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From Plans to People: Territorial Planning and Poverty in Colombia

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Abstract

Land-use policies shape the spatial allocation of infrastructure, services, and development and thus have direct implications for welfare. This paper examines the effects of Colombia's municipal territorial plan updates on poverty through the lens of the housing and services channel. Using municipality-level data from 2005 to 2023 and quasi-experimental treatment-effects methods, we find that in a matched design with extensive controls, plan updates reduce multidimensional poverty by roughly 1.6 percentage points. The gains are concentrated in smaller and medium-sized municipalities, especially those implementing broader plans (EOTs) and those with mid-range administrative capacity. Channel-specific estimates point to improvements in water access and housing quality. Overall, the findings indicate that the welfare impacts of planning reforms are real but place dependent, highlighting the roles of local capacity and baseline service deficits in determining whether regulatory updates translate into observable improvements.

JEL classification

R52, O18, I32

Keywords

urban planning, land-use regulation, multidimensional poverty, Colombia, program evaluation

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1 Introduction

The concentration of population and economic activity in cities raises the stakes when it comes to the production and servicing of the built environment. When urban growth is irregular, municipalities face persistent frictions: informality, exposure to environmental and disaster risks, and, most directly, unequal access to basic services and inadequate housing conditions. In such settings, welfare losses often arise less from the absence of economic activity per se than from the failure to coordinate land development with networks and standards. This leads to the settlement of households where water and sanitation are unavailable or costly to extend, the deterioration of housing quality when serviced land is scarce, and the forcing of public investment into reactive, higher-cost expansion (United Nations Human Settlements Programme, 2015; Walters, 2016; United Nations Human Settlements Programme, 2023; Ratcliffe et al., 2021). Territorial planning is designed to reduce these coordination failures by establishing enforceable land-use rules and investment priorities that align development with infrastructure corridors, service provision, and minimum habitability standards (United Nations Human Settlements Programme, 2015; Metternicht, 2018; Kim, 2011). But whether planning improves living conditions is ultimately an empirical question, because plans may be ineffective when implementation capacity is limited and tighter regulation may increase costs without generating commensurate gains in service access or housing quality (Hoch, 2002; Abis and Garau, 2016; Kim, 2011; Turner et al., 2014; Hsieh and Moretti, 2019).

In this paper, we evaluate Colombia's municipal land-use planning instruments, the Planes de Ordenamiento Territorial (POTs), through the lens of these housing-and-services mechanisms. Introduced under Law 388 of 1997, POTs provide municipalities with legally binding tools to regulate land use, guide urban expansion, protect sensitive or high-risk areas, and coordinate the use of infrastructure and services (Congreso de Colombia, 1997; Pinilla Pineda and Rodríguez Vitta, 2018; Giaimo et al., 1997). A distinctive feature of Colombia's system is that it has seen two waves of planning. The first, concentrated in the early 2000s, involved the adoption of initial plans under relatively limited requirements. The second has consisted of subsequent revisions and updates as municipalities revisit diagnoses, zoning, and implementation instruments in a more mature regulatory and technical environment (United States Agency for International Development and Departamento Nacional de Planeación, 2017). Hence, we focus on the second wave as the relevant margin for assessing whether strengthening planning translates into improvements in multidimensional living standards through better-serviced, higher-quality housing.

The first wave offers limited variation in identification because adoption was nearly universal. In contrast, second-wave updates vary substantially across municipalities: many updated their plans, whereas others continued to operate under first-generation instruments (United States Agency for International Development and Departamento Nacional de Planeación, 2017; Saavedra et al., 2022). Second-generation POTs are also more comprehensive and operationally detailed, making them a stronger policy shock to local rules and tools that govern where housing can be built, how urban expansion connects to existing infrastructure, and how minimum standards for habitability and service provision are enforced. If planning reforms improve welfare over a plausible horizon, the effects should appear through precisely the following margins: access to potable water, sanitation connectivity, and housing quality.

We gather municipal-level data for 2005–23 and define treatment as the adoption of a second-generation POT during 2013–21. The control group consists of municipalities that retained first-generation instruments.[1] The primary outcome is the municipal Multidimensional Poverty Index (MPI), complemented by indicators that capture the most direct, poverty-relevant mechanisms in this setting: access to potable water and sanitation and housing deficits. The adoption of POTs is not random: it is correlated with baseline size, geography, and administrative capacity. We address this selection using genetic matching on pretreatment municipal characteristics and institutional features of the first-generation planning instrument, constructing a balanced counterfactual prior to estimating treatment effects in a panel framework.

The results show that second-generation POT updates reduce multidimensional poverty once treated and control municipalities are made comparable. In the preferred matched specification with extensive controls, plan updates reduce the MPI by about 1.6 percentage points (p.p.). These gains are highly heterogeneous, being concentrated in small and medium-sized municipalities, especially those implementing EOT instruments, and in municipalities with midrange administrative capacity. Channel estimates align with a housing-and-services interpretation. Treated municipalities experience statistically significant increases in potable-water access and declines in the qualitative housing deficit, while effects on sewage access and the quantitative housing deficit are not statistically distinguishable from zero. The heterogeneity in these mechanisms mirrors the heterogeneity in poverty impacts, with the strongest improvements concentrated among EOT municipalities and mid-capacity settings. Together, the evidence supports a focused conclusion: planning updates matter for welfare to the extent that they translate into improved service coverage and housing habitability, outcomes that as one might expect depend on local implementation conditions.

This paper contributes to the empirical literature on spatial planning by providing causal evidence on a nationally standardized planning reform in a middle-income country with an emphasis on outcomes and mechanisms that are central to multidimensional poverty. Much of the existing evidence emphasizes changes in spatial form, regulation-induced constraints, or macroproductivity channels (Long et al., 2021; Kim, 2011; Hersperger et al., 2018; Turner et al., 2014; Rossi-Hansberg, 2004; Hsieh and Moretti, 2019; Duranton and Puga, 2020). By contrast, the Colombian setting allows us to evaluate whether making planning instruments more operational improves the most immediate components of living standards (that is, basic services and housing quality) and to show how these effects depend on municipal size, instrument type, and administrative capacity.

The paper proceeds as follows: section 2 situates territorial planning within the literature, emphasizing the housing and basic-services mechanisms that link planning to multidimensional poverty. Section 3 describes Colombia's planning framework and the transition from first- to second-

[1] We exclude the few municipalities that did not participate in either wave. We also exclude municipalities that adopted their first POT between 2005 and 2012 (the update status of which is not observed during the analysis window) and municipalities that updated in 2022–23, because their postupdate outcomes are not observable within our study horizon.

generation POTs. Section 4 presents the data, defines the treatment and comparison groups, and outlines the matching and regression strategy. Section 5 reports the main estimates, heterogeneity, and channel evidence. Section 6 concludes with an interpretation of the findings, a discussion of the study's limitations, and a presentation of the implications for the design and targeting of territorial planning reforms.

