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Authors
Zolt, Eric M
Bird, Richard M

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Technology and Taxation in Developing Countries: From Hand to Mouse

Richard M. Bird and Eric M. Zolt

Bird: Professor Emeritus of Economics
Rotman School of Management
University of Toronto
105 St. George Street
Toronto, ON M5S 3E6
Canada
Tel.: 905-274-8841
Email: rbird@rotman.utoronto.ca

Zolt: Professor of Law
UCLA School of Law
405 Hilgard Ave.
Los Angeles,
CA 90095-1476
USA
Tel.: 310-206-0394
Email: zolt@law.ucla.edu

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Abstract

Tax systems in developing countries, like those in more developed countries, face both new challenges and new possibilities as a result of technological change. In developing countries, taxpayers and tax administrations must cope with more difficult environments with fewer resources. Some issues (such as privacy, the benefits and costs of public/private partnerships, and corruption) are common to both developing and developed countries, but differ in relative importance in particular countries. Other issues (such as how new technology may or should influence the way a country's tax system or particular taxes are designed and administered) may be more important in developing countries. This paper examines the general issues facing developing countries from technological changes and provides some promising examples of technological innovation and application in tax administration and tax policy.

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Technology and Taxation in Developing Countries: From Hand to Mouse[1]

Richard M. Bird and Eric M. Zolt

Technology has influenced the way we work, play, and interact with others. It is not surprising that technology has also affected how tax systems are designed and administered in developing countries. These changes have not always been for the better. In a pioneering study of tax administration in developing countries, Radian (1980) noted that the three decades since World War II had seen a number of cycles of ineffective reform, including computerization. Many countries shared the experiences of Trinidad, in which the Commissioner of Internal Revenue said that "since 1969 we have not produced any meaningful statistical data. In that year, we transferred our returns, processing and accounting work onto a computer" (Radian 1980, 217).[2]

Technological change continues. Most countries have now moved from rooms full of clerks posting entries by hand in large ledger books—or, as we observed in one country as late as the early 1990s, writing in pencil on little pieces of paper—to

[1] This revised version of the conference paper has benefited from discussion at the conference, detailed comments received from the editor and two anonymous referees, and the comments of some tax officials from developing countries. These helpful contributions make clear that much more work can and should be done. We hope the present paper serves as a useful introduction to this complex and important area and that some readers will take up the torch and improve our understanding of how technology may influence tax administration and design.

[2] Radian (1980, 224) went on to conclude that "all four countries studied [Trinidad, Jamaica, Thailand, Philippines] have succeeded in installing a computer, but not one managed to use it properly. . . . If the data input is poor, the processed output cannot be better. This first principle of computer processing has been too frequently ignored by those who advocated the use of computers and tried to sell them to poor countries."

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widespread use of computers to administer their tax systems.[3] The transition from hand to mouse has been incomplete and uneven. Major differences exist among and within developing countries, both with respect to how their tax systems are designed and administered, and, more generally, with respect to how technological advances have changed the manner in which their economies operate.

In this article, we present some initial observations on how changes in technology may influence tax administration and tax design in developing countries. Roller and Waverman (2001) demonstrate that the introduction of mobile telephones has enabled developing countries to bypass the heavy infrastructure development of land-based telephone systems, and has facilitated market integration and more rapid economic development. Does the use of technology in the tax systems of developing countries mark a similar opportunity for developing countries to improve tax administration and design? Ideally, to answer this question one needs to consider the costs and benefits of different types of technological changes for administrators, taxpayers, and third parties involved in the taxing process in countries at different levels of development. We cannot undertake this major task here; instead, we present an overview and selective survey of many of the issues raised by how technology influences tax administration and design. Technology is definitely not a "magic bullet" to solve the manifold problems of development taxation.[4] It may, however, provide part of the answer for many countries.

One part of the answer, for example, focuses on how tax administrators can use technology. Both the size of the tax collection agency (Slemrod and Yitzhaki 1987) and how the tax agency allocates its budget among its different functions of enforcement, return and data processing, and taxpayer service (Plumley and Steurele 2004) may be

[3] In contrast to the 1960s, this second generation of computerization relies on personal computers and a network-based information system, rather than stand-alone mainframe computers.

[4] For a recent overview of those problems, see Bahl and Bird (2008).

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affected. What are the necessary preconditions in developing countries for successful adoptions of new technology? [5]

Another part of the answer focuses on the larger question of tax system design. Slemrod (1990) notes that the design of optimal tax systems requires consideration not only of changes in the technology of collecting taxes but also of how technology may alter the economic environment in which governments seek to collect revenue.[6] Policymakers need to consider the impact of changes in technology on both the design of specific taxes and the relative use of different tax instruments in raising revenue.

We begin by examining how technology may be used to improve tax administration. We then turn to a broader and less explored question, the potential for technology to change the design of tax systems in developing countries. Following a brief review of some issues common to both developed and developing countries that

[5] Jenkins (1996, 13) noted in an early review of technology and taxation in developing countries that "if we want to avoid the cycle of unfulfilled expectations, we need to have a clear strategy for administrative reform, which is much broader and more sophisticated than one which simply implements information technology." Similarly, in words echoing Radian's work a quarter century earlier, Dhillon and Bouwer (2005) noted that imposing new information technology (IT) systems without altering the underlying business processes of the tax administration, or without establishing sufficient links to information providers within and outside the public sector, as well as providing adequate staffing infrastructure, was a recipe for failure. Given the extensive experience with the adoption of new technology in tax administrations around the world, one might expect that those closely involved in this process would have developed a systematic taxonomy of the way in which country characteristics (such as income level, educational level, economic structure) interact with the characteristics of different technologies. This would provide a useful starting point for countries contemplating climbing the technology ladder to improve tax administration and design. To our knowledge, however, no such guide exists and we do not attempt to make up for this deficiency in the present paper.

[6] Technology may influence the institutional and political context in many ways. For instance, technology may change the tax environment by altering distribution methods or reducing cash transactions. Technology may improve the quantity and quality of information available to taxing authorities and their ability to use that information effectively. Technology may make tax administrations more effective by improving information flow, facilitating coordination, and improving their allocation of resources. Technological changes may reduce taxpayer compliance costs by improving information and services to taxpayers (for example, software for maintaining books and records, and for calculating tax liabilities, or electronic or return-free filing alternatives). Technology may reduce opportunities for corruption by reducing the face-to-face interaction between taxpayers and taxing authorities. On the other hand, since silver linings seldom arrive without clouds, technology may equally well increase corruption by increasing the opportunities for more sophisticated collaboration between taxpayers and corrupt officials.

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result from the increased use of technology in tax design and administration, we conclude by offering a few tentative observations about the future relationship of tax and technology in developing countries.

Technology and Tax Administration

Tax advisors frequently note that "tax administration *is* tax policy" in developing countries (Casanegra de Jantscher, 1990, 178). Limitations in tax administration constrain tax policy choices. In this section, we first consider several challenges facing tax administrations in developing countries. We then examine how technology may improve the ability of tax authorities in developing countries to perform different administrative functions.

Challenges Facing Tax Administrations

A large literature has developed examining the difficulties facing developing countries in administering tax systems (Bird 2004). Some of the key challenges are reviewed here. The first two challenges, the size of the agricultural and informal sector and the use of the financial sector, relate to the economic environment in which tax administrators operate. The other two challenges we review, organizational change and political will, relate to the ability of tax administrators to improve their efficiency whether through technological or other changes.

Size of agricultural and informal sector. Many developing countries have a large traditional agricultural sector and a significant informal (shadow) economy, both operating largely outside the formal tax system. No country has managed to tax these

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sectors effectively (Alm, Martínez-Vazquez, and Wallace 2004).[7] As a result, the tax base that tax authorities can potentially reach is relatively small in many developing countries.

The conventional wisdom has long been that the informal economy consisted largely of small providers of goods and services operating largely outside the formal economy. There was also a belief that as countries developed economically, the size of both the agricultural sector and the informal economy, relative to total economic activity, would decline. However, as Chen (2007) highlights, in some countries not only is there an informal sector operating in almost all parts of the economy but there is also substantial interaction between the formal and informal economy. Not only do many firms in the formal sector buy from and sell to informal firms, they may even control (or be controlled by) "shadow" enterprises. Nor does economic development necessarily result in a smaller role for the informal economy. Indeed, when the barriers to formalization are as high as they are in many developing countries, growth may be more likely to manifest itself in the informal sector of the economy.[8]

The decision to operate in the informal economy rests on the relative costs (for example, tax and regulatory costs) and benefits (for example, access to financial sector and legal systems) of operating in the formal economy. These relative costs and benefits vary between developed and developing countries, as well as among developing countries. One important cost of operating informally is the probability of detection by

[7] The relative size of the informal sector is often three or four times larger in developing countries as compared to developed countries (Alm, Schneider, and Martínez-Vazquez 2004). The size of the untaxed economy may itself be a function of the design and implementation of the tax system. For example, the high social insurance tax rates levied by some countries create an incentive for a large informal economy by discouraging employers from reporting the extent of employment and encouraging the under-reporting of wages (Rutkowski 2007). The resulting lower tax revenues often lead governments to raise tax rates still further, thus exacerbating incentives to evade taxes.

