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Those Who Collect Taxes Use Transfers Better: Evidence of Decentralization Design and Service Outcomes in Bolivia

Quienes recaudan impuestos usan mejor las transferencias: evidencia sobre el diseño de la descentralización y los resultados de prestación de servicios en Bolivia

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Abstract

This paper examines whether the design elements of decentralization –own-revenue effort, operations and maintenance (opex), capital expenditure (capex), and total execution– help explain municipal differences in poverty-relevant service conditions and their downstream influence on human capital and the local economy. A recursive SEM is estimated within departments, with services defined as an SDG1-based composite. Robustness replaces the mediator with a basic-infrastructure services composite (biservices1) and reparameterizes execution as total executed expenditure *per capita*. Four results stand out: (i) own-revenue effort is the strongest predictor of services, while execution scale is positive but smaller; in

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composition, opex –not capex– supports services; (ii) capex influences the economy directly, consistent with an investment pass-through; (iii) higher services raise the predicted level of human-capital and economic outcomes in the model, with the former path larger; and (iv) population scale and density matter. The pattern is consistent with a *flypaper-with-effort* interpretation: where fiscal effort and operations and maintenance (O&M) discipline are present, available resources –including transfers– translate more effectively into poverty-relevant service conditions. At the same time, investment has a direct influence on the economy. Estimates are directed influences within the maintained model, not counterfactual causal effects. Policy implications: (i) embed effort-compatible transfers so own-source revenue unlocks additional grant resources; (ii) protect O&M floors to keep assets working; (iii) pair new capex with credible O&M plans; and (iv) keep services abreast of agglomeration.

Keywords: Decentralization design; Own-source revenue; Intergovernmental transfers; Operations and maintenance (O&M); Capital investment (capex); Service delivery; Structural equation modeling; Flypaper effect; Municipal finance; Bolivia.

Resumen

Este artículo examina si los elementos de diseño de la descentralización –esfuerzo de recaudación propia, operación y mantenimiento (O&M), gasto de capital (capex) y ejecución total– ayudan a explicar las diferencias municipales en condiciones de prestación de servicios relevantes para la pobreza y su influencia aguas abajo sobre el capital humano y la economía local. Se estima un modelo de ecuaciones estructurales (SEM) recursivo intradepartamental, con servicios definido como un compuesto basado en ODS1. La robustez sustituye al mediador por un compuesto de servicios de infraestructura básica (biservices1) y reparametriza la ejecución como ejecución total *per cápita*. Destacan cuatro resultados: (i) el esfuerzo de recaudación propia es el predictor más fuerte de servicios; la escala de ejecución es positiva pero menor y, en la composición, O&M –no capex– sostiene la prestación de servicios; (ii) capex influye directamente sobre la economía, de forma coherente con una transmisión de obras y encadenamientos; (iii) mayores servicios elevan el nivel previsto de capital humano y economía en el modelo, con un efecto mayor en el primero, y (iv) la escala poblacional y la densidad importan. El patrón es coherente con una lectura de "flypaper-con-esfuerzo": cuando existen esfuerzo fiscal y disciplina de O&M, los recursos disponibles –incluidas

las transferencias– se traducen más eficazmente en condiciones de servicios relevantes para la pobreza; al mismo tiempo, la inversión influye directamente sobre la economía. Las estimaciones son influencias dirigidas dentro del modelo mantenido, no efectos causales contrafactuales. Implicaciones de política: (i) incorporar transferencias compatibles con el esfuerzo (fórmula/PBGS) para que la recaudación propia habilite recursos adicionales; (ii) proteger pisos de O&M; (iii) emparejar capex con planes creíbles de O&M; y (iv) asegurar que los servicios acompañen la aglomeración.

Palabras clave: Diseño de la descentralización; recaudación propia; transferencias intergubernamentales; operación y mantenimiento (O&M); inversión (capex); prestación de servicios; modelo de ecuaciones estructurales; efecto flypaper; finanzas municipales; Bolivia.

Classification/Clasificación JEL: H77, H71, H72, H54, O18, O54, C38.

List of Acronyms

LMAD	Ley Marco de Autonomías y Descentralización (Autonomies and Decentralization Framework Law)
CPE	Constitución Política del Estado (Bolivian National Political Constitution)
LPP	Ley de Participación Popular (Popular Participation Law)
OSR	Own-source revenue
CAPEX	Capital expenditure (investment)
OPEX	Operational expenditure
O&M	Operations and maintenance
SDG1-based	Poverty-relevant service composite based on the first SDG
SDGs	United Nations Sustainable Development Goals
ODS	Objetivos de Desarrollo Sostenible
Biservices1	Basic-infrastructure services composite
PBGS	Performance-based grants system
PDIA	Problem-Driven Iterative Adaptation
SUS	Sistema Único de Salud (Unified Health System)
SEM	Structural Equation Model
CFI	Comparative Fit Index

TLI	Tucker-Lewis Index
RMSEA	Root Mean Square Error of Approximation
SRMR	Standardized Root Mean Square Residual
LODO	Leave-One-Department-Out
IDH	Impuesto Directo a los Hidrocarburos (Direct Tax on Hydrocarbons)
OECD	Organization for Economic Co-operation and Development
SEA	Servicio Estatal de Autonomías (State Service for Autonomies)
IDB-OVE	Inter-American Development Bank-Office of Evaluation and Oversight
INE	Instituto Nacional de Estadística (National Institute of Statistics)

1. Introduction

Design –not only devolution– shapes whether public money becomes public services. A succinct way to state the central idea studied here is the paper's title: Those who collect taxes use transfers better. The observation is policy-salient in settings where transfers are large, yet service conditions and development outcomes remain uneven.

