or socially undesirable to collect user fees, such as with the construction of a new public elementary school. This could include situations in which user fees are feasible to collect, but would have a disproportionate negative impact on low-income individuals.

USE CONVENTIONAL GOVERNMENT DEBT FINANCE AS THE DEFAULT APPROACH TO FINANCING.

Debt finance is often the appropriate tool for infrastructure investment. When a project is funded by tax revenues, policy makers are sometimes reluctant to rely on current revenues. This might be due to the general difficulty—political or economic—of raising taxes or reducing other spending, especially for large projects. Moreover, user fees can be collected only after the project is completed, making them unavailable for the costs of design and construction.

There is typically a strong case to be made that infrastructure development merits a different approach than is appropriate for other government programs. As with a private firm's capital investments, infrastructure investments entail immediate expenses followed by a stream of future returns. A government can therefore borrow the funds required for the infrastructure project and repay the loan with future tax revenues (hopefully enhanced by the extra economic growth caused by the new project).⁴

However, debt finance presents different problems. When it is proposed that federal infrastructure investment be paid for with new debt, instead of current revenues, policy makers must take into account the additional debt-service payments that will be incurred. Furthermore, if the social benefits from an infrastructure project do not primarily consist of monetary benefits that eventually raise tax revenue (and if user fees are not practical or desirable), then debt finance merely delays the problem of paying for the infrastructure. This is sometimes economically justified, but policy makers with an excessively short-term focus will be tempted to delay paying for infrastructure more than is appropriate.

Some infrastructure financing initiatives have focused on supporting state governments' access to debt markets, which can be limited due to volatile state revenues (Galston and Davis 2012). The Transportation Infrastructure Finance and Innovation Act (TIFIA) loan program, reauthorized in 2015, leverages relatively small appropriations of federal funds to facilitate large loans for state and local transportation projects. Through subsidies for taxable debt issued by state and local government in 2009–10, the Build America Bonds (BABs) program worked toward a similar objective.

EXPLORE THE USE OF PPPS WHEN IT IS IMPORTANT TO COORDINATE DESIGN, CONSTRUCTION, FINANCING, OPERATION, AND MAINTENANCE OF INFRASTRUCTURE.

An alternative to conventional public debt finance is the PPP. With a PPP, private firms can play a role in the financing of infrastructure projects. Because PPPs are so diverse in structure, it can be difficult to broadly describe them. Some PPPs involve either thoroughgoing cooperation or complete private control of the production and administration of the infrastructure.

Often, a PPP will have the character of equity finance, as opposed to the debt finance previously discussed. In exchange for the right to collect fees or tax revenue in the future, a private firm pays some or all the cost of producing and operating the infrastructure project. This usually involves the private firm taking on some measure of risk, either in terms of unexpected development costs or uncertain future tax and user fee receipts. Like debt finance, this allows for new infrastructure projects to be developed without an initial outlay of government funds (or with a smaller outlay, if costs are shared).

It is important to reiterate that—as with municipal bond markets—a PPP does not obviate the need to eventually pay for the investment with either taxes or user fees. For instance, if a PPP is structured so that the firm pays all construction and operational expenses of a new road, receiving in exchange the right to collect tolls, then the financing is functionally similar to that of a government that borrows funds and repays its loan with user fees.

However, a chief benefit of using a PPP is the associated involvement of the private firm in the construction and operation of the investment. To see this, suppose that the government uses a conventional procurement process for an investment project. To some extent, the government will be able to specify through contract—and then follow up with active monitoring—that the winning firm must use high-quality materials and must avoid cutting corners. To the extent that this is not possible—i.e., contracts and monitoring are imperfect—the contractor could decide to cut corners, increasing the likelihood that in the future the government will be forced to conduct expensive maintenance.

A PPP that assigns to the firm both the responsibility for making initial design and construction choices and the long-term responsibility for maintenance and operation helps to address this concern. Anticipating future repair costs, the firm will make appropriate decisions at the outset regarding construction and operation of the infrastructure project. Similarly, if initial decisions made by the firm are relevant to the benefits generated in the future (e.g., a better-constructed road attracts more drivers who are willing to pay higher fees), a PPP that gives the firm “skin in the game” will encourage better decision making.

