Ten Tech Policy Principles to Promote Innovation

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[*] The views expressed in this paper are those only of the authors' and do not necessarily reflect those of TPI, its staff, its board of directors, or its academic advisory board.

Innovation is a key to economic growth and improvement in our standards of living. Public policies can have large effects on the rate and direction of innovation. This paper lists policies and principles we believe will promote innovation and allow the U.S. to maintain its technological leadership.

Recognize that the Unique Nature of Innovation Requires Global Linkages and Sufficient Investment in Research and Development

1. Enable the free movement of workers, investment capital, and information across borders to help ensure that resources are used efficiently. This will spur technological progress because innovation is a global phenomenon.
2. Maintain U.S. technological leadership by providing sufficient resources for our research institutions, including universities, national laboratories, NIH, NSF, and corporations. Focus public R&D spending on areas the private sector is least likely to fund—fundamental or basic research is more likely to fall into this category than is research aimed at commercialization.

Make Evaluation Fundamental to Proposed Programs

3. Evaluate programs rigorously to determine whether they are achieving their intended objectives in a cost-effective manner. Integrate evaluation criteria and methods into program design. Do not penalize agencies for finding that a program doesn't work.

Encourage Innovation and Investment in ICT

4. Move away from public utility type regulation of broadband. Use antitrust enforcement based on sound economic analysis to address competition issues in the communications sector.
5. Allow innovative business models, a defining feature of the Internet economy, including ones based on price and non-price differentiation without requiring regulatory approval.
6. Streamline processes for making spectrum available, including by moving it from government to non-government control. Allow flexible uses for all spectrum licenses and continue to make them easier to trade. Develop economics-based criteria for allocating spectrum between licensed and unlicensed.
7. Recognize that 100 percent broadband connectivity is aspirational, but not realistic. Funds intended to boost broadband deployment should be distributed in ways that will generate the largest bang-for-the-buck, such as reverse auctions.
8. Adopt coherent privacy rules based on cost-benefit analysis and apply them consistently across the economy.

Promote Cybersecurity

9. Ensure that incentives are properly aligned for the private sector and government to implement effective cybersecurity procedures.

Ensure that Intellectual Property Rights Increase Innovation and Social Welfare

10. Ensure that intellectual property rights policies promote innovation and creativity and base reforms on sound data and analysis.

Recognize that the Unique Nature of Innovation Requires Global Linkages and Sufficient Investment in R&D

Technological progress rests on the foundation of solid and ongoing research. Many factors must be in place to promote scientific progress, but several are especially important for policymakers to recognize. The first is the public good nature of research. While innovation can generate enormous returns to the investor, the largest returns typically accrue to society as a whole. One person's use of a research result does not typically reduce someone else's ability to use it, and others can take the intellectual capital generated by research and extend it in ways not previously imagined. These features of innovation can lead to a market failure in which certain types of research are unlikely to receive sufficient funding from the private sector alone. The second is that research efforts are intertwined around the globe, and benefits from innovation in one part of the world also generates benefits elsewhere. Finally, despite the global nature of innovation, it remains important to maintain world-class domestic research institutions to ensure that high-value work remains in the U.S.

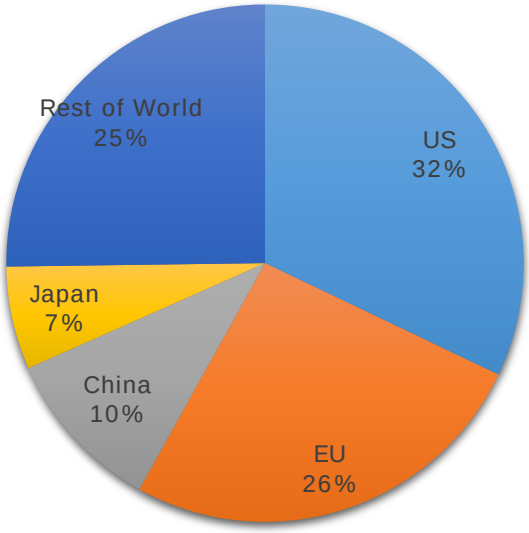
Recognize the Global Nature of Innovation

Enable the free movement of workers, investment capital, and information across borders to help ensure that resources are used efficiently. This will spur technological progress because innovation is a global phenomenon.

A unique feature of research and innovation is that their results can be used in unexpected ways and in unexpected places. These so-called "spillovers" mean that the benefits of innovation extend beyond any particular geographic area. People in other countries benefit from U.S. innovations and vice-versa. However, raising barriers to the free flow of goods, services, data, people, and capital across borders will slow technological progress and innovation generally, including in the U.S.

Data from the National Science Foundation's Science and Engineering Indicators report demonstrate the extent to which knowledge-intensive industries are distributed and interlinked around the world. Figure 1 shows the share of total value added in knowledge and technology-intensive industries by countries and region. In 2014, the U.S. generated nearly one-third of all global value added in these industries, followed by the EU, China, and Japan.

Figure 1: Share of Value-Added in Knowledge and Technology-Intensive Industries, 2014