Background and motivation. Bolivia's decentralization framework (CPE/LMAD) mandates that municipalities promote economic and human capital development through the provision of public services. International and Bolivian literatures converge on a simple proposition: decentralization performs best when own-revenue autonomy and effort harden budget constraints and strengthen accountability; when operations and maintenance (opex) keep services "on"; and capital investment (capex) is paired with credible operations and maintenance so assets deliver. Yet evidence is often presented in fragments –on spending levels, on investment waves, or on single outcomes– without tracing how effort, execution, and agglomeration jointly shape service conditions and, downstream, development.

Research problem and gap. The missing piece is a transparent, system-level test of the directed influences from own-revenue effort and budget execution (scale and composition) to poverty-relevant service conditions, and from those conditions to human-capital and economic outcomes –while accounting for scale (population) and agglomeration (density). In particular, few studies simultaneously (i) compare effort vs. execution scale as predictors of

services, (ii) disentangle opex vs. capex in the service-delivery channel, and (iii) allow capex to influence the economy directly.

Purpose and approach. The study estimates a theory-driven, recursive path model (SEM) in which a services composite is a mediator, operationalized as a poverty-relevant composite (SDG1-based). All variables are transformed, standardized, and estimated within departments to emphasize municipal-level variation. Robustness assessments replace the mediator with a basic-infrastructure services composite (biservices1) and re-parameterize execution as total executed expenditure *per capita*, keeping the model's logic intact.

Main findings. Three consistent results emerge.

1. Upstream. Own-revenue effort is the strongest predictor of services. Execution scale is positive but smaller; within execution, opex –not capex– supports services.
2. Investment channel. Capex influences the economy directly, consistent with public works and supply-chain pass-through, beyond what is transmitted through services.
3. Downstream. Higher services raise the predicted level of human-capital and economic outcomes in the model, with a larger path to human capital. Population scales the economy and can strain human capital at the margin; density strengthens services but can depress the economy unless services keep pace.

Contribution. Substantively, the analysis discriminates among upstream levers (effort vs. scale; opex vs. capex) and traces their pass-through via services to development outcomes –in the spirit of LMAD's service-first directive. Methodologically, it provides a transparent poverty-relevant services measure and a within-department SEM that yields directed influences rather than undirected correlations. The pattern aligns with a flypaper-with-effort reading; municipalities that raise revenue and protect operations translate available resources –transfers included– into better service conditions, while investment primarily influences economic activity directly.

Roadmap. Section 2 reviews international and Bolivian literatures with a design matters lens. Section 3 details data, transformations, and a SEM specification. Section 4 reports results, robustness, and interpretation. Section 5 concludes with implications, limitations, and directions for future work.

2. Theoretical Framework: A Design-Matters Approach to Decentralization

2.1. International Evidence: Why Design Matters

Fiscal decentralization research has increasingly converged on the conclusion that design is the decisive factor shaping whether decentralization advances or hinders development. Early theories emphasized efficiency gains from tailoring public services to local preferences (Oates, 1972) and from competition among jurisdictions (Tiebout, 1956), yet subsequent political economy frameworks demonstrated that these gains materialize only when institutional design aligns incentives for accountability and responsible fiscal behavior (Weingast, 1995; Bardhan & Mookherjee, 2006). The foundational warning by Martínez-Vázquez and McNab (2001) that decentralization cannot be expected to generate positive outcomes absent coherent institutional architecture remains central to contemporary scholarship.

Across two decades of empirical work, evidence confirms that decentralization outcomes are conditional on specific design features. The most consistent positive impacts –improved service delivery, enhanced accountability, and reduced corruption– emerge when subnational governments possess real discretionary authority paired with mechanisms for citizen oversight and transparency (Faguet & Pöschl, 2015, Ch.1; Martínez-Vázquez *et al.*, 2017). Conversely, decentralization that devolves responsibilities without decision-making power or resources results in "partial" or "cynical" reforms that entrench patronage and inefficiency (Faguet & Pöschl, 2015, Ch.1).

The core design principle is the alignment of functions with financing. OECD (2018) shows that decentralization improves efficiency and policy responsiveness only when expenditure responsibilities are matched with meaningful own-source revenue. Revenue decentralization –especially authority over tax bases or rates– strengthens accountability, fiscal effort, and policy innovation, whereas spending-only decentralization financed predominantly through transfers weakens incentives, blurs responsibility, and generates vertical fiscal imbalances. Jia *et al.*, (2021) reinforce this by demonstrating that fiscal autonomy must be accompanied by hard budget constraints to prevent soft-budget behavior, over-borrowing, and bailout expectations that undermine discipline. Subnational borrowing frameworks, fiscal rules, and

credible no-bailout commitments are therefore essential complements of decentralization reform.