[8] World Bank (2000) attempts to assess the height of these barriers, which were originally highlighted by the seminal work of DeSoto (1989). Stern and Barbour (2005) examine the extent to which tax barriers have deterred small business growth in sub-Saharan African countries. Bennett and Estrin (2007) emphasize the importance of informality as a stepping stone to growth.

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tax or other government authorities, and resulting penalties. Here, again, countries differ greatly. By providing additional tools to observe and monitor transactions and taxpayers, technology may significantly enhance the ability of tax authorities to detect economic activity in the informal sector. For example, technological improvements may provide tax authorities with greater capabilities to track use of physical inputs, electricity, and labor and hence to estimate revenue and profits.

Use of the financial sector. Countries also vary greatly in the role played by financial institutions in the operation of the economy. Where activity is primarily in cash or barter transactions, it is difficult to monitor transactions.[9] In contrast, the use of banking channels for payment makes transactions easier to observe and monitor. The growth of the financial sector and its greater role in the market economy broadens the potential scope of taxation and makes administration of certain taxes easier.

The increased use by businesses of financial institutions to channel receipts and expenditures provides information not only on those businesses, but also on their suppliers and on businesses further down the economic activity chain. Similarly, the increased use of credit cards or more sophisticated electronic payment mechanisms, provides not only information as to the financial capacity of the purchaser, but also information that may be used to confirm the value-added tax (VAT) and income tax filings of the sellers.[10]

[9] In recognition of this problem, India, for example, allows the deduction (for income tax purposes) of only 80% of current expenditures (above a small amount) that are paid in cash.

[10] For example, since 1999, Korea has encouraged the use of credit cards through two incentives. First, 20% of credit card expenditures can be deducted from the user's taxable income. Second, a lottery was introduced in 2000 to further encourage credit card use. Although credit card use has increased rapidly in recent years, it is not clear to what extent these incentives may be responsible.

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Organizational change. Over the last 40 years, reform efforts in tax administration in developing countries have generally centered on information technology (IT). The gains from adopting new technology, however, have often failed to reach expectations. Successful reform efforts did not simply computerize antiquated processes but re-engineered the whole system.[11]

Radical improvement in tax administration requires changes in organization and methods, and modern IT greatly facilitates the needed transformation (Engelschalk 2000). To take an example from a few years ago, a 1992 study of the enforcement efficiency of the income tax department in India identified the following problems: poor use of information collected by the central intelligence branch; ineffectiveness of surveys of business premises; absence of an adequate system of taxpayer identification numbers; absence of an adequate system of third party information collection; and deficiencies in the record-keeping system (Das-Gupta, Mookerjhee, and Panta, 1992). Although many of these problems can be solved by adopting appropriate and available technology, as India has increasingly done (for example, with the introduction of an online tax accounting system in 2004), successful use of IT requires restructuring and retraining the tax administration. [12]

As with most new technologies, IT is a double-edged sword. In the hands of taxpayers, it may make tax administration more difficult (especially in an open economy). In the hands of tax authorities, it may enable a more robust response to such

[11] For experiences of particular countries with administrative reform, see Bird and Casanegra de Jantscher (1992), Jenkins (1996), and Das-Gupta and Mookerjhee (1998). A particularly interesting account of business process re-engineering in Singapore is Sia and Neo (1997). Pinhanez (2007) examines in detail how the nature of the value-added tax (VAT)—the principal tax of Brazilian states—shaped IT, organizational redesign, and human resource policies in their tax administrations.

[12] A striking illustration of the difference in the pace of new technology, and the change in human resources required to meet effective use of that technology, occurred when Indian tax authorities seized a large volume of computer-based records in 1992 in connection with an investigation. The clerical staff then proceeded to punch holes in the seized floppy diskettes to attach identifying tags. In recent years, India has moved much further along the road of adopting appropriate technology in tax administration (UN 2007), although, from different perspectives, both Kumar, Nagar and Samanta (2007) and Manglik (2008) suggest that there is still a long way to go.

Electronic copy available at: https://ssrn.com/abstract=1086853

challenges. Experience suggests a number of lessons with respect to the successful application of IT in tax administration. An appropriate strategy must consider the obstacles and constraints arising from such organizational rigidities as civil service salary structure and procedural hurdles in acquiring the necessary expertise, hardware, and software.[13] A relatively centralized innovation strategy is required since equipment and software should be standardized to facilitate training, operation, networking, and maintenance. Whenever possible, software should be bought off the shelf rather than developed internally, both for cost reasons and to accommodate subsequent technological developments. Ultimately, the pace of change and the success of any modernization program depend on human resources—on the training and skills of the people who are expected to use and operate the technology.

Considerable organizational re-engineering is usually needed to gear the tax administration to a computerized environment.[14] In certain cases (for example, with property taxes in Indonesia) it may be advantageous to reorganize tax administration by sector (Kelly 1996). In other cases it may be better to follow the Spanish system, where key information regarding a taxpayer's obligations (for example, the filing of returns and the making of payments) is combined with a "tax vector" created for each taxpayer (Moya and Santiago 1992). As Pinhanez (2007) explains, the very nature of the VAT, the most important tax in most developing countries, requires administrators to

[13] For an overview of how IT fits within an administration reform strategy, see Gill (2000). Pinhanez (2007) illustrates and elaborates this point with respect to Brazilian state tax administrations.

[14] Singapore has been one of the most successful countries in using technology to modernize and improve its tax system. (Jenkins 1996; Das-Gupta and Mookerjhee 1998; and Bird and Oldman 2000). This reform demonstrates the importance of careful and systematic planning and the thorough re-engineering of all the business processes of the tax administration. Singapore's experience also suggests that even good tax administrations may often gain from outside assistance in undertaking extensive IT reforms. Even then it is a long process: Singapore began its conversion to an IT-based system in 1992 and the process was still going on eight years later in 2000 (Bird and Oldman 2000). The Brazilian state tax reforms discussed in Pinhanez (2007), however, suggest that motivated and well-led revenue administrations, even in relatively poor states, can substantially improve their performance within a relatively short time through appropriate use of technology.

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understand business chains—the interconnected nature of activities in different stages of production and distribution process.

Experience in Kenya and elsewhere demonstrates that the successful introduction of new technologies requires consideration of the susceptibilities of existing staff and their resistance to change (Peterson 1996). Indeed all those in a position to affect how well any new IT system can function must work together.[15] As a complex system is more likely to engender resistance and problems, the design, structure, and operations of the system, should be as simple as possible. In some situations it may even be advantageous to entrust part of the responsibility for setting up an information system to organizations outside the tax administration, or even outside the government.[16] We return to the question of privatization later in this paper.

Administrative capacity. Many who examine tax administration in developing countries conclude that there is simply insufficient "administrative capacity," usually defined in terms of skilled human capital, for the tax administration to function properly. Countries differ greatly in administrative capacity. In countries with very low levels of administrative capacity, technological innovation may to some extent be able to substitute for inadequate human capacity. For example, while a few highly skilled people would still be required to implement and operate any modern data processing system, it might be easier in many countries to find, say, three capable university graduates rather than many literate and numerate high school graduates who might otherwise be needed to do the same work.

[15] In one country, for example, an expensive new computer system was completely disabled the day after it was launched simply because an employee looking for a convenient place to plug in his tea kettle disconnected a key power cord at a critical moment.

[16] There are limits. In one country, a foreign service provider proposed, for security reasons, to install the servers at its home country's embassy! For an early, but still useful, consideration of out-sourcing in tax administration, see Ramírez Acuña (1992).

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More generally, at any given level of administrative capacity, more can be done better with appropriate advanced technology, often by complementing and increasing the productivity of skilled staff instead of replacing it. In some cases, technology can and has substantially extended the capacity of tax administration officials by permitting them to assemble and evaluate the mass of information already currently available but not effectively used. Technology alone cannot do the job of good tax administration, and good tax administration can be carried out without technology. Technology increases the opportunities of what can be done in any tax administration and often makes it possible to perform administrative functions both differently and better than without technology.

Political will. Although technology can improve tax administration in developing countries, some countries lack political will to use technology effectively to improve tax compliance. When the will is there, the way usually already exists and need only be introduced. Undoubtedly, introducing creative technology in many developing countries will yield significant gains, as shown by the use of financial networks operated through mobile telephone networks to bypass infrastructure efficiencies. For the most part, what really needs to be done to improve tax administration in developing countries is well-known and can sometimes be implemented within a surprisingly short time span, as has been demonstrated in both Brazil (Pinhanez 2007) and Chile (Toro 2005). Technology may enable countries to leap over infrastructure gaps and even to overcome (to some extent) human capital deficiencies. But it cannot circumvent the critical political obstacles that plague tax administration in many developing countries.

Using Technology to Improve Tax Administration

Tax administrators in developed and developing countries play many roles. They are expected to collect revenue, process returns and information, limit tax evasion, provide services to taxpayers, and in many countries, implement social programs through

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the tax systems. The objectives and policies of tax administrators differ among countries and over time. Yet, without a clear understanding of the short-term and long objectives, it is difficult to measure the success or failures of tax administrators. It is also difficult to decide how to allocate resources, whether personnel or investments in technology, among the different administrative functions. The IRS has found it hard enough to make the "right" decisions on such matters (Plumley and Steuerle 2004); it is not surprising that the task has proven even more challenging in the much more difficult circumstances facing developing countries.