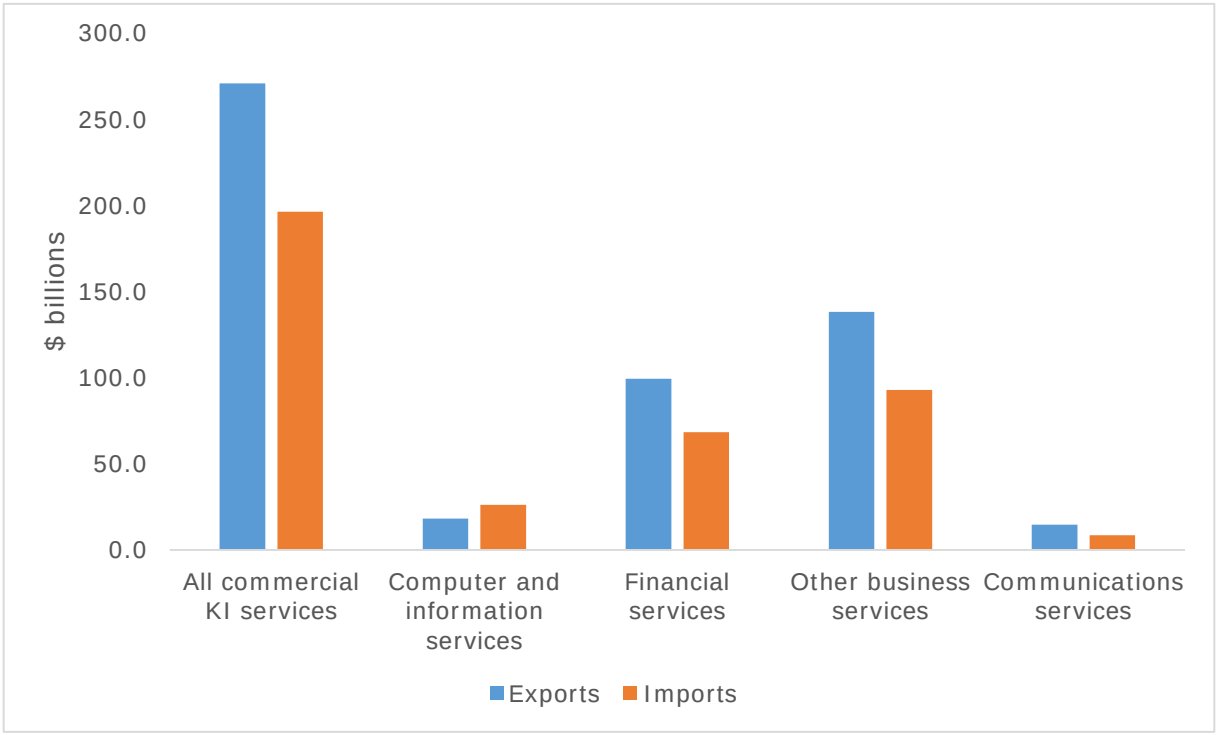


Note: Total value-added in these industries in 2014 was about $21.3 trillion.
Source: National Science Foundation 2016 Science and Engineering Indicators, Appendix Table 6-2.[1]

[1] https://www.nsf.gov/statistics/2016/nsb20161/#/data

Value-added in a country does not imply that those goods and services remain in that country. Figure 2 shows U.S. imports and exports of knowledge-intensive services.

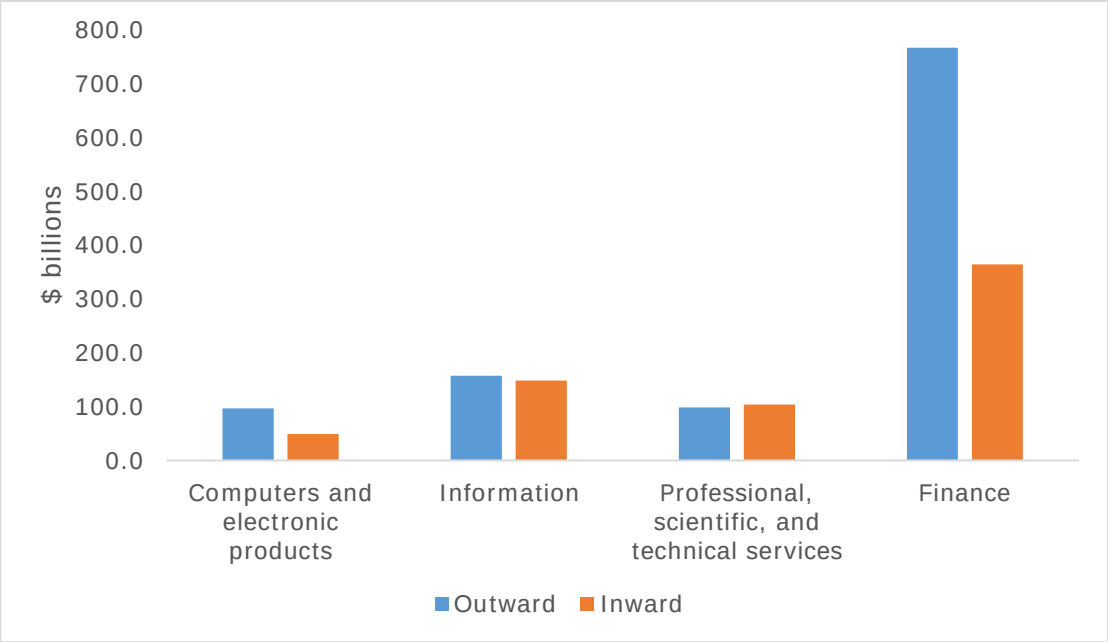
Figure 2: Knowledge-Intensive Services Trade, 2013



Source: National Science Foundation 2016 Science and Engineering Indicators, Table 6-2.

Relatedly, firms will invest where their capital is likely to yield the largest returns. Locations generating the highest returns vary across and within industries, meaning that many firms will invest both domestically and abroad. That generalization applies to non-U.S. firms, as well, meaning that not only do U.S. firms invest abroad, but so, too, do foreign firms invest in the U.S. Figure 3 shows this two-way cross-border investment.

Figure 3: Investment in the U.S. by Foreign Firms and in Foreign Countries by U.S. Firms, 2013



Source: National Science Foundation 2016 Science and Engineering Indicators, Tables 6-5, 6-6.