Transfers and equalization mechanisms further illustrate how design shapes outcomes. Transfers are indispensable for territorial equity, but their architecture determines whether they promote effort or dependency. Well-designed transfers are rules-based, predictable, and transparent, providing equalization that secures minimum standards without eroding local incentives for revenue mobilization (Martinez-Vazquez *et al.*, 2017, Bahl & Martínez-Vázquez, 2022). Poorly designed systems –particularly derivation-based revenue sharing or politically negotiated grants– reinforce disparities and weaken accountability. The growing shift toward performance-based grants and consolidated block grants must also be designed carefully, as they risk rewarding high-capacity jurisdictions unless accompanied by capacity-building and fair baseline guarantees (Bahl & Martínez-Vázquez, 2022).

Other design elements increasingly recognized as pivotal include clarity and exclusivity in functional assignments, to avoid duplication and blurred accountability, and multi-level coordination mechanisms, especially for infrastructure and capital spending, where decentralization can fail without cross-jurisdictional planning (OECD, 2018). Capacity and accountability must be embedded from the outset: autonomy without capacity or oversight undermines performance, while capacity building without real discretion yields bureaucratic compliance rather than innovation.

The literature further reveals that design choices must reflect structural and contextual conditions. The role of geography in shaping efficient scales of government and preference heterogeneity (Canavire-Bacarreza & Martínez-Vázquez, 2012) indicates that assignment, revenue instruments, and equalization must be tailored to territorial realities. Political motivations matter as well: reforms driven by political survival, state-building, or conflict management often shape design quality and sincerity (Faguet & Pöschl, 2015, Ch.1), affecting long-term institutional credibility.

Beyond fiscal federalism, a complementary strand emphasizes state capability and mission-oriented design. The PDIA approach argues that governments improve performance through iterative, problem-driven adaptation rather than blueprint reforms (Andrews *et al.*, 2012; 2017), while "good enough governance" stresses feasible institutional improvements over

idealized checklists (Grindle, 2007); in parallel, mission-oriented public value frameworks align instruments and incentives around concrete societal goals (Mazzucato, 2023). These perspectives are consistent with the design lens: effort-compatible transfers and operations and maintenance discipline are capability-enhancing rules that make decentralization work in practice.

Recent scholarship thus calls for a "third-generation" decentralization approach that integrates fiscal, administrative, and political design into a coherent institutional system rather than isolated reforms (OECD, 2019; Martínez-Vázquez, 2025). In essence, decentralization succeeds not because power is devolved, but because the architecture of incentives, authority, resources, accountability, and rules are mutually reinforcing. Where these design elements are aligned, decentralization can foster dynamic, innovative, and equitable local governance; where they are misaligned, decentralization magnifies fragmentation, inefficiency, and fiscal risk.

2.2. Bolivian Evidence

For Bolivia's trajectory and design debates, Finot (2016) remains a foundational synthesis: a historical narrative of reforms (LPP, IDH, LMAD), a diagnosis of transfer-driven imbalances, and a proposal to reconcile efficiency with equity via effort-based financing and clear assignment of social vs. territorial goods. That agenda is taken here as background to the "design matters" test at the municipal level.

Recent evidence on Bolivian decentralization confirms that institutional design choices critically shape incentives and outcomes. Early reforms under the *Ley de Participación Popular (LPP)* improved allocative responsiveness and basic service access, as municipalities shifted spending toward local needs (Faguet, 2004; Ugarte & Bolívar, 2018). However, the model relied heavily on central transfers, weakening tax effort and creating soft budget constraints –an incentive failure documented through econometric analysis (Barja *et al*., 2013, Sec.3). The commodity boom of the 2000s further entrenched this dependency, amplifying vertical and horizontal fiscal imbalances and exposing municipalities to volatility in hydrocarbons revenues (Andersen & Jemio, 2016). Despite long-standing recommendations to

strengthen subnational tax autonomy –particularly through property tax modernization and diversification– progress remained limited (Brosio, 2012).

The post-2009 *Constitución Política del Estado* (CPE) and *Ley Marco de Autonomías y Descentralización* (LMAD) expanded formal autonomy, creating a multi-level autonomy framework, and introduced a more complex multilevel system of concurrent, shared, and exclusive competencies. Evidence from its first decade shows that the system continues to operate primarily as a transfer-dominated and highly asymmetric municipal sector. Municipal revenues rose sharply between 2011 and 2014, peaking at roughly 3.2 billion USD, before stabilizing around 2.8-3.0 billion USD (SEA, 2020). Despite this expansion, 73.5% of municipal income still comes from national transfers, and small municipalities depend on them for 95-96% of their resources (SEA, 2020). Own-source revenue remains highly concentrated on department capitals plus El Alto, which collect 77% of all municipal tax revenues, while more than 50 municipalities report essentially no tax collection at all (SEA, 2020). This reflects both structural limits (low local economic bases) and the absence of a national system for cadastre modernization, valuation, and enforcement.

