

EXCERPT

DIGITAL REVOLUTIONS IN PUBLIC FINANCE

**SANJEEV GUPTA
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INTERNATIONAL MONETARY FUND

Note to Readers

This is an excerpt from *Digital Revolutions in Public Finance* edited by Sanjeev Gupta, Michael Keen, Alpa Shah, and Geneviève Verdier.

Digitalization holds vast potential for fiscal policy. By transforming how we collect, process, and act on information, it can expand and reshape the way we operate within the frontiers of policymaking. Policymakers now have access to better information and better systems. Digitalization allows for greater storage and tracking of individual information through the maintenance of electronic records, linking of data registries across government using digital platforms, and enhanced capabilities to handle and analyze large data sets.

Although some studies have focused on the impact of new technological digital advances on economic activity, there is little existing literature and guidance on the opportunities and challenges for fiscal policy. This book offers a useful perspective on how governments can leverage new technology to achieve better fiscal policy outcomes and chart such a path.

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Digital Revolutions in Public Finance

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Digital Revolutions in Public Finance

Editors

*Sanjeev Gupta, Michael Keen, Alpa Shah, and
Geneviève Verdier*

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Editors

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Foreword

Fiscal policy has a significant impact on us all. How governments mobilize resources and spend them on public goods and services, and how fiscal policy is used to steer the economy, are critical for the well-being of societies. The better equipped countries are to formulate and execute fiscal policies, the better people's lives will be.

The digital revolution holds vast potential to improve fiscal policy. By transforming the way countries collect, process, and act on information, digital technology can reshape the way governments design and implement their tax, spending and macro-fiscal policies. If technology is used in a smart way, fiscal policy will be more efficient, transparent, equitable, and impactful—improving lives all over the world. The potential benefits are huge.

Governments now have access to *better data*. Digitalization allows for greater storage and tracking of information through electronic records, linking of data registries between different parts of government, and enhanced capabilities to handle and analyze large data sets. With these new data and new capabilities come *better systems*. Many countries are already finding that it costs less to collect taxes, deliver public services, administer social programs, and manage public finances. This has opened *new policy options*, including a more innovative and progressive design of tax systems. Who knows what cognitive systems and artificial intelligence have in store for tax systems and public service delivery in the future?

Most importantly, new policies and better systems can have a *greater impact* on people's lives. The digital revolution in public finance now underway can be transformative for governments *and* for the people they represent and serve.

Each country will need to chart its own path—either by taking incremental steps to digitalize or by leapfrogging to newer and more sophisticated policies and implementation methods. We must not underestimate the institutional challenges and capacity constraints along the way, and the design of new policies must be equitable and inclusive. There are also privacy and cybersecurity concerns and new avenues for fraud, which call for international cooperation and regulation as information increasingly travels across borders. Yet the potential benefits far outweigh the risks.

The IMF and the Bill & Melinda Gates Foundation are proud to be partners in taking forward this important agenda. We share a vision of the future in

which technological innovation helps the poorest and most vulnerable lead healthy, productive lives. In terms of fiscal policy, this means a future in which governments use technology to collect and deploy resources to the benefit of all their citizens.

We hope that this book will take us closer to that future. Together we can harness new technology to achieve better fiscal policy outcomes for all.

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Introduction

Reshaping Public Finance

SANJEEV GUPTA, MICHAEL KEEN, ALPA SHAH, AND GENEVIÈVE VERDIER

The effectiveness of fiscal policy—the collection and use of resources to stabilize the economic cycle, pursue distributional objectives, and enable public spending—depends crucially on the information and technologies available to government, and how it exploits them. Governments stimulate the economy during recessions and retrench during booms. They tax in order to finance social safety nets, health and education services, infrastructure, and so on. The design and implementation of fiscal policy is therefore fundamentally shaped by the reliability, timeliness, and detail of the information available to the government about the economy and its actors. This includes taxpayers' incomes and assets, the identity and circumstances of social program beneficiaries, the employment status of workers, the size of the output gap, and the magnitude and timing of government transactions. By transforming the way in which governments can collect, process and act on information, digitalization¹ is reshaping the formulation and implementation of these policies—a process that has only just begun. This reshaping is the topic of this book.

Computerization—the use of computers to perform human tasks—has become as familiar and routine in government as anywhere else. But now it is yielding to the inherently more profound process of digitalization. And deep-learning technologies are pushing the boundaries of digitalization one step further, with artificial intelligence machines now able to learn by themselves based on information fed to them. Using such technology, computers are now capable of designing industrial objects, generating scientific hypotheses, and even composing music (McAfee and Brynjolfsson 2017).

Digitalization has also vastly increased the possibilities for data collection and storage. In 2000 only 25 percent of data were stored digitally; by 2007 this metric

¹Though the two terms are often used interchangeably, we use *digitization* to refer to the transformation of information storage into digital formats (a series of binary numbers) for use by computers and *digitalization* to refer to the integration of digital technologies into everyday life, including government systems. So the core concern of this book is with digitalization.

had risen to 94 percent (Ross 2016). With multiple means to access and share information—computers, tablets, phones—this revolution has left virtually no corner of the world untouched: in 2014, 90 percent of the world’s population had access to a mobile phone (ITU 2014; GSMA 2013). This digital revolution is having a wide-reaching impact, presenting markets, society, and governments with the challenges of responding to and absorbing this continual change.

This chapter first argues that while the digital revolution offers exciting new opportunities for public finance (better information, systems, and policy)—which are the focus of the next section—it is not without significant challenges and limitations. These are taken up in the second section. The third section discusses how countries will need to take steps based on their own circumstances, and highlights the need for them to cooperate in tackling emerging challenges. The remainder of the chapter details the contributions of the book.

NEW OPPORTUNITIES

Through digitalization, government can potentially conduct current fiscal policy more effectively—doing what we do now, but better—and perhaps before too long, design policy in new ways—doing things, that is, that we do not, and cannot, do now. They can have better information, build better systems, and design and implement better policies.

Better Information

Of the digital revolution’s many potential benefits, the most visible and crucial may well be the ability to collect, process, and disseminate more timely, easily accessible, and transparent information on economic activity. Greater storage capacity and computing power means that governments can now collect *more* information, by tracking and recording a vast range and volume of transactions and interactions.