Of course, PPPs do come with possible drawbacks and limitations. Most importantly, it must be feasible to bundle responsibility for different contracting phases with a single private firm. Also, the required contractual relationships for a PPP will likely be more complicated than for a traditional government contract. For instance, even when construction and subsequent operation costs can be predicted with some degree

of accuracy, it will be necessary to specify the process by which the contract would be renegotiated in the event of unforeseen costs. These renegotiations, if too easy to enter into, can select for firms that have lobbying rather than technical expertise (Engel, Fischer, and Galetovic 2014).

Conclusion

America's infrastructure demands increased attention. Simply returning U.S. infrastructure to a state of good repair will be both costly and economically valuable. As policy makers decide on the best ways to approach the problem, it will be important for them to consider basic questions about what projects should be undertaken, who should conduct the projects, and how they should be funded and financed.

The application of careful cost-benefit analysis, insulated from political pressure where possible, is of central importance. Often, this analysis will imply that repair and maintenance of existing infrastructure are the best investments.

When public investment is deemed necessary and useful, escalation to higher levels of government—local to state to federal—should occur as required to properly implement large projects with benefits that spill over multiple jurisdictions. Federal involvement can, however, be tailored to support state and local governments in their infrastructure efforts.

Finally, discussions of appropriate funding and finance should be informed by economic principles and evidence. User fees are often an important part of good infrastructure policy, especially when the fees help to distinguish between productive and unproductive projects, and when fees can mitigate congestion in infrastructure use.

Endnotes

1. This figure may be an overestimate. Some have argued that the American Society of Civil Engineers, by calculating infrastructure needs based only on the physical condition or age of infrastructure, and without reference to system performance, will tend to overstate investment requirements (Little 1999). In addition, the Congressional Budget Office (2016) finds that pavement and bridge quality have likely improved somewhat in recent years.
2. A similar logic applies to federal budget policy more generally, as explained in Elmendorf and Sheiner (2016).
3. The distinction between user fee and tax may sometimes be unclear. For instance, highway construction and maintenance are largely funded by a federal tax on gasoline. This is not precisely the same as a user fee, given that gasoline consumption is not identical to use of the highway system, but generally speaking drivers will pay more (less) gasoline tax as they use highways more (less).
4. Some observers believe that it would even be appropriate for the federal government to adopt a capital budget, separate from the traditional budget, that would reflect the distinctive immediate-costs-and-future-benefits time profile of infrastructure and other investments. However, as Deshpande and Elmendorf pointed out in a 2008 Hamilton Project strategy paper, there are important objections to this approach: the difficulty of quantifying social benefits, the loose relationship between social benefits and increased future tax revenues, and the temptation to mis-identify traditional spending as capital investment would all make it difficult for the federal government to properly implement a capital budget.

Acknowledgments

The Hamilton Project is grateful to Lauren Bauer, Elaine Buckberg, David Dreyer, Ronald Fischer, Joy Fox, Owen Kearney, Aaron Klein, William Galston, Bert Lue, Kriston McIntosh, Louise Sheiner, and David Wessel for insightful comments. It is also grateful to Audrey Breitwieser and Megan Mumford for research assistance.

References

- AASHTO (American Association of State Highway and Transportation Officials) and TRIP. 2009. "Rough Roads Ahead: Fix Them Now or Pay for it Later." Report, AASHTO and TRIP, Washington, DC.
- Aizer, Anna, Janet Currie, Peter Simon, and Patrick Vivier. 2016, August. "Do Low Levels of Blood Lead Reduce Children's Future Test Scores?" Working Paper 22558, National Bureau of Economic Research, Cambridge, MA.
- Altman, Roger C., Aaron Klein, and Alan B. Krueger. 2015, May. "Financing U.S. Transportation Infrastructure in the 21st Century." Discussion Paper 2015-04, The Hamilton Project, Brookings Institution, Washington, DC.
- American Society of Civil Engineers. 2013. "2013 Report Card for America's Infrastructure." American Society of Civil Engineers, Reston, VA.
- American Water Works Association. 2001. "Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure." Study, Water Industry Technical Action Fund, American Water Works Association, Denver, CO.
- Aschauer, David Alan. 1989, March. "Is Public Expenditure Productive?" *Journal of Monetary Economics* 23 (2): 177–200.
- Auerbach, Alan J., and Yuriy Gorodnichenko. 2013. "Fiscal Multipliers in Recession and Expansion." In *Fiscal Policy after the Financial Crisis*, edited by Alberto Alesina and Francesco Giavazzi, 63–98. Chicago, IL: University of Chicago Press.
- Blinder, Alan S. 2016. "Fiscal Policy Reconsidered." Policy Proposal 2016-05, The Hamilton Project, Brookings Institution, Washington, DC.
- Bureau of Economic Analysis. 2016. "National Data: GDP & Personal Income." Bureau of Economic Analysis, U.S. Department of Commerce, Washington, DC.
- Bureau of Labor Statistics. 2016. "Nonfarm Business Sector: Real Output per Hour of All Persons, Annual Percent Change." Bureau of Labor Statistics, U.S. Department of Labor, Washington, DC.
- Byrne, David M., John G. Fernald, and Marshall B. Reinsdorf. 2016, March 1. "Does the United States Have a Productivity Slowdown or a Measurement Problem?" *Brookings Papers on Economic Activity*, Brookings Institution, Washington, DC.
- Canning, David, and Peter Pedroni. 2004, November. "The Effect of Infrastructure on Long Run Economic Growth." Working Paper, Research Division, Federal Reserve Bank of St. Louis, St. Louis, MO.
- Center on Budget and Policy Priorities. 2016, February 23. "It's Time for States to Invest in Infrastructure." Report, Policy Futures, Center on Budget and Policy Priorities, Washington DC.
- Chandra, Amitabh, and Eric Thompson. 2000. "Does Public Infrastructure Affect Economic Activity?: Evidence from the Rural Interstate Highway System." *Regional Science and Urban Economics* 30 (4): 457–90.
- Commonwealth of Virginia. 1998. "Chapter 6: Competitive Sealed Bidding." Virginia's eProcurement Portal, <https://eva.virginia.gov/library/files/APSPM/Chapter6.pdf>.