Trade includes more than goods and services. Increasingly, for example, cross-border data flows have become important parts of the economy. While it is difficult to estimate the value of data flows, in 2014 Michael Mandel noted:

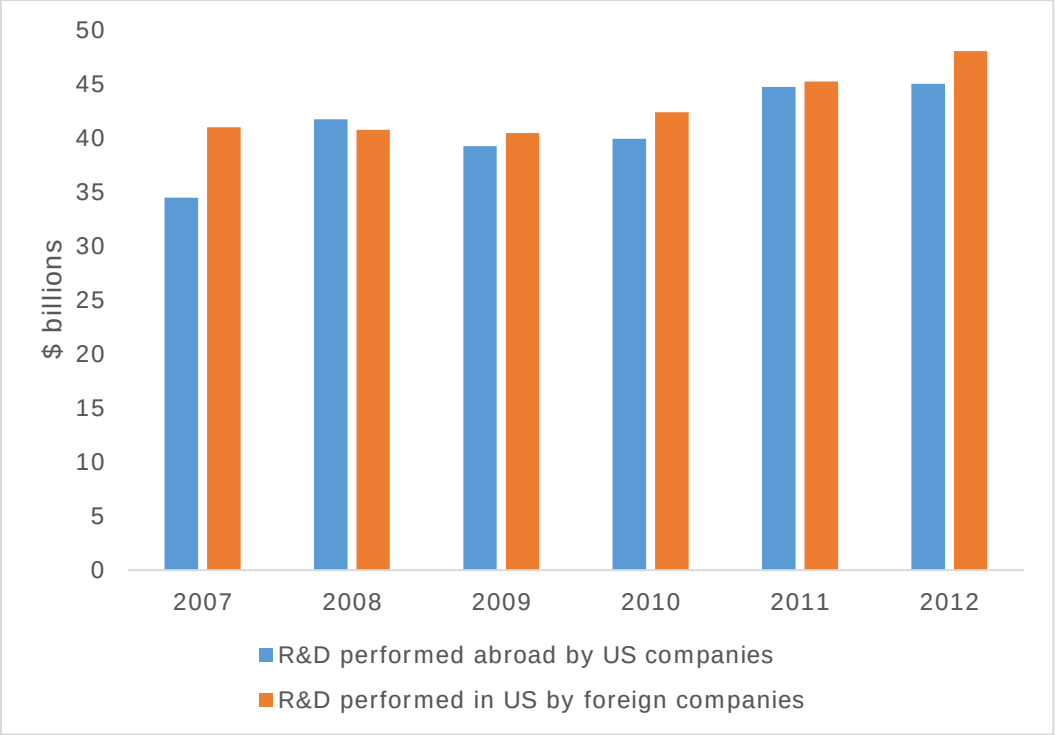
> Data flows that cross national borders are essential to everything from small business exports to manufacturing supply chains, global finance, international medical and physics research, entertainment, tourism, education, social media, and our local communities.[2]

As companies become increasingly automated and more people and things around the globe connect to the Internet, data flows will only become more important.

Research and development, another key to technological progress, is also intertwined around the world. Figure 4 shows that non-U.S. companies do a significant amount of R&D in the U.S., and vice-versa. In 2012, the most recent year available, foreign companies spent about $48 billion on R&D in the U.S. while U.S. companies spent about $45 billion abroad. Companies invest in R&D in particular locations for many reasons, including locations of suppliers and particular groups of researchers, tax policies, and others. Making it more difficult for U.S. firms to invest in R&D abroad is not likely to cause them to move all of that research to the U.S. Some of it would simply disappear, while foreign companies may hesitate to continue investing in the U.S.

[2] Michael Mandel, "Data, Trade, and Growth," April 2014, 2.

Figure 4: R&D Spending by Foreign Companies in U.S. and Vice-Versa[3]



Source: National Science Foundation 2016 Science and Engineering Indicators, Appendix Tables 4-17, 4-18.

Although advancements in science, technology, and innovation are globally interconnected, local innovation clusters like Silicon Valley and domestic research institutions and investment remain important. The next principle focuses on that issue.

Maintain U.S. Technological Leadership and Scientific Institutions

Maintain U.S. technological leadership by providing sufficient resources for our research institutions, including universities, national laboratories, NIH, NSF, and corporations. Focus public R&D spending on areas the private sector is least likely to fund—fundamental or basic research is more likely to fall into this category than is research aimed at commercialization.

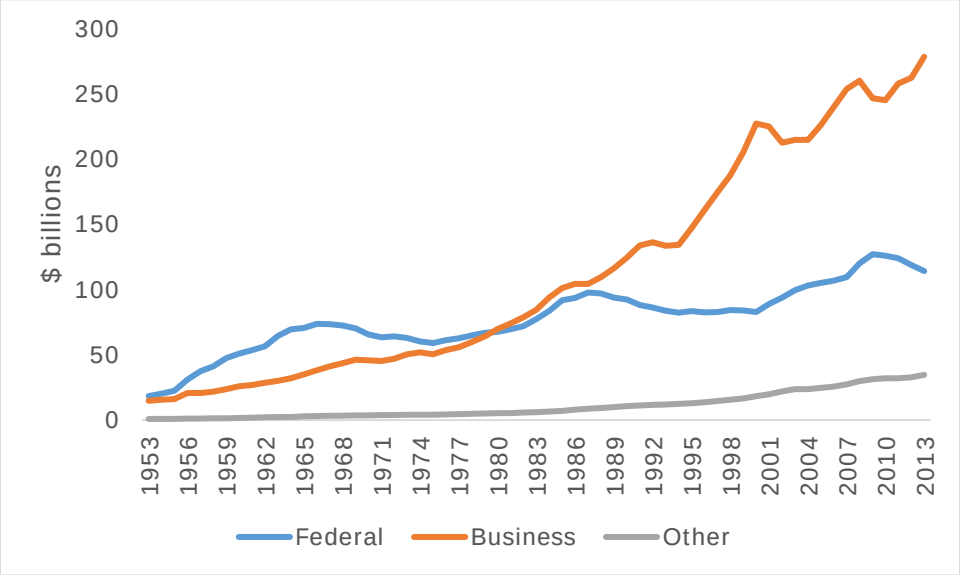
Research results can be used and extended by anybody in new and unexpected directions. This feature of research yields enormous benefits, but also can generate a classic market failure since the private sector will invest less than it would if it could earn all the returns to that investment. Policies to correct this market failure include the patent system, which grants a temporary monopoly to generators of new ideas, and government funding of research and development.

