

Land information updating, a *de facto* tax reform

Bringing up to date the cadastral database of Bogota

Maria Camila Uribe Sánchez
Cadastral of Bogota

The mission of the Cadastre of Bogota is to maintain the city's geographical information up to date. All parcels—of formal or informal origins—are included. From a tax perspective, the most useful part of the information that the Cadastre administers is the cadastral value of each parcel, which is the base for the property tax. This means that efforts to reduce a lag in the agency's database will raise the base for the property tax, which property owners will perceive as a change in the rules of taxation. In the last decade, attempts to reduce the lag in cadastral information have been few and far between. This has turned recent Cadastral Updating processes into full-fledged tax reforms at the local level. Thus, these processes in Bogotá have had the same political economy dynamics of a tax reform and have come under the same public scrutiny. In 2008, property tax represented 19.8% of Bogotá's tax revenues generating the second largest amount of resources of all local taxes, after the business income tax (ICA).

This paper focuses on the Cadastral Updating Project of Bogota implemented in 2008. The study of this Project provides insights into public administration and governance at the local level, institutional reform and tax management in a developing metropolis.

In the first section, the context in which the Cadastral Updating takes place is introduced. In the second section some of the technical innovations, political strategies and main results of the CUPB are described. Finally, the paper ends with a short overview of the current reform agenda and a closing remark.

1. Cadastral Updating in Bogota

1.1. Heavy reliance on fieldwork

Beyond providing the base of the property tax, the Cadastre's information must reflect the building, usage and ownership dynamics of the city. In Colombia the task of keeping this cadastral information up-to-date—like in most developing countries—is not a question of a periodic review of administrative records and a systematic crossing of databases. The shortage of sources of robust information and the lack of inter-agency synergies prevent automated or simpler processes to develop.

The agencies in charge of the official registry of property in its different aspects (e.g. transaction registration, construction permits) fulfill their mission in an independent manner. The lack of communication is even more severe between national and local agencies. There is no system that links all the real-estate information coming from different sources within the city. In many cases, the differences between the agencies' schemes for collecting and storing information further hinder the possibilities for exchange and analysis. The National Registry Office (Supernotariado), the city's Planning Department (SDP) and the urban curators, the National Statistics Department (DANE), the Department for Emergency Management (DPAE), the utility

companies, and the Park Services Department (IDRD) have independent systems with crucial information of the city's parcels.

In addition to this lack of interoperability, the real-estate market is opaque. The costs of property transaction registry and formalization are proportional to the transaction amount, and thus provide an incentive for evasion; buyers and sellers declare lower values of transaction. As a consequence, reliable information on sale and purchase values of real property between agents in the secondary market is hard to obtain.

This is why in Bogota—as in many other developing metropolis—building and keeping up-to-date a robust parcel inventory requires a series of burdensome processes with a heavy component of fieldwork in which the Cadastre must survey hundreds of thousands of parcel.

1.2. Legal constraints

Resolution 2555 of 1988 of the National Geographical Institute (IGAC)—the policy design and regulatory agency of cadastres in Colombia—controls Cadastral Updating processes and restricts the methods the cadastres can use to calculate the values of each parcel.

The Resolution establishes that the cadastral value of a parcel is, in all cases, the sum of the individually estimated values of its land and its building(s). It also defines the method to determine the value of the land: neighborhoods are divided into Physically Homogeneous Zones (ZHF) and then into Geoeconomically Homogeneous Zones (ZHG). Finally, the Resolution stipulates that statistical methods—that consider physical characteristics of the parcel and its location—are to be used to determine the value of construction.

On the one hand, the ZHF are constructed through the study of a neighborhood's land use bylaws, the access to utilities and roads, topography and the actual land use. Neighboring real properties sharing these characteristics will define the polygon of the ZHF. Variations in the actual value of land within a ZHF will further divide it into ZHG—i.e. areas that share the same value of land.

On the other hand, in order to use statistical methods to calculate the value of the building, Bogota's Cadastre has developed tools to register its main physical characteristics. Under the mandate of Resolution 2555, every Updating process must include a parcel survey, that is, a visit to every parcel of the neighborhood being updated in order to capture information on the physical features and age of its building(s) and the area of its land and building(s). The parcel survey's main tool is the Parcel Form (*ficha predial*). Designed in 1984, with over 60 fields the Form is used to collect information on myriad variables—e.g. upkeep of the structure, construction materials, quality of the bathrooms and the kitchen.

