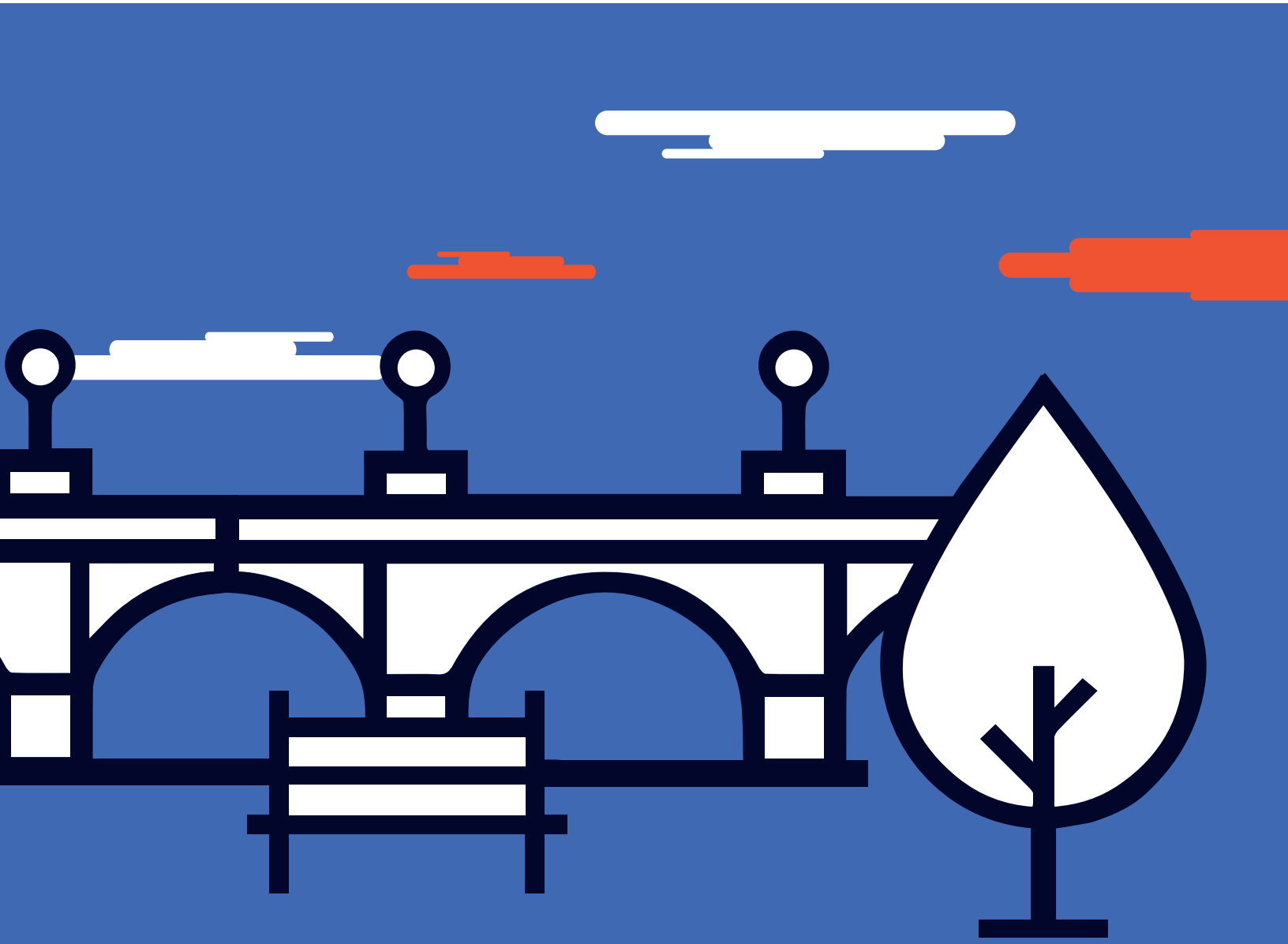
The Potential of Land Value Capture

for financing urban projects:
methodological considerations and case studies



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IDB

Cataloging -in-publication data provided by the Inter-American Development Bank
Felipe Herrera.
The potential of land value capture for financing urban projects: Methodological considerations and case studies / Andrés G. Blanco B., Nancy Moreno M., David M. Vetter, Marcia F. Vetter.
p. cm. — (IDB Monograph; 494)
Includes Bibliographic References:
1. Capital gains tax-Latin America. 2. Capital gains tax-Caribbean Area. 3. Land use, Urban-Latin America. 4. Land use, Urban-Caribbean Area. 5. City planning-Latin America. 6. City planning-Caribbean Area. 7. Infrastructure (Economics)-Latin America. 8. Infrastructure (Economics)-Caribbean Area. I. Blanco Blanco, Andrés Guillermo. II. Moreno M., Nancy. III. Vetter, David Michael, 1943-. IV. Vetter, Marcia F. V. Banco Interamericano de Desarrollo. División de Viviendas y Desarrollo Urbano. VI. Serie.
IDB-MG-494

JEL codes: A10, B41, C50, C63, H70, N96, O18, O22, R14, R52, R58
Keywords: Land Value, Financing Mechanisms, Urban Projects, Infrastructure and Services, Cities of Latin America and the Caribbean, Urban Development, Urban Planning, Financing Strategies, Urban Sustainability.

Art and Design Direction:
Sergio Moreno

Layout:
PH3 estudio
www.ph3estudio.com

Index

Acknowledgements

This publication is based on studies, workshops and consultations carried out during 2015 and 2016. Special thanks to the colleagues of the Fiscal and Municipal Management Division and the Housing and Urban Development Division, particularly to Ricardo De Vecchi, José Larios, and Isabelle Zapparoli, who collaborated on the preparation of the case studies.

This document would not have been possible without the support, the motivation and the valuable contributions of the Quetzaltenango and Xalapa municipal governments, as well as from the representatives of the state and national governments, academic entities and the private sector. We particularly appreciate the collaboration of the following:

Quetzaltenango

Quetzaltenango municipal government[1]

LG Luis Grijalva - *Mayor*
OM Olga Moscoso - *Trustee*
MA María Alvarado - *Councilmember*
AC Armando Castillo - *Councilmember*
CG Carlos González- *Councilmember*
MG Mirta García - *Councilmember*
RS Roberto Soto - *Councilmember*
FA Fabiola Ávila - *Councilmember*
FM Felisa Muñoz - *Councilmember*
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MF Mario Fernández - *Municipal Manager*
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YA Yunnior Alvarez - *Appraisal Technicia*
MO Miguel Ocaña- *Appraisal Technician*
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LL Luis López - *Cadaster Assistant*
CJ Carmen Jaimes - *Municipal Audit Office*
SD Silvia Díaz - *Environment Director*
SR Silvia Rivera - *Land Use Head*
GC Gabriela Cotom - *Building Permits*
YR Yaquelin Rojas - *Mayor's Office Secretary*
MC Marcela Citán - *Municipal Manager (2015)*
LR Luis Rodríguez -*Computer Science Technician (2015)*
DR Daniel Ruiz - *Deputy Manager (2015)*

General Secretariat for Economic Planning – SEGEPLAN

KR Karla Ruiz - *Departamental Delegate in Quetzaltenango (2015)*

Academia

LC Luis Castillo -*Architecture Professor*
CUNOC, Universidad de San Carlos de Guatemala
VH Víctor Hernández - *Director of Engineering*
CUNOC, Universidad de San Carlos de Guatemala
MM Mirna Montes - *Academic Director*
CUNOC, Universidad de San Carlos de Guatemala
CO Cristian Ovalle - *Engineering Research Director*
CUNOC, Universidad de San Carlos de Guatemala
DR Dora Reyna- *Architecture Professor*
CUNOC, Universidad San Carlos de Guatemala
JZ Javier Zúñiga - *Geomatics Laboratory*
CUNOC, Universidad San Carlos de Guatemala
AM Andrés Morales - *PhD Student*
University of Twente, The Netherlands

Private Sector

OG Otto Gordillo - *Cerex*
AH Aldo Herrera- *Debursa*
AH Álvaro Herrera - *Debursa*
MH Marcos Herrera - *Debursa*
LG Luis Gómez- *Sacándole Brillo a Xela*

[1] We thank the 2012-2016 Mayor's Office and Municipal Council's teams, which also contributed during 2015.

Xalapa

Xalapa municipal government

AZ Américo Zúñiga - *Constitutional Municipal President*
RA Rogelio Álvarez - *First Alderman*
CA César Acosta - *First Ward Alderman's Office Advisor*
HP Heriberto Ponce - *Sixth Ward Alderman*
JR José Alberto Robledo- *Municipal Advisor to the President*
DA Darío Arroyo - *Head of Cadaster Department*
CD Carlos Durante - *Municipal Treasurer*
EG Ernesto García - *Revenue Officer*
AM Agustín Martínez - *Head of the Tax Foreclosure Department*
RH Ramón Hernández - *Urban Development and Environment Director*
JF Juan C. Flores - *Urban Development and Environment Deputy Director*
JM Juan Marín - *Citizen Participation Director*
FA Fernando Alvarez - *Citizen Participation Directorate Representative*
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RM Raúl Mendoza- *Business Development Sub-Directorate*
JO Julio César Ornelas - *Director of Municipal Services*
FT Favio Tobón - *Municipal Services Directorate Representative*
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Government of the State of Veracruz

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CIMIC, Xalapa Delegation
GF Giovanna Fernandez - *President of the School of Architects*

Abbreviations and acronyms

ALG	Transportation Infrastructure & Logistics
BANOBRAS	*Banco Nacional de Obras y Servicios Públicos*
BIAs	Betterment Improvement Areas
BIDs	Business Improvement Districts
BRT	Bus Rapid Transit
CAF	*Corporación Andina de Fomento*
CAMA	Computer Assisted Mass Appraisal
CEPAC	Certificates of Potential Additional Construction
CEPAL	*Comisión Económica para América Latina y el Caribe*
CIAT	*Centro Interamericano de Administraciones Tributarias*
COS	*Coeficiente de Ocupación del Suelo*
CUNOC	*Centro Universitario del Occidente*
CUS	*Coeficiente de Utilización del Suelo*
ESC	Emerging and Sustainable Cities Program
FAR	Floor Area Ratio
FINDETER	*Financiera de Desarrollo Territorial*
GDP	Gross Domestic Product
GIS	Geographic Information System
IAAO	International Association of Assessing Officers
IDB	Inter-American Development Bank
IUSI	*Impuesto Único Sobre Inmuebles*
KCSM	Kansas City Southern Mexico
LAC	Latin America and the Caribbean
POET	*Plan de Ordenamiento Económico Territorial*
POT	*Plan de Ordenamiento Territorial*
PPP	Public-Private Partnerships
SCT	*Secretaría de Comunicaciones y Transportes*
SEGEPLAN	*Secretaría de Planificación y Programación de la Presidencia*
TIF	Tax Increment Finance
TOD	Transit-Oriented Development
UN - Habitat	United Nations Human Settlements Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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Executive summary

Land value capture as an instrument for financing urban projects.

Applying land value capture to urban projects in emerging cities

A. Xalapa
B. Quetzaltenango

Land value capture as an instrument for financing urban projects

Latin America and the Caribbean (LAC) has been experiencing remarkable urban growth for several decades. With more than half of its population living in cities, the region is considered the second most urbanized on the planet. This situation makes cities the central players in the development of their countries, transforming them into places that offer not only opportunities (e.g. human capital, greater investment levels, employment, etc.), but that also face great challenges (e.g. spatial inequality and segregation, housing deficits, proliferation of informal settlements, pollution, etc.).

The lag in the effective provision of basic services and infrastructure is one of the most important challenges facing the region's urban areas. Although significant progress has been made as far as service coverage and quality are concerned, increasing urbanization has, in many cases, outstripped the technical and financial capacities of local governments, generating substantial gaps between the demand and supply of urban goods and services.

Beyond the implications of this in terms of sustainability and quality of life, infrastructure investments play a fundamental role in the economic development of cities. Studies indicate that doubling infrastructure investments would boost the annual growth rate of region's Gross Domestic Product (GDP) by around 2%. Unfortunately, LAC's public investment has progressively decreased since the eighties, settling at about 2% of GDP during the last decade (IDB, 2013).

For most cities in the region, increasing demands for more and better services and increased infrastructure investment needs, together with the shortages of the local resources, have broadened the financing gap. For this reason, collaborating with municipal governments to strengthen their traditional revenue sources (e.g., own-source revenues, transfers, etc.) is of vital importance, as is the identification and application of relatively new and unexplored financial instruments that can provide alternative resources for effectively satisfying the basic needs of their citizens.

One such alternative is land value capture. This alternative involves capturing the increments in land prices generated by urbanization in order to finance needed infrastructure and services. Numerous empirical studies show that the value generated by improvements in access to infrastructure and urban services is capitalized into real estate prices. The ultimate goal is capturing the value generated by municipal investments to provide positive feedback by generating additional resources for new investments to help reduce the deficits in service and infrastructure provision at a local level.

In addition to the benefits in terms of public finance, many authors point out that land value capture can also help to improve the economic efficiency of municipal investments, contribute to social equity, and serve as a tool for urban growth management and land price control, as well as reduce the uncertainty of private developers about the timing of project approval and infrastructure provision.

The instruments for capturing the value generated by investments and other public sector interventions that affect land value can be classified into the following types: (i) taxes, (ii) fees, and (iii) regulations (Smolka and Amborski, 2000). At present, many LAC subnational governments are using such instruments to capture value; and in some countries, their application is even regulated by national laws. Nevertheless, value capture is not currently used to its full potential, partly due to either the lack of adequate legal frameworks or the failure to consistently apply regulations when they do exist. (Smolka, 2013).

Among the main reasons causing the under-utilization of the value capture instruments are: Technical difficulties in measuring the increment in value generated by public interventions and its interpersonal distribution, the risks of high initial costs and implementation problems, and in some cases, general public resistance.

Four types of value capture instruments are commonly used to finance urban projects: Betterment levies, selling of development rights and exactions, Tax Increment Financing (TIF), and land readjustment. Each one of them has advantages and disadvantages, and their efficiency and feasibility depend on multiple variables internal and external to the project.

When deciding which value capture instrument is most suitable to finance a specific project, several factors are decisive: Type of project (rehabilitation of deteriorated areas or greenfield development), its origin (public or private sector's interest), scope of the value capture (recovery of just project cost or the full land value increment), time of collection (ex-ante or ex-post), and the degree of sophistication the instrument required.

Applying land value capture to urban projects in emerging cities

In this study, we analyze land value capture's potential as a financial tool for urban projects in the Emerging and Sustainable Cities Program (ESC) of the Inter-American Development Bank (IDB). For this, we propose a straightforward methodological approach that complements that of ESC and can be implemented in a timely manner. To this end, we provide methodological guidance for doing a prefeasibility analysis of the potential for financing a project via value capture and identify the most effective instruments for so doing.

The proposed methodological approach begins with the project description including: The delimitation of its impact area, assessment of the value of the stock of land and buildings in the impact area, estimation of the increment in land value, financial prefeasibility analysis, and identification and selection of the most viable value capture instruments.

In order to illustrate the proposed methodological approach in practice, we develop two case studies in cities participating in the ESC Program: Xalapa in Mexico and Quetzaltenango in Guatemala. In broad terms, the interventions studied in both cities involve the revitalization of abandoned structures, recovery of green spaces and infrastructure provision. The main results are as follows.

A. Xalapa

Our estimate is that the increment in real estate value derived from the Program's implementation would be of P$14 billion (23% of the present real estate stock's cadastral value), an increase that was considerably higher than the intervention costs (P$79.5 million), meaning that capture of only 0.6% of the projected valorization from the Program could finance the project. Similarly, a betterment levy of only 0.13% of the stock's current total value would cover the Program's total cost.

In the preliminary analysis, Tax Increment Financing (TIF) and betterment levies were identified as potentially the most effective land value capture instruments. However, the very low rate of the property tax and the resulting low revenues from it (only P$7.38 million for the first five years, less than 1% of the Program's costs) greatly reduced the viability of TIF. Therefore, we opted for betterment levies. In this case, a property of average cadastral value within the project's impact area would pay an annual levy of P$265 (US$16) during the first five years to cover the Program's total cost or make a one-time payment of P$1,330 (US$80). This one-time levy would be much lower than the expected valorization generated by the Program during the first five years, representing only 2.6% of the projected increase in value for a property of average cadastral value.

Finally, to assure that Program costs are equitably distributed, the affordability analysis assesses the structure of the levies in relation to payment capacity of property owners. To make the payment structure equitable, we allocated 68% of the project's costs to the fourth quartile (group of properties with highest cadastral value), which resulted in a one-time betterment levy of P$3,612, compared to that of the first quartile (lowest value properties) in which the levy would be P$99 per property. For both quartiles, the levy is attractive for the owners, as the payment for the fourth quartile corresponds to only 2.86% of the expected valorization for the first five years, and to only0.76% for the first quartile. See the following chart.

B. Quetzaltenango

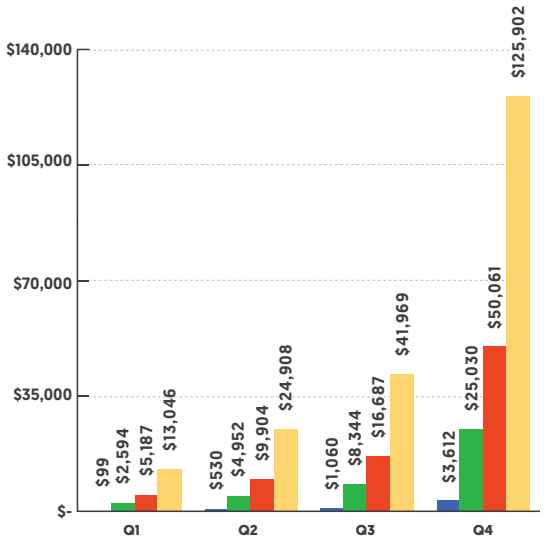
In this case, the estimate of valorization was 6% for the first five years (Q$342 million), equal to eight times the interventions' total cost. In other words, about 12% of the valorization generated by the project would cover project costs.

In legal and financial terms, betterment levies were considered the most feasible instrument for land value capture. The estimated annual levy for a property of average appraised value of Q$691,200 (US$88,615) would be Q$1,021 (US$131) for five years. A 1% increase in property value would be significantly higher than the levy's value.

In the affordability analysis, the payment structure was assessed using quartiles defined by property value. Higher value properties in the fourth quartile pay a levy of Q$13,330, compared Q$1,025 for the first quartile. See the Quetzaltenango Chart.

For both cities, the results from the application of the methodology showed the high potential of value capture instruments for financing urban projects. In both cases, the projected valorization covered the

Chart: Xalapa -
Comparative analysis of the betterment levies with a one-time payment with the increase in the average cadastral value by quartile (P$)



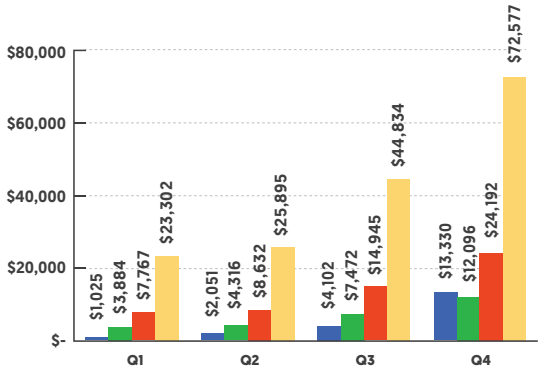
- Betterment levy for a property of average cadastral value (P$)
- Hypothetical increment of 1% in average cadastral value (P$)
- Hypothetical increment of 2% in average cadastral value (P$)
- Increment in the average cadastral value of a property due to the interventions of the Program during the first five years

Source: Estimates made by the authors based on 2014 cadastral data.

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos.

cost of the intervention by a wide margin. This means that using land value capture to finance these projects could provide a double benefit for taxpayers by helping to revitalize abandoned structures, recover green spaces, and provide infrastructure and public facilities, as well as by generating valorization greater than its costs and also the payments required to finance them.

Chart: Quetzaltenango-
Comparative analysis of the betterment levies one-time payment and the increase in median market value, per quartiles (Q$)



- Total amount of a betterment levy with one-time payment for a property of median market value (Q$)
- Hypothetical 1% increase in median market value (Q$)
- Hypothetical 2% increase in median market value (Q$)
- Valorization of a property of median market value due to Program interventions in the first 5 years (Q$)

Source: Authors' calculations with cadastral data (2013) and Morales' database (2015).

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

Introduction

The world has been experiencing significant urban growth for many decades. According to United Nations estimates, more than half of the global population currently lives in cities (4.0 billion). Over a thousand urban settlements have 10 million or more inhabitants. If this trend continues, the urban population is expected to reach 60% of the world's total population by 2030 (United Nations, 2016).

Although urbanization is generally increasing, the speed of the process has been different for each region. Thus, for example, the regions of North America, Europe and Latin America and the Caribbean (LAC) show concentrations of more than 70% of their population in urban areas, whereas in Africa and Asia, urbanization is below 50%. However, these last two regions register a more accelerated urban growth. See Chart 1.

Although the urban growth rate in LAC is decelerating, 80% of its population was already living in urban centers in 2014, which makes it the second most urbanized region on the planet, after North America (United Nations, 2014). This growth has multiple and wide-ranging implications. On one hand, cities offer greater opportunities in terms of growth: Strengthening human capital development, attraction of new investments to take advantage of economies of scale and agglomeration, more and better job opportunities, improvements in quality of life, among others. On the other hand, challenges are equally numerous: Rising inequality and spatial segregation, growing demand for urban services, traffic congestion and pollution, widening of the infrastructure and housing deficits, rise in informal settlements, negative impacts on competitiveness and productivity, etc.

Effectively providing public goods and services effectively is one of the most significant challenges facing cities, as their provision determines to a great extent their competitiveness, poverty levels and quality of life. While it is the responsibility of local governments to provide basic services in most countries of the region, their adequate provision requires that local institutions have the necessary technical and financial capacities to satisfactorily meet the demands of their inhabitants.

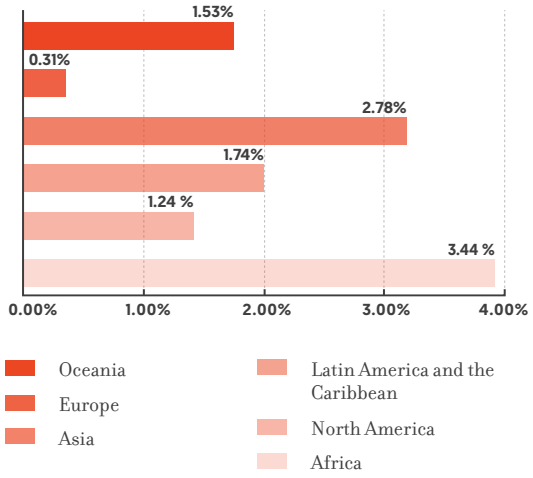
Although in recent years LAC has made significant progress in improving service coverage and quality (e.g. water and sanitation, solid waste management, housing, etc.), the intensity of the region's urbanization has sometimes exceeded the capacity of cities to provide services, causing significant delays.

The review of recent data on LAC's coverage of drinking water and basic sanitation services highlights the gap between population's growth and service provision. Although coverage has increased in relative terms, it has not kept pace with population growth in absolute terms. As a result, in 2015 more than 13 million people still did not have access to potable drinking water, and nearly 60 million lacked adequate basic sanitation. See Chart 2.

In addition to demographic growth, these infrastructure deficits have been accentuated by the rise in informal settlements located outside the perimeters of urban service networks, socioeconomic conditions that affect equitable access to these networks, and pollution that reduces the availability of water resources. However, according to the UN-Habitat Report 2012 on the state of LAC cities, the limited access to drinking water and basic sanitation is closely linked to the lack of management capacity and problems related to infrastructure provision. Studies show high investment needs. To achieve 100% coverage for water and basic sanitation[2] of the region's urban population by 2030 would require investments of around US$12.0 billion per year[2] (CAF, 2012), with an annual investment of US$4.4 billion to just extend the water and sewerage networks.

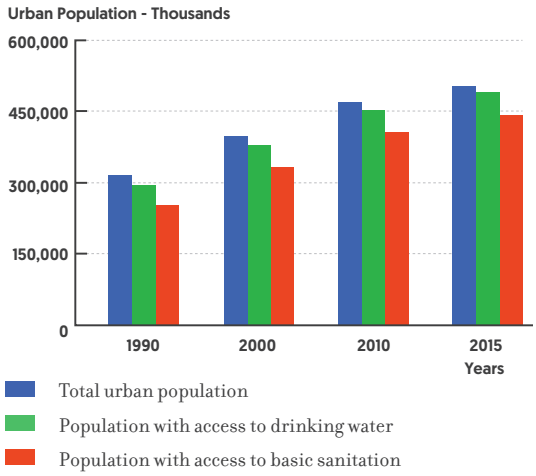
The challenges for solid waste management are similar. Approximately 10% of the solid waste collection is inadequate, and 45% of final disposal

Chart 1
Annual urban population growth rate by region (1995-2015)



Source: Based on UN-Habitat (2016)

Chart 2
Water and sanitation service coverage in urban areas of LAC (1990-2015)



Source: Prepared using data from the Joint Monitoring Programme (JMP) for Water Supply and Sanitation. (http://www.wssinfo.org) . Accessed in August 2016.

[2] These estimates include investments in drinking water, sewage system, wastewater treatment, drainage network, new water sources and connection to the systems.

is inadequate in the region's urban areas (IDB, 2015). In general, local governments are responsible for solid waste management in their cities. Approximately 20% of municipal budgets are allocated to urban solid waste management (UN-Habitat, 2012). Nevertheless, many LAC cities face significant difficulties in improving service coverage and quality due to the lack of planning instruments, and also technical and financial limitations in service administration.

With regard to urban mobility, the physical and economic development of cities has increased the number and distance of trips. The lack of sustainable land use planning —that promotes high densities and mixed land use— has resulted in increased distances between places of residence, work and basic services (such as health and education), thereby increasing congestion and travel times.[3] This lack of planning has raised the need for public transportation. Given that this service has not been successfully provided, automobile use rates have doubled in last the two decades, with important consequences in terms of traffic congestion and pollution. The shortage of local resources has limited the development, improvement, and maintenance of urban transport systems, leaving an unmet demand that becomes increasingly hard to satisfy.

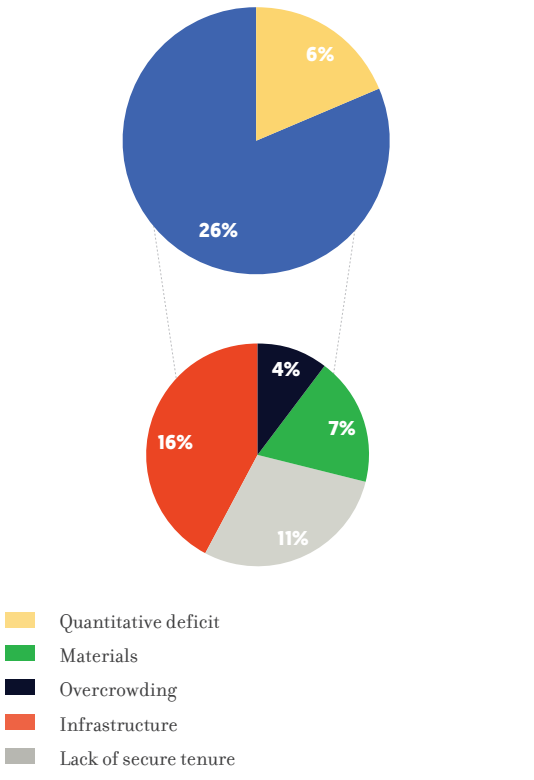
Another significant issue linked to infrastructure investments for city governments is the provision of adequate housing. The cities of the region need to make significant efforts to reduce the existing housing deficit. Both demographic aspects and changes in household composition are affecting the demand for housing solutions. The urban housing deficit of LAC was estimated at 32% of total households in 2009, in which 26% corresponds to qualitative deficit (approximately 34 million homes), which is mostly related to water and sanitation deficiencies (Bouillon, Medellín, and Boruchowicz, 2012). See Chart 3.