2 Where Do We Stand? A Brief Review of the Literature

Spatial (or territorial) planning can be understood as a place-based policy that coordinates land development with the provision of public goods. For poverty and welfare analysis, the most direct and policy-relevant mechanisms run through the housing sector and basic services. Planning influences where housing can be built, the availability of serviced land, and the sequencing of infrastructure expansion. When these margins are binding, as they are in many rapidly urbanizing settings, the welfare consequences are immediate: inadequate access to potable water and sanitation, overcrowding, the use of low-quality building materials, and settlement in poorly serviced or risky areas. International policy frameworks explicitly frame integrated urban and territorial planning as a tool to coordinate land use with infrastructure investment, service provision, and environmental and risk management (United Nations Human Settlements Programme, 2015).

A useful conceptual distinction is that planning operates through both allocative and informational functions. Allocatively, it sets land classifications and development parameters that condition the supply of buildable land and the location of infrastructure and facilities. Informationally, it can reduce uncertainty by clarifying permissible uses and investment priorities, thus supporting the coordination of developers, utilities, and local governments. This view aligns with the land-use transitions (LUT) literature, which emphasizes that land-use change entails not only visible land-cover shifts but also changes in less-observable attributes such as property rights, management regimes, and land functions (Long et al., 2021). These recessive dimensions are central to housing and services because welfare often depends on tenure security, the feasibility of network extensions, and the ability of municipalities to plan and finance investments (United Nations Human Settlements Programme, 2015).

The welfare effects of planning are not clearly established, particularly with respect to housing and services. On the one hand, planning may correct coordination failures that otherwise would lead to fragmented development and high-cost, reactive infrastructure provision. By identifying infrastructure corridors and aligning land-use decisions with network expansion, planning can facilitate service delivery and improve living conditions, particularly for low-income households. On the other hand, restrictive regulation can constrain housing supply and increase prices, potentially excluding poorer households from formal markets and shifting growth into informality. The empirical literature on growth-management and containment policies documents changes in spatial form alongside persistent concerns about sorting and policy endogeneity (Nelson and Moore, 1993; Dawkins and Nelson, 2003; Crane, 2000; Knaap et al., 2001). Complementary work in urban and spatial economics has found that restrictive land-use regulation can generate welfare losses by constraining housing supply and distorting the spatial allocation of households and firms (Turner et al., 2014; Hsieh and Moretti, 2019). These findings underscore that the net effects of planning on housing outcomes depend on whether coordination gains dominate constraint costs and on local capacity to implement and enforce rules.

A substantial share of the planning literature explicitly identifies basic services as a key mechanism. By influencing the spatial configuration of water and sanitation networks, waste management systems, and facility locations, territorial plans can shape health outcomes through exposure and infrastructure pathways. International guidance emphasizes the integration of health considerations into urban and territorial planning through infrastructure, urban form, and exposure management (United Nations Human Settlements Programme and World Health Organization, 2020). The health returns to safe water and sanitation are well documented (Hunter et al., 2010) and urban diagnostics stress that inadequate sanitation and wastewater management imposes substantial welfare and environmental costs (United Nations Human Settlements Programme, 2023). Planning can reduce the political and technical frictions associated with expanding these services by clarifying land-use compatibility and site constraints for network infrastructure and treatment facilities (Giaimo et al., 1997).

Housing is the other central channel. By allocating developable land and regulating densities, planning affects the availability of serviced plots and the feasibility of formal housing construction (Metternicht, 2018). At the same time, restrictive zoning and growth controls can raise housing prices and exclude low-income households, potentially worsening welfare even if services improve for those who remain in formal areas (Kim, 2011; Ihlanfeldt and Sjoquist, 2000). Planning also conditions the timing and feasibility of real estate investment by defining permissible uses and infrastructure obligations (Ratcliffe et al., 2021); professional guidance emphasizes that housing outcomes are dependent on interactions between regulation, land supply, infrastructure sequencing, and market responses (Planning Institute of Australia, 2022). In addition, improvements in housing quality can occur not only through new construction but also through upgrades in habitability standards associated with serviced land and utility expansion.

Other channels (for example, labor markets, human capital, and municipal finance) may also respond to planning reforms, but these pathways typically operate indirectly and over longer horizons. For a study focused on multidimensional poverty within a finite postupdate window, the most credible and proximate mechanisms are those that enter the MPI directly through public services and housing conditions. This motivates an empirical approach that prioritizes service coverage and housing deficit indicators as intermediate outcomes and interprets poverty effects through these margins.

In this literature, Colombia offers a distinctive environment because of its legally sophisticated planning framework combined with decentralized municipal implementation (Pinilla Pineda and Rodríguez Vitta, 2018; Haddad et al., 2021). Diagnostic assessments argue that second-generation plans were developed using more-sophisticated technical tools and information and are perceived as relevant to the closing of gaps in service provision and territorial development (United States Agency for International Development and Departamento Nacional de Planeación, 2017; Saavedra et al., 2022). The key empirical questions are whether these improvements in the operational content of planning instruments translate into measurable welfare gains and whether these improvements are consistent with the mechanisms emphasized above (that is, whether the gains are reflected in basic services and housing quality).

3 Institutional Setting: Spatial Planning in Colombia

Colombia is widely regarded as having one of Latin America's most developed urban and territorial planning frameworks, with land-use principles articulated from the 1991 Constitution through municipal planning instruments (Pinilla Pineda and Rodríguez Vitta, 2018). The constitutional shift toward decentralization strengthened municipal autonomy and positioned local governments as central actors in service delivery and territorial development (Haddad et al., 2021). This institutional architecture was consolidated through the Organic Law on the Development Plan (Law 152 of 1994) and, most importantly, Law 388 of 1997, which remains the cornerstone of Colombia's modern territorial planning regime (Congreso de Colombia, 1997).

Law 388 establishes the Plan de Ordenamiento Territorial (POT) as the primary instrument governing land use, spatial development, and the occupation and transformation of land by means of binding objectives, policies, and regulatory norms. To account for heterogeneity in municipal scale and capacity, the law differentiates planning instruments by population size, distinguishing POTs for municipalities with more than 100,000 inhabitants, PBOTs for those with 30,000–100,000 inhabitants, and EOTs for smaller jurisdictions. Although these instruments vary in scope and technical depth, they share a common legal logic and planning structure, as summarized in appendix table 1.

The Colombian planning system operates within a multilevel governance structure in which the national government defines overarching territorial policies and strategic determinations of national interest, departments provide regional coordination, and municipalities retain the primary authority to formulate, adopt, and enforce land-use regulations (Pinilla Pineda and Rodríguez Vitta, 2018). At the local level, implementation relies on planning offices, environmental authorities, and consultative bodies, supported by land administration and cadastre systems that underpin zoning decisions and regulatory enforcement. Substantively, the framework treats urban planning as a public function and subordinates individual property rights to their social and ecological function, placing participation, urban–rural integration, and the equitable distribution of development benefits and burdens at the core of territorial regulation (Departamento Nacional de Planeación, 2023).