Expenditure patterns further highlight design bottlenecks. Municipal budgets are concentrated in multisectoral, education, health, and urban programs, but core social services –especially health– depend heavily on *coparticipación* and *IDH*, and an increasing share of these sources is earmarked for national programs such as the SUS, Renta Dignidad, and risk management (SEA, 2020). This earmarking significantly reduces municipal discretion even when nominal revenues remain stable. Meanwhile, LMAD's complex competence typology and strong central regulatory authority create overlapping mandates and uncertainty in execution (Del Campo & Sánchez-Reinón, 2022). Formal coordination bodies exist but tend to be under-institutionalized or politicized, weakening vertical integration of planning, budgeting, and sector policies.

Outcome-based assessments mirror these structural patterns. Municipal budget execution and investment efficiency vary widely, driven by administrative capacity constraints, fragmented planning-budgeting-procurement chains, and weak project appraisal systems (IDB-OVE, 2015; World Bank, 2021). Territorial inequalities persist despite earlier gains in access: improvements in service quality, continuity, and sustainability remain uneven. Recent

quasi-experimental evidence shows that greater municipal fiscal autonomy causally improves service outcomes, including emergency response during COVID-19 and governance spillovers (Oporto & Maldonado, 2023). Complementary political economy research finds that reforms to revenue sharing and autonomy implementation have been shaped more by national-local bargaining than by principles of efficiency or equity (Arellano-Yanguas & Mejía-Acosta, 2014).

Overall, Bolivia's empirical record demonstrates both the promise and the limits of its decentralization architecture. Formal autonomy expanded dramatically, yet incentive-compatible finance, systematic capacity-building, effective coordination, and performance-oriented transfers remain underdeveloped. The system appears to have reached the frontier of what a transfer-driven model can deliver: while access expanded and foundational infrastructure improved, further gains in efficiency, equity, and resilience require shifting from normative autonomy to designed autonomy –one grounded in incentives, capacity systems, and coherent intergovernmental rules.

3. Data and Econometric Strategy

The analysis uses cross-sectional variables drawn from 2012-2019 pre-pandemic sources. Fiscal variables reflect 2017 municipal budgets; outcome composites draw on 2012-2016 administrative indicators that move slowly over time. These measures are interpreted as poverty-relevant service conditions observed near the 2017 finance snapshot[1].

3.1. Data, Transformation, and Sources

3.1.1. Intervention or Exogenous Variables

These are related to the functioning of the autonomous municipal governments (GAM in Spanish) and expressed in the programmed budget in millions of Bs (pbudget), budget execution rate in percent (budget_rate), proportion of own tax revenues in percent (owntaxes), total public investment in millions of Bs (capex) and public investment *per capita* in Bs/person

1 This timing does not assert short-run causality; it reads outcomes as relatively persistent conditions around the late-cycle period.

(investpc or capexpc). The source is the Atlas Municipal ODS Bolivia (Andersen *et al.*, 2020), where the GAM data is available only for the year 2017.

Based on these, a total executed budget in millions of Bs (budgetx = pbudget*budget_rate/100) is computed, and a total executed operating expense in millions of Bs (opex = budgetx – capex) is approximated. Their *per capita* version was also computed (execpc = budgetx/pop2017 and opexpc = opex/pop2017), considering the municipal population in 2017 (pop2017 = capex/capexpc).

3.1.2. Outcome indicators or Endogenous Variables

The three endogenous variables of interest are those that represent outcomes or performance in service provision, as well as economic and human capital advancement, at the municipal territorial level. Each of these are composite indicators[2].

Service provision is a composite of four other indicators: (i) the extreme energy poverty rate of 2016 which is the percentage of households that consume less than 25% of the limit for the dignity tariff of 210 kWh/year; (ii) the unsatisfied basic needs index (UBN[3]) of 2012 in percentage of population; (iii) the multidimensional poverty index[4] (MPI) of 2012; and (iv) the access to the three basic services of electricity, water and sanitation index[5] (3BS) of 2012. These indicators compose the poverty eradication objective (SDG1) in the Atlas Municipal ODS Bolivia, which is their source. SDG1 is the equally weighted sum of (1 - normalized extreme energy poverty) + (1 - normalized UBN) + (1 – normalized MPI) + (normalized 3BS). Since a higher value of the composite index is better, it is the reason why here it refers to the poverty-relevant service provision index (services, 0-1, higher is better).

Human capital is a composite of three other indicators: (i) the percentage of the population aged 19 or older who completed secondary education in 2012. This indicator directly captures a basic level of educational achievement and the acquisition of useful skills; (ii) the chronic malnutrition rate for children under 5 years old in 2016. This is an important

2 Although outcomes lean toward earlier-year inputs (*e.g.*, 2012 census-based indicators), they capture structural, slow-moving conditions. It is useful to read them as initial conditions that finance and management must change.