The lack of formal housing solutions is one of the aspects that most influences the proliferation of informal settlements. In the absence of affordable formal housing options in cities, new households must choose informal solutions, with all the implications that this has on urban development, quality of life and social equity. [4] This also contributes to the increase of the urban housing deficit. Studies indicate that the investment needed to cover this deficit is of approximately US$310.0 billion, a figure that exceeds the financial capacity of the region's urban governments by a wide margin (Bouillon, Medellin and Boruchowicz, 2012).

As can be seen, there are multiple and diverse challenges facing LAC's urban centers in terms of basic services and infrastructure, if they are to increase their sustainability and improve the living conditions of their citizens. However, the above discussion only partially covers the impact of these investments. Their importance goes far beyond those cited thus far. An extensive literature emphasizes the importance of infrastructure investments for generating economic development in cities. This literature stresses that these investments increase competitiveness by boosting productivity and enhancing competitive advantages (e.g. lower costs, better infrastructure, etc.), augmenting employment and reducing inequality. Studies indicate that the real annual growth potential of the region's Gross Domestic Product (GDP) would increase by around 2% if infrastructure investments were to double. Unfortunately, LAC's public investment has progressively decreased since the eighties, fixing at about 2% of GDP in the last decade (IDB, 2013).

Effectively providing public goods and services effectively is one of the most significant challenges facing cities, as their provision determines to a great extent their competitiveness, poverty levels and quality of life.

Chart 3
Urban housing deficit in LAC, 2009
(percentage of households)



Source: Based on Bouillon, Medellín and Boruchowicz (2012)

Note: The sum of the percentages for each type of deficiency is greater than the total percentage of the qualitative deficit because households can experience multiple deficiencies.

[3] In 2007, a LAC urban dweller spent in average 1.1 hours just commuting daily (CAF, Urban Mobility Observatory, databases accessed in August 2016).

[4] According to UN-Habitat data (2012), more than 110 million urban inhabitants live in informal neighborhoods of LAC.

Despite the clear benefits generated by urban infrastructure and the increasing demand for more and better services, the capacity of cities to intervene has been limited by their lack of institutional, technical, and, most importantly, financial resources. As the local governments are responsible for financing infrastructure, their lack of fiscal capacity to meet rising investments needs increases the financing gap. Therefore, bolstering the availability of resources is paramount in LAC's urban development strategy, especially by identifying and employing instruments that have not traditionally been used in many cities of the region and adapting them to the specifics of each project.

Therefore, the purpose of this study is to analyze nontraditional instruments for financing public infrastructure investments, focusing specifically on the set of instruments based on urban land value capture. This document is structured in three parts. In the first, we will provide an overview of alternatives for financing urban development in LAC, describing their current state and evolution, highlighting their strengths and weaknesses as revenue sources for these types of investments. Next, we will present the theoretical framework on land value capture instruments and the advantages of their use, including representative examples from experiences in the region. Then, we will discuss some methodological considerations for the design and implementation of value capture strategies. Finally, we will analyze the potential of these instruments for financing urban development based on the results of two case studies.

In summary, this study is to generate and disseminate knowledge that will provide LAC cities with practical and straightforward instruments for capturing land value to help them finance their strategic interventions.

Studies indicate that the real annual growth potential of the region's Gross Domestic Product (GDP) would increase by around 2% if infrastructure investments were to double.

The strengthening of existing sources of resources, but above all, the identification and implementation of complementary mechanisms, are essential for the urban development of LAC.

I. Overview of financing alternatives for urban development in the region

A. Own-source revenues
B. Intergovernmental transfers
C. Debt
D. Other revenue sources with potential for financing urban projects

As urbanization increases, so do demands for urban services and infrastructure, which in turn generate pressure on the investment budgets of subnational governments. [5] The rate of urban growth has surpassed the capacity of local authorities to respond to these demands, resulting in wide and growing gaps in service provision, consequently reducing competitiveness, sustainability and the quality of urban life. It is, therefore, extremely important to have the adequate tools to help close these gaps for financing the required investments.

Currently, LAC's urban governments are highly dependent on traditional revenue sources (such as intergovernmental transfers) which are often uncertain and earmarked. Therefore, financing urban development in the region requires efforts to: (i) strengthen existing revenue sources; (ii) identify and employ new sources that have the potential to finance the needed investments; and (iii) encourage local entities to become financially autonomous by consolidating collection systems and improving revenue, expenditure and investment management.

This section will cover these issues. We will start by characterizing the most commonly used revenue sources in the region, indicating their strengths and weaknesses in relation to the required infrastructure investments. Next, we describe some instruments that have not yet been fully explored or utilized in LAC and can contribute to meeting financial challenges.

A. Own-source revenues

Well-functioning revenue collection systems enhance local fiscal autonomy by providing reliable revenue sources for city governments. Although own-source revenues are not the main source for investment budgets at a municipal level in LAC, their potential to grow to provide urban goods and services is significant. This category includes local taxes, charges and fees, and other non-tax income.

Local taxes. This revenue source is of strategic importance, as its control usually pertains to subnational governments that can employ it as they see fit. Therefore, the more effectively and reliably these taxes are collected, the greater will be local fiscal autonomy. For this very reason, it is extremely important for subnational entities to have the necessary technical and administrative capacities to manage these resources effectively.

Analysis of the available data on municipal tax revenues shows only slight growth for most countries in the region during the past few years, and also that the importance of municipal revenues continues to be low in comparison to those at the central level (15% in 2013) and also as a percentage of the GDPs of the respective countries (IDB and CIAT, 2015). See Table 1.

Given that own-source revenues provide autonomy and stability to local governments, they should be one of the main revenue sources for funding municipal investment budget. However, it is clear that this is usually not the case. Data collected by the Economic Commission for Latin America and the Caribbean (ECLAC) for 2008 reveals that, the relative weight of own-source revenues within the local budgets is low at less than 41% in the countries of the region, except for Costa Rica (99% of total municipal revenues), Chile (71%) and Brazil (55%). Mexico and Peru register the lowest percentage (around 13%) [6] (Gómez and Jiménez, 2011).

Financing urban development in the region requires efforts to: (i) strengthen existing revenue sources; (ii) identify and employ new sources that have the potential to finance the needed investments; and (iii) encourage local entities to become financially autonomous by consolidating collection systems and improving revenue, expenditure and investment management.

[5] Except for the referenced statistical data, the terms local, municipal, territorial and subnational are used interchangeably in this document.

[6] Information available for nine Latin American countries.

Table 1
Municipal Revenue Collection in LAC, 1990-2013
[GDP percentage]

COUNTRY	1990	1995	2000	2005	2010	2013*
Argentina	0.41	1.26	1.37	0.99	0.96	0.96
Belize	0.17	0.10	0.13	0.25	0.23	0.22
Bolivia	0.00	0.70	1.11	0.99	1.05	1.02
Brazil	0.97	1.24	1.29	1.54	1.71	1.57
Chile	1.13	1.23	1.48	1.35	1.32	1.43
Colombia	0.92	1.30	1,.46	1.78	2.00	2.15
Costa Rica	0.37	0.29	0.38	0.47	0,61	0.67
Ecuador	n.d.	0.33	0.20	0.43	0.43	0.43
El Salvador	0.13	0.41	0.54	0.45	0.39	1.03
Guatemala	0.05	0.06	0.10	0.16	0.19	0.18
Honduras	0.72	0.84	0.90	1.01	1.02	n.d.
Jamaica	0.00	0.00	0.17	0.20	0.15	0.24
Mexico	0.17	0.19	0.15	0.19	0.22	0.16
Nicaragua	n.d.	0.53	1.36	1.51	1.52	1.67
Panama	0.37	0.37	0.37	0.33	0.29	0.29
Paraguay	0.32	0.41	0,51	0.47	0.52	0.78
Peru	0.64	0.64	0.60	0.70	0.67	0.70
Dominican Republic	0.02	0.04	0.02	0.01	0.18	0.00
Uruguay	1.96	1.70	1.58	1.49	2.59	3.18
Trinidad and Tobago	0.50	0.58	0.41	0.32	0.31	0.36

Source: Prepared using information from the database from Equivalent Fiscal Pressure in Latin America and the Caribbean (IDB; CIAT). Accessed in August 2016

** The values of Argentina, Ecuador, Jamaica, Mexico, and Panama correspond to the year 2012 (last available).*

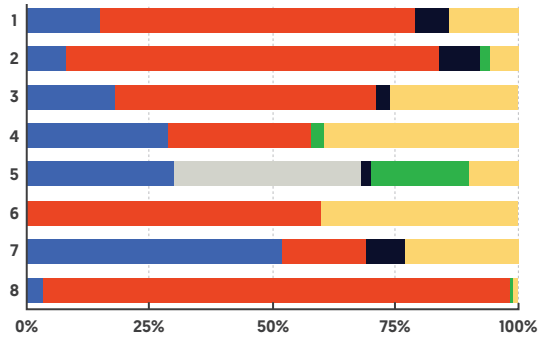
There are several factors limiting the potential for the use of own-source revenues at the local level. One is the level of fiscal decentralization in LAC countries. In many cases, the transfer of responsibilities from the central to the local level has been partial. The delegation of tax management to municipalities is often restricted. In some cases, such as Brazil, El Salvador or Uruguay, local governments have the legal capacity to create new taxes, modify the rates of existing ones, and implement their collection. However, in Honduras or Ecuador, their powers are restricted to rate definition and collection, and in cases such as Peru, their sole responsibility is tax collection (UN-Habitat, 2012). This lack of autonomy in local tax management has impeded the use of own-source revenue at the local level, reducing their efforts to improve their collection capacity and take full advantage of their potential to finance investments in services and infrastructure.

By tax base, subnational tax revenue is mainly composed of taxes on property, economic activity, remuneration, motor vehicles and transfer of ownership. There are also other taxes which vary by country, such as levies on fuel, entertainment, etc. Chart 4 shows the distribution of these taxes.

In general terms, most taxes are on economic activity, followed by property taxes, which are particularly significant in Peru. It is important to note that the property tax still plays a secondary role in several countries, even though it can be the most predictable and stable source of revenue for local governments.

As there is a close link between real estate tax payment and the provision of services and infrastructure, the adequate administration of this tax can

Chart 4
Subnational tax composition in Latin America
(2000–2009)



1. Argentina
2. Brazil
3. Colombia
4. Ecuador
5. Mexico
6. Panama
7. Peru
8. Venezuela

Property
Economic activity
Remuneration
Motor vehicles
Transfer of Ownership
Other

Source: Based on Corbacho, Fretes, and Lora (2012)

Note: The averages for Chile (2001-09), El Salvador (2004-07) and Panama (2000-08) vary according to the information available.

serve as an indicator of the effectiveness of local government, more than in the case other local taxes. Taxpayers expect their real estate taxes to generate more and better investments in the area where they live, which can also help to improve their collection. If the government does not provide the expected goods and services, the tax will be unpopular. However, this tax can be prone to mismanagement, as it is expensive to administer and can be used for political ends (improper tax reduction, unnecessary amnesties, infrequent updates, etc.). Finally, it is important to stress that since this tax provides a stable and predictable revenue source, its proper use can improve planning and implementation for the longer term (Bonet, Muñoz and Pineda, 2014).

Table 2 shows different trends in property tax collection throughout the region. In terms of performance, countries such as Brazil, Chile and Colombia show the highest collection levels. However, in most countries, the trend in property tax collection as a percentage of GDP during the decade has been negative, except for Colombia, Mexico, the Dominican Republic and Uruguay. The estimate of average collection for this tax in Latin America remains at around 0.28% of the GDP for this period, considerably lower than for more developed countries, where collection often surpasses 1% of the GDP (Bonet, Muñoz and Pineda, 2014).

Various factors can impact the collection levels for this tax. Among these, the following stand out: (i) as with the other local taxes, high decentralization and fiscal autonomy at the local level tend to favor tax collection; (ii) income levels of the population influence the capacity and willingness to pay (Bonet, Muñoz and Pineda, 2014); (iii) the technical capacity of the entities responsible for tax management, as system obsolescence and the lack of qualified human resources to perform tax appraisals can cause the tax base to be outdated and generates inefficiencies in collection; (iv) the lack of effectiveness of service and infrastructure provision affects taxpayers' willingness to pay, since they perceive that the taxes they pay are not transformed into improvements in their welfare.

COUNTRY	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10
Argentina	0.65	0.63	0.54	0.58	0.59	0.47	0.44	0.37	0.38	0.37	-
Brazil	0.46	0.45	0.46	0.47	0.46	0.45	0.45	0.43	0.41	0.42	0.42
Chile	0.71	0.71	0.68	0.69	0.59	0.60	0.55	0.54	0.57	0.54	0.49
Colombia	0.48	0.49	0.51	0.54	0.56	0.58	0.57	0.53	0.53	0.61	0.61
Costa Rica	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03
Ecuador	0.05	0.10	0.12	0.16	0.15	0.09	0.10	0.09	0.08	0.09	-
Guatemala	-	-	-	-	-	-	-	0.09	0.08	0.18	0.17
Mexico	0.07	0.09	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.13	0.13
Nicaragua	-	-	-	-	-	0.26	0.30	0.30	0.26	0.27	-
Peru	0.17	0.16	0.17	0.17	0.17	0.18	0.15	0.16	0.17	0.18	-
Dominican Republic	0.13	0.14	0.16	0.17	0.18	0.32	0.32	0.31	0.28	0.52	0.26
Uruguay	0.25	0.28	0.25	0.26	0.27	0.28	0.62	0.58	0.57	0.54	-

Table 2
Real estate property tax collection in Latin America, 2000-2010 (percent of GDP)

Source: Bonet, Muñoz, and Pineda (2014)

Finally, although tax collection continues to be a traditional source of revenue for local governments in LAC (that has increased over the years), its potential to finance investment projects is not fully utilized.

Tariffs and user fees. Fee-for-service is another type own-source revenue for subnational entities. These are charges and fees that are levied on the users of services provided by local entities (e.g. water, electricity, garbage collection, etc.) and are intended to fully or partially recover the cost of service provision. Accordingly, these should be one of the most appropriate tools for financing public services.

This is a type of non-tax revenue for the subnational entities that offers important advantages for management and diversification of their revenue structure. It is a reliable, fair and efficient revenue source because payment is directly linked to use by the beneficiary and also because it allows cost recovery by the service providers, if properly managed. Also, local governments have a certain autonomy over its management, fee structure, and collection.

However, fee collection in the region for services such as drinking water, basic sanitation, urban solid waste management, and transportation is often insufficient to cover operational costs. This leads these entities to look for additional resources to cover the deficits generated. Commonly used instruments in these cases are subsidies and transfers. A study of the Inter-American Development Bank (IDB) on water and sewerage services in Latin America found that at least 16% of the companies analyzed were unable to cover their full operational costs (IDB, 2015). Investment, maintenance and connection costs add further to this financing gap when they cannot be covered by revenue from tariffs. The situation is worse in the solid waste sector, where it is estimated that municipalities only recover 40%-50% of their operational costs (UN-Habitat, 2012).

From this viewpoint, fee adjustment should be an important part of the solution. However, such fee adjustment can be politically sensitive. If fee hikes are not accompanied by improvements in the quality of the service provided, they can generate complaints, negatively impact attitudes on payment and reduce collections. Furthermore, fee structures must be socially equitable, so as not to negatively impact access to public services.

On the other hand, the fee structure is not the only factor that directly impacts this source of revenue. As in the case with taxes, adequate collection management requires robust technical capacities that facilitate control and consumption measurement, avoid erroneous billings, limit unauthorized access to services, and promote the culture of payment for users.

The operational deficit that creates the limited financial capacity of public service providers generates repercussions that go beyond the mere lack of resources. On many occasions, they result in strategies that are detrimental to the service's quality (such as cuts in maintenance and system expansion) that reduce the users' willingness to pay and also increase unauthorized use, thereby further increasing the deficit.

In spite of the difficulties related to the lack of efficient collection, the potential of this revenue source to finance service provision at the local level is unquestionable. Additionally, if well managed, revenue from fees contributes to municipal financial autonomy, allowing them to rely on a relatively stable revenue source while facilitating long-term investment planning and financing.

Although tax collection continues to be a traditional source of revenue for local governments in LAC (that has increased over the years), its potential to finance investment projects is not fully utilized.

In spite of the difficulties related to the lack of efficient collection, the potential of this revenue source to finance service provision at the local level is unquestionable.

B. Intergovernmental transfers

Resources transferred from other levels of government (generally the national) are a predominant source of revenue for numerous LAC cities. See Chart 5. These transfers seek to minimize imbalances among governments at the subnational level, including vertical (differences between responsibilities and revenue collection capacity) and horizontal (inequalities among municipalities) (UN-Habitat, 2012). Depending on the legal provisions and the transfer structures of each country, these can be non-earmarked or earmarked for specific uses (e.g. drinking water, education, etc.) and their allocation can be discretionary or done automatically according to established criteria.

Transfers are quite important in the composition of municipal revenue in the region. In the countries analyzed, most of the expenses at the local level are financed with resources from central level transfers. This is a general trend in LAC. Studies indicate that almost two-thirds of revenue at the subnational level in the region comes from national governmental transfers (Corbacho, Fretes, and Lora, 2012), which demonstrates a high level of fiscal dependency at the municipal level.

The importance of these transfers in Latin America increased during the decade ending in 2007. See Chart 6. This is especially true in countries such as Argentina, Mexico, and Bolivia, where these transfers represented more than 6% of their GDP in 2007. On the contrary, in accordance with subnational governments' revenue structure shown in Chart 5, Chile has maintained a low level of transfers, which has induced the local level to make greater efforts to generate own resources to finance their expenditure responsibilities.

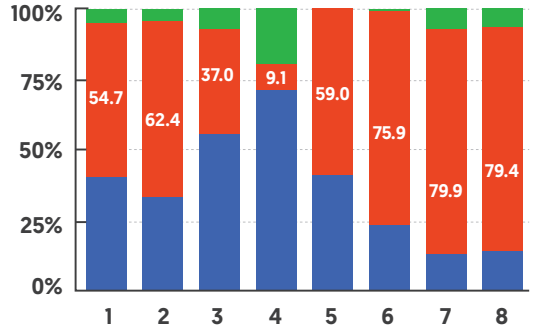
From a practical point of view, the increase in revenues of subnational governments from transfers enables them to finance a greater part of their current expenditures, as well as invest more at the local level. Transfers can, therefore, serve as a redistributive tool that reduces the existing imbalances among municipalities with more and fewer resources. Nevertheless, there are several disadvantages linked to the high dependency on transfers. For one, if transferred resources are from the national or federal budgets, their availability is subject to the macroeconomic trends that may impact these budgets. This makes transfers a vulnerable, unstable and less predictable source of financing that jeopardizes the ability to do medium and long-term planning at the local level. Also, when transfers are earmarked, subnational entities may not be able to use them in their areas of greatest priority. Finally, transfers can discourage the fiscal effort necessary to increase own-source revenues, and, therefore, financial autonomy at the subnational level.

A considerable literature strongly advocates the use of predictable and transparent transfer systems that are not susceptible to political interests and manipulation and, therefore, promote equitable and efficient resource allocation.

C. Debt

Debt instruments, such as bank loans or bonds, are usually attractive options to finance infrastructure projects, not only because they generate significant amounts of capital for long-term financing, but because they

Chart 5
Subnational government revenue structure in selected Latin American countries, 2008
(percentage of total revenue)

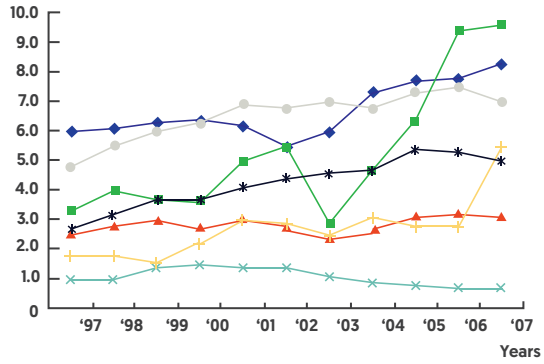


1. Argentina
2. Bolivia
3. Brazil
4. Chile
5. Colombia
6. Ecuador
7. Mexico
8. Peru

Own-source revenues
Transfers
Other revenues

Source: Based on Gómez and Jiménez (2011)12)

Chart 6
Subnational transfers in selected Latin American countries.
(Percentage of GDP)



Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
Mexico

Source: Jiménez and Podestá (2009)

also offer the possibility of reducing the lag between investments and the collection of the revenue that they can generate. Furthermore, the debt market provides measures of a government's management performance by penalizing inefficient management with higher interest rates or lack of access to credit.

The debt crisis in the eighties led governments in LAC to design and promote policies to restrict access to credit by local government. Although these policies have limited financing options for local governments in many countries of the region, they have also helped to reduce their vulnerability to new economic crises.

One direct consequence of the implementation of these reforms has been the reduction of total debt as a percentage of GDP in the region's subnational entities (see the right axis Chart 7). Factors contributing to this reduction of subnational debt include the increase in own-source revenues and transfers, as well as the greater control of subnational debt by national governments (Jiménez and Podestá, 2009). However, the findings are not so positive when comparing debt with revenues. Although there are considerable differences between countries and cities, debt amounts are still significantly high, representing more than 46% of total revenue and 117% with respect to the local own-source revenue, which indicates low debt sustainability at the subnational level (Jiménez and Ter-Minassian, 2016). See the left axis of Chart 7. This can be even more worrying in those cases in which subnational governments incur debt irresponsibly, expecting to be rescued by the central government (Fretes and Ter-Minassian, 2016).

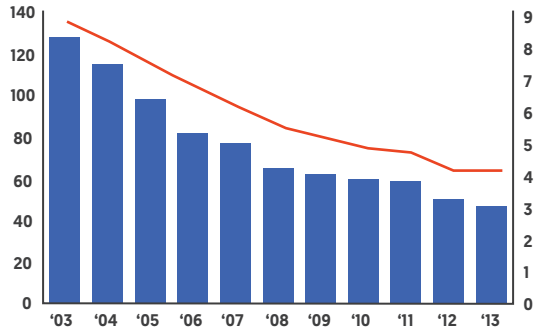
Local governments are not yet fully utilizing these debt instruments. In many cases, credit access is limited by several factors including legal restrictions on local debt, lack of creditworthiness of local governments (e.g. unfavorable credit ratings), weak capital markets, and lack of bank appetite for subnational lending.

Given this situation, alternative debt financing instruments have emerged that can facilitate the access of local entities to financial markets in safer and more effective ways. Among the more effective of these are specialized financial entities that lend to local governments and assemble municipalities for joint financing. In some LAC countries, entities have been created to offer financing options for local development through instruments that adjust to the financing needs of investment projects at the subnational level. Some examples of this kind of institutions are *Financiera de Desarrollo Territorial* (FINDETER) in Colombia or *Banco Nacional de Obras y Servicios Públicos* (Banobras) in México. Another option is assembling municipalities into cooperative programs to obtain financing for infrastructure investments through debt instruments. The most well-known experience in LAC is in Mexico, where several municipalities can unite to issue bonds to finance basic infrastructure. These collaborative arrangements allow them to reduce their costs and risks, thereby improving their creditworthiness and facilitating their access to the capital market (Andersson, 2015).

Debt instruments are an efficient source for financing urban interventions. It is important to implement strategies for strengthening financial management that allow local authorities greater access to the capital market (e.g. improvements in transparency and creditworthiness), accompanied by proper instruments to control and monitor debt levels.

In the countries analyzed, most of the expenses at the local level are financed with resources from central level transfers.

Chart 7
Subnational debt of selected Latin American countries



Source: Jiménez and Ter-Minassian (2016)

Debt instruments are an efficient source for financing urban interventions.

D. Other revenue sources with potential for financing urban projects

In addition to the revenue sources that have traditionally financed urban development in LAC, there are other sources that have not yet been fully explored in the region. Even though we will not review each one of these extensively, we provide a short description of those showing the most potential for financing investment projects.

Private sector resources. Public-Private Partnerships (PPP) are a typical arrangement for project financing. The Economist (2014) defines PPP's as "projects in which there is a long-term contract between a public-sector body and a private sector entity for the design, construction (or modernization), operation and maintenance of public infrastructure." Risk distribution and responsibilities depend on the type of contract used (e.g. concession, leasing, management contracts, etc.).

When considering this type of financing, the following should be taken into account: (i) the legal and regulatory framework that governs PPPs in each country; (ii) the institutional framework for participating entities; (iii) the technical and operational capacity of the public entity involved; (iv) the political, social and business environment for the investment; and (v) the financial instruments to be used for the planned intervention (The Economist, 2014). Many of these aspects still represent challenges for the cities of the region and need to be resolved. These can impede the decision to use structures of this type.

Nonetheless, the use of structures of this type is gaining ground for financing local infrastructure financing in LAC. Mexico and Brazil are leading in PPP-related contracts at a local level, approaching or surpassing performance at the federal and national levels of their respective countries. Their recent experience shows additional challenges that subnational entities must confront when implementing these partnerships. The main ones are linked to the private sector's perception of the riskiness of local authorities, the complexity of tax systems, and lack of transparency of financial statements (The Economist, 2014).

PPPs could be a highly important source of financing for interventions that require high investment levels. Additionally, this approach offers the advantage of capitalizing on the private sector's experience and operational efficiency in public service and infrastructure provision.

Resources derived from land value capture. An important and innovative alternative for generating local revenue is the capture of land valorization generated by public interventions. Land value capture involves partially or fully taking the increase of land value generated by measures external to the owner, such as public investments in infrastructure or administrative changes in land use rules and regulations (Smolka, 2013).

The main virtue of these land-value based instruments is that they provide local authorities with a significant potential pool of own-source revenue, thereby contributing to their financial autonomy. To effectively use these instruments, the municipalities must develop the technical and management capabilities required for designing, implementing and managing them, so as to bridge the lag between the moment when

valorization takes place and when it generates revenue. In the following sections, we will further discuss the use of these types of strategies for financing urban infrastructure projects in the region.

In summary, it is crucial that subnational entities make greater efforts to search for and harness innovative revenue sources that allow them to confront the most pressing challenges for their cities, especially those linked to the provision of urban goods and services. To this end, they should consider the strengths and weaknesses of each financial option proposed, taking into account the needs of specific projects. Given the current magnitude of investment needs, it may well be advisable to develop financing strategies involving a combination of diverse revenue sources. A major challenge is to adapt the many different financial instruments available to local conditions and the needs of a specific intervention.

Finally, simultaneous efforts should be made to strengthen the traditional revenue sources, while promoting the diversification of financial instruments to help integrate the different social sectors into the urban spatial pattern. See Table 3 on the following page.

It may well be advisable to develop financing strategies involving a combination of diverse revenue sources. A major challenge is to adapt the many different financial instruments available to local conditions and the needs of a specific intervention.