Like any other government agency or private sector enterprise, tax administrators need to make difficult choices on allocating scarce resources among different types of taxes, different administrative functions, and different types of technology. To make informed decisions on alternative feasible technology investments, tax administrators need estimates of the current costs of administering the tax system, the costs of administering particular taxes, and the expected costs and benefits from the additional investment.[17] Ideally, decision-makers need estimates of not only total or average costs, but also the relative marginal costs for different investments and different tax instruments. Even with this information, decision-makers will have different time frames and objective functions. For example, if the primary focus is on short-term tax revenue, decision-makers may choose not to invest in projects that have potentially large long-term benefits and the potential to strengthen the state by improving its "tax interface" with society (Moore 2007). Such subtleties may be left aside in most developing countries, as these countries lack the relevant information to make such determinations. In many countries, the only data systematically collected by tax administrations is current tax revenue collections. Even the large revenue administration improvement programs funded by international agencies such as the World Bank, have not, to our knowledge,

[17] Costs include not only the costs of the tax authority, but also the costs imposed on taxpayers and other parties. (Slemrod 1990). As the review by Evans (2003) makes clear, almost no such compliance cost data is available in developing countries. For an interesting early review of the allocative problem that stresses the importance of objectives other than simply revenue, see Shoup (1969, chap. 17).

Electronic copy available at: https://ssrn.com/abstract=1086853

assembled or used data on relative marginal costs and benefits to make informed decisions on different proposed administrative reforms. In this, as in other areas of development policy, faith and ideas derived from experience elsewhere may have determined more allocative decisions than has evidence-based analysis.[18]

The lack of hard evidence does not mean that there has been no change in the organization or functioning of tax administrations in developing countries. On the contrary, there has, for example, been a substantial movement away from organizing tax administration on a tax-by-tax basis towards organization based on administrative functions (Vehorn and Brondolo 2003) as well as special attention in many countries to dealing with the large taxpayers who provide most of the tax revenue (Baer, Benon and Toro 2002). In addition, some countries have introduced more autonomous revenue authorities.[19] Here, we focus primarily on the question of how technology has the potential to change how taxing authorities perform all the interconnected tasks of locating and identifying taxpayers, information reporting and withholding, processing returns, auditing, collecting, educating taxpayers, and providing taxpayer services.

The availability, cost, and accessibility of computers make them ideal for the large-scale information-processing and coordination problems facing tax administrations in even the poorest countries.[20] Among the areas that may be computerized are: (1) taxpayer records and tax collection (taxpayer compliance); (2) internal management and

[18] This conclusion is of course based on our own limited knowledge and experience, and we would be delighted to learn of careful empirical studies in any country that have guided allocative decisions in tax administration.

[19] For detailed discussions of such "semi-autonomous revenue authorities," see Gray and Chapman (2001), Fjeldstad (2002), Mann (2004), and Taliercio (2004). Our reading of this growing literature is that any country able to assemble the will, strategy, and resources needed to reform substantially its tax administration, probably does not need such a separate revenue authority; countries lacking these critical ingredients are unlikely to be successful even if they create such authorities.

[20] Tax administrations need more expertise in information technology in part because many of their largest taxpayers, multinational companies and large domestic firms, employ sophisticated computer systems. We do not discuss here the important questions raised for taxation by cross-border digital commerce: for a preliminary look, see e.g. Bird (2005).

Electronic copy available at: https://ssrn.com/abstract=1086853

control over resources; (3) legal structure and procedures; and (4) systems to lower taxpayer compliance costs.

Tracking taxpayers. Almost all tax systems use a taxpayer identification number (TIN) to track taxpayers.[21] In every country that has successfully adopted improved technology for tax administration, allotting a unique identification number has been a necessary requirement. Without such a number, information can neither be stored properly nor used effectively. Countries may use a number unique to the tax system or one linked to other government activities. Several countries have begun issuing "smart" ID cards to citizens that contain TINs as well as other information.[22]

Improvements in technology allow governments to coordinate the numbers assigned with respect to various government services and financial services to TINs issued by taxing authorities. The coordination will make it more difficult for those without TINs to access government services to obtain passports or driver's licenses, register cars, transfer and register property, or use public schools or hospitals. TINs could also be required to open bank accounts, purchase airline tickets over certain dollar amount, or gain access to electrical, gas or water services—thus increasing the costs of operating outside the tax system. [23]

[21] Good tax administration requires a reliable single, centrally-maintained register of taxpayers. This register should contain only such relevant particulars as the name, address, and the nature of business or activity of the taxpayer, together with location of branches, each under a unique taxpayer identification number (TIN), which should remain permanent and should not change, for example, when taxpayers change location.

[22] Such cards may, for example, contain a microchip which has a digital image of the user's fingerprint. To use the card for commercial or tax transactions, the user presses his or her finger against a sensor on the card. The sensor reads the fingerprint and compares it with the fingerprint stored on the card's memory chip to ensure a match (Ainsworth 2006). As an illustration of the variability in the use of technology within developing countries, one of the authors was recently in a country that required digital fingerprinting and verification first to get a boarding pass and then to board an airplane. That country does not have reliable TINs.

[23] Werbach (2007) and Eschet (2005) provide (as yet very limited) examples of applications along some of these lines in the US and UK. To some extent, of course, such applications may be considered simply an

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Information reporting and withholding. An important task of tax administration is to bring together information from different sources, both within the administration, and from other relevant government and private sources, in order to verify the information supplied by taxpayers themselves.[24] Tax laws in most countries already require various private and public agencies to furnish information regarding various transactions and activities to the tax authorities. In some, but not all cases, those agencies are also supposed to withhold a part of the payment made by the agent to the potential taxpayer. Withholding thus serves the two-fold purpose of helping to identify potential taxpayers and ensuring that at least a part of the tax is realized at source, thereby minimizing risk as well as delay in payment. Neither internal nor external sources of information are of any use in the absence of an efficient system of monitoring, or of adequate IT infrastructure to collate and store data with easy access for retrieval and

extension of the "tax compliance certificate" some countries currently require before issuing such documents as a passport or an export license. Such programs may have increased tax compliance to a limited extent; but in some instances they have also demonstrably provided an occasion for extortion and harassment as well as raising yet another barrier to moving from the formal to the informal sector. China is reportedly testing a program that combines smart identification cards with video surveillance, thus allowing officials to track movements of card holders (New York Times 2007). George Orwell would presumably be horrified, although not surprised. For a review of efforts by British authorities to monitor Orwell's movements, see http://books.guardian.co.uk/news/articles/0,,2161853,00.html. We discuss the issue of privacy below.

[24] Useful sources of third party information may include: financial institutions for transactions such as bank loans, bank drafts, or credit cards; insurance agencies for assets insured; public and semi-public agencies granting various licenses and permits for imports, exports, the existence of businesses or trade; the construction of houses; utility authorities for connections of electricity, water, or gas; agencies operating communication services, telephone, or cable television service; professional societies for persons enrolled as doctors, lawyers, or accountants; authorities or agencies empowered to register transactions in real property; and even newspapers carrying advertisements for sale of goods and services, and real estate. Financial institutions are particularly important because they can also play a substantial role in working with tax administrations not only in providing essential information but also in collecting taxes (Bentley 1999). In some developing countries, tax administrators have told us that they often find it easier to get information from private organizations than from other public sector agencies, as other public agencies may jealously guard their control over information.

Electronic copy available at: https://ssrn.com/abstract=1086853

cross-checking. A reliable single, centrally-maintained register of taxpayers, each with a unique TIN, is therefore essential.[25]

Withholding in developing countries could cover not only traditional items such as wages, interest, and dividends, but also professional fees, payments to independent contractors, rents, and (in some instances) a wide range of business transactions. Some countries have even introduced what may be called "reverse withholding" in which purchasers (government agencies or large enterprises) withhold tax from sellers (small enterprises). Such widespread withholding is not a panacea (Soos 1990). It makes its own information demands as the tax administration must be able to control withholders to make sure they hand over to the Treasury the amounts withheld, and it must also be able to check whether amounts that taxpayers credit against their liabilities have in fact been withheld. But it can still be very useful, particularly with respect to imposing some taxes on the informal activities.

From an administrative perspective, most taxes collected in developing countries come from a relatively small number of tax collecting agents.[26] Accurate tracking of fiscal flows through such large entities, which probably account for 80% or more of current collections in many countries, is critical to successful tax administration.[27]

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[25] Even countries with a very high-level IT capacity, like India, may fall short in this respect. For a detailed account of the problems with the TIN used for income tax purposes in India, the Permanent Account Number (PAN), see Manglik (2008).

[26] Examples of tax collecting agents are customs administration (VAT and excises on imports, import surcharges, and tariffs), social security agencies (social security contributions and personal income tax (PIT) on transfers), the government itself (PIT withholding on wages), state enterprises (PIT withholding, VAT, excises, and corporate or enterprise income taxes (CIT)), and a few large private enterprises (PIT withholding, VAT, excises, and CIT plus perhaps taxes on dividends and interest).