In practice, POTs translate a territorial diagnosis into a legally binding spatial development model through an iterative cycle of diagnosis, formulation, implementation, and monitoring as regulated by Law 388 and complementary norms such as Decree 1077 of 2015 (Pinilla Pineda and Rodríguez Vitta, 2018). Municipal responsibilities extend well beyond zoning to include land classification, the designation of infrastructure and public facilities, the reservation of public space and environmental protection areas, and the use of land management and financing instruments.

These include partial plans, urban macroprojects, neighborhood upgrading programs, licensing regimes, and land-value capture mechanisms designed to align private development incentives with public objectives.

This institutional design has generated distinct generational waves of POTs with clear implications for causal analysis. While first-generation plans were adopted broadly following the 1997 mandate, leaving limited scope for identifying their effects, subsequent updates have exhibited substantial heterogeneity in both timing and take-up across municipalities. These second-wave POTs represent a discrete policy shock, because they involve comprehensive revisions of diagnoses, regulations, and implementation instruments under a more mature legal and technical environment. Importantly, municipalities updating their plans typically moved from largely declarative instruments toward more-operational frameworks, characterized by clearer zoning rules, stronger enforcement mechanisms, improved integration of infrastructure and environmental risk management, and expanded use of land-management and land-value-capture tools (Pinilla Pineda and Rodríguez Vitta, 2018). This incomplete adoption creates plausibly exogenous variation in exposure to effective land-use regulation, conditional on observable municipal characteristics, enabling a quasi-experimental evaluation of the welfare effects of spatial planning. By focusing on second-generation POT updates, the present analysis isolates the incremental impact of strengthening and operationalizing land-use planning, rather than conflating planning effects with the initial introduction of formal territorial regulation (see table 1).

Table 1: Comparison between First- and Second-Generation POTs

Aspect	First-generation POTs	Second-generation POTs
Regulatory framework	• Defined by Law 388 of 1997. • The minimum guidelines for POTs may be ambiguous, mainly regarding land use.	• Defined more precisely by Regulatory Decree 1077 of 2015. • The definition of land uses was clarified and consolidated in that decree.
Technical support	• During the first formulation of POTs, technical support from the national level was limited, mainly because this was the first time territorial entities were preparing these instruments.	• Through strategies such as POT Modernos, territorial entities had more tools to formulate them. • A larger number of professionals working on these issues improved the technical content of the instrument.
Municipal capacities	• Municipalities did not have sufficient capacities to formulate the instruments. • Financial and technical limitations made it difficult to formulate POTs for the first time.	• There were learning-curve-related improvements in second-generation instruments. • Territorial entities had better alternatives for financing and preparing their plans. • There were stronger technical capacities due to experience in formulating other planning instruments.
Data availability	• Although the preparation of first-generation POTs required the review of territorial information, it was still limited, particularly regarding cadastre and geographic information.	• Territorial entities have better technology to capture the characteristics of their territory and, under legal mandates, are obliged to collect territorial information.

4 Data and Methods

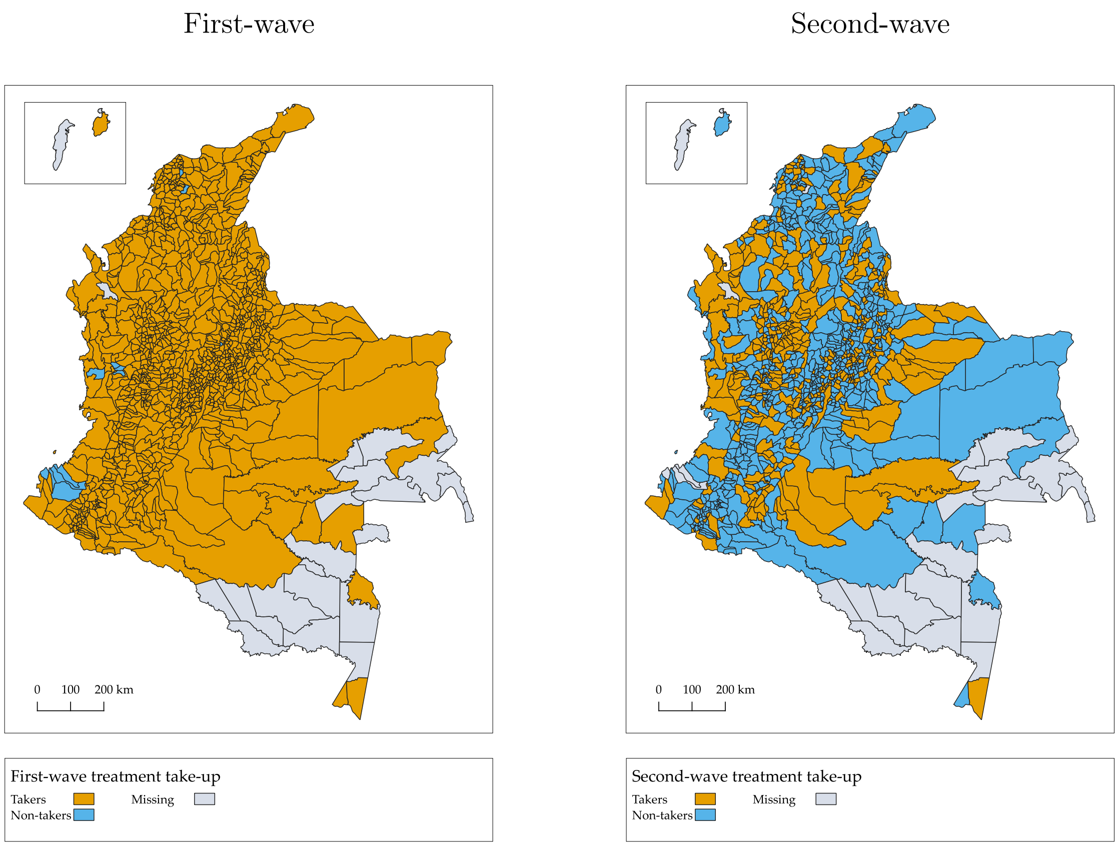
4.1 Data

We assemble a municipality–year panel combining administrative records in territorial planning instruments with census-based and administrative data. Poverty outcomes are drawn from the official Multidimensional Poverty Index (MPI) produced by the Departamento Administrativo Nacional de Estadística (DANE; National Administrative Department of Statistics). The MPI is constructed from harmonized census and administrative modules and is available at the municipal level over the study period. We complement the MPI with administrative indicators of service coverage and housing quality drawn from sectoral registries, including water and sanitation coverage from the Superintendencia Servicios Públicos Domiciliarios (SSPD; Superintendence of Public Utilities) and qualitative and quantitative housing-deficit indicators from DANE.