1.3. The failed process of 2006

In 2006, the Cadastre outsourced the updating process to a consortium of private firms. The great increases in some parcels elevated the political pressure, which led to a tight review of all the process' technical and legal aspects. During an audit from the city's control agencies, the practice of impersonation of professional contractors by non-technical personnel surfaced. The scandal grew until the Mayor withdrew in April 2007 the results of the process from the official database.

Beyond reducing tax property revenue, the failed process undermined the Cadastre's legitimacy and the confidence in its technical capacity and ultimately affected the city's tax culture.

In 2007, during a period of harsh criticism of Cadastral Updating process in Bogota, several studies and evaluations ended detecting recurring flaws in past processes. Building on this diagnosis, in the first semester of 2008, the current administration conducted an evaluation and overall revision that defined the group of activities and processes to be improved that is described below:

- **Weak contract relation between the Cadastre and fieldwork personnel:** the contracting scheme did not demand full-time involvement of personnel nor made them accountable for the quality of the information collected. This generated a lack of commitment and a breach of the time and responsibilities, allowed subcontracting, and did not provide job stability for contractors.
- **Inadequate schemes for personnel selection:** the professional profiles required specific experience on previous Updating processes, which severely restricted the options of candidates and prevented new professionals to train. This trapped the Cadastre in an asymmetrical scheme where a few contractors grew in their expertise and the lack of new skilled or trained professionals.
- **Ample discretion of personnel:** the lack of adequately detailed technical and operational manuals allowed—and in some case forced—discretionary decisions that were not in line with a coherent massive process.
- **Excessive transport and handling of information:** the fact that one group of people would fill the paper forms in the field and a different group of people would later type its content into the system generated a high number of mistakes that translated into total or partial loss of data and high supervision costs.
- **Inadequate use of statistical techniques:** the lack of a full-time quantitative analysis support group lowered the quality of massive valuation tasks: the error of samples and econometric models was higher. In particular, the design of independent samples for the valuation of land and buildings increased the risk of inconsistencies in total values. Additionally, the non-skilled handling of econometric models affected drastically its predictive capability and their performance when applied to the universe of parcels.
- **Lack of communication with stakeholders:** given the magnitude of the fieldwork and the impact of Cadastral Updating process on the local property tax, the lack of a clear and stable communication scheme with the process' stakeholders facilitated the building-up of restlessness and generated abrupt reactions of the citizenry.

2. Cadastral Updating Project of Bogota - Fiscal Year 2009 (CUPB)

2.1. Short-term technical innovations

The CUPB implemented many short term changes and allowed the administration to study in depth the implications and challenges of mid and long term reforms.

2.1.1. Management of human resources

Innovations started with the selection of personnel based on professional merits and contracting them under a more binding scheme (both for the contractor and the agency). First, a call for candidates was open to the public and did not required experience in previous processes, just a compatible background (e.g. civil engineering, architecture). To compensate the lack of specific experience, preselected candidates took training courses and had to pass a test in order to enter the list of eligible candidates. As a result, the Cadastre was able to select the Project's personnel from a list of candidates arranged by scores. Second, the Cadastre hired the Project's personnel as temporary local government employees (*supernumerarios*). This made them as accountable for their work as any civil servant and established a direct and exclusive relationship. In this hiring method quality and time commitment rules were clear from the beginning and wages and conditions were more favorable for workers (e.g. severance payment, bonuses).

2.1.2. Taylorist approach

The project used to be divided by sectors, not processes. Thus, one professional would be in charge of carrying out all the processes for his assigned neighborhoods. This year the project was divided into specialized tasks within a production chain scheme, easing direct monitoring and allowing the formation of specialized teams. Technical manuals were revised and the level of detail for each task was increased. These changes reduced the level of discretion in decision-making and facilitated the homogeneity of criteria throughout the Project.