Tax authorities are increasingly gaining access to the vast amount of information held by the private sector—such as data on bank transactions and interest income—through the use of digital systems, standardized reporting formats, and electronic interfaces. Systems for sharing information have also improved. The increasing trend toward single-view online portals or digital platforms allows fiscal authorities access to data across government departments. New norms in global tax transparency have led to the development of a global reporting standard on automatic exchange of information on the financial records of nonresidents with the tax authorities in their country of residence.

Governments can now collect more *timely* information. Tax authorities in Australia and the United Kingdom are now receiving real-time reporting of payroll information, and, in Brazil and Russia, electronic invoicing systems allow immediate access to data on firm sales. With the automation of public finance management, a number of governments can now access high-frequency fiscal data through their information technology systems. Some countries—such as Brazil

and the United States—even make these daily cash operations available to the public.

Digitalization also allows for more *precise* identification of individuals and their associated activities. New technology to monitor and record biometric characteristics provides a unique, secure, and less-costly alternative to more traditional paper-based official documentation systems. In many developing countries, this technology has given governments and citizens the means to authenticate official identity, strengthening civil registries and national ID card systems using various physical traits, including fingerprints, iris scans, vein patterns, and DNA. Gelb and Clark (2013) find projects to biometrically identify people—small and large, by governments and by nongovernment organizations—in more than 80 countries. Latin America leads the way in biometric-enabled national identity systems, but other regions are not far behind. Africa, Angola, Ghana, Nigeria, and South Africa have established or are planning such systems. Countries in South Asia such as Afghanistan, Bangladesh, Nepal, and Pakistan are following suit. India's *Aadhaar* is the world's largest biometric identification system, with more than 1.1 billion citizens registered.

In the private sector, the constant recording of digital information in real time has given rise to a data economy, with individuals leaving a digital trail with every internet search, retail transaction, and activity that is carried out using digital means. Businesses are already buying and selling these data, and using them in conjunction with artificial intelligence algorithms to better target their advertising efforts. Governments are already starting to catch on, and such big data and cognitive computing may also expand policy and enforcement options.

Better Systems

With new information and new capabilities, a wide range of new possibilities emerge for enhanced implementation of tax and spending policies. These include lower costs of tax collection and compliance, as well as of delivering public services, administering social programs, and managing public finances.

Tax Administration

Electronic filing of tax returns has reduced the cost of compliance for taxpayers and of administration for the government. Many countries began experimenting with electronic filing of tax returns, for example, as early as 10 to 15 years ago (OECD 2006; Deloitte 2013). Furthermore, access to third-party information has allowed governments increasingly to “prepopulate” tax returns, easing the compliance burden even further, with taxpayers simply having to verify the information they are presented with. And access to additional information sources and capabilities to link existing information in various government systems is helping tax authorities to better detect evasion or avoidance.

Digitalization has allowed governments to implement electronic tracking of business activity. For example, tracking of sales through the use of e-invoices has

facilitated more efficient administration of indirect taxes, a common area of fraud and revenue leakage. Russia has seen the rollout of online cash registers that record information on each transaction, which is then transferred immediately to a server where tax authorities can access it. For decades, massive cross-checking of value-added tax (VAT) invoices (to verify that sellers have been charged the tax for which they seek a credit) was presumed to be technically impossible; now China is showing that it can be done.² In Brazil, the Public System of Digital Bookkeeping or SPED system allows tax authorities to determine a company's income tax obligation based on information the business enters into an annual digital bookkeeping report.

With data being collected in more standardized formats, increased processing capabilities have allowed tax authorities to assess taxpayer risks by analyzing large data sets and by combining different sources of data (for example, firm-level input and output data for VAT purposes). In the United Kingdom, HM Revenue and Customs' Connect computer draws on information from a wide range of government and corporate sources, as well as individual digital footprints, to create a profile of each taxpayer's total income. Such analytical capability could even be used to assess the behavioral impact of new tax and spending policies.

Digital systems present new roles for consumers and third parties in facilitating enhanced compliance. The emerging peer-to-peer (P2P) economy, in which a digital platform intermediates transactions between individual buyers and sellers, has introduced organization and formalization to previously informal and perhaps undocumented activities. Such platforms record large volumes of consumption and income data which, if accessible by tax authorities, could play an important role in tax administration (as discussed in Chapter 3 by Aslam and Shah). Estonia, for instance, uses the platform technology to connect Uber drivers directly with the tax office, adding income from rides directly to their tax return. Offering a role for consumers as auditors, the *Nota Fiscal Paulista* program in São Paulo, Brazil, using a digital payments system, is designed to encourage better enforcement of the VAT at the final consumer stage by providing a 30 percent tax rebate and monthly lottery prizes to consumers who ask for receipts.³

Public Spending, Service Delivery, and Administration

Digitalization can help improve public service delivery. First, governments can take advantage of greater capabilities to disseminate important information. Studies have found that sharing information through text messaging about best agricultural practices and commodity prices can improve farmer knowledge. Similarly, information about breastfeeding and sexual and reproductive health shared through mobile phones has increased recipients' knowledge (see Chapter 8 by Aker). Estonia stands out in its use of digital platforms for delivering government services. Using an electronic identity card, citizens can vote online and

²See for instance Fan and others (2017).

³See Naritomi (2015) for an assessment.

consult medical records—just a few of the 600 e-services that the government offers (see Chapter 12 by Cangiano, Gelb, and Goodwin-Groen). Digital technology can also help improve the quality of services. Results from impact evaluations in Haiti, India, Pakistan, and Uganda suggest that digital monitoring can reduce the pervasive absenteeism of some key public service workers, including nurses, doctors, and teachers (World Bank 2016).