[27] No elaborate universal TIN system is needed for this purpose: the aim of TINs is more to extend the reach of the tax system from the existing central core of large taxpayers into the remainder of the potential tax base. It is perhaps worth noting that an effective VAT system may require an additional VAT registration number (or perhaps simply an extended TIN) because possessing a VAT number in effect gives a taxpayer the ability to issue invoices that can be used to claim VAT credits and even refunds. Developing countries have enough trouble controlling their tax system without turning over the keys to the Treasury to everyone with a TIN. This is one important reason why a relatively high VAT threshold is often a good idea in such countries (Bird and Gendron 2007).

Electronic copy available at: https://ssrn.com/abstract=1086853

Before devoting much effort to this difficult task, however, it is critical to ensure that tight control is maintained over the payments and liabilities of large taxpayers. One way to do so, commonly recommended by experts, is to set up a "large taxpayer unit" (LTU) to monitor closely the non-filing, stop-filing, and compliance behavior of such taxpayers (Baer, Benon, and Toro 2002). In some developing countries, experience in computerizing the information flowing through and to such LTUs has proven to be a useful testing ground for developing systems that can be later extended to the whole taxpaying population.

Given the importance of the VAT as the primary source of revenue in many developing countries, the VAT is likely the tax that has the greatest potential for substantial gains from the use of technology. A key tool in enforcing VAT compliance is to cross-check purchases of one taxpayer against sales recorded by others.[28] Few developing countries have systematically used such programs to detect under-reporting, let alone outright fraud. In one country, tax authorities finally began systematic limited cross-checking only when a review of companies from whom the tax authorities had acquired services (on which it paid VAT) revealed that very few of these companies had bothered to report such sales on their VAT returns.[29] On the whole, for the immediate future, less technologically advanced countries are likely to achieve greater gains improving the training of auditors and adopting audit practices such as exchanging

[28] Cross-matching invoices under a VAT system is similar to conditioning deductibility under an income tax system on the availability of reliable information from the recipient of the payments for which they claim deductions. Thus, similar information systems could be useful in administering income as well as consumption taxes. Ebrill et al. (2001, 148-50) present the usual case against relying on such matching. For a more positive appraisal, see Jenkins, Kuo, and Sun (2003, 179); see also Das-Gupta and Gang (2003).

[29] Early attempts in Korea at widespread matching of VAT invoices failed to produce successful results (Choi 1990). In countries such as Taiwan and Singapore, subsequent experience in using modern information technology to match invoices of buyers and sellers seems to have been more successful. However, these countries are substantially more technologically advanced than most developing countries.

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information between income tax audits (for example, transfer pricing audits) and indirect tax audits than by depending on computer-assisted techniques.[30]

The European Union (EU) has implemented a test program that allows businesses and individuals to participate voluntarily in a new fully-digital VAT system, which could eventually be linked to smart ID cards.[31] The EU's Digital Sales Directive provides for a paperless VAT reporting and payment environment for non-established businesses selling to final consumers in the EU. In a somewhat similar manner, the Streamlined Sales Tax in the U.S. under the certified service provider (CSP) model allows businesses to enter a paperless world of retail sales tax compliance (Ainsworth 2006).

Processing returns and payments. One of the first uses of IT was to process tax returns and payments. Partly because banks had more adequate data processing systems than tax administrations, several Latin American countries initially outsourced the receipt and processing of tax returns and payments to the banking systems. More recently, even countries like Panama and Paraguay[32] have adopted electronic filing, which has facilitated return processing. Since 2001, Chile, likely the most advanced tax administration in Latin America, has supplied most wage-earners and pensioners with "pre-populated returns" that contain taxpayer identifying information, details on gross

[30] However, such countries can still make good use of simplified information technology to improve outcomes. For example, returns might initially be scanned to determine whether their mark-up ratios (or other parameters such as wage bills) fall within normal ranges for comparable firms. Those that fall outside these parameters should then be subjected to additional desk investigation (for example, cross-checking information with customs and income tax for the period in question).

[31] As Ainsworth (2006) notes, there is more scope for such methods with respect to business-to-business (B2B) transactions than with respect to final sales to consumers (B2C). OECD (2005) discusses a variety of ways in which new technologies are being used in tax administration in developed countries; see also Goolsbee (2004).

[32] In Panama, 36% of corporate and 24% of individual income tax returns were filed electronically in 2006. Even in Paraguay, which is considerably less advanced, an increasing number of returns are being filed through the use of official software and the Internet, although the numbers are still small—about 20,000 in 2006.

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income received from various sources, tax withheld, information on certain deduction items, a calculation of the tax assessed, any credits, and the tax payable or refundable (OECD 2006).[33]

In many developing countries, however, most wage earners do not file returns at all, because their income tax obligations are considered to be fully satisfied by the tax withheld by their employers. Even in such developed countries as the UK, most personal income taxpayers do not have to file returns because cumulative averaging results in the correct amount being withheld. Other countries, such as Australia, are also considering "return free" systems that relieve most taxpayers from the obligation of filing a return.[34] Such systems have obvious attractions for both taxpayers and the tax administration. However, questions may be raised about the long-term desirability of freeing citizens from the painful obligation of explicitly facing up to the fiscal needs of the state at least once a year.

Whether or not returns are filed with tax offices, there are advantages in requiring payments to be made to financial institutions if only because keeping cash out of the tax office reduces opportunities for corruption. Of course, payments may be made electronically no matter how returns are processed. Given the rapidly spreading use of mobile telephones as a way of making financial transactions even in very low income countries, more use of electronic filing and payment of taxes seems likely in the near future.

[33] In 2005, 1.2 million of Chile's 1.7 million taxpayers received a complete pre-populated return over the Internet, and 57% of these taxpayers accepted this return without adjustment. In Chile, 96% of taxpayers filed returns over the Internet.

[34] Interestingly, Coleman (2007) argues that this reform is unlikely to be accepted in Australia because, with the present over-withholding in that country, most Australians are accustomed to receiving a refund, and they would rather have a refund and a return than no return and no refund. One wonders.

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Auditing taxpayers. Auditing is a necessary element of good tax administration. If information matching or cross-checking fails to identify underpayment of tax, then auditing is the only way to uncover intentional noncompliance. Typically, auditing means the examination of filed returns by tax authorities to determine the correctness of self-assessed taxes. The authorities may also use audits as the basis for statistical studies of taxpayer characteristics to be used in developing presumptive indicators—a prominent feature of taxation in many developing countries (Bird and Wallace 2004).[35] The success of auditing and the feasibility of various auditing strategies depend on the quality of the information available to the auditor, which in turn depends on three factors: the information gathered from the taxpayer and third parties, the information processing capacity of auditors, and the strategy pursued. As more advanced IT systems improve the first two factors, the authorities have a greater range of auditing strategies.

In developing countries, and often in developed countries, many taxpayers play the tax lottery. A good audit strategy alters the taxpayer's perception of the odds of avoiding tax. If taxpayers are distinguishable by certain indicators (such as age, marital status, profession, or visible assets), and these indicators are correlated with reported income (that is, are reasonable presumptive indicators), then using such indicators to refine estimates of audit results should raise the effectiveness of auditing. The Internal Revenue Service has adopted this rationale in using a statistical technique to rank taxpayers for audit selection in the United States. Even with fully computerized records and third party information, developing and implementing such systems requires significant skills of limited availability in many developing countries. To make better use of limited administrative resources available for audit, Colombia provides taxpayers a second chance. A notice is sent to taxpayers informing them of their selection for audit and giving them the opportunity to revise their return before the audit and pay any additional taxes and interest. Those whose

[35] For a recent survey of the special regimes to cope with hard-to-tax taxpayers in place in ten Latin American countries, see IDB (2007). A useful review of issues with respect to taxing small and medium enterprises (SMEs) in general is World Bank (2008).

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revised tax liability is within a predetermined percentage of the extra taxes expected of them (as calculated by a formula such as that indicated above) avoid being audited.[36]

Good case tracking of files and regular evaluation of results are essential for effective auditing. Auditors need adequate infrastructure support in the form of computer facilities, access to information which is centrally stored, quick communication facilities, and so on. When making a field visit, the audit team should have access to the full records of the taxpayer. The technology now exists for field auditors to download complete and up-to-date taxpayer files, and to check field results through secure access to encrypted mobile units. However, it takes time to use it properly, even in technologically advanced countries.[37]

Services to taxpayers. Developing countries have made significant progress in using technology to improve services to taxpayers. For example, Chile reduced the burden on taxpayers by eliminating payment by cash or check, and replacing it with payment by electronic funds transfer. Singapore has gone even further, often saving taxpayers the trouble of making a payment by dipping directly into their bank accounts (although one may perhaps doubt whether taxpayers appreciate this degree of service). Other developing countries have also taken steps to make the lives of taxpayers easier—and, not incidentally, to improve the reliability of their revenue streams. A few decades ago it was not uncommon to see long lines of taxpayers in the street in front of the local tax office when the time came to make the monthly, quarterly, or annual tax payments. Even when computers were first introduced, taxpayers frequently had to line up to get the forms that they had to submit. Such sights are now largely history in most parts of the world. Now the painful act of paying taxes can often be done from one's home

[36] As Vazquez-Caro and Slemrod (2005) discuss, Colombia's tax administration remains far from ideal in many ways, including auditing practices.