Table 3
Summary table showing urban development financing alternatives in LAC

Source: Prepared by the authors

FINANCING SOURCE	CHARACTERISTICS	STRENGTHS	WEAKNESSES	POTENTIAL / USE
OWN-SOURCE REVENUES				
Local taxes	• Strategic revenue source for investment financing • Local governments are responsible for their management • They are non-earmarked revenues and municipal authorities usually decide their use • The taxes are mostly on economic activity • Real estate property tax plays a secondary role	• Form a steady revenue source • Are reliable and predictable • Augment local financial autonomy • Facilitate medium and long term local planning	• Existence of restrictions in local tax allocations • Property tax: Often unpopular and prone to mismanagement • Requires subnational entities to have adequate technical capacity	High / Low
Charges and fees to users	• Charges levied on public service users • Non-tax revenue that aims to recover operational costs • Continuous, fair and efficient revenue source • Fee collection is often not sufficient to cover operational costs	• Stable revenue source • Allow long-term investment planning and financing • Contribute to municipal financial autonomy	• Can help close the financing gap • Sensitive to tax adjustments • Low collection and payment culture	High / Low
TRANSFERS				
Intergovernmental transfers	• Transfers of government revenues from other levels to subnational governments • High participation in subnational revenue structure • Seek to reduce vertical and horizontal imbalances among subnational entities • Can be automatic or discretionary, or unearmarked or earmarked subject to compliance requirements	• Increase subnational revenue • Can work as a redistributive tool	• High dependency on this revenue source • Discourages municipal fiscal effort • Unstable source with low predictability • Reduces subnational financial autonomy	Medium / High
DEBT				
Debt instruments	• Market instruments: Bank loans or bonds • Low creditworthiness of subnationals • Appearance of alternative debt instruments • Subject to greater control and monitoring	• Allows financing of large capital amounts over the long term • Helps to bridge time lags • Efficient financing source	• Existence of policies that restrict access to borrowing by subnational governments • Expectation of rescue by central governments • Requires creditworthiness and developed capital markets	Medium / Low
OTHER REVENUE SOURCES				
Private sector resources	• Private sector participation in urban development projects • Typical structure: Concession or PPP • Long-term contracts between a public and private entity for infrastructure investments	• Long-term contracts between a public and private entity for infrastructure investments • Effective for interventions that require large investment amounts • Private sector's operational experience and efficiency	• Numerous technical challenges • Private sector's lack of confidence in subnational governments	High / Low
Land value capture	• Alternative for generating local revenue • Instruments that capture the in crease in land value	• Provide high potential to increase own-source revenues • Contributes to local financial autonomy	• Requires strong technical and management capacities • Time lags between generation and capture	High / Low

II. Land value capture and urban development

A. The concept of land value capture and its applications
B. Land value capture instruments for financing urban projects
C. Implementing urban projects through land value capture

A. The concept of land value capture and its applications

The concept of value capture is based on the idea of capturing the valorization of the price of the land generated by the provision of urban infrastructure and services in order to finance this development. As the demand for land is a derived demand, its price depends on the potential benefits that it can generate for those who use it. [7] Public interventions (including those that allow transformation of land use from rural to urban, provide infrastructure, and permit higher development density) can all increase benefits for those properties impacted. This, in turn, can result in higher land prices. As this valorization (called plusvalía in Spanish) is generated solely by public decisions and interventions,[8] the public has the right to capture this value for its benefit.

This idea has a long tradition in the history of economic thought, with such authors as Henry George and David Ricardo proposing some of its key elements. In 1977, Joseph Stiglitz formalized these elements into a theorem which demonstrates that, under certain conditions, the total revenue increase will be equal to the total cost of a public asset (Fujita and Thisse, 2002). However, this concept was stated most forcefully by Donald Shoup, who asked in his famous statement of the urban underinvestment anomaly: "Why is it so difficult to finance public infrastructure that increases the value of the serviced land by much more than the cost of the infrastructure itself?" (Shoup, 1994).

Numerous empirical studies confirm the existence of this anomaly suggested by Shoup by verifying that access to urban infrastructure and services is capitalized into the price of real estate (Baranzini, 2008). Smolka (2013), for example, uses data from case studies in Latin America that show how an investment in drinking water costing US$1.02 per square meter of urban land, can increase its price by US$11.10 per square meter in locations of 5 to 10 kilometers from the center in cities such as Curitiba, Brasilia, and Recife. This is to say that, in these cases, investments in drinking water increased land value up to 11 times their costs. Other services studied in these cities also showed net benefits, such as street paving, with an increase of 3.52 times in the cost, and the sewage system with a multiplier of 2.80 (Smolka, 2013).

According to this same author, the rural/urban transformation has generated similar levels of valorization in the cases of Rio de Janeiro and Quito, where multipliers ranged from up to four times of their original land price. Similarly, the increase in development density allowed by the authorization to construct five-story buildings in neighborhoods of Bogota increased land values by up to 100%, depending on their economic strata and location. Finally, access to public transportation also generated valorization, with increments ranging from the 15% to 20% at a one km radius from the articulated bus Transmilenio stations in Bogotá after their inauguration (Smolka, 2013).

Land value capture is a useful way of addressing the anomaly identified by Shoup (1994), in that it provides a way in which the benefits generated by municipal investments can provide positive feedback in the form of additional resources for new investments. The concept can be summarized in Chart 8: Public investments and regulatory changes can increase real estate property value. If the municipality captures part of this additional value, the increase in revenue could finance new investments. In other

'Urban underinvestment anomaly'

"Why is it so difficult to finance public infrastructure that increases the value of the serviced land by much more than the cost of the infrastructure itself?" (Shoup, 1994).

[7] In the literature of urban economics, this is called the doctrine of the highest and best use: The market assigns the property to the use that generates the highest economic benefits, assuming that land is scarce and holding all other factors constant.

[8] Some authors prefer the word `recovered' because this value is the result of public interventions and therefore `belongs' to the society as a whole. We have decided to use the word `capture' because it is commonly used in the international literature, where it is called LVC for *Land Value Capture*.

words, land value capture can create a virtuous circle by generating fiscal space[9] to finance the additional infrastructure investments. The municipality can include these land value capture instruments in a capital investment plan that includes the financing from municipal sources and private sector partners. Furthermore, some structures allow ex-ante recovery, and others allow for borrowing that can help to solve the cash flow problem generated by the need to invest in the present to generate future benefits. Therefore, revenue from land value capture can add "flexibility for infrastructure financing decisions" (Peterson, 2009).

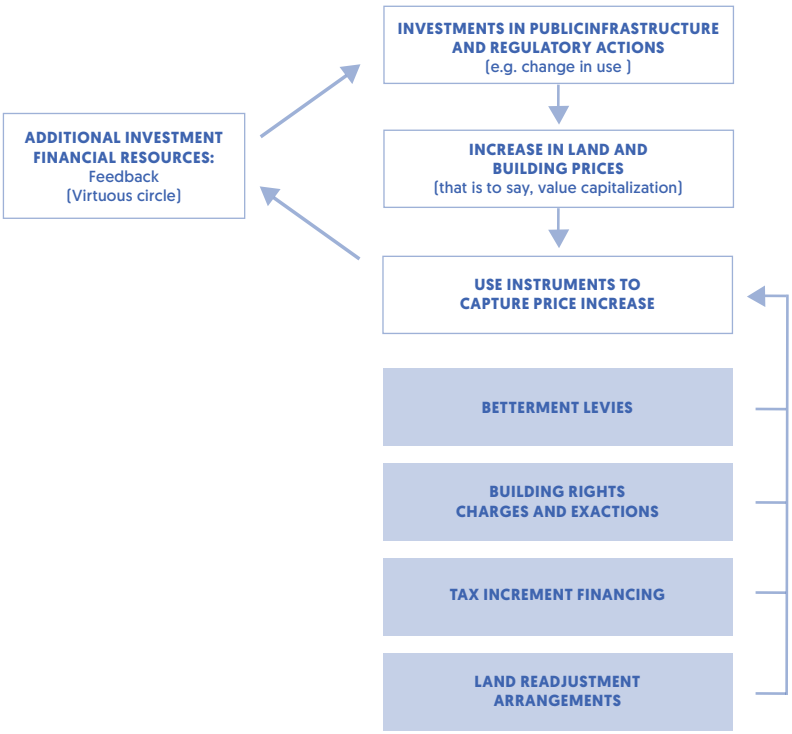


Chart 8
Concept of Land Value Capture

Source: Adapted from Vetter (2015)

Besides its positive effect from the viewpoint of public finance, land value capture can also help to increase the economic efficiency of municipal investments. Peterson (2009) argues that the underlying principle behind the concept is that the urban land market capitalizes the benefits of infrastructure projects in land value. Therefore, "as long as the spatial distribution of project benefits can be internalized within a well-defined 'benefit zone', it is economically efficient to finance infrastructure projects by tapping the increments in land values resulting from them."

This author also argues that, even when the project benefits are not confined to a specific zone, it can be efficient to recover part of the costs through land value capture, if it is possible to identify an area that is directly benefitting. Similarly, Bird (2005) argues that "The efficient provision of goods and services requires local governments to charge directly for services wherever possible." Furthermore, land value capture can also contribute to social equity, as it can allow cross-subsidization when used in high-income areas to finance infrastructure and housing for low-income families, including renters who live in benefitted areas or house buyers that intend to settle in them.

[9] Heller (2005) defines fiscal space as: " room in a government's budget that allows it to provide resources for a desired purpose without jeopardizing the sustainability of its financial position or the stability of the economy."

Other authors argue that land value capture can also be an urban growth management tool since it can affect the spatial patterns of urbanization by influencing the relative development costs among different locations (Skidmore and Peddle, 1998; Burge et al., 2007). For example, by applying higher levies at the urban fringe, compared to central areas, land value capture can discourage low-density suburban sprawl and promote greater density in built-up areas. However, to achieve this effect, land value capture must be high enough relative to development costs to counteract the impact of other market variables that stimulate peripheral urban development, such as lower land costs, ease in finding lots, low need for demolition of existing structures, demand preferences, etc. (Blanco et al., 2012).

The theoretical literature also suggests that land value capture can control land prices. This is clearer in inelastic real estate markets since under these conditions, developers will have greater difficulty transferring the additional cost from land value capture to the final demand, and, therefore, will have to compensate by insisting on lower land prices. There are few conclusive empirical studies on this subject due to the methodological difficulties involved (Evans, 2004). Nonetheless, the high price of the land relative to the average incomes in LAC makes this a possible way of controlling speculation (Smolka, 2003).

Finally, some authors consider that another benefit of land value capture is that it can reduce private developers' uncertainty concerning project approval and timely infrastructure provision, since the value capture payments are, in fact, going to make the project viable. Thus, land value capture could reduce transaction costs and the risks associated with real estate development (Nelson et al., 1992).

There are several instruments for capturing the value generated by investments and other public sector interventions that affect the land price. According to their characteristics, these instruments can be classified as: (i) taxes, such as differential property tax rates or Tax Increment Financing (TIF); (ii) fees, such as betterment levies; and (ii) regulations, such as exactions, sale of building rights or land readjustment charges (Smolka and Amborski, 2000). At present, many LAC local governments are using these instruments to capture value, and in some countries, their application is even regulated by national laws.[10] Nevertheless, the current level of use does not reflect value capture's full potential, either because the legal frameworks do not exist, or if they do, they are not regulated or consistently applied (Smolka, 2013).

There are several instruments for capturing the value generated by investments and other public sector interventions that affect the land price. According to their characteristics, these instruments can be classified as: (i) taxes, (ii) fees and (ii) regulations.

The reasons for this lack of implementation include inadequate transfer systems that discourage local fiscal effort. For example, automatic transfers from higher government levels can be so high that they significantly reduce the need to recover local public investment costs. If transfers include discretionary subsidies, many mayors prefer to pressure the national government for such transfers instead of facing the political cost of charging their constituents. Fortunately, several governments in the region are moving towards stable revenue transfer systems, based on pre-established formulas and limiting discretionary grants. As a result, land value capture is becoming a more attractive option for those municipalities interested in improving their infrastructure.

Moreover, misconceptions about fiscal risk at the municipal level impede efforts to strengthen the legal framework for local public finances.

[10] For a detailed description of the land value capture instruments used in Latin America, see Smolka (2003)

Although the press often covers cases of extreme local fiscal irresponsibility, many municipalities have good fiscal performance. For example, an empirical analysis of Brazilian municipalities using international creditworthiness criteria showed excellent financial performance for those classified by these criteria in the first two quartiles (Vetter and Vetter, 2011). This analysis also revealed that many municipalities classified in the lower half of the Human Development Index are grouped in the upper half in terms of their financial performance. This indicates that the use of financial performance as an eligibility criterion for a municipal development program does not necessarily have to be regressive by excluding the poorest municipalities since many of them manage their public finances responsibly.

Technical difficulties in the measurement of the amount and distribution of the valorization generated by public interventions can also constrain the use of value capture. Although this methodological difficulty is indisputable (as will be discussed in the following section), this should not be an excuse for not exploring instruments that can work with the available information. In this regard, Lungo and Smolka (2005) argue that the difficulty in establishing the impact of the public sector on the private can result in the appropriation of benefits by the private sector, while the costs are borne by the public sector. Additionally, some stress that these instruments have high initial costs and implementation risks. Costs such as the legal work or planning can be especially high in more complex instruments, such as the sale of development rights, augmenting the risk of a failure of project implementation. These risks can be partly mitigated by preparing model bidding documents and contracts for the different instruments, as was done in the United Kingdom for its public-private partnership program.

Finally, in some cases, there can be resistance from the general public or specific interest groups due to the way these instruments have been employed in the past. However, Maricato and Ferreira (2002) argue that land value capture instruments are neutral in themselves and that they can be used to improve general social welfare. Understanding the economic importance of the real estate market can raise public understanding of the potential of value capture. For example, residential stock's value in the Metropolitan Region of Rio de Janeiro is approximately equal to its GDP (Vetter et al., 2014). In this sense, it is crucial to disseminate the results of successful land value capture experiences and to train people to use them. Blanco et al. (2016) provide an analysis of case studies in the region and the lessons learned from them.

B. Land value capture instruments for financing urban projects

As seen in the previous section, land value capture is a broad concept. As such, its justification goes well beyond being just a financial tool, given that it can also contribute to other public objectives, such as economic efficiency, social equity, and sustainable urban development. However, in this study, we will focus on the use of value capture as a tool for financing urban projects, as our goal is to propose alternative methodologies for evaluating the feasibility of value capture as a source of financing for specific projects.

The section will, therefore, focus on reviewing the following instruments commonly used to finance urban projects: Betterment levies, the sale of

building rights charges and exactions, Tax Increment Financing, and land readjustment.

Betterment levies. In general terms, betterment levies are charges on real estate property owners who benefit from infrastructure improvements. This instrument is classified as a fee because the beneficiaries of the infrastructure project are responsible for its payment. There are different ways to structure this instrument. For example, its collection can be ex-ante (i.e., before the work's construction) or ex-post. Moreover, the amount charged can be defined based on the cost of the project being financed or on the full valorization that the project will produce. Finally, the impact can be defined as general (when the project benefits the whole the city) or local (when it impacts only a specific area), the most common case.

The effectiveness of this instrument depends on its structure. Structuring involves the definition of (i) the impact area of the public investment, (ii) the amount to be collected, and (iii) the criteria used to determine the distribution of these payments. In theory, the impact area should correspond to the spatial scope of the project's benefits. For this, there are some different methodologies that can be used that we will discuss in greater detail in the next chapter. The amount to be collected can be defined as the project's cost or as a percentage of the expected benefits regarding valorization, or a combination of these two. The distribution criteria can include several aspects, such as the relative level of benefits received for specific areas, the area or cadastral value of the property, or the payment capacity of the families.

One of the cities with a long tradition of using this instrument is Bogota, Colombia, where it is called contribución por valorización. According to Borrero (2012), in the 60's, collections for this levy amounted to 16% of the city's total revenue. By the mid 90's, they had reached 24%. In the last 20 years, Bogota has collected about a billion dollars from these levies, and it plans to collect a similar amount in the coming years. Colombia has had specific legislation for this instrument since 1921, which allows various structures for collecting them.[11]

In the case of Bogota, although there have been general levies based on the valorization for the entire city, most have been for local areas. For local levies, impact areas (also called `zones of influence'), are defined based on proximity and accessibility criteria, as well as other factors, including the type and location of the civil works, the kinds of benefits generated, and land uses. When the levies cover more than one project, the definition of the impact area for the collection contract for a specific project takes into account the areas of other projects. If the levy seeks to cover only project cost, estimates of the value generated by the intervention may not be necessary. The factors used to define the impact area include different characteristics for each property, such as its size, socioeconomic strata, land use, and level of economic activity, along with other characteristics "that relate sites to the civil works'", such as proximity, accessibility and level of benefits received, etc. (Borrero, 2012).

Building rights charges and exactions. Instruments of this group stipulate or negotiate payment in exchange for the permission to develop a property in the form of money, infrastructure or land. Exactions and building rights charges are different, as the former often involves the provision of land for public use, and the latter requires payment for the right to

Instruments commonly used to finance urban projects: Betterment levies, the sale of building rights charges and exactions, Tax Increment Financing, and land readjustment.

[11] Borrero (2012) includes an excellent analysis of the models from the main Colombian cities.

build at heights over an established baseline. Nonetheless, we include these instruments in the same group because both are based on the idea that a new development involves public costs for the provision of urban infrastructure and services, and on the precept that the government has the right to regulate building.

These instruments differ from betterment levies in that they are collected at the time of approval of a new development and, therefore, are the builder's responsibility. According to Smolka (2013), these instruments are the most common in LAC, where they typically involve requiring developers to provide a percentage of the area to be constructed for public purposes, generally between 15% and 35%.

These instruments can be defined based on the cost of the infrastructure necessary to enable the proposed development or on the increment in land value that the regulatory changes will generate. An example of the first case is the `road impact' system in Guatemala City, in which the municipality prepares a plan to mitigate the increase in traffic generated by a new development project, then requires the builder to carry it out at his own expense.

Building rights charges usually involve negotiated or predefined charges for approval of requests to increase the limits on building heights. In this case, the municipality calculates the value of the newly-built space that will be generated and defines the payment in civil works or money. For example, building rights charges in Colombia stipulate that between 30% and 50% of the increment in value generated by regulatory changes must be recovered for public use. A special application of this type of instruments involves the requirement to produce social housing inside or outside of the project to be approved (Smolka, 2013).

The methods used in calculation and definition of the amounts charged vary according to the specifics of the instrument, but they generally involve appraisals by third parties or calculation of the value of the approved increase in the area at market prices. A simple illustration of this method for an approval of permitting 1,000 square meters of additional space would be that the value of the approval would be more or less equivalent to buying 1,000 square meters of additional land in a similar location. Although this method is inexact, given that it is difficult to estimate the impact on valorization, it is a way of assuring consistency in the definition of the charges for building rights (Smolka, 2013).

An example of the use of this type of instrument to finance urban projects is the rehabilitation of Puerto Norte in Rosario (Argentina), where moving the port to a peripheral area of the city freed up more than 100 hectares in a central location. Over several years, the municipality selected a master plan for the area from the alternatives generated via a public competition. Planning areas were established, and negotiations initiated with private sector stakeholders using an instrument called 'urban development agreements'. These agreements included the setting aside of land for construction of roadways, as well as for streets and utility networks. Furthermore, 15% of the land surface was set aside for public uses and facilities in return for the right to develop at the density levels defined by the plan. As a result, the municipality was able to obtain 42 hectares of public space, 0.63 hectares of social housing in situ, 4.30 hectares of social housing outside the project area, and 2.54 hectares for community facilities (Terraza et al., 2015).

Another special case is the building rights charges carried out in some cities in Brazil, including Sao Paulo, Rio de Janeiro, and Curitiba. Originally developed in Sao Paulo, this instrument is innovative in that building rights are sold as securities called Certificates of Potential Additional Construction (CEPACs) that can be used at any location within a defined redevelopment area. CEPACs allow the holder to build more than the baseline amount (permitted at no charge) for each lot to the maximum limit defined by the urban plan. Another innovation of CEPACs is that they are periodically sold to the highest bidder, allowing their price to be determined by the market. Given these characteristics, CEPACs are most appropriate for financing large projects in areas of high market demand for high density development. Application of this instrument in Sao Paulo generated more than US$2.2 billion in less than ten years.[12]

Tax Increment Financing. This instrument, commonly referred to as TIF, consists in using the future flow of property tax increases generated by a public intervention to finance its costs. TIF has a long tradition in US municipalities, where it was introduced in 1952. It is commonly applied in urban renewal or redevelopment projects.

The process begins with the preparation of a master plan that establishes the boundaries of the area subject to intervention and defines the characteristics planned for each type of land use, as well as municipal infrastructure required to develop the area according to the plan. The development agency also prepares a real estate market study that assesses the feasibility of implementing the plan and projects its impact on property values.

This projection of the project's impact on real estate prices is used to estimate the increase in property tax revenue. This increase in revenue is utilized to secure municipal debt (called TIF bonds), which are issued to finance the public expenditures required for plan implementation. For this financial structure to work, the municipality must turn the renewal area into a `TIF District'. With this, the increases in property tax revenue generated by the project are earmarked to cover the payments on the TIF bonds, and, therefore, will not go into the municipality's general budget during the tenor of the bonds (usually more than 20 years).

Thus, the city continues collecting taxes based on the initial property tax base value (i.e., the total cadastral value before the creation of the TIF District), whereas the increase in tax revenues due to the rise in property prices generated by the project goes to cover the payments on the debt incurred to pay for the public infrastructure. Note that the tax rate itself does not rise, what increases is revenue collection due to the value created by the intervention.

Since the tax rate by itself does not rise and beneficiaries do not pay for the project until after the value is created, political acceptance of TIFs can be reasonably high. The use of municipal debt also helps to resolve the cash flow problem posed by having to pay for the project before it generates value by using future revenues from the investments to secure the bonds (Blanco et al., 2016). Nevertheless, TIFs have been criticized, because they allow recovery of only a small portion of the value created when property tax rates are relatively low. Furthermore, the proliferation of TIF Districts reduces municipal resources available for other expenditures, which can reduce the capacity of the city to address its overall priorities for all areas.

[12] Sandroni presents a full description of the instrument and its implementation in Blanco et al. (2016).

A recent example of TIF is the Beltline (i.e. beltway) in Atlanta. This TIF district was created to promote new development on underutilized industrial land along existing railway lines. Based on the concept of Transit-Oriented Development (TOD), the project covers more than 2,500 hectares, and it includes social housing and economic development, connections to public transport, and the construction of parks and public schools. The total cost of the project exceeds US$2.2 billion of which 80% is expected to be paid with TIF bonds, backed by the specific allocation of the property tax increases for 25 years (City of Atlanta, 2012). Note that not all TIFs have the large size and scope of the proposed for Atlanta's Beltline. There are other districts of around one hectare and debt of around US$1 million. It demonstrates that this instrument can be used with flexibility and in a wide variety of urban projects.

Land readjustment. This group of instruments allows the merging of individual lots within a defined area and to reconfigure them in accord with a plan that increases their value and provides the land necessary for public uses. The process begins with the development of a plan to urbanize a medium-size area that includes multiple lots and different owners.

This approach is unique in that plan implementation is not lot by lot, but rather for the development of the adjustment area as a whole. In this, each owner accepts that his plot is reconfigured according to the plan, in terms of location, as well as in size. The costs of the infrastructure and public facilities of the project are allocated proportionally among the lots in the adjustment area.

Thus, an owner of an irregular lot transfers it to the project and receives a smaller one in return, but one with higher potential for profitable development within the parameters and locations defined by the plan. The reason why land readjustment can be attractive for the owner is clear: Although he receives a smaller plot, the price of the square meter of land will appreciate due to the implementation of the project and the installation of its infrastructure and public facilities. In other words, its total asset value will increase.

Land adjustment is a value capture instrument because the infrastructure and public facilities costs are partially or fully covered by the project development. The valorization generated by plan implementation profits the owners, and also covers the cost of infrastructure and public facilities.

Land readjustment is more frequently used in new developments in the urban periphery that involve the transition from rural to urban land use. However, it has also been used in urban renewal projects. Several countries have used the land adjustment in varying ways, but the most well-known at the international level are Germany, Japan, and South Korea.[13] South Korea introduced this instrument in 1934, and by 2000, it had been used in the financing of 654 projects, covering almost 44 thousand hectares, in which between 25% and 68% of the land has been allocated for public uses in accord with the project plan (Lee, 2002).

There are more sophisticated versions of the instrument, such as the trusts involving owners and sometimes the government, in which each owner ceases to own the land per se and becomes a shareholder in a development entity.

[13] In LAC, Colombia has begun to implement this instrument (Smolka, 2013). Adriana Hurtado in Blanco et al. (2016) describes the experiences in Bogota.

Another alternative is the incorporation of a public land development company that is endowed with the right to use expropriation. This company consolidates private land lots and sells land to private builders at prices that allow it to compensate the owners, pay for infrastructure and public facilities, and also receive part of the valorization.

C. Implementing urban projects through land value capture

Each of the land value capture instruments described in the previous section has advantages and disadvantages, and its efficiency and feasibility will depend on many variables internal and external to the project itself, including its type, context of the real estate market, institutional capacity, and the scope of the existing laws. This section compares the conditions under which each of the previously described value instruments works better regarding its potential for financing an urban project.[14]

In this, a first consideration is whether the project seeks to rehabilitate degraded areas of the city or to develop vacant land (i.e., greenfield). For degraded areas, the more effective instruments for capturing the valorization within a broader impact area that is 'external' to the civil works of the project (such as betterment levies and TIF) may be the more useful. In the case of greenfield development, such as in the transition from rural to urban uses, instruments that capture value within the project area itself, such as exactions, building rights charges and land readjustment, may be more appropriate. However, in the case of projects involving increasing development density in areas with a demand for high-rise construction, building rights charges can work very well.

It is also important to distinguish between projects that are an initiative of the public sector, such as the provision of infrastructure or public facilities, and projects that the private sector originates, such as real estate development in a specific area. Instruments such as betterment levies and TIF are best for public sector projects because they capture the value from residents as final users. Instruments that capture value directly from the developer (such as exactions and charges for building rights) can work better for private projects since they collect directly from the project's developer.

With regard to project financing, one must decide whether the objective of land value capture is to recover only the public investment costs, or if it seeks to capture part of the full valorization produced by the project. Although all of the above instruments can be adjusted to operate on these two levels, instruments such as betterment levies and TIF have traditionally been used as cost recovery methods, while exactions, building rights charges, and land readjustment have been used to capture value beyond just cost recovery. Nevertheless, it is important to stress that this division is not strict, since cities such as Medellin, Colombia use value capture for both cost recovery, and also to capture part of the further valorization. In the case of Guatemala City, the 'road impact' instrument seeks to cover infrastructure costs, rather than the full measure of value generated.

Another decision is whether the collection is going to be ex-ante or ex-post. The ex-ante collection helps solve the cash flow problem by generating revenue as the investment is being made, while the ex-post may be more politically acceptable, given that collection occurs after the project's benefits have been received. The more effective instruments for

Each of the land value capture instruments described in the previous section has advantages and disadvantages, and its efficiency and feasibility will depend on many variables internal and external to the project itself

[14] For a complete review of all the value capture instruments according to their impact, context, process, advantages, risks and capacity, see Smolka (2013).

ex-ante collection are exactions, building rights charges or land readjustment, as well as instruments that use valorization to secure debt, such as TIFs. Instruments such as betterment levies are well suited for ex-post collection. However, in some cases (such as Bogota, Colombia) collection precedes project execution.[15]

Finally, another consideration is the degree of sophistication required to employ the instrument, concerning both institutional technical capacity, and also the adequacy of the existing legal and financial environment needed to support value capture. From this viewpoint, the instruments that require less regarding preconditions for implementation are betterment levies (especially when they seek only to recover costs) and exactions. Building rights charges require greater technical capacity but are within the know-how of most municipalities in the region. On the other hand, the more sophisticated instruments require greater institutional capacity, in the capital markets (as in the case of TIFs and CEPACs) or the legal framework for land use governance (e.g. land readjustment). Table 4 summarizes the conditions under which each instrument works better.

Table 4
Most favorable implementation conditions for each instrument

Source: Prepared by the authors

	BETTERMENT LEVIES	EXACTIONS AND BUILDING RIGHTS CHARGES	TAX INCREMENT FINANCING (TIF)	LAND READJUSTMENT
Type of project or development	Development in built up areas	New development (or for increasing development density)	Development in built up areas	New development
Originator by sector or competence	Public for infrastructure	Private for real estate development	Public for infrastructure	Private for real estate development
Scope of capture	Cost recovery (and full land value capture)	Land value capture	Cost recovery	Land value capture (or cost recovery)
Timing of resource availability	Ex- post investment (or ex-ante, depending on political feasibility)	Ex-ante investment	Ex-ante investment	Ex-ante investment
Prerequisites for implementation	Low (especially for cost recovery)	Low for exactions and building rights charges. High for CEPACs.	High for financial market development	High for legal framework

[15] Although with some citizen resistance. See Borrero (2012).