The use of electronic payment systems has helped cut bureaucratic inefficiencies, produce fiscal savings, and facilitated the delivery of benefits (see Chapters 8, 11, and 12 by Aker; Roy and Rai; and Cangiano, Gelb, and Goodwin-Groen, respectively). In Haiti and the Philippines, for instance, the cost per transaction of some social assistance programs fell by close to or more than 50 percent per transaction once payments had been digitalized (Zimmerman, Bohling, and Rotman Parker 2014). Governments are now extensively using biometric technology to expand coverage of social benefits and improve targeting. Launched in 2013, the Indian government's Direct Benefit Transfer program significantly changed the delivery system of subsidy and welfare benefits by transferring payments directly into bank accounts linked to beneficiaries' Aadhaar biometric ID (see Chapter 11 by Roy and Rai and Chapter 12 by Cangiano, Gelb, and Goodwin-Groen).

At the same time, digitalization of government payments has often reduced fraud and corruption (see Chapter 13 by Lund, White, and Lamb). In Sierra Leone, the introduction of e-payments through mobile wallets during the Ebola crisis restored payments to healthcare workers whose salaries had often been stolen (Bangura 2016). In Côte d'Ivoire, most secondary school students pay their school fees digitally, virtually eliminating the high levels of theft and bribery that were commonplace after the country's civil war (Frydrych, Scharwatt, and Vonthron 2015).

A world in which databases are linked across government agencies and relevant third parties offers opportunities to expand benefit coverage. Attempts to fight poverty through redistribution are often thwarted by the failure of many eligible citizens to register for benefits. Non-take-up rates can be high: a 2016 study for the French National Assembly estimated that one-third of eligible citizens failed to take up guaranteed minimum income benefits (prior to its 2016 reform).⁴ The non-take-up rate for in-work benefits was higher, at two-thirds of eligible citizens. If information about individuals is synchronized across public agencies and employers—with digital authentication (biometric if necessary) linked to banking information—changes in individual circumstances automatically captured in these data could immediately trigger coverage and benefit payment without requiring lengthy and possibly stigmatizing procedures for proving eligibility that involve filling in forms and standing in queues. Coverage inclusion as the default—rather than exclusion—would more closely align with the original policy objective and reduce poverty, though possibly at a higher fiscal cost.

⁴See <http://www.assemblee-nationale.fr/14/rap-info/i4158.asp> for more information.

Better Policies

Greater access to information and enhanced digital systems and processing capabilities could also open up new policy options.

The ability to monitor and unify information on taxpayers' income, consumption, and wealth on a timely basis offers scope to rethink the design of tax policy. For example, current systems have arbitrarily imposed a one-year period as the normal basis for income taxation, but with better access to and ease of manipulating data, something closer to a lifetime basis—arguably more equitable, and potentially more efficient too—may become possible. While for practical reasons, capital gains under current tax systems are often taxed only on realization, technology can now allow regular tracking and recording of asset values to allow gains to be taxed upon accrual.

The increased scope for individual taxpayer information exchange and matching across countries might even, ultimately, be used to impose capital income taxation directly on shareholders, eliminating the role of the corporate tax as a device for withholding tax on final shareholders. Technology that allows electronic tracking and tagging of individual consumer purchases could pave the way to more innovative and progressive systems of consumption tax, for example, by tracking (and taxing) lifetime consumption.

The availability of high-frequency fiscal data presents significant opportunities for fiscal policymakers, such as better forecasting of revenues and budget preparation. Daily fiscal data can be particularly useful to policymakers attempting to stabilize the business cycle, allowing governments to monitor economic activity in real time. With increased capacity to store and analyze data, governments can exploit the correlation of tax receipts with the business cycle to anticipate a crisis or monitor cash balances to better assess liquidity and borrowing needs (see Chapter 6 by Misch, Olden, Poplawski-Ribeiro, and Kejji).

In many countries, digitalization is also enabling improvements in governance and fiscal transparency, allowing citizens easy access to information on government revenues and spending, such as through data.gov.uk in the United Kingdom, or encouraging public participation in the budget process, as through D-Brain in Korea.⁵ In this regard, the so-called Digital 5 countries—Estonia, Israel, New Zealand, Korea, and the United Kingdom⁶—have committed to build better digital public services based on the principles of open standards, open source systems, open markets, and transparency in government.

⁵See Chambers, Dimitrova, and Pollock (2016) for a report on outcomes.

⁶See the Digital 5 Charter at <https://www.ict.govt.nz/assets/Uploads/D5Charter-signed-accessible.pdf>.

NEW CHALLENGES—AND OLD ONES THAT WON'T GO AWAY

While the book illustrates the many potential benefits of the digital revolution, it also stresses that digitalization reforms require careful design and safeguards, and a clear understanding of the challenges and limitations.

Old and Familiar Challenges

Government Adoption of Technology

The implementation of new technology by governments must be appropriate to their capacity. Countries have absorbed new innovations at differing paces, reflecting the challenges of adopting technology in the public sector. Political, institutional, and human capacity constraints will continue to hinder government innovation and uptake of advanced technological solutions.

Past failures in introducing integrated financial management information systems, particularly in developing countries, illustrate some of these constraints.⁷ In many countries, obstacles to successful implementation of such systems included institutional bureaucratic resistance, limited capacity of governments to adopt innovative systems, as well as exploitation of new technologies for personal gain (Diamond and Khemani 2005; USAID 2008). There is no shortage of warnings to be drawn from examples of governments failing to reap the potential advantages of technological transformation.

Digital Inclusion

In order to digitally administer tax payment and spending systems, governments must ensure that as many individuals and businesses as possible are able to access the digital world and are taking up digital technology. This may involve financial inclusion initiatives to ensure that citizens have access to a formal banking system or—perhaps more risky given the possibility of foregoing revenue unnecessarily—tax incentives such as reduced VAT or turnover tax rates to encourage the use of digital payment systems over cash payments, as seen in Argentina, Korea, and Uruguay. Other countries (China, United Arab Emirates) have launched digital wallet or mobile money initiatives to provide an alternative to cash for those without access to bank accounts.

The rollout of new technology and initiatives must be carefully designed, recognizing the transition time and costs for adoption by individuals and businesses. For example, new electronic-reporting requirements may impose a high burden on small businesses, and some individuals may have no access to digital technology, requiring alternative arrangements. The November 2016 surprise

⁷Integrated financial management information systems computerize and automate budget and accounting operations, enabling access to reliable operations data and increasing fiscal transparency and control.

demonetization in India is a case in point. The seemingly overnight decision to remove large-denomination notes—while intended to reduce the scale of illegal transactions conducted with “black” money and accelerate the digitalization of the Indian economy—caused widespread disruption in retail markets for small businesses and consumers alike.