2.1.3. Introduction of hardware and development of applications

One of the biggest innovations of the CUPB was the inclusion of portable digital devices (PDAs) into parcel survey processes. The use of PDAs reduced the errors of data transcription and provided a direct and permanent link between the cadastral information system and fieldwork personnel. It also allowed the Cadastre conduct online control and monitoring of the information collected on the ground, of the performance of employees, and of the time taken collecting information and traveling to the parcels. These devices included information validating algorithms that automated a part of quality control process.

Beyond the PDAs, web-based applications were developed for citizens to review and correct the ownership information of their parcels, forms for professional valuers (see next section) to register the real-estate market research, protocols for map digitizing and database-crossing with other city agencies. These technology developments made fieldwork more efficient, and provided a centralized, homogeneous and controlled storage of the Project's information.

2.1.4. CUPB – Economic Component

Given the impact of the Cadastral Updating on the property tax, the economic component required careful monitoring throughout the Project. This led to technical and methodological innovations that improved the precision of parcel value assessments.

In order to understand the importance of this component, it is necessary to go into some detail.

2.1.4.1. Robust reference information: the key to an equitable outcome

First, in order to maintain a principle of equity it is crucial for the Project to have robust reference information on the real-estate market to establish the differences in value between parcels. The goal of the Cadastral Updating is not to equate the cadastral value to the market value as much as to assign cadastral values that reflect the behavior of the market—i.e. similar

predictive errors and the same difference between cadastral and market value for all parcels. In this manner, the goal is to avoid overestimation of some values and biases in a given area, stratum¹, or group of parcels. Therefore, to ensure an equitable outcome, the database with market information of the Cadastral Real Estate Observatory (OIC) was strengthened with a two-pronged strategy. First, the Observatory's field team collected—under clearly defined protocols—all the real-estate offers in the neighborhoods that the CUPB covered. In order to attain values closer to the real market, trained technicians posing as buyers negotiated by phone the price of an eventual transaction. Second, data on transactions and commercial valuations were obtained through outreach to actors of the real estate sector (i.e. guilds, online realtors, city agencies, banks, and other mortgage institutions).

2.1.4.2. Collection of parcel information

As explained in section 1.1 cadastral values result from the sum of estimations of the value of land and building for each parcel. In order to estimate the values, professional assessors are hired to value a statistical sample of parcels.

The interpretation of regulations in previous Updating projects led to the design of two separate samples of valuated parcels to estimate the value of land within a ZHG and the value of buildings. For the CUPB a single sample was designed to fulfill the needs of the two processes while abiding by regulations: the sample was representative of both building uses and ZHF. The unified sample allowed for a unified fieldwork and reduced costs.

To ensure quality standards in the assessors' market values estimations of the sampled parcels, a quantitative analysis team compared them with other sources of information, namely, the database of the Real Estate Observatory and individual studies of prominent assessing firms.

In the past, the assessment of each parcel was review separately. The lack of overall consistency of these discrete processes was overcome by introducing one of the main innovations of the Economic Component: the experts committees. They used support statistical analysis, and general descriptive tables to take massive decisions based on quality information and reduce risks associated with discretion in decision-making, and in definition of values and methodologies. In this manner, the Cadastre took direct control over the definition of each value guaranteeing coherence in the overall behavior of values at the neighborhood, use, and stratum level.

2.1.4.3. Econometric models

Historically, work teams dissociated from other cadastral tasks were in charge of generating the econometric models to estimate the value of buildings. The lack of interaction with the other areas of the updating process resulted in static models that depended on few variables. Additionally, the assessors seeking consistency at the micro level would manipulate the models, getting a better fit to the reality of the neighborhoods they were in charge of. This affected the statistical soundness of the models and hampered the possibility of conciliating, within a broad framework, the model's results with experience on the ground.

¹ The city's Planning Department assigns a stratum to every parcel according to its physical configuration (entrance, garage, yard, length of front) and the quality of the building (material of facade and ceiling). There are six stratum, one being the lowest and six being the highest. This scheme allows the city to structure its utility fees and tax obligation structures in a progressive manner.

Previous projects built models for each one of the eighty cadastral uses without statistical evidence that supports such a separation. This practice made harder to establish the value of multiple-use parcels. Some of these models also used spatial factors in their market value estimations. Nevertheless, the employed geographical references were artificial partitions of the city that did not represent the dynamics of the real estate market and were incapable of adequately capturing price variations. For example, even though a citizen accepts neighborhoods and districts (*localidades*) as geographical units, the limits that separate them (e.g. political, topographic, social) do not always translate into variations on the value of parcels.