III. Establishing land value capture's potential for financing a project

A. Methodological considerations
B. Project Description
C. Impact area
D. Stock's Current Value
E. Impact of the project
F. Financial prefeasibility
G. Identifying and designing the instruments for land value capture

A. Methodological considerations

As previously mentioned, this study seeks to analyze land value capture's potential as a tool for financing urban projects. This effort is part of the IDB's interest in creating instruments for financing urban sustainability in the region. The ESC Program is one element of this effort that seeks to develop urban interventions through a multidisciplinary approach for identifying comprehensive solutions for the problems facing LAC's rapidly growing intermediate size cities.

To this end, the ESC Program proposes a straightforward methodology for analyzing urban problems that can substitute the traditional approach (involving extensive data gathering and analysis) with one that can allow a quicker diagnosis of problems and generation of concrete proposals for addressing them. This approach uses existing data and an active dialogue between the ESC technical team and the local counterpart team.

This chapter first sets out a straightforward methodology that can be applied quickly, and that is compatible with ESC's approach. The objective is to carry out a quick prefeasibility analysis that indicates whether a given project can be financed with the valorization it generates and, then, which value capture instruments would enable it to do so. The following is a description of the methodology that we developed based on two case studies in cities participating in the ESC Program: Xalapa in Mexico and Quetzaltenango in Guatemala. The following chapters describe results of these studies.

The objective is to carry out a quick prefeasibility analysis that indicates whether a given project can be financed with the valorization it generates and, then, which value capture instruments would enable it to do so.

B. Project Description

The proposed methodology assumes that a project has already been formulated at least to the extent that its components have been identified and their costs estimated. With this, the first step in the methodology is to identify a subset of project components with the highest priority regarding expected impact, and that can be implemented in a relatively short term (such as 5 years).

One criterion could be to select those components that generate value by more fully developing underutilized land and buildings, and that also have relatively low costs. The goal is for the project to generate quick wins and be relatively simple to present and explain to the communities that will benefit from its development. It is also important to have a clear preliminary idea of components' costs since the main objective of the prefeasibility analysis is to verify if the valorization generated by the project will cover its costs.

In the identification of the components and estimation of their costs, it is important to analyze the temporal distribution of costs during project execution and to identify times when the costs may be particularly high. This is to anticipate periods in which the cash flow from value capture would not be sufficient to cover the costs of project execution, thereby negatively affecting implementation. It is also important to analyze the spatial distribution of the impacts of the components, so as to identify areas benefitting most from their implementation. This information will be useful in identifying the project's impact area in the next stage.

C. Impact area

A project's impact area is usually defined as the area of influence in which citizens (users or not) will be benefitted (Weisbrod and Weisbrod, 1997). In our case, this area corresponds to the geographic space in which the project will influence land prices. As discussed in the previous chapter, this is important, as it is precisely the existence of valorization generated by a public intervention that justifies the use of value capture. It is important to maintain the principle that the one who benefits is the one who pays. In this way, if the benefits of the project encompass the whole city, land value capture should be general and cover all land in the urban area.

Estimating the benefits of a project in terms of its impact on land price is not easy, as will be discussed later. Defining the geographic limits of this impact is also complex, especially in the case ex-ante value capture, where the project has not yet been fully defined. In cases in which the benefits are contained to the area occupied by the project itself, defining the impact area can be more straightforward, as could be the case of real estate projects in peripheral areas financed by exactions and building rights charges or in land readjustment.

In cases in which the intervention involves infrastructure or public facilities in relatively populated areas, the challenge is greater. In this case, the definition of the impact area will depend not only on the type of project but also on multiple factors, such as the quality of existing alternatives in the city, real estate market conditions, transport connections, and citizens' preferences, etc. Therefore, it is difficult to use international benchmarks. For example, in the international literature, a walking distance of 500 meters is a commonly accepted benchmark. This benchmark can be useful for estimating the impact area of a local park or a station belonging to a mass transport system, but its utility drops when the park or the station have greater range and receive visitors using different means of transportation. Additionally, human-made boundaries (such as roads) or natural ones (like rivers) may exist within that 500-meter radius. Furthermore, this benchmark is irrelevant for some types of projects, such as freeway interchanges.

A more rigorous ex-ante method for defining an impact area is through a commercial real estate appraisal. For example, Manizales, Colombia uses this method to define impact areas for betterment levies (Borrero, 2012). The first step in this method is to define the general area of the city where civil works of a defined type will have an impact. This general area is then divided into homogeneous areas with similar characteristics including urban regulations, spatial structure, and land use. The next step involves using statistical methods to appraise the land values for several locations under two assumptions: One with the prevailing situation and another with the hypothetical project. For this, "similar civil works that were previously carried out are taken into account in making predictions on the future value" (Borrero, 2012). Both estimates for each location are compared and extrapolated into homogenous zones, using Geographic Information Systems (GIS) to generate contour maps and determine the potential impact in each area. The impact area is defined as the homogenous zone where the project has a positive influence on appraised values.

Alternatively, spatial analysis techniques can be used to determine how the location of infrastructure or public facilities affects their use. For

example, to define impact areas for betterment levies for the construction of specific roads and interchanges, Bogota has used traffic flow modeling based on origin and destination surveys to identify the residential areas occupied by those more likely to use the new infrastructure (Borrero, 2012). This method, as with the previous one, works not only to define the impact area but also to determine the distribution of impacts within the area itself. Residents of those areas benefitting more could be charged more.

Although these methods are rigorous, applying them can be expensive and may not be feasible in all cities. For example, the statistical method can require from 100 to 200 observation in a medium size city, depending on the size and number of homogenous zones (Borrero et al., 2011). Furthermore, some cities may not have the geo-referenced information system for properties or the origin and destination surveys required to apply these methods.

In cases where these more rigorous methods cannot be applied, and especially in an initial stage of evaluation or in smaller-scale projects, an impact area can be defined through qualitative techniques, supported by evidence from ex-post studies on the impact of similar infrastructure in other cities and by interviewing municipal government officials, consultants, researchers and appraisers with good understanding of the real estate market and the local planning provisions. Using this qualitative method, estimating the differential effects within the impact area (e.g. between an area of primary impact and another of secondary impact) can be based on the characteristics of the project's components. As the purpose of defining the impact area is to estimate the valorization of the properties located within it, there must exist data on land prices that can be aggregated into spatial units.

D. Stock's Current Value

It is first necessary to estimate the current value of the stock to estimate the project's impact on land prices within the impact area. In general, information on land prices in our region's cities is either unavailable or is available for only a small sample for particular areas of the city. Nevertheless, it is possible to use more commonly available data on the total value of the stock of land and buildings, because what concerns us is the impact of the benefits generated by the project on this stock (without regard to measures that the owner decides to take). In this sense, it is possible to infer that the estimated change in total property price generated by the project will be equal to the change in the price of land.

Although some cities have sample data on property prices based on real estate transactions, these databases are usually scarce in our region. For this reason, the best sources of information are cadastral databases. The methodology commonly used in LAC cities for establishing the cadastral value of a property (including vacant lots) is the sum of the value of its land and buildings, where each one is estimated using `demerit' factors. In the case of land, these factors include characteristics such as gradient, shape, the length of frontage and location. So then, the equation to calculate the total cadastral value of a property is the following:

$$V_{cat} = V_t + V_c$$

$$V_t = (A_t)\,(V_{ut})[(dt_1)\,(dt_2)\ldots(dt_n)]$$

$$V_c = V_{c1} + V_{c2} \ldots + V_n$$

$$V_{ci} = (A_{ci})\,(V_{ut})[(d_{c1})\,(d_{c2})\ldots(d_{cn})]$$

Where:

V_{cat}	Total cadastral value of a property
V_t	**Total cadastral value of land**
A_t	Land area of the lot
V_{ut}	Per unit cadastral value of land
$(dt_1)\,(dt_2)\ldots(dt_n)=$	Product of the demerit factors applicable to a lot
V_c	**Total cadastral value of built space**
V_{ci}	Per unit cadastral value of building type "i"
A_{ci}	Total area of building type "i"
V_{uci}	Per unit value of building type "i"
$(dc_1)\,(dc_2)\ldots(dc_n)=$	Product of the demerit factors applicable to the building

Equation
to calculate the total cadastral value of a property

Source: Instructions for Cadastral Appraisal in the State of Veracruz

The cadaster contains basic information needed to calculate the value of land and buildings for each property, including the size of the lot and building, as well as other relevant characteristics useful for estimating market value (e.g. access to water and sewerage networks, and types of building materials). A geo-referenced cadaster also allows analysis of the role of transportation and other public service networks in establishing land use density and value. This information is, of course, important when appraising the value of land and buildings, as well as urban planning (e.g. land use and transportation planning).

Cadastral databases also have the advantage of allowing calculation of the total building surface area, estimation of development densities, and detection of vacant lots, as well as helping to identify areas with potential for high rise development and to estimate the degree of dispersion in the property values in the impact area. In the cases in which cadastral bases are geo-referenced, the GISs can be used to identify properties that fall into a certain impact area. For those cases in which the cadaster is not geo-referenced, the analysis will have to use the existing cadastral zones (or another unit of spatial analysis used by the cadaster) to define the impact area and calculate the cadastral value of the stock.

In many cities of the region, as cadasters are not updated in a timely manner, cadastral values can differ significantly from current market values. In this case, the cadastral estimates can be adjusted using sample data from more recent surveys of market value done by appraisers or real estate brokers. The following chapter presents an example of this kind of adjustment for Quetzaltenango.

E. Impact of the project

The impact of a project on the prices of residential properties is very difficult to calculate because housing is an asset with multiple attributes,

each one of which affects its value. Therefore, housing can be conceptualized as a service, or more precisely, as a set of services. Each housing unit is unique not only in terms of its characteristics, such as the number of rooms, and its area, age, style, and amenities but also of its location within the urban area and its accessibility to workplaces, public facilities and other opportunities (Blanco et al., 2014).

Even when analyzing a project's ex-post impact, it is methodologically complex to isolate the effects of a project from the changes produced by other factors. Annex I includes an analysis of the methodological challenges of ex-post evaluation of project impact on housing prices. Ex-ante estimation of project impact is much more difficult, as it has not even been developed.

The most rigorous methodology to carry out ex-ante estimation would be to do appraisals in homogenous areas to generate contour maps showing prices. However, as described in the previous section on defining the impact area, this can turn out to be too expensive and complicated for smaller projects or prefeasibility analyses.

When there is cadastral information for the city as a whole, and this data is geo-referenced, hedonic econometric models can be used to isolate the effect of each attribute on property price. These models take the following general structure (Nicholls, 2012):

$$P = \beta_1 + \beta s Xs + \beta n Xn + \beta c Xc + \beta l Xl + \beta e Xe + \beta r Xr + \mu$$

Where:

- P are the observed prices (i.e. the cadastral values)
- X_s are the structural attributes of the household (number of rooms, bathrooms, etc.)
- X_n are the attributes of the neighborhood (average income, socioeconomic strata, etc.)
- X_c are the attributes of the community (school district, locality or borough, etc.)
- X_l are the locational attributes (accessibility to public facilities, workplaces, etc.)
- X_e are the environmental attributes (air quality, noise, etc.)
- X_r are time-related attributes (year of construction, etc.)

In this type of model, the coefficients (βx) represent the relationship between each of the independent attributes and the observed prices, when all the other attributes remain constant. With certain modifications in the original equation, these attributes can be turned into elasticities. Thus, if a variable representing the project is included in the analysis, it will be possible to estimate its effect on housing prices.

For example, in the case in which the project involves building a park, the current distance of each house to the closest park can be included as an independent variable, calculated using geographic information techniques, or the distance from the park in a predetermined radius. Then,

the resulting coefficient can be used to estimate the impact that the new park would have in its area of influence, when reducing the distance from each household to a park or when increasing the park area in its radius of proximity. If the cadastral information is not geo-referenced, one approach for determining the impact of access to an amenity or infrastructure is to use cadastral zones as the unit of spatial analysis and to introduce a variable in the analysis that indicates whether the zone has the amenity or infrastructure in question or not. In the next chapter, we use the methodology for the case of Xalapa.

Hedonic analyses can be complemented —or replaced if not applicable— with the scenario analysis. This method is commonly used to make financial projections in risk analyses, especially for stress testing of financial operations and institutions (Marrison, 2002). Dowd (2002) describes scenario analysis as a way of responding to a 'what if?' question, by defining different scenarios to understand "what we stand to gain or lose under them." The idea of these analyses is to assign values to the key variables, according to different sets of assumptions (i.e. scenarios) on how these variables can evolve in the future (for example, in the best, worse and most probable case scenarios).

Dowd (2002) notes that it is not easy to carry out this type of analysis, as its validity depends on the researcher's capacity to identify the 'correct' scenarios without rigorous rules to guide his decision process. Therefore, it is important to make sure that the scenarios generated are internally consistent, and do not utilize improbable assumption. To mitigate these potential problems, it is essential that scenarios use relatively conservative assumptions and are straightforward and transparent so that the interested parties can review them easily. Sensitivity analyses can be used to test the validity of the assumptions used in the definition of scenarios by measuring the effects of modifying the values of key variables on the simulations of project impact. Simulations of the Monte Carlo type are one method of doing scenarios analysis by defining the possible ranges of values for key variables and estimating their probability (Marrison, 2002). In the case of estimating the impact of a project on land prices, hedonic model results can provide a solid base for effective scenario analysis.

In relation to office or commercial properties, the methodological challenges for the impact analysis are greater than for households, because of real estate value, in this case, involves the project's capacity to increase commercial revenue by attracting more customers. Furthermore, the number of commercial real estate transactions is normally much lower, which makes it difficult to estimate property values. Finally, the independent key variables that influence commercial real estate prices and services are difficult to measure (for example, attractive design of a commercial zone, the presence of competition, or access to clients and suppliers). As a result, there are thousands of studies on residential hedonic prices (Baranzini et al., 2008), but only a handful on commercial activities and offices.[16]

Another possible impact of the project is that it will generate new construction, either by the occupation of vacant lots or by increasing the density of development for currently occupied areas. This impact is also difficult to estimate. One option can be to use cadastral data to identify areas with development potential and to propose possible scenarios of new developments based on their practical feasibility.

[16] Thrall (2002) reviews some hedonic models that attempt to explain the spatial variation of office rents within a metropolitan region. In these models, agglomeration economies are very important. For example, office rent models in Atlanta prepared by Bollinger et al. (1998) show that, after controlling construction characteristics and the terms of the leasing contract, independent variables related to salaries, transportation prices, and proximity to concentrations of workers play an important role when explaining the spatial variation of office rents.

For example, it will be more likely to use vacant lots in the short term than to have a building on occupied lots that requires demolition and high-rise construction.

F. Financial prefeasibility

The project's financial prefeasibility, in our case, is determined via the comparison of the estimated valorization generated with its costs. Note that this does not mean that land value capture is limited to recovering just project costs. On the contrary, we want to define a minimum level of valorization necessary for financing the project by applying the value capture instruments.

To this end, prefeasibility should be defined using the most probable scenarios. In each of these scenarios, it is important to define whether the private sector will cover any part of the financing, in order to estimate the costs that the municipality will have to cover with value capture or other revenues. The first stage of the financial prefeasibility analysis involves comparing project cost with the value that the project is expected to generate during the implementation period. It is important to emphasize that the final feasibility analysis should include rigorous analysis of project impact based on real estate appraisals, especially in the case of large-scale projects. Table 5 shows the basic calculations for a financial prefeasibility analysis.

Talbe 5
Financial prefeasibility analysis

Source: Prepared by the authors

Lines	Components/ Estimations	Scenario A	Scenario B
A	Total cost of the Program		
B	Percentage of investment financed by private sector partners		
C = A * B	Investment financed by private sector partners		
D = A – C	Cost of the project to be financed by the municipality with different revenue sources		
E	Percentage financed with the city's general investment budget		
F = D * E	Financed with the city's general investment budget		
G = D – F	Municipal financing through land value capture		
H	Current total cadastral value of the stock of land and buildings in the impact area of the Program		
I = G/ H	Cost of the Program financed by the city through land value capture/ Current cadastral value of the stock of land and buildings		
J	Impact of the interventions: % of cadastral base increase for the first 5 years		
K	Land valorization due to the Program's interventions in the first 5 years		
L = D/ K	Cost of the Program/ valorization for the first 5 years		
M	Total land lot valorization due to the Program's interventions		
N = D/ M	Cost of the Program/ total valorization generated by the Program		

G. Identifying and designing the instruments for land value capture

After determining that the valorization generated by a project can help pay for it, the next step is to select the value capture instrument. As discussed in the previous chapter, there are several different instruments for capturing value to finance an urban project, and each one has specific characteristics that will determine its suitability.

For example, betterment levies work best for public infrastructure projects in built-up areas. They can be used for just cost recovery or to capture full valorization. Furthermore, they can be used before or after (i.e. ex-ante or ex-post) infrastructure construction, depending on the financial needs and political practicality. Their prerequisites concerning legal environment or depth of the financial system are relatively low.

Exactions or building rights charges are most suitable conditions for development of vacant lots (especially exactions), although they can also be used for increasing development density. They are more suitable for real estate projects initiated by the private sector, and they allow the capture of value beyond just cost recovery. They are usually charged ex-ante investment, and their institutional prerequisites are low in the case of exactions and building rights charges, but higher in the cases involving auctions, such as CEPACs.

Tax Increment Financing is most appropriate for infrastructure development in built-up areas. Theoretically, it would allow value capture beyond just the investment cost. However, as it can be used to secure the debt financing needed for the infrastructure, it can also be considered an instrument for cost recovery. TIF allows financing the investment ex-ante via the bonds issued. However, for this same reason, its prerequisites are high, as it requires a developed financial market.

Finally, land readjustment is used more in real estate development projects on undeveloped land. They can be used to capture the full valorization or just to recover costs. They generate revenues ex-ante, but their prerequisites are high because they need a sophisticated legal environment to make agreements related to land-use governance viable.

In summary, the decision on the most suitable instrument should be the result of a careful study of the project's characteristics and its impact area, as well as its political, legal and financial environment. These elements will be very important in the instrument's design. It is essential that the charges be affordable, as this increases their political viability and improves chances for successful implementation.

When the project is going to be financed through land value capture from the public in the impact area (such as in the case of betterment levies or TIF), it is important to verify that the payments required are compatible with the payment capacity of the families. A simple exercise is to group the properties of the impact area in the cadastral database into quartiles based on their cadastral value, and, then, compare the average value of each quartile with the average charge for it.

Different distributions of payments for the different quartiles can be considered so that properties of higher cadastral value pay a higher proportion of the project or investment costs. Besides, it is possible

to establish if these payments are reasonable based on the expected valorization for each quartile. Table 6 shows an example of affordability analysis developed in Xalapa and Quetzaltenango.

Table 6
Property affordability analysis grouped by quartiles, according to their cadastral value

Source: Prepared by the authors

COLUMNS	VARIABLE	TOTAL	PROPERTY GROUPED INTO QUARTILES (Q) ACCORDING TO THEIR CADASTRAL VALUE			
			Q1	Q2	Q3	Q4
A	Current total cadastral value of the stock of land and buildings the stock of land and buildings in the impact area of the Program					
B	Total Program cost allocation among quartiles (%)					
C	Total Program cost allocation among quartiles					
D = C / A	Cost of the Program financed by the city through land value capture/ Current cadastral value of the stock of land and buildings					
E	Average cadastral value of a property in the Program's impact area					
F = D * E	Total value of betterment levies for a property of average cadastral value					
G = F / 5	Equal annual contribution payments for 5 years					
H = E * 1%	Hypothetical 1% increase in average cadastral value					
I = E * 2%	Hypothetical 2% increase in average cadastral value					
J	Impact of the interventions: % of cadastral base increase for the first 5 years					
K = E * J	Valorization of a property of average cadastral value derived from Program interventions in the first 5 years					

Land value capture's potential to finance urban projects: the cases of Xalapa and Quetzaltenango

A. Xalapa: Case Study of the program to integrate the railroad into the city's structure

1. General context
2. Methodological application
3. Conclusiones y recomendaciones

B. Quetzaltenango: case study on the project to revitalize the Intercultural and sports center

1. General context
2. Application of the methodology
3. Conclusions and recommendations

As pointed out in the previous sections, an alternative with high potential for the financing infrastructure is to capture the valorization that the project itself generates. This chapter presents two case studies that demonstrate how a financial strategy of this type can be formulated: Xalapa, Mexico, and Quetzaltenango, Guatemala.

The main objective of these case studies is to analyze the feasibility of using land value capture instruments to finance selected public interventions. To this end, we describe interventions and their impact areas, detail the costs of each project, estimate the initial value of the stock of land and buildings, and project the potential impact of interventions on valorization. Finally, we assess the financial prefeasibility and affordability of land value capture, and provide guidelines to assist in project implementation.

The main objective of these case studies is to analyze the feasibility of using land value capture instruments to finance selected public interventions.

In this way, this section seeks to answer the following questions:

- To what extent can the capture of the value generated by public investments and land use regulations help finance infrastructure projects?
- Is land value capture a financially viable strategy?
- How can we make value capture affordable?
- Which could be the most effective land value capture instruments for financing the projects of the case studies?

A. Xalapa: Case Study of the program to integrate the railroad into the city's structure

1. General context

Xalapa is a Mexican city of approximately 460,000 inhabitants that is located 316 kilometers to the east of the Federal District. As the capital of the State of Veracruz, it is where the main political, administrative and cultural activities of the region converge, as it encompasses both municipal and state government institutions. Its economic activity is based on service provision, trade, and industry (IDB, 2014).

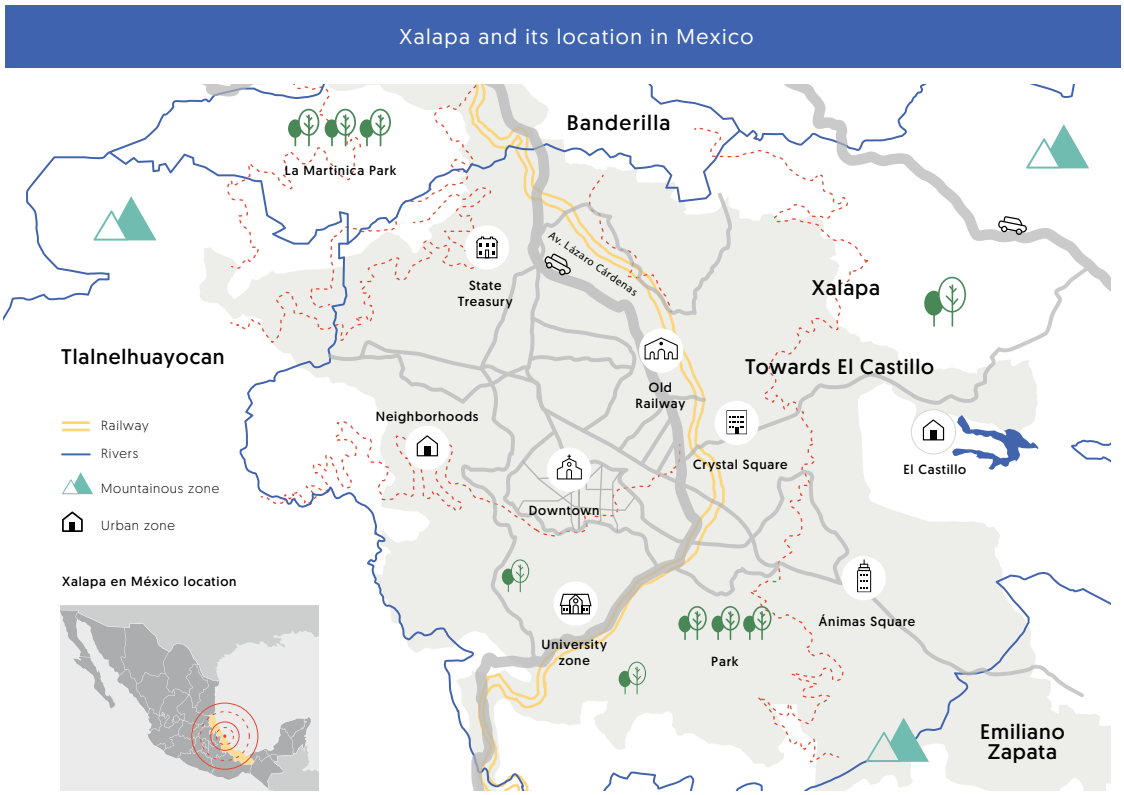
As with many cities in LAC, Xalapa has experienced the same urbanization trends that are taking place at the global level. The municipality has undergone significant growth of its population and rapid expansion of the urban footprint during the last decades. This dispersed and disorganized way in which this growth has occurred is jeopardizing the city's sustainability by generating negative environmental, spatial and urban management effects.

Regarding spatial organization, Xalapa's growth patterns have promoted socio-spatial segregation, generating marked spatial differences in levels of income, access to public services and quality of infrastructure in different areas of the city. This, in turn, has resulted in high levels of social inequality. (IDB, 2014). See Map 1 (next page)

The railroad that transverses the city has accentuated these problems, as it splits the urban area in half, impedes accessibility and marginalizes several communities. For these reasons, the *Xalapa Sostenible* Action Plan advocates taking measures that will generate a more integrated urban structure that strengthens social cohesion, as it considers this to be one of the great challenges facing the city. (IDB, 2014).

Map 1
Xalapa and its location in Mexico

Source: IDB (2014)



"The incompatibility of having a railroad pass through the urban area has been aggravated by the elimination of passenger train services after the privatization of the railroad, as the private concessionaire's sole focus is on freight service, resulting in the abandonment of the train station and facilities related to passengers, and also the increase in freight train frequency." (ALG, 2014).

To address these issues, the Action Plan proposes a program to integrate the railroad and the abandoned passenger train station into the city's structure *(el Programa Multisectorial de Convivencia Tren – Ciudad/ hereafter the Program)*, which seeks to "induce a more harmonious relationship between the railroad and the city, integrating the communities on the east side of the railroad tracks with the rest of the city, improving the quality of the area's public spaces and optimizing land use along railroad's route" (IDB, 2014).

2. Methodological application

A brief description of the Program. Our financial strategy for the Program involves generating land value and capturing part of the value created to finance needed infrastructure so that the Program partially finances itself. In this case, valorization results from the implementation of a re-vitalization plan involving the development of green space and underused buildings that are part of the abandoned train station and also infrastructure provision in the Program's impact area.

Program formulation involved the active participation of local authorities, consultants and neighborhood associations. The plan for the Program's implementation is contained in the document *Conectando Xalapa* (2014) and includes revitalization proposals for the abandoned train station, as well as for the green space surrounding the station and for the area alongside the railroad tracks.

The Program comprises different interventions distributed in five sections along the railroad tracks (see Map 2). Among the most important are the rehabilitation of the abandoned passenger station and its surrounding green space, a neighborhood improvement program, and the construction of bicycle lanes and pedestrian walkways alongside the railways. These interventions extend over 9.78 kilometers and are expected to benefit more than 120 thousand inhabitants of Xalapa. (See Table 7)

Map 2
The five sections of the Program

Source: IDB (2014)

The five sections of the Program

Sections	Definition of section boundaries	Extension (km)	Population benefitted
I	Between Banderillas exit and the station area	2.30	29,000
II	Section where switchyards, services, and the old railway station are located	1.90	32,000
III	Between the station section and the crossing with Chedraui Ave.	1.00	16,000
IV	Between Chedraui Ave. and Murillo Vidal Ave.	2.20	28,200
V	Between Murillo Vidal Ave. and exit route to Coatepec	2.38	17,000
Total		**9.78**	**122,200**

Table 7
Xalapa - Program sections, their extension, and the population benefitted

Source: IDB (2014)

For the purpose of the financial analysis, we have selected a small subset of Program components that we consider of high-priority for the city in terms of value generation and capture, and that also can potentially be implemented in the next five years. These components would be implemented in two phases: The first, involves the establishment of a solid technical, institutional and legal base for the Program (e.g. social marketing strategy, institutional arrangements, regulatory adjustments, etc.); and the second, the initiation of civil works (e.g. rehabilitation of the train station at its green spaces, bicycle lanes, pedestrian crossings, etc.).