Complementary Institutional Reforms

Taking full advantage of the opportunities of digitalization can require government to organize itself differently and move away from traditional skill mixes. For instance, digitalization eases the more complete integration of tax and social benefit systems (recognizing that social support payments are simply negative taxes). Indeed, many tax administrations increasingly find themselves not only collecting money, but paying it out as well. And that can require quite different skills and processes. Sorting out a complex tax case can take months or years, to no very great harm. But complex and rapidly changing personal circumstances—the mother who finds herself suddenly homeless—need quick response, and personal skills required to deal with such emergencies can be quite different from those needed to explain VAT refund entitlement. At a wider level too, linking information across government agencies—between the tax administration and health services, for instance—and between government and private institutions—the tax administration and P2P enterprises, for example—can require developing new channels and protocols for such exchange.

New Challenges

Revolutions are not easy times to live through and can have their nastier aspects. The digital revolutions discussed in this book are no exception.

New Taxation Problems

Governments might approach the digital revolution with some caution and vigilance, with some awareness that innovations can often incentivize individual and corporate behavior in directions that make effective taxation harder, not easier.

There is no shortage of examples of tax fraudsters undermining or even exploiting governments’ deployment of new technologies. The use of electronic cash registers, for instance, led to the development of “zappers”: software that simply deletes the records of some sales in ways intended to be undetectable. In 2009, the Emissions Trading System of the European Union (buying and selling of rights to emit carbon) was brought to a halt by VAT fraud—at a revenue loss put by Europol at €5 billion—that exploited online trading and was in part hidden behind the cover of the sheer speed and volume of derivatives trading. And some European countries have been attacked by VAT schemes that involved automated submission of multiple fraudulent VAT refund claims, each too small by itself for the tax administration to focus its attention on, but, through their sheer number, significant in aggregate. Criminal attacks, it is important to bear

in mind, can be extraordinarily sophisticated. It will not be easy for governments to keep one step ahead.

In the corporate sphere, much recent attention has been given to the tax planning strategies used by multinationals to reduce their tax base (IMF 2014; OECD 2013). Over recent years, digitalization has intensified these challenges by enabling an increasing number of companies, including many household names, to operate and sell electronically in multiple jurisdictions without having much of a physical presence there. As discussed in Chapter 4 by Devereux and Vella, one approach to this problem is to widen the current notion of what it means to be active in a country for tax purposes—a “doing what we do now but better” approach. A more radical alternative, also explored in that chapter, is to change the nature of the corporate tax more profoundly, so as to impose the tax liability where consumers or shareholders are located, rather than where the business has a production-related presence—very much a “doing things differently” approach.

As information becomes valuable and readily traded, questions arise as to whether it should be an object of taxation in itself. It could be argued, for instance, that information about the behaviors and preferences of a country’s citizens is a collective asset of that country in much the same way as would be any oil, gold, or other natural resource asset lying within its borders. From that, it is a short step to see a potential taxing right akin to that widely recognized and exercised in relation to natural resources. This, again, would be a radical departure from current norms.

Getting the Information

The impact of digitalization depends heavily on the accuracy and timeliness of information collected. Prepopulation of tax returns, for instance, might be an attractive option for reducing compliance and administration costs, but the system must be carefully designed and implemented to ensure that it does not provide opportunities and motivation for cheating. If the prepopulated information is unduly favorable to the taxpayer, for instance, one might not expect the taxpayer to voluntarily correct it: psychologically, prepopulation transfers “ownership” of errors from the taxpayer to the revenue agency (see Chapter 5 by Chen, Grimshaw, and Myles).

Ensuring adequate data quality requires appropriate incentives for revealing such information. Those wishing to avoid prosecution or large tax bills, for instance, have an incentive to find ways not to leave a digital trail of their transactions. One route to this is the use of cash, and eliminating this opportunity for concealment is a key merit of the movement to a cashless economy notably urged by Rogoff (2016). Several countries have taken steps to “demonetize” or withdraw large-denomination notes from circulation to stamp out undocumented activity and encourage use of digital money transfers, with India, discussed in Chapter 11 by Roy and Rai, being the prime example. The dark web, however, has shown private initiative to be adept in developing ways to transact online without leaving traceable footprints. While this will become less attractive as the ease of traceable

digital transactions continues to increase, reducing incentives to use untraceable alternatives, such as decentralized cryptocurrencies, will remain a key concern.

Privacy

While increased information provides opportunities for more targeted design and implementation of tax and spending policy, there are significant sensitivities surrounding the collection of detailed individual and corporate information. The real-time recording of digital information on individuals and the use of such data by businesses in their marketing efforts have raised concerns about how the management and use of information should be regulated and protected. And while people often readily provide their data to retail companies or leave digital footprints in the form of social media activity, government recording and management of individual data is often met with Orwellian unease.

As noted earlier, some countries are now moving to a single-platform approach, connecting information on citizens held by different government ministries and centralizing storage and processing in a handful of data centers. While such data systems can be used for more efficient and targeted tax and spending policies, in the wrong hands they could easily be used to cause social and economic disruption. Indeed, recent years have seen intrusions of privacy with hacking, leaks, and ransom attacks at major government institutions worldwide, highlighting the vulnerability of government systems to outside intrusion.

In the end, the nature and extent of possible data collection is a function of institutional and sociopolitical factors and may be more limited in countries where trust in government or rule of law is weak. However, what is clear is that to envisage the enhanced fiscal policies conceptualized in this book, government oversight of citizens may require a new level of scrutiny if citizens are to trust in how oversight is exercised.