- Congressional Budget Office. 2015, March 2. "Public Spending on Transportation and Water Infrastructure, 1956 to 2014." U.S. Congress, Congressional Budget Office, Washington, DC.
- Congressional Budget Office. 2016, February. "Approaches to Make Federal Highway Spending More Productive." U.S. Congress, Congressional Budget Office, Washington, DC.
- Delaney, John. 2015, July 21. "Delaney Publishes Op-Ed on Infrastructure 2.0 Act, Outlines Best Framework for Tax Reform & Infrastructure Package." Press Release, U.S. House of Representatives, Washington, DC.
- Deshpande, Manasi, and Douglas W. Elmendorf. 2008, July. "An Economic Strategy for Investing in America's Infrastructure." Strategy Paper, The Hamilton Project, Brookings Institution, Washington, DC.
- Driessen, Grant A. 2016. "Tax-Exempt Bonds: A Description of State and Local Government Debt." [RL30638; March 26, 2008, by Steven Maguire; updated January 9, 2015, by Steven Maguire and Jeffrey M. Stupak; updated December 23, 2016, by Grant A. Driessen.] Congressional Research Service, Washington, DC.
- Duranton, Gilles, and Matthew A. Turner. 2012. "Urban Growth and Transportation." *Review of Economic Studies* 79 (4): 1407–40.
- Elmendorf, Douglas, and Louise Sheiner. 2016, October. "Federal Budget Policy with an Aging Population and Persistently Low Interest Rates." Working Paper #18, Hutchins Center, Brookings Institution, Washington, DC.
- Engel, Eduardo, Ronald Fischer, and Alexander Galetovic. 2011. "Public-Private Partnerships to Revamp U.S. Infrastructure." Policy Proposal, The Hamilton Project, Brookings Institution, Washington, DC.
- . 2014. *The Economics of Public-Private Partnerships: A Basic Guide*. New York: Cambridge University Press. 15 September, 2014.
- Federal Reserve Bank of St. Louis. n.d. "10-Year Treasury Constant Maturity Rate." FRED Economic Data, Federal Reserve Bank of St. Louis, St. Louis, MO.
- Fernald, John G. 1999. "Roads to Prosperity? Assessing the Link between Public Capital and Productivity." *American Economic Review* 89 (3): 619–38.
- Frankel, Emil H. 2013, October 25. "Return of Transportation Earmarks Wouldn't Solve Gridlock." Bipartisan Policy Center, Washington, DC.
- Friedman, Benjamin M. 2006. *The Moral Consequences of Economic Growth*. New York: Vintage House. Paperback reprint. First published 2005 by Knopf.
- Galston, William A., and Korin Davis. 2012, December 13. "Setting Priorities, Meeting Needs: The Case for a National Infrastructure Bank." Governance Studies, Brookings Institution, Washington, DC.
- Gordon, Robert J. 2016. *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War (The Princeton Economic History of the Western World)*. Princeton, NJ: Princeton University Press.
- Gramlich, Edward. 1993, September. "Infrastructure Investment: A Review Essay." *Journal of Economic Literature* 32 (3): 1176–96.
- Joint Committee on Taxation. 2014, June 6. "Letter to Senator Orrin Hatch." U.S. Congress, Joint Committee on Taxation, Washington, DC.
