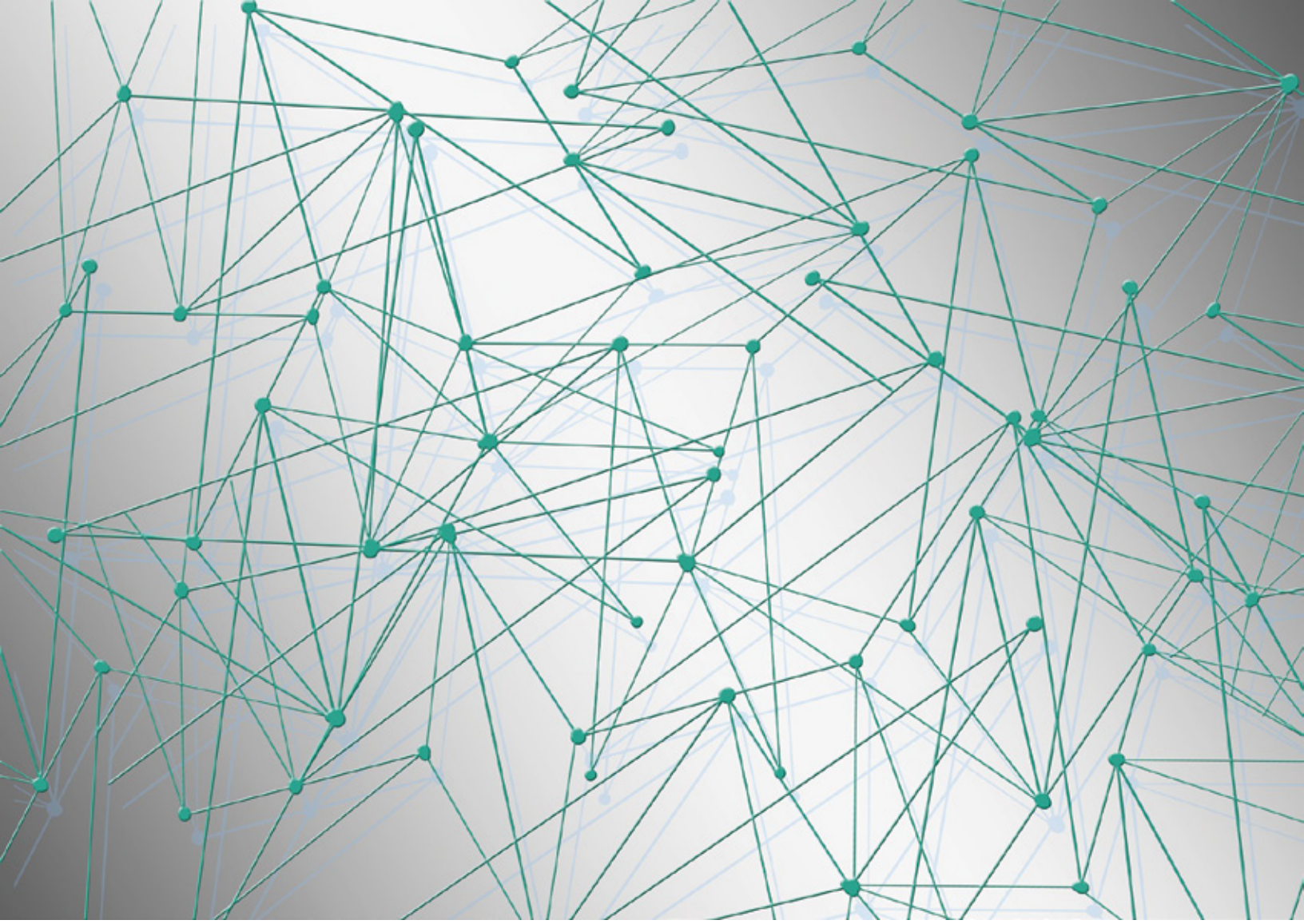

Electronic Invoicing in Latin America

English Summary of the Spanish Document

Alberto Barreix
Raul Zambrano
Editors

CIAT

IDB

Electronic Invoicing
in Latin America

English Summary of the Spanish Document

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Foreword

The technological developments of recent decades are changing the management practices of governments around the world. The implementation of digitization in public endeavors has made it possible to improve the services provided to the population. These developments, moreover, have touched upon public finances and tax collection, the essential basis for the maintenance of good public services. Used correctly, therefore, technology can create a virtuous circle for the benefit of society.

Electronic invoicing is a Latin American innovation to the process of tax transparency, and it has been able to use the available technological developments to improve control of taxes and make the services of the tax administrations (TAs) more efficient. Over time, and in conjunction with the enhancement of the technologies, this tool has been strengthened, as regards both its swift and easy availability to the public and as a safeguard of information. Moreover, it has not only improved the TAs but has made taxpayers' accounting easier, more efficient and more accessible, mainly among small and medium-scale taxpayers.

At the same time, it has been shown that this mechanism has generated positive externalities, since many governments have acquired potential to meet specific needs in each country. Some new uses that have been made of electronic invoicing include: control of goods, a single accounting system, electronic payroll, and factoring as a financing mechanism. Nonetheless, the seven experiences and their assessment reveal that a precondition for the effective implementation of electronic invoicing is a mature TA whose functions and processes are operating efficiently, as well as an economic environment of sufficient quality, and communications and information technology infrastructure.

When considering the externalities created, it is crucial to think beyond the present and imagine the uses that could be made of this tool in the future: its widespread use could enable information to be cross-referenced, so as to fight evasion and avoidance; and an international electronic invoice could even be created, so as to learn the sources in which taxpayers' incomes are generated. Furthermore, the large volume of information created in this system can be used for risk analysis; and it could even improve national accounting and the mechanisms used to regulate competition. A complete electronic mapping of the transactions in the entire economy and their international interaction offers myriad uses for the wellbeing of society. All that needs to be done is to continue the effort to use this tool as a platform, not only to improve voluntary compliance in the region and for risk analysis, but also to provide new services to the economy, services that are adapted to the countries' circumstances.

This book is an initial examination of electronic tax invoicing and its experience in the region where it was born. We invite readers to explore the Latin American experience, and the different uses that have been devised for electronic invoicing. Finally, we invite readers to reflect on how to take advantage of the virtues of this innovative system. This tool came to begin a process of changes adapted to the new technological conditions; now we have to decide how we are going to keep refining and adapting it to the interests and needs of the region.

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Content

Electronic Invoicing in Latin America: Process and Challenges

Alberto Barreix and Raul Zambrano

1. Introduction. 4
2. What is EI?. 6
   - 2.1. A standard format 6
   - 2.2. The tax administration has all the documents 6
   - 2.3. User (taxpayer) benefits 7
   - 2.4. The documents are signed digitally 8
   - 2.5. Mandatory use 8
3. EI in the context of tax transparency and the fight against evasion 8
4. Development of tax institutions in LAC 11
5. Preconditions for implementing EI 15
   - 5.1. Minimum operational processes in the tax administration. 15
   - 5.2. The tax administration's technological capacity 16
   - 5.3. Positive attitude to change and innovation 16
   - 5.4. Credibility of the tax administration 16
   - 5.5. Communications infrastructure 16
6. Operational models 17
   - 6.1. By scope. 17
   - 6.2. By manager of the model 18
   - 6.3. By format 18
   - 6.4. By the time of transmission and the role of the administration 19
7. Advantages and challenges of EI 24
   - 7.1. Advantages. 24
   - 7.2. Challenges 27
8. Extensions of EI in practice 29
   - 8.1. Electronic payroll in Argentina. 30
   - 8.2. Factoring in Chile. 32

8.3. Control of ground-vehicle freight 32
8.4. Expansion of services in Mexico 33
8.5. Uses beyond the tax administration 33
8.6. Electronic invoicing in international trade. 34

9. Impact assessments. 35
9.1. Methodologies used and findings obtained 37

10. Conclusion. 40

11. Description of the book 41

Evidence of the Impact of Electronic Invoicing of Taxes in Latin America

Karla Hernandez and Juan Robalino

1. Introduction. 47

2. Identification Strategies 48
2.1. Regression Discontinuity. 49
2.2. Difference in differences 50
2.3. Matching. 52

3. Findings 53
3.1. Interventions 53
3.2. Descriptive statistics on the studies 56
3.3. Impact estimates 57
3.4. Specific findings 60

4. Conclusions 61

Illustrations, Figures and Tables

Electronic Invoicing in Latin America: Process and Challenges

Illustrations

Illustration 1. Global Forum Standards on International Transparency, BEPs Actions and Recommendations of the FATF 10

Illustration 2. Tax Administration: Institutional Arrangements in Major Milestones, 1950–2017. 12

Illustration 3. Fiscal Crises and Reforms to Tax Administration and Customs in Latin America, 1990–2015 14

Figures

Figure 1. 1.a. Salary Tax Wedge in Latin America and the Caribbean and the OECD (% labor costs of unmarried employee without children, with average salary, 2013) 31

1.b Labor Informality in Latin America (% of workers who do not contribute to social security, 2013) 31

Figure 2. Yield of Taxes controlled by Electronic Invoicing and Electronic Payroll, and as % of Total Tax Revenue, 2015) 35

Figure 3. Percentage of Taxpayers That Issue Electronic Invoices (EI) as a Percentage of All Vat Payers and Percentage of EI Issued in All Issued Invoices, 2016 36

Tables

Table 1. Characteristics of Electronic Invoicing. 20

Table 2. Rate of VAT and Business Income Tax with Their Rates of Evasion, Administration Functions and Autonomy of the TA 37

Table 3. Impact of Electronic Invoicing in Selected Countries 39

Figures

Figure 1. Regression Discontinuity 50

Figure 2. Difference in Differences 52

Tables

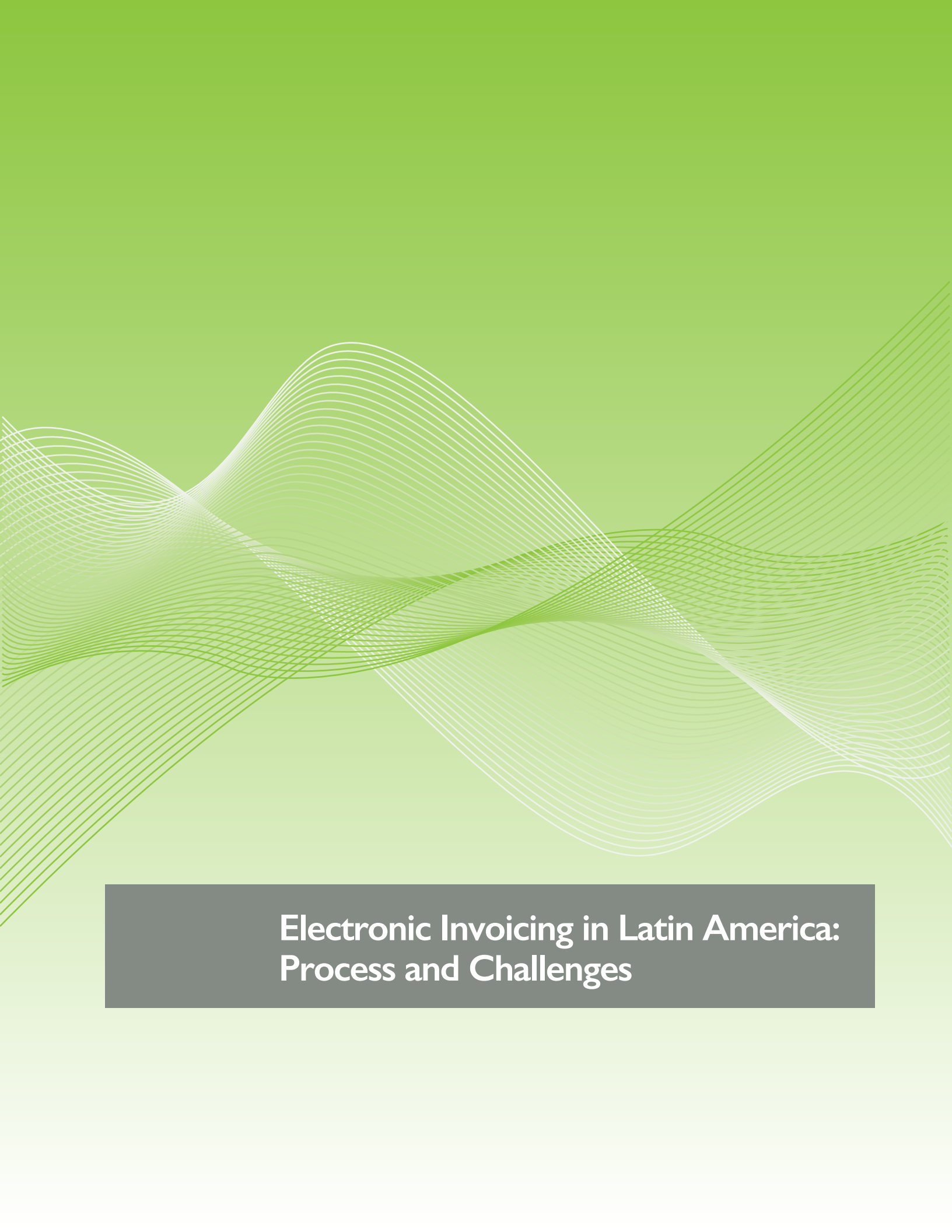
Table 1. Characteristics of the Evaluation of the Impact of Electronic Invoicing in Latin America 55

Table 2. Ex-ante and Ex-post VAT Revenue 57

Table 3. Main Effects of the Impact Assessments. 59

Graph

Graph 1. VAT Payers that Issue Electronic Invoices 56



Electronic Invoicing in Latin America: Process and Challenges

Electronic Invoicing in Latin America: Process and Challenges[1]

Alberto Barreix and Raul Zambrano

Abbreviations

AFIP	Administración Federal de Ingresos Públicos / Federal Public Revenue Administration (Argentina)
ANIP	Autoridad Nacional de Ingresos Públicos / National Public Revenue Authority (Panama)
B2B	Business to business
BEPS	Base erosion and profit shifting
CFD	Digital tax receipt
CFDI	Online digital tax receipt
CFE	Electronic tax receipt
CIAT	Inter-American Center of Tax Administrations
DEI	Dirección Ejecutiva de Ingresos / Executive Revenue Directorate (Honduras)
DGI	Dirección General Impositiva / General Tax Administration (Uruguay)
DGII	Dirección General de Impuestos Internos / General Directorate of Internal Taxes (Dominican Republic)
DGT	Dirección General de Tributación / General Directorate for Taxation (Costa Rica)
EDOS	Business that deducts fake operations
EFOS	Business that invoices fake operations
EI	Electronic invoicing
EP	Electronic payroll
FATCA	Foreign Account Tax Compliance Act
FATF	Financial Action Task Force
GAFILAT	Financial Action Task Force of Latin America
ICMS	Tax on the movement of goods and service provision
IRS	Internal Revenue Service (United States)
OECD	Organization for Economic Cooperation and Development
PAC	Authorized certification providers
SAT	Superintendencia de Administración Tributaria / Superintendency of Tax Administration (Guatemala)
SAT	Servicio de Administración Tributaria / Tax Administration Service (Mexico)
SII	Servicio de Impuestos Internos / Internal Tax Service (Chile)
SIN	Servicio de Impuestos Nacionales / National Tax Service (Bolivia)
SPED	Public system of digital accounting
SRI	Servicio de Rentas Internas / Internal Revenues Service (Ecuador)
SUNAT	Superintendencia Nacional de Aduanas y de Administración Tributaria / National Superintendency of Customs and Tax Administration (Peru)
TA	Tax administration
UBO	Ultimate beneficiary ownership
VAT	Value added tax

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1. INTRODUCTION

The electronic invoicing (EI) of taxes[2] is one of Latin America's contributions to international taxation in support of the fight against evasion, global efforts towards tax transparency, and the digitization of tax administrations (TAs). It sprang from the innovative efforts of the region's more advanced TAs, especially those that embarked on their modernization process in the 1990s under the impetus of the ideas behind the Washington Consensus and the influence of "reinventing government" (Osborne and Gaebler, 1993) for public administration. This postulated a service focused on the government's mission and the citizen, using results-based efficiency criteria.[3] The other key factor behind the modernization of the TAs was the imperative need to improve the collection efficiency of the region's governments in order to offset the disequilibria caused by financial-fiscal crises.

Initially, EI was conceived as an instrument of documentary control over the invoicing process, so as to avert both the omission of sales and the inclusion of false purchases. The original idea was extended to other areas of tax control, such as payroll, goods in transit, and new services like factoring. To some extent, EI can be regarded as the start of the process of digitizing the TAs in the broad sense.

EI can also be viewed as an instrument of the third industrial revolution (computing, the Internet and telecommunications; Schwab, 2016) based on the creation and dissemination of data. It is very likely that EI will spearhead the digitization of other taxes, such as the widespread use of electronic payroll systems, and will serve as a new means of controlling non-compliance by means of risk analysis, because for Latin America there is evidence that EI improves collection. For example, this chapter summarizes five impact assessments of EI[4] that reveal positive effects on collection in the five countries under study: the findings show a positive differential effect in VAT returns[5] and payments from the time of implementation in countries that differ in the structure and period of their economic cycles, as well as in their legislation and TAs.

Moreover, EI will change the relationship between the taxpayer, the private sector in general, and the public sector. On the one hand, EI makes it possible to offer additional services to taxpayers, and thereby depart a little from traditional thinking about control and enforcement. For example, factoring, the control of goods transit or the disclosure of the prices of certain goods, comprise an improvement in the different markets' access, efficiency and clarity. As will be seen, all this will help the public sector to better discharge its duties as a regulator, so as to ensure real competition in the markets and make the prices

2 In this text, an "electronic tax invoice" means electronic invoices that are not only valid for all tax purposes but that are also received in their entirety by the TA.