Moreover, we compile pretreatment municipal characteristics capturing population size, urbanization, baseline economic structure, geographic constraints, exposure to conflict, and fiscal and administrative capacity. These variables are drawn from DANE population censuses and projections, the Departamento Nacional de Planeación (DNP; National Planning Department, the fiscal performance indicators of the Contraloría General (Comptroller General), and administrative records from sectoral ministries. All covariates are measured prior to POT updating to avoid posttreatment bias.

Planning data are obtained from the Instituto Geográfico Agustín Codazzi (IGAC; Agustín Codazzi Geographic Institute) and the Ministerio de Vivienda, Ciudad y Territorio (Ministry of Housing, City, and Territory , which track the type of planning instrument (EOT, PBOT, POT), the year of adoption, and the validity status of plans over time. Figure 1 documents the national update cycle and cross-sectional heterogeneity generated by municipalities' transitioning or not to second-generation plans during this period.

Figure 1: First- and Second-Wave Take-Up of Land-Use Plans



Spatial planning and treatment assignment:Take-up of municipal land-use plans differed sharply across the two POT waves. Adoption of first-generation POTs was nearly universal, leaving little cross-sectional variation, whereas second-wave updates exhibit substantial heterogeneity (figure 1). Second-generation POTs are also richer and more operationally detailed, providing a stronger policy shock to municipal planning capacity. Accordingly, our analysis focuses on the effects of second-wave adoption, defined as the update to a first-generation POT.

Treatment assignment is based on the year of the latest POT update. The treatment group comprises municipalities that adopted a second-generation POT between 2013 and 2021, when most first-generation instruments were reaching the end of their validity cycle.

To construct a cleaner counterfactual, we exclude municipalities that adopted their first POT between 2005 and 2012 (the update status of which is not observed during the analysis window) and municipalities that updated in 2022–23 (postupdate outcomes are not observable within our study horizon).

4.2 Empirical Approach and Identification Strategy

Because municipalities self-select into updating their territorial planning instruments, naïve comparisons may confound the effect of second-generation POT adoption with differences in baseline characteristics and trends. To approximate the counterfactual evolution of poverty in treated municipalities absent updating, we implement a quasi-experimental design based on genetic matching, which constructs a comparison group by minimizing multivariate imbalance in pretreatment covariates.

Let $D_{it} \in \{0, 1\}$ indicate whether municipality i has adopted a second-generation POT by year t and let $Y_{it}(1)$ and $Y_{it}(0)$ denote potential outcomes under treatment and nontreatment, respectively. The parameter of interest is the average treatment effect on the treated (ATT),

$$\text{ATT} = \mathbb{E}[Y_{it}(1) - Y_{it}(0) \mid D_{it} = 1].$$

Identification relies on conditional independence,

$$\{Y_{it}(0), Y_{it}(1)\} \perp D_{it} \mid X_i,$$

where X_i is a high-dimensional vector of pretreatment municipal characteristics.

We estimate the ATT by constructing a matched sample in which treated and control municipalities are balanced on X_i. Let $\mathcal{T}$ denote the set of treated municipalities in cohort c (defined by year of update) and $\mathcal{C}$ the set of candidate controls that have not yet adopted by cohort c. For each treated municipality $i \in \mathcal{T}$, genetic matching selects weights $W = (w_1, \ldots, w_K)$ over the K covariates in X_i and identifies a set of matched controls $j \in \mathcal{C}$ that minimize the Mahalanobis distance,

$$d_{ij}(W) = \sqrt{(X_i - X_j)'\Sigma^{-1}(W)(X_i - X_j)},$$

where $\Sigma(W)$ is a positive definite weighting matrix that rescales covariates by their relative importance for achieving balance. The genetic algorithm searches over the space of admissible weighting matrices

W to minimize a global imbalance objective function,

$$\min_{W} \mathcal{L}(W) = \sum_{k=1}^{K} \left| \overline{X}_k^T(W) - \overline{X}_k^C(W) \right|,$$

where $\overline{X}_k^T(W)$ and $\overline{X}_k^C(W)$ denote the postmatching means of covariate k in the treated and matched control groups, respectively. The optimization proceeds iteratively using a genetic algorithm that mutates and recombines candidate-weighting matrices, retaining those that minimize covariate imbalance according to $\mathcal{L}(W)$.

After matching, we estimate the treatment effects in a panel framework with municipality and year fixed effects:

$$Y_{it} = \alpha_i + \lambda_t + \beta D_{it} + X_{it}'\gamma + \varepsilon_{it}, \tag{1}$$

where α_i absorbs time-invariant municipal heterogeneity, λ_t captures common shocks, and X_{it} includes time-varying controls. Standard errors are clustered at the municipality level. Under the conditional independence assumption and stable unit treatment value assumption (SUTVA) (no interference across municipalities), β identifies the ATT.

A potential violation of these assumptions is that spatial spillovers may violate SUTVA if updates in one municipality affect neighboring outcomes; we therefore estimate specifications excluding municipalities adjacent to treated units in the same adoption cohort. Balance diagnostics (appendix figure 1) confirm that the genetic matching procedure achieves near-exact balance on the full vector X_i prior to outcome estimation.

5 Results

5.0.1 Baseline Covariate Distributions and Balanced Sample

Table 2 reports the distribution of the national population across evaluation groups. During the period of study a majority of Colombia's population resided in treated municipalities (58.17 percent, or 30.31 million inhabitants), while control municipalities accounted for 35.62 percent (18.56 million) and excluded municipalities for 6.21 percent (3.24 million). This distribution reflects the fact that Colombia's largest urban areas (Bogotá, Medellín, Cali, and Barranquilla, along with most departmental capitals) are concentrated in the treatment group. This baseline imbalance is methodologically relevant because the treated municipalities are, from the outset, larger and more economically dynamic on average, underscoring the need to adjust for pretreatment differences in size and development.

Substantial baseline differences also exist between treated and control municipalities along other observable covariates (see appendix table 2). In the unmatched sample, treated and control municipalities differ systematically in terms of population size, geographic characteristics, and institutional features of the first-generation planning instrument. These imbalances motivate a design that prioritizes covariate balance prior to outcome analysis in order to reduce model dependence

Table 2: Proportion of the Population by Assessment Group

Group	Population	Percentage of total population
Control	18,560,704	35.62%
Treatment	30,313,715	58.17%
Excluded	3,238,341	6.21%

and strengthen the credibility of the counterfactual. Thus, we implement genetic matching using pretreatment municipality characteristics only, which include demographic indicators, income proxies, geographic and spatial controls, the type of planning instrument, the year of adoption of the first-generation instrument, and whether the initial instrument remained current. These variables capture institutional and structural features that plausibly affect both the likelihood of updating and subsequent outcomes.