- Kahn, Matthew E., and David M. Levinson. 2011. "Fix It First, Expand It Second, Reward It Third: A New Strategy for America's Highways." Policy Proposal, The Hamilton Project, Brookings Institution, Washington, DC.
- Kirk, Robert S., William J. Mallett, and David Randall Peterman. 2017. "Transportation Spending Under an Earmark Ban." [R41554.] Congressional Research Service, Washington, DC.
- Little, Richard G. 1999, October. "Educating the Infrastructure Professional: A New Curriculum for a New Discipline." *Public Works Management & Policy* 4 (2): 93–99.
- Maskell, Jack. 2014. "Post-Employment, 'Revolving Door,' Laws for Federal Personnel." [R42728; January 7, 2014, by Jack Maskell.] U.S. Congressional Research Service, Washington, DC.
- Munnell, Alicia H. 1992. "Infrastructure Investment and Economic Growth." *Journal of Economic Perspectives* 6 (4): 189–98.
- National Conference of State Legislatures. Updated 2013, April. "Statutory Restrictions on Legislators Contracting with the State and Disclosure Requirements." National Conference of State Legislatures, Washington, DC.
- Pereira, Alfredo M. 2001, January 1. "On the Effects of Public Investment on Private Investment: What Crowds in What?" *Public Finance Review* 29 (1): 3–25.
- Reyes, Jessica W. 2007. "Environmental Policy as Social Policy? The Impact of Childhood Lead Exposure on Crime." *The B. E. Journal of Economic Analysis & Policy* 7 (1): 1–41.
- Syverson, Chad. 2016. "Challenges to Mismeasurement Explanations for the U.S. Productivity Slowdown." Working Paper 21974, National Bureau of Economic Research, Cambridge, MA.
- TRIP. 2016. "Bumpy Roads Ahead: America's Roughest Rides and Strategies to Make Our Roads Smoother." Report, TRIP, Washington, DC.
- U.S. Department of the Treasury. 2016, May. "An Economic Framework for Comparing Public-Private Partnerships and Conventional Procurement." Office of Economic Policy, U.S. Department of the Treasury, Washington, DC.
- U.S. Department of the Treasury. n.d. "USASpending.Gov: About." U.S. Department of the Treasury, Washington, DC.
- U.S. Department of the Treasury and Council of Economic Advisers. 2010. "An Economic Analysis of Infrastructure Investment." U.S. Department of the Treasury and Council of Economic Advisers, Washington, DC.
- U.S. Department of Transportation. 2016a. "2015 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance." Federal Highway Administration, Federal Transit Administration, Washington, DC.
- . 2016b. "2016 TIGER Applications FAQs." U.S. Department of Transportation, Washington, DC.
- U.S. Environmental Protection Agency. 2013, April. "Drinking Water Infrastructure Needs Survey and Assessment: Fifth Report to Congress." Office of Water, Office of Ground Water and Drinking Water, Drinking Water Protection Division, Washington, DC.
- U.S. Government Accountability Office (GAO). 2010, June. "Highway Trust Fund: Nearly All States Received More Funding Than They Contributed in Highway Taxes Since 2005." GAO-10-780. U.S. Government Accountability Office, Washington, DC.
- Winston, Clifford. 2013. "On the Performance of the U.S. Transportation System: Caution Ahead." *Journal of Economic Literature* 51 (3): 773–824.