3 The Washington Consensus spurred the modernization of TAs but its emphasis was in keeping with macro-fiscal thinking (collection) and with economic opening. Nonetheless, it is right to acknowledge the significant influence of, and the progress fostered by, the concept of "reinventing government" and its new paradigms of service in the public administration.

4 Additionally, one chapter in the book analyzes in detail the assessments carried out. The individual assessments are available online.

5 In the case of Mexico the impact on the business income tax was also assessed.

of public-services procurement more transparent. Furthermore, the deployment of EI could also include a novel mechanism for collaboration with the private sector. An example of this is the case of Mexico, which required a joint undertaking with technology infrastructure firms to ensure the effective operation of EI. In all, EI and these innovative services will change the role of the TA from controller of taxpayers' compliance to supplier of services to taxpayers and to the public sector itself, within a more flexible relationship.

Implementing EI effectively and optimizing its potential in innovative uses will be a real challenge for the TAs, and will require that they adapt their mission, authorities, organization, processes, technological facilities and, above all, the profile and capacity of their human resources. Additionally perhaps, their new potential to generate information and their greater capacity to affect behavior could come to influence the creation of new tax policy designs.

The twenty-first century has witnessed this modernization effort, which began in Chile in 2003 and, by mid-2017, was at advanced stages in Argentina, Brazil, Ecuador, Mexico, Peru and Uruguay. Projects are underway in several other countries of the region, including Costa Rica, Colombia, Guatemala, Panama and Paraguay, and an intent to develop national systems has been expressed in the Dominican Republic, El Salvador, Honduras and Venezuela. Some countries of Southeast Asia, especially South Korea,[6] are considering the introduction of electronic tax invoicing. Meanwhile, since the early years of this century EI has been deployed in the private sectors of several European Union countries such as Austria, Germany, Sweden and the United Kingdom. Some European countries have begun requiring the use of EI alone for all transactions with the public sector, especially Denmark (where it has been obligatory since 2005), Finland, and Italy (which will require the use of EI for all B2B operations as of 2019). There are also projects in African countries such as Angola and Kenya, both of them members of CIAT.

This chapter will present the stylized facts of EI and its experience in Latin America. The first part explains what EI is and its link to standards of transparency, and describes how this idea, which originated in Latin America, has become a worldwide tool with great potential to tackle evasion. Thereafter, it explores the preconditions for implementation of a robust EI system and the models now operational. The chapter then describes the advantages and challenges of implementing EI, from the viewpoint of the TAs and of the other economic actors, followed by a comparative picture of the characteristics of the countries that have implemented the EI systematized in the book. The impact assessments that measure EI's impact on collection in five jurisdictions are then summarized. The chapter ends with some concluding thoughts on the EI process.

6 Since the end of the last century South Korea has encouraged online payment of taxes and filing of returns, the use of electronic payment media and the issuance of electronic invoices between businesses and final consumers, and even electronic payment of salaries. After considering that electronic invoicing was not effective, the country made it obligatory in 2009. All corporate enterprises were included in 2011, and in 2014 all businesses billing more than US$250,000 joined the system, giving a coverage of about 500,000 businesses. Singapore has allowed electronic invoicing since 2003 between taxpayers as long as they request authorization from the administration and meet the legal requirements on VAT. Since 2008 EI has been required in the sale of goods and services to the government (Lee, 2016). Since 2011 in Taiwan it has been mandatory for all businesses that issue electronic invoices to use the platform set up by the finance ministry, and thus to transmit all the information to this state database (Chen et al., 2014).

2. WHAT IS EI?

The simplest description of what electronic invoicing means is in the name itself. It is an invoice that exists in electronic form and that, in all situations and for all actors, has the same purposes as a paper invoice, for issuers, recipients, and interested third parties. Put another way, it is a document that records an entity's commercial transactions in electronic form, fulfilling the principles of authenticity, integrity, and legibility in all applicable situations and for all the actors in the process, in the commercial, civil, financial, logistical and, undoubtedly, tax spheres.

The fact that the invoices are electronic adds some conditions arising from the very digitization of documents—for example, that they can be stored and transmitted using electronic media, that there are no differences between originals and copies (since they are identical), and that there is a set of rules and defined processes that enable interpretation of this data structure as the documentation of a transaction. Latin American EI systems share certain characteristics but also have significant differences, such that there are no two equal implementations of EI. These systems have the following characteristics in common.

2.1. A standard format

Each jurisdiction defines a single format to be used by all issuing taxpayers, and that format is regulated by the TA. This is fundamental because, within the national territory, it enables all taxpayers to issue and receive invoices with the same format and under the same operational model; this obviates the risk that the electronic document might be viable only for small groups of taxpayers, or that groups of taxpayers might impose formats on the system's other users.

2.2. The tax administration has all the documents

This characteristic simultaneously creates enormous potential and challenges for the administration. Just storing all the documents becomes a challenge, and processing them demands a computing capacity far beyond what any given administration would have had before the system was introduced. When the system is fully installed, the number of electronic invoices that the TA will receive and process in a few days will be significantly higher than the number of tax returns and information files received from third parties in a year.

The characteristics of the operational model—which requires decision-making that ranges from prior authorization to the use of third parties as aides for the tax administration—condition and determine the effort needed for proper implementation, both as regards the initial investments and the continuous increase in storage and processing capacities.

EI's potential for the administration is extraordinary, and is evident in the areas of both tax control and services. As regards control, it is clear that the simple accumulation of debits for a taxpayer in the invoices issued and credits in the invoices received—contrasted with the periodic tax returns covering the corresponding tax—creates a returns-related control capacity that is much greater than any of the mass control practices used previously. Processes such as the sampling of invoices issued in the verification and scrutiny stages become obsolete when the administration's systems have an electronic record of all the documents. Similarly, it is clear that some methods of fraud, such as duplicating invoices (invoices with the same number sent to two different buyers for different operations) become unworkable.

The control-related potential goes beyond this simple summation and checking, however, which is only a first step. Using statistical, analytical and applied-artificial-intelligence techniques and tools, the processes of risk management and case-selection for detailed analysis and auditing can be improved significantly, ranging from probable data errors to probable fraud schemes involving inter-related groups.

2.3. User (taxpayer) benefits

The widespread implementation of a national electronic invoicing system has substantial advantages for taxpayers, both as regards lowering compliance costs and the prospect of boosting their efficiency thanks to the reduction in operating costs and the possibilities of automation. The lowering of costs for taxpayers that issue a large volume of invoices stems from considerations such as savings on paper and on physical space for document storage during the period required by law, as well as savings related to the physical dispatch of documents to customers.

These benefits extend to small and medium taxpayers because the TAs have provided mechanisms for them to take part in the system at low cost, either with an online system on a TA website, as in Chile and Argentina; or using free applications that taxpayers can download and install, as in Brazil and Ecuador; or by ensuring that third parties authorized to certify documents offer free options to taxpayers, as in Mexico.

Another important benefit for taxpayers is the reduction in compliance costs and the possibility of easing certain obligations to the TAs, such as sending information to the administration or even the obligation to maintain purchase and sales ledgers. In September 2017, Chile's SII began making proposals on pre-filled tax returns and offering registration of purchases and sales to a large proportion of the country's taxpayers.[7]

7 In a four-month period (August to November 2017), 1.2 million tax returns were filed. The main users (95 percent) are small taxpayers and micro and small enterprises (Villalón, 2018).

Finally, it should be noted that taxpayers' opportunities to reduce transaction costs include upgrades to their own processes—for example, improvements in the accounting records on receivables, payments to suppliers and inventory management, and the possibility of inter-operating with other taxpayers.

2.4. The documents are signed digitally

EIs are signed and authenticated so as to allow the originator to be determined and thereby prevent the issuer from rejecting the document. They also include mechanisms that, for all practical purposes, guarantee that the document is whole and that it has not been altered since it was signed.

Generally, this is done by digitally signing an electronic document supported by a PKI[8] platform that is backed by the national certification authority or the TA itself. Use of the cryptographic capacities related to the use of digital certificates, moreover, allows the content of the documents to be enciphered during its online transmission to the TA.

2.5. Mandatory use

Though it might seem like good practice to introduce an optional electronic invoicing system during a long period in which taxpayers can voluntarily choose to join the system, international experience shows that these systems are only consolidated when they are made mandatory.

Some countries have therefore decided to make use of the electronic document obligatory for all taxpayers subject to indirect excise taxes; others have introduced progressive strategies to extend its scope in line with considerations such as economic activity or sector, volume of invoicing, taxpayers' prior situation as regards issuing paper invoices, total sales, or geographic location.

Apart from the objections that arise when the projects start, it is apparent that the use of electronic invoicing systems has been well received by taxpayers, even when its use is mandatory.

3. EI IN THE CONTEXT OF TAX TRANSPARENCY AND THE FIGHT AGAINST EVASION

International cooperation on tax transparency and the fight against evasion, promoted by the G20 and led by the OECD, has become a policy priority after two critical geopolitical events. The first, the attacks of

8 Public key infrastructure.

September 11, 2001, triggered the global effort against money laundering and the financing of terrorism (ML/FT) with the strengthening of the Financial Action Task Force[9] (FATF). The second was the outbreak of the financial crisis in the developed western world and the consequent fiscal crisis, which gave impetus to the conceptual development and practical implementation of standards on tax transparency and the exchange of information. All this was implemented to tackle the evasion and avoidance attendant on the aggressive tax planning of large multinationals (the "base erosion and profit shifting" project or BEPS) in an effort to transfer their profits to countries with little or no tax so as to avoid paying corporate tax.

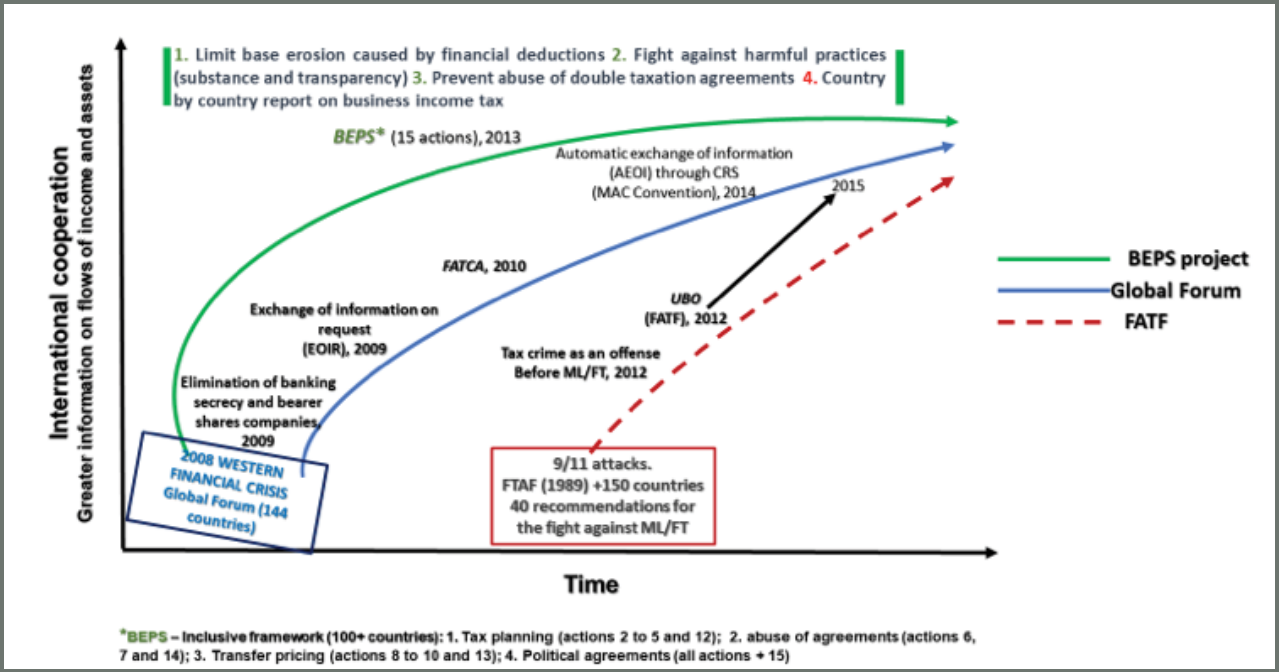
One of the immediate reactions to the 2008 financial crisis was to take forward an international effort led by the G20 (see Illustration 1) to implement tax transparency measures. This attempt to improve clarity in the markets intensified after the fiscal and sovereign debt crisis in the advanced economies. Development of the principles of tax transparency and the exchange of information between jurisdictions comprised one of the two great areas of international consensus. The second was the multilateral institutions' coordination of bailouts for the financial system[10] and for countries, since critical financial measures has to be taken. These continue to be applied, both in local financial markets and to address the subsequent fiscal crisis that still afflicts some countries. These bailouts unfolded during the period known as the "great recession," which is now coming to an end.

In effect, the 2008 financial crisis changed the status of TAs throughout the world. These changes emerged in the developed countries because of the fiscal needs spurred by the crisis and because of the pressure of public opinion, which reacted to the bailouts of the financial sector and the revelations of aggressive financial planning on the part of (large) depositors and companies, some of them given special treatment by the recipient jurisdictions themselves. It is clear that the developing countries have also benefited from this tax transparency process, given their higher levels of evasion and more limited institutional capacity (collection, regulatory and judicial agencies), which is much less developed and has very limited oversight powers.

9 In the region, the Financial Action Task Force of Latin America (GAFILAT) is the regional body belonging to the international network of organizations devoted to preventing and fighting against money laundering and the financing of terrorism. GAFILAT is a regional inter-governmental organization that brings together 16 countries from South, Central and North America.

10 The United States and Europe suffered a loss of savings (assets) and an increase in the country risk because of the breakdown of financial markets. As a whole they slumped in the three-year period between 2007 and 2009. Some 17 of the world's 30 biggest financial (and insurance institutions) had to be supported by the monetary authorities. Wall Street, the leading stock market, lost 40 percent of its market value, almost US$6 trillion, while just a single European bank posted a third of that loss in personal assets.

Illustration 1. Global Forum Standards on International Transparency, BEPs Actions and Recommendations of the FATF



Source: prepared by the authors.

In plain terms, the implementation of tax transparency standards, developed in the Global Forum,[11] makes it possible to complete the "external" knowledge of financial flows and the stock of ownership. The exchange of tax information is regulated by the Multilateral Convention on Mutual Administrative Assistance in Tax Matters (so far signed by 114 countries). The Convention allows for the periodic and systematic transmission[12] of non-preselected information from the State of the source to the State of residence, relative to a series of preestablished categories of income: dividends, interest, royalties, salaries, pensions and so on.[13] Additionally, it makes it possible to identify (register) the ultimate beneficial owner (UBO) of the property,[14] and thus the capital stock of the company and the individual can be determined.

11 The Global Forum (GF) which consists of about 146 jurisdictions, including the main financial centers, has completed more than 250 reviews of the exchange of information on request standards in seven years and has issued 121 ratings.

12 The Common Reporting Standard (CRS) was adopted in 2004; this serves as a support guide for the TAs and the financial institutions in complying with the commitments and obligations stemming from the automatic exchange of information.

13 The 2010 US Foreign Account Tax Compliance Act (FATCA), which transformed the international outlook for information exchange, must be accorded particular merit. Under FATCA, foreign financial institutions (FFIs) must identify the accounts of US citizens or persons (of interest), and periodically and automatically must report information on those accounts to the US Internal Revenue Service (IRS). FFIs that do not report information face a 30 percent tax withholding on certain payments to them from US sources.

14 The property's beneficial owner (BO) is a concept developed by the Financial Action Task Force (FATF) that links tax transparency with the process of fighting money laundering and the financing of terrorism. It refers to the natural person(s) who ultimately owns or controls a customer and/or the natural person on whose behalf a transaction is being conducted. It also includes those persons who exercise effective ultimate control over a legal person or arrangement. That is, what is important is who enjoys the benefits even though that individual might have only a small percentage of ownership, or the individual (or group of individuals) who directly or indirectly has voting rights or influence over decisions on a financial asset or company.

In addition to the knowledge that facilitates the international exchange of tax information, EI and its extensions (as seen below) are tools that allow for greater knowledge of tax subjects in their domestic operations, since they remain under the control of national institutions. In fact, EI is an instrument that allows the TA to acquire almost complete information on the taxpayer universe and on taxpayers' transactions. Thus it is possible to monitor several links in the chain of economic activity (production of goods and services) and, therefore, improve the effectiveness of tax oversight. The latter, thanks to the introduction of EI, has greater capacity to validate, aggregate and contrast all the available data so as to identify errors in tax returns or accounting records, and detect evidence of fraud.