[37] A decade after Canada adopted a VAT, the Auditor General (1999) still found it necessary to push the revenue agency to do more and better VAT audits.

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computer—at least in countries in which the electricity supply is reliable and in which most taxpayers have access to computers. Neither condition holds in many developing countries, notably those in sub-Saharan Africa, but they do hold, increasingly, even in countries like India that have huge poor populations but also increasingly large middle classes. Even taxpayers without a computer can usually pay their taxes at any local bank branch in many countries, and (as mentioned above) payment through mobile telephones may also become more common in some developing countries.

Countries such as Singapore, Chile, and South Africa, already have excellent web pages that provide taxpayers with information about their obligations, answer many taxpayer questions, and provide return-free filing. Brazil has managed to extend electronic filing coverage to 90% of its taxpayers. Even when governments do not provide such facilities, tax preparation software is often readily available to taxpayers and is usually acceptable for official purposes.

Management of tax administration. In many developing countries, the different tax administrations concerned with internal taxes, customs, and social security, fail to share information or coordinate the processing of returns and the maintenance of records. This state of affairs clearly leads to duplication and a loss of administrative effectiveness. The effective use of new technology can help resolve these problems.[38]

Adopting new technology has permitted major changes in tax administration, structure, and operation in many developing countries.[39] However, competent accountants

[38] In the Philippines, database links between customs and internal revenue have been used to match VAT declarations and imports. SAS, Customer Success: Philippines Bureau of Internal Revenue, http://www.sas.com/success/philippinesbir.html. In Peru, data mining software has reportedly allowed tax authorities to reduce customs fraud and tax evasion by 14%. SAS Helps Peruvian Tax Authority Reduce Customs Fraud and Tax Evasion by 14 Percent, http://www.sas.com/news/preleases/021805/news1.html. The computerization of back-office functions in South Africa has permitted the shifting of increased personnel to front-line customer relations. Areff and Mabaso (2005).

[39] For other country examples, see UN (2007) and FIAS (2006).

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and careful application of already existing technology remain more essential in improving tax administration in most developing countries than bold and creative technological innovation.

Finally, properly developed technology systems have the potential to reduce corruption in part by reducing face-to-face interaction.[40] In some countries, taxpayers meet with tax officials only when the officials are soliciting bribes. Removing the opportunities for corruption (and harassment) is one reason often given for introducing various simplified, and presumptive substitute, tax systems (Engelschalk 2004). More generally, the adoption of new technology in developing countries may facilitate the drastic change that is needed in tax authorities' attitude and operations if countries are to move from treating taxpayers as thieves to be caught to viewing them instead as (reluctant) clients to be served.[41]

Technology and the Design of Tax Systems

Our discussion of technology and tax administration does not lead to any radical new conclusions, but then for the most part we were covering well-trodden ground. In contrast, how technology may influence the design of tax systems or the design of specific tax instruments in developing countries is a much less discussed question. We first consider some general questions about tax system design in developing countries, and then look briefly at some proposals with respect to specific tax instruments that may be more feasible as a result of improvements in technology.

[40] For example, in Karnataka, India, 7 million farms can now obtain printed copies of land titles (which they need several times a year to secure bank loans) online in ten minutes at government-run or privately operated Internet kiosks, for a fee of 15 rupees (about 33 cents). Under the previous titling system, reportedly two-thirds of users had to pay bribes much greater than this fee. In contrast, only 3% of users of the online system report paying bribes.

[41] The importance of such a shift in attitude is emphasized in Bird (2004): for some of the reasons, see, for different but complementary views, Moore (2004) and Kirchler, Hoelzl and Wahl (2008).

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Tax System Design

Technological advances will alter the economic environment in which governments seek to collect tax revenue. These advances will make some persons or transactions easier to tax. Particularly in developing countries, use of various methods of electronic payments will move more transactions from the informal to the formal economy. As discussed earlier, technology will also provide tax administrators with more tools to track the movements of goods and individuals. It should also increase opportunities and reduce costs of cooperating with tax administrators in other countries to improve tax compliance of persons with investments and activities outside the country.

But technology will also make some persons or transactions harder to tax. For example, it is currently much harder for tax authorities to track goods in digitized form than those that are physically transported across or between countries. Foreign lawyers, accountants, and management consultants can provide services with little or no physical presence in a country. Advances in the financial service industry allow domestic investors access to foreign banks and securities with simple internet access. The globalization of financial markets has made it harder for any one country to tax income from mobile capital.

Technology may also influence incentives of governmental officials in the design and administration of tax systems. Hettich and Winer (1999) set out a model in which changes in administrative costs may affect both the size of the public sector and the choice of tax structure. Costs may change because of changes in administrative technology like those we have just discussed, or they may change because technology has changed the nature of the economy.[42] For example, as we noted earlier, the more

[42] As mentioned earlier, almost nothing is known about the relevant cost curves. However, for an interesting econometric exploration of this hypothesis using aggregrate country data, see Kenny and Winer (2007).

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developed the financial structure of a country is, the more likely it is to rely more heavily on "modern" taxes such as the VAT (Gordon and Li 2005).

Technology may have a double-edged impact on tax complexity. On one hand, the greater flexibility afforded tax policy designers allows them to introduce ever more refined classifications and categorizations into legislation – for example, targeted client-specific provisions (e.g. low-income allowances) can more readily be implemented at lower administrative and compliance cost. On the other hand, techniques such as pre-populated returns and web-based returns (e.g., keyed to "plain-language" explanations of terms) may make it simpler for taxpayers to comply even with complex laws.

Indeed, one important lesson emerging from experience in various countries is that an essential precondition for the reform of tax administration is sometimes to simplify the tax system to ensure that it can be applied effectively in the generally low-compliance contexts of developing and transitional countries.[43] Tax reforms in both Chile and Colombia demonstrate that considerable improvements can be made in administration with less drastic, but nonetheless effective, simplifications in tax policy. Reducing the number of income tax deductions, for instance, permitted these countries to eliminate filing requirements for most wage earners, thus greatly reducing the administrative burden as most income taxpayers were able to fulfill their obligations solely through withholding.[44]

Tax systems vary greatly in their reliance on different tax instruments to generate revenue in order to support government operations. Bird and Zolt (2005) examine how developing countries rely much more on trade taxes, excise taxes, and general

[43] The experience of Bolivia, which introduced a major simplification of its tax system in 1986, is instructive. Much of the initial success achieved in reforming Bolivian tax administration was clearly attributable to the extensive simplifications made in the tax system (Silvani and Radano 1992). Indeed, as Bahl and Martinez-Vazquez (1992) argue in the case of Jamaica, it seldom makes sense to reform tax administration without simultaneously reforming tax structure

[44] For Chile's experience, see Harberger (1989). For Colombia's experience, see McLure and Pardo (1992). Some countries go the other way, as shown in the discussion of the Polish VAT in Bird (1999).

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consumption taxes, and less on income tax, than developed countries. The relative use of different tax instruments is influenced by many factors, including economy-specific characteristics, the ability of taxpayers to understand, comply with, or evade, tax provisions, and the ability of taxing authorities to administer the tax laws. In addition, it is partly explained by the different costs of different tax technologies in developed countries, as compared to that in developing countries.

Technology may change this calculus of tax structure. First, as we discussed above, it may enable tax authorities to ply their trade more effectively, and hence change the policy mix towards taxes that can now be more effectively administered. Secondly, the characteristics of an economy influence the design of a tax system. As discussed earlier, the classic developing country profile consists of a large subsistence agricultural sector, a substantial small service sector marked by cash transactions, small retail establishments, and the relative absence of large employers (other than the government and a few domestic and foreign companies). Technology may change both the size and structure of this tax base.

Technological change may, for example, reduce the threshold for effective taxation, whether based on the size of a transaction or the size of a firm. Developed countries are more effective than developing countries at taxing consumption and income in large part because taxpayers have more adequate books and records and tax authorities have greater ability to observe and monitor transactions. The introduction of electronic cash and smart cash registers has, in principle, dramatically reduced the size of the transaction or firm that authorities can observe. As such technologies spread to serve the expanding middle class in many developing countries, the capacity of tax administrations to observe transactions will improve.