The revision of technical processes of the CUPB defined the need to use statistical methods to model the behavior of continuous variables affected by their location. This led the Cadastre to contact the Geoda Center at Arizona State University, specialists in the construction and application of spatial econometric models. With the support of the Geoda center, the Cadastre was able to estimate the value of a parcel using not only its physical characteristics, but also a spatial component that links the value with its location within the urban perimeter.

This vision of the real estate market underscores the interrelation between parcels that share physical characteristics or location. The latter was captured by calculating Euclidean distances between each parcel in the city to real-estate landmarks. The data were stored in large matrices that accurately reflected the interaction between a parcel's location and its proximity to others. These matrices also allow mathematically representing a path in a certain direction: two parcels will be near only if all distances to landmarks are similar, while a movement in any direction will be reflected on the matrices as a continuing increase in the distance to one or several landmarks.

The used landmarks include: mass transportation infrastructure, proximity to other strata, schools, parks, hospitals and clinics, commerce (malls), red-light districts, country clubs, cemeteries, temples, amusement parks, coliseums and stadiums, museums, waterbodies, airports, penitentiaries, police and military buildings, landfill, forestry reserves. Beyond these physical landmarks, locations of crimes committed in 2008 (mugging, murder, bank or store robberies) and the state of nearby roads were also included.

2.2. Abating political pressure

Beyond its technical shortcomings, the collapse of the failed 2006 project was a consequence of political pressure of different groups. Beyond adjusting the technical aspects of the project, strategies were implemented to abate the political pressure. They include mitigating the project's impact on the property tax and engaging stakeholders and civil servants.

2.2.1. Mitigation of the impact of the Project on the Property Tax

The Bogota's Cadastre is advancing towards becoming a true multipurpose cadastre. To accomplish that goal, it must reduce its role in the fiscal matters of the city and strengthen it in those of planning. In this line, the Cadastre enforced two measures to weaken the link between Cadastral Updating and increases in the property tax.

Mass valuation methodologies are founded in statistical techniques with a measurable error, and therefore the cadastral value must be a fraction of the market value in order to prevent any parcel from being overvalued. Historically this fraction had been established at 80% for previous Updating efforts. Nevertheless, the lack of updating processes and the yearly

upgrading of the database through a price index² led to an average of 57% reaching in some cases 35%. For the FY2009, the Cadastre decided to apply a homogeneous criterion for all parcels included in the CUPB to preserve the equity of the process. After estimating the process' statistical error, the cadastral value was set at 70% of the market value in average.

Historically, the lag of the cadastral database's information has had a heavy impact on the property tax, turning every updating process into a tax reform putting heavy political pressure on the process and the agency as a whole. In 2008, the Cadastre and the Finance Secretary presented before the City Council a project to mitigate the impact of large increases in the cadastral value on the property tax. The project passed and became an Agreement that imposes ceilings on increases that range from 10% for the poorest in the city to 80% for the most affluent³. This Agreement will keep this and future updating efforts from being perceived as tax reforms. This was by far the most important strategy to abate political pressure.

2.2.2. Engagement of stakeholders

It is noteworthy the way the Cadastre was in touch with the public throughout the Project. This effort included visits to neighborhoods to present and explain the main implications of the Project and to introduce the fieldwork processes that were to take place. In addition, the Cadastre conveyed a citizen participation committee in which different stakeholders (property owners organizations, professional guilds, control agencies, and academics) were able to have their say and have in-depth discussions on key aspects of the Project. This committee was instrumental in the continuing betterment of the CUPB.

Merchants are one of the strongest groups of stakeholders, most notably those having stores in shopping malls. Parcels within malls have been amongst the most undervalued properties in the cadastral database and their affluent owners have strong political leverage.

For these reasons the CUPB paid special attention to this group of parcels in order to understand fully the main aspects that shape their market value. CUPB personnel interacted with mall developers and storeowners in different scenarios throughout the second semester of 2008.