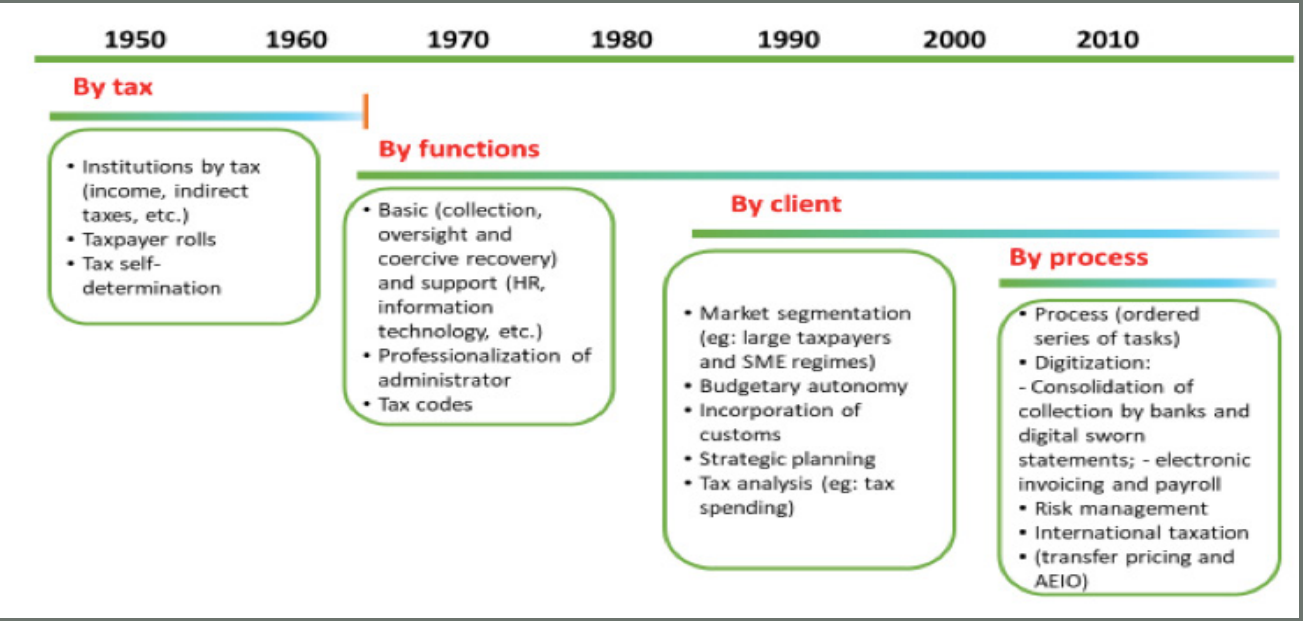
Moreover, one of the (almost natural) extensions of EI is electronic payroll (EP), which includes information on salaried employees. This makes determination of the payment of personal income tax and social security contributions more transparent. To complete this circle of control, the introduction of EI in foreign trade would help resolve problems ranging from European-style "carousel"[15] fraud to transfer pricing. The combination of these three systems, which would cover the three pillars (Barreix et al, 2017) of collection at the world level (VAT, income tax and social security contributions) would entail vast and valuable information on taxpayers.

4. DEVELOPMENT OF TAX INSTITUTIONS IN LAC

Tax management has evolved significantly since the middle of the last decade, and digitization is very likely to accelerate the process. Since the consolidation of national states, the dominant tax comprised import duties complemented by real property taxes and some excise taxes. In the wake of the Second World War, Latin American countries began to develop autonomous bodies for tax administration—specific taxes on consumption and transactions, on the one hand, and income tax on the other. In that primal stage, which we term **by tax** in Illustration 2, taxpayer rolls and the first forms of collecting and auditing each tax were consolidated.

15 The (temporary) VAT regime in the European common market since 1993 establishes that goods and services acquired by one member-state to be transported to another member jurisdiction are exempt from VAT in their place of origin (deferred VAT), and some firms exploit this exemption to buy and sell real or fictitious products, the supplier of all of them being a company, often one that does not actually exist, that does not pay VAT. In some cases this abuse of intra-EU operations masks money laundering.

Illustration 2. Tax Administration: Institutional Arrangements in Major Milestones, 1950–2017



Source: prepared by the authors.

With the intensification of corporate income tax, and the mass levying of personal income tax, modern TAs began to be consolidated **by substantive function** (collection, oversight, recovery and so on) and by **support function** (planning, information technology and so forth), and their personnel were professionalized. This process was strengthened by the introduction of VAT in the region from the mid-1960s onwards. Subsequently, with the "lost decade" of financial and fiscal crises in the 1980s—which made it crucial to increase tax revenue so as to service the debt and finance growing budgets—TA management began to be segmented: units for control and timely recovery were introduced for large taxpayers, as were advantageous special regimes for small taxpayers. In this period, several countries began to modify the institutional structure by combining the TAs with customs, and in the first decade of the twenty-first century three countries were incorporating collection of social security contributions. The TAs' powers increased, including budgetary independence in some cases, and their staff were further professionalized.

Finally, with advances in information technology and telecommunications, tax management methodologies **by process** were introduced[16] and the outsourcing of some activities was expanded, such as collection through banks and digital tax returns. With the new processes arising from technological progress, EI and its extensions are among the most advanced spheres and new areas have begun to be developed,

16 The processes are defined as an ordered series of tasks to attain a specific goal.

such as risk management and the provision of services such as factoring or price transparency (see below). Obviously, this division by time period highlights the characteristics of each stage, but it is a concentric process in the sense that the influence of taxes in the organization persists: for example, the sector devoted to auditing income tax or VAT refunds, or to functions still present in the organizational charts of units for collection at the international level, or even at the decentralized level, such as collection in regional or local offices.

This evolution of the TAs is inherently correlated with business developments in the broad sense, with knowledge management and marketing (Witzel, 2012). In much of the western world the activities of large companies are concentrated in the provision of few products, just as the TAs provide management of a limited range of taxes. The automotive industry is an example. After a process of industrial concentration in dominant vehicle-producing oligopolies up to the middle of the twentieth century, the large companies—especially the manufacturing firms—began to diversify into other sectors such as financing manufactured goods, or distribution and sales, all of these being processes that were gaining importance in businesses' functional structures (Drucker, 2009). To some extent this transformation is akin to the professionalization and diversification of the TAs in Latin America, which are now organized according to functional criteria and not to structures determined by tax type (direct and indirect).

Later, around the final quarter of the twentieth century, as markets became more open, the segmentation and targeting of the customer base and suppliers became crucial as a source of competitive advantage (Armstrong and Kotler, 2016), similar to the differentiation of taxpayers that the region's TAs began to undertake in the 1980s.

Finally, almost two decades ago, together with the major advances in information technology and telecommunications, delocalized management by processes began,[17] with cross-cutting approaches and some decentralization of the organization. Moreover, taking advantage of globalization, value chains have been extended and operations have been allocated to various countries, from the manufacture of aircraft to clothing production or, in services, from call centers to computing. Similarly, but with national jurisdiction, the TAs use dedicated teams to carry out a particular process, such as international exchange of information or the implementation of EI itself.

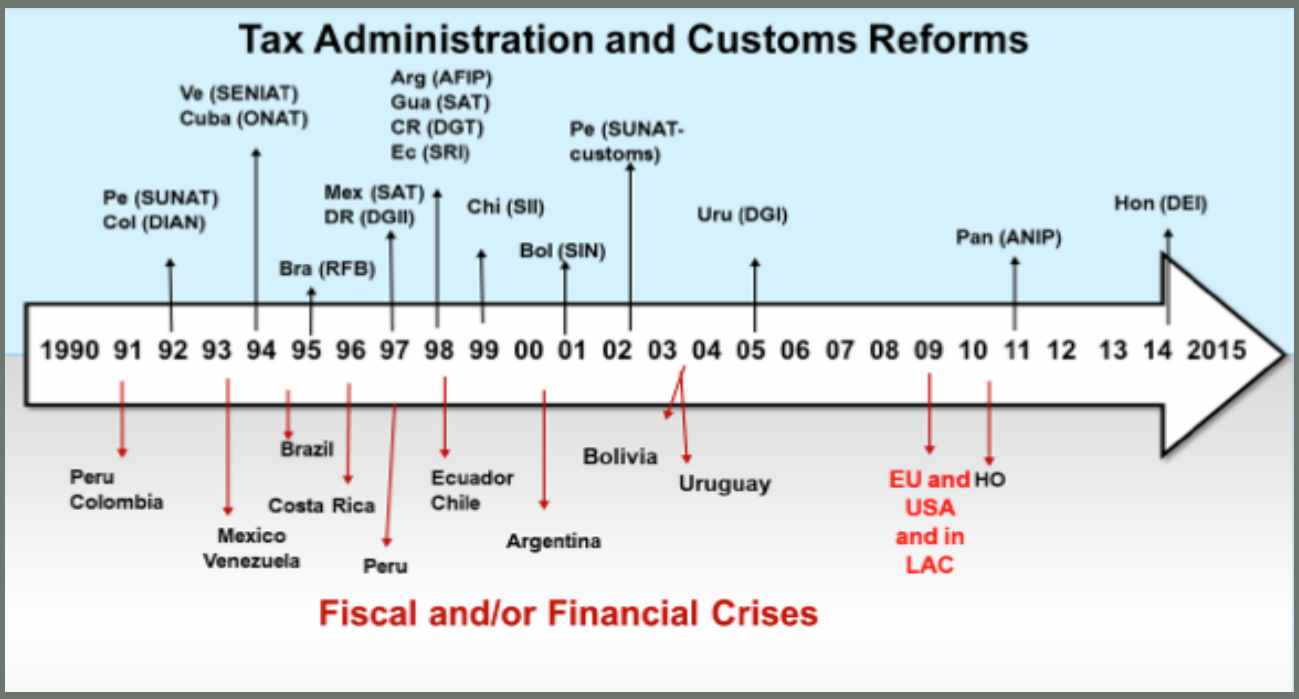
As regards the TAs of Latin America, there are clear differences between them in terms of levels of collection and their composition (Barreix and Diaz, 2017), and they are organizationally and institutionally diverse. We should also note the disparities in the countries' productive structures. Some sectors are highly concentrated and very sophisticated in their methods of production, marketing and financing, with state-of-the-art technologies, using highly skilled legal and tax consultancy services; these coexist with mid-level taxpayers and/or business sectors, and with others in the informal sector or on the edge of it.

17 A process is defined as an ordered series of tasks to attain a concrete product or service.

It is clear, nonetheless, that the management indicators reveal a lag among the Central American and Caribbean administrations (IDB-CAPTAC-CIAT, 2013; CIAT, 2016). It is also apparent that the region does not conform to the traditional explanatory variables of the TA's development level, such as per capita income, the level of public spending, or the characteristics of its international trade.

Considering the above-described evolution of the TAs as valid, and capacities in tax matters, it is worth asking what prompted the modernization of the region's TAs and, consequently, their adaptation to technological advances such as digitization.

Illustration 3. Fiscal Crises and Reforms to Tax Administration and Customs in Latin America, 1990–2015



Source: prepared by the authors on the basis of M. Pecho (IMF).

A simpler analysis, based on the recent timeline of reforms to the administration—sometimes matched by reforms to tax policy—as presented in Illustration 3, shows that in many cases reforms occur after a large-scale financial-fiscal crisis. It can be inferred from this that in most cases in South America, the reform sprang from the need to improve the TA for the sake of the government's (the State's) very survival, since the government lacked the external credit to finance itself. By contrast, most of the Central American and Caribbean crises were addressed with different kinds of bailouts—probably because there were fewer geopolitical considerations or factors related to the scale of the financial aid—that resolved

the fiscal emergency without the need to professionalize the TA or to pay the political costs of obliging the electorate to pay taxes. Overall, externally financed bailouts seem to replace the necessary political will to drive the modernization of the TA, and that is the real force that gives impetus to improving the administration, including expanding its authority, updating its technology, and professionalizing its human resources.

5. PRECONDITIONS FOR IMPLEMENTING EI

The complexity of EI-related processes requires a minimum set of conditions that must be met by the TA and the country's technological infrastructure before EI can be implemented. If a TA has problems processing tax returns, or if most of the returns are not submitted online, it is unlikely that the necessary conditions prevail to implement an EI system that surpasses by some order of magnitude the current volume of transactions managed electronically by the TA.

Without these preconditions, it is likely that an attempt to implement and even the partial implementation of an EI system will significantly impair the TA's management capacity, affect its reputation, lessen taxpayers' sense of risk as regards compliance, and in the end deliver none of the benefits that taxpayers hope for. The management gap can widen even further because of the TA's own digital deficit, affecting the rest of the economy and depriving it of new and better services, as shown below.

5.1. Minimum operational processes in the tax administration

The following processes must be operational and working reasonably well in the TA:

- Taxpayer registration—especially with respect to taxpayers' obligations as regards the taxes to which they are subject and their formal obligations. Matters of identification, duplication of registrations, management of corporate succession and permanent closure, suspension or cancelation of a registration and related matters must function reasonably well.

- Receipt and processing of electronic returns, especially those related to consumption taxes.

- The frequent and routine receipt of information from third parties through electronic media.

- The presence of efficient auditors and effective coercive collection foster voluntary compliance because of the perception of the risk of being properly penalized in the event of non-compliance.

5.2. The tax administration's technological capacity

It is clear that a TA needs the infrastructure, storage and communications capacities to handle the volume of documents. Additionally, however, it is desirable that the functionality of the information systems and the business intelligence related to the use of the system for the purposes of management and control be the property of the administration. This guarantees that the natural evolution of electronic invoicing is not interrupted because of constraints on the amounts available to contract out computing services from third parties.

It is plain that because of the concrete circumstances of developing countries, or those with relatively small administrations, they will not have the capacity to deal with those developments using their own resources; but even in that case, efforts should be made to ensure that the administration defines and determines the goals and scope of the services contracted out or developed by third parties.

5.3. Positive attitude to change and innovation

The establishment of a national electronic invoicing system poses challenges attendant on the necessary process adjustments, especially in the area of oversight, as well as the above-mentioned technological challenges. For the process to generate significant gains in a relatively short time, it is crucial that the administration's officials are receptive to modifying the new control processes.

5.4. Credibility of the tax administration

Clearly, this is a sensitive matter. It is unlikely that society will accept willingly that the TA has all of the country's invoices in its possession, or most of them, unless there is a climate of trust and credibility between society and the administration. It seems essential that there should be no recent events that discredit the administration: in implementing mass systems, in the proper and non-abusive use of oversight authority and, even more important, relatively regular episodes of corruption.

5.5. Communications infrastructure

The country's technological capacity, especially as regards communications and the availability of Internet access, is a critical matter for the national deployment of EI. This capacity is even more crucial if all the transactions, including those of the final consumer, are subject to electronic invoicing, because the system must then be available and operational in remote and economically disadvantaged areas that might have limited connectivity and deficiencies in telecommunications infrastructure.

In other words, an effective installation of EI that facilitates voluntary compliance requires that certain preconditions be met: some of them are related to the State's institutional apparatus, such as the TA's installed capacity for the oversight of growing transaction volumes, the speed of judicial collection, or the

effective application of penalties. Other preconditions are related to the operability of the physical infrastructure for communications. Hence it is important to emphasize that the success of electronic invoicing depends on the solidity of the TA and not the other way around.

6. OPERATIONAL MODELS

Apart from the similarities mentioned above, the operational models for national electronic invoicing systems in Latin America differ among themselves. In an effort to characterize them, we will use the following criteria:

6.1. By scope

The national electronic invoicing systems cover other electronic documents. Credit and debit notes are naturally included in the system, but they can also hold documents supporting internal goods transport, withholding certificates, social security contributions certificates and so on.

On the other hand, the kinds of operations covered might or might not include operations with final consumers of B2B. Argentina, Chile and Brazil use different documents for these operations, although in Argentina the Type B invoices, which cover these operations, are supported by the same electronic invoicing system. Ecuador and Mexico do not distinguish these type of invoices.

Brazil has begun to implement an electronic invoice for the final consumer, already applied successfully in several states.[18] There is a trend towards the gradual substitution of machines issuing tax vouchers by the electronic system.

Chile uses a "voucher" for final consumer operations at the retail level, and there is an electronic model used largely by supermarket chains and so on. The "voucher" in Chile can also be replaced by the credit card payment receipt for these operations, which is sent to the Internal Revenue Service.

It is important to keep this difference in mind when reviewing the total number of electronic documents issued by the different countries and models. Those that use the same system as Mexico and Ecuador will have relatively smaller numbers than the other countries.

18 ICMS is a state-level tax similar to VAT.

6.2. By manager of the model

A distinctive feature of the different operational models for EI is the figure of the manager of the centralized recipient of electronic documents, which could be the TA itself or private businesses authorized by the TA to act on its behalf.

In this connection, Mexico's administration has authorized operators that provide this service, known as Authorized Certification Providers (PAC). The model has worked satisfactorily and is being considered by other countries of the region (Colombia, Peru). There is a significant number of PACs, more than 70, which provide the service of the initial certification and collection of receipts.

The other countries have developed their systems with models administered directly by the TAs. This means that the normal operation of the system, the resources necessary to ensure the system's high capacity, the existence of backup sites, operations in contingency mode, and the receipt, storage and processing of the documents fall under the responsibility of the TA. Consequently, the total effort of the initial investment, operation of the data centers, and the development, maintenance and evolution of the solutions that provide internal and external services fall on the administration itself.

In the case of Brazil's federal model of ICMS, several actors are involved in the process: the state TA, the "National Environment" administered at the level of the Union by the public company SERPRO, and the "Virtual SEFAZ" administered by the Treasury Secretariat of Río Grande do Sul. These environments are managed independently and provide back-up to each other in order to facilitate the operation, which to some extent reduces the individual financial effort of each state.

For its part, the approach taken in Mexico lessens the effort required of the TA as regards the receipt and certification of the documents, and the PACs, because of the model itself, can back up each other. In this sense the amount of direct investment made by the administration is relatively small, as is the effort to implement the model in the management of technical support and in the guarantee of high capacity.

6.3. By format

As expected, the existence of a standard format, regulated by the administration, of mandatory use across the national territory, has been a key element in the development and expansion of national systems of electronic invoicing. Despite the existence of defined standards proposed for the invoice, only Peru and Colombia chose to adopt the UBL[19] standard as the basis of their national format. The other countries have opted for their own formats, defined during the conception of the initial project, refined in

19 Universal Business Language, defined by the OASIS company.

pilot phases, generally managed in consultation with the private sector, and updated over time with new versions and revisions. The formats used in Peru and Colombia (underway) have been complemented with elements of information absent from the original standard.

The reasons why countries choose their own formats rather than predetermined standards are doubtless various and not necessarily the same from one country to another. Probably, though, priority was given to having control over the format; the use of a common language and terminology; the uses and customs of identifying addresses and units of measure; and the arrangement of taxes and rates.