Fundamental Limits

While the digital revolution undoubtedly expands the fiscal policy frontier, solving some institutional or development problems may remain beyond the scope of technology. Electronic payment systems tighten controls and can reduce fraud and corruption. But one must not be naive. Criminals have already proved remarkably adept in attacking tax systems. Bribery and theft can occur after transfers made electronically to a government worker have been cashed at the local bank. Farmers may receive better information about agricultural practices but will still need access to roads and markets to sell their commodities. Blockchain technology may allow for more secure management of land registries, but this will be of little use in a country whose original paper-based registry has been destroyed. Capital gains will remain difficult to tax on accrual for assets that are not regularly traded, and so are hard to value. In other words, digitalization will not remove the institutional constraints under which fiscal policy must often operate, for example, where public and private incentives are not aligned, access to markets is limited for large segments of the population or property rights are ill-defined.

Moreover, digitalization does not solve one fundamental problem of public finance: the inability to observe private information to distinguish between individual ability, effort, and luck. An ideal tax and transfer system would not be based on an individual's income, but rather her initial circumstances and characteristics. The debate has only just begun as to whether these characteristics might at some point become observable, and then subject to manipulation.⁸

LOOKING FORWARD

The digital revolution is already well under way. Governments must respond or be left behind.

Each country's path to digitalization must depend on its circumstances. While most advanced economies are choosing more incremental approaches, for developing countries, technological advances offer the potential to "leapfrog" to newer and more sophisticated policy formulation, design, and implementation.

Countries with more basic infrastructure may be able to leapfrog directly to the latest digital technologies. For example, some countries without universal fixed landline infrastructure have jumped to more sophisticated and accessible mobile phone and internet technology. Kenya—which has pioneered the use of mobile-phone-based money transfer through M-Pesa—now even allows the direct payment of taxes and for government services by mobile phone (see Chapter 10 by Ndung'u). Such technology has been extended to fragile states such as Afghanistan, where the ability to raise revenues is hampered by conflict and corruption. Estonia, starting from a low infrastructure base after independence from the Soviet Union, jumped over several stages of development, now operating in a fully digitalized environment, using blockchain-distributed ledger technology to keep systems secure, and a "data embassy" housed in Luxembourg, capable of rebooting the country in case of cyberattack.

The digital revolution is raising hard questions around inequality and redistribution. Digitalization comes with an increased automation of manual labor jobs, with software and robots performing some jobs partially, or even, at times, entirely (Acemoglu and Restrepo 2016). This can have important implications across countries too: automation may have adverse effects for developing countries, for example, where a large amount of low-cost labor is employed by multinational companies to carry out manufacturing work. And as digitalization allows scope for substantial profit generation, there will be implications for employment and income distribution as the greatest benefits are likely to be enjoyed by the providers of intellectual and financial capital.

These changing employment and distributional trends are already starting to raise questions about the appropriate fiscal policy response. One example is the suggestion that the increased use of labor-replacing "robot capital" should be

⁸This is touched on in Chapter 2 by Jacobs and Chapter 5 by Chen, Grimshaw, and Myles, which take contrasting positions.

taxed.⁹ Another approach, more in line with economists' reluctance to forgo improvements in the efficiency of production, would be to ensure a fairer distribution of ownership and to tax the economic value created by robots. More immediately, the possibility of increasing job destruction and structural unemployment is raising anew the question of whether it is time to move toward adoption of a universal basic income (IMF 2017).¹⁰ Others are more optimistic. Brynjolfsson and McAfee (2014) present a vision of a future in which we can shape technology rather than the opposite and in which policy can increase overall economic growth to improve job prospects for all, even as digitalization takes hold, by investing in education, research and development, and infrastructure.

The digital revolution also underscores the importance of international cooperation. Information is now flowing across borders with unprecedented pace and volume, with significant impacts on innovation, global supply chains, international trade, and capital flows.¹¹ Serious cybersecurity threats and concerns have highlighted the vulnerability of systems to widespread and costly disruption of economic activity and the importance of international cooperation in an interdependent digital economy, including to address these threats. In an ever-more-interconnected global system, greater coordination may well also be necessary to resolve the international tax challenges exacerbated by the digital revolution.

The challenges that lie ahead for governments, if they are to realize the full potential of digitalization, will try the established ways in which they have gone about their business—and even how they think about what that business is.

WHAT DOES THIS BOOK COVER?

This book is divided into five parts. Part I explores the new frontiers in tax policy and revenue administration, starting with a broader look at the implications of digitalization for tax policy design before focusing on the emerging P2P economy, challenges of corporate taxation in an increasingly digitalized economy, and the use of prepopulation and online guidance for tax administration. Part II discusses the transformative potential of digitalization for broader fiscal management, from the availability of daily fiscal data to blockchain and artificial intelligence. Part III turns to spending policy and discusses how even simple and now-ubiquitous technology and information—mobile phones, biometric data—can help improve public service delivery and perhaps even the targeting of social

⁹The Korean government is proposing something along these lines, not introducing a tax, but scaling back tax incentives for investment in automation (see *The Telegraph* 2017).

¹⁰In its most commonly used definition, a universal basic income is a uniform transfer given to all citizens on a regular basis. Most prominently, some form of a universal basic income has been advocated by Atkinson (2015). IMF (2017) also discusses universal basic income as a policy option for tackling inequality.

¹¹See He and others (2017) for a discussion of the impact of new technological innovations in the financial sector, in particular in the area of cross-border payments, including possible regulatory challenges and areas for international cooperation.

benefits, while also stressing that they do not in themselves necessarily solve or sidestep deeper institutional problems. Part IV describes and reviews experiences with digitalization in a number of countries, including, notably, Kenya and India. Part V concludes by quantifying the size of the potential benefit from the digital revolution.

Part I: Pushing the Frontiers in Tax Policy and Revenue Administration

Bas Jacobs opens in Chapter 2 by exploring the implications of expanded information and analytical capacity presented by the digital revolution for tax policy and enforcement. These can be profound, since information constraints lie at the heart of the traditional economic analysis of taxation. For the optimal tax theorist, in an ideal world, governments would be able to completely verify all relevant fixed economic characteristics of taxpayers at zero cost. In such a world, nondistortionary individualized lump-sum taxes would be available to redistribute income and raise revenue: information being perfect, tax avoidance and evasion would be impossible. In reality, of course, the government does not have such perfect information, and taxpayers may misrepresent their income, consumption, wealth, or bequests to avoid or even evade taxes. To alleviate these problems, the government uses tax audits to verify economic outcomes, along with penalties for noncompliance.