Figure 5 shows the source of R&D funding in the U.S. over time. The figure demonstrates increasing corporate spending on R&D, but recently decreasing federal funds. And because the

[3] Note: Current dollars. "R&D performed in US by foreign companies" indicates R&D performed by majority-owned U.S. affiliates of foreign parent companies. "R&D performed abroad by US companies" indicates "majority-owned foreign affiliates of U.S. parent companies."

economy has been growing, federal funding for R&D as a share of GDP has fallen further than the figure demonstrates.

Figure 5: Source of R&D Funds in the U.S. in Constant Dollars, 1953-2013



Source: National Science Foundation 2016 Science and Engineering Indicators, Appendix Table 4-6.

While it is not possible to determine the "correct" level of public R&D funding, in general government funding should focus on areas that the private sector is less likely to fund, such as fundamental science and basic research. Unfortunately, policymakers are often tempted to direct research funding at projects intended for commercialization. In principle, commercializable projects that would not be funded privately exist. In practice, little evidence suggests government knows how to pick such projects. Instead, government officials are likely to select which projects to fund the same way as the private sector, by picking the projects with the highest expected likelihood of yielding a commercial product.[4] The result is that federal funds aimed explicitly at commercializing products are more likely to be corporate welfare, simply replacing private funds.[5]

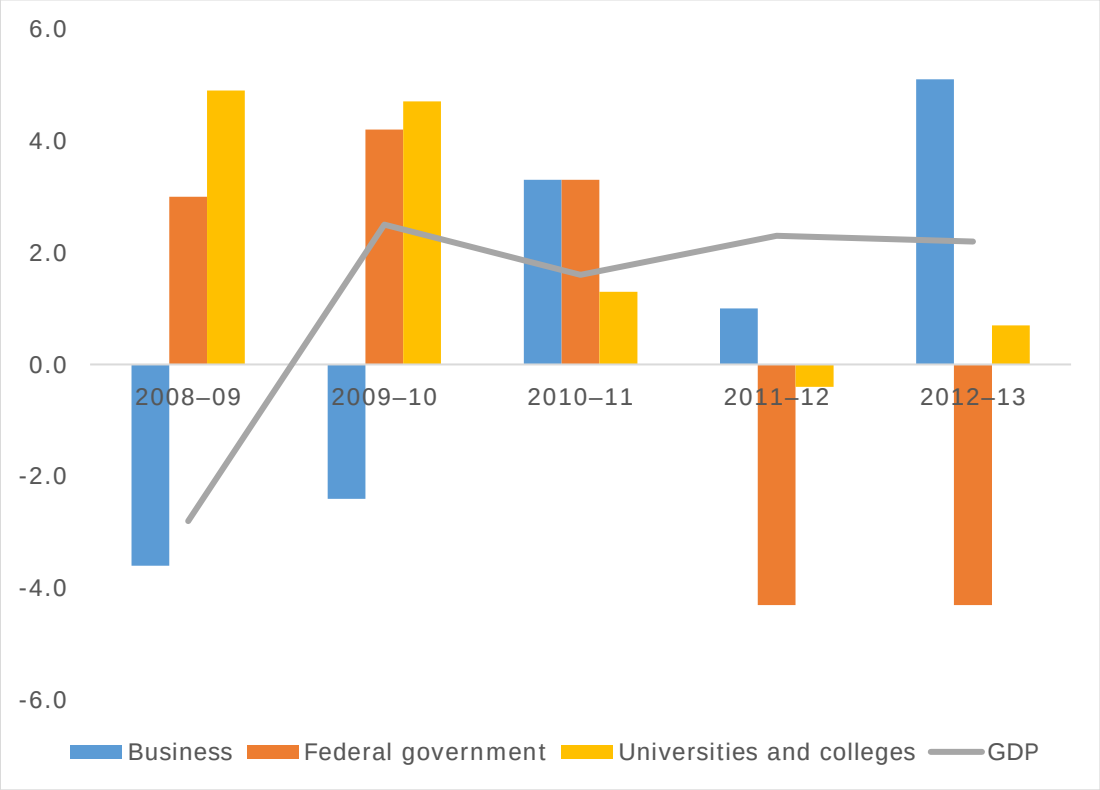
Maintaining our national research infrastructure, however, is crucial. The National Institutes of Health and National Science Foundation, for example, both fund research that business is unlikely to fund. Consider antibiotics. It is well-known that antibiotic-resistant bacteria are a serious and growing public health problem.[6] While pharmaceutical companies are researching new antibiotics, the economics of such research is not especially conducive to private investment. In particular, while there will be demand for most new drugs immediately, best

[4] Scott Wallsten, "The Effects of Government-Industry R&D Programs on Private R&D: The Case of the Small Business Innovation Research Program," *Rand Journal of Economics* 31, no. 1 (2000): 82–100.
[5] Sometimes government funds projects unlikely to be funded by the private sector in order to achieve other social objectives, such as green energy projects. This is a different subject we do not address here.
[6] The White House, "National Action Plan for Combating Antibiotic-Resistant Bacteria," March 2015, https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibotic-resistant_bacteria.pdf.

public health practices mandate that new antibiotics be held in reserve, to be used only if all other antibiotics fail.[7] In other words, the financial returns to antibiotics research are likely to be lower than for other drugs. Yet the pressing need for new antibiotics implies that it must be funded somehow, making this a perfect example of a market failure that can be solved, at least in part, by government funding.[8]

Some evidence suggests that we may be neglecting our research institutions, especially relative to other countries. First, Figure 6 shows generally decreasing R&D funding spent at universities and government research institutions.

Figure 6: Annual Change in R&D by Performing Sector



Source: National Science Foundation 2016 Science and Engineering Indicators, Table 4-2.