6.4. By the time of transmission and the role of the administration

Three types of operational models can be identified in the region:

6.4.1. Those in which the submission of invoicing information to the TA happens after the issuing of the invoice and its delivery to the recipient

In these cases, in practical terms the model splits the life cycle of the electronic document into two. On the one hand, the recipient of the document receives and processes it independently of what happens to the document in the TA. In cases of problems with validation, for example, the administration will notify the issuers, who must deal with their clients by issuing credit/debit notes that address the problems. The role of the administration is less immediate, and it does not intervene directly in the invoicing process, or in the delivery and receipt of the invoice. Consequently, the information system's operating problems or failings do not interfere with operations between third parties.

6.4.2. Models in which the submission to the TA for validation and authorization, or to a company authorized for such purpose, necessarily happens before the delivery to the recipient

In these cases, the dispatch to the TA, except in contingency operations, only happens after the authorization of use is sent to the recipient.

In this model the TA has a determinant role, since it intervenes directly during the transaction. Possible failings and interruptions will have a direct impact on operations and will have negative consequences for the participants and for the reputation of the administration itself. This model has been adopted broadly by Brazil and Mexico, and in particular cases by Argentina and Ecuador. The model is generally used as a low-cost solution for small and medium taxpayers whose transactions are carried out online, regulated by the administration or by a TA-authorized firm.

6.4.3. Those in which the dispatch of the invoice to the recipient and the TA occurs simultaneously in practical terms

This model can be assimilated into the previous one because, in practice, many taxpayers send the documents to the TA first, and to the recipient only after hearing that the TA has validated the documents. In practical terms, an interruption in the service can cause delays and inconvenience for taxpayers, whose internal processes can be held back if they have been adapted to await confirmation that the electronic documents have been validated.

6.4.4. Those in which the administration does not receive the electronic documents but rather the detailed information on the issued invoices, in a relatively brief period of a few days after the issuing of the invoices

This model has been adopted with some variations by Portugal and Spain, whose experience is described in the corresponding chapters of this book. In Latin America, the first version of electronic invoicing in Mexico was fairly similar—that is, taxpayers sent to the TA summaries of issued invoices, not the electronic documents themselves. The model, known as CFD, was replaced by the current CFDI in 2011. The details of these transactions are described in the chapter on Mexico.

It should be noted that the European Union has developed a proposal that the standard of the message reporting the elements of a tax nature or of tax interest be invoice to invoice, either after the operation or in real time.

Table 1 shows other distinctive characteristics of the EI models used in the countries that have adopted them on a mass scale. The details are set out in the chapters on the EI systems in each country.

Table 1. Characteristics of Electronic Invoicing

Characteristic	Argentina	Brazil-SP	Chile	Ecuador	Mexico	Peru	Uruguay
Year in which the electronic invoicing process started[1]	2006	2006	2003	2012	2004	2010	2012
Year in which large taxpayers were completed[2]	2014	2010	2014	2015	2014	2016	2017
Mandatory model for taxpayers[3]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard document format (XML)[4]	Yes	No	Yes	Yes	Yes	Yes	Yes
Free TA portal for small taxpayers or others[5]	Yes	Yes	Yes	Yes	Yes	Yes	Planned for 2019

Characteristic	Argentina	Brazil-SP	Chile	Ecuador	Mexico	Peru	Uruguay
El mandatory for the final consumer[6]	No	Yes	No	No	Yes	No	No
Includes professionals (as seller)?[7]	Yes	No	Yes	Voluntary	Yes	Yes	Yes
Exempt or zero-rated invoices controlled?[8]	Both	Both	Both	Both	Both	No	Yes
Exports controlled?[9]	Yes	Yes	Yes	Yes	Yes	No	Yes
Mandatory digital certificate for the signing of documents[10]	No (through services with taxpayer ID)	Yes	Yes	Yes	Yes	Yes	Yes
Digital certificate for communication with the TA or third-party platform[11]	No (through services with taxpayer ID)	Yes	Yes	Yes	Yes	Yes	Yes
Digital certificate for persons[12]	No (through services with taxpayer ID)	No	Yes	Yes	Yes	Yes	No
Digital certificate for businesses[13]	No (through services with taxpayer ID)	Yes	No	Yes	Yes	Yes	Yes
Private digital certification bodies	No	Yes	Yes	Yes	No	Yes	Yes
Electronic invoicing certification solutions on the part of the TA[15]	No	No	Yes	No	No	No	No
Responsible for the document validation platform[16]	Tax adminis tration	No	Tax adminis tration	Tax adminis tration	Third-party certificates third parties	Tax adminis tration/	Tax adminis tration
Validation of the documents is ...[17]	Real time	Real time	Real time	Real time and ex-post	Real time	Real time	Ex-post
Buyer has notification of acceptance or rejection of documents[18]	No	Real time	Yes	No	No	Rejec No	tion option
Buyer has confirmation or acceptance or rejection of documents[19]	Option of consultation	Yes	Option of consul tation	Option of consultation	No	Option of consultation and possibility of rejection	Option of consul tation
Tax agency platform for credit assignment (factoring)[20]	Planned	Yes	Yes	Yes	Under way	Only valid for EI	No

Characteristic	Argentina	Brazil-SP	Chile	Ecuador	Mexico	Peru	Uruguay
Graphical representation of documents with bar code[21]	Yes	Planned	Yes	Yes	Yes	Yes	Yes
Email exchange of documents between businesses[22]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
System of VAT withholding by the buyer for control of dubious invoices (Type M invoice in Argentina)[23]	Yes	No	Yes	Yes	Yes	Yes	No

Source: prepared by the authors on the basis of interviews with the TAs.

AR 7. May be included but is not obligatory; in Brazil not applied regarding ICMS.

BR-SP São Paulo Invoice. Only applied among ICMS taxpayers. 7. May be included but is not obligatory; in Brazil not applied regarding ICMS.

CH 2. Large taxpayers obliged to account as of 11.01.2014 (Law 20.727); 6. In Chile it is mandatory to issue an invoice or when it is a matter of intermediate consumption, not considering the final consumer; 7. In Chile the issuance of the invoice document is, by law, electronic in the case of professionals if they issue invoices and given that they undertake first-category activities (capital takes primacy over personal activities) is obliged to issue an electronic invoice; 15. Certification of solutions is voluntary (to date there are four certified solutions). It is obligatory to certify the documents issued by the solutions more than the solutions themselves; 18. In Chile only accepted documents have certification; 21. In Chile it is an electronic stamp based on a two-dimensional bar code (PDF 417); 23. Chile has the invoice for taxpayers who are difficult to oversee or that lack access to documentation.

EC 3. Groups obliged to issue electronic invoices are established by ruling; 5. Desktop electronic invoicer and SRI&YO online portal; 7. May be included but is not obligatory; in Brazil not applied regarding ICMS. 14. Two public and two private certification bodies; 17. What is known as the "Off Line" scheme is mandatory as of January 2018; 18. If the recipient lacks email a printed version of the electronic document is sent.

MX 1. Although electronic invoicing was included in the regulations in 2004, the first electronic invoice was issued in January 2005. As of 2014, it is mandatory for all taxpayers to issue the invoice; 5. The Tax Administration Service offers two free services for taxpayers. 6. All taxpayers that want to deduct or credit must have an electronic invoice; 15. In the case of Mexico, the services offered by authorized certification providers is assessed; 16. In Mexico, both the Tax Administration Service and the providers have a platform for document validation.

PR	6. The date on which it becomes mandatory for taxpayers in the simplified regime to issue electronic invoices is to be analyzed; 7. May be included but is not obligatory; in Brazil not applied regarding ICMS.
UR	2. Missing 33 of 338, including the banks; 3. For those whose inclusion was compulsory (certain tax drafts of interest to the TA and then universalized by income level); 6. Businesses with incomes below 305,000 UI (ceiling of the simplified regime, about US$40,000) are not included in the schedule of universalization; also excluded are agrobusinesses with incomes below 400,000 UI; 8. Included in the format of the electronic invoices sent to the General Tax Administration; 9. There is a specific electronic invoice to document exports; 18. If the General Tax Administration rejects the invoice, the issuer must communicate the rejection to the recipient; 19. On the seller's if it is for final consumption; for the rest, on the website of the General Tax Administration; 21. It was decided to choose a QR code; 22. As a minimum exchange platform.

While this book centers on the kinds of EI implemented in Latin America, it also includes analysis of EI in Spain and Portugal, because they have implemented electronic systems to oversee invoicing that share some characteristics with Latin American EI systems. In fact, the two countries' TAs receive information on the operations carried out by economic operators in a relatively short period to administer VAT. In Portugal, since 2013 and irrespective of whether the invoices are electronic or paper, operators must communicate the content of the invoices electronically to the TA. The communication of the invoice information that the TA requires of all economic agents must be sent by the twentieth day of the month after which they were issued.

In Spain, since July 1, 2017, some 63,000 taxpayers—representing about 80 percent of the country's total business invoicing—must supply their electronic invoicing registers through the "Immediate Supply of Information" system (SII). To that end they must send to the tax agency the details of electronic invoicing within four days of carrying out the operation.

In both cases, while formal obligations are reduced and the groundwork is laid for implementing pre-returns VAT systems, taxpayers themselves can correct errors and inconsistencies, and there is a greater prospect of tackling tax fraud by streamlining the management of VAT refunds.

7. ADVANTAGES AND CHALLENGES OF EI

7.1. Advantages

As mentioned earlier, EI has the obvious advantage of providing the tax authorities with a vast amount of information on taxpayers. Other benefits that arise from the implementation of an EI system are probably less obvious. We can divide the advantages into four categories: (i) tax control; (ii) economic dynamics; (iii) accounting benefits for taxpayers; and (iv) information security. As will be discussed below, points (ii), (iii) and (iv) refer to direct advantages for taxpayers, which is very important for the functioning of the EI system. The virtue of the system (if it is well designed) lies in the ability to make the taxpayers' and the TAs' incentives compatible, in such a way that it is optimal for taxpayers to bring transparency to their commercial relations with the other participants in the system.

7.1.1. Tax control and auditing activities

The first advantage is tax control, as is evident for reasons mentioned earlier, but which bear expanding upon. The first reason is that it allows control by opposing different interests, which not only ensures that taxpayers have incentives to join the system, but also makes it unlikely that they will collude in an effort to cheat the tax authorities. On the other hand, the information generated by the EI system helps detect unusual or irregular behavior on the part of taxpayers, which improves the effectiveness of tax fairness. A third advantage in terms of tax control is identification of the moment of tax causation (VAT, income and so on), which helps better orient efforts at tax collection—that is, without room for spurious maneuvering. Finally, the implementation of electronic payroll (EP) as an extension of EI helps make the employee-employer relationship more transparent, which is crucial for collecting income taxes and social security contributions.

Taxpayer oversight has reached the point at which the authorities even have real-time data on the transactions. Moreover, the information available today is of higher quality and is more precise, and the most important thing is that with EI the authorities have a broader outlook on the transactions in the economy. Having this vast amount of information is clearly positive for the purposes of auditing taxpayers. Furthermore, while the costs of information storage and processing are significant, they are offset by the benefits of controlling a lot of information in real time.

As regards the immediacy of the information, it is worth asking why this model is right for Latin America. In the Iberian model, for example, the information on electronic invoicing is sent to the TA weekly, not instantaneously. Is this model not suitable for Latin America? If the quality of the information sent weekly to the TA was high and perfectly replicated the data on the invoices, there would not be many differences between one model and another. In Latin America, however, experience shows that the information on

invoicing is generally poor. The most effective means of ensuring the quality of the information is to have it sent immediately, since this has two effects: (i) taxpayers' perception of risk is heightened, which aligns the incentives with the goals of the TA; and (ii) it lessens the possibilities of maneuvering on the part of taxpayers and their advisors to avoid or evade, especially as regards B2B sales and retail sales.

It is important to mention that the perception of risk will wane if taxpayers have the impression that the information is not used intensively for oversight purposes and simply accumulates unproductively in the TA. More than a few Latin American countries have had this experience with information from fiscal printers, which were underused or not used at all. Additionally, the TA's validation of the invoices that it receives also affirm or undermine the seriousness of the process. If, for example, the buyer's registration number is not valid, taxpayers will perceive that the system is weakly controlled and will act accordingly, thereby impeding audits.

As regards auditing activities, we should mention two cases: Chile and Uruguay. In August 2017 Chile introduced the first prefilled monthly VAT returns and advance income tax payments, based on information drawn from the almost 40 million electronic invoices issued every month. This system had begun to be developed in 2011, since the authorities had all the credits and debits of almost 100 percent of transactions because of the comprehensive mandatory nature of EI. This proposal seeks to oblige taxpayers, with differences between the proposal and their registers, to coordinate themselves in order to solve problems with their suppliers. The TA's capacity for action is thereby increased as a result of the taxpayer's self-monitoring.

With respect to Uruguay, the TA has "cubes" to manage the mass information from EI.[20] These cubes can have several oversight purposes: for example, to make mass comparisons of the differences between what the taxpayer claims and the daily EI registers. In other words, two/three sources of information are compared and it is then possible to: (i) create lists of individuals who are buying large quantities of products that leave the formal circuit in the later stages of marketing; and (ii) identify personal purchases that are not related to business activities, among other uses. Still pending is the development of data mining capacities in the TAs, so as to explore and analyze the details of invoices, focusing on variable such as prices, features, volumes and so on, with a view to obviating abuse on the part of some taxpayers who include false sales or purchases that are unnecessary for their business, or are for undeclared activities.

20 The mass information on EI is stored in data warehouse cubes (multidimensional analysis). Essentially, there are two cubes. One of them (the EI cube) contains information from two sources: (a) registry data (type of taxpayer, operational unit, order, legal nature, and so on); and (b) information on the invoices themselves (date of issue, information on the issuer, information on the recipient). Hence this cube can be searched by issuer or recipient, since information is available for the "two points" of the operation. The other cube (reports versus tax returns) has three sources of information. The first (a) is the same as in the previous cube (registry data). The other two are: (b) data from the daily reports containing total sales, VAT and withholdings invoiced by the taxpayer apart from the invoices that have been sent; and (c) data from these taxpayers' sworn returns and, especially, the statements on VAT and withholdings expressed to the General Tax Administration. This cube enable a mass comparison to be made between what is reported by each taxpayer and what is affirmed on the aforesaid returns.

7.1.2. Economic dynamics

EI has a strong dynamic in taxpayers' commercial relations, and thus can be regarded as a positive externality. In fact, EI makes commercial operations more efficient because physical registers of transactions can be eliminated completely. The foregoing, together with an environment in which information and communications technologies are common and within reach of most of the population, makes electronic invoicing a mechanism that collaborates with the immediacy of economic relations. In fact, e-commerce could provide impetus for the widespread use of electronic invoicing, since it improves the perception of trust in transactions, and therefore interaction with clients. Finally, maintaining electronic registers of purchase and sales transactions means that the tax is deducted automatically, thereby lowering compliance costs.

7.1.3. Accounting benefits

The creation of an information technology platform to support EI also has advantages for taxpayers. The first is that it has the potential to become an accounting system for them. This is particularly important for small and medium enterprises that lack the resources for a robust accounting system. Moreover, it reduces invoicing costs since it does away with paper and with the costs of storing paperwork as an accounting and administrative safeguard.

For that reason it is highly advisable that the TA offer a system for small taxpayers to issue electronic invoices. Its main characteristics should be that it is free and offers and economic alternative for small taxpayers when they are obliged to use EI. There are broad benefits, such as: (i) the universe of taxpayers is completed, making them easier to oversee, especially those that are hard to tax, by making it mandatory to use EI (with or without the administration's system) at low cost because the system is free; (ii) technological disparities between small and large businesses are reduced, given that the TA offers a free platform, generally with various complementary services (accounting, inventories and so on); (iii) it fosters the use of technology in small firms; and (iv) it favors the use of EI for other ends, which could directly benefit small taxpayers (see the case of factoring in Chile).

7.1.4. Information security

Finally, it is important to mention that the technological infrastructure of an EI system must be sufficiently robust to allow a preservation of taxpayers' accounting information with sufficient guarantees as required by law. Moreover, since this is a public system with so much information on taxpayers, sophisticated security systems have to be used. Currently, it is common to use electronic signatures or other security mechanisms (such as blockchain) for all kinds of systems. The options for safeguarding the information are varied at the moment, which underpins the extension of EI in other Latin American countries and beyond the region. But apart from security in terms of safeguarding information, it is important that security measures be complemented with legal penalties for those practices that seek to breach the

system; in Latin America these range from closing the business to regarding such practices as a criminal offense.

Overall, experience shows that there is no absolute guarantee that the information will remain confidential. Past hacking events have affected the financial sector, e-commerce, and the technology companies themselves; political and social organizations have also been affected. Hence we can conclude that gaps in information security are inevitable. The most important thing, in our view, is to correct the gaps or mistakes in the TAs and apply civil penalties, and above all use criminal penalties when offenders fall under the jurisdiction of criminal law.

7.2. Challenges

The benefits of establishing EI systems are substantial, but there are challenges to be taken into account when implementing them. Latin America's experience offers several lessons learned that other interested countries should consider when applying the system. The lessons can be divided into four large categories: (i) fake electronic invoices; (ii) data quality; (iii) risk of inaction; and (iv) increased demand for new TA services.

7.2.1. Fake electronic invoices

The fact that the invoice is electronic does not eliminate the traditional problem of fake invoices, which are issued illegally without any connection to economic reality. Normally, fake invoices are issued in an effort to fraudulently reduce the amounts of tax to be declared and paid, or in other cases to mask and justify unjustified operations or income.

The use of electronic invoicing affects the way in which false bills are addressed, especially in the case of the falsification of documents. An electronic document per se does not eliminate the difficulties that arise from document tampering or fake operations. Authentic tax documents are used in these cases, involving verifiable flows of money, but they do not reflect what has actually happened, either because the elements described have been altered or because they do not exist at all. When there are verifiable financial flows, the source of these payments recovers the amounts after the exaction of the "commissions" generated in the process.