By changing the relative compliance and enforcement costs and compliance rates of different tax instruments, technology influences the relative revenue that can be generated by different taxes. Technology may not only allow policy-makers to change thresholds in such a way as to increase the scope of some taxes. It may also permit

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decreases in regressivity or increases in progressivity of specific tax instruments that may allow them to be more significant revenue contributors. More than that, by lowering economies of scale in tax administration, improved technology may increase the feasibility of collecting income taxes or value-added taxes at sub-national levels of government. Decentralizing important revenue sources might be one way to increase the effectiveness of government spending. Another means to this end that might also be facilitated by technology would be if improved measurement of the benefits provided to specific individuals or groups by government spending increased opportunities for benefit taxation. Linking revenues and expenditures in such visible and meaningful ways might be an important way for the tax system to contribute to the building of social capital in developing countries.[45]

Tax Instruments

The VAT has emerged as the major source of tax revenue in developing countries (Keen and Lockwood 2006). In sub-Saharan Africa, the VAT is about 30% of total tax revenue (Cnossen 2006). In Asia, the VAT contributes about 21% (Cnossen 2006a). Many major design issues in the VAT are affected by changes in technology. One issue that comes up in many countries, for example, is the coordination of VAT information with information from the customs authority. In Ghana, the Ghana Community Network (GCNet) was created to modernize Ghana's customs operations. For instance, shipping lines provide electronic manifests to GCNet, which are then transferred to the Ghana Ports and Harbors Authority, the Ghana Shipping Council (which obtains all information regarding the movement of ships and airplanes), customs (which obtains customs goods declarations electronically), banks (which inform customs electronically of payments made), and the Ministry of Finance (which can download all trade information as well as

[45] For interesting reflections on this topic, see Brautigam, Fjeldstad, and Moore (2008).

Electronic copy available at: https://ssrn.com/abstract=1086853

all transactions of taxpayers identified by personal identification number) (De Wulf and Sokol 2003).

As noted earlier, the use of electronic invoices increases the potential for matching invoices. Not only does this allow tax authorities to match identifications of buyers and sellers, but if VAT taxpayers are permitted to access the taxpayer registry, they can check that they are in fact buying or selling to legitimate VAT taxpayers. Moreover, as Mushkin (1972, 407) presciently suggested long before technology made it feasible, the regressivity of the VAT (or other consumption taxes) could be reduced by providing differential treatment to low-income taxpayers (Ainsworth 2008). The use of smart cards would allow for no or reduced taxes on food and other items for low income taxpayers, perhaps making it even more likely that developing countries would continue to rely heavily on consumption taxation.

In many developing countries, excise taxes currently raise more revenue than individual income taxes. On average, excise taxes are about 19% of tax revenue in sub-Saharan Africa and 16% in Asia. The primary products subject to excise taxes are tobacco, alcohol, gasoline, and motor vehicles. New technology would, for example, allow countries to adopt differential rates for high and low value alcohol and tobacco (using encoded information), or to reduce rates for targeted populations.

As with excises, trade taxes are much more significant in developing countries than developed countries. Although trade liberalization and the attraction of joining the World Trade Organization has significantly reduced trade tax revenue in developing countries, trade taxes still constitute about 25% of total tax revenues in low-income countries, compared to less than 3% in high-income countries (Fox and Gurley 2005).[46] Generally, taxes on imports are of much greater importance than taxes on exports. Curiously, this oldest form of taxation likely has been the object of the greatest

[46] As Keen (2007) shows, in addition, much VAT in many developing countries is also collected at the border, and much of the VAT collected at import is not subsequently credited against output VAT on later sales. In effect, it is a final tax imposed on informal economic activities.

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technological innovations and applications as taxing authorities around the world seek to improve their ability to monitor and value goods entering the country. Three examples of such technology are Tamper-resistant Embedded Controllers (TRECs), Radio-frequency identification (RFIDs), and Laser Surface Authentication (LSA). The EU has a program using TRECs to monitor container shipments with greater security and efficiency.[47] If the container deviates from the pre-programmed shipping route, the system notifies the interested parties (Swedberg 2006).[48]

TRECs are fairly expensive and bulky and economically feasible only for large shipping containers. But RFID tags are relatively small and inexpensive and can be used to track individual packages. Such tags are currently used by retailers such as Wal-Mart to track shipments from suppliers, and to monitor inventory, as well as by pharmaceutical companies to reduce the risk of counterfeit drugs entering their supply chain.[49] An even more advanced technology is LSA, which generates a unique digital serial code for an item by analyzing the surface of that item. This code acts as an individualized fingerprint for each item and can thus be used to identify each item uniquely. Since the code naturally occurs from microscopic imperfections that exist in the manufacturing process, products can be tracked without the addition of any chips, inks, or other tags ("Customs and Biometrics" 2006). Smugglers may be getting smarter, but so are the systems that countries use to deal with them.

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[47] Each Tamper-resistant Embedded Controller (TREC) contains a microprocessor, a Global Positioning System (GPS) receiver, and links to various sensors on the containers. Using its GPS device, the TREC wirelessly transmits the location of each container. For more information on IBM's TREC platform and its Secure Trade Lane Container Information Services, see Dolivio (2007).

[48] The TREC can also sense if the container has been opened or closed, and can detect when the container has been loaded or unloaded from a vessel. In addition, RFID readers can be connected to the TREC unit to allow shippers to track RFID-tagged items inside the container.

[49] Information Technology for Adoption and Intelligent Design for e-Government (ITAIDE) recently demonstrated, through a pilot project, how technology could improve the administration of excise taxes on imports (ITAIDE 2007). For information on an alternative technology that can be used to track large metal shipping containers, see Monarch (2007).

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Property taxes play a relatively small role in most developing countries (Bahl and Martinez-Vazquez 2007). Revenues from property taxes generally account for little more than a 0.5% of gross domestic product (GDP). One reason for their relatively small role may be political, as those who control or influence the political process are often those who would be disproportionately burdened by property taxes.[50] In many developing countries, the lack of reliable surveys and records, and the difficulty in valuing land and improvements also limit the use of property taxes. While political constraints will remain important, improvements in technology make it easier to have an effective property tax system if a country really wants to do so. Given the prevalence of decentralization around the world, taxes that can be effectively implemented at a local level (such as property taxes) may become more important.

Effective property taxation requires adequate records to identify property and locate owners, and a reliable method of valuing property. Internet-based resources (such as Google Earth or Microsoft's VirtualEarth service) allow for satellite imagery that assists in identifying and monitoring specific property locations and improvements. In some respects, this is just a continuation of existing practices: extensive use was made of aerial photographs, for example, in establishing the cadastre (land registry) in Latin American countries such as Chile and Colombia over 40 years ago. Taxing authorities in some countries are now relying on satellite images to determine improvements in property in lieu of the corruption-prone alternatives of depending on information from other sources and walking the streets.[51] Improvements in Internet capability both increase the availability and reduce the cost of the new technology.

[50] A particularly egregious case occurred in one small developing country in which a proposed property tax reform in the capital city was derailed when it became clear that one of the principal owners of property in that city was the wife of the country's political leader. In contrast, in another country, examination of individual property tax records revealed that, in practice, taxes were being applied only to members of a minority ethnic group.

[51] Jain (2008) discusses how satellite imagery may be used to estimate property tax liabilities in an Indian city (Dehradun). In Mexico, the city of Acapulco has linked its land registry documents with photographs in a document imaging management system (Laserfiche) to improve property tax collection and to ensure

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Internet-based valuation programs may also prove useful in at least some countries. One model, used by such sites as Zillow.com and Redfin.com, may provide taxing authorities additional information in determining the value of properties. These programs rely on publicly-available data on prior sales and then use an algorithm to estimate the value of other properties. In countries where an active real estate market exists, these programs may supplement existing valuation methods.[52] In rural areas, a simplified property tax system could sort land into three or four categories based on productivity or other characteristics.[53] Here, programs such as satellite imagery that permit some assessment of soil quality may facilitate imposing property taxes.

Finally, consider income taxes. Technology obviously offers many opportunities to alter the design of such taxes to make them simpler, more enforceable, and, if desired, more progressive. Individual income taxes may be readily coordinated with payroll or other employee taxes. Smart cards with employee-specific information may be used for purposes such as targeted credits and exemptions. If everyone who provides services is required to furnish an ID number or smart card, it would be possible to improve information reporting and withholding on payments for services and small suppliers. Businesses could claim deductions only if they provide the ID information or proof of withholding. Similar treatment could be applied to interest payments, with deductions allowed only if it was clearly demonstrated that the recipient of the payment was filing taxes properly with respect to that income.[54] It would also be much easier for taxing authorities to monitor different types of activities carried out by small businesses, for

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the inclusion of new construction projects in the tax base. Of course, much the same could be done with earlier, cruder technology: in one Argentinian city, tax officials examined aerial photographs and found that buildings covered at least 45% of the land recorded in the tax roll as "vacant".

[52] However, as experience in even the most developed jurisdictions shows, computerized methods cannot and should not completely replace traditional valuation methods (Slack, Tassonyi, and Bird 2007).

[53] For a recent proposal along these lines for India, see Rajaraman (2004).

[54] Alternately, countries could follow the Singapore approach for dividends, and require interest payments and dividend payments to be paid from a central fund. The government could then withhold tax at the appropriate marginal rate for every taxpayer. We do not discuss here the more complex issues raised by cross-border payments.

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example, by tracing the flow of inputs or outputs or by video surveillance of customers' activities.[55] Improved monitoring techniques may allow tax authorities either to eliminate presumptive taxes completely (as all potential taxpayers could be included in the normal tax base), or to make such taxes more effective and easier to integrate with the regular tax system.[56]

Tax Reform Process

Good tax administration relies on the good use of information. Good tax reform similarly depends on the good use of information. Improvements in information technology allow countries to administer existing taxes better, and to change both the administration and the structure of taxes to better achieve their developmental objectives. Techniques for developing tax forecasting and tax simulation models are now advanced enough—which, paradoxically, means they are simple enough to be understood and used by anyone at the university level—that even small and unsophisticated tax departments can use such models to provide information to policy-makers. Better information about predicting consequences of tax reform proposals, improved ability to determine the revenue and distributional consequences of proposed tax changes, and better ability to forecast future government tax receipts, should lead, over time, to better designed and administered tax systems in developing countries.