So, what does the digital revolution mean for tax policy design and enforcement? First, *Jacobs* argues that digitalization can help improve the enforcement capacity of tax authorities by providing more possibilities to verify the true economic outcomes of taxpayers. For instance, greater use of digital payment methods may provide the government with more information on total individual consumption expenditures, allowing tax authorities to verify more effectively than at present whether reported (labor and capital) income and wealth holdings are in line with observed consumption levels. Digitalization could also help improve compliance by creating and linking data registers on wealth and capital incomes, with financial institutions acting as third-party reporters—indeed this is to some degree already happening.

Second, digitalization can allow governments to implement more sophisticated tax systems than are currently in place. For example, tax liabilities could be conditioned not only on the taxpayer's current yearly income, but also on income earned in different periods, income earned by spouses, asset holdings, and so on. By conditioning tax schedules on more information, the government can target income redistribution better and potentially in more efficient ways. Of course, whether governments will actually implement such tax reforms is determined not only by the economic benefits of having better tax enforcement or more efficient tax systems, but also by horizontal-equity considerations and citizens' concerns over privacy and the potential abuse of state powers. Indeed, these concerns might be the reason why many of the suggested tax reforms have not been implemented so far. Nonetheless, as the author concludes, understanding the new position of

the tax policy frontier is important for policymakers in an increasingly digitalized world.

In addition to recognizing the potential opportunities for tax policy, governments must also position themselves to adequately respond to new types of economic activity generated in this increasingly digital world, particularly where such activity presents challenges for domestic revenue mobilization.

In Chapter 3, *Aqib Aslam* and *Alpa Shah* take up a leading instance of this, exploring the tax policy and administration issues associated with digitally intermediated P2P activities—facilitated through online platforms—that have emerged as an increasingly popular way to organize activity and provide goods and services. They review the key features of the P2P economy that could be deciding factors in its future tax treatment. Importantly, they argue that the emergence of P2P activities does not necessarily require a radical rethink of the existing tax system or the principles on which it is based.

Instead, the P2P economy—should it continue to grow—is forcing tax policy and administration to reconsider old trade-offs in a new light. Specifically, as the P2P sector continues to grow, the number of new small businesses is increasing, particularly at the lower end of the income distribution. Should this continue, existing well-known challenges for taxing large numbers of small businesses will only increase. Furthermore, these new entrants could displace larger firms, while at the same time formalizing previously undocumented activity.

Happily, the P2P economy also presents an important and distinct opportunity. Digital platforms can already act as custodians for tax administrations by withholding various taxes (potentially including both sales taxes and income tax on those providing the intermediated services), a role which could help ease both compliance and administration while raising revenue, particularly in low-capacity countries. In addition, as online intermediaries, P2P platforms are recording data on the myriad of transactions taking place in their virtual markets. If governments were to cooperate with them to access these data, this could alleviate information constraints and strengthen tax enforcement and allow for better quantification of activity that has until now been undocumented.

In Chapter 4, *Michael Devereux* and *John Vella* explore the challenges created by digitalization for the taxation of the profits of multinational enterprises. Under the current international tax architecture, source countries are allocated primary taxing rights on businesses' active income and residence countries on the primary taxing rights on passive income, such as dividends, royalties, and interest. However, the actual allocation of taxable profit depends on the nature and extent of avoidance—"profit shifting"—activities undertaken by multinationals.

The authors explore the ways in which digitalization has increased the internationalization of business, generating increasingly complex supply chains which expand the possibilities for profit shifting and challenge traditional notions of a strong physical presence in a country being required for a company to be liable to corporate tax there, posing serious challenges for the national taxation of such multinational corporations. Digital businesses are at the forefront of these concerns, seeming to be particularly adept at shifting profit to low-tax jurisdictions.

The chapter calls for fundamental reform to address the stresses now placed on the international corporate tax system, arguing that they point instead to some system in which taxation is based on relatively immobile factors—so limiting opportunities for the tax base to be shifted elsewhere. It raises and explores two possibilities: to tax where shareholders are located or where consumers are located. (For the first of these, digitalization may eventually come to help implementation, enabling profits to be directly attached to shareholders, as noted earlier, and taxed at their level.) It also discusses the distinct and highly contentious corporate tax challenges posed by certain types of digital business that offer their services for “free” to one side of the market they serve.

In Chapter 5, *Jingnan Chen*, *Shaun Grimshaw*, and *Gareth Myles* report direct evidence from laboratory experiments in the United Kingdom on the behavioral implications of digital interventions to improve taxpayer compliance. One experiment relates to the prepopulation of tax returns, which is already practiced in several advanced economies (such as Australia, Denmark, and the Netherlands). Here the issue they examine is how taxpayers are likely to react when the information they are presented with is incorrect. When the mistake is in the taxpayers’ favor, it emerges that taxpayers tend not to correct it. This does not in itself mean that, overall, prepopulation is bad for compliance—that seems unlikely to be the case, and there are clear advantages in terms of reducing the taxpayers’ costs of complying with their obligations—but it does caution that inaccurate or incomplete prepopulation carries dangers in signaling weaknesses in the information available to the revenue service. Perhaps surprisingly, the results also suggest that when the error is in the direction of imposing too much tax, taxpayers tend to accept this too. The second issue they examine is the relative effectiveness of providing information to taxpayers online rather than on paper. This proved less significant than the nature of the guidance itself—online guidance, in that sense, is not necessarily in itself better.

The chapter thus provides a very tangible reminder that digitalization is not perfection, that established practices and concerns can remain important in checking the full accuracy of the final return, and that convenience of obtaining information is not a substitute for its clarity. The chapter also stresses the importance of rigorously evaluating digital innovations, with lab experiments among the most important tools to this end.

Part II: Innovations in Fiscal Management

The second section of the book explores the practical application of new technology in macroeconomic policy and public finance.