Table 8 shows the costs implied in potentially carrying out each one of these high-priority actions as part of the Program.

Table 8
Xalapa - Preliminary estimates of Program costs by component [P$]

Source: Estimations based on ALG cost data (2014)

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos

Stages/Components	Total	Years				
		1	2	3	4	5
Subtotal Stage 1: To establish solid technical, institutional and legal bases	**3,314,000**	**2,154,100**	**1,159,900**	-	-	-
Preliminary investment plan for the primary impact area and social marketing strategy for the new neighborhood image [17]	2,485,500	1,657,000	828,500	-	-	-
Technical and legal support for the negotiation with the licensee (Kansas City Southern Mexico - KCSM) and entities of the national government and State of Veracruz	828,500	497,100	331,400	-	-	-
Subtotal Stage 2: Civil works initiation	**76,222.000**	**1,657,000**	**8,285,000**	**9,113,500**	**13,256,000**	**43,910,500**
Rehabilitation of passenger station	8,285,000	-	4,142,500	4,142,500	-	-
Rehabilitation of green spaces	4,971,000	828,500	1,657,000	2,485,500	-	-
Neighborhood Improvement Program	8,285,000	828,500	1,657,000	1,657,000	1,657,000	2,485,500
Rehabilitation of 5 railroad crossings	3,314,000	-	828,500	828,500	1,657,000	-
Construction of bicycle lane	21,541,000	-	-	-	1,657,000	19.884,000
Construction of pedestrian crossing	9,942,000	-	-	-	3,314,000	6,628,000
Rehabilitation of the yard area	19,884,000	-	-	-	4,971,000	14,913,000
Total	**79,536,000**	**3,811,100**	**9,444,900**	**9,113,500**	**13,256,000**	**43,910,500**

Impact area of interventions. A project impact area is the spatial area over which the project affects users or nonusers, whether it involves route or a terminal facility (Weisbrod and Weisbrod, 1997). In this case study, the impact area of the interventions is the spatial area in which the Program will influence land and the building prices. It is worth indicating that, as in most projects, some of the Program benefits will go to people living

[17] The preliminary investment plan should identify potential partnerships with the private sector, formulate terms of reference to develop the necessary studies, and develop bidding documents for the civil works.

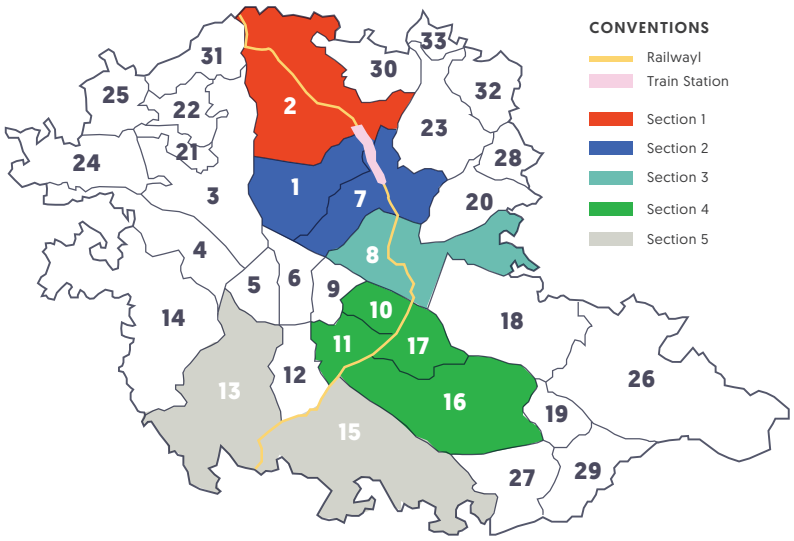
outside the area of influence. An example is those people who live outside the impact area and can visit the train station that has been revitalized or use the bicycle lanes that are part of the Program. Therefore, not all project benefits are "internalized" [18] within its impact area. This is important when deciding how much value should be captured inside and outside the impact area.

We defined the impact areas for these two case studies based on meetings and field visits with municipal government officials, advisers, consultants, and academics, who were familiar with the project components and the project impact area. We also used cadastral maps, as well as other local planning documents and data.

In the case of Xalapa, municipal officials from different departments participated in the identification process, including from the cadaster, municipal planning and finance departments. We first proposed delimiting the impact area using concentric and/ or parallel areas around the location of the planned interventions. However, as the cadaster data had not yet been georeferenced, we had to use the existing cadastral regions as our units of spatial analysis. As the cadaster system modernization proceeds and these data are georeferenced, it will be possible to do a much more precise and rigorous analysis, as it will be possible to generate any desired spatial unit of analysis.

Next, we divided the Program's five sections (Tramos) into primary and secondary impact areas. As shown in Map 3 and Table 9 (next page), the primary impact area includes sections 1, 2 and 3, covering cadastral regions 1, 2, 7 and 8. The secondary area covers sections 4 and 5, corresponding to cadastral regions 10, 11, 13, 15, 16 and 17. Table 9 also indicates the number of properties in each cadastral region located in the five sections. The main criterion used in defining these subdivisions within the impact area was the presence of benefits from the Program's interventions of discussed above (e.g. rehabilitation of the train station and the surrounding green space, pedestrian crossing, etc.).

Xalapa - Cadastral regions and sections of the Program



Map 3
Xalapa - Cadastral regions and sections of the Program

Source: Municipal cadaster

[18] Paving a street in a residential area with no through traffic is an example of a case where all benefits are internalized within the project impact area. If the street also serves through traffic between neighborhoods, some of the benefits will go to travelers outside the direct impact area.

Impact areas	Sections	Cadastral regions	Number of properties
Primary	Section 1	02	14,019
	Section 2	01	6,287
		07	7,946
	Section 3	08	8,064
	Subtotal		**36,316**
Secondary	Section 4	10	2,481
		11	2,261
		16	4,359
		17	2,254
	Section 5	13	6,435
		15	5,878
	Subtotal		**23,668**
Total			**59,984**

Table 9
Xalapa - Cadastral regions in each of the Program's sections

Source: Prepared by the authors based on the meetings held with municipal officials and the available cadastral data

The impact area encompasses 59,984 properties (i.e., cadastral units) in residential and nonresidential use categories. Residential use units are classified as apartments or houses; the nonresidential properties can be empty lots, green space or for other public and private uses (commercial, service, industrial and other activities).[19]

In general, land use in both the primary and secondary impact areas is mostly residential (87.9% of all properties.) See Table 10

Table 10
Xalapa - Impact areas of the Program: Cadastral units by section and type of economic activity (2014)

Source: Estimates made by the authors based on 2014 cadastral data

Number of cadastral units	NON-RESIDENTIAL					RESIDENTIAL				Total
	Public-private activities	Green spaces	Vacant lots	Subtotal	Subtotal (%)	Apartments	Houses	Subtotal	Subtotal (%)	
Primary	**1,181**	**88**	**1,822**	**3,091**	**5.2**	**3,063**	**30,162**	**33,225**	**55.4**	**36,316**
Section 1	461	31	710	1,202	2.0	251	1,.566	12,817	21.4	14,019
Section 2	363	34	656	1,053	1.8	1,132	12,048	13,180	22.0	14,233
Section 3	357	23	456	836	1.4	1,680	5,548	7,228	12.0	8,064
Secondary	**681**	**74**	**3,402**	**4,157**	**6.9**	**4,409**	**15,102**	**19,511**	**32.5**	**23,668**
Section 4	420	36	917	1,373	2.3	3,468	6,514	9,982	16.6	11,355
Section 5	261	38	2,485	2,784	4.6	941	8,588	9,529	15.9	12,313
Total	**1,862**	**162**	**5,224**	**7,248**	**12.1**	**7,472**	**45,264**	**52,736**	**87.9**	**59,984**

The combined land area in the primary and secondary impact areas is 18.4 million M2. Of this, residential units occupy 59.0% of the surface area with the remaining 41.0% distributed among the non-residential uses. Among the latter, vacant lots occupy the largest area (19.3%/ 3.5 million M2) with 3% in the primary impact area and 16.3% in the secondary.

With regard to building space, the Program's impact area has a total of 9 million M2, approximately half of the total land area. Of this, 86.5% of this space is residential buildings, of which 79.9% are houses and 6.6% are apartments.

[19] The categories used in the cadastral database do not differentiation between public and private sector activities.

Consequently, with very few exceptions, densities (measured as built space/ land surface) are relatively low for both residential and non-residential areas. The higher density levels are in the residential areas of sections 3 and 4 (1.41 and 2.18 per M2, respectively). See Table 11.

Densities	NON-RESIDENTIAL	RESIDENTIAL		
	Public or private activities	Apartments	Houses	Total
Primary	**0.98**	**0.70**	**1.06**	**1.00**
Section 1	0.93	0.19	1.16	1.00
Section 2	0.79	0.72	1.07	1.00
Section 3	1.35	1.41	0.90	1.00
Secondary	**1.04**	**1.52**	**0.90**	**1.00**
Section 4	1.29	2.18	0.75	1.00
Section 5	0.76	0.79	1.05	1.00
Total	**1.00**	**1.00**	**1.00**	**1.00**

Table 11
Impact areas of the Program: Densities per M2 in the primary and secondary areas classified by sections and types of economic activity (2014)

Source: Estimates made by the authors based on 2014 cadastral data

The current value of the stock of land and buildings. We use data from the cadastral system to estimate the current value of existing stock of land and buildings in the Program's impact areas, as these data approximate real estate market prices. [20] In this regard, the city has made a major effort to modernize its cadastral system, which has resulted in a significant increase in revenue, even with a major reduction in the real estate property tax rate. This modernization process is ongoing with the technical and financial support of Banobras (see Annex II).

Table 12 shows that in 2014 the total cadastral value for both impact areas is US$3.7 billion. For the primary area, this value is of US$2.1 billion, and for the secondary, it is US$1.6 billion.

Table 12
Xalapa - Impact areas: Current value of the stock of land and buildings (2014

Source: Estimates made by the authors based on 2014 cadastral data

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos

Impact areas	Number of properties	Total cadastral value		Average cadastral value of a unit (US$)	Land surface (m²)
		P$ million	US$ million		
Primary	36,316	34,179	2,063	56,799	8,228,493
Secondary	23,668	27,184	1,641	69,316	10,167,447
TOTAL	**59,984**	**61,363**	**3,703**	**61,738**	**18,395,940**

Using this database, the estimate of the average cadastral value per M2 of all properties in the Program's impact area is P$5,065 (2014). The average values per M2 range from P$1,032 for vacant lots located in Section 5 to P$7,521 for properties with public and private uses in Section 4. Likewise, the average cadastral value for residential use per M2 is P$5,405. See Table 13 (next page)

The impact of the interventions. The impact of the interventions on land and building prices inside the impact area is measured by estimating the increment of total valorization that the Program's interventions will generate. As discussed in the previous chapter, estimating this increment

[20] According to municipal government officials, cadastral values represent around 90% of their market value. The municipality monitors land and building value per M2 through the real estate property registry. Although this registry is part of the state government, the municipal cadaster office participates in the review process for title registration. In this way, the municipality can collect the data on the prices being registered to keep the cadaster up to date.

Table 13
Xalapa - Impact areas of the Program: Average cadastral value per M2 in the primary and secondary impact areas by section and type of economic activity (2014)

Sourc: Estimates made by the authors based on 2014 cadastral data

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos

Average cadastral value	NON-RESIDENTIAL				RESIDENTIAL			Total
	Public-private uses	Green spaces	Vacant lots	Subtotal	Apartments	Houses	Subtotal	
Primary	**5,994**	**1,931**	**1,275**	**3,096**	**5,443**	**5,268**	**5,284**	**5,098**
Section 1	5,591	1,942	1,177	2,889	5,752	5,000	5,014	4,832
Section 2	5,987	2,358	1,339	2,975	5,709	5,397	5,424	5,243
Section 3	6,522	1,286	1,334	3,548	5,218	5,595	5,508	5,304
Secondary	**6,773**	**2,218**	**1,302**	**2,214**	**5,357**	**5,686**	**5,612**	**5,015**
Section 4	7,521	2,505	2,033	3,724	5,139	6,113	5,774	5,526
Section 5	5,568	1,946	1,032	1,470	6,161	5,363	5,442	4,544
Total	**6,279**	**2,062**	**1,292**	**2,591**	**5,392**	**5,408**	**5,405**	**5,065**

is methodologically complex, and require sophisticated evaluation techniques and detailed information (cadastral and market) that is updated and, preferably, geo-referenced.

The following demonstrates how we estimated this increment in Xalapa with the information available in the cadastral database. The basic assumption in this analysis is that these interventions will reduce the differences in access to infrastructure, public facilities, services and workplaces within the project's impact area, thereby tending to equalize land values within the area.

Given this, we first perform a detailed analysis of the appraised values in the impact area using cadastral maps and the Street View option in Google Earth to review housing and other conditions of the area. Then, we develop a model to project property values under different scenarios.

• Map revision. Map 4 (from Google Earth) shows a partial view of the Program's impact area in which the abandoned passenger station is located at the center (the red lines indicate a distance of 400 meters on each side of the station). Within this same area, Map 5 displays the values per M2 contained in the cadastral map for the area located on the west side of Avenida Ferrocarril, below Avenida Miguel Alemán. As observed, the average value estimated per M2 of land in the streets facing the green space located along Avenida Ferrocarril Interoceánico is only half (P$828) of that in the street immediately behind (Street Norberto Martínez, P$1,584). It indicates that the market perceives this green space as a disadvantage (i.e. disamenity) rather than an amenity, perhaps because this space is undeveloped and perceived as unsafe. Uncertainty regarding property titles may also partly explain this.

Furthermore, the cadastral values along Avenida Miguel Alemán (P$4,660) are three to almost six times higher than those in other streets of the map, probably because the area is zoned for commercial activity.

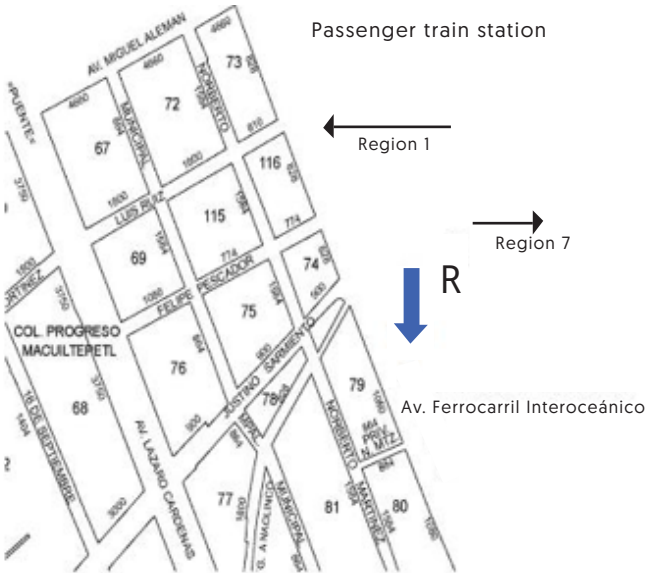
However, on the opposite side of the railroad tracks, properties around Parque de los Pinos have low cadastral values, similar to those along Avenida Ferrocarril, probably due to the lack of infrastructure and the proximity to a low-income neighborhood.

Aerial view abandoned passenger station

Map 4
Aerial view of the sites around the abandoned passenger station located in cadastral regions 1 and 7 along Avenida Ferrocarril Interoceánico in the Program's impact area

Source: *Google Earth*, May 2016

Xalapa - Cadastral region 1:
West side of Avenida Ferrocarril Interoceánico



Map 5
Cadastral region 1: West side of Avenida Ferrocarril Interoceánico

Source: Xalapa, Cadastral map.

This situation also contrasts with the values of the properties adjoining Macuiltépetl Ecological Park (see Map 6 next page). This park is completely developed and is located within the Program's impact area (cadastral region 1), less than one kilometer away from the Avenida Ferrocarril Interoceánico (the red line shows 800 meters). Here, the cadastral value of adjacent properties is P$3,000, almost four times more than the lots that face the green space along Avenida del Ferrocarril. Although it is not possible to ensure that Program interventions will raise property values

Aerial view abandoned passenger station

Map 6
Xalapa - Aerial view of the sites around the abandoned passenger station and Macuiltépetl Ecological Park located in cadastral regions 1 and 7

Source: *Google Earth*, May 2016

around the train station up to this level, we would expect them to rise significantly, as the result of the improvements of the project. In summary, based on the literature discussed above, the Program's implementation should help to reduce the differences in access to public facilities and services, as well as the dispersion of appraised values within the impact area.

• Analysis of scenarios. For ex-ante analysis, we propose several scenarios to address the following questions: How much will the value of existing stock of land and buildings increase? What will be the value of new buildings in the impact area? When will these increases take place?

The analysis of scenarios to address these questions involves the following steps: (i) estimation of the increase in the total value of the existing stock with Floor/Area Ratios (FAR) greater than 0.10 using a model; (ii) appraisal of the value of the new space built on vacant lots and in low-density areas with FARs of less than or equal to 0.10; and, (iii) distribution in time of the increment in the value of existing stock and new buildings.[21]

(i) Increase in existing stock's total value. To estimate the increment in the value of the existing stock, we use an econometric model of the type used in Computer Assisted Mass Appraisal (CAMA)[22] for real estate property appraisals. For this, we use the updated cadaster information provided by the city that was available for only one year. We first analyze the descriptive statistics on the distribution of appraised value per M2 within the impact area. Second, we develop a model using the variables that explain this variation. Finally, we use this model to do projections under different scenarios.

Table 14 and Chart 9 (next page) provide the descriptive statistics, the histogram and boxplot of the appraised value per M2 (2014) of all cadastral units with FAR superior to 0.10 that are located within the project's impact area.

In the boxplot (next page), the rectangular box in the center shows from the first to the third quartile (i.e. the interquartile range), with the median marked as a line in the center, and the "mustaches" that indicate the minimum and maximum values. The descriptive statistics show that the

[21] New construction on properties with FAR higher than 0.10 are excluded from the analysis.

[22] Some municipalities use computerized models to assist in the continuous updating of cadastral values. CAMA consists in the calibration of an econometric model using micro-data (i.e. individual transaction data) from the real estate property register or other sources, in which property value is the dependent variable and the characteristics of the lot and buildings are the independent variables (including the geographic coordinates of properties). CAMA is widely used in the United States. The International Association of Assessing Officers (IAAO) has developed detailed guidelines on its use (IAAO, 2013). Eckert (2008) argues that the use of these CAMA systems is viable and effective in developing countries; and also suggests ways to combine GIS with CAMA.

average appraised value per M2 is P$5,457 and the median is P$5,197. The charts and the descriptive statistics demonstrate that value distribution is relatively normal, but with a positive skew toward the units of higher cadastral value.

N	53,786					
	Mean	*Mean SE*	*SD*	*Variance*	*Skewness*	*Kurtosis*
Appraisal value P$ per M2	5,457	5.46	1,266	1,601,657	0.91	1.37
	Minimum	*1st quartile*	*Median*	*3rd quartile*	*Maximum*	*IQR*
Appraisal value P$ per M2	1,057	4,676	5,197	6,070	12,141	1,394

Table 14
Xalapa: Descriptive statistics and frequency distribution [P$]

Source: Estimates made by the authors based on 2014 cadastral data

Note: The total number of units (53,786) does not include the vacant lots (5,224), green space (162) or lots with FAR equal to or less than 0.10 (812)

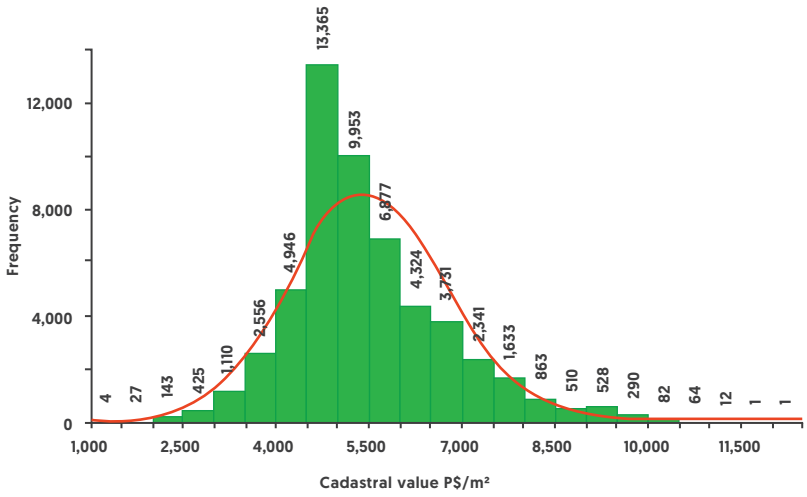
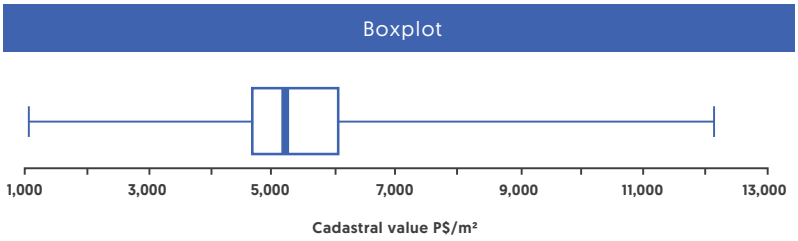


Chart 9
Xalapa - Histogram and boxplot [P$]

Source: Estimates made by the authors based on 2014 cadastral data



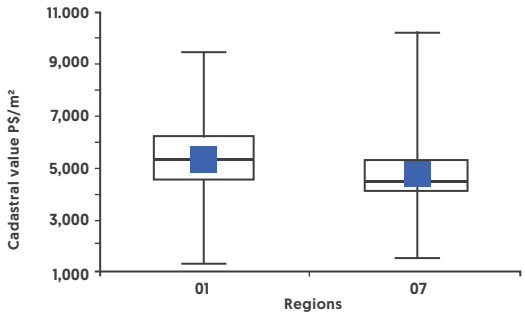
Boxplot

Source: Estimates made by the authors based on 2014 cadastral data

The cadastral database does not contain variables that allow the direct measurement of the impact that public facilities would have on the property values in the impact area (e.g. access to green space, bicycle lanes, schools and other public or private services). Nonetheless, we know from previous studies and site visits that some cadastral regions have more public facilities than others. For example, neighborhoods located at the west side (region 1) of the railroad tracks have better services than those on the east side (region 7).

Partially as a result of these differences, the boxplot in Chart 10 shows that the median appraised cadastral value per M2 (line in the center of the rectangular box) and the mean value (blue point) are higher in region 1 than in region 7. From this perspective, the interventions should improve the level of public facilities and services levels in region 7 up to levels similar to those in region 1. This, in turn, should cause the differences in the median and mean appraised cadastral values per M2 to drop. In graphic terms, the mean and median value per M2 of region 7 would move upwards in the direction of those of region 1, as increased equality of service levels would reduce the differentials in land value within the impact area.

Chart 10
Xalapa: Boxplot diagram for cadastral regions 1 and 7 (P$)



Source: Estimates made by the authors based on 2014 cadastral data

To analyze these changes, we calibrated a CAMA-type model using cadastral data from 2014, in which the total cadastral value is the dependent variable and the independent variables are the following[23]:

- Land surface (M2)
- Built area (M2)
- Year of construction
- Region 1 (binary): 1 = located in the region 1;
  0 = Not located in the region 1
- Residential use (binary): 1 = residential; 0 = other use
- Condition (binary): 1 = good condition; 0 = not good condition

The continuous variables are transformed into logarithms, and the model is calibrated using the Ordinary Least Squares Method to use the multiplicative model suggested by Eckert (1990). Table 15 shows the results.

R^2	0.896
R^2 adjusted	0.896
SE of fit (RMSE)	0.23567

Parameter	Estimate	95% CI		SE	VIF	p-value
Constant	8.340	8.313	to 8.366	0.0134	-	<0.0001
Region 1 binary	0.0661	0.0597	to 0.07257	0.0033	1.02	<0.0001
Residential use binary	-0.1119	-0.1235	to -0.1004	0.0059	1.05	<0.0001
Condition binary	0.1452	0.1326	to 0.1579	0.0065	1.02	<0.0001
log age	-0.0334	-0.0363	to -0.03056	0.0015	1.02	<0.0001
log of land area	0.2928	0.2892	to 0.2963	0.0018	1.55	<0.0001
log of building space	0.7789	0.7753	to 0.7825	0.0018	1.57	<0.0001

Table 15
Xalapa - Results for CAMA type model

Source: Estimates made by the authors based on 2014 cadastral data

These results show that the fit of the model is relatively good with a coefficient of determination (R2) of 0.896. Besides, all of the linear coefficients have the expected signs and are statistically significant. The linear coefficient of the binary variable region 1 is 0.0661, and its 95% confidence limits are 0.0597 and 0.07257. One way to interpret these coefficients is that the cadastral values in region 1 are 6% to 7% higher on average than the current land value the other regions, with a 95% confidence,

[23] Empty lots and those with FAR equal or inferior to 0.10 are excluded, as well as lands destined to leisure activities and the green spaces.

after controlling for other independent variables in the CAMA model. Chart 11 (next page) shows the scatterplot of the regression results.

There are different ways of using these results to generate scenarios. One scenario uses the results of the model for cadaster region 1 as a minimum in the estimations for all of the other regions in the Program's impact area. In other words, this scenario explores the impact of moving all cadastral values to the levels of region 1 by using the region's linear coefficient (6.61%) in the projections of the property valorization of the other regions, thereby reducing the differentials among the regions within the impact area.

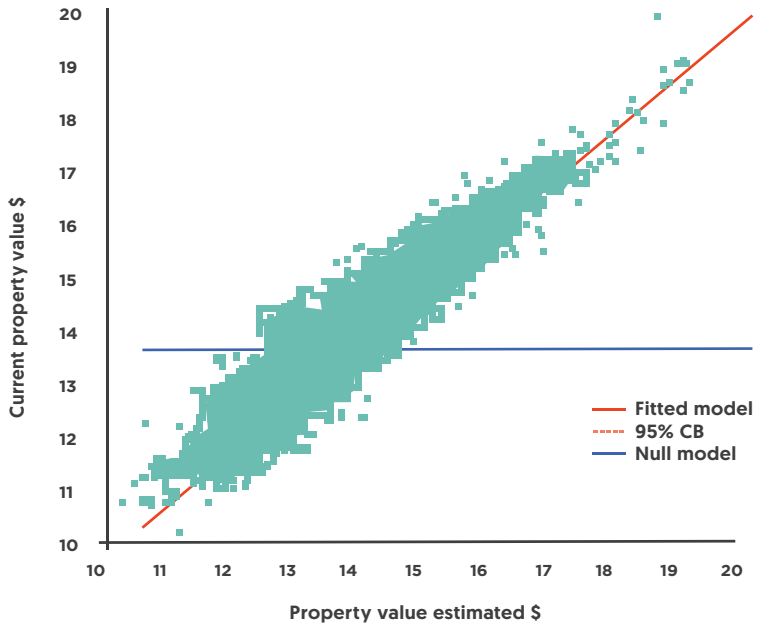


Chart 11
Xalapa - Scatterplot of the current property value and the value estimated using the CAMA model

Source: Estimates made by the authors based on 2014 cadastral data

Table 16 shows the estimates of the potential impact of Program interventions on the value of the stock of land and buildings using the scenario discussed above.