In these circumstances the issuers of fake documents, issued fraudulently, generally have no real economic activity, lack the economic capacity to generate the volume of transactions stated on the invoices, or are engaged in an activity that does not accord with the order stated on the invoices. Also present in these circumstances are recipients of fake documents, generally taxpayers engaged in real economic activity, who consciously and illegally acquire and use the documents to include non-existent tax credits or unjustified expenditures with the aim of lessening their tax burden or even garnering taxes collected and paid by third parties.

The TA's capacity to detect these problems has caused individuals acting illegally with such practices to refine their fraudulent schemes—for example, by setting up apparently legitimate and compliant businesses designed to avoid the risk profiles that are quickly detectable by the administration, and that can have a relatively short life span. In the face of this threat it is necessary to recognize that, in an electronic world, the capacity that these businesses have to cause huge problems in short periods is a significant risk for revenue collection and therefore for the fiscal wellbeing of the state.

Some administrative and legal measures to tackle false invoicing include categorizing tax crime as an offense with criminal consequences for those involved, both issuers and users; inverting the burden of proof on the economic reality of suspicious operations, so that tax credits and reported expenditures can be recognized or not; suspending the taxpayer's registration; or publishing the names of taxpayers that have used such mechanisms. Mexico's EI system makes it possible to implement new administrative measures against fake invoices, with the EFOS[21] and EDOS[22] mechanism described in detail in the annex to the Mexico chapter. Basically, EFOS and EDOS find patterns in companies' behavior that implicates them in tax fraud, especially as regards deductions with false receipts or the simulation of non-existent operations.[23] Once there is proof that a business used fraudulent documents, the authorities begin a legal process until the business loses the deductions from which it benefited. Another alternative, used in Argentina, is the Type M invoice, whereby issuers deemed to be risky under certain well defined assumptions[24] are subject to a full withholding of VAT and a withholding on income tax. This, aside from the financial matters, lessens the problem of fraud. These tax withholdings are temporary until, at a later stage, the issuer's monthly sworn VAT returns are reassessed. If the assessment is satisfactory the taxpayer is allowed to issue Type A invoices (on which there is no withholding); otherwise the taxpayer continues with Type M invoicing until the next reassessment (Costa, 2017). Finally, Ecuador regards the issuing and receipt of false invoices as a criminal tax offense, in addition to the financial penalties involved.

7.2.2. Data quality

Deficiencies in the quality of the data transmitted is one of the main risks related to managing a system that involves such a large amount of information. Once the bulk collection process begins, the volumes are so great that in practical terms it is impossible to correct problems after the data has been sent. This is to say that, in general, **the processes of validating the original information on receipt** comprise the best control point to secure data of sufficient quality. If this desired minimum quality is not ensured, it is unlikely that use of the electronic documents will meet expectations. Serious problems of information quality could make the documents unusable, both for the TA in terms of control and for taxpayers themselves in automation processes.

21 Businesses that make tax deductions using tax receipts that disguise non-existent operations.

22 Businesses that invoice for non-existent or fake operations.

23 These patterns are described in the annex to the Mexico chapter.

24 Applicants deficient in fiscal solvency, according to a series of parameters determined using "big data" techniques (Costa, 2017).

Activities geared to improving the quality of the data include increasing the number of authentications so that they go beyond control of bands, domains and types, and extend to defining field value codes for different items of recommended use. Data analysis techniques can also be used to find statistically improbable data for issuers. Necessarily, these elements must be weighed against the effect that they could have on taxpayers' compliance, so that they do not become an excessive burden.

7.2.3. Risk of inaction

One scenario that the administrations must avoid is to neglect the control processes that naturally arise from the implementation of electronic invoicing. If the administration fails to react to concrete situations for long periods, there is a risk of losing the subjective effect on voluntary compliance.

7.2.4. Demand for services

Since they have all the electronic documents, the TAs will face previously unexpected demands for services related to managing the system; this will call for resources, procedures, and technical support. Many of these services involve the management of the documents themselves, such as consultation and download mechanisms related to all the documents issued by and for a taxpayer, verifying the validity of the paper rendering of the invoice, and certifying a document's integrity to third parties.

8. EXTENSIONS OF EI IN PRACTICE

As mentioned earlier, the implementation of electronic invoicing in Latin America is confined to the experiences of Argentina, Brazil, Chile, Ecuador, Mexico, Peru and Uruguay. There are specific cases in the region that are worth emphasizing because of the uses to which electronic invoicing has been put, beyond simply improving the traceability of taxes. The experiences addressed in this book are those of electronic payroll in Argentina; Brazil's integration of the technology for controlling goods in transit with electronic tax documents and the Public System of Digital Accounting; the influence of electronic invoicing on the development of factoring in Chile; and Mexico's experience of outsourcing and technologically standardizing the issuing of electronic invoices.

In addition to these four experiences, which are analyzed in their respective chapters, we comment on EI's contribution to the transparency agenda and, therefore, to market efficiency—for example, in terms of clarity in the relevant prices offered in Brazil's consumer goods and public procurement markets; and

Ecuador's experience of determining the composition of the market, and the national value added, for alcoholic beverages. In both cases, EI allows the authorities to gather fundamental information to ensure effective competition and to grant tax incentives.

8.1. Electronic payroll in Argentina

The case of **EP in Argentina** is very pertinent because of the importance of social security contributions and personal income tax in total revenue, not only in Argentina but throughout the region. This tool has been key to centralizing information and streamlining the validation of the information on the sworn tax returns provided by employers. Thus the Federal Public Revenue Service (AFIP) has been able to eliminate inconsistencies in the information, simplify employers' tasks, make the employee-employer relationship more transparent and, most importantly, facilitate control of payments and contributions to social security. The information for overseeing taxpayers is significant, and therefore is it recommended that other TAs in the region adopt this tool, given the importance of social security contributions and the weight of personal income in total income tax revenues.

Specifically, Figure 1a shows the salary tax wedge for the LAC countries and the average for the region and the countries of the OECD. As the figure shows, social security contributions as a percentage of the employee's labor cost are particularly significant in LAC, being the third revenue pillar in the region. Electronic payroll helps clarify the real burdens facing employers and workers, which improves transparency and the TAs' oversight. At the same time, revenue from personal income accounts for about two-thirds of the total collected by income tax, which provides another incentive to implement EP.[25] It is important to note that in implementing the system there might be a risk of exacerbating evasion and informality, which is already high in LAC.

25 It is important to underline that in the case of electronic payroll, there could be problems of evasion or avoidance, since the number of actors providing information is small (employee and employer), and therefore it is easy for them to collude against the tax authorities (and society) for their mutual benefit. In the case of commercial electronic invoicing this situation is more complex, because the cost of coordination between the participants in the process of production and marketing is high and complex in markets, including highly concentrated or integrated markets, since there is a whole chain of actors and because of the compatibility of incentives. A similar case is that of personal (professional) services, in which the production chain is relatively shorter between the final consumer and the service provider.

Figure 1. **Figure 1.a. Salary Tax Wedge in Latin America and the Caribbean and the OECD (% labor costs of unmarried employee without children, with average salary, 2013). Figure 1.b. Labor Informality in Latin America (% of workers who do not contribute to social security, 2013)**

Figure 1.a

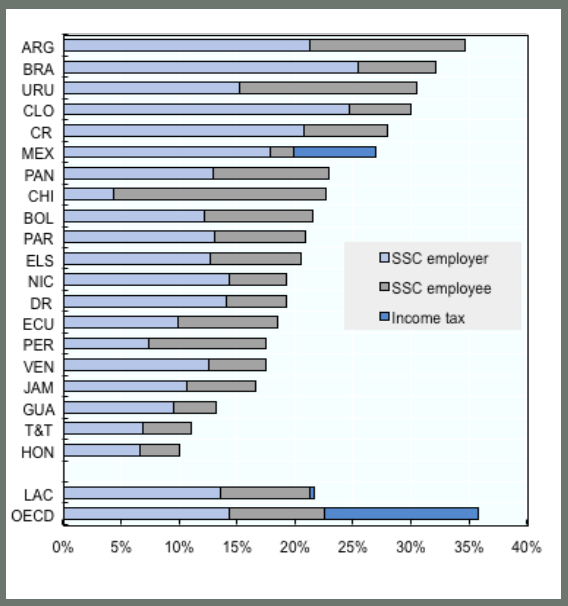
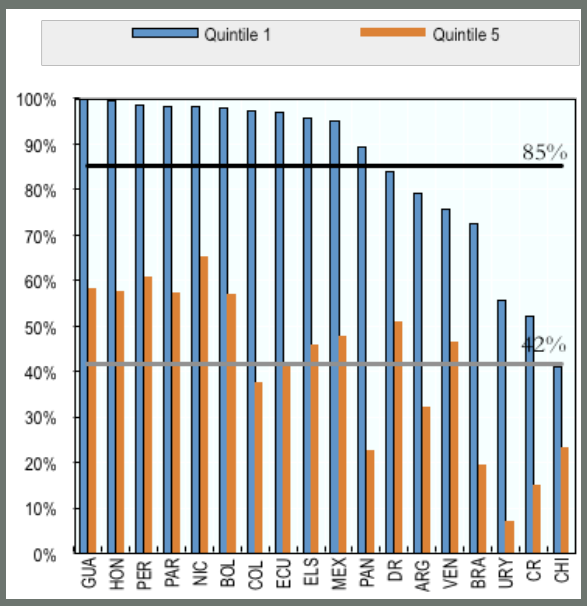


Figure 1.b



Source: BID (2015) and OECD/CIAT/IDB (2016).

Labor informality is a substantial problem in LAC, since 64 percent of workers do not contribute to social security programs (OECD/CIAT/IDB, 2016). As Figure 1.b shows, informality is very high in the first income quintiles in LAC, reaching an average of 85 percent of workers who do not contribute to social security programs. Moreover, OECD/CIAT/IDB (2016) calculates the theoretical costs of formalization, showing that they are around 70 percent for the first decile and then fall to a range of between 35 percent and 20 percent for the other deciles. It is clear that, unlike EI, where there is an opposition of interests—both for VAT debit and credit and for income-deduction in the chain of transactions in the payroll—evasive collusion between employers and employees is simpler for mutual benefit. Beyond this risk, it is very important to begin the EP process so as to bring greater clarity to labor markets and to highlight the importance of oversight in the fight against informality.

8.2. Factoring in Chile

In Chile, the mandatory nature of electronic invoicing gave impetus to the development of factoring, because of the greater security and speed with which transactions can be carried out relative to paper invoicing. These two conditions of electronic invoicing facilitated taxpayers' access to financing. On the one hand, the fact that the invoice is electronic makes the transactions immediate, which facilitates the exchange of information and therefore commercial activities. As regards security, it is important that the invoices issued are granted a right of execution, which makes them enforceable for the collection of the suns stated therein. That helps give legal certainty to the system, an important matter in the healthy development of any market.

Consequently, factoring has increased appreciably in the past four years, growing by 50 percent on average and exceeding US$20 billion in amounts assigned electronically in 2016 (almost 8 percent of GDP). Moreover, it is to be noted that this financing model is very important for micro and small enterprises, since often they face problems in accessing sources of financing, such as the banking system.[26] To some extent, therefore, factoring has completed a significant part of the financial market.

8.3. Control of ground-vehicle freight

Brazil's experience of electronic invoicing reveals innovative uses for this tool. Specifically, Brazil's TAs are developing a freight-vehicle tracking project using radio frequency, integrated into the electronic tax documents related to transported goods. While the vehicles are on the move, antennas scan them each time they pass by goods-transport control units located along the highways. This allows the TAs to monitor goods traffic in real time, and the goods are matched to their respective tax documents. In addition to the tax control, it is expected that the exchange of information will also help reduce the theft of vehicles and cargos.

Apart from this real-time control of freight, the use of information technologies in Brazilian states has allowed for the simplification of companies' obligations to the TAs. Brazil is also developing the Public System of Digital Accounting (SPED), which has become the only channel between firms and the TAs. This system includes modules for electronic invoicing, digital bookkeeping, and digital tax records, among other projects.

26 Note that the level of access to banking services in Chile is about 63 percent, which is comparable to the average for the OECD countries.

8.4. Expansion of services in Mexico

Finally, Mexico has established new models of tax management which facilitate services provided by third parties that have technological infrastructure, thus offering taxpayers more options and means of support. The presence of third parties gives more support to the information and adds a witness to the EI process. This is another new and differential facet of the digital era, in this case driven by EI, whereby the private sector collaborates with the TA in fulfilling the control function (in opposition to other taxpayers and repressive of evasion) that has always characterized it.

8.5. Uses beyond the tax administration

In addition to the cases included in this book, there are two very important experiences of EI use that are worth describing as services to market efficiency.

8.5.1. In Brazil

To begin, **in Brazil** there are new Internet applications that use EI's databank as an input to foster competition, completing the information in the market. Specifically, there are two uses that improve the information, enhance transparency, and therefore boost market efficiency on the demand side: (i) price consultation applications that businesses have for the final consumer; and (ii) the setting of maximum prices to be accepted in public procurement.

As regards the first of these, the data on the electronic consumer invoice (corresponding to purchases of final goods) is used as an input. Consumers thus have information on the prices of goods and can identify the most suitable. This use has been developed in the states of Piauí, Amazonas, Espírito Santo and Paraná, the latter being the state deemed to have the best model. More specifically, EI has become **a pillar of clarity for important goods in free markets**, such as the price of fuels or intermediate products (construction inputs, for example) which are important because they are of mass consumption.[27]

As regards **maximum prices in public procurement**, note that the EI databank makes it possible to determine product details and the quantities sold, and it is a matter of comparing the price of similar products so as to secure the best deal for the state. The states of Amazonas, Bahía and Río Grande do Sul use this application.

27 This process is in accordance with respect for tax secrecy by authorizing corresponding and regulated disclosure in line with the regulations of each Brazilian state.

8.5.2. Traceability of EI in Ecuador

In Ecuador, **the traceability of EI has allowed identification and analysis of value added and market composition**, the percentage of Ecuadoran goods and services in production chains for a series of economic sectors, complementing other sources of information. This type of study has two important applications as regards knowledge of the value chain. The first is to support public policy design, identifying national production nodes and the industries with the densest chains; the second is to improve the impact of public investment and tax incentives, gearing them to those activities with a greater national component and multiplier effect. Overall, this application gives the TA a role in the process of regulation and competition, and in improving traditional fiscal policies on the design of public investment and tax incentives.

8.6. Electronic invoicing in international trade

Finally, **implementation of EI in international trade** would be very useful and would support the digitization **of customs**. In fact, communication between the countries' TAs and customs services would help fight evasion, as in the case of the "carousel" fraud (see footnote 14) in the single European market in the case of goods and services. Moreover, at the global level it would help control avoidance by making available relevant information on the prices of goods and services, from freight to insurance, capital income, and from royalties to interest. Several of the countries studied already have EI working at the export level, and thus exchange agreements could be the next objective, and could also be considered by the WTO.

In sum, the implementation of EI is the crucial phase in developing the digitization of a TA: it will cover not only other taxes and a means of managing them more effectively, but will also provide new services to the economy such as those described above, which probably will be introduced in the near future (Brynjolfsson and McAffee, 2014). Hence, in addition to their function as tax controllers, the TAs take on the role of a producer (collaborator) in the digital economy. To meet the challenge of modernizing their principal mission and the new one as a creator of value for clients, the TAs will have to undergo substantial changes to their legal powers, their organizational structure, their operating procedures and their resources, most particularly the capacities of their human resources.

9. IMPACT ASSESSMENTS

The quantitative relevance of EI and electronic payroll (EP) lies in the importance of VAT, efforts to tax income and social security contributions as the three basic pillars of tax collection at the global level and, of course, in Latin America. Indeed, these three together amount to at least two-thirds of tax revenues (see Figure 2). Moreover, the amount collected through EI is at least 30 percent of revenue and, if the potential for revenue collection through electronic payroll is included, the share is close to 65 percent. This gives some idea of the power that EI will instill in tax control.

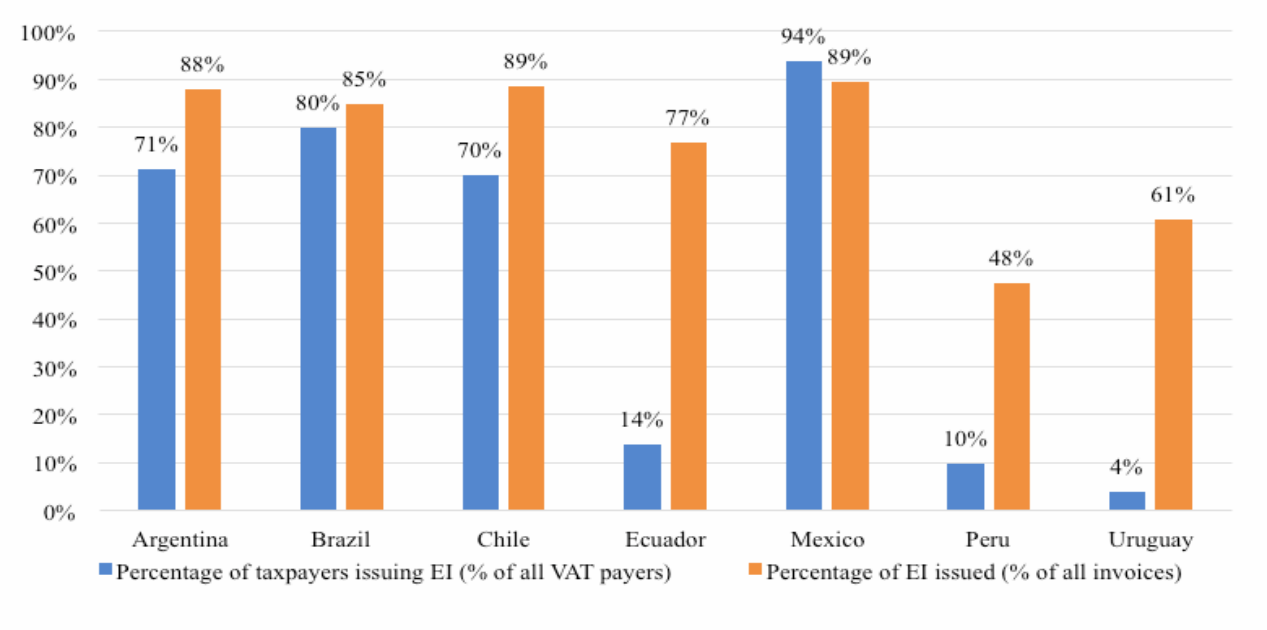
Figure 2. Yield of Taxes Controlled by Electronic Invoicing and Electronic Payroll, and as % of Total Tax Revenue, 2015

Source: prepared by the authors on the basis of data from EFP, BID-CIAT (2015).