[55] A good field audit can achieve the same results. For an example of excellent field audit skills, see the activities of Ryoko Itakura, the tax inspector in Juzo Itami's movie, *A Taxing Woman* (1988).

[56] For a detailed discussion of the limitations of most existing presumptive income tax systems, see Bird and Wallace (2004).

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Privacy and Privatization—Some Cautionary Notes

In developing countries, as in developed countries, adopting new technology carries with it potential pitfalls as well as potential gains. Here we discuss briefly two areas with potential problems: privacy and privatization.

Privacy—Big Brother Is Watching

Schwartz (forthcoming__) in this symposium provides a general overview of privacy issues relating to tax and technology. Privacy scholarship has focused primarily on issues in developed countries. Here, we examine privacy issues in the context of developing countries.

Conceptions of rights to privacy differ among societies.[57] It is difficult to determine the scope of privacy rights without a particular context, whether it is risks of tax evasion or risks of terrorism. Our focus here is on the use (and abuse) of information by tax authorities. The challenges and scope of privacy rights extend beyond tax to the use of information by other government agencies, other governments, or private actors. Improved technology and access to information has made it possible for anyone to obtain the salaries of professors at public universities,[58] the political contributions of friends and foes,[59] and the value of the houses of one's neighbors.[60]

Improvements in technology have also made it easier for tax administrators to observe transactions and taxpayers. In the last decade, there has been a substantial

[57] For example, Europeans and Americans apparently have different conceptions of privacy rights. Europeans focus more on a dignity-based concept, whereby privacy is violated when there is an unauthorized portrayal of the individual. In contrast, Americans focus more on a liberty-based approach, whereby privacy is violated when the state makes an unauthorized intrusion on the rights of the individual (Whitman 2004).

[58] http://www.sfgate.com/news/special/pages/2005/ucsalary.

[59] http://www.opensecrets.org.

[60] http://www.zillow.com.

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increase in the ability to trace transactions (the tracing of payments and the tracking of physical products), the use of smart identification cards to match individuals to specific jobs and locations, and the use of devices (such as photo surveillance and traceable mobile telephone technology) to monitor movements of individuals.[61] The final outcome of the advent of the digital economy may thus be to strengthen, not weaken, the government's role as tax collector. At the extreme, as Rädler (2000, 798) put it, "[I]n a few years each of us will know his or her uniform global tax identification number to be used on a world-wide basis. It will give our place of residence . . . cash will totally disappear . . . its use will fade away because everybody will be obligated to exclusively use his money-card."[62] In Rädler's perhaps dark vision of the world, "Income taxation may be rather simple: most of the information needed is already contained in the central computer and will be correspondingly processed. The taxpayer has only to check whether the information provided by the computer is correct." This is not simply a utopian (or dystopian) vision. To some extent it is already a reality in Singapore, where withholding has been taken to its logical limit so that the government can transfer funds directly from a person's bank account to the treasury to settle tax liabilities as calculated by the government.

Some have suggested that the real danger from new technology may not be the erosion of the tax base as taxpayers use technology to avoid tax, but the erosion of privacy as governments take defensive action to protect the fisc in the emerging digital economy. Perhaps the only viable answer is for citizens (at least in countries in which they have a say in such matters) to reach a consensus that permits access to private activities necessary for the sustenance of their public communities, without allowing such information to be misused. One author's answer to this dilemma was what he called "the transparent society"—one in which, above all, people are held accountable for their

[61] For example, in recent years divorce lawyers have made increasing use of information from toll tags to establish the existence of extra-marital relationships. http://www.msnbc.msn.com/id/20216302.

[62] See also "Barter"s Latest Comeback," *The Economist* 21 (October 2000): 78.

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actions, including what they do with the information to which they have access (Brin 1998).[63] In other words, although presumably none of us wants our foibles and weaknesses publicly available, more transparency may simply be yet another part of the price we pay for living in a complex modern society.

Countries around the world, developed or developing, need to balance the benefits of providing taxing authorities with additional tools and resources, against the costs of invasion of privacy and potential for abuse by government officials and others. (Swire 1999). Different countries may strike different balances. Given the high levels of tax avoidance and the large size of the informal economy in most developing countries, it is likely that the benefits from providing these technological tools and resources to tax officials are greater in developing countries than in developed countries. Unfortunately, as discussed below, it is perhaps also likely that the potential for abuse and the associated costs are also likely to be greater in developing countries.

The potential gains to tax authorities from increased use of information from improvements in technology are clear. However, the availability of different types of information may also result in government officials using information for financial gain, political gain or discrimination, or simply for the thrill of invading the privacy of well-known individuals. Government officials could also use information, not for personal gain, but in a manner inconsistent with the laws governing privacy in order to achieve what they believe is good government policy. In addition, the potential exists for unauthorized third parties to hack into government computers for their own financial gain or political purposes.

Bennett (1991) frames the privacy-protection approach nicely by focusing on technology control, civil rights, and institutional accountability. Tax authorities can

[63] In a comment on this possible future, Manasian (2003, 25) suggested, rather despairingly perhaps, that the "antidote to the rapid erosion of personal privacy may prove to be not new laws but new rules of etiquette." Dependence on the politeness of tax collectors is not likely to strike most citizens as a very firm reed on which to rely.

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adopt safeguards for the different stages of information processing: input, storage, and output. Such safeguards include password protection, encryption, proper training of computer staff, and otherwise limiting access to the information. Swire (1999, 477-85) uses the analogy of the vault 600 feet down as a device in order to illustrate how societies could make choices about how to access information, how to limit unauthorized uses, and how to limit the disclosure of information with high privacy risks.

To date, most privacy legislation in developed countries has focused on protecting the rights of individuals. For example, the EU Data Protection Directive provides rules for private-sector processing of personal information. The U.S. Privacy Act of 1974 sets forth guidance on the use by the Federal government of data about individuals. Section 6103 of the Internal Revenue Code provides rules on the disclosure of tax return information.[64] The U.S. Treasury has also issued regulations covering the disclosure or use by tax return preparers of tax return information.[65]

A major challenge is to design regimes in order to ensure institutional accountability. There is nothing unique about increased use of technology in tax design and administration. In both developed and developing countries, the key issue is whether the legal and political institutions provide sufficient checks and balances to allow use of the information generated by improvements in technology without the likelihood of substantial abuses.

Given the diversity of cultures and societal norms, there likely exists a wide range of tolerance and intolerance for measures that infringe on privacy in different developing countries. Privacy International, a human rights group, surveys developments in 70 countries, assessing the state of technology, surveillance, and privacy protection.[66] Many policy initiatives adopted by governments may challenge personal privacy. Such

[64] For access to records from the Internal Revenue Service, see generally Saltzman (1991, para. 205).

[65] http://www.irs.gov/irb/2006-03_IRB/ar16.html.

[66] http://www.privacyinternational.org.

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initiatives include many of the technologies that may be used to improve the tax system discussed earlier: the use of identity cards using fingerprint and iris scanning biometrics, the linkage of public sector computer systems, the development of real-time tracking and monitoring through the communications spectrum, the development of real-time geographic vehicle and mobile telephone tracking,[67] national DNA databases, and the creation of global information sharing agreements.

Privacy International ranks countries according to constitutional protection, statutory protection, privacy enforcement, identity cards and biometrics, data sharing provisions, visual surveillance, communications interception, workplace monitoring, law enforcement access to data, communication data retention, surveillance of travel and finances, and global leadership and democratic safeguards. In the national privacy rankings for 2006, the countries with the lowest rankings include not only such expected candidates as Russia and China, but also Singapore and Malaysia—two countries that would likely rank near the top of most lists of developing countries with respect to the quality of their tax administration.[68] Developing countries with membership in the EU score relatively well, as do several Latin American countries. Although not rated, we suspect that Chile, which also ranks high at least on our list of developing countries with good tax administrations, would also score well in privacy rankings. On the whole, however, it seems probable that if tax administrators were to improve significantly their capacity to acquire information, few developing countries would have adequate procedural safeguards to offer sufficient privacy protection—at least from the perspective of current standards in most developed countries.

[67] Some Brazilian states employ GPS tracking devices backed up by mobile units of tax officials to keep track of cross-border trucking. The Brazilian state VAT is essentially levied on an origin basis which requires some check at the state border. Illustrating how good technology can help overcome poor tax design, appropriate use of IT obviously facilitates this archaic process.

[68] The UK ranks near the bottom of the list because of its widespread use of surveillance cameras. If concerns about personal security continue to trump concerns about privacy in other developed countries, they too may fall in the privacy rankings.

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The costs of disclosure of information may also differ among developing countries. In Colombia, for example, one reason offered by some for the recent discontinuation of the long-standing wealth tax, in existence since 1935, was fear that the misuse of this tax information might increase the risk of kidnapping.[69] In environments in which lives may be at stake when tax information is misused, the barriers against such misuse should clearly be very high. If it is not possible to erect and enforce adequately such barriers, then it may make sense not to collect the information, even if it prevents tax administrators from making distinctions among persons and the tax base that would theoretically improve the tax system.