Impact areas	Stock's current cadastral value (*)	Projected cadastral value using the model	Impact	
			P$ millones	%
Total	**55,078**	**58,237**	**3,159**	**5.74**
Primary	32,768	34,452	1,685	5.14
Region 1[24]	7,283	7,283	-	-
Regions 2, 7 and 8	25,485	27,170	1,685	6.61
Secondary	22,310	23,785	1,475	6.61
Regions 10, 11, 16, 17, 13 and 15	22,310	23,785	1,475	6.61

Table 16
Xalapa - Estimation of the potential impact of interventions on the value of the existing stock of land and buildings in the Program's impact area (P$ million)

Source: Estimates made by the authors based on 2014 cadastral data

Note: (*) Vacant lots, green spaces or sites with FAR equal to or less than 0.10 are excluded because they will be covered in the next section on the construction of new buildings

[24] This conservative scenario does not include the valorization in region 1, because we are using it as the base of comparison with the other regions in the impact area. However, it is clear that this region will also benefit from the valorization generated by the interventions, as it is part of the defined impact area.

(ii) The potential for the construction of new buildings. We need to estimate the total value of new construction generated by the Program's interventions in each of Section i (See Map 2) within the impact area (VCONSTi). The first step is to use cadastral data to estimate the total land area with potential for construction of new buildings in each Section i (PAREAi). We assume that all new building construction will be carried out on the 6,036 lots that are vacant or have FARs that are equal to or less than 0.10[25] (even though some existing buildings could be expanded or replaced by larger ones). Next, we multiply PAREAi by the percentage of the total surface area available for new construction under the setback (COS) and FAR coefficients of the municipal land use regulation (PUSEDi), and then by the ratio built space/land surface available for construction (RSPACEi) to generate the total area of new construction in Section i. Finally, we use the average cadastral value per M2 of the buildings (AVALUEi) as a conservative estimate of the value of the new units.

The following equation summarizes the method used:

$$VCONST_i = PAREA_i * PUSED_i * RSPACE_i * AVALUE_i$$

Where:

$VCONST_i$ = Projected total value of the new buildings generated by the Program in section i.
$PAREA_i$ = Total lot surface with potential new construction in section i (vacant lots and with FAR equal to or less than 0.10 in section i).
$PUSED_i$ = Percentage of the lot surface available for construction in section i.
$RSPACE_i$ = Ratio total construction/ total surface on land available for construction in section i.
$AVALUE_i$ = Average cadastral value per M2 of construction in section i.

Table 17 shows that the total surface area of the vacant and low-density lots in the primary and secondary impact areas is 6.3 million M2 (3.5 million M2 correspond to vacant lots, and 2.8 million M2 are low-FAR properties).

Impact sections and areas	<10%	Vacant lots	Total
Primary	**804,201**	**546,878**	**1,351,079**
Section 1	324,125	149,022	473,147
Section 2	397,987	268,139	666,126
Section 3	82,089	129,717	211,806
Secondary	**2,018,090**	**2,995,984**	**5,014,074**
Section 4	911,173	1,163,565	2,074,738
Section 5	1,106,917	1,832,419	2,939,336
Total	**2,822,291**	**3,542,862**	**6,365,153**

Table 17
Total area of vacant and low-density (low-FAR) lots in the primary and secondary impact areas (M2)

Source: Estimates made by the authors based on 2014 cadastral data

[25] Vacant lots (5,224) and sites with low FAR (812). The 162 units for recreation and green spaces are not included in this part of the analysis.

Based on the usual land use coefficients in the area, it would be possible to construct 4.8 million M2 of new building space on the land available for new construction in the impact area.

Impact sections and areas	New building area
Primary	**1,013,309**
Section 1	354,860
Section 2	499,595
Section 3	158,855
Secondary	**3,760,556**
Section 4	1,556,054
Section 5	2.204,502
Total	**4,773,865**

Table 18
Xalapa - Potential new construction in the primary and secondary impact areas (M2)

Source: Estimates made by the authors based on 2014 cadastral data

Note: PUSEDi = 50%; RSPACEi = 1.5

Finally, using the average cadastral values per M2 of construction for each section, the maximum total projected land and building value that the Program could generate in the impact area is P$17 billion (US$1.05 billion), assuming that all vacant and underused lots are developed to their utmost potential.

Impact sections and areas	Average cadastral value per M2 of buildings (*)	Total cadastral value projected (**)
Primary	-	**3,656,623,974**
Section 1	3,642	1.,292,313,758
Section 2	3,602	1,799,371,103
Section 3	3,556	564,939,113
Secondary	-	**13,662,763,586**
Section 4	3,688	5,739,300,207
Section 5	3,594	7,923,463,.379
Total	-	**17,319,387,561**

Table 19
Xalapa - Projection of the total land and new building value in vacant and low-density lots in primary and secondary impact areas (P$)

Source: Estimates made by the authors based on 2014 cadastral data

Note: (*) The values of the vacant lots, parks, and lots with construction value equal to zero are not part of the calculation
(**) It includes land and new constructions' value

(iii) Distribution of the increase over time. These increases in the total value of the existing stock and new construction will occur over time, as the market internalizes the improvements made by the Program. This impact on prices will depend in part on the confidence of the market that interventions will be carried out as planned. In our scenario for the existing stock, we assume that, in the primary impact area (where the bulk of the interventions are concentrated), 100% of the total projected valorization will take place during the first 5 years versus 50% in the secondary impact area. Regarding new construction, based on expert opinion, we assume that, in the primary impact area, only 10% of the total projected valorization will take place during the first five years versus 5% in the secondary impact area.

The total projected increase in the value of all properties in the impact area is 23.13%. The projected increase over the first five years is 5.03%. (See Table 20)These simulations are based on the methodology described above, assuming stable national and municipal macroeconomic conditions. As the cadaster modernization progresses, real estate sales data from the property register will allow more precise estimations.

Financial prefeasibility. One way of doing the financial prefeasibility analysis of value capture is to evaluate whether it can cover the costs of the intervention. Given that one of the objectives of these case studies is to assess the potential value capture to finance urban interventions, we focus first on the viability of capturing enough value to cover just project costs. In this way, we will analyze whether the valorization is lower than, equal to or higher than the costs of the intervention.

Table 20
Xalapa - Total projected increase in value over a five year period .

Source: Estimates made by the authors based on 2014 cadastral data

Impact areas/ Existing stock and new buildings	Current total cadastral value P$ million	Total potential Increase of cadastral values		Percentage of the increase to occur in the first five years [26]	Increase in the first five years	
		P$ millones	%		P$ millones	%
TOTAL	**61,363**	**14,195**	**23.13**	**-**	**3,087**	**5.03[27]**
Primary	**34,179**	**3,931**	**11.50**	**-**	**1,910**	**5.59**
Existing stock of land and buildings	32,768	1,685	5.14	100%	1,685	5.14
Land with new building construction	1,411	2,246	159.18	10%	225	15.92
Secondary	**27,184**	**10,264**	**37.76**	**-**	**1,177**	**4.33**
Existing stock of land and buildings	22,310	1,475	6.61	50%	738	3.31
Land with new building construction	4,874	8,789	180.32	5%	439	9.02

Table 21 (next page) shows that a payment of only 0.13% of the total value of the stock of land and buildings (line I) would cover the Program's total cost. Similarly, valorization generated by the project is considerably superior to the Program's estimated costs, representing 0.6% of the expected total valorization and 2.6% of the valorization expected during the first five years of the Program. These results demonstrate the viability of financing the Program's interventions using a value capture instrument that allows cost recovery and could also provide additional revenues to finance other infrastructure projects necessary for the city's development.

Identifying and designing the value capture instrument. Once financial prefeasibility is established, we proceeded to identify and design the instrument that best captures the revenues necessary to finance the intervention. Consultants and city government representatives from the cadaster, urban development, and finance departments participated in this identification.

Initially, two potential instruments were identified for analysis in the city of Xalapa: Tax Increment Financing and betterment levies. An analysis

[26] These percentages are based on cost weighting of the interventions in each impact area..

[27] Ex-post evaluations on the impact of Business Improvement Districts (BIDs) on the valorization of lands within their impact areas showed increases of up to 9.3% in the first five years starting from the beginning of project implementation (see Ha, S., 2011). Therefore, we consider that the results obtained are consistent with previous experiences and represent a conservative scenario.

Table 21
Xalapa - Financial prefeasibility analysis

Source: Estimates made by the authors based on cadastral data and ALG's cost information (2014)

LINES	Components/ Estimations	Scenario A (without private sector)	Scenario B (with private sector)
A	Total cost of the Program (P$000s)	79,536	79,536
B	Percentage of investment financed by private sector partners (100% of the passenger station revitalization)	0.0%	10.4%
C = A * B	Investment financed by private sector partners (P$ 000s)	0	8,285
D = A - C	Cost of the project to be financed by the municipality with different revenue sources (P$ 000s)	79,536	71,251
E	Percentage financed with the city's general investment budget	0.0%	0.0%
F = D * E	Financed with the city's general investment budget (P$ 000s)	0	0
G = D - F	Municipal financing through land value capture (P$ 000s)	79,536	71,251
H	Current total cadastral value of the stock of land and buildings in the Program's impact area (P$000s)	61,363,274	61,363,274
I = G/ H	Cost of the Program financed by the city through value capture/ Current cadastral value of the stock of land and buildings	0.13%	0.12%
J	Impact of the interventions: % projected increase in total cadastral value in the first 5 years	5%	5%
K	Property valorization due to the Program's interventions in the first 5 years (P$ 000s)	3,086,550	3,086,550
L = D/ K	Cost of the Program/ valorization in the first 5 years	2.6%	2.3%
M	Total land lot valorization derived from the Program's interventions (P$ 000s)	14,195,000	14,195,000
N = D/ M	Cost of the Program/ total valorization generated by the Program	0.6%	0.5%

of the instruments based on their financial feasibility and the policies currently governing municipal administration in matters of taxation and indebtedness revealed that betterment levies were the most viable choice.

• Tax Increment Financing. The study of this land value capture instrument to finance the Program was based on the estimated increase in the property tax collection due to the increase of total cadastral value. Table 22 (next page) presents the estimated impact of valorization on municipal revenue from the property tax.

Although the increase in total cadastral value is superior to P$3 billion, the increase in property tax collection would only be of P$7.38 million, due to the tax's low rate (0.052%). If we consider that intervention costs are P$79.5 million, the increase in city revenue would be insufficient to support the debt necessary for financing the Program. Although raising the tax rate could enable the use of this instrument, the municipality considered this impractical, making this instrument inviable in the case of Xalapa.

Table 22
Xalapa - Projection of property tax's total increase (P$ millones)

Source: Estimates made by the authors based on 2014 cadastral data

Impact areas	Cadastral base increase for the first 5 years	Increase in property tax collection for the first five years	Total increase of the cadastral base	Total increase in property tax collection
	A	B = A * 0.052%	C	D = C * 0.052%
TOTAL	**3,087**	**1.61**	**14,195**	**7.38**
Primary	**1,910**	**0.99**	**3,931**	**2.04**
Existing stock of land and buildings	1,685	0.88	1,685	0.88
Land with new building construction	225	0.12	2,246	1.17
Secondary	**1,177**	**0.61**	**10,264**	**5.34**
Existing stock of land and buildings	738	0.8	1,475	0.77
Land with new building construction	439	0.23	8,789	4.57

• Betterment levies. Betterment levies or a temporary increase in the property tax rate were considered the most viable instruments, as they are legally sound, as well as transparent and straightforward for use at the municipal level. The use of other instruments (e.g. exactions or building rights charges) could require more complex institutional structures.

An additional advantage of betterment levies (which does not apply in the case of a temporary increase in property tax rate) is that revenue collected must be used to finance the interventions (or improvements) that generate the valorization. The stronger the link that the beneficiaries perceive between the payment for and the benefits derived from the interventions (e.g. improved infrastructure and services and increase in the value of their properties), the greater will be their willingness to pay. For this reason, it is important that local authorities employ a legal budget mechanism to earmark the revenue received from the levies for the exclusive use of the project.

How to estimate the amount of the betterment levy? Line A in the following table shows the relationship between the Program cost financed by the city through value capture and the current cadastral value of the stock of land and buildings in the impact area. This shows that in a scenario without private sector participation, the total amount of the needed contribution to finance the project corresponds to 0.13% of the current cadastral value of the stock of land and building in the impact area.

We estimate the amount of a one-time levy for the owner of a unit with an average cadastral value by multiplying the cost/value percentage (line A) by the property's average cadastral value (line B). The result for an average property value of around P$1,023,000 (US$61,738) would be a single payment of P$1,330 (US$80) or annual payments of P$266 (US$16) during five years (line D) (See Table 23). This information would help the city to estimate whether it would be necessary to take on debt if the revenues would not be sufficient to cover the project's cost during its execution.

Table 23
Xalapa - Viability of implementing betterment levies

Source: Estimates made by the authors based on cadastral data and ALG's cost information (2014)

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos

Lines	Components/ Estimations	Scenario A (without private sector)		Scenario B (with private sector)	
		P$	US$	P$	US$
A	Cost of the Program financed by the city through value capture/ Current cadastral value of the stock of land and buildings	0.13%	0.13%	0.12%	0.12%
B	Average cadastral value of a property in the Program's impact area	1,023,000	61,738	1,023,000	61,738
C = A * B	Single payment of betterment levies for a property of average cadastral value	1,326	80	1,228	74
D = C/ 5	Equal annual payments for 5 years	265	16	246	15
E = B * 1%	Hypothetical 1% increase in average cadastral value	10,230	617	10,230	617
F = B * 2%	Hypothetical 2% increase in average cadastral value	20,460	1,235	20,460	1,235
G	Impact of the interventions: % of cadastral base increase for the first 5 years	5%	5%	5%	5%
H = B * G	Valorization of a property of average cadastral value derived from Program interventions in the first 5 years	51,457	3,105	51,457	3,105

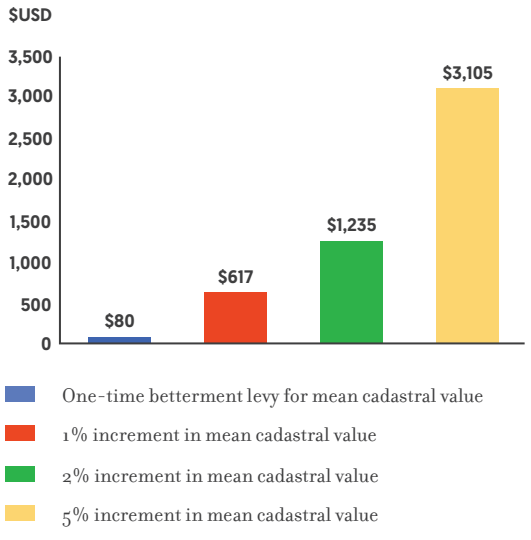
Furthermore, to compare the amount of the levy with the potential valorization that the Program would generate, we compared the amount of the levy with hypothetical 1% and 2% increases in the average cadastral value (lines E and F). Since Program costs are relatively low (with respect to the current stock value), valorization exceeds the amount of the levy even with increases in the average cadastral value lower than 1% or 2%.

How to make value capture affordable? To analyze affordability, we can group properties using variables of the municipal cadastral database, such as by quartiles based on cadastral value, types of land use (e.g. residential or commercial) or impact area characteristics (e.g. infrastructure deficits).

Table 24 (next page) shows the results of an affordability analysis for value capture done for the city of Xalapa, in which we group the properties into quartiles based on their cadastral values. In this way, the first quartile (Q1) holds the properties with the lowest cadastral values, and the fourth quartile (Q4), those with the highest values. Line A shows the distribution of the total current cadastral value of the stock of land and buildings (P$61.3 billion - US$3.7 billion) among the quartiles. By far the highest concentration of cadastral value is in the fourth quartile (61.2%).

The next step is to allocate the program costs among the quartiles, as shown in line B. The highest percentage is allocated to the properties in the fourth quartile, given their higher cadastral values, valorization levels and payment capacity.

Chart 12
Xalapa - Comparative analysis of the betterment levies single payment and the increase in the average cadastral value (US$)



Source: Estimates made by the authors based on 2014 cadastral data

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos

Table 24
Xalapa - Affordability analysis of betterment levies for properties grouped into quartiles based on their cadastral value

Source: Estimates made by the authors based on cadastral data and ALG's cost information (2014)

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos

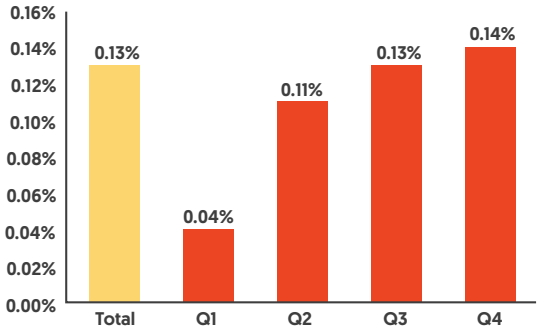
COLUMNS	VARIABLES	TOTAL	PROPERTIES GROUPED INTO QUARTILES (Q) BASED ON THEIR CADASTRAL VALUE			
			Q1	Q2	Q3	Q4
A	Current total cadastral value of the stock of land and buildings in the impact area of the Program (P$000s)	61,363,274	3,889,509	7,426,028	12,512,256	37,535,491
B	Total Program cost allocation among quartiles (%)	100,0%	2.0%	10.0%	20.0%	68.0%
C	Total Program cost allocation among quartiles (P$ 000s)	79,536	1,591	7,954	15,907	54,084
D = C / A	Cost of the Program financed by the city through land value capture/ Current cadastral value of the stock of land and buildings (%)	0.13%	0.04%	0.11%	0.13%	0.14%
E	Average cadastral value of a property in the Program's impact area (P$)	1,023,000	259,370	495,194	834,366	2,503,031
F = D * E	Total value of betterment levies for a property of average cadastral value (P$)	1,326	99	530	1,060	3,612
G = F / 5	Equal annual contribution payments for 5 years (P$)	265	20	106	212	722
H = E * 1%	Hypothetical 1% increase in average cadastral value (P$)	10,230	2,594	4,952	8,344	25,030
I = E * 2%	Hypothetical 2% increase in average cadastral value (P$)	20,460	5,187	9,904	16,687	50,061
J	Impact of the interventions: % of cadastral base increase for the first 5 years	5%	5%	5%	5%	5%
K = E * J	Valorization of a property of average cadastral value due to Program interventions in the first 5 years (P$)	51,457	13,046	24,908	41,969	125,902

Under this scenario, the property owner in the 1st quartile (the 25% of owners with the lowest cadastral values) would have to pay an annual levy of P$20 for 5 years, while the valorization of the property of average value would exceed P$13,000. Chart 13 illustrates how the project cost/ stock value (the rate of the levy) in (line D) increases only moderately for the last three quartiles, because the relative allocation of costs and cadastral values among the quartiles are very similar (line A).

Chart 14 (next page) summarizes these results of the affordability analysis for Xalapa's Program.

Finally, to increase the effectiveness of value capture using this instrument, many cities have created Betterment Improvement Area (BIAs) [28] to provide additional services or infrastructure to the businesses located within this improvement area, after reaching agreement with the property owners on the levels of betterment levies. Residential properties usually do not pay this levy. The district's governance is usually by a board of directors selected from representatives of businesses in the district, the municipal government and other contributing entities. Besides preparing the relevant financial reports, an independent audit is usually required.

Chart 13
Xalapa - Distribution of betterment levy rates for properties grouped by quartiles according to their cadastral value



Source: Estimates made by the authors based on 2014 cadastral data

[28] Also called Business Improvement Districts, Business Revitalization Zones and Community Improvement Districts.

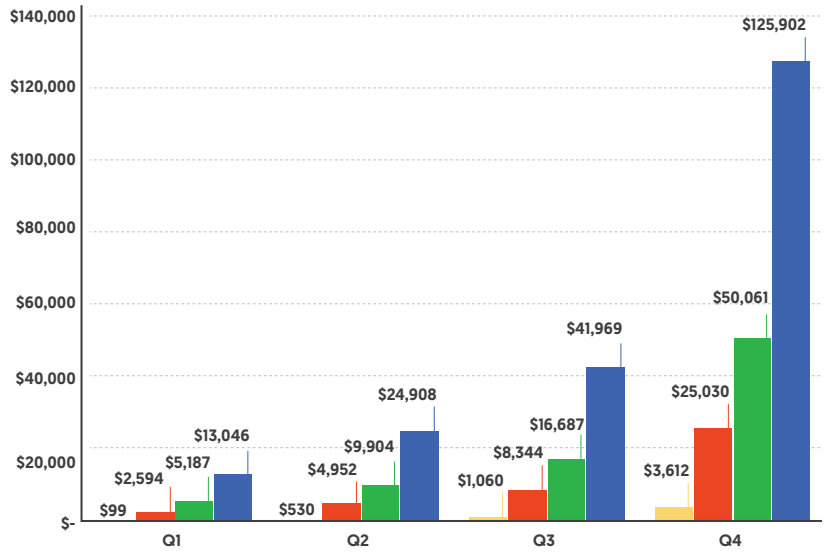


Chart 14
Xalapa - Summary of the results of affordability analysis: Amount of the one-time betterment levy and the increases in the average cadastral values by quartile (P$)

- The amount of betterment levy for a property of average cadastral value
- Hypothetical valorization of 1% in the average cadastral value
- Hypothetical valorization of 2% in the average cadastral value
- Projection of the valorization in average cadastral value based on the Program interventions in the first 5 years

Source: Estimates made by the authors based on 2014 cadastral data

Note: Exchange rate at time of calculations US$1 = $16.57 Mexican pesos

3 . Conclusions and recommendations

In broad terms, the Program's interventions aim at the revitalization of abandoned structures, improvement of green spaces and provision of infrastructure. We explored the viability of using value capture to finance these types of projects. To this end, we developed the case study that examines the financial prefeasibility of value capture and identified the most appropriate instruments for so doing, taking into account the methodological points discussed in previous chapters.

Using the proposed methodology, we established via analysis of cadastral data and development of valorization models that land value capture could potentially finance the interventions proposed by the Program. Our estimate of the total increment in cadastral value, due to the Program's interventions could reach up to P$14 billion (23% of the current stock's cadastral value) and that a 5% valorization would be obtained during the first five years.

Furthermore, the financial prefeasibility analysis showed that the costs are considerably lower than valorization, representing only 2.6% of the projected increase in valorization during the Program's first 5 years. Given this financial viability of financing the Program via value capture, we moved to identifying and designing the most appropriate instrument for this particular case.

Together with municipal officials and other local professionals, we explored the possibility of using Tax Increment Financing or betterment levies as instruments for capturing capital gains. We rejected this first option due to the insufficient flow of revenues from the property tax due to its very low rate. In the case of betterment levies, the financial prefeasibility and affordability analysis showed that the estimated amount of the levy would be significantly lower than a valorization of only 1%. We, therefore, concluded that regarding legal, institutional and financial viability, the land value capture instrument with the highest potential for effectively financing the Program in Xalapa is betterment levies.[29]

Using the proposed methodology, we established via analysis of cadastral data and development of valorization models that land value capture could potentially finance the interventions proposed by the Program.

[29] An alternative structure for financing the rehabilitation of passenger station could be a PPP (e.g. concession or leasing). A private partner could be interested in financing part of the investments required for this station, given the income from the planned business activities for this renewed space (e.g. restaurants, galleries and other retail).

With regard to the implementation of the Program, a first step would be to formulate an investment plan that incorporates the strategy for the generation of value and its capture, including the instrument identified as viable. This plan should outline the steps involved in setting up the legal structure required for the municipality to work effectively with a private partner (if it so desires), as well as the social marketing strategy to establish a new image for the neighborhoods in the impact area. Establishing this new image can be one of the most important elements for value generation in the plan.

Likewise, once the municipality resolves the issues related to ownership and control in the impact area, it will be able to prepare an action plan with the participation of all stakeholders (e.g. residents, neighborhood associations, commercial establishments, service providers, etc.).

With regard to the implementation of the interventions and in line with the Action Plan *Xalapa Sostenible*, we make the following recommendations:

• Finish cadaster modernization. It is quite important, because it is one of the main sources of revenue for the city, and also provides relevant information for implementing financing strategies based on value capture.

• Gain control of the green spaces that surround the passenger station. This is crucial for the rehabilitation of these areas, so that they can be transformed into user-friendly public facilities, and also contribute to enhance quality of life of citizens in adjacent neighborhoods.

Note that the national entity that currently controls the remaining properties from the privatization of railways, still holds part of the area near the station, including several hectares of undeveloped green space. Transferring control of these properties to the municipality is a key element in the neighborhood improvement process, since only in this case will the city be able to initiate the improvements necessary to open these green spaces to the general public.[30]

• Close the agreements on development rights of the abandoned passenger station. The issues about the control of these rights are rather complex. According to the municipal cadaster, three different organizations control the buildings related to the train station and the adjacent plot.

The rail system concessionaire (*Kansas City Southern Mexico - KCSM*) controls part of the buildings, which it uses for office space. A part of the waiting area of the passenger station and the adjacent building (with approximately 2,000 M2) has reportedly been transferred to the government of the State of Veracruz for educational purposes. Nevertheless, according to local officials, the possibility of implementing some of the proposals in *La Estación de Todos* from the *Conectando Xalapa* plan could be explored (e.g. train-museum, artisan market and center for municipal service provision). Therefore, we suggest that the discussions with the state government begin as soon as possible to make this intervention viable.

• Analyze the feasibility of forming a PPP that could finance the improvements and operation of the renewed passenger station. Incorporating commercial activities, such as restaurants or coffee shops, gymnasiums and, perhaps, some convenience stores, could attract people to the area and help to finance the necessary investments for the station's rehabilitation.[31]

The estimated amount of the levy would be significantly lower than a valorization of only 1%.

[30] At the moment, this area is undeveloped and partially fenced in with barbed wire.

[31] Regarding this type of interventions, there are successful experiences that are worth mentioning, such as those in Medellín, Colombia.

• Discuss proposals for the development of a bicycle lane alongside the railway lines, the pedestrian bridge and the recovery of the abandoned train cars with the relevant national entities and the concessionaire. The Secretariat of Communications and Transport (SCT) is responsible for regulating the concession of railroad-related activities granted to KCSM. On this matter, we suggest that the municipal local authorities discuss with SCT and KCSM the viability of developing the bicycle lane proposal and the possibility using the abandoned train cars beside railway lines (e.g. renovation, transformation or removal).

• Modify the regulations on land use to make the proposed interventions viable and to raise density levels. Given the need for greater commercial and services activity in the Program's impact area, the city could modify the zoning regulations. Also, it could act quickly to modify the land occupation and land use coefficients (COS and FAR) [32], taking them to levels that facilitate an environmentally proper development of higher density and nearer to the workplaces. These adjustments in coefficients would also allow the real estate market to respond to the increases in property value.

• Implement a neighborhood-improvement program for railroad settlements. Legalizing property titles of the housing units located in the impact area would have a significant impact on the value of real estate, as well as on the wealth and well-being of low-income families located in the area.

• Introduce a support program for low-income families, especially those that are not owners (e.g. tenants). Due to the increases in property values resulting from the Program, households living in rented units can be forced out by rising rents. Therefore, it is important that the municipality considers several different housing alternatives, including rental units, when necessary. Developing solutions aimed at specific market sectors (e.g. students) can be useful and should be discussed at the local level.

B. Quetzaltenango: Case Study on the Project to Revitalize the Intercultural and Sports Center

1. General context

Quetzaltenango, also called Xela or Xelajú, is considered the second most important city in Guatemala. Located in the country's southwest, it is a multicultural city, home to approximately 155 thousand people. Its population is mainly young (under 25 years old) and presents positive indicators in terms of human development and quality of life as compared with other cities of the country. Commerce is one of its main economic activities, driven to a great extent by the trade of agricultural commodities from bordering municipalities. The education and the tourism sectors also stand out as important (IDB, 2014).