In Chapter 6, *Florian Misch*, *Brian Olden*, *Marcos Poplawski-Ribeiro*, and *Lamya Keiji* explore how digitalization of public finances and public financial management (PFM) tools have facilitated the construction of disaggregated and high-frequency fiscal data (in this case, daily). Many countries have implemented information technology systems to automate the management of their public finances. These systems record daily government transactions—tax receipts, wage payments, debt issuance, and so on. The authors argue that such data are both

accessible and can be exploited for policy purposes by complementing lower-frequency conventional macroeconomic aggregates for real-time macroeconomic analysis. The chapter makes two main contributions. First, it demonstrates that digitalization has made daily fiscal data accessible in many countries. Second, the authors argue that removing noise from the data is relatively easy, facilitating its practical use in fiscal policy analysis.

The chapter presents several case studies and examples to illustrate the usefulness of daily fiscal data to monitor tax revenue, assess fiscal vulnerabilities, and monitor economic activity using cash balances and payroll receipts in real time. The authors acknowledge possible drawbacks. Safeguards must be in place to ensure that false alarms are not triggered through misinterpretation of short-term volatility in the data. In addition, information systems reflect only cash transactions and may not capture some important fiscal operations. Nevertheless, the chapter makes a strong case for exploiting this underused source of fiscal information, given proper safeguards and capacity building.

Arvind Krishna, Martin Fleming, and Solomon Assefa explore in Chapter 7 two emerging digital technologies, blockchain and cognitive computing, and potential applications to government and public finance. Blockchain technology can reduce frictions and increase trust in transaction systems by putting data into shared, distributed ledgers—synchronized databases—that allow every participant access to the system of record for a transaction. Cognitive systems can process and analyze these data to gain insight and detect patterns. They argue that the advent of digitalization and cloud computing gives government and industry access to advanced technical solutions through the internet. This reduces the need for large, capital-intensive investments in infrastructure and lowers cost.

The authors examine how blockchain and cognitive computing could, individually and in combination, help governments improve certain core functions, for example, digital citizen identity, tax collection, and benefit payments. With billions of people lacking proper identification, blockchain offers the possibility of establishing permanent, immutable records of identity for citizens that cannot be lost or stolen. In fact, Estonia already offers its citizens a digital identity card based on blockchain technology. Blockchain could also be used in revenue collection, which is currently a separate process from the commercial transactions on which it depends. With blockchain, companies would not be required to submit a return, as their tax account could be continuously maintained and settlement automated. The existing separation between the commercial transactions and their tax component encourages both deliberate and accidental underreporting. Cognitive systems can spot this underreporting by looking at the patterns of commercial transactions and their relative tax generation. Furthermore, blockchain technology can also help improve the payment of welfare benefits—in the United Kingdom, for example, the Department of Work and Pensions is engaged in a pilot program to record benefit payment transactions on a distributed ledger to improve their management and reduce overpayment of claims.

The authors offer a series of recommendations on how best to prepare to harness these emerging technologies. In particular, they emphasize the need for

governments to increase their capacity to manage and standardize data and processes. This includes the ability to maintain large-scale, high-quality standardized data sets which will facilitate data sharing and collection—a core requirement for blockchain and cognitive computing—and the willingness to standardize processes for work flow, document management, authentication, and certification. More importantly, governments must invest in human capital—a key to success in adopting disruptive technologies.

Part III: Modernizing Public Service Delivery and Spending

The third section considers the impact of technology on spending policies and public service delivery. Indeed, the growth of digital technology worldwide has generated considerable optimism about its scope for alleviating key market failures associated with public service provision. Over the past decade, the number of digitally based public service initiatives has increased substantially, with an estimated 400 deployments as of 2017. Yet research on the impact of these initiatives is still limited, often focusing on particular countries and sectors, so with little sense of its general applicability.

Jenny Aker reviews some of these initiatives in Chapter 8, focusing on mobile phone technology in developing countries across a range of sectors including health, education, and agriculture. Mobile phones are used in a variety of ways, including as pedagogical devices in the classroom, as platforms to distribute social transfers, as medical recordkeeping devices, and as communication devices for key agricultural information on the weather or commodity prices.

She finds that such initiatives can, at times, be successful along certain dimensions. For example, in social protection, they have increased the efficiency of provision—that is, to lower the cost of providing a public service of a given quality. In education, research finds that digitalization can improve effectiveness—ensuring that programs meet their stated goals. Results are mixed, however, in agriculture and health. While mobile devices offer new opportunities, they also add new challenges—text requires literacy, and voice platforms are costly. In addition, they do not always overcome structural barriers to development, such as lack of access to other essential infrastructure, such as roads or property rights.

The chapter concludes that digital public service provision should build on a thorough understanding of the market failures—information asymmetries, transactions costs—that are a binding constraint to technology adoption and public service provision.

In Chapter 9, *Ravi Kanbur* cautions against overoptimism in viewing technology as a solution for difficulties in targeting public expenditure for poverty reduction. His chapter revisits the fundamentals of the theory of targeting to pinpoint the possible impacts of the digital revolution on three key dimensions of fine targeting—information costs, high implicit marginal tax rates, and political economy. For example, he argues that while biometric information may provide a unique identifier, fine targeting requires detailed information on income and

consumption, which will remain scarce in developing countries with large informal sectors, even with efforts to digitalize. Similarly, digitalization will not solve the problem of high implicit marginal tax rates required by fine targeting.

Finally, digitalization may not necessarily eliminate constraints brought about by political economy considerations, norms, and existing institutions. Middle-income citizens may object to spending that benefits the poor with little benefit to them; corrupt officials may bypass the digital system meant to reduce leakage. However, digitally based social protection programs have often successfully lowered the program's costs. This seems to suggest a need for empirical studies based on household data to examine the trade-offs involved in the kind of finer targeting that digitalization may enable.

Part IV: Country Case Studies

This section presents country case studies and offers lessons for those seeking to embark on a path of digital reform.

Njuguna Ndung'u describes in Chapter 10 how the digital revolution in Kenya has paved the way for significant changes in tax policy design and administration. This revolution was set in motion by the creation of *M-Pesa*, a money-transfer system which gradually advanced into a real-time retail payments system and further into a virtual savings and credit supply platform. These developments fostered a dramatic increase in financial inclusion and have provided a springboard for the tax authorities to devise more efficient systems for tax payments, including web-enabled application systems for the administration of domestic taxes (the *iTax* system) and a mobile phone application that facilitates tax payment and taxpayers' access to tax information (the *M-Service* platform).