Additionally, it is important to note that in these countries EI has not been implemented 100 percent for all taxpayers. An example of this is reflected in Figure 3, which shows that the percentage of VAT payers that issue EI has still not reached 100 percent, and there are even quite incipient processes such as Peru and Uruguay, where the rates are 10 percent and 4 percent, respectively.[28] Figure 3 also shows that not 100 percent of invoices are issued electronically, because not all VAT payers are in the EI system.

28 It should be recalled that large taxpayers account for a very high proportion of the invoicing, both of purchases and of sales. Controlling their operations, therefore, purchase and sales, leads to the monitoring of a very high proportion of all the operations in the economy (the "hourglass theory").

Figure 3. Percentage of Taxpayers That Issue Electronic Invoices (EI) as a Percentage of All Vat Payers and Percentage of EI Issued among All Issued Invoices, 2016



Source: prepared by the authors on the basis of a survey of the authorities in each country.

a Rate of 10 percent for certain goods and services in the basic basket.
b Last available data, 2007.

Finally, to finish this reflection on the importance of thoroughly implementing EI, Table 1 shows the estimates of VAT and income tax evasion in the countries studied in this book. As regards VAT, the rates are around 18 percent, and for income tax they are above 45 percent. It is important to ensure that EI is mandatory in order to tackle these rates of evasion, but this also underscores the potential of electronic payroll to enable control of income tax evasion.

Table 2. Rate of VAT and Business Income Tax with Their Rates of Evasion, Administration Functions and Autonomy of the TA[29]

	VAT		Income		Admin. Functions		Autonomy[e]
	Rate	Evasion	Rate	Evasion	Social security	Customs	
AR	21%/10.5%[a]	19.8%[c]	35%	49.7%	Yes	Yes	Yes
CH	19%	22.2%	27%	48.4%	No	No	Yes
EC	12%	n.a	22%	65.3%	No	No	Yes
MX	16% [b]	21.8%[d]	30%	46.2%	No	Yes	Yes
PE	18%	28.3%	27%	51.3%	Yes	Yes	Yes
UR	22%/10% [a]	10.5%	25%	49%	No	No	No

Source: Barreix, A. and F. Velayos (2013), Gómez-Sabaini and Morán (2016), and the finance and treasury ministries of each country. [a] Rate of 10% for certain goods and services in the basic basket. [b] Almost the entire basic basket has a rate of 0%. [c] Last available data, 2007. [d] Last available data, 2012. [e] Autonomous or dependent on the economy ministry (or equivalent), with some or complete autonomy in human resources and budget relative to the rest of the public administration.

It is evident that these issues must be studied theoretically and empirically, but now there is a starting point to generate public policy questions relating to the scope of these innovative instruments. In this book, as a first step in empirical research on the effect of EI, we have brought together the impact assessments that are available for the region, four of which were carried out concomitantly with the book. Below we present a summary of the assessments' details, which are expanded on in the specific chapters; additionally, the original studies can be accessed online.

9.1. Methodologies used and findings obtained

This book reviews the impact assessments of electronic invoicing in several countries of the region, documenting systematic evidence of its positive impact on tax collection. This is a very important matter, in addition to the considerations discussed in previous paragraphs, in that not only are there efficiency gains in tax processes and positive externalities from its implementation, but also the sum of all these benefits positively affects collection.

29 There is no information for Brazil-SP because the ICMS has no data on evasion and the tax is managed at the state level.

Chapter 3 summarizes the methodologies and the findings. According to the quantitative assessments applied, EI has had a positive impact on improving collection and control in five of the seven jurisdictions in which it has been implemented: Argentina, Brazil-São Paulo,[30] Ecuador, Mexico and Uruguay, for VAT and income tax. These assessments estimated the proportion of the growth in tax revenues that is attributable to the implementation of electronic invoicing. To that end, econometric impact assessment techniques were used to correctly isolate the effect of EI on the increase in revenue and other variables, so that the effect was not conflated with additional effects that can influence growth in the variables to be studied.[31] For that purpose it is important to define a counterfactual scenario in which electronic invoicing was not implemented, and compare it with the real scenario, so as to measure the true impact.

The econometric technique used will depend on the characteristics of each scenario in particular. Since these are quasi-experiments, we have to exploit the qualities of the event to be studied in order to determine the true impact of electronic invoicing. This is known as an identification strategy. Specifically, the impact assessments of electronic invoicing in Latin America have used three techniques: discontinuous regression, difference in differences, and matching. Each of these has a distinct principal of identification, and the use of one or another technique depends on each specific experience.

On the one hand, the identification principle of **discontinuous regression** is that in the experiment there is a variable for which a specific value generates a cut-off point. In essence this point is a discrete leap in the data, which is interpreted as the effect of treatment. Thus the values on one side of the cut-off point are the untreated elements (counterfactual), while those on the other side represent the treated elements. The magnitude of this discrete leap is the impact of electronic invoicing. The identification principle of the **difference in differences** technique is based on studying changes in the variables, and thus extracting the effect that changes other than the invoicing might have had on the variable to be studied. With this technique it is assumed implicitly that the change in the untreated observations would have been the counterfactual change of the treated observations, if these had not adopted electronic invoicing (parallel trends assumption). Finally, as its name suggests, the **matching** methodology bases its identification principle on relating a treated observation with another or others that were not treated, but that have similar characteristics. Intuitively, it is like seeking "twins" and comparing the treated twin with the untreated. The differences in the dependent variable between one group and another derive from whether or not they were treated. For a broader discussion of these methodologies, see the chapter on evidence of the impact of electronic invoicing, which summarizes the assessments of EI in Latin America.

30 It was carried out only in the state of São Paulo, and thus the text makes reference throughout to Brazil-SP so as to make clear that the assessment was conducted only in that state.

31 For example, changes in economic activity or in tax legislation.

The findings, summarized in Table 2, show that most of the effects have been positive and significant. In fact, none of the rare negative effects of electronic invoicing is significant, which shows that electronic invoicing has benefits in collection and compliance in all the countries studied.[32]

Table 3. Impact of Electronic Invoicing in Selected Countries

Study	Country	Period	Empirical strategies	Dependent variable	Percentage effect on revenue
Artana and Templado (2017)	Argentina	2005-2016	• 2007-2015 Difference in differences • In 2016, discontinuous regression	Revenue	Increase in revenue of between 0% in 2008 to 10.7% in 2013
Naritomi (2015)	Brazil-SP	2004-2011	Difference in differences	Reported earnings	The program increased the firms' reporting of earnings by 22% in four years
Ramírez et al. (2017)	Ecuador	2011-2016	Difference in differences, with selection of controls with propensity score matching and Pipeline	Assessed tax	2015: Significant positive effect of 18% 2016: Significant positive impact of 25%
Fuentes et al. (2016)	Mexico	2010-2015	Discontinuous regression	Declared amount of cumulative income	Increase of 6.5% and 6.6% in the assessed business income tax for 2014 and 2015
Bergolo et al. (2017)	Uruguay	2010-2016	• Study of events • Difference in differences	Revenue	An estimated 3.7% impact on firms' payment amounts

Source: prepared by the authors on the basis of the assessments presented in detail in this book's summary chapter on the quantitative assessments.

32 Note that we do not include a cost-benefit analysis because all the EI systems have developed differently. Moreover, a large number of factors have to be taken into account, including various types of costs and benefits that are very difficult to measure in relatively young processes wherein new uses have not yet been developed, such as risk perception, competition analysis and so on, in applications that have not reached maturity.

These increases could be explained by the fact that EI has various effects. First, it is clear that it improves the control of the TAs, and thus improves the traceability of transactions (in the case of VAT and also income). Moreover, at least when its starts to be implemented, it has repercussions for taxpayers' perception of risk, because with electronic reporting they presuppose an increase in the probability of fraud being detected. Finally, it is important to mention that there are TAs that take advantage of and strengthen the incentives that EI creates to be more transparent on tax returns.[33] In conclusion, the empirical evidence shows that implementation of electronic invoicing has positive effects on tax collection, and the TAs can take advantage of those effects.

Finally, it is important to mention that the scale of the impacts of electronic invoicing cannot be compared among countries, because there are structural differences that make such comparisons invalid. Specifically, there are structural factors that influence the tax system's design quality—for example, if VAT is zero-rated for the internal market, incentives or exemptions, cash payments,[34] or the quality of the TA in the broad sense. Moreover, it is not solely a matter of the efficiency of internal taxes and customs, but also of other institutional factors such as public registers, the quality of public services, or the judiciary's enforcement authority to resolve cases of tax fraud, among other considerations. EI's impacts are therefore comparable within a country, but not among countries.

10. CONCLUSION

EI is a Latin American contribution to the global process of tax transparency, and an instrument with huge potential in the fight against evasion and in fostering voluntary tax compliance. It is the initial process that offers an opportunity for the digital development of tax administrations and taxpayers, which could serve as a basis for new, advanced digital applications such as "shadow" filings on the taxpayer's activity or new developments in risk analysis, or its expansion to other taxes such as electronic payroll. At the same time, as an initial digitization process EI also makes it possible to offer new services to users, such as facilitating factoring operations or improving control of carriers and freighted goods, or underpinning the spread of uniform prices for mass-market goods and services. In parallel, it is an important input for improving the public procurement system, and an instrument for analysis of market structures, offering support to regulation and competition processes, as well as to the design of public investment policies and tax incentives.

33 The incentives that Brazil-SP gave for consumers to play the role of "tax auditors" is an example of this. The Nota Fiscal Paulista gave monetary rewards to final consumers for requesting receipts related to their purchases.

34 As in the case of Mexico.

This new TA function as a provider of services to the taxpayer and to the government—improving market efficiency and transparency—brings with it the role of collaborator (producer) with the private sector and the economy in general, in addition to the modernization of a TA's management function (controlling compliance and curbing evasion) in the collection of tax revenues.

It must be said, however, that to bear fruit EI has implementation requirements for a TA: it must perform adequately in its basic functions (registration, collection, auditing and recovery). The country must also have sufficient data processing capacity, adequate telecommunications infrastructure, and a minimum degree of computer literacy among taxpayers. Like any instrument, especially technology tools, EI is a necessary condition to catalyze the modernization of TAs, but it is insufficient to attain the modernization of their performance.

It should also be said that the implementation of EI brings new challenges. Some of these can be regarded as protection of the TA and the taxpayer, from data security and confidentiality to the detection and handling fake invoices. Others stem from the undertakings involved in implanting an instrument of the third industrial revolution (Schawb, 2016), like EI, towards developments and applications of the fourth revolution, such as developing artificial intelligence or managing big data. EI applications will make it possible to improve tax control and voluntary compliance, in opposition to taxpayers, but will also work in their favor, creating value by offering new services, in collaboration with the business sector and the rest of the economy, and even with partner jurisdictions in foreign trade.

Finally, these changes stemming from EI and the digitization of the TAs will make it imperative to update their processes and technological infrastructure, but also their powers (rights and duties), their governance, organization and, most particularly, the capacities and staff regulations of their human resources, which are fundamental in the provision of a service of such importance for a country's economic life.

11. DESCRIPTION OF THE BOOK

The contents of this book can be divided into three main parts: (i) description of the seven mass experiences of electronic invoicing in Latin America, and two similar processes in Portugal and Spain; (ii) the review of the uses or extensions of EI in the region; and (iii) a summary of the five impact assessments of EI as an instrument of tax control. [35]

35 The country-specific impact assessments of EI that were prepared in coordination with this study (Argentina, Ecuador, Mexico, which was led and financed by the SAT, and Uruguay) are summarized in a chapter of this book and the originals can be consulted on their corresponding web pages. The book also includes Naritomi's (2015) assessment for São Paulo, Brazil.

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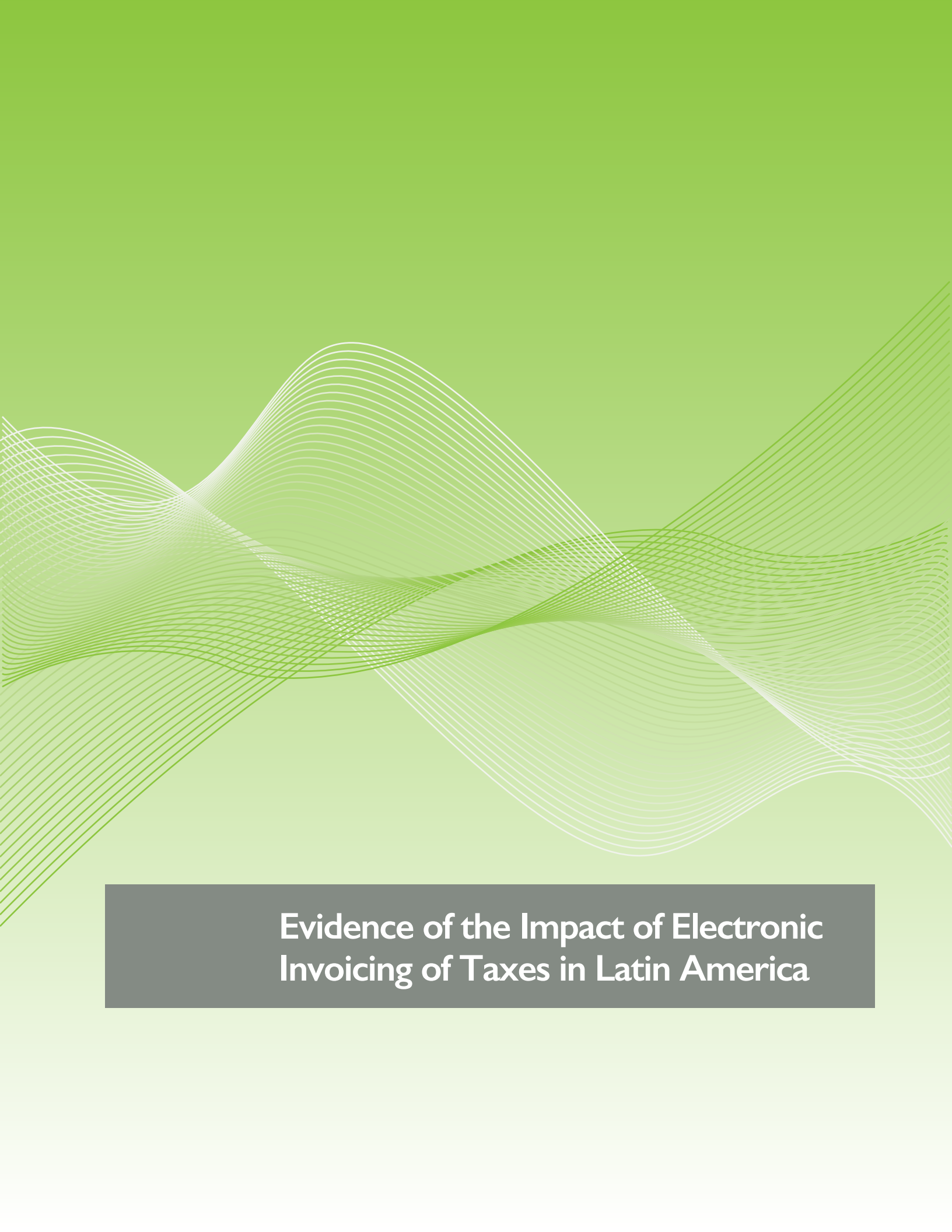


Evidence of the Impact of Electronic Invoicing of Taxes in Latin America

Evidence of the Impact of Electronic Invoicing of Taxes in Latin America

Karla Hernandez and Juan Robalino

1. INTRODUCTION

Tax evasion is a big problem in developing countries because it affects the equity and efficiency of the tax system. One of the proposed solutions for achieving tax compliance, in developed and developing countries alike, is to use technology. Electronic invoicing in particular, as part of the digitization of tax administrations, offers a promising option to increase tax revenue.

In Latin America, national systems of electronic invoicing have been implemented successfully, with millions of issuers each generating dozens of electronic documents. Argentina, Brazil-SP,[1] Chile, Ecuador, Mexico, Peru and Paraguay are the countries of the region that have consolidated electronic invoicing systems. Nonetheless, each tax administration has implemented the system differently—each with distinct characteristics, procedures, and rules—in an effort to ensure optimal adaptation to the particularities of each country.

The main advantages ascribed to electronic invoicing include: (i) it shortens processing cycles, including tax recovery; (ii) it lessens the risk of human error; (iii) it cuts transaction costs (such as printing, storage, and so on); (iv) it aids the fight against fraud; and (v) it helps modernize the economy and strengthen the technology sector through the large-scale use of communications technologies, digital signatures, and services development.

The advantages of electronic invoicing have spurred expectations of possible positive effects on revenue collection. But there has been scant evidence for these effects. The aim of this chapter is to present five research studies in Latin America that address this matter rigorously in Argentina, Brazil-SP, Ecuador, Mexico and Uruguay.