Privatizing Tax Administration

Many technology-based proposals to change tax administration raise questions about the role of the private sector in the assessment and collection of taxes. This public-private issue for tax regimes is not new to issues of technology. The allocation of tasks to private actors has a long tradition in tax systems. The Romans, Egyptians, Ottomans, Mamluks, and the French each sold rights to collect taxes in geographic regions in return for a fixed fee. Other states have used privatized tax collection, whereby private actors collect taxes for the state in return for a percentage of the take.[70]

A large academic literature exists examining the advantages and concerns about privatization of services that were traditionally provided by the government. Privatization covers a wide range of arrangements, from outsourcing certain limited tasks to assigning full responsibilities of certain formerly government activities to private actors. Examples in developing countries range from the use of pre-shipment inspection

[69] Cynics may suspect that this argument hides less worthy motives. That may be, but the fear is nonetheless real.

[70] The recent use by the Internal Revenue Service of private debt collection agencies, highlights the advantages and concerns of using the private sector in tasks that have been traditionally performed by government employees.

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to establish valuations for customs purposes in countries from Indonesia to Liberia, to the out-sourcing of customs administration in Mozambique to a private consulting firm.

Those who support increasing the role of the private sector in providing government services note that several advantages might result from private initiatives. These advantages include the potential for improvements in the quality and effectiveness of services, increased competition and incentives for innovation, and the ability to avoid limitations that would be tied to government employees providing the services directly. (Trebilcock and Iacobucci 2003; Hart, Schleifer, and Vishny 1997). Concerns include the potential mismatch between private profit incentives and the social provision of goods, the loss of accountability for private actors, and the loss of public support for public institutions (Minow 2003). This last factor is especially important in the privatization of certain tax functions in countries where support for tax systems and tax administrators is weak.

A review of the competing considerations of private production and government provision of services is well covered elsewhere. We agree with the approach that in examining the merits of outsourcing or privatization, the analysis must be relative: the relative advantages of using the private sector over government employees, and the relative potential (and costs) for private sector failures as compared to government failures (Trebilcock and Iacobucci 2003).

Significant spillover potential exists from adapting private sector applications to improve government operations. Whether using technology (originally designed for inventory management) for identification and valuation purposes by customs officials, or using data management programs to allow sharing of information among different government agencies, private sector expertise and services clearly provide great potential benefits for tax design and tax administration. The question is how best to achieve these benefits without incurring unnecessary social costs.

Electronic copy available at: https://ssrn.com/abstract=1086853

The key challenge in outsourcing technology-based services is the loss of control of the confidentiality of taxpayer information, the protection of taxpayers' rights, and the tax administration's ability to have the expertise to continue to perform their activities. Again, the comparison is between the potential for failure for private sector activities against the potential for failure if the government provided such services directly, and the costs of such failures.[71] Even such simple cases as the use of private banks to receive and process returns from taxpayers carries with it potential problems as well as benefits. Just as oversight and process controls are needed to monitor the actions of government employees, similar measures are required to monitor the private provision of historically government functions. In countries where administrative, judicial, and political safeguards work relatively poorly when overseeing government employees, there is little reason to believe that such safeguards would work better when monitoring the actions of private actors.

The outsourcing of technology-based services in developing countries raises additional challenges. First, where foreign donors provide financing for such services, there may be direct or indirect pressure to select certain vendors or suppliers who may or may not be the best provider. Second, even where no outside pressure exists, developing countries may lack the expertise to select and monitor outside contractors. Finally, where whole functions or departments are outsourced, no internal capacity may be developed, and there will be challenges in taking over the tasks at the expiration of the contracts.

The Future Relationship of Tax and Technology

[71] An historic example is the Chinese Maritime Customs imposed on China as a means of servicing foreign debts in the late 19th century. For our purposes, the question is neither the efficacy of this foreign controlled agency in collecting the required revenues, nor the fact that some of the foreigners involved in the agency ended up with very large personal fortunes. The key question is whether tax administration in China was, on balance, benefited or damaged by this compulsory outsourcing of a principal revenue function.

Electronic copy available at: https://ssrn.com/abstract=1086853

Our review of tax and technology leads us to the following four conclusions. First, improvements in technology are not magic bullets to improve tax policy or tax administration in developing countries. Over the last 40 years there have been significant technological advances, but developing countries still have relatively low levels of tax collections as a percent of GDP, and relatively high levels of tax non-compliance. The challenges to designing and implementing effective tax regimes in these countries cannot be met solely by better tools for tax administrators, without substantial changes in the institutional and political environment. Building a good tax system is much like building a good state. In fact, both activities are likely to advance more quickly and soundly if they are undertaken together (Brautigam, Fjeldstad, and Moore, 2008).

Second, technological innovation makes it essential to reexamine tax policy and administration in developing countries. Many low-income developing countries still rely on the basic tax regime inherited from colonial powers.[72] Most tax revenues come from trade taxes and other taxes on consumption such as excise taxes and value-added taxes. Technological innovations has and will continue to change the way individuals and firms operate in the economy in ways that will make it both easier and harder for tax authorities to observe and monitor their transactions. These changes will give rise to additional choices for developing countries in choosing the relative role of different types of taxes in raising revenue and in designing the tax instruments.

Third, the potential gains from improvements in technology are likely greater in developing countries than developed countries. This assertion rests partly on the existing high levels of non-compliance, and the presence of more low-hanging fruit in developing countries relative to developed countries. Most developed countries have already adopted information reporting systems that cover a substantial portion of economic activity. Improving the capacity of tax authorities in developing countries to observe and

[72] To take an extreme example, at least until recently, the basic income tax nominally in force in Iraq was that imposed under the British mandate in the 1920s.

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monitor transactions will yield substantial benefits. Technological improvements reduce compliance costs and delays associated with paying taxes (for example, clearing goods at customs or standing in line to pay taxes), and such costs are generally higher in developing countries. Technology will also provide tax administrators with better tools to tax more effectively the informal economy and informal employment arrangements.

Fourth, the potential costs of using more sophisticated technology may also be greater in developing countries than in developed countries. Privacy concerns exist in all countries. Countries have adopted different approaches to minimize the loss of privacy rights from government or business activity. Although some developing countries have been successful in adopting administrative, judicial, and political safeguards (such as Argentina), most developing countries lack effective mechanisms to help prevent or discourage the abuse of information by government officials, or to limit access by non-governmental entities.[73]

New technology may result in the increased use of public-private partnerships, whereby private firms will take responsibility for tasks usually handled by government employees. The advantages and disadvantages of this type of privatization are similar in both developed and developing countries. What may differ, however, is the likelihood of introducing adequate institutional safeguards to minimize the potential costs from allowing private firms to assist with, or to take over, tax functions of the government.

Given the diversity among developing countries, it is difficult to make generalizations as to the future relationship between tax and technology. Some economies in developing countries are growing at over 10% a year with a high rate of technological change. Other developing countries (or, more accurately, non-developing countries) have stagnant or declining growth rates, and even declining life expectancies in a few instances. With this qualification, we offer the following observations.

[73] Developed countries also face substantial challenges in preventing unauthorized access to government records. In the United Kingdom, detailed tax identification and financial information on 25 million taxpayers was misplaced (lost in the post, more or less) by the tax authorities in 2007.

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First, like developed countries, the higher-income developing countries will continue to experience dramatic changes in their economy from technological and other factors. The increased use of banking systems, credit cards, smart cards, and online transactions will present both opportunities and challenges to tax authorities. This new economic environment will allow for improvements in tax compliance for some taxes and more challenges for other taxes.

Second, further improvements in tracking technology for both people and goods will provide additional tools for tax authorities to improve tax compliance. With its declining costs and improved capability, the use of tracking technology by tax administrators in developing countries will increase. For example, it is likely that many capital goods (cars, heavy machinery, or even televisions) will have identification and tracking tags included as part of the manufacturing process. This ability to monitor the movement of goods will provide new opportunities in customs, excise, and VAT administration.

Third, perceptions of increases in crime and terrorism will likely lead to higher levels of government surveillance and often greater acceptance of government monitoring of individual and business activity. For example, developed countries have made greater use of video cameras, and of tracking funds through banking channels. Combining video technology with smart identity cards will allow officials to track the movement of individuals. These and other technological advances will make it easier for government officials to monitor economic activity. As Slemrod (2006) noted, however, it does not follow that tax authorities will (or should) have access to such information.[74]

In conclusion, advances in technology will clearly change the tax environment in developing countries by changing the underlying economy. Technology will provide additional tools to tax administrators to observe and monitor individuals and transactions.

[74] See Cockfield (2007) for consideration of some of the privacy issues arising from new state surveillance techniques.

Electronic copy available at: https://ssrn.com/abstract=1086853

This combination will provide an opportunity for countries to make tax policy changes both as to the relative role of different taxes in financing government, and as to the design of specific tax instruments. With potential benefits come substantial potential costs. Most notably, developing countries need political, administrative, and judicial safeguards to protect the privacy of individuals and to protect against potential misuse of information gathered for tax or other purposes.

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