R&D spending at businesses has increased consistently, which is good for innovation and the economy. However, while the increase in spending and performance by business has managed to keep total spending as a share of GPD from falling, total spending by China has steadily increased (Figure 7). Given China's rapidly growing economy, this increase in spending as a share of GDP is even more impressive.

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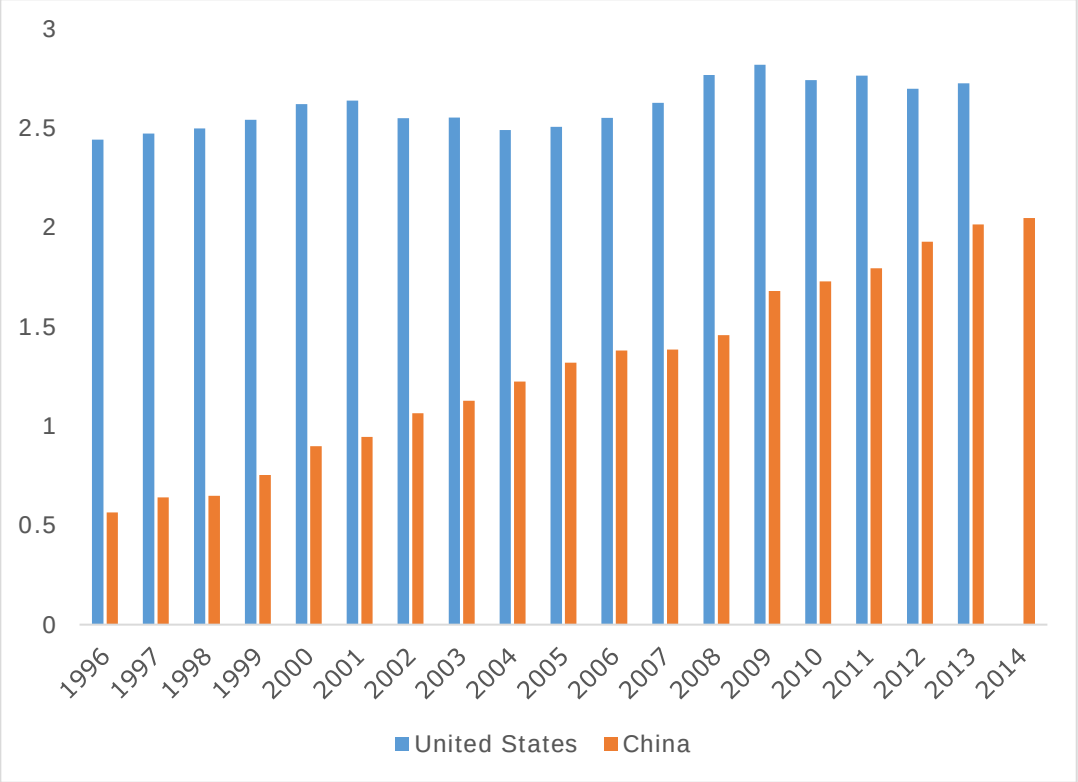
[7] Tom Clarke, "Drug Companies Snub Antibiotics as Pipeline Threatens to Run Dry," *Nature* 425, no. 6955 (September 18, 2003): 225–225, doi:10.1038/425225a.

[8] It also highlights other methods of stimulating additional research. In addition to direct funding, NIH is offering $20 million in awards for "new, innovative and novel laboratory diagnostic tests. The diagnostic tests being sought are those that identify and characterize antibiotic resistant bacteria and those that distinguish between viral and bacterial infections to reduce unnecessary uses of antibiotics."

Figure 7: Total R&D Spending as a Share of GDP in U.S. and China



Source: UNESCO Institute for Statistics.

Policy should ensure that business continues to have incentives to invest in R&D. But we should also ensure that our national research institutions, ranging from government agencies to universities and national laboratories, are adequately funded and incentivized to invest in research least likely to be conducted by the private sector alone.

Make Evaluation Fundamental to Proposed Programs

Evaluate programs rigorously to determine whether they are achieving their intended objectives in a cost-effective manner. Integrate evaluation criteria and methods into program design. Do not penalize agencies for finding that a program doesn't work.

A problem inherent to any government program is that beneficiaries become a constituency that fights changes. Beneficiaries include not just consumers or businesses that receive subsidies, but also the government agency that runs the program. Without hard budget constraints that force agencies to prioritize or the threat of going out of business, programs can continue indefinitely regardless of their benefits. Scarce resources used in one place have an opportunity cost in terms of resources not used elsewhere, even if the agency itself does not pay the opportunity cost.

At the same time, some societal issues can be solved only through, or in cooperation with, government. Universal service in telecommunications is a good example. As a society we have

decided that we want everyone to have the ability to connect to the Internet. In some cases that means subsidizing infrastructure in places where the private sector would not invest on its own and finding ways to encourage people to connect who would not do so otherwise.

Achieving such goals is neither simple nor inexpensive. Not only do funds spent on such projects come with opportunity costs, as described above, but collecting the funds via taxes or fees that are then distributed distort peoples' and firms' decisions, imposing real costs on the economy. It is therefore crucial for programs not just to do what they are supposed to do, but to do so in a cost-effective manner.

These common-sense goals are most likely to be achieved by testing proposed programs via experiments and then building evaluation into the project itself. As many, including the Government Accountability Office, have noted, programs often lack both evaluation and ways to conduct evaluation.[9] Making experiments and evaluations meaningful, however, requires two complementary commitments.

First, those who design and run these programs must commit to learning from the results of experiments and evaluations. The Federal Communications Commission (FCC) admirably ran a series of experiments to test how various aspects of a Lifeline program might affect adoption by low-income non-adopters. The results, however, were disappointing from the point of view of the agency because so few people signed up under the experimental plans. The final Lifeline reform thus barely mentioned the experiments and ignored the results.