1 The information on Brazil is for São Paulo State, and is thus described herein as Brazil-SP.

It is not easy to tackle the challenge of isolating the effects of electronic invoicing on collection-related variables such as reported sales and earnings, and assessed and actual revenue. Between one period of collection and another, many changes in other factors affect these variables. Hence a simple comparison between tax collection in a period without electronic invoicing and another with such invoicing captures changes in other factors, thereby creating biases in estimating the impact of the invoicing. Moreover, the businesses that join the system in the early periods are dissimilar from those that remain outside, and thus comparisons between firms that joined and those that did not are also unhelpful in isolating the effects of electronic invoicing. Two methodologies are mainly used to resolve this problem: difference in differences, and regression discontinuity. In the right circumstances, these can isolate the effect of electronic invoicing with greater precision.

These studies generally find evidence that electronic invoicing increases firms' reported sales and earnings, and raises the tax take. It is important to keep in mind, however, that the effects can vary over time and by economic sector. There might be substantial increases in the short term, but the effects decline as time goes by (Artana and Templado, 2017). They also vary by economic activity (Artana and Templado, 2017; Bérgolo, Ceni and Sauval, 2017). It can also be expected that activities in which there is a greater likelihood of customer complaints will be the most affected (Naritomi, 2015).

Implementation of electronic invoicing is a promising instrument to enhance businesses' compliance with their tax obligations. This is especially important in the region where levels of collection and compliance are fairly low relative to the more developed countries.

2. IDENTIFICATION STRATEGIES

One of the most significant challenges in evaluating public policies is producing an unbiased estimate of the causal effects on the dependent variables of interest. The difficulty arises because, in order to estimate a policy's impact, we have to estimate precisely what would have happened if it had not been implemented. This is known as the counterfactual scenario. Evaluating electronic invoicing is no exception. We have to estimate what would have happened, for example, with tax collection, revenues or reported taxable profits if electronic invoicing had not been implemented. This is followed by an estimate of the impact of invoicing, an estimate that compares what happened with what would have happened in the counterfactual scenario.

For example, a comparison between revenue collection in the year before and after the implementation of electronic invoicing could lead to an overestimate or an underestimate of the policy impacts. This is because, from one year to another, the implementation of the policy was not the only thing to have hap-

pened; there were changes in a range of economic variables that affect collection levels. If economic growth was high between one year and the other, for instance, the tax revenue increase stems not only from electronic invoicing but also from that growth. In such a case, the impact of the implementation of electronic invoicing on revenue would be overestimated. Similarly, if we only compare businesses subject to electronic invoicing with those that were not, again we could not attribute all of the difference to electronic invoicing. This is because normally the criterion used to determine entry into the system—either by choice or by order of the authorities—means that the businesses have different characteristics that determine different levels of earnings or revenue.

Classic regression analyses have been used to resolve these kinds of problems when the characteristics of the firms and overall determinants of revenue are observable by the researcher. Nonetheless, it is still common for a series of non-observable factors to be omitted from the analysis, which can bias the findings. These kinds of problems are more apparent in less developed countries where the compilation of data on different variables at the firm level, and even at the macroeconomic level, is insufficient to ensure unbiased estimates.

In view of that, and using the characteristics of the data, strategies have been designed that seek to resolve the problem of identifying the policy's causal effect, which is known in the literature as the identification problem. Given the structure of the data present to evaluate the impact of electronic invoicing, there are several pertinent quasi-experimental options: regression discontinuity, difference in differences, and matching. These designs can even be implemented jointly if the data so allow. There follows a discussion of the advantages and limitations of each of these methods.

2.1 Regression Discontinuity

The regression discontinuity approach has been used to assess a wide variety of policies in different spheres (see Hahn et al., 2001). The principle of identification is that there is a variable for which there exists a value, which generates a cutoff that partly or wholly determines whether something is or is not influenced or treated by a policy (Imbens and Lemieux, 2008). This variable could be related to the dependent variable, but it is assumed that the relationship between this variable and the dependent variable is continuous. Thus, if there were discontinuity in the cutoff point in the variable of interest, that could be attributed to the policy (see Figure 1).

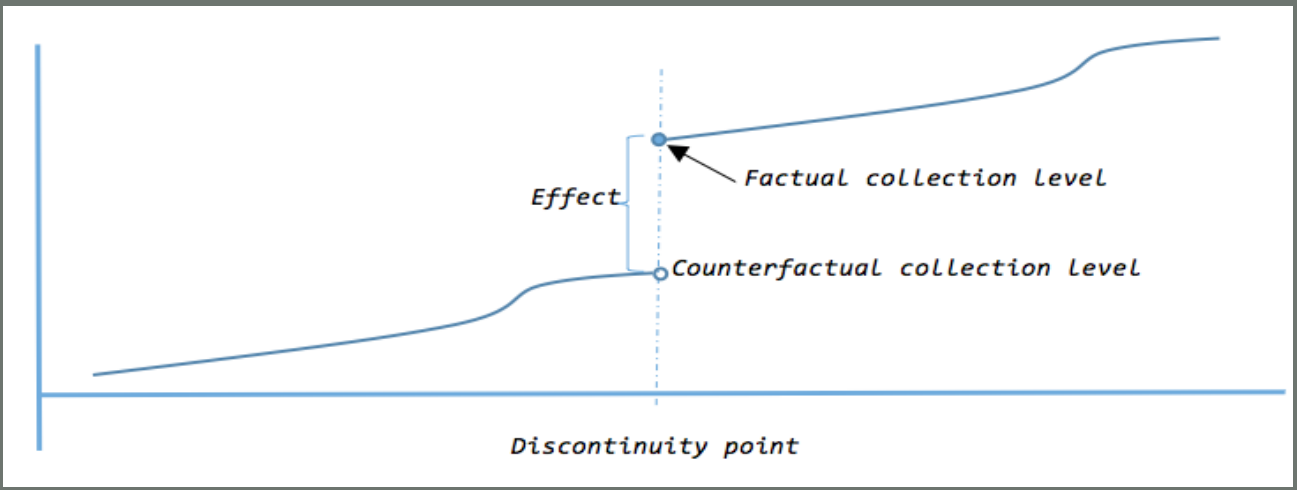
Time is the most used variable in this approach, since policies are normally implemented as of a particular date. This date acts as the cutoff point that determines what is treated by the policy. For example, if electronic invoicing was implemented as of a particular date, it is unlikely that revenue collection would change substantially by the following month unless the invoicing had a significant effect.

Apart from time, other kinds of variables can be used if there is a point at which firms have to start using electronic invoicing. For example, if businesses that are bigger than a specified size are obliged to take

part in electronic invoicing, that size can serve as a cutoff point. It is unlikely that collection would rise substantially among the firms below the cutoff relative to those that are barely above it unless the invoicing had a significant effect.

For this approach to be meaningful it has to meet two important conditions. The first is that there should not be any other reason for a gap in the cutoff points. If the time variable is used, and a cutoff date, this can happen when another policy came into force at the same time. An example of this is that two measures to increase tax revenue come into force on the same day, such as implementation of electronic invoicing and an increase in tax rates. If this happens, there is no way to distinguish the effect of each measure. The second condition is that there should not be a long gap between one period of assessment and another. Long gaps allow other factors affecting the dependent variable to change as well. The identification criterion rests on the assumption that no other factor varied (or varied only marginally) between one period and another. This is not the case when, for example, there is annual data collection. For this analysis to be convincing, it should be shown that this has not happened.

Figure 1. Regression Discontinuity



2.2 Difference in differences

Another means of identifying the policy impact is the difference in differences strategy. This consists of comparing changes in the dependent variable before and after the treatment, for the observations that were treated and those that were not. In the case of electronic invoicing, this is a matter of comparing the change in, for example, tax revenue before and after the implementation of electronic invoicing among those firms that joined the invoicing system with the change in revenue during the same period among those firms that did not join.

This requires panel data for at least one period before implementation and another period after it. Moreover, it requires information for observations that are influenced by the policy—in this case, that are inside the invoicing system—as well as observations that were not influenced by it—in this case, that are outside the system.

It is assumed implicitly that the change in the untreated observations would be the counterfactual of the treated observations. In other words, the change in collection from firms that did not join the system would be the change in collection from firms that did join if they had not done so (see Figure 2). Thus we can estimate the counterfactual levels of collection—that is, what would have happened after the implementation of electronic invoicing for firms in the system if they had not joined it. The effect is estimated by comparing the counterfactual levels with the revenue that was in fact attained within the system (see Figure 2).

This approach resolves the problem that arises if we only compare observations before and after treatment because, if there are other changes unrelated to the treatment, they can be identified by studying the changes in the untreated observations. For instance, if the firms in the system significantly increase the payment of taxes, it is not clear whether this change stems from electronic invoicing or from another factor, such as an increase in economic growth. Nonetheless, when we observe the changes that affected the untreated observations we can estimate the changes that stem from other factors, and thereby correct the estimator of the effect of the invoicing.

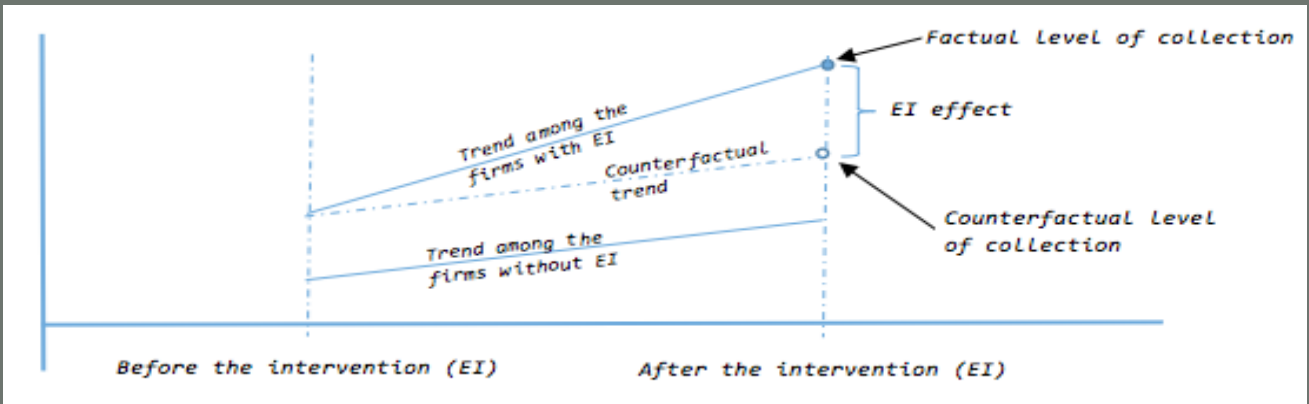
This approach also resolves the problem that arises if we only compare observations with and without treatment because, if there are differences between the two groups that are unrelated to the treatment, these can be identified by comparing the two groups before and after treatment. For example, if the firms in the system were of a different size than those outside the system, we can calculate the original differences in collection before the implementation of electronic invoicing, and thereby correct the estimator. These two corrections are made simultaneously using the difference in differences method.

Like the other strategies used to identify a causal effect, this is based on an identification assumption that must be met in order to ensure that the coefficients are not biased. For difference in differences, the assumption is that there should be no factors that change over time and that affect revenue collection differently between the treated and untreated observations. In other words, the trends in the absence of treatment have to be the same for the two groups—otherwise, the estimator will capture not only the policy impact but also changes in the trend.

An argument used to defend this identification assumption is to show that before the intervention, the collection trend among the treated group is similar to the trend among the untreated group. However, this requires data on two periods before the implementation of electronic invoicing.

The difference in differences strategy is more appropriate than the regression discontinuity method when other factors have changed at the time of the invoicing. However, if there are differences in the trends and the frequency of the data is sufficiently high to identify a gap without other variables having changed, then the regression discontinuity approach is better.

Figure 2. Difference in Differences



2.3 Matching

The final method of analysis is known as matching. This consists of identifying untreated observations with characteristics similar to treated observations. The final goal is that the differences in the dependent variable between each group stem solely from the group's treatment status.

The first step in applying the matching method is to identify the characteristics to be used in determining if there is similarity. All the variables that affect the probability of treatment (entering the electronic invoicing system), and that simultaneously are correlated with the dependent variable, have to be included in the analysis—otherwise, we can expect the coefficients to be biased.

The second step is to define similarity. The most common means of doing this is the propensity score. The latter is the estimated probability that an observation has been treated. This probability is estimated using a probit or logit model in which the independent variables are the defined characteristics in the first step, and the dependent variable takes the value of 1 if the observation was treated and 0 if it was not. Once this is estimated for each observation, the similarity between a treated and untreated observation is determined using the difference in the propensity score. Observations with comparable scores are defined as similar observations, and observations with different scores are defined as dissimilar observations. The similar observations for each treated observation are identified, and non-matching observations are eliminated from the sample. According to Rosenbaum and Rubin (1983), conditioning with this method, and as long as the proper conditions for the explanatory variables are met, the estimator of the effect will be unbiased.

Once we have comparable treated and untreated observations, in the third step we can estimate the effect. One option is to compare the means of each group, but differences could persist in the observable characteristics. In that case, other econometric methods can be used to eliminate them. For instance, in a cross-sectional database, regression analysis could be used with the sample of comparable observations. If the data were a two-period panel, the difference in differences method could also be used with the comparable observations. Using matching before the different econometric methods of evaluation yields results closer to random controlled experiments (Heckman et al., 1997; Ferraro and Miranda, 2014).

3. FINDINGS

This section presents the findings of the five studies. Three of them were carried out in Argentina, Ecuador and Uruguay, with the support of the Inter-American Development Bank, to assess the impact of the implementation of electronic invoicing. There is also a study that assesses the implementation of electronic invoicing in Mexico,[2] and another that evaluates an intervention that increases customer reporting through the electronic invoicing system in São Paulo. Each of them uses some of the abovementioned methodologies.

The first part of this section presents the details of the studies. The second part discusses the context using descriptive statistics. The third part focuses on the overall outcomes of the interventions. Finally, specific results of each intervention are discussed.

3.1 Interventions

By joining forces with universities and researchers, Latin America's tax administrations have made great efforts to assess the impact of electronic invoicing in their countries. Five of the seven countries that have implemented EI successfully have conducted such assessments using quasi-experimental methodologies, thereby making it possible to isolate the effect of EI on the increase in the different variables of interest related to tax collection. Table 1 provides a description of the main aspects of the interventions.

For Brazil, Naritomi (2015) assesses the São Paulo Tax Invoice (Nota Fiscal Paulista, NFP), part of a program that seeks to use consumers as tax auditors by introducing monetary incentives and a system of cross-checks. Implementation of the NFP began in 2007, and thus the period of analysis was 2004–2011, using the difference in differences methodology.

2 Financed by Mexico's Tax Administration Service (SAT) and carried out by the Instituto Tecnológico de Monterrey as part of these studies of electronic invoicing in the region.

For Ecuador, Ramírez, Oliva and Andino (2017) also consider the use of EI as a treatment, specifically for receipts generated in transactions distinct from final consumption in the years 2011–2016. The authors analyze EI in Ecuador using the difference in differences approach, taking advantage of the scheduling of the obligation to join the system. The process was divided into three stages: development, testing, and production. The control group comprised those taxpayers that were chosen to be part of the electronic invoicing program, but that for scheduling reasons were included in the system at a later stage—that is, taxpayers in the stages of development and testing. The treatment group comprised taxpayers in the production stage.

In Uruguay, electronic tax receipts began to be introduced in 2012 through the General Tax Administration. These receipts "are documents generated and signed electronically by an authorized issuer, documenting operations that have tax effects" (Bérgolo, Ceni and Sauval, 2017). Initially the firms voluntarily chose to join the system. In 2015 the tax authorities established a timetable for mandatory registration based on the firms' billing in the previous year.

The treatment in the assessment by Bérgolo, Ceni and Sauval (2017) consists of the inclusion of taxpayers in the electronic invoicing system as of 2012. To this end, they conducted an event study with difference in differences from 2010 to 2016, taking advantage of the divergences in the moments the electronic invoices were applied during a period of almost seven years.

A study of Mexico examined taxpayers' adoption of the Online Digital Tax Receipt in the period 2010–2015. This was introduced as an alternative to physical receipts and consists of the delivery of an electronic invoice through the company's website or some other electronic medium at the customer's disposal. Since the Tax Administration Service (SAT) established as a first stage (2011–2014) an invoicing obligation for taxpayers with earnings of 4 million pesos or more, the regression discontinuity design was used (Fuentes et al., 2017).

For their part, Artana and Templado (2017) assess Argentina's inclusion of firms in the electronic invoicing policy in the period 2005–2016. These authors also took advantage of EI's implementation scheme, comparing in each year the group that was obliged to take part in EI with the group that was obliged to take part but that did not join, using a difference in differences analysis and controlling for variables to eliminate possible remaining biases in the estimates. In 2016 the Federal Public Revenue Administration (AFIP) presented a schedule that segmented by level of invoicing (taking account of total annual invoicing in 2015), and thus a cutoff value was established for those that invoiced more than 2 million pesos. The regression discontinuity method was used to analyze the latter period.