The differences between market values of commercial parcels within a mall replicate the development stages of a mall. At first, when the mall is just a project, the developer seeks the presence of major brands that will secure an appropriate flow of shoppers—i.e. cinemas, supermarkets (anchors) fast food chains, famous garment brands (semi-anchors). These parcels are different from others: they require larger areas and they have the lowest price per square meter of the mall. Once the developer has sealed deals with the anchor(s) and semi-anchors and

² Since Cadastral Updating processes do not cover all neighborhoods and by definition take several years to update the entire city, the value of non-updated parcels tends to lag behind. To counter this lag, the Cadastre applies the Urban and Rural Real estate Valuation Index (IVIUR)—i.e. price index establishing the percent changes in the real estate market from one year to the next. The IVIUR is calculated using high quality statistical methods, for groups of parcels (by use and stratum). The results of the statistical process are submitted to a committee chaired by the Mayor. In most years, the committee has tweaked results to fit a political agenda in most cases reducing the percentages to be applied and thus increasing to cadastral database lag.

³ Before this project was approved, the ceiling for increases was 100% for all strata.

the project's viability is secured, he sells at higher price the remaining smaller parcels to the smaller merchants and real-estate investors.

The price differences tend to remain over time but can change due to location within the mall (i.e. floor, type of corridor, proximity to escalators and entrances), parcel characteristics (area, front's length), co-ownership coefficient (i.e. share in the mall's common elements). This last variable is key in the determination of prices within the mall. It reflects initial conditions of negotiation and co-owners accept it widely as an equitable mechanism of burden distribution (i.e. care, upkeep and surveillance costs). In a broad sense, the co-ownership coefficient represents most of the characteristics that influence market values of commercial parcels within malls.

2.2.3. Engagement of career civil servants

In the first stages of the project there was a clear divide between the newly appointed managing team and the agency's career civil servants. The differences went beyond the fact that the first had been there for only a couple of months and the latter have worked for decades within the agency. The new managers lacked the technical expertise and experience in this kind of projects while the agency's servants had worked under several administrations that had had myriad approaches to this process. They were skeptical about the feasibility of the project and resistant to change. Few volunteered to participate and many were transferred directly to the project without seeking or consenting the transfer. The managing team kept busy planning and trying to avoid making the mistakes that hampered previous efforts. This polarized initial landscape had changed dramatically by the last stages of the project. Civil servants held most of the senior positions of the project and were committed and empowered in their task, working hand-in-hand with members of the managing team. What were the conditions that allowed this change to take place?

The conditions include a Taylorist approach, the empowerment of lower-rank professionals and their incorporation into the planning/decision-making processes.

2.2.3.1. Taylorist approach

Dividing the project by processes allowed a person to be in charge of hierarchically organized teams performing a single process for all the sectors included in the project. This empowered the people in charge of the different processes, to direct their teams and to become accountable for their results.

2.2.3.2. Empowering lower-rank professionals

Within the agency's career civil servants there is a highly hierarchical structure of positions and ranks. Theoretically speaking, higher ranks are assigned to more capable and experienced professionals, which in turn allow them to be trusted with higher responsibilities and higher wages and benefits. Nevertheless, in practice the rules and procedures to promote a professional within the agency are muddy. After years under this scheme, the resulting structure of ranks is unbalanced when not openly unfair: professionals having higher skill levels and more experience can have lower ranks. In the course of the project, several of these lower-rank professionals were put in charge of specific processes. Ignoring the established structure allowed highly skilled professionals to access higher positions, which, in addition to working under a committed management team responding to their needs, empowered them. At the end,

they were responsible for the success of the project in many fronts and their contribution was openly recognized as instrumental.

2.2.3.3. Gradual incorporation of the agency's professionals into planning/decision-making processes

Before this incorporation could happen, two parallel processes took place. On the one hand, the scandals and legal problems of the 2006 project left them fearful of participating in a new project and closed their perspective about the possibilities of change and success of a new venture. Some even feared that the true intentions of the new administration were to fail again in order to close the Cadastre and contract with private firms all of the city's cadastral needs. They had to be convinced that the new administration not only wanted but needed a successful Updating process and that the new managing team was capable of implementing it. On the other hand, after having a clearer idea of what the project and its processes were about, the directive team became more open to incorporating the servants' experience and know-how.