As part of the territorial planning and mobility strategies proposed by the Xelajú Sostenible Action Plan, the Intercultural Center Revitalization Project (hereafter the Project) is one of the key initiatives for the economic and cultural revival of the city. According to the Action Plan "The Intercultural Center is the perfect place for its character and size to be converted to a place of mixed use that can boost many more economic and cultural projects" (IDB, 2014).

[32] Land Use Coefficient (COS) = Footprint of the building / Total land area of the lot, and the Floor Area Ratio (FAR) = Floor area of the building/ Total land area of the lot. FAR is called the Coeficien-te de Utilización del Suelo (CUS) in Xalapa.

In this way, the Project seeks to convert the Intercultural Center into a space that makes it possible to market goods and services, such as visual and audiovisual arts, design, recreational and sports services, etc. It requires the restoration of existing structures, the redesign of green space, the provision of urban furniture and basic infrastructure, as well as opening access points for pedestrian traffic (IDB, 2014).

Quetzaltenango and its location in Guatemala

Map. Quetzaltenango
and its location in Guatemala

Source: www.lahistoriaconmapas.com

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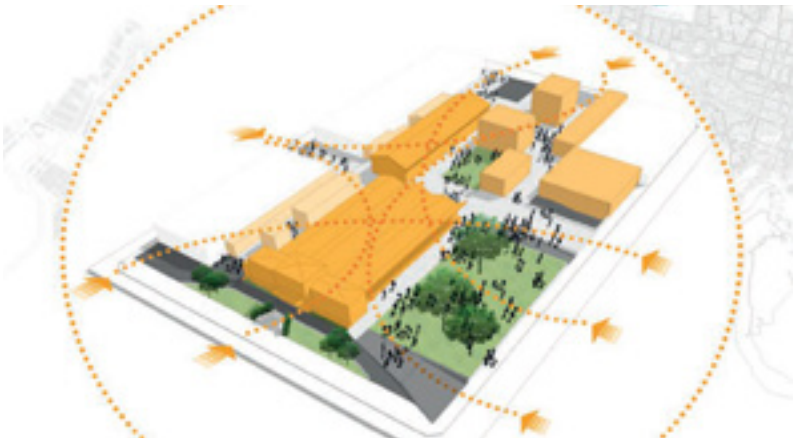
2 . Application of the methodology

Concise Project Description. As in the previous case study, the strategy is to finance the Intercultural and Sports Center Project by selecting those components that contribute most to the generation of higher value and

its capture, so as to generate the resources necessary to finance the required infrastructure investments. Valorization depends on harnessing the potential of the underused buildings and open spaces that are part of the Intercultural Center, as well as on improving the quality of its infrastructure.

Xelajú Sostenible Action Plan (2014) provides background on the Project's site: "in 1912, the construction of the *Estación del Ferrocarril de los Altos* begins on the first and only electric railroad in the country that would connect Quetzaltenango and the South Coast of Guatemala. On March 30, 1930, the station and the new transportation system are opened, but unfortunately, on September 19, 1933, a heavy storm destroys the railroad tracks (. . .), and the station is abandoned." Later, 1961, the station was turned into a military base. After the peace accords, the control of the building was transferred to the municipality to use for promoting cultural activities. In 2005, the city assigned the Center's land and buildings to the Intercultural and Sports Council of Quetzaltenango (hereafter the Council), that has been in charge of its administration since that time.

The superblock of Quetzaltenango's Intercultural Center



Map 7
The superblock of Quetzaltenango's Intercultural and Sports Center

Source: IDB (2014)

The Intercultural Center (also known as the superblock) is located in one of the main business centers of the city (cadastral Zone 3) and has a surface of approximately 40,000 M2. The municipality controls the land and the buildings that are part of it, except for the section on the west side (used by the national government for the offices of the national Highway Maintenance Department), and the block's right upper corner, that is privately owned (see white blocks in Map 7). These areas are not included in the analysis.

Within the buildings that are part of the Center and the Project, two buildings occupy a total of around 6,000 M2 that can accommodate 3,350 seats that are used for different events (e.g. real estate exhibitions, furniture, etc.). There are four additional buildings of different dimensions, some of which are abandoned. In general, the buildings inside the Center require significant improvements to increase their potential. The site also has considerable parking space. The block is usually closed to pedestrian traffic (rather than being open as suggested in Map 7), except for when it is opened for specific activities or public events.

Investments made to improve buildings and adjoining areas would contribute to add value to the super block and its impact area while contributing to the economic, social, cultural and sports objectives of the Center. However, one of the main obstacles for this has been the persistent lack of resources to renovate these buildings and their surroundings. Table 25 shows the estimated costs of the Project components that we judge feasible to implement during the next five years and their estimated costs for two overlapping stages.

Table 25
Quetzaltenango - Estimated costs of the Intercultural Center Project and investments within Zone 3 by stages and components (Q$)

Source: Estimates made by the authors based on cost data included in the Action Plan (2014)

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

STAGES/COMPONENTS	TOTAL	YEARS				
		1	2	3	4	5
TOTAL COST: STAGE 1 Y 2	**42,120,000**	**1,170,000**	**4,680,000**	**10,920,000**	**12,870,000**	**12,480,000**
STAGE 1						
Subtotal cost Stage 1	**7,020,000**	**780,000**	**1,560,000**	**1,560,000**	**1,560,000**	**1,560,000**
Investment plan	780,000	780,000	-	-	-	-
Intercultural Center: Rehabilitation of the existing buildings and revitalization their surrounding areas	6,240,000	-	1,560,000	1,560,000	1,560,000	1,560,000
STAGE 2						
Subtotal cost Stage 2	**35,100,000**	**390,000**	**3,120,000**	**9,360,000**	**11,310,000**	**10,920,000**
Cadaster modernization	6,240,000	390,000	1,560,000	1,560,000	1,560,000	1,170,000
Planned Green Corridor from 4ta Calle towards Cerro El Baúl	18,720,000	-	780,000	3,900,000	7,020,000	7,020,000
Implementation of plan to improve traffic flow in Zone 3	10,140,000	-	780,000	3,900,000	2,730,000	2,730,000

The first stage of the Project involves the development of an investment plan for Zone 3, rehabilitation of existing buildings and revitalization of their surrounding areas. The second stage includes cadaster modernization and general improvements in infrastructure in Zone 3, as defined in the Action Plan and the Land Use Plan (POT). Modernizing the city's cadaster would provide resources not only for improvements in Zone 3 but also for the rest of the city. The estimated costs for stages 1 and 2 are of Q$7.02 million (US$900,000) and Q$ 35.1 million (US$4.5 million), respectively.

Impact area of the intervention. The impact area is the area over which the Project affects land and building values. The improvements carried out in the Intercultural Center have the potential to generate value by making land use more productive in the surrounding areas by providing goods and services to residents and attracting more customers to businesses located in the area.

The superblock is located on Quetzaltenango's main commercial street (4ª Calle), in one of the most accessible and high-value areas of the city. Map 8 shows the location of the Center within the central business district of the city (Zone 3), at the intersection of the main arterial roads running from north to south (19th Avenue) and east to west (4th and 7th Street). The POT proposes a Bus Rapid Transit for these roads.

As in the case of Xalapa, in the absence a modern cadastral system with updated property values, we used the cadastral sectors as our unit of spatial analysis in the definition of the impact area. In defining this area, we worked with municipal officials including those responsible for the city's cadaster and property tax administration, the consultants who formulated the POT and the Plan de Ordenamiento Económico Territorial (POET) [Economic Land Use Plan], and professionals from the Geomatics Laboratory of the Division of Science and Technology of the University San Carlos of Guatemala – Centro Universitario de Occidente (CUNOC). After our preliminary analysis of the information in the cadastral database, we decided to define all of cadastral Zone 3 as the Project's impact area.

Intercultural Center's Location

Map 8
Intercultural Center's Location

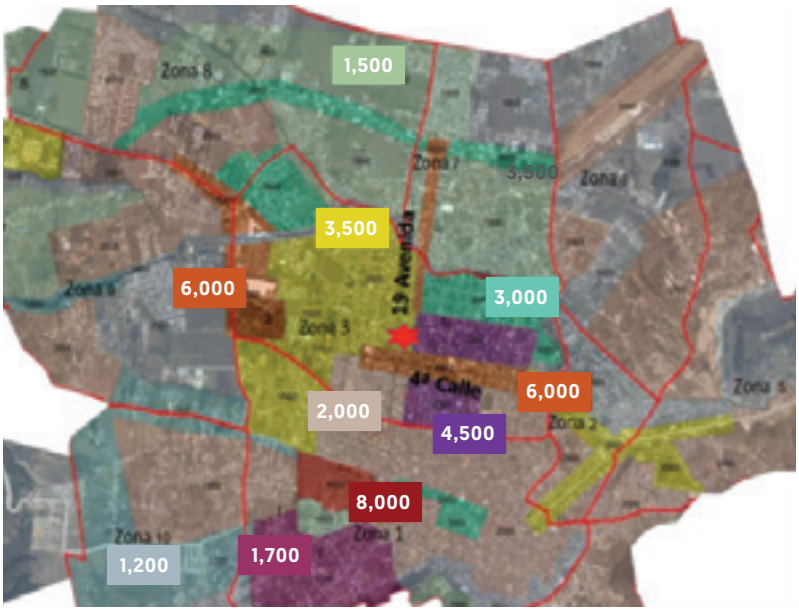
CENTRALIDADES

- Centro Intercultural
- Metropolitana
- Barrial / Vecinal
- Potencial
- Predio con potencial
- BRT

Source: Summary Map, Graphic Atlas, POT (2014)

Average cadastral values in Zone 3 (homogenous areas) can range up to Q$6,000 per M2 (US$770) in 2013, as is the case of the properties located along the 4a Calle. See Map 9. Although the Intercultural Center is located in the middle of the commercial area of highest value in the city, the appraised values of the land located on the four streets that surround it vary considerably. It is due in part to the fact that the super block is normally closed to pedestrian traffic and recreational activities. As a result, the average land value per m2 along the 4a Calle is around Q$ 6,000 (indicated with a brown color in Map 9) but falls precipitously in the surrounding areas (Q$ 4,500 - purple, Q$ 3,500 - yellow and $ 3,000 - green). We, therefore, expect that the investments required for the revitalization of the Intercultural Center will cause valorization in the surrounding areas by providing additional services and improving accessibility (by allowing pedestrians to walk diagonally across the block).

Homogenous areas in terms of land value per m²



Mapa 9
Quetzaltenango - Homogenous areas in terms of land value per m2 in Q$ by area (2014)

- ★ Inter-cultural center
- *Zone boundaries*
- Q$ 8,000
- Q$ 6,000
- Q$ 4,500
- Q$ 3,500
- Q$ 3,000
- Q$ 2,000
- Q$ 1,700
- Q$ 1,500
- Q$ 1,200

Source: Montes, M. et al. (2014)

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

The current value of the stock of land and building. To estimate these values in the Project's impact area, we used the information available in the databases of the cadaster and the real estate property tax, and also academic studies.

According to the Action Plan (2014), the real estate property tax (known in Guatemala as the *Impuesto Único Sobre Inmuebles/IUSI*, the Single Tax on Real Estate) "is administered by the municipality, making it (if well managed) an instrument that can be compatible with cost of living in the municipality and with the benefits that this government provides to its citizens and private economic agents." In the particular case of Quetzaltenango, the IUSI "is the most important tax figure in the municipality's budget, amounting to approximately Q$13.5 million in 2012, 13% of budget revenue."

However, the analysis of cadastral data for Zone 3 revealed that the revenue from IUSI would be considerably higher if: (i) the cadaster covered all land and buildings in the city; and (ii) the cadastral values represented current market prices. The analysis also established that the land values registered in the cadaster per M2 vary considerably along the same street (in relatively homogenous areas), which means that some owners pay much higher taxes than others for properties with similar market values.

With regard to cadaster coverage, Table 25 indicates that 47.2% of the 8,251 properties located in Zone 3 do not show any type of building, which is striking for one of the most densely occupied areas of the city. Furthermore, 8.1% of the properties show no information on their land area.[33]

In Guatemala, the Ministry of Finance of the national government has transferred responsibilities for IUSI management to the municipalities, along with their corresponding technical and legal responsibilities. Table 26 presents IUSI rates in Quetzaltenango.

[33] It was not possible to exclude the areas used for churches, green spaces and other areas that could be exempt from paying IUSI due to the lack of codes in the database for these uses.

Total number of properties	8,251	100,0%
Properties showing no buildings	3,892	47.2%
Properties showing no data on land area	665	8.1%

Table 25
Quetzaltenango - Total of number of properties in Zone 3 [2013]

Source: Table prepared by the authors using cadastral data.

Note: It includes properties that may be exempt, such as churches, green spaces, etc.

Brackets based on property value		Rates	
Q$	US$	%	Thou-sands
Up to Q$2,000. 00	Up to US$256.00	Exempt	Exempt
From Q$2,000. 01 to Q$20,000. 00	From US$256.01 to US$2,564. 00	0.200%	2
From Q$2,000. 01 to Q$70,000. 00	From US$564.01 to US$8,974. 00	0.600%	6
From Q$70,000. 01 or more	From US$8,974. 01 or more	0.900%	9

Table 26
Quetzaltenango - Real estate property tax rates by brackets based on property value

Source: Rates established by Decree Number 15-98 of the Congress of Guatemala, Single Property Tax Law.

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

Given that Zone 3 is one of the most valuable areas in the city, we would expect the cadastral value of most properties in the area to exceed Q$70 thousand (US$8,974). Nevertheless, a little less than 17% of properties pays the IUSI over 0.9%, and almost 40% pays only 0.2%, and approximately 9% is exempt from this tax altogether. See Table 27.

Tax Rate (by thousand)	Amount	%
Total	**8,251**	**100.0%**
0	757	9.2%
2	3,209	38.9%
6	2,888	35.0%
9	1,397	16.9%

Table 27
Quetzaltenango - Distribution of properties located in Zone 3 according to property tax rates and the brackets

Source: Estimates made by the authors based on 2013 cadastral data.

Note: It includes properties that may be exempt, such as churches, green spaces, etc.

To get a better idea of the variations along a street within a homogenous area, we look at 4a Calle as an example (main business street of Zone 3). Map 9 shows land values along 4ª Calle as part of two homogenous areas with land values/M2 ranging between Q$3,500 and Q$6,000.

Due to these limitations of the cadastral information for Zone 3 (2013), we complement it with market data from of a sample of properties collected as part of a survey recently carried out in the city (Morales, 2015).[34] During the first semester of 2015, students from the Geomatics Laboratory collected information for the appraisals of a random sample of 213 properties located in central Quetzaltenango. Of this sample, 108 units were located in Zone 3. The survey's variables include the appraised value, the geospatial coordinates and land use, as well as the characteristics of lots and the buildings in the area.

Table 28 shows that the mean cadastral value per M2 is not only much lower than the market values illustrated in Map 9, but their coefficients of variation are quite high as well.

[34] Andrés Morales provided these data that were collected as an input for his PhD thesis in the Urban and Regional Planning and Geo-Information Management Program of the Geo-Information Science and Earth Observation (ITC) School at Twente University, The Netherlands. His study seeks to generate a baseline of land market values and estimate the impacts of interventions planned by the municipality on these values, particularly those related to urban accessibility. Its methodology consists in developing a spatial model with geo-referenced data that allows the analysis of the impact that different variables have on land value, as well as the generation of land value surfaces for the city.

Data source	Number of properties	Mean: Value per M2		Standard deviation	Coefficient of variation
		Q$	US$(*)	US$(*)	
Cadastral value (**) [2013]	8,251	549	70	176	250.0%
Estimated market value	108	3,996	512	207	40.3%
Market value/ Cadastral Value		7.3	7.3		

Table 28
Quetzaltenango - 4ª Calle in Zone 3: Coefficients of variation of mean property values

Source: Estimations done by the authors based on the data from the above sources mentioned above.

Note: (*) Exchange rate at time of calculations US$1 = $7.80 quetzales
(**) It includes properties that may be exempt, such as churches, green spaces, etc.

Consequently, we used the data provided by Morales (2015) to estimate the current value of the stock of land and buildings in Zone 3. Given that the cadaster fails to include much of the built space, we use the number of properties in Zone 3 (8,251 according to 2013 cadastral base) as the base for our calculations. We then multiplied the median of property values from the Morales data (Q$691,200 or US$88,615) by the total number of properties in Zone 3. Using this method, the estimated market value of the stock of land and buildings is of Q$5.7 billion (US$731 million), which is seven times higher than the zone's cadastral value. Although these estimates are approximate, they show the order of magnitude of the difference between market and cadastral values. Table 29 summarizes these estimates.

	Q$	US$
Median market value per property [Morales, 2015]	691,200	88,615
Stock's market value	5,703,091,200	731,165,538
Stock's cadastral value [cadaster, 2013]	736,028,416	94,362,617

Table 29
Quetzaltenango - Approximation to the market value of the stock of land and buildings in Zone 3

Source: Estimations done by the authors based on data from the mentioned sources.

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

The impact of the interventions. One of the main reasons for doing urban revitalization projects in the central business district is to generate a positive impact retail sales made there and, therefore, on property values. In this case study, the Project's impact area is Zone 3, which encompasses Quetzaltenago's central business district. In this sense, Smolka (2013) provides a complete review of the studies about large-scale urban projects, including their impact on property value. Although these studies indicate significant increases in the property value, they usually do not use rigorous studies to estimate these impacts.

Due to the methodological challenges and the lack of accurate data on the real estate property market values for the case of Quetzaltenango, we used the results of empirical feasibility studies on this type of project to guide our analysis on the impact that interventions on land values in Zone 3. In this way, Ha's study (2011) for the city of Asheville, North Carolina served as one reference.

His study for the city of Asheville cites one of the more extensive evaluations of Business Improvement Districts (BIDs) on property values in the city of New York. In this study, Ellen et al. (2007) analyze the change of commercial property values before and after implementing the BIDs.

This analysis covered 55 BIDs in New York with a wide range of sizes, budgets, services, and locations. The results revealed that after the development of the District, the difference in price between the properties located in BIDS and those outside them increased by an average of 15.7 percentage points.

In the case of Asheville, the study involved a careful analysis of the available information, including the value of commercial and residential properties. The study does a statistical analysis of data on land values in the business district and an adjacent control area and incorporates data from the existing literature. The study estimates that the municipality can expect the BID to generate an annual increase of about two percent (Ha, 2011).

As previously noted, the data on property values in Quetzaltenango are quite limited, except from the small sample survey from Morales (2015). Our objective is to project the increment in property values that could be generated by the Project in its impact area. In this, we use data from the cadaster, the sample survey, and the map of homogenous areas (Map 9).

The steps followed for this projection are:

1. Reduce the inconsistencies in cadastral data by excluding properties with no estimate of land value or with very low cadastral values.
2. Generate quartiles based on the cadastral value of the properties.
3. Assign the land values per M2 from the homogenous regions to each quartile (Map 9).

Quartiles	Q1	Q2	Q3	Q4
Land value/M2	Q$2.500[35]	Q$3.500	Q$4.500	Q$6.000

4. Estimate the total cadastral value of Zone 3 by multiplying the values of each quartile (previous table) by the land area (M2) in each quartile, taken from the cadastral database.
5. Calculate the proportion (%) of each quartile with respect to the total cadastral value of Zone 3.
6. Use these percentages to allocate market values to each quartile based on the data provided by Morales (Q$5.7 billion or US$731.2 million).
7. Include the assumption that the improvements generated by the Project will increase the land value by to the next value level for each quartile (e.g. from Q$4,500 to Q$6,000 or from Q$6,000 to Q$8,000).[36]
8. Calculate the percentage increase in each quartile (step 6 divided by step 2).
9. Multiply these percentages by the market value estimated for each quartile (step 5) to calculate the total valorization the Project could generate under the proposed scenario.
10. Calculate the total land value increase for each quartile (step 8 minus step 5).
11. For a conservative scenario, we assume that only a fifth of the total estimated valorization will take place in the first five years of the Project.

The main results of this projection are shown in Table 30

[35] For the first quartile, we used the average value of the two homogenous areas with the lowest values in Zone 3.

[36] As for applying this assumption to the first quartile, we took the intermediate value of the three lowest-value homogeneous areas as a conservative estimation of the land value increase per M2 for the properties grouped in said quartile.

Table 30
Quetzaltenango - Estimation of the Project's impact on the value of the stock of land and buildings by quartiles based on cadastral value (Q$ million)

Source: Authors' calculations with cadastral data (2013), Morales (2015), and Montes, M. et al. (2014).

Quartiles based on the units' cadastral value		Stock value before the Project (step 6)	Stock value after the Project (step 9)	Estimated total valorization (step 9 and 10)	Estimated total valorization (%) (step 9 and 10)	Percentage of increase for the first 5 years (step 11)
Total		**5,703**	**7,456**	**1,753**	**30.70**	**6.10**
Lowest cadastral value	**Q1**	798	957	160	20.00	4.00
	Q2	886	1,140	253	28.60	5.70
	Q3	1,535	2,046	512	33.30	6.70
Highest cadastral values	**Q4**	2,484	3,313	828	33.30	6.70

Based on international literature and calculations, we estimate that the Project's impact on median market property value in Zone 3 could reach a total increase of 6% in the first five years.[37]

Financial prefeasibility. Table 31 shows the results of the prefeasibility analysis in terms of cost recovery. As in the previous case, we seek to determine if valorization is less than, equal to or higher than project costs.

Table 31
Quetzaltenango - Financial prefeasibility analysis

Source: Authors' calculations with cadastral data (2013) and Morales' database (2015).

Lines	Components/ Estimations	Scenario A (without private sector)	Scenario B (with private sector)
A	Total cost of the Project (Q$)	42.120.000	42.120.000
B	Percentage of investment financed by private sector partners (100% of the Intercultural Center's revitalization)	0,0%	14,8%
C = A * B	Investment financed by private sector partners (Q$)	0	6.240.000
D = A - C	Cost of the project to be financed by the municipality with other revenue sources (Q$)	42.120.000	35.880.000
E	Percentage financed with the city's general investment budget	0,0%	0,0%
F = D * E	Financed with the city's general investment budget (Q$)	0	0
G = D - F	Municipal financing through land value capture (Q$)	42.120.000	35.880.000
H	Current total market value of the stock of land and buildings in the impact area of the Program (Q$)	5.703.091.200	5.703.091.200
I = G/ H	Cost of the Project financed by the city through land value capture/ Current market value of the stock of land and buildings	0.74%	0.63%
J	Impact of the interventions: % of market value increase for the first 5 years	6%	6%
K = H * J	Land lot valorization derived from the Project's interventions in the first 5 years (Q$)	342,185,472	342,185,472
L = D/ K	Cost of the Project/ valorization of the first 5 years	12.3%	10.5%

[37] Given that an ex-post study on the impact of Business Improvement Districts (BIDs) estimated that the value of land in the district would increase by 9.33% in its first five years (see Ha, S., 2011), this projection can be considered consistent with previous experiences and as a conservative scenario.

The increase in the value of the properties in Zone 3 is significantly higher than the total cost of the Project, as the cost is only 12.3% of projected valorization during the first five years. These results indicate the viability of using the value capture instruments for financing the Project and also to generate additional resources to facilitate the implementation of other strategic projects for the city.

Identifying and designing the land value capture instrument. We agreed with the municipality to select betterment levies as the instrument to capture the value needed to cover Project costs, given the wide gap between cadastral values and market prices. Other instruments, such as Tax Increment Financing, could be considered when the cadastral base is updated and the system modernized (see Annex II).

• Betterment levies. This instrument is legally viable, and also transparent and straightforward to implement at the municipal level. It could be handled as a levy or as a temporary increase of the property tax rate.

To effectively use betterment levies, the revenue collected must be earmarked for the interventions that create the value. This is a fundamental aspect because taxpayer's willingness to pay is based on the benefits that they will receive from the improvements (e.g. better infrastructure and services, and increases in the value of their properties). For this reason, the local authorities must utilize legal mechanisms that require that the revenue from value capture be used solely to finance investment that generate the value in the municipal budget.

How to estimate the amount of the levy? Line A in the in Table 32 shows the ratio between the total Project cost financed by the city through land value capture and the total current market value of the stock of land and buildings. In calculating this total market value (Q$5.7 billion or US$731 million), we have used the sample data collected by Morales (2015).

Table 32
Quetzaltenango - Feasibility of implementing betterment levies

Source: Authors' calculations with cadastral data (2013) and Morales' database (2015).

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

Lines	Components/ Estimations	Scenario A (without private sector)		Scenario B (with private sector)	
		P$	US$	P$	US$
A	Cost of the Project financed by the city through land value capture/ Current market value of the stock of land and buildings	0.74%	0.74%	0.63%	0.63%
B	Median of a unit's market value in the impact area of the Project (Q$)	691,200	88,615	691,200	88,615
C = A * B	Single payment of betterment levies for a property of median market value.	5,105	654	4,349	558
D = C/ 5	Equal annual payments for 5 years	1,021	131	870	112
E = B * 1%	Hypothetical 1% increase in a unit's median market value	6,912	886	6,912	886
F = B * 2%	Hypothetical 2% increase in a unit's median market value	13,824	1,772	13,824	1,772
G	Impact of the interventions: % of market value increase for the first 5 years	6%	6%	6%	6%
H = B * G	Valorization of a property of median market value derived from Program interventions in the first 5 years	41,472	5,317	41,472	5,317

The amount of the single levy that the owner of a property of median market value would pay is the product of the above ratio (line A) and the median market value (line B). Consequently, in the scenario without private sector participation, the owner of a property appraised at Q$691,200 (US$88,615) would have to pay a one-time levy of Q$5,105 (US$654) or an annual payment of Q$1,021 (US$131) for five years (line D).

We were also able to calculate the annual cost and levy payments for the Project implementation period of five years in this case (see the section on the estimated cost of the interventions). This information would allow the municipality to determine the need to borrow during the Project's implementation, as it allows analysis of the cost and revenue cash flows.

Furthermore, we compare the revenue from value capture from betterment levies with the increments in land prices within the impact area. For this, we first used 1% and 2% hypothetical increases in the property median market value (lines E and F). Since the costs of the Project are relatively low (with respect to the market value of the stock), even a 1% increase would be higher than the levy. We also used the projection of the increment in market value from the previous section (6% for 5 years) in the analysis (lines G and H).

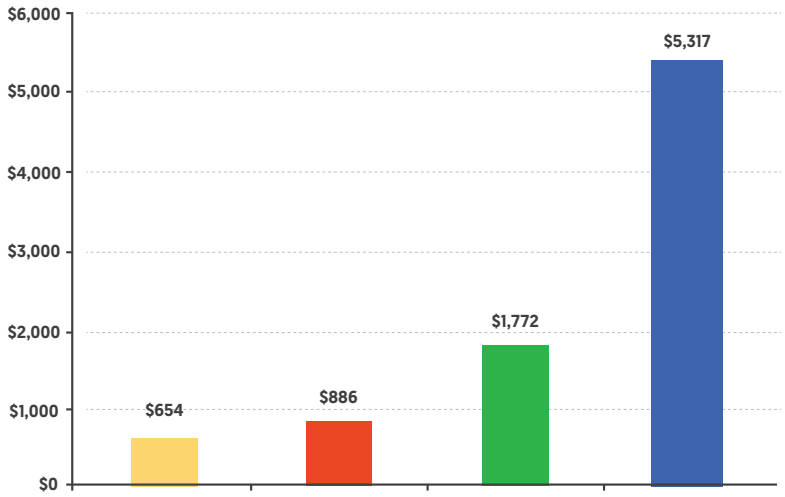


Chart 15
Quetzaltenango - Comparative analysis of the single payment betterment levy and the increase in the median value market [US$]

- One-time betterment levy for property of median market value
- 1% increment in media market value
- 2% increment in media market value
- 6% increment in media market value

Source: Authors' calculations with cadastral data (2013) and Morales' (2015).

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

How to make land value capture affordable? To analyze affordability, we grouped the properties in Zone 3 into quartiles based on their cadastral value, allocating the properties with the lowest cadastral values in the first quartile (Q1) and those of the highest values in the fourth quartile (Q4). Line A in Table 33 shows the market value of the total stock of land and buildings (Q$5.7 billion) and its distribution by quartiles. We can highlight the concentration of values in the fourth quartile (44%).