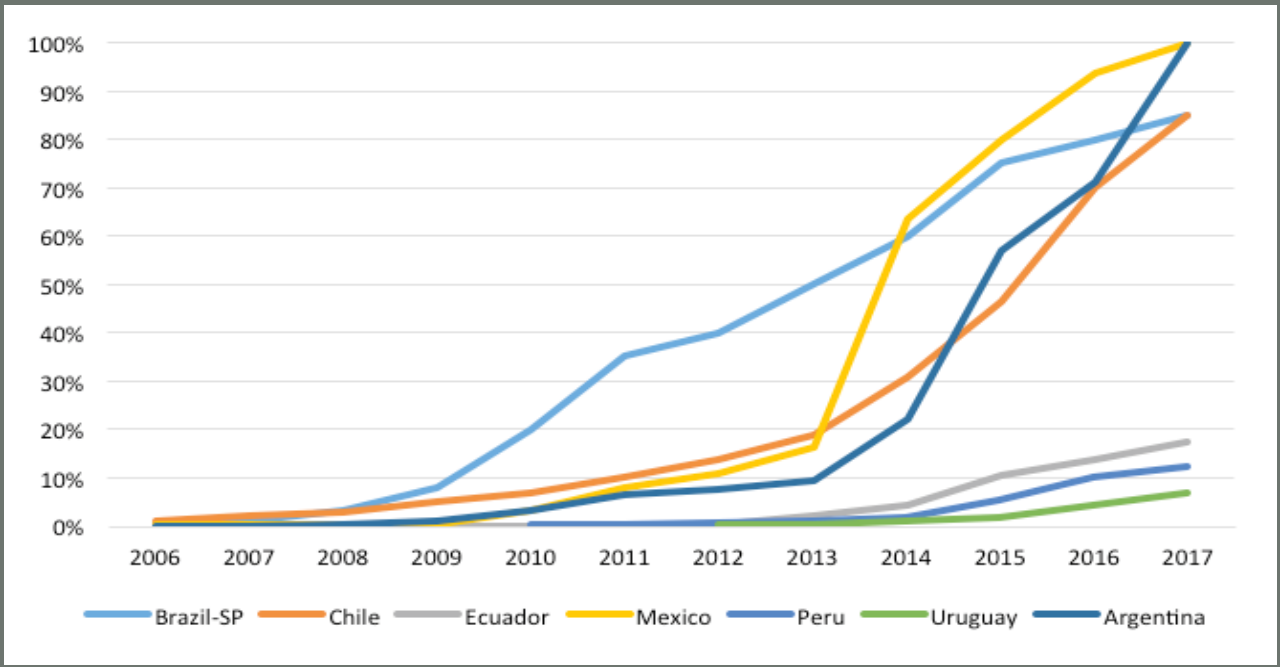
Table 1. Characteristics of the Evaluations of the Impact of Electronic Invoicing in Latin America

Study	Country	Period of analysis	Empirical strategies	Description of treatment	Intervention process	Download
Artana and Templado (2017)	Argentina	2005-2016	2007-2015 Difference in differences. In 2016, regression discontinuity	Firms' inclusion in the electronic invoicing policy	Undertaken slowly in specific sectors. In 2016 it was made mandatory to register with the program	
Naritomi (2015)	Brazil-SP	2004-2011	Difference in differences	Assessment of the Nota Fiscal Paulista, part of a program that seeks to use consumers as tax auditors by introducing monetary incentives and a system of cross-checks	The policy is applied in São Paulo and generates lottery tickets for each US$50 spent by consumers, with a view to promoting consumers' function as auditors of the electronic information provided by the firms. Inclusion in the program takes place in parallel with the system for electronic transmission of receipts.	
Ramírez et al. (2017)	Ecuador	2011-2016	Difference in differences, with selection of controls with propensity score matching and Pipeline	Registration of firms with the electronic invoicing policy by Ecuador's tax authority	Registration was made mandatory for the following taxpayers: financial institutions, credit card issuers and administrators, companies providing telecommunications and pay TV services, exporters, self-assessing taxpayers, online sales and special taxpayers. The obligation to register is enforced by means of receipts in transactions distinct from final consumption.	
Fuentes et al. (2016)	Mexico	2010-2015	2011-2013 regression discontinuity 2014-2015. There is a discontinuity between 2013 and 2014	Taxpayers' adoption of the online digital tax receipt, which was introduced as an alternative to physical receipts. An electronic invoice is delivered to the client through the company's website or some other electronic medium at the client's disposal	Mandatory for all taxpayers as of 2014; from 2011 to 2014 it was mandatory for taxpayers with earnings of 4 million pesos or more	
Bérgolo, Ceni and Sauval (2017)	Uruguay	2010-2016	Difference in differences	Consists of taxpayers' inclusion in electronic tax documentation, generating and digitally signing documents that have tax effects related to taxes administered by the General Directorate of Taxation (DGI)	Taxpayers that want to join the system must submit a request to the DGI and complete an induction process. A timetable for inclusion in the system was established as of 2015. Eight deadlines were set for entry, based on firms' total invoicing in the previous year	

3.2 Descriptive statistics on the studies

Although the countries began to implement electronic invoicing in different years, they have all engaged in a slow process of incorporating taxpayers into the system. In the early stages of piloting and consolidating the initiative, the percentage of new taxpayers using EI was smaller than when the mandatory phases began in each country. Once the tax administrations began to put EI into effect, the number of taxpayers joining the system rose significantly. Moreover, as Graph 1 shows, countries such as Argentina and Mexico, which were the first to implement electronic invoicing, have now reached 100 percent coverage of VAT payers that issue invoices electronically.

Graph 1. VAT Payers that Issue Electronic Invoices (cumulative percentage)



Source: prepared by the authors on the basis of interviews with the tax administrations.

Table 2 shows that there are significant differences between the countries in terms of initial levels of revenue as a percentage of GDP during the year in which each began electronic invoicing. In Mexico, revenue amounted to less than 3.5 percent (taking refunds into account); in Ecuador it reached almost 5 percent; and in Argentina and Uruguay it stood at 6.4 percent and 9.1 percent, respectively. This is important because the effects of any intervention in a place where revenue collection rates are low can be expected to differ from the effects in a place where the rates are already high.

Table 2. Ex-ante and Ex-post VAT Revenue *

Country	Period of analysis	Rate	Revenue a year before the start of the intervention (% GDP)	Revenue after the intervention (2015) (% GDP)
Argentina	2005-2016	21%/10.5%[a]	6.4	7.4
Ecuador	2011-2016	12%	4.8	6.4
Mexico	2010-2015	16% b	3.4	3.9
Uruguay	2010-2016	22%/10% [a]	9.0	8.3

Source: prepared by the authors on the basis of the Equivalent Fiscal Pressure database, IDB-CIAT (2015).
* Data unavailable for Brazil-SP. a Rate of 10% for certain goods and services in the basic basket.
b Almost the entire basic basket has a rate of 0%.

Table 2 also shows that, in every country except Uruguay, revenue rose as a percentage of GDP during the intervention period, even though the rates did not change. As was mentioned in the methodology section, however, this does not mean that the implementation of electronic invoicing has been positive or negative. The intervention periods are so long that any other factor important for revenue could have changed in the same period. To estimate the effects of the intervention properly, we have to use one or other of the methodologies outlined in Section 2.

3.3 Impact estimates

As Table 3 shows, the estimated effects on revenue are generally positive in all the countries studied. In other words, according to the studies mentioned above, electronic invoicing has positive and significant effects on revenue. As is to be expected, however, the magnitude of these effects varies by country for each year and each variable of interest.

Mexico's Online Digital Tax Receipt has an impact on the assessed tax amounting to 16 percent, 11.1 percent and 14.6 percent for the years 2011, 2012 and 2013. These estimates were arrived at using a regression discontinuity design based on the cutoff point at which participation in the system became mandatory (4 million pesos in 2011). Additionally, the analysis found an increase of 6.5 percent and 6.6 percent in the assessed income tax on legal entities (businesses) for 2014 and 2015 (Fuentes et al., 2017). These results spring partly from taxpayers' inclusion in the electronic invoicing system.[3]

3 The increase detected between 2014 and 2015 could stem from factors distinct from the inclusion of taxpayers in the electronic invoicing system, and that occurred simultaneously to registration in the system.

For Ecuador, which yields the highest results, Ramírez, Oliva and Andino (2017) undertake the analysis for 2014, 2015 and 2016. For 2014 they find, for the taxpayers included in the study, positive impacts for local sales taxed at 12 percent (general rate) and local purchases taxed at 0 percent (increases of 1 percent and 0.5 percent), and negative effects for local sales taxed at 0 percent, local purchases taxed at 12 percent and the amount of assessed VAT (changes of -2 percent, -2 percent and -1 percent, respectively). However, no result in that year was statistically significant. For 2015, they find positive and significant impacts for sales taxed at 12 percent (17 percent increase) and amount of VAT (positive change of 18 percent). The estimates are not significant for sales taxed at 0 percent and purchases taxed at 0 percent and 12 percent (3 percent, -1.4 percent and -8.3 percent, respectively). For 2016, they also find positive and significant impacts for sales taxed at 12 percent (increase of 38 percent), purchases taxed at 12 percent and at 0 percent (increasing by 46 percent and 40 percent, respectively) and the level of VAT (which rose by 25 percent that year). The estimates were not significant, however, for local sales taxed at 0 percent (8.1 percent). The foregoing suggests that a progressive process arises from including taxpayers in the EI regime.

The effects in Argentina and Uruguay were also positive, although on a lesser scale than in Ecuador. Bérgolo, Ceni and Sauval (2017) estimate a 3.7 percent impact on the amount paid by firms in Uruguay for a six-month period of analysis. For their part, Artana and Templado (2017) find that the introduction of EI in Argentina yielded effects that vary in magnitude and depend on the year being measured. The effects on revenue varied from 0 percent in 2008 to 10.7 percent in 2013, with positive results in 2007, 2010, 2011, 2012 and 2015.

For Brazil-SP, Naritomi's (2015) analysis over six-month periods found a 22 percent increase in earnings reported on firms' income statements in the period 2008–2011. Although this intervention is somewhat different from the others—since the focus is on the effects of complaints made by third parties, who are given lottery incentives in the current electronic system—the results are quite high. Moreover, this is one of the strategies that could be used in any of the countries once the electronic invoicing system is up and running.

Table 3. Main Effects of the Impact Assessments

Authors	Country	Method	Dependent variable	Percentage effect on revenue
Artana and Templado (2017)	Argentina	Difference in differences and regression discontinuity	Taxed sales	2007: Significant positive effect of 8.4% 2008: Non-significant effect of 4.2% 2009: Non-significant impact of 1% 2010: Significant impact of 1.5% 2011: Significant effect of 1.8% 2012: Significant effect of 9.3% 2013: Significant impact of 13% 2014: Significant impact of 5.5% 2015: Significant effect of 2.8%
			Tax debit minus credit	2007: Significant positive effect of 6.7% 2008: Non-significant effect of 1% 2009: Non-significant impact of -0.3%% 2010: Significant impact of 2.6% 2011: Significant effect of 2% 2012: Significant effect of 5% 2013: Significant impact of 7% 2014: Significant impact of 5.7% 2015: Significant effect of 2.8%
			Revenue	Increase in revenue of between 0% in 2008 to 10.7% in 2013
Naritomi (2015)	Brazil-SP	Difference in differences	Reported earnings	The program led to a 22% increase in the firms' reported earnings in four years
Ramírez et al. (2017)	Ecuador	Difference in differences	Taxed local sales	2014: Non-significant positive impact of 1% 2015: Significant impact of 17% 2016: Significant impact of 38%
			Untaxed sales	2014: Non-significant negative effect of -2% 2015: Non-significant positive impact of 3% 2016: Non-significant positive effect of 8.1%
			Taxed purchases	2014: Non-significant negative effect of -2% 2015: Non-significant negative impact of -8.3% 2016: Significant positive effect of 46%
			Untaxed purchases	2014: Non-significant positive impact of 0.5% 2015: Non-significant negative impact of -1.4% 2016: Significant positive impact of 40%
			Assessed tax	2014: Non-significant negative effect of -1% 2015: Significant positive effect of 18% 2016: Significant positive impact of 25%
Fuentes et al. (2016)	Mexico	Regression Discontinuity	Declared amount of cumulative income	The study finds an impact of 16%, 11.1% and 14.6% on assessed tax for 2011, 2012 and 2013. It also finds an increase of 6.5% and 6.6% in the assessed business income tax for 2014 and 2015
Bérgolo, Ceni and Sauval (2017)	Uruguay	Event Study–difference in differences	Revenue	An estimated 3.7% impact on firms' payment amounts

3.4 Specific findings

The findings of the research in Ecuador by Ramírez, Olivia and Andino (2017) show positive and significant impacts in variables important for revenue collection. The effects on the variables included in the research, however, do not translate automatically into an increase in revenue, as described by Fuentes et al. (2017) for Mexico—where deductions mean that the assessed tax differs from the tax actually collected. For Uruguay, Bérgolo, Ceni and Sauval (2017) estimate effects for different subgroups and compare them with the average effect. They find no difference in the effects for firms that used electronic payment instruments before electronic invoicing was introduced and those that did not. Similarly, they estimate differences in effects between firms that tend to retain higher and lower shares of VAT. They find that the effects are greater for the latter businesses.

Finally, they conduct an analysis that distinguishes by sector, and find that the greatest effects are in manufacturing industry and the wholesale trade, while the least effects are in agriculture, fisheries and mining, and the production of electricity, gas and water.

In similar vein, for Argentina, Artana and Templado (2017) find statistical evidence that electronic invoicing raised levels of reported taxed sales and had varying effects over time, since the impact coefficients for 2007, 2010, 2011, 2012, 2013, 2014 and 2015 are 6.91 percent, 2.45 percent, 2.81 percent, 7.88 percent, 5.80 percent, 5.29 percent and 2.31 percent. No effect was found for 2008 and 2009. Diverse sectoral analysis shows that EI has a positive impact on reported taxed sales in construction, commerce, transportation, information and communications, real estate services and the professional services sector. In the healthcare sector, on the other hand, the introduction of EI did not bring about a higher level of reported sales. Moreover, for industrial businesses that began issuing electronic invoices in 2011 there is a positive effect on taxed sales, in contrast to firms that began to issue such invoices in 2009. This suggests that the impact of joining the electronic invoicing regime varies not only over time but also by productive activities.

For her part Naritomi (2015) finds for Brazil-SP that the *Nota Fiscal* increased the earnings reported in retail sales sectors by at least 22 percent during the four years under study. She also concludes that the estimated effect is large for sectors with high transaction volumes. Moreover, she finds that when consumers decide to complain, firms report 14 percent more receipts and 6 percent higher earnings after being the subject of their first complaint.

4. CONCLUSIONS

This chapter has discussed the role that the implementation of electronic invoicing can play in reported sales and earnings, and in turn on the taxes collected (VAT and income tax). The analysis focused on five studies of Latin American countries that implemented the policy: Argentina, Brazil-SP, Ecuador, Mexico and Uruguay. There is evidence that electronic invoicing increases reported sales and earnings, and raises the tax take. The implementation of electronic invoicing could spur significant increases in revenue collection in the other countries of the region.

An important matter to consider is that the effects can vary according to the timeframe. Substantial increases are apparent in the short term, but the effects wane as time goes by (Artana and Templado, 2017). This might be because initially there is a perception of a substantially greater probability of being detected in the event of under-reporting income. This perception shifts as firms become used to the new system and their assessment of this probability improves (the risk of being detected). To offset this, there are strategies to reinvigorate the perception of such a probability, as happened in Brazil-SP—where consumers were given incentives to file complaints, which led to an increase in reported earnings.

Finally, it is important to understand that the effects will not be uniform in all economic activities (Artana and Templado, 2017; Bérgolo, Ceni and Sauval, 2017). It can therefore be expected that the results will vary among the different countries in line with each one's characteristics. It is also likely that the most affected activities will be those in which there is a greater likelihood of customer complaints. Positive effects, however, are apparent in periods of both economic growth and recession.

In conclusion, implementation of electronic invoicing is a promising instrument to enhance businesses' voluntary compliance with their tax obligations. This is especially important in the region where levels of collection and compliance are fairly low relative to the more developed countries.

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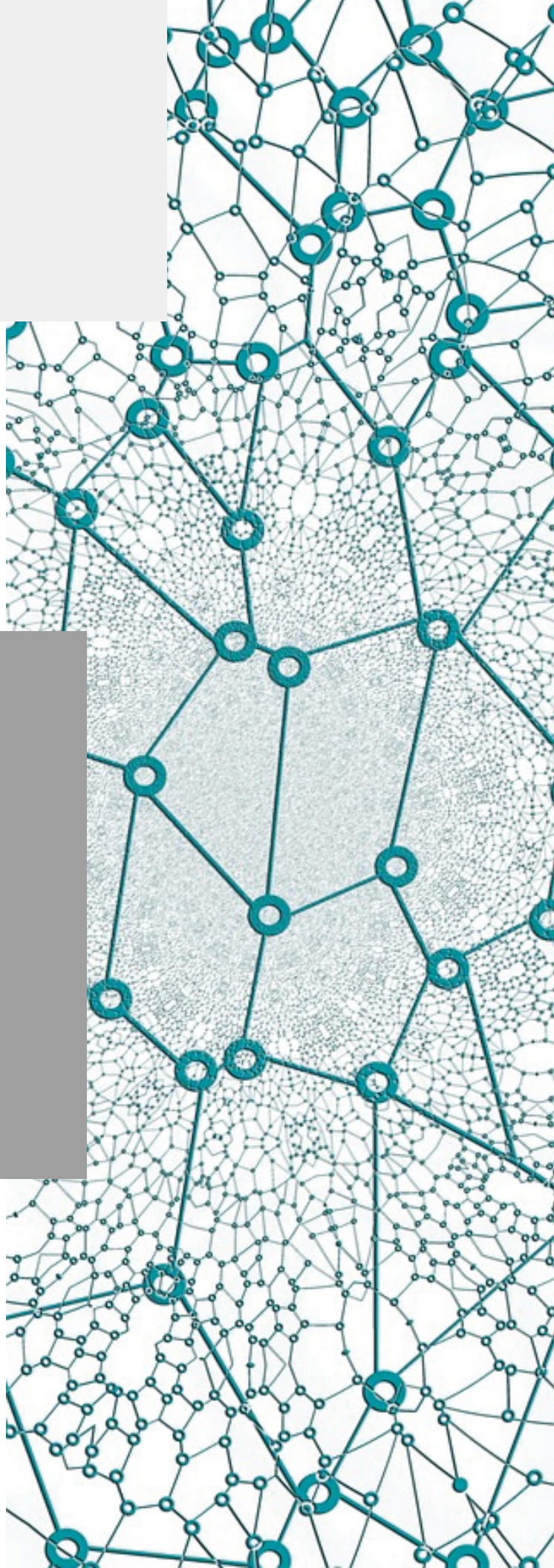

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