This strategy targets the most observable sources of baseline imbalance and yields substantial improvements in balance. After matching, absolute standardized mean differences decline sharply across covariates, and the matched control group closely tracks the treated group along both municipal characteristics and institutional features, as summarized in appendix table 3.

5.1 Primary Estimates

Table 3 reports the estimated average effect of POT updates on multidimensional poverty. Across specifications, the point estimates are generally poverty reducing, although their magnitude and precision depend on how treated and control municipalities are made comparable. In specifications that rely on the full sample or on matching only municipal characteristics, the estimated effects are negative but imprecisely estimated, consistent with residual heterogeneity between treated and control municipalities along institutional and structural dimensions. Once we restrict attention to comparable municipalities using genetic matching and condition on the full set of municipal and instrument characteristics (column 3), POT updates are associated with a statistically significant decline in the MPI of about 1.6 points.

Table 3: Treatment Effects on Poverty

	(1) Full sample	(2) Match: Mun.	(3) Match: Mun. & ins.
Treated	-1.043	-0.592	-1.597**
	(1.107)	(0.686)	(0.735)
Controls	No	Yes	Yes
Sample	Full	Mun.	Mun. & ins.
Observations	959	529	514
Adj. R-squared	-0.000	0.815	0.822

Robust standard errors in parentheses.

Matched columns use genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Interpreted through the lens of the conceptual framework, this average effect captures the extent to which updated territorial planning regimes translate regulatory intent into realized improvements in multidimensional living standards. The magnitude and timing of the effect are consistent with POTs' operating primarily by improving the spatial coordination of infrastructure and service provision, thereby relaxing coordination failures in urban expansion and enhancing access to basic services and housing quality, particularly for vulnerable populations (Henderson, 2013; Departamento Nacional de Planeación, 2023). The absence of robust effects in less restrictive specifications underscores that these welfare gains materialize where planning updates are plausibly implemented and embedded in local institutional capacity, rather than reflecting mechanical changes in labor market conditions or short-run income responses (United Nations Human Settlements Programme, 2015; Luo and Xu, 2018).

5.1.1 Heterogeneous Effects

The literature suggests that the impacts of POT updates are likely to be heterogeneous across space and institutional contexts. Differences in municipal administrative capacity and in the type and scope of planning instruments condition implementation, compliance, and enforcement, generating uneven effects across municipalities. Planning reforms also interact with land markets: changes in permitted uses, densities, and infrastructure provision can reshape land values and development incentives, with implications that vary across municipal typologies and stages of development.

Table 4 examines heterogeneity by municipal capacity using the DNP's Municipal Performance Measurement Index classification. The poverty-reducing effects of POT updates are concentrated in mid-capacity municipalities, where adoption is associated with a decline of approximately 3.0 MPI points. In contrast, the estimated effects for high-capacity municipalities are close to zero, while the estimates for low-capacity municipalities are negative but imprecisely estimated.[2] These patterns are consistent with the view that planning updates generate the largest welfare gains where baseline capacity is sufficient to translate regulatory changes into service delivery and infrastructure improvements, but not so high that marginal reforms yield limited additional impact. Although the estimates for low-capacity municipalities are not statistically significant, they are poverty reducing in sign; given the smaller sample size in this group, the imprecision of these estimates leaves open the possibility that meaningful effects may also arise in lower-capacity municipalities that typically are smaller.

Table 4: Treatment Effects on Poverty by Classification of Municipality

	(1) High level	(2) Mid- levels	(3) Low level
Treated	0.221	-2.988***	-1.352
	(0.973)	(1.109)	(2.284)
Controls	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.
Observations	133	305	76
Adj. R-squared	0.797	0.643	0.507

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Because the instrument type is determined by population thresholds at the time of adoption but may not fully reflect subsequent changes in municipal size, we also examine heterogeneity by observed population in 2012. This allows us to separate the role of planning instrument type from contemporaneous municipal size during the study period.

We therefore re-estimate effects using population brackets defined by quartiles of the matched-sample population distribution: (1) the bottom quartile, (2) the middle two quartiles, and (3) the top quartile. Table 5 shows that poverty reductions are concentrated in the first three quartiles of the distribution (that is, small and medium-sized municipalities in relative terms), with the largest decline in the bottom quartile and a statistically significant reduction of approximately 1.9 MPI points in the middle half of the municipalities.

[2]We further disaggregate the Mid category into Mid-high, Mid, and Mid-low. The results are reported in appendix table 4.

Table 5: Treatment Effects on Poverty by Population Brackets, Defined by quartiles

	(1) Quartile 1 (<8906)	(2) Quartiles 2–3 (8906–36445)	(3) Quartile 4 (>36445)
Treated	-2.829**	-1.859*	0.824
	(1.168)	(1.055)	(1.745)
Controls	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.
Observations	111	263	140
Adj. R-squared	0.888	0.846	0.516

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

This concentration is unsurprising, given Colombia's highly skewed municipal population distribution (figure 2) in which the vast majority of municipalities fall below the 30,000-inhabitant threshold.

Figure 2: Cumulative Distribution of Total Population, 2012

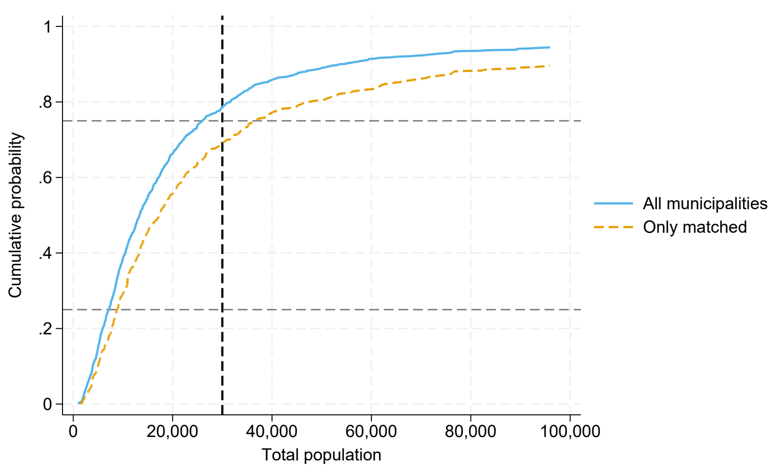


Table 6 further stratifies the results by the type of territorial planning instrument defined in the regulatory framework (EOT, PBOT, and POT). The estimated effects are negative for EOT and PBOT municipalities and positive but extremely imprecise for POT municipalities. The only statistically significant effect is observed for EOT municipalities, where POT updates are associated with a reduction of approximately 1.7 MPI points. Caution is necessary when developing interpretations across instrument types, however, because the POT group is very small in the matched sample, leading to limited precision.

Taken together, tables 4–6 indicate that poverty-reducing effects of POT updates are not uniform.