3 The UBN index is compiled by the National Institute of Statistics (INE) and its components are: unsuitable living materials and spaces, inadequate water and sanitation services, energy supplies, health and education.

4 The 2012 MPI was compiled by INESAD from the number of households with deficiencies in four or more dimensions from nine in the provision and use of basic services.

5 This index was compiled by INE.

health indicator that affects long-term human capital formation. Its resolution requires a high degree of cooperation and social cohesion, and (iii) the global labor force participation rate for women in 2012. This indicator serves as a proxy for the removal of social and cultural barriers that limit women's economic opportunities, leading to a more productive and inclusive workforce that fully utilizes its human capital. The source of the first indicator is INE, while the Atlas Municipal ODS is the source for the other two. The human capital composite index (humancap, 0-1, higher is better) is the equally weighted sum of (normalized secondary education completion rate) + (1 – normalized chronic malnutrition rate) + (normalized women's labor force participation rate).

Economy is a composite index of two other indicators: (i) municipal level GDP in million Bs. This indicator captures the total scale of economic activity or value added from economic sectors; (ii) municipal level *per capita* GDP in Bs/person. This indicator captures economic intensity or average productivity per person. The source of both indicators is FAM-ARLAT[6] for the year 2019. The economy composite index (economy, 0-1, higher is better) is the equally weighted sum of (normalized ln(GDP)) + (normalized ln(*per capita* GDP)).

3.1.3. Context Variables

Two important demographic municipal characteristics were included as contextual control variables: (i) a 2020 population projection (population), produced by INE and available in the Atlas Municipal ODS, that captures the significant heterogeneity in population size among municipalities. This variable accounts for how population size can influence the economies of scale that enable the broader provision of services and infrastructure, as well as overall economic activity; (ii) a 2019 population density in inhabitants per km^1 (density), computed by FAM-ARLAT, serves as an agglomeration variable. It addresses heterogeneity arising from long-term rural-urban migration. Agglomeration economies can have a direct effect on the unit cost of service provision.

3.1.4. Transformations and Notation

The following outlines the methodology used to prepare and transform the data for statistical analysis: (i) pre-processing: Budget-related variables and population density were winsorized

6 Data base from the Local Economic Systems Project of the Federación de Asociaciones Municipales de Bolivia (FAM), delivered by Análisis Real Latinoamérica (ARLAT) with UNDP funding.

at the 1st/99th percentiles; all other continuous variables are clipped to [1st, 99th] percentiles. The budget execution rate was capped to [1, 120] and own-source revenue rate to [0, 100]; (ii) functional form: positive, unbounded variables (levels or *per capita*) use natural logs; variables owntaxes and services were logit-transformed; (iii) standardization: all transformed variables are standardized (z-scored) to have a zero mean and unit variance. This allows the beta coefficients to be directly comparable within the same model, as they are all measured in standard deviation units; (iv) within-department adjustment: each standardized variable is regressed on department dummies. Residuals free of departmental effects are kept and standardized again; (v) centering and nonlinearity for density: population density was log-transformed and then centered (cden). It was also squared ($cden^2$) to allow for nonlinear agglomeration effects; (vi) variable notation as zr_lvariable means it was log/logit transformed (l), department adjusted (r), and standardized (z). Descriptive statistics for key variables in their raw form are in Annex 1.

3.2. SEM Path Analysis Specification

Structural equation modeling (SEM) starts from a theory-driven path diagram. The diagram specifies which variables are exogenous and which are endogenous, as well as the hypothesized direction of direct connections among them (arrows). Estimation proceeds by fitting the model-implied covariance matrix to the sample covariance matrix. Maximum likelihood with robust correction is the standard estimation method. SEM delivers comparable direct, indirect (mediated), and total effects, which is why it is well-suited to explain mechanisms in complex systems; however, it does not substitute for counterfactual causal analysis.

3.2.1. Theory of Change

The proposed path diagram for evaluating the functioning of the Bolivian municipal decentralization system is derived from Bolivia's LMAD (Law 031), which stipulates that municipal governments must promote local economic, human, and urban development through the provision of public services. In the budgetary dimension, LMAD defines revenue sources (transfers and own-source revenue), budget programming, and budget execution, split into opex and capex. Translating this directive into a testable structure: intervention variables (revenues and expenditures) should raise service provision, and improved services should, in

turn, be associated with better economic outcomes and human capital advancement. Context variables account for scale and agglomeration.