The FCC's apparent reluctance to learn from its Lifeline experiments highlights the second commitment: critics and others should not interpret failed experiments as failed policy. The experiment did not turn out how the agency expected, and the low participation rate made it difficult to test many of the specific questions the experiments posed with any statistical precision. However, the failure itself highlighted a crucial gap in our knowledge: we do not truly know how to encourage the last group of low-income non-connected people to subscribe. Revealing a previously unknown unknown and turning it into a known unknown is a significant accomplishment. In short, well-designed experiments can yield crucial insights even if those insights fall outside the bounds of expected results.

Encourage Innovation and Investment in ICT

It is no exaggeration to say that the digital revolution has radically changed the way we live and work over the past two decades or so. On the one hand, it is understandable that policymakers would take a greater interest in these technologies as they are increasingly integrated into our lives. On the other hand, that intervention comes with the risk of slowing or changing innovation.

[9] See, for example, Thomas W. Hazlett and Scott Wallsten, "Unrepentent Policy Failure: Universal Service Subsidies in Voice and Broadband," June 2013.

At a minimum, government should take care that its interventions do not discourage ICT investment and use.

Do Not Regulate Broadband Using Common-Carrier, Utility-Style Regulation

Move away from public utility type regulation of broadband. Use antitrust enforcement based on sound economic analysis to address competition issues in the communications sector.

From the time the 1996 Telecommunications Act was passed until the FCC's Open Internet Order in 2015, broadband ISPs were considered to be "information services" rather than telecommunications services and, therefore, not subject to common carrier regulations. The FCC's rationale for the reclassification as a telecommunications service, and the net neutrality rules that came with it, was consistent with a "precautionary principle" approach to regulation rather than an attempt to correct an existing market failure. In other words, the rules are largely directed at preventing hypothetical concerns rather than remedying existing problems that had no other solution.

The problem with this approach is that it assumes benefits and no costs resulting from the rules.[10] This projection is unlikely to be true as it ignores our generally unhappy experiences with common carrier rules in the past.[11] Common carrier rules enacted by the Interstate Commerce Commission, founded in 1889 in response to the rise of rail transport, led to 229,000 allowed rate classifications, prevented railroads from competing with new forms of transport, and ultimately drove them into bankruptcy. In telecom, FCC innovation-by-permission prevented AT&T from introducing mobile telephony for a decade after it requested the right to do so.[12] There is little reason to believe this new experiment with common carrier regulation on the Internet will have a better outcome.

Concerns with common carrier rules do not mean we should ignore concerns about potentially anticompetitive behavior. Antitrust laws are intended for precisely that purpose, but typically recognize that questions related to competition are complicated. While it is not always possible to define accurately in advance what is and is not anticompetitive, it is possible to define principles and approaches to investigating claims of anticompetitive behavior. Broadband provision is not so different from other sectors of the economy that competitive concerns should be regulated differently. Antitrust concerns should be taken seriously and investigated rigorously, but specific rules focused on ISPs are likely to become increasingly costly as the broadband and related industries progress.

Common carrier regulations are likely to affect investment. Title II classification, specifically, is likely to affect the relative returns on investment in broadband infrastructure, potentially

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[10] See, for example, John W. Mayo et al., "Assessing the Economic Benefits and Costs of the FCC's Imposition of Title II Regulation" (Georgetown Center for Business and Public Policy Economic Policy Vignette, August 2015), http://cbpp.georgetown.edu/sites/cbpp.georgetown.edu/files/Mayo-assessing-economic-benefits-costs-FCCs-imposition-titleII-regulation.pdf.

[11] Scott Wallsten, "FCC Effort to Regulate Internet Ignores History of Past Failures," *The Conversation*, February 24, 2015, http://theconversation.com/fcc-effort-to-regulate-internet-ignores-history-of-past-failures-37953.

[12] Ibid.

affecting the level of investment, the choices firms make about what to invest in, or both.[13] One could imagine, for example, ISPs choosing to invest in private networks not subject to this regulation instead of the public Internet if the relative returns to private networks increases.

Allow Companies to Experiment with Different Business Models without Obtaining Regulatory Permission

Allow innovative business models, a defining feature of the Internet economy, including ones based on price and non-price differentiation without requiring regulatory approval.

The commercial Internet has developed in ways that emphasize particular pricing models: In general, consumers pay directly for Internet connections but then use many of the most popular services for free in exchange for use of certain information about them. This model has generated large benefits, but there is no particular reason to believe this is the only, or the most optimal, business model. Already, consumers have demonstrated their willingness to pay for online video and other subscription services.

Encouraging competition among broadband providers, including wireless, and consumer adoption means allowing companies to experiment with different business models without approval from regulators. Currently, companies are experimenting with zero-rating services—plans that offer unlimited use of certain services or types of services—to help differentiate their offerings from other companies. T-Mobile's Music Freedom and Binge-On programs have helped it compete with bigger wireless providers.

Similar plans may also be useful to encouraging people who have no connections to sign up for Internet service. The FCC's Lifeline experiments referenced above, which were intended to test various features of programs targeted at low-income non-adopters, found that previously unconnected people who signed up as part of the experiments largely did so in order to stay in touch with people.[14] Programs like Facebook's Free Basics, a zero-rating initiative primarily in developing countries that gives consumers unlimited access to any sites (including Facebook) willing to adhere to certain low-bandwidth technical standards, are likely to help encourage people to connect.

Other examples of innovative business models exist, as well. Some providers offer increased data allowances in exchange for providing information or watching ads.[15] AT&T experimented with giving consumers discounts in exchange for their permission to use their data.

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[13] See, for example, John W. Mayo, "Regulation and Investment: Sk(r)ewing the Future for 21st Century Telecommunications?" (Georgetown Center for Business and Public Policy Economic Policy Vignette, June 2016), https://cbpp.georgetown.edu/sites/cbpp.georgetown.edu/files/EPV%20Regulation%20and%20Investment%20John%20W.%20Mayo%206-16-2016.pdf.