The Hamilton Project seeks to advance America's promise of opportunity, prosperity, and growth. We believe that today's increasingly competitive global economy demands public policy ideas commensurate with the challenges of the 21st Century. The Project's economic strategy reflects a judgment that long-term prosperity is best achieved by fostering economic growth and broad participation in that growth, by enhancing individual economic security, and by embracing a role for effective government in making needed public investments.

Our strategy calls for combining public investment, a secure social safety net, and fiscal discipline. In that framework, the Project puts forward innovative proposals from leading economic thinkers—based on credible evidence and experience, not ideology or doctrine—to introduce new and effective policy options into the national debate.

The Project is named after Alexander Hamilton, the nation's first treasury secretary, who laid the foundation for the modern American economy. Hamilton stood for sound fiscal policy, believed that broad-based opportunity for advancement would drive American economic growth, and recognized that "prudent aids and encouragements on the part of government" are necessary to enhance and guide market forces. The guiding principles of the Project remain consistent with these views.

THE HAMILTON PROJECT ADVISORY COUNCIL

GEORGE A. AKERLOF
Koshland Professor of Economics
University of California, Berkeley

ROGER C. ALTMAN
Founder & Senior Chairman
Evercore

KAREN ANDERSON
Senior Advisor, Results for America
Executive Director, Results for All

ALAN S. BLINDER
Gordon S. Rentschler Memorial Professor
of Economics & Public Affairs
Princeton University
Visiting Fellow
The Brookings Institution

ROBERT CUMBY
Professor of Economics
Georgetown University

STEVEN A. DENNING
Chairman
General Atlantic

JOHN DEUTCH
Emeritus Institute Professor
Massachusetts Institute of Technology

CHRISTOPHER EDLEY, JR.
Co-President and Co-Founder
The Opportunity Institute

BLAIR W. EFFRON
Co-Founder
Centerview Partners LLC

DOUGLAS W. ELMENDORF
Dean & Don K. Price Professor
of Public Policy
Harvard Kennedy School

JUDY FEDER
Professor & Former Dean
McCourt School of Public Policy
Georgetown University

ROLAND FRYER
Henry Lee Professor of Economics
Harvard University

JASON FURMAN
Senior Fellow
Peterson Institute
for International Economics

MARK T. GALLOGLY
Cofounder & Managing Principal
Centerbridge Partners

TED GAYER
Vice President & Director
Economic Studies
The Brookings Institution

TIMOTHY F. GEITHNER
President
Warburg Pincus

RICHARD GEPHARDT
President & Chief Executive Officer
Gephardt Group Government Affairs

ROBERT GREENSTEIN
Founder & President
Center on Budget and Policy Priorities

MICHAEL GREENSTONE
Milton Friedman Professor in Economics
Director
Energy Policy Institute at Chicago
University of Chicago

GLENN H. HUTCHINS
Chairman
North Island
Co-Founder
Silver Lake

JAMES A. JOHNSON
Chairman
Johnson Capital Partners

LAWRENCE F. KATZ
Elisabeth Allison Professor of Economics
Harvard University

MELISSA S. KEARNEY
Professor of Economics
University of Maryland
Nonresident Senior Fellow
The Brookings Institution

LILI LYNTON
Founding Partner
Boulud Restaurant Group

MARK MCKINNON
Former Advisor to George W. Bush
Co-Founder, No Labels

ERIC MINDICH
Chief Executive Officer & Founder
Eton Park Capital Management

SUZANNE NORA JOHNSON
Former Vice Chairman
Goldman Sachs Group, Inc.

PETER ORSZAG
Managing Director & Vice Chairman of Investment Banking
Lazard
Nonresident Senior Fellow
The Brookings Institution

RICHARD PERRY
Managing Partner & Chief Executive Officer
Perry Capital

MEEGHAN PRUNTY
Managing Director
Blue Meridian Partners
Edna McConnell Clark Foundation

ROBERT D. REISCHAUER
Distinguished Institute Fellow
& President Emeritus
Urban Institute

ALICE M. RIVLIN
Senior Fellow
The Brookings Institution
Professor of Public Policy
Georgetown University

DAVID M. RUBENSTEIN
Co-Founder & Co-Chief Executive Officer
The Carlyle Group

ROBERT E. RUBIN
Co-Chair, Council on Foreign Relations
Former U.S. Treasury Secretary

LESLIE B. SAMUELS
Senior Counsel
Cleary Gottlieb Steen & Hamilton LLP

SHERYL SANDBERG
Chief Operating Officer
Facebook

RALPH L. SCHLOSSTEIN
President & Chief Executive Officer
Evercore

ERIC SCHMIDT
Executive Chairman
Alphabet Inc.

ERIC SCHWARTZ
Chairman and CEO
76 West Holdings

THOMAS F. STEYER
Business Leader and Philanthropist

LAWRENCE H. SUMMERS
Charles W. Eliot University Professor
Harvard University

PETER THIEL
Entrepreneur, Investor, and Philanthropist

LAURA D'ANDREA TYSON
Professor of Business Administration and Economics
Director
Institute for Business & Social Impact
Berkeley-Haas School of Business

DIANE WHITMORE SCHANZENBACH
Director