Table 6: Treatment Effects on Poverty by Type of Instrument

	(1) EOT	(2) PBOT	(3) POT
Treated	-1.744*	-1.983	0.795
	(0.923)	(1.514)	(6.799)
Controls	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.
Observations	369	111	34
Adj. R-squared	0.775	0.866	0.895

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

They are most clearly detected in smaller and medium-sized municipalities (the first three quartiles of the population distribution) and in municipalities with intermediate levels of institutional capacity; there is suggestive evidence that the overall effect is more consistent with rural than urban channels.

5.1.2 The Housing and Services Channel

The previous section shows that territorial planning updates reduce multidimensional poverty, with effects concentrated in smaller municipalities (the first three population quartiles, those below roughly 36,000 inhabitants) and, within that group, in municipalities that adopt *EOTs* and exhibit mid-range logistical and administrative capacity. These patterns are consistent with territorial plans' affecting welfare primarily through channels linked to the spatial organization of basic services and the built environment. By aligning land-use patterns with infrastructure corridors and service standards, planning can facilitate the expansion and quality of water and sanitation services and improve housing conditions, thereby directly affecting nonincome dimensions of poverty. The next set of results examines these channels explicitly by estimating the effects of POT updates on service coverage and housing quality outcomes.

Access to potable water is particularly salient, given its well-documented links to health outcomes (Hunter et al., 2010). Sanitation and solid-waste management also represent central urban challenges with large welfare and environmental externalities (United Nations Human Settlements Programme, 2023). Territorial planning can lower the costs and conflicts associated with expanding these services by identifying suitable land uses and locations for infrastructure and service provision (Giaimo et al., 1997). Planning updates may also influence housing and real estate dynamics. By clarifying land-use rules, development parameters, and minimum standards, territorial planning can affect the supply and habitability of housing, access to amenities and transport, and patterns of socio-spatial inequality (Mouratidis, 2021; Planning Institute of Australia, 2022). In addition, planning frameworks shape how projects are designed and financed, with implications for feasibility and land values (Ratcliffe et al., 2021), and may interact with market dynamics in ways that either reinforce or dampen development (Munanga et al., 2021).

Table 7 provides evidence on these development-oriented intermediates. The clearest pattern is an improvement in basic infrastructure and connectivity: treated municipalities experience a statistically significant increase in water access (3.7 p.p.) and in the housing dimension, the qualitative housing deficit falls by about 3.3 p.p., consistent with planning updates improving habitability conditions via better serviced land, clearer standards, or more-coordinated provision of utilities. In contrast, the effects on sewage access and the quantitative housing deficit are not statistically different from zero, suggesting that network-intensive expansions and net additions to the housing stock may be harder to achieve within the study horizon than quality-related margins.

Table 7: Treatment Effects on Development Channels

	(1) House quant. deficit	(2) House qual. deficit	(3) Water access	(4) Sewage access
Treated	1.410	-3.302***	3.709**	1.471
	(1.131)	(1.223)	(1.495)	(1.433)
Controls	Yes	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.	Mun. & ins.
Observations	514	514	514	514
Adj. R-squared	0.656	0.444	0.574	0.684

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

A key question is whether these improvements are concentrated in the same municipalities that drive the decline in poverty. The heterogeneity patterns support that interpretation. By instrument type, appendix table 5 shows that the most robust gains in services and housing quality are concentrated among municipalities with an EOT (water access, sewage access, and qualitative housing deficit all improve), whereas estimates for PBOT and POT municipalities are generally smaller and less precisely estimated (with POT results also relying on a much smaller sample). By implementation capacity, appendix tables 6 and 7 indicate that service-access gains are most clearly detected among mid-capacity municipalities (water and sewage access increase), while estimates for high-capacity municipalities are comparatively muted. Taken together, these heterogeneity results mirror the earlier poverty findings and are consistent with a mechanism operating through improvements in basic services and housing quality in municipalities where planning updates are both more prevalent (EOT) and more likely to be implemented effectively (mid-capacity).

6 Conclusion and Discussion

This paper evaluates whether strengthening Colombia's municipal territorial planning instruments, through updates to second-generation Planes de Ordenamiento Territorial (POTs), translates into measurable improvements in multidimensional living standards. The core premise is that more-operational plans can reduce coordination failures in land development by clarifying zoning rules, aligning urban expansion with infrastructure corridors, and strengthening minimum habitability standards. Within the study horizon, the most proximate and policy-relevant pathways therefore operate through the built environment and basic services, which enter multidimensional poverty directly.

The main finding is that second-generation POT updates are associated with a statistically significant reduction in municipal multidimensional poverty once treated and control municipalities are made comparable. In the preferred specification combining genetic matching with extensive controls, plan updates reduce the MPI by roughly 1.6 points (table 3). This result indicates that strengthening the operational content of territorial plans translates into tangible welfare gains beyond purely declarative regulatory changes.

These effects are strongly place dependent. Poverty reductions are concentrated in smaller and medium-sized municipalities, particularly those below the top quartile of the population distribution, and are most clearly detected among municipalities implementing EOT instruments (tables 5 and 6). Impacts are also concentrated in municipalities with intermediate administrative capacity (table 4), consistent with a setting in which planning reforms bind most where baseline deficits remain sizable and local institutions are capable of translating updated rules into implemented actions.

The channel evidence is consistent with this interpretation. POT updates are associated with improvements in outcomes that directly reflect the coordination of land development with service provision and habitability standards. Treated municipalities experience statistically significant gains in potable water access and reductions in the qualitative housing deficit (table 7). The effects on sewage access and the quantitative housing deficit are smaller and not statistically distinguishable from zero within the study horizon, suggesting that some network-intensive margins adjust more gradually. Importantly, the heterogeneity in these intermediates mirrors the heterogeneity in poverty impacts: the clearest gains in services and housing quality occur in EOT municipalities and in mid-capacity settings (appendix tables 5–7). This alignment supports a coherent mechanism in which planning updates reduce multidimensional poverty primarily by improving service coverage and housing habitability where implementation is most feasible.

The empirical design combines quasi-experimental variation in second-wave plan adoption with high-dimensional matching on pretreatment municipal characteristics and institutional features of first-generation plans. While municipality-level poverty is observed at discrete census intervals, the consistency of results across specifications and the close alignment between poverty impacts and service and housing channels reinforce the interpretation that the estimated effects reflect genuine welfare gains associated with strengthened territorial planning.

Overall, the evidence indicates that the updating of territorial plans can be an effective lever for improving living standards, but that returns are highly context specific. The strongest and most consistent gains arise in smaller and medium-sized municipalities and in mid-capacity settings, where second-generation planning reforms appear to move beyond formal compliance and translate into concrete improvements in basic services and housing conditions. These findings underscore the importance of pairing regulatory updates with implementation support in the contexts where the marginal returns to planning reform are highest.