3.2.2. SEM Model

The following is the model used for estimation:

$$\text{zr\_lservices} \leftarrow \text{zr\_lowntaxes zr\_lopexpc zr\_linvestpc zr\_cden zr\_cden2} \quad (1)$$

$$\text{zr\_economy} \leftarrow \text{zr\_lservices zr\_linvestpc zr\_cden zr\_lpopulation} \quad (2)$$

$$\text{zr\_humancap} \leftarrow \text{zr\_lservices zr\_lpopulation} \quad (3)$$

$$\text{cov}(\text{e.zr\_economy*e.zr\_humancap}) \quad (4)$$

The model describes a recursive SEM where effects flow in one direction only (assumes no reciprocal paths) with no latent factors and is overidentified[7]. Equation (1) models service provision as the mediating channel through which management quality (proxied by own-revenue share), operational scale (opex *per capita*), and investment scale (capex *per capita*) translate into outcomes. Density and its square capture non-linear agglomeration effects in the unit cost of service provision. Equation (2) models the local economy as affected by services (the service delivery channel) and by capex directly (through capital spending and supply-chain linkages), plus controls for population scale and density. In equation (3), human capital responds to services (basic and infrastructure services) and is controlled for population scale.

The last line estimates cov(economy, human capital) disturbances to allow for unobserved common shocks (institutions, labor markets, regional cycles) not explicitly modeled. This is in addition to the covariance among all exogenous regressors, which in path analysis are usually allowed to covary. Indirect effects from each intervention and context variable to the economy and human capital are computed through services (the mediating channel). An alternative specification substitutes opex *per capita* and capex *per capita* in equation (1) for the total executed budget *per capita*.

7 'Effect' denotes a model-implied directed influence in a recursive system (no reciprocal paths), estimated on transformed, within-department data. Counterfactual causality is not claimed; feedback loops may exist beyond the maintained structure.

3.3. Goodness of Fit and Robustness of Inference

Model fit is evaluated by contrasting the model-implied and observed covariance matrices using robust χ^2 (Null: exact fit). Because this test is sensitive to sample size and model complexity, it is complemented with absolute fit indices (RMSEA, SRMR)[8] and comparative fit indices (CFI, TLI)[9]. As a guide, values near RMSEA/SRMR ≤ 0.08 (preferably ≤ 0.05) and CFI/TLI ≥ 0.90 (preferably ≥ 0.95) indicate an acceptable to good fit. Degrees of freedom, sample size, and (for RMSEA) its 90% confidence interval and test of close fit are reported. Also, a coefficient of determination for the system is reported.

AIC/BIC are used to balance fit and parsimony across theoretically adjacent specifications. Modification indices (ways to improve fit) are considered when compatible with the pre-specified theory of change.

Maximum likelihood is used for baseline model estimation. The following are reported to guard inference against non-normality and minor misspecification: ML with Satorra-Bentler corrections (robust chi-square and robust fit indices) and ML with bootstrap standard errors.

4. Results and Interpretation

Throughout this section, services denotes the poverty-relevant services composite defined in 3.1.2 (the SDG1-based index combining access to basic services and reductions in deprivations). Higher values indicate greater progress on poverty-relevant service conditions. All reported path coefficients are estimated within departments (variables were transformed, standardized, and residualized by department).

Explanatory note: A path coefficient is the estimated strength and direction of a specified arrow in the path diagram. SEM software labels these as direct, indirect, and total effects. Here, they are interpreted as directed influences within the maintained model, not as counterfactual causal effects.

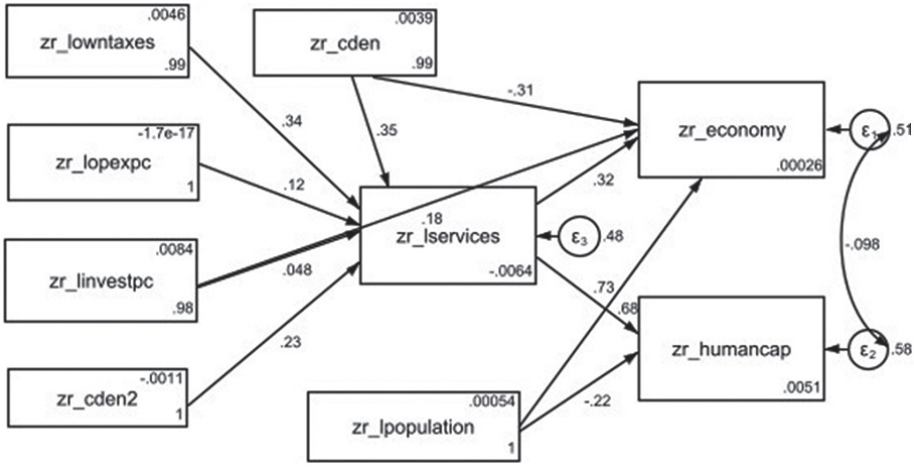
8 RMSEA is root mean square error of approximation; SRMR is standardized root mean square residual.

9 CFI is comparative fit index; TLI is Tucker-Lewis index.

4.1. Model Results and Fit

Figure 1 presents the structural equations model (SEM) in its path diagram form, including estimated path coefficients (standardized direct effects), and Table 1 completes by reporting standardized direct, indirect, and total effects and their p-values. The SEM is estimated as a system of three simultaneous structural equations (services, economy, human capital), where all reported coefficients are in standard-deviation units. This allows direct comparison of magnitudes across regressors and across equations. Indirect and total effects are computed through the paths defined in the model, in particular through the mediating role of service provision. The SEM also estimates the covariance structure among exogenous predictors; these covariances (19 parameters) are not shown here but are included in model estimation. Only the additional residual covariance between the economy and human capital equations is shown here.