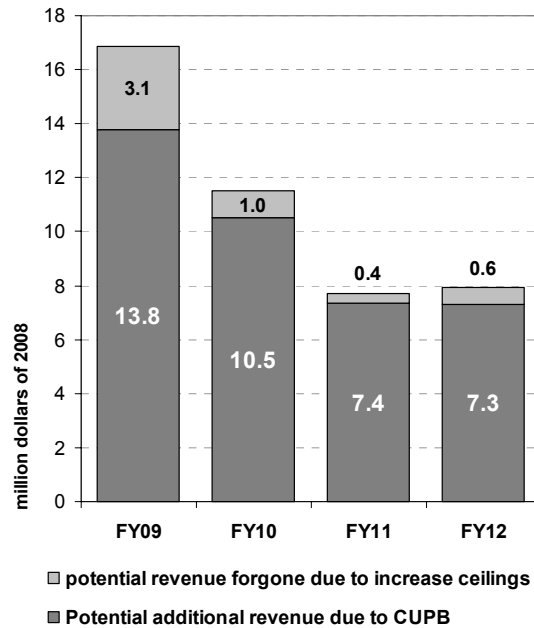
2.3. Main results

The CUPB updated the information of 827.000 parcels out of the city's two million parcels. This means that the information in the cadastre's database reflects physical, legal and economic reality of the city's parcels, which allows for a more equitable distribution of the tax burden. On the one hand, the tax will be based on the actual value of properties, which will account for changes in the city in the past five years. On the other hand, it reassures owners that pay a tax proportional to the value of their property within a progressive scheme.

From an organizational perspective, the success of the project gave back to the Cadastre the legitimacy that it lost in the failed of the 2006 process. The District Comptroller ranked the Cadastre as the second best public agency of the city. This legitimacy will help the administration bring about profound technical and administrative reforms. Additionally the momentum of the CUPB will facilitate politically and institutionally a larger updating effort this year: our goal is to update the remaining 1,2 million urban parcels. Furthermore, the CUPB provided civil servants—that will remain within the agency long after the current administration has left—with an experience that will enrich future updating processes.

From a fiscal perspective, the city will see property tax revenue increase in around 8%. The following chart summarizes the impact of the CUPB on the city's revenues:

Chart 1: Additional property tax revenue due to CUPB



It is noteworthy that the introduction of ceilings on increases had a mild impact (less than 13% reduction in additional revenue) on the additional tax revenue that CUPB will generate.

3. Future improvements

Given that this year’s effort will complete the updating of the entire cadastral database, the next few years will be the perfect time to implement reforms that will strengthen and simplify the Cadastre’s organization and methodologies. These reforms will work around:

- **Restructure:** The Cadastre will undergo deep institutional redesign to improve and simplify its methodologies and processes and improve its human resource management.
- **Improving parcel surveying:** With the use of the latest object-recognition and restitution technologies and inter-institutional information sharing, the Cadastre will reduce the number of parcels that must be visited during and updating process.
- **Yearly updating of cadastral values:** Currently, to update cadastral values, the Cadastre hires scores of professional assessors to value a sample of parcels. These assessments are a subjective process based on real estate offers. In the future, the Cadastre will update cadastral values through econometric models based directly on offers, using fewer assessors and only as technical support, not providers of the base for the design of models.
- **Strengthen the computational capacity:** With the support of the World Bank the Cadastre will overhaul its entire computational infrastructure
- **Encourage regulatory changes:** As explained in section 1.1, cadastral values must be calculated as the sum of the independent assessments of building and land.

Nevertheless, in the context of a large urban center full of horizontal properties, calculating independent values for building and land is burdensome and technically slack. The Cadastre will promote regulatory independence for decentralized cadastres to set the methodologies that better suit the particularities of their cities.

- **Open forums for technical discussions:** The Cadastre will promote these forums to promote the continuing improvement of cadastral methodologies.

4. Closing remark

The technical aspects of the cadastral updating in Bogotá were strengthened and will be further improved. Nevertheless, implementing what is seen as a *de facto* tax reform generates enormous political pressure. A significant lag on a Cadastre's database calls for the implementation of schemes such as increase-ceilings to break the link between the cadastral value and the property tax. Without them the cadastres in charge of these processes will come under a pressure that will prevent them from becoming suppliers of vital information for the city's planning, that is, from becoming true multipurpose cadastres.