The chapter describes these innovations, detailing the critical role of the monetary authorities and the telecommunications regulator in providing an appropriate legal and regulatory framework, and the importance of the modernization efforts of the Kenya Revenue Authority prior to the implementation of the *iTax* and *M-Service* systems. While sufficient data are not available to quantify the impact of these digitalization efforts on tax collections, the chapter argues that digitalization of the tax system has reduced direct interaction between taxpayers and tax officers, thus reducing the opportunities for bribery and fraud, and has allowed the revenue authority to reduce the costs of tax collection, with many small and previously undocumented businesses now using mobile phones for tax payments. The Kenyan case illustrates that widespread use of digital financial services and greater financial inclusion can be an important impetus to the digitalization of public finances.

In Chapter 11, *Rathin Roy* and *Suyash Rai* focus on the fiscal policy consequences of digitalization of the Indian economy. They review the steps taken to facilitate digitalization, including the demonetization decision in 2016. With the introduction of *Aadhaar*, the government has sought to improve the effectiveness of public expenditure, especially transfers. Successful financial inclusion programs were essential to these efforts—under the *Pradhan Mantri Jan Dhan Yojana*, more

than 280 million bank accounts were opened between 2014 and 2017, allowing the delivery of social benefits payments directly to beneficiaries' bank accounts. In addition, the government has developed an online system of public procurement and sought to use digital technology to improve tax collection and enforcement.

The best-known and most internationally publicized demonetization initiative of recent years is probably that of India. In a November 2016 surprise announcement, the government declared its decision to withdraw large-denomination notes—about 87 percent of currency in circulation—to expand the tax base and reduce the use of cash and illegal cash holdings (so-called “black” money). The government hoped for a permanent shift of a predominantly cash-based economy to digital payments resulting from demonetization.

The authors note that it is too early to fully measure the impact of most these initiatives, although available evidence suggests that the use of biometric information has delivered less-corrupt payment systems and a reduction in leakage. Preliminary evidence also suggests that the direct delivery of social benefits to beneficiaries can generate nontrivial fiscal savings. And while demonetization and its surprise rollout may have weakened economic activity in the short term, it is too early to assess its full impact on the informal economy and on digitalization in India.

Marco Cangiano, Alan Gelb, and Ruth Goodwin-Groen document in Chapter 12 the promise of digitalization in PFM. They argue that it is time to mainstream digitalization of payments as part of a functional PFM system to better achieve both PFM and broader reform goals. In so doing, care should be exercised to avoid common mistakes incurred in implementing government financial management information systems. Case studies illustrate the benefits of integrating digitalization of payments with a government's PFM.

In India, the government has combined the use of unique biometric identifiers (the *Aadhaar* program) and financial inclusion for both efficiency and effectiveness in social benefits and to reduce the number of illegitimate beneficiaries under welfare programs. In Mexico, aligning the policy objectives of digitalization and centralization of payments through a “single treasury account” has improved the efficiency and effectiveness of both and contributed to financial inclusion. By creating X-Road—a data exchange layer that enables secure internet-based data exchange between information systems—and an advanced digital identity system, Estonia has significantly enhanced the effectiveness of government. Ghana's efforts to standardize digital identification and shift away from a cash-based economy are still facing challenges, but have contributed to a reduction of ghost workers included in public payrolls.

These cases point to key success factors for digitalization and PFM integration: first, high-level leadership, needed to neutralize opposition that will inevitably arise with lengthy reforms; second, an integrated comprehensive approach to building a digital and regulatory infrastructure for PFM; and finally, an appreciation of the risks of the digital economy, which requires attention to data privacy and security.

Part V: How Much Is It All Worth?

To conclude the book, in Chapter 13, *Susan Lund, Olivia White, and Jason Lamb* quantify the potential value at stake when government payment transactions shift from cash to digital. They focus on savings stemming from reducing leakage in government payments and tax receipts, reducing fraudulent payments and tax evasion, and cost savings from digitalizing payment processes. They find that digitalizing government payments in developing countries could save roughly 1 percent of GDP, equivalent to \$220–\$320 billion in value annually. This is equal to 1.5 percent of the value of all government payment transactions. Of this total, roughly 0.5 percent of GDP—about \$105–\$155 billion each year—would accrue directly to the government and improve fiscal balances, while the remainder would benefit individuals and businesses as government spending reaches its intended targets. These estimates may well underestimate the value of digitizing public finances, as they leave aside potentially significant second-order effects arising from the improvement in government service delivery, including encouraging more widespread use of digital finance in the private sector, and shifting of economic activity from the informal to the formal sector.

Clearly, much remains to be done in understanding the likely implications of the digital revolutions now under way in the design and conduct of fiscal policies—and quantifying them will be even harder. The implications are also likely to vary widely across countries: in some cases, for instance, they may enable the size of government to increase so as to address unmet spending needs and achievement of the Sustainable Development Goals; in others, it may be a matter of raising and spending much the same in aggregate but doing both more effectively.

Although the outcomes of revolutions are inherently hard to predict, the chapters in this book make it clear that the effects of current and future digital revolutions are likely to be profound.

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Simon Johnson
Ronald A. Kurtz (1954) Professor of Entrepreneurship
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"With the technological revolution and the rise of data economies and platforms, the need for digitalization across the public sector is no longer just an option. It is now an urgent imperative, and is the most powerful lever to drive large-scale change and development today. This book presents multiple approaches for a digital revolution in the public sector, in an engaging and refreshing manner, with balanced and diverse perspectives. The country-specific case studies provide an insight into the real-world consequences of driving large-scale digital efforts. An engaging read that is relevant to all who are keen to discover and study the possibilities that digitalization brings to governments and people, across the world."

Nandan Nilekani
Founding Chairman
Unique Identification Authority of India (Aadhaar)

EXCERPT:

DIGITAL REVOLUTIONS IN PUBLIC FINANCE