Figure 1: SEM Path diagram with estimated path coefficients



Source: Own, based on Stata outcome.

Table 1
Direct, indirect, and total effects from the estimated model

Structural	Direct effects		Indirect effects		Total effects	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
zr_lservices						
zr_lowntaxes	0.3382	0.000	-	-	0.3382	0.000
zr_lopexpc	0.1183	0.026	-	-	0.1183	0.026
zr_linvestpc	0.0484	0.241	-	-	0.0484	0.241
zr_cden	0.3519	0.000	-	-	0.3519	0.000
zr_cden2	0.2332	0.000	-	-	0.2332	0.000
zr_economy						
zr_lservices	0.3239	0.000	-	-	0.3239	0.000
zr_lowntaxes	-	-	0.1095	0.000	0.1095	0.000
zr_lopexpc	-	-	0.0383	0.039	0.0383	0.039
zr_linvestpc	0.1821	0.000	0.0157	0.244	0.1978	0.000
zr_cden	-0.3113	0.000	0.1140	0.000	-0.1972	0.001
zr_cden2	-	-	0.0755	0.000	0.0755	0.000
zr_lpopulation	0.6792	0.000	-	-	0.6792	0.000
zr_humancap						
zr_lservices	0.7282	0.000	-	-	0.7282	0.000
zr_lowntaxes	-	-	0.2462	0.000	0.2462	0.000
zr_lopexpc	-	-	0.0861	0.017	0.0861	0.017
zr_linvestpc	-	-	0.0353	0.253	0.0353	0.253
zr_cden	-	-	0.2562	0.000	0.2562	0.000
zr_cden2	-	-	0.1698	0.000	0.1698	0.000
zr_lpopulation	-0.2182	0.000	-	-	-0.2182	0.000

Source: Own, based on Stata outcomes.
Note: All coefficients are standardized (SD units).

In the services equation, three patterns dominate: (i) municipal own-source revenue effort (management and quality proxy) is the strongest predictor of services (large, positive, and statistically significant on the order of $\beta \approx 0.34$ SD; (ii) operational expenditure *per capita* (opex) positively influences services, though with a smaller magnitude than own-source effort ($\beta \approx 0.12$ SD), consistent with the idea that staffing, operations, and maintenance are what sustain service delivery. By contrast, capital expenditure *per capita* (capex) does not provide reliable evidence of a direct influence on services; (iii) agglomeration effects matter strongly; both density and density squared enter positively, indicating that the marginal influence of agglomeration on services strengthens over the observed range.

In the economy equation, several channels appear: (i) services positively influences the local economy ($\beta \approx 0.32$ SD), consistent with the theory of change; (ii) capex exerts an additional direct positive influence ($\beta \approx 0.18$ SD), consistent with project spending and supply-chain linkages; (iii) population is a strong positive predictor of the economy (scale effects), while density exerts a negative direct influence on the economy that is partly offset by its positive pathway via services, yielding a negative total influence. Concentrating people without commensurate service expansion can impose congestion and cost pressures on economic activity.

In the human capital equation, (i) services strongly influences human capital (largest path coefficient in the system, $\beta \approx 0.73$ SD); (ii) while population exerts negative direct influence in the main specification; in a basic infrastructure services robustness variant, population is not a reliable predictor, and omitting it leaves the services coefficient and model fit essentially unchanged (here it is retained for comparability).

Taken together, Table 1 shows: (i) service provision is a core mediator. Many determinants –fiscal effort, operating expenditure, density– act first on services, and services in turn feed into economic performance and human capital outcomes; (ii) own-source revenue effort dominates in magnitude. The path coefficient on zr_lowntaxes in the services equation (~0.34) is roughly three times larger than the path coefficient on operational expenditure (~0.12). This suggests that "management quality/fiscal effort" is more important than "spending scale" in explaining differences in service provision across municipalities (within the same department); (iii) capital spending behaves differently, it does not materially explain service provision, but it does explain local economic performance directly. While opex sustains services, capex fuels production and income.

Table 2 reports model fit under three inferential approaches: standard maximum likelihood using the observed information matrix (OIM), maximum likelihood with Satorra–Bentler correction, and maximum likelihood with bootstrap standard errors. Across methods, the model exhibits low RMSEA/SRMR and high CFI/TLI, indicating good overall fit in terms of both absolute and comparative indices. Under OIM and bootstrap, the robust chi-square rejects the exact fit at conventional levels ($p = 0.020$), which is common in SEM with moderately large samples and complex covariance structures. Under the Satorra–Bentler

correction, however, the chi-square test does not reject exact fit ($p = 0.107$). The Satorra–Bentler version also delivers the lowest RMSEA/SRMR (0.042, 0.022) and highest CFI/TLI (0.989 / 0.973), all of which are consistent with a very good fit. AIC/BIC are somewhat higher under the Satorra–Bentler run, reflecting a mild loss of parsimony, but the fit improvement and inferential robustness justify using the Satorra–Bentler estimates as the main reported results. Finally, the system coefficient of determination (CD ≈ 0.685) indicates substantial shared variance explained by the system.