[14] Scott Wallsten, "Learning from the FCC's Lifeline Broadband Pilot Projects" (Technology Policy Institute Working Paper, March 2016), https://techpolicyinstitute.org/wp-content/uploads/2016/03/Wallsten_Learning-from-the-FCCs-Lifeline-Broadband-Pilot-Projects.pdf.

[15] Thomas M. Lenard and Scott Wallsten, "An Economic Analysis of the FCC's Privacy Notice of Proposed Rulemaking" (Technology Policy Institute Working Paper, May 25, 2016), https://techpolicyinstitute.org/wp-content/uploads/2016/05/Lenard_Wallsten_FCCprivacycomments.pdf.

It is conceivable that none of these models will prove popular over time, but there is no reason to be locked in to a single method of providing and paying for Internet connectivity and use of services. It is important that firms be allowed to experiment with different business models to encourage investment and innovation.

Continue Making it Easier for Spectrum to Move to More Valuable Uses

Streamline processes for making spectrum available, including by moving it from government to non-government control. Allow flexible uses for all spectrum licenses and continue to make them easier to trade. Develop economics-based criteria for allocating spectrum between licensed and unlicensed.

Access to the radiospectrum is a key input into providing wireless services. The FCC and other policymakers have done an admirable job at moving spectrum into the market, increasing the availability of licensed and unlicensed spectrum, as well as promoting sharing as a mechanism of making government spectrum available for non-governmental uses. More, however, can and should be done.

The FCC should continue making more spectrum available for any, rather than specific, uses, subject to avoiding interference. Newly licensed spectrum generally allows so-called "flexible use," as it should, but the Commission should apply that rule to all existing licenses, not just new ones.[16] This change would reduce the transactions costs involved in moving spectrum to higher-value uses, yielding significant benefits.

Wireless demand has increased for both licensed and unlicensed spectrum. Auctions and secondary trades make it possible to estimate the value of licensed spectrum. Unlicensed spectrum is not subject to market trades, so its demand is expressed largely through lobbying efforts. Research is needed to develop better ways of valuing unlicensed spectrum to help facilitate decisions regarding which spectrum should be sold for exclusive, licensed use and which should be assigned for unlicensed uses.

Allocate Funds for Broadband Buildout Using Techniques Designed to Identify Cost-Effective Projects

Recognize that 100 percent broadband connectivity is aspirational, but not realistic. Funds intended to boost broadband deployment should be distributed in ways that will generate the largest bang-for-the-buck, such as reverse auctions.

Ensuring that all residents and businesses have access to broadband is a bipartisan goal. Both the supply and demand objectives must be considered rationally, however. Consumers desire the services that broadband makes available, not particular broadband technologies. Thus, wired connections will not be feasible everywhere, as the National Broadband Plan made clear.[17]

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[16] See, for example, Christopher DeMuth, "Wireless Telecommunications Policy for American Leadership in the 21st Century," in *Unleashing Opportunity*, ed. Jim Manzi et al. (National Affairs, 2016), 78–96.
[17] Federal Communications Commission, "National Broadband Plan: Connecting America" (Washington, DC, March 2010), http://www.broadband.gov/.

Additionally, as wired and wireless technologies continue to develop, the right type and mix of connections for different areas is likely to change. It is also unrealistic to expect that 100 percent of people or households will connect to the Internet. Even by 2007, about 2.5 percent of American households had neither wireline nor wireless voice telephone service.[18]

With limited resources, therefore, it is important to get the biggest bang for the buck by focusing funds on ways likely to make a difference in connectivity. On the supply side that has two implications.

First, any public subsidies should be distributed in a way that awards projects in order of cost-effectiveness. That is, the first project funded should be the one that will yield the most additional connections per dollar of subsidy spent, with further funding awarded by cost-effectiveness. Such a method could include reverse auctions or similar mechanisms, as done by the FCC in the Mobility Fund Phase I or as described by the *71 Concerned Economists* letter.[19] The outcome would not be perfect, of course—some winning bidders may not be able to follow through on their commitments and bidder projections could turn out to be incorrect. But an analytical approach aimed at achieving cost-effectiveness if more likely to yield an effective outcome than is one based on cost models and politics.

Second, subsidy programs should take demand into account. This is necessary to define minimum standards any supplier must meet in order to participate in the subsidy program. To date, the FCC's changing definition of broadband has been arbitrary.[20] Instead, the definition should consider what people do with their connections and how much they value those different applications. Taking consumer preferences into account is likely to open subsidy programs to a wider range of technologies, including terrestrial wireless and satellite.

Understanding broadband demand is crucial for designing supply subsidy programs, but is also important for designing programs intended to help unconnected low-income people get online. The FCC recently reformed the Universal Service Lifeline program by increasing its funding and allowing it to provide almost $10 per month towards broadband connections for households that meet certain income-based criteria. The problem with the program is that it did not consider the reasons the remaining unconnected people do not connect other than acknowledging the downward slope of the demand curve. While a lower price will attract some additional subscribers on the margin, the benefits are likely to accrue primarily to people who are already online,[21] reducing the effects of the program on connectivity.

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[18] Industry Analysis and Technology Division, Wireline Competition Bureau, "Trends in Telephone Service" (Federal Communications Commission, September 2010), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf Table 7.4.

[19] Paul Milgrom et al., "Comments of 71 Concerned Economists: Using Procurement Auctions to Allocate Broadband Stimulus Grants," 2009, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1377523.

[20] See, for example, Scott Wallsten, "We Don't Need to Define Broadband," *The Hill*, February 2, 2015, http://thehill.com/blogs/pundits-blog/technology/231405-we-dont-need-to-define-broadband.