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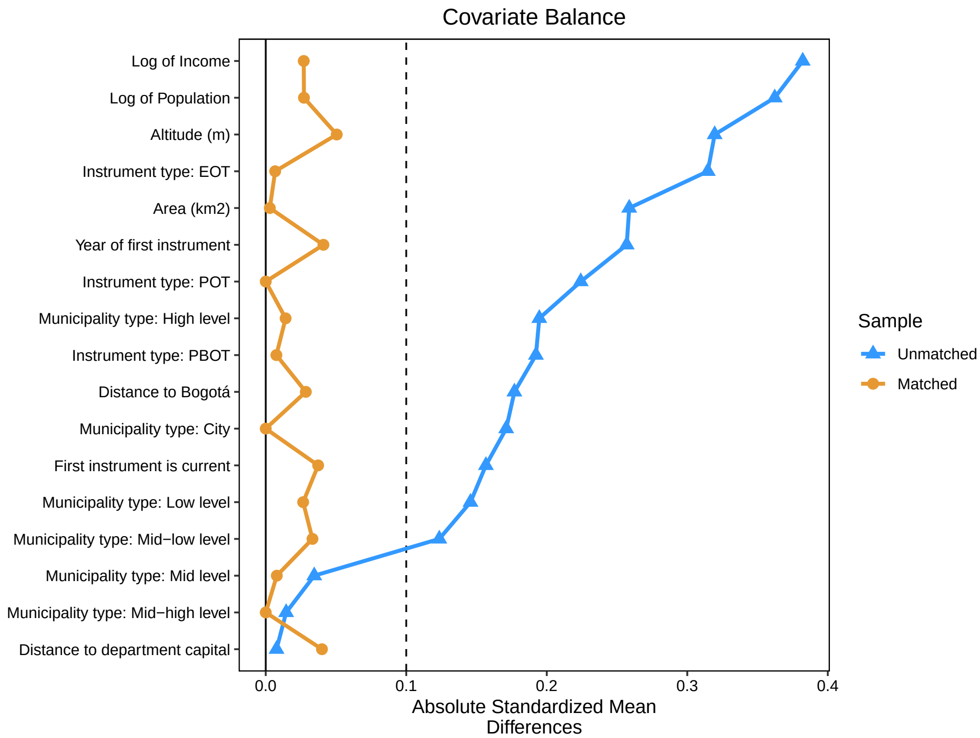
Appendix

Appendix Table 1: Comparison of the Types of Planning Instruments, by Key Features

Features	**POT**	**PBOT**	**EOT**
Applicability by population	Municipalities with more than 100,000 inhabitants	Municipalities between 30,000 and 100,000 inhabitants	Municipalities with less than 30,000 inhabitants
Focus	Comprehensive urban and rural development	Simplified approach of the POT for smaller localities	General guidelines for small localities
Key components	zoning, land use, infrastructure, public services, transportation, environmental protection	Land use, basic services, transportation, adapted to medium-sized municipalities	Land use, urban development, environmental protection, rural development
Main objective	Establish policies, objectives, strategies, and programs for comprehensive development	Establish policies and guidelines adapted for the organization of medium-sized territories	Provide guidance for growth and organization, emphasizing the balance between development and resource protection
Detail and complexity	High complexity and detail	Intermediate complexity and detail	Lower complexity and detail
Specific planning aspects	Comprehensive urban and rural planning approach focusing on sustainability and growth	Focus on land use, infrastructure, and services adapted to medium needs	Focus on basic guidelines for territorial expansion and resource protection
Management instruments	Complex and diversified for a wide range of urban and rural actions	Simplified compared to POT, adapted to the capacities of medium-sized municipalities	Basic and general, suitable for the management capacity of small municipalities

Appendix Figure 1: Balance on Covariates Before and After Genetic Matching by Municipality and First-Instrument Characteristics



Appendix Table 2: Balance in Treatment, Year 2012

	Treatment	Control	Diff (Treatment - Control)
Municipality characteristics			
Log of population	9.908	9.439	0.469***
Log of weighted GDP	24.131	24.524	-0.393***
Log of income	9.724	9.244	0.479***
Log of area (km2)	5.943	5.622	0.321***
Altitude (m)	995.283	1278.138	-282.856***
Distance to department capital	76.413	76.869	-0.456
Distance to Bogotá	328.853	297.046	31.807**
Municipality type: City	0.034	0.003	0.031***
Municipality type: High level	0.261	0.175	0.085***
Municipality type: Mid-high level	0.202	0.208	-0.006
Municipality type: Mid-level	0.193	0.206	-0.014
Municipality type: Mid-low level	0.168	0.214	-0.046*
Municipality type: Low level	0.143	0.194	-0.051**
First instrument characteristics			
Year of first instrument	2002.786	2001.600	1.186***
First instrument is current	0.519	0.597	-0.078**

Instrument type: EOT	0.686	0.832	-0.146***
Instrument type: PBOT	0.214	0.135	0.079***
Instrument type: POT	0.099	0.032	0.067***
Department			
Amazonas	0.000	0.002	-0.002
Antioquia	0.168	0.092	0.075***
Arauca	0.019	0.002	0.017***
Atlántico	0.040	0.015	0.025**
Bogotá	0.003	0.000	0.003
Bolívar	0.031	0.037	-0.006
Boyacá	0.068	0.134	-0.066***
Caldas	0.025	0.029	-0.004
Caquetá	0.028	0.011	0.017**
Casanare	0.025	0.014	0.011
Cauca	0.016	0.043	-0.028**
Cesar	0.053	0.009	0.044***
Chocó	0.037	0.009	0.028***
Cundinamarca	0.062	0.137	-0.075***
Córdoba	0.043	0.020	0.023**
Guainía	0.000	0.002	-0.002
Guaviare	0.003	0.005	-0.002
Huila	0.040	0.034	0.007
La Guajira	0.009	0.017	-0.008
Magdalena	0.006	0.025	-0.018**
Meta	0.028	0.020	0.008
Nariño	0.034	0.062	-0.027*
Norte de Santander	0.068	0.026	0.042***
Putumayo	0.016	0.011	0.005
Quindío	0.016	0.011	0.005
Risaralda	0.022	0.009	0.013
San Andrés	0.000	0.002	-0.002
Santander	0.047	0.102	-0.055***
Sucre	0.019	0.028	-0.009
Tolima	0.043	0.046	-0.003
Valle del Cauca	0.031	0.043	-0.012
Vaupés	0.000	0.003	-0.003
Vichada	0.000	0.003	-0.003

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix Table 3: Balance Results for Genetic Matching with Municipality and First-Instrument Characteristics