Line B shows the percentage allocation of total Project cost among the quartiles. The highest relative allocation goes to the fourth quartile because the higher market values in this quartile means higher valorization of properties and greater capacity to pay the contribution. The amount of the levy is the product of multiplying a unit's median market value (line E) by the ratio Project cost/ stock value (line D). Allocating a higher percentage of total project cost to the top three quartiles increases affordability by lowering the amount of the levy for those in the lower quartiles. See Chart 16 (next page).

Table 33
Quetzaltenango - Affordability analysis of betterment levies for properties grouped by quartiles based on their market value

Source: Authors' calculations with cadastral data (2013) and Morales' database (2015)

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

Columns	Variables	Total	PROPERTY GROUPED INTO QUARTILES (Q) BASED ON THEIR CADASTRAL VALUE			
			Q1	Q2	Q3	Q4
A	Market value of the stock of land and buildings in the Project's impact area (Q$ 000s)	5,703,091	797,622	886,413	1,534,702	2,484,355
B	Total Project cost allocation among quartiles (%)	100.0%	5.0%	10.0%	20.0%	65.0%
C = A * B	Total Project cost allocation among quartiles (Q$ 000s)	42,120	2,106	4,212	8,424	27,378
D = C / A	Cost of the Project financed by the city through land value capture/ Current market value of the stock of land and buildings (%)	0.74%	0.26%	0.48%	0.55%	1.10%
E	Unit's median market value in the impact area of the Project (Q$)	691,200	388,362	431,590	747,240	1,209,616
F = D * E	Total value of betterment levies' single payment for a property of the median market value (Q$)	5,105	1,025	2,051	4,102	13,330
G = F / 5	Equal annual levy payments for 5 years (Q$)	1,021	205	410	820	2,666
H = E * 1%	Hypothetical 1% increase in median market value (Q$)	6,912	3,884	4,316	7,472	12,096
I = E * 2%	Hypothetical 2% increase in median market value (Q$)	13,824	7,767	8,632	14,945	24,192
J	Impact of the interventions: % of median market value increase for the first 5 years	6%	6%	6%	6%	6%
K = E * J	Valorization of a property of median market value derived from Program interventions in the first 5 years (Q$)	41,472	23,302	25,895	44,834	72,577

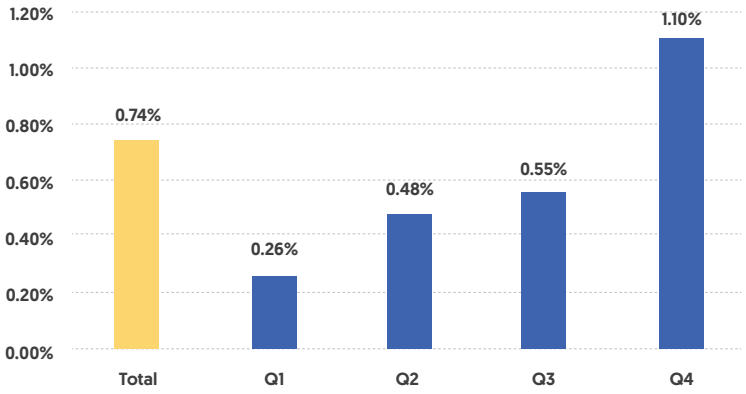


Chart 16
Quetzaltenango- Distribution of levy rates for properties grouped by quartiles according to their market value

Source: Authors' calculations with cadastral data (2013) and Morales 'database (2015).

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales.

Finally, Chart 17 summarizes the estimates of the affordability analysis, including the amount of the levy and the valorization of the properties for each of the quartiles for the Project of Quetzaltenango's Intercultural Center.

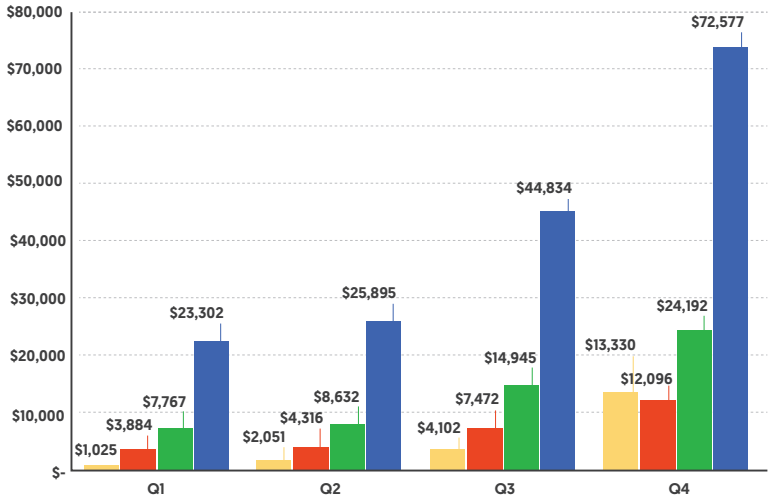


Chart 17
Quetzaltenango - Comparative analysis of the betterment levies with a one-time payment with the valorization in the median market value by quartiles (Q$)

- Total amount of one-time betterment levy for a property of median market value
- Hypothetical 1% increase in median market value (Q$)
- Hypothetical 2% increase in median market value (Q$)
- Estimated valorization of a property of median market value resulting from Program interventions in the first 5 years (Q$)

Source: Authors' calculations with cadastral data (2013) and Morales' database (2015)

Note: Exchange rate at time of calculations US$1 = $7.80 quetzales

3. Conclusions and recommendations

Among the measures planned for the Intercultural Center Project are the restoration of its buildings and revitalization of its green spaces, as well as complementary interventions in Zone 3 (e.g. divided main street, green corridor, etc.) that would help to increase its property values. Given the need for resources for financing the Project, we analyzed the viability of using value capture instruments to implement these interventions. This case study presents the results of our analysis.

Using this study's methodology, we determined that value capture could potentially finance the planned interventions of the Center Project. After evaluating the cadastral data, collecting market data and reviewing the existing literature on the impact of this type of projects, we found it reasonable to expect a 6% valorization of land's market value in Zone 3 during its first five years of the Project. In absolute terms, this increment is Q$342 million, eight times the total cost of the interventions. Accord-

ing to this financial analysis, value capture could quite feasibly provide resources necessary to finance the Project.

We concluded that, from both the legal and financial viewpoints, betterment levies are the most appropriate instrument for the case of the Center Project, as they would best allow capture of part of the value generated by the Project. [38]

Additionally, in meetings with professionals of the city, we emphasized the importance of cadaster modernization, not only to develop a fairer and more effective real estate property tax collection, but also to provide reliable information to properly manage other value capture instruments, such as betterment levies. In this scenario, Quetzaltenango would have the option of using instruments such as Tax Increment Financing, in which the initial increase of the fiscal revenues derived from cadaster modernization could be earmarked for funding infrastructure and service projects. It is important to note that, in this case, revenue would come from higher IUSI collection resulting from cadaster modernization, except for the tax revenue generated by the proposed interventions. Annex II shows the potential impact of cadaster modernization in municipal revenue.

Within the steps to be taken to implement the Project, we suggest that the municipality first defines the potential of the private sector to contribute to the attainment of the cultural, economic, social and athletic objectives of the Intercultural Center and Zone 3. For this, the Action Plan (2014) recommends a process it calls "citizen dynamics". In this process, the different stakeholders involved in the Project could formulate the basic guidelines for the participation of a PPP. These policies should aim at a minimum:

- Establish a governance structure that facilitates the private sector's participation in the achievement of the Intercultural Center's objectives.
- Define a financial strategy that makes it possible to achieve the Center's operational and investment objectives.
- Specify the rights and responsibilities of the public and private sectors participating in the partnership in a legal document.
- Provide guidelines for the elaboration of tender documents, if necessary.

Finally, since some Project benefits will go to properties outside of the impact area, it is necessary to determine how much of the total cost would be covered by the owners of properties located within the impact area via value capture, versus the amount that would be financed via other municipal resources. In so doing, the policy maker should take into account that the values of properties inside the impact area will increase, as the Project provides more and better services and attracts potential customers into the area by improving its accessibility. The beneficiaries of the Project (especially the owners of commercial properties) may pay a relatively low levy in comparison with the potential of increase in the property values. The affordability of the structure defined for the levies also needs to be taken into account.

We concluded that, from both the legal and financial viewpoints, betterment levies are the most appropriate instrument for the case of the Center Project, as they would best allow capture of part of the value generated by the Project.

We found it reasonable to expect a 6% valorization of land's market value in Zone 3, eight times the total cost of the interventions.

[38] We considered the possibility of forming a PPP (e.g. concession or leasing), given that it could generate the necessary resources to attain the economic, social and cultural objectives of the Project. A private partner could participate in the development of the Center Project through sponsorship by a PPP, as common in sports facilities management of (e.g. Movistar Arena in Santiago de Chile or HSBC Arena in Rio de Janeiro). In this case, the sponsor (private) earns revenue derived from management of facilities and benefits from brand positioning and the marketing activities that can take place there.

Conclusions and lessons learned

Both the theoretical perspective discussed and the findings of the cases studies support the argument that capture of the value generated by public interventions at the local level can contribute significantly to the strategies for financing urban projects in the region. Fostering the use of financial instruments of this type can strengthen municipal financial autonomy, and also helps to reduce the deficits in the provision of infrastructure and basic services, thereby helping to make the region's cities more competitive and sustainable.

The shortage of available resources for infrastructure investments at the local level, combined with the sizable increase in demand for urban goods and services generated by rapid urbanization, have generated significant deficits. These infrastructure deficits are, in turn, impeding urban development. Studies indicate that infrastructure deficits generate negative impacts on productivity, employment, and equality. Although duplication of infrastructure investments would boost the annual growth of the region's GDP by around 2%, public investment in the region has progressively decreased since the eighties, settling at about 2% of GDP in the last decade (IDB, 2013).

Given that local governments are largely responsible for investments in services and infrastructure, the strengthening of the existing revenue sources of local budgets (e.g. own-source revenue, transfers, etc.) and the implementation of nontraditional financial instruments are crucial aspects of the region's urban development.

One of these nontraditional instruments with the highest potential for financing urban projects is land value capture. The ultimate goal of value capture is to use the benefits generated by municipal investments to generate positive feedback in the form of additional resources for new investments so that these resources can help reduce the deficits in the provision of services and infrastructure at a local level.

Although several local governments in Latin America are using a wide range of value capture instruments, their use has not yet reached its full potential. Some of the technical difficulties that inhibit their use are problems in estimating the level of valorization and its distributional impacts, complications in project implementation that increase the risk of incurring high initial costs without return, and the resistance of some societal sectors.

The most commonly used instruments are betterment levies, building rights charges and exactions, Tax Increment Financing and land readjustment approach. Defining the most suitable capture instrument to finance a particular project depends on multiple variables that are internal and external to the project itself (e.g., type of project, scope, timetable, etc.).

To support cities in their process of designing financial strategies based on capturing valorization, one part of this study focuses on formulating a methodology that is straightforward and user-friendly and also complements the ESC Program approach. This methodology begins with the project description and includes the delimitation of the impact area, estimation of the current value of the stock of land and buildings, assessment of the project's impact on the valorization of the stock, financial prefeasibility and affordability analysis, and selection and design of the most viable capture instruments.

Based on the proposed methodology and with the objective of providing a practical guide on the use of value capture, we developed case studies in two emerging cities of the region: Xalapa, Mexico, and Quetzaltenango, Guatemala. The results from both cases can be summarized as follows:

- Interventions in both cities show the importance of generating value by revitalizing abandoned buildings or underused areas, developing green spaces and providing infrastructure, as well as regulatory changes that allow greater density of development and zoning changes to improve access to urban services within residential neighborhoods.

- Valorization generated by project implementation significantly exceeds their costs, requiring less than 15% of the land value increase to finance the interventions.

- Betterment levies were identified as the most viable value capture instruments in these cities. The amount of the levies represented less than 3% of the valorization generated by the projects.

Overall, the results from the application of the methodology in both cities evidenced the high potential of value capture for financing urban projects.

Lessons learned

The following are some of the lessons learned from these cases for emerging cities in Latin America that are interested in developing financial strategies of this type:

- The projects that include the revitalization of abandoned or underused spaces can generate significant benefits within their impact areas at relatively low costs. Although the monetary costs of obtaining legal control of the properties are usually low, considerable administrative and bureaucratic effort is often required for so doing.

- The changes in land use regulations proposed in the city's actions plans can also generate benefits in terms of property valorization.

- Effective methods to define a projects' impact areas include meetings with expert municipal employees, consultants, and researchers, as well as field trips and the review of cadastral data and planning documents. Google *Earth's Street View* is also a useful tool to learn about the impact area.

- Implementing other interventions located in the projects' impact area helps to develop synergies among them.

- The cadastral database can provide the necessary data to estimate the current value of the stock of land and buildings in the project's impact area. Although cadaster modernization can significantly increase this estimation's reliability, a sample survey of property values can provide the information needed to carry out the preliminary estimations of stock value, if the cadastral information is unreliable.

- Betterment levies are a straightforward and transparent instrument for value capture at the municipal level. The use of other instruments

(e.g. exactions or building rights charges) could require more complex institutional structures.

- In doing affordability analysis, cities can design payment structure by grouping properties using different criteria (e.g. cadastral values, land use, neighborhoods, etc.).

- In certain cases, when some intervention benefits reach people living outside of the project´s impact area (for example, those living outside the impact area who use the recovered green space), the municipality could finance part of the project with revenue from sources other than land value capture.

- Financial arrangements, such as PPPs or debt agreements, can help in handling the mismatch in the timing of revenue and expenditures.

Finally, we hope that this study serves as a practical and effective tool for helping LAC cities to employ value capture instruments to finance their strategic interventions.

Annex I. Evaluation of a project's ex-post impact

In the ex-post evaluation, we can compare the initial baseline value of the stock of lands and buildings with the value after finishing the project. Even though these ex-post data exist, the analysis is methodologically difficult, since as previously mentioned, there are many variables external to the project that can affect property prices. One methodology for addressing these issues it to compare the average land and building values before and after the project in the impact area with those of another similar area (i.e. control area), as shown in the following:

Table: Ex-post evaluation with a control area

	Before: baseline (real estate values before the project)	After: final value (real estate values once the project has ended)
Impact area of the project		
Control area		

Literature refers to this comparison as the difference-in-differences approach since it involves comparing the difference in spatial units (the impact and control areas of the project) with the differences in the time (before and after the project). Conceptually, for this approach to be effective, the project and control areas would have to be exactly the same in all the aspects, except for the project. This is quite difficult because the housing units vary in terms of multiple attributes. To address the complex nature of other land uses and housing, many studies use hedonic models that introduce different characteristics (size, location, building materials, services, etc.) as independent variables to control these differences.

In their review of this approach, Parmeter and Pope (2012) indicate that: "there has recently been a dramatic increase in the number of studies that combine quasi-experimental methods with hedonic models." They indicate that when natural and quasi-randomized experiments are applied in economics, the average effect of the treatment is calculated by comparing prices corresponding to the treated and not treated properties. Thus, P1i could be the price of the property i when it receives treatment (within the project's impact area), and P0i would be the price of the property i with no treatment (within the control area).

According to these authors, the basic regression function would be the following if houses and neighborhoods are homogenous:

$$p_i = \beta_0 + \beta_1 D_i^A + \beta_2 D_i^t + \gamma_1 D_i^A * D_i^t + \varepsilon_i,$$

Donde:

p^i = is the price of the i^{th} property
D^A = Is the dummy variable reflecting the treatment area:
1, when the property is in the treatment area
0, when the property is not in the treatment area
D^t = Is the dummy variable reflecting "before and after" the treatment:
1, after the treatment
0, before the treatment

Coefficient D^A (the Lambda Greek letter in the equation above) multiplied by D^t is key because it shows the impact for those properties in the area of the treatment after the treatment itself. This is shown in the following table:

Table: Differences in differences analysis

D^A = the dummy variable reflecting the treatment area	D^t = Is the dummy variable reflecting "before and after" the treatment	
	Before the treatment = 0	After the treatment = 1
Properties in the treatment area = 1	Property in the treatment area before treatment	Property in the treatment area after treatment
Properties outside the treatment area (i.e. in control area) = 0	Property in the control area before treatment	Property in control area after treatment

The final regression model will have two additional sets of variables that indicate the characteristics of the property (lot and building size, building materials, etc.) and the neighborhood where it is located. Applying this quasi-experimental approach is complex, as shown by the 10-point list to take into account in quasi-experimental methods using hedonic models, proposed by Parmeter and Pope (2012):

1. Investigate if the quasi-experiment can be considered exogenous
2. Determine the quasi-experiment's spatial and temporal relevance
3. Collect data on prices and housing characteristics for the different temporal and spatial dimensions
4. Gather data on the spatial and accessibility attributes for the different temporal and spatial dimensions
5. Collect control demographic data for the different temporal and spatial dimensions
6. Organize data based on observations (housing units) and review its consistency
7. Determine the appropriate econometric method and the model's functional form
8. Review the model's robustness
9. Interpret the treatment's effect
10. Judge the internal and external validity of the treatment's effect

Acevedo (2014) uses a quasi-experimental approach with hedonic methods (differences in differences procedure) in her ex-post evaluation of the first stage of the urban development project in the Brazilian municipality of Campo Grande (State of Mato Grosso do Sul). For this, she uses a time series of the housing values from 2008 to 2013 from Campo Grande's real estate transfer tax. Although the quality of data decreased in the last two years of the time series (due to a problem that has since been corrected), the study demonstrates that sophisticated methods are viable for ex-post evaluation of projects. Vetter (2015) uses this study's results in the costs-benefits analysis of the housing component for the second stage of the project.

Box: Ex-post evaluation of Campo Grande Urban Project

The quasi-experimental technique of difference-in-differences is used to measure the intervention's impact on the price of the property. This technique is based on the assumption that the trends of treatment and control groups are synchronous (i.e. they have the same trend) over time in the absence of the program. The impact of the intervention is estimated by comparing the changes in prices of the areas subject to the intervention with changes in areas outside the project's immediate impact area.

The following model is specified:

$$p_{ist} = \alpha T_{st} + \mu_s + \pi_t + \beta X_{ist} + \gamma k_s + \varepsilon_{ist} \qquad (1)$$

Where:

pist is the logarithm of the price per square meter of property i located in sector s (treatment and control) in semester *t*.
Tst is a variable with the value the value of 1 for the treatment sector from the semester in which the treatment begins and 0 for the rest of the semesters.
μs is a dummy variable for sector *s*.
πt is a dummy variable for semester *t*.
Xist are the observable characteristics of the property
Ks is a dummy variable with value 1 for sectors where other urban infrastructure interventions have taken place.
εist is the error term that gathers the unobservable characteristics of property prices.

The standard errors are grouped by sector. At the start of the treatment period, we take the semester in which the works of the intervention begin, assuming that property price instantaneously adjusts to the changes in the expected value. The coefficient will capture the intervention's added impact from the beginning of the project in late 2013.

The impacts per treatment period are also analyzed, to establish differential effects before, during or after the project's' implementation periods. Thus, model 2 is estimated:

$$p_{ist} = \Sigma_{j=1}^{j=n} + \alpha_j T_{stj} + \mu_s + \pi_t + \beta X_{ist} + \gamma k_s + \varepsilon_{ist} \qquad (2)$$

Where *Tstj* eis a dummy variable with value 1 for treatment sectors for semester j and 0 for the rest of the semesters. The rest of the variables are interpreted as in equation (1).

Annex II. The importance of cadaster modernization

A modern cadastral system contains detailed information on real estate property and related taxes that provide multiple advantages for urban management. The information in the cadastral database is useful for evaluating the viability of financial strategies based on land value capture, as well as for carrying out the economic and financial analysis of projects. Most importantly, a properly managed cadastral system has the potential to increase a city's financial autonomy by generating additional revenue.

"A modern cadaster is an integrated database that brings together information on land registration and ownership, physical characteristics, estimates from an econometric model for property appraisal, and variables related to zoning, transport, environment, and socio-economic and demographic factors." (Erba and Águila, 2005). Although there are wide differences in the condition of cadasters in the region, many municipalities do not update their cadasters periodically, causing the cadastral information to differ greatly from the current land use and market values, thereby reducing data reliability and real estate property tax collection.

The case of Xalapa clearly demonstrates the advantages of having a modern cadaster. This cadaster has provided the municipality with both relevant and reliable information for the feasibility analysis of the proposed value capture strategy, as well as with additional revenue from real estate property and transfer taxes. This cadaster modernization (that has been supported by Banobras) allowed the city to increase its property tax revenue by approximately US$1.0 million (25.6%) while cutting the tax rate by half for occupied properties. Likewise, revenue stemming from real estate transfer tax increased by US$677,000 (34.0%), because the cadastral value is used as the base for calculating this tax. Consequently, the city increased its revenue by a total of US$1.7 million for the 2014-2015 period.[39]

Taxes	2014	2015	Change	
			Absolute	%
Total	**98,156**	**126,048**	**27,891**	**28.4%**
Property tax	65,097	81,763	16,666	25.6%
Transfer tax	33,059	44,284	11,225	34.0%
US$ (000s)				
Total	**5,924**	**7,607**	**1,683**	**28.4%**
Property tax	3,929	4,934	1,006	25.6%
Transfer tax	1,995	2,673	677	34.0%

Table
Xalapa - Estimated increase in revenues from the real estate property and transfer taxes (2014-2015)

Source: Estimations done by the authors based on financial information from 2014 and the Municipal Treasury's 2015 projections.

Note: Exchange rate used US$1 = 16.57 Mexican pesos

If the city continues with the cadaster modernization process and keeps the property records updated, it will recover part of the increase in land value caused by infrastructure investments and the regulatory changes through increased property tax revenue.

On the other hand, Quetzaltenango's cadastral system is at a different stage of development. As mentioned in its case study, the analysis revealed a significant difference between cadastral values and the market prices of properties located in Zone 3. Market values are seven times higher than cadastral values. Similarly, the analysis showed that the cadaster's coverage of building space areas is low. Updating the cadastral database together with the system's modernization would increase municipal revenues significantly.

[39] Note that the municipality's annual revenue increase for the first year was higher than the total cost of cadaster modernization: US$1.2 million (P$20.0 million).

The following table shows how updating cadastral values would not only increase the total size of the tax base but would also push most properties in Zone 3 into the highest tax bracket (0.9%). With this cadaster modernization, the projected IUSI collection would increase to around US$3.3 million [40], a sevenfold increase over IUSI collection with current cadastral tax base in Zone 3. Although a larger sample size than from Morales (2015) could result in a lower estimate of this increment in total revenue, this preliminary estimate demonstrates that cadaster modernization could generate a significant increase.

	Q$	US$
Median market value per property (Morales, 2015)	691,200	88,615
Land and building stock's current market value	5,703,091,200	731,165,538
Land and building stock's current cadastral value	736,028,416	94,362,617
Ratio: Market value/ cadastral value	7.7	7.7
Tax base = % of market value or cadastral value	50%	50%
IUSI calculated on the stock's market value (tax base * 0.90%)	25,663,910	3,290,231
Increase in revenue by property tax (IUSI) using market value	3,312,128	424,632
Increase in revenue by property tax (IUSI) using market value	22,351,783	2,865,599
% increase in revenue by property tax	674.85%	674.84%
Annual property tax on a property appraised as within median market value	3,110	399

Table
Quetzaltenango - Estimations of the impact of cadaster modernization on revenue associated to real estate property tax

Source: Estimates made by the authors based on 2013 cadastral data and Morales' database (2015

Note: Exchange rate used US$1 = $7.80 quetzales

In conclusion, the cadaster can play a remarkably important role in the management of cities. Having a modern cadaster facilitates land use planning providing the municipality with reliable and timely information. Furthermore, it can significantly increase local revenues available for financing investments, thereby reducing the deficits in the provision of services and infrastructure.

[40] Note that the national regulations allow the municipality to set the fiscal value on which IUSI is imposed. These fiscal values of properties in Quetzaltenango range between 25% and 75% of their cadastral value. For this reason, we use 50% of the cadastral value in estimating the fiscal value.

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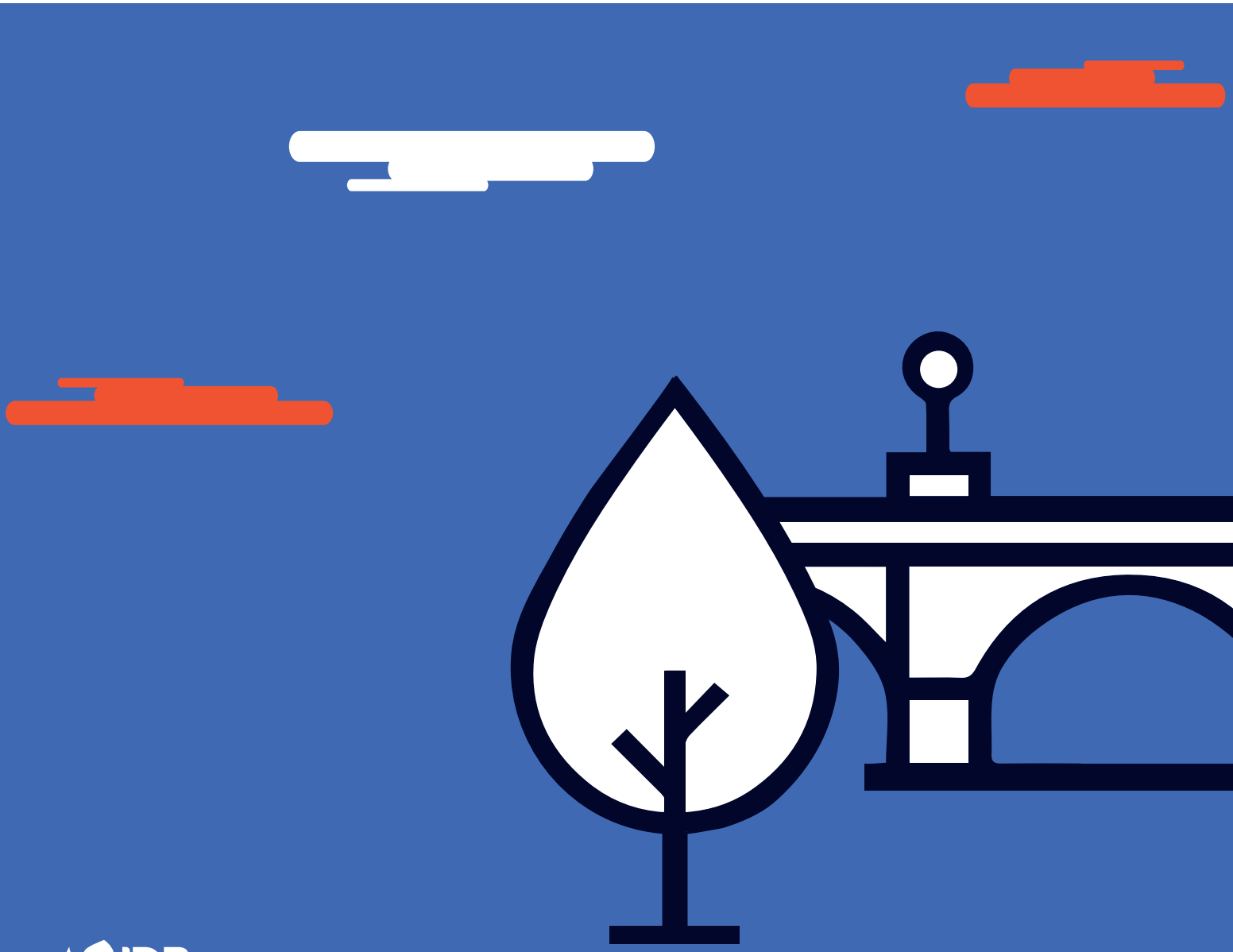

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