[21] See, for example, Olga Ukhaneva, "Universal Service in a Wireless World" November 17, 2015, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2430713; John Mayo, Olga Ukhaneva, and Scott Wallsten, "Towards a More Efficient Lifeline Program" (Comments Submitted In the Matter of Lifeline and Link-Up Reform and Modernization WC Docket No. 11-42, August 31, 2015),

As discussed earlier, in 2012 and 2013 the FCC and several ISPs conducted pilot programs to test empirically what is likely to encourage the remaining unconnected low-income people to subscribe. The results were surprising: the experiments managed to sign up only about 10 percent of the number of people they expected, even when offering plans that cost only a few dollars a month.[22] The major lesson from the experiments is that we do not truly understand what keeps this last group from signing up, although surveys of those who did participate are informative. In particular, they generally noted that they signed up not because they got a good price, but because they thought subscribing would help them stay in touch with friends and family.

The implication is that if increasing connectivity is a goal, the FCC (and other organizations) should conduct additional experiments and be willing to learn from them.

Adopt Consistent Privacy Rules for All Firms

Adopt coherent privacy rules based on cost-benefit analysis and apply them consistently across the economy.

The FCC recently adopted a set of privacy rules that require consumers to opt-in to allowing ISPs to use data they collect.[23] The rules have two crucial flaws. First, they do not take into account any of the benefits that use of data has generated, thereby assuming that the rules yield net benefits rather than trying to determine whether they do. Rules such as those adopted by the FCC, which limit the amount of data that can be collected and how it can be used, shared, and combined with other data, are likely to be particularly costly in the world of big data, artificial intelligence and machine learning. Innovations in these areas depend on the ability to use large amounts of data, sometimes in unanticipated ways.

Second, the FCC rules apply only to ISPs despite little rationale for why that should be the case. The Federal Trade Commission, whose jurisdiction over privacy policy included ISPs until Title II reclassification gave the FCC that authority, has labored for years to create coherent privacy rules that balance the benefits of data analysis with consumers' desires to protect certain types of information. Having a single set of rules grounded in cost-benefit analysis will help allow firms to compete against each other, society to continue to reap the benefits of data analysis, and consumers to know that their sensitive information will be kept secure.

Promote Cybersecurity

Ensure that incentives are properly aligned for the private sector and government to implement effective cybersecurity procedures.

The more that information, infrastructure controls, and devices throughout our lives become accessible remotely, the more important it becomes that only intended users have access. The problem is difficult because it involves objectives whose tools are not always inherently

https://www.techpolicyinstitute.org/files/wallsten_lifeline%20and%20link%20up%20reform.pdf.

[22] Wallsten, "Learning from the FCC's Lifeline Broadband Pilot Projects."

[23] Ibid.

compatible: making access easy and intuitive for legitimate users versus locking out all others. At one extreme, all information could be available to everyone without even a username and password. At the other extreme, information may be most secure if every machine operated completely independently, without any connections to the rest of the world. Either of those is, of course, absurd, so the challenges include how to balance the tradeoff and work towards methods of access that are easy for authorized users and difficult for unauthorized users.

The National Institute of Standards and Technology's (NIST) Cybersecurity Framework, which was created through cooperation between government, industry, and others is a positive first step.[24] It recognizes that no single, top-down solution is likely to be effective—that different types of information and systems require different types of security, and provides guidelines and principles for organizations to follow.

Government efforts should continue NIST's approach, with emphasis on ensuring that both the private sector and government actors face incentives to properly take into account the risks of information breaches. In the parlance of economics, policy should ensure that the holder of the information internalizes the costs associated with data breaches.

Ensure that Intellectual Property Rights Increase Innovation and Social Welfare

Ensure that intellectual property rights policies promote innovation and creativity and base reforms on sound data and analysis.

Intellectual property rights are intended to give creators an opportunity to earn a return on their creations in order to encourage creative efforts. One benefit of much creative output like music, movies, and research results is that they can be replicated and used at zero short-term cost, making their benefits potentially available instantly to large numbers of users. However, unrestricted immediate use of inventions or copying of creations would erode the creator's ability to earn a return, thereby substantially reducing the incentives to create new content in the first place. Those are the competing social interests that intellectual property laws try to balance: generating incentives for creators to create by making it possible for them to earn a return on their work versus ensuring that benefits of the creation are widely enjoyed. To put it another way, intellectual property laws attempt to maximize societal benefits of inventions subject to retaining sufficient incentives for people and companies to invest in innovation.

The U.S. Constitution enshrined the importance of taking this balance seriously by noting in Article 1, Section 8, Clause 8 that "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." These exclusive rights are protected by copyrights and patents, respectively.

[24] National Institute of Standards and Technology, "Framework for Improving Critical Infrastructure Cybersecurity Version 1.0," February 12, 2014, https://www.nist.gov/sites/default/files/documents/cyberframework/cybersecurity-framework-021214.pdf.

The limited life of intellectual property rights (as compared to the unlimited term of other forms of property) is a recognition of the public good nature of the creation, with the implication that at some point the creation should be freely available to all users.

The rise of the digital economy has brought new challenges and opportunities to both the copyright and patent regimes. For example, on the copyright side, the digitization of content facilitates the widespread distribution of pirated works. Addressing this problem is a significant challenge. On the other hand, new digital technologies afford an opportunity to introduce competition into the current heavily regulated music licensing system, with the potential to yield significant benefits.

On the patent side, the digital revolution has raised questions about the quality of patents for software and other information technologies. A related vigorous debate involves the need for patent litigation reform and, if so, what those reforms might be. None of these issues is amenable to easy answers.

Copyright and patent reform remain ongoing issues and potential reforms inevitably alter the contours and value of the property right itself. Such reforms, therefore, have important implications for incentives to innovate and create, and should be based on sound data and analysis and a careful weighing of costs and benefits.

Conclusion

Technological progress is a key to long-term increases in standards of living. Government plays a crucial role in ensuring this continued progress. It must allow and encourage the global linkages that help create a virtuous cycle of innovation while also properly supporting our domestic R&D institutions. It should create an environment conducive to investment in ICT infrastructure, creative works, and cybersecurity. Finally, it should require that regulatory interventions pass a cost-benefit test and that proposed subsidy programs be subject to rigorous evaluation and experimentation.