Variable	Status	Means Treated	Means Control	Std. Mean Diff.	Var. Ratio	eCDF Mean	eCDF Max	Std. Pair Dist.
Altitude (m)	All	995.28	1278.14	-0.32	0.94	0.09	0.16	
Altitude (m)	Matched	995.28	950.55	0.05	1.11	0.02	0.05	0.42
Distance to Bogotá	All	328.85	297.05	0.18	0.90	0.06	0.13	
Distance to Bogotá	Matched	328.85	323.73	0.03	1.05	0.03	0.09	0.40
Distance to department capital	All	76.41	76.87	-0.01	1.26	0.02	0.07	
Distance to department capital	Matched	76.41	74.04	0.04	1.15	0.03	0.08	0.35
Distance	All	0.41	0.29	0.57	2.96	0.18	0.29	
Distance	Matched	0.41	0.40	0.05	1.10	0.02	0.07	0.21
City	All	0.03	0.00	0.17		0.03	0.03	
City	Matched	0.03	0.03	0.00		0.00	0.00	0.00
High level	All	0.26	0.18	0.19		0.09	0.09	
High level	Matched	0.26	0.25	0.01		0.01	0.01	0.03
Mid-high level	All	0.20	0.21	-0.01		0.01	0.01	
Mid-high level	Matched	0.20	0.20	-0.00		0.00	0.00	0.00
Mid-level	All	0.19	0.21	-0.03		0.01	0.01	
Mid-level	Matched	0.19	0.20	-0.01		0.00	0.00	0.07
Mid-low level	All	0.17	0.21	-0.12		0.05	0.05	
Mid-low level	Matched	0.17	0.18	-0.03		0.01	0.01	0.08
Low level	All	0.14	0.19	-0.15		0.05	0.05	
Low level	Matched	0.14	0.13	0.03		0.01	0.01	0.03
Year of first instrument	All	2002.79	2001.60	0.26	4.87	0.05	0.11	
Year of first instrument	Matched	2002.79	2002.60	0.04	1.10	0.02	0.04	0.27
First instrument is current	All	0.52	0.60	-0.16		0.08	0.08	
First instrument is current	Matched	0.52	0.54	-0.04		0.02	0.02	0.16
Log of area (km2)	All	5.94	5.62	0.26	1.13	0.08	0.14	
Log of area (km2)	Matched	5.94	5.95	-0.00	1.12	0.02	0.06	0.44
Log of population	All	9.91	9.44	0.36	1.64	0.11	0.18	
Log of population	Matched	9.91	9.94	-0.03	1.15	0.02	0.07	0.38
Log of income	All	9.72	9.24	0.38	2.15	0.12	0.18	
Log of income	Matched	9.72	9.69	0.03	1.21	0.02	0.06	0.29
EOT	All	0.69	0.83	-0.31		0.15	0.15	
EOT	Matched	0.69	0.68	0.01		0.00	0.00	0.02
PBOT	All	0.21	0.14	0.19		0.08	0.08	
PBOT	Matched	0.21	0.22	-0.01		0.00	0.00	0.02
POT	All	0.10	0.03	0.22		0.07	0.07	
POT	Matched	0.10	0.10	-0.00		0.00	0.00	0.00

Appendix Table 4: Treatment Effects on Poverty by Classification of Municipality

	(1) High level	(2) Mid-high level	(3) Mid- level	(4) Mid-low level	(5) Low level
Treated	0.222	-1.599	-2.802	-4.184**	-1.293
	(0.967)	(1.578)	(2.134)	(1.901)	(2.315)
Controls	Yes	Yes	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.	Mun. & ins.	Mun. & ins.
Observations	133	110	106	89	76
Adj. R-squared	0.801	0.687	0.400	0.687	0.470

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix Table 5: Treatment Effects on Development Channels by Type of Instrument

	(1) Water access	(2) Sewage access	(3) House quant. deficit	(4) House qual. deficit
Panel A. Municipalities with EOT				
Treated	3.872**	2.932*	1.670	-3.889***
	(1.915)	(1.665)	(1.397)	(1.419)
Observations	369	369	369	369
Adj. R-squared	0.493	0.615	0.655	0.442
Panel B. Municipalities with PBOT				
Treated	4.032	-2.956	0.778	-2.072
	(2.568)	(2.524)	(1.933)	(2.906)
Observations	111	111	111	111
Adj. R-squared	0.737	0.748	0.786	0.470
Panel C. Municipalities with POT				
Treated	-2.347	-3.803	3.611	5.050
	(3.013)	(12.439)	(8.335)	(3.465)
Observations	34	34	34	34
Adj. R-squared	0.938	0.867	0.818	0.960
Controls	Yes	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.	Mun. & ins.

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix Table 6: Treatment Effects on Development Channels by Classification of Municipality

	(1) Water access	(2) Sewage access	(3) House quant. deficit	(4) House qual. deficit
Panel A. High-level municipalities				
Treated	1.619	-2.088	0.503	-1.712
	(1.735)	(2.518)	(1.414)	(1.818)
Observations	133	133	133	133
Adj. R-squared	0.565	0.524	0.539	0.484
Panel B. Mid-high-level municipalities				
Treated	7.774**	5.873*	-0.678	-4.547*
	(2.974)	(3.517)	(1.576)	(2.519)
Observations	110	110	110	110
Adj. R-squared	0.578	0.644	0.684	0.510
Panel C. Mid-level municipalities				
Treated	2.322	2.209	0.340	-0.624
	(3.910)	(3.441)	(3.017)	(2.746)
Observations	106	106	106	106
Adj. R-squared	0.417	0.463	0.573	0.464
Panel D. Mid-low-level municipalities				
Treated	8.080**	6.769*	-6.348*	1.082
	(3.994)	(3.932)	(3.447)	(3.537)
Observations	89	89	89	89
Adj. R-squared	0.569	0.428	0.680	0.465
Panel E. Low-level municipalities				
Treated	3.663	1.847	10.41***	-10.80***
	(4.881)	(3.792)	(3.504)	(3.664)
Observations	76	76	76	76
Adj. R-squared	0.312	0.209	0.729	0.639
Controls	Yes	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.	Mun. & ins.

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix Table 7: Treatment Effects on Development Channels by Classification of Municipality

	(1) Water access	(2) Sewage access	(3) House quant. deficit	(4) House qual. deficit
Panel A. High-level municipalities				
Treated	1.619	-2.088	0.503	-1.712
	(1.735)	(2.518)	(1.414)	(1.818)
Observations	133	133	133	133
Adj. R-squared	0.565	0.524	0.539	0.484
Panel B. Mid-level municipalities				
Treated	4.482**	4.123*	-1.976	-1.417
	(2.024)	(2.132)	(1.543)	(1.588)
Observations	305	305	305	305
Adj. R-squared	0.481	0.481	0.616	0.398
Panel C. Low-level municipalities				
Treated	3.663	1.847	10.41***	-10.80***
	(4.881)	(3.792)	(3.504)	(3.664)
Observations	76	76	76	76
Adj. R-squared	0.312	0.209	0.729	0.639
Controls	Yes	Yes	Yes	Yes
Sample	Mun. & ins.	Mun. & ins.	Mun. & ins.	Mun. & ins.

Robust standard errors in parentheses.

Observations are weighted by genetic-matching weights.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$