Table 2
Goodness of fit by inference method

Description	Fit statistic	Robustness of inference ML method		
		OIM	Satorra-Bentler	Bootstrap
		Value	Value	Value
	Likelihood ratio			
model vs saturated (ms)	chi2_ms(9)	19.681	14.463	19.681
	p > chi2	0.020	0.107	0.020
baseline vs saturated (bs)	chi2_bs(21)	686.831	500.045	686.831
	p > chi2	0.000	0.000	0.000
	Population error			
Root mean square error of approximation	RMSEA	0.059	0.042	0.059
	90% CI, lower bound	0.022	0.022	0.022
Probability RMSEA ≤ 0.05	Upper bound	0.095	0.095	0.095
	pclose	0.293	0.293	0.293
	Information criteria			
Akaike's inf. criterion	AIC	7570.513	7624.513	7570.513
Bayesian inf. criterion	BIC	7639.328	7796.550	7639.328
	Baseline comparison			
Comparative fit index	CFI	0.984	0.989	0.984
Tucker-Lewis index	TLI	0.963	0.973	0.963
	Size of residuals			
Standardized root mean squared residual	SRMR	0.022	0.022	0.022
System coefficient of determination	CD	0.685	0.685	0.685

Source: Own, based on Stata outcomes.

In addition, multicollinearity was checked by obtaining variance inflation factors (VIF) from OLS regressions of equations (1) and (2); VIF ≤ 1.25 for all individual variables in equation (1) and VIF ≤ 1.80 for all individual variables in equation (2).

4.2. Robustness

Two alternative specifications are estimated to assess robustness. In the first, total executed expenditure *per capita* replaces its two components (opex *per capita* and capex *per capita*) in the services equation. In the second, the mediator variable services (SDG1-based) is replaced with biservices1, a basic infrastructure services composite (water, sanitation, and electricity access, clean cooking, electricity consumption *per capita*, and telephony coverage).

The first alternative focuses on the overall scale of municipal execution rather than its composition. The model is also estimated with the Satorra–Bentler correction and achieves a similarly strong fit: RMSEA_SB = 0.039, SRMR = 0.021, CFI_SB = 0.989, TLI_SB = 0.977, the chi-square_SB test does not reject exact fit (p = 0.126; pclose = 0.311), and the coefficient of determination CD = 0.686.

Results from this specification (Annex 2) confirm the main findings: (i) the effect of own-source revenue on services remains larger than the effect of executed expenditure *per capita*, so own-source revenue effort continues to dominate; (ii) executed expenditure *per capita* has a positive and significant influence in service provision, confirming that "more money per inhabitant" supports service delivery, however, municipalities that raise and manage their own-source revenue do substantially better at translating resources into services, so scale matters, but capacity matters more; (iii) the economy and human capital equations, and their key pathways from services, population, density, and investment, remain structurally unchanged. This means that the broad logic of the model does not depend on how execution is parameterized (opex + capex separately, or a single execution-per capita measure).

The second alternative focuses on mediator measurement sensitivity. The model is also estimated with the Satorra–Bentler correction and also achieves a strong fit: RMSEA_SB = 0.057, SRMR = 0.025, CFI_SB = 0.985, TLI_SB = 0.970, the chi-square_SB test again does not reject exact fit (p = 0.095; pclose = 0.320), and the coefficient of determination CD = 0.619.

Results from this specification (Annex 3) again confirm the main findings: (i) own-source revenue effort continues to dominate; (ii) scale matters, but capacity matters more; (iii) the economy equation remains structurally unchanged, (iv) in the human capital equation, the key pathway from services remains strong, but the control variable population is not a reliable predictor; excluding it leaves the services coefficient and overall fit essentially unchanged. These results mean that the broad logic of the model does not depend on how the mediator variable is measured (SDG1-based or basic infrastructure-based); the findings are not an artifact of SDG1's deprivation components.

For additional checks, see the robustness box, which is based on Annex 4 (LODO), Annex 5 (population terciles and fit), and Annex 6 (effort terciles and fit).

Summarizing, robustness checks support three core claims: (i) municipal fiscal effort (proxied by own-source revenue share, transformed and residualized within department) is the primary predictor of services; (ii) spending scale *per capita* provides a positive but secondary influence, with capex acting directly on the economy; (iii) services transmit influence to both the economy and, especially, human capital.

Robustness at a glance (Annexes 4-6)

Leave-one-department-out (LODO). Dropping any single department leaves the five headline paths' signs, significance, and magnitudes essentially unchanged (*e.g.*, owntaxes→services centers ~0.36; execpc→services ~0.13; services→economy ~0.32; capex→economy ~0.17; services→human-capital ~0.73). No region drives the findings above and beyond controls for population and density. Across population and fiscal-effort terciles, the lever ranking is invariant –own-revenue effort » execution scale in the service equation– and downstream transmission are stable, indicating system-wide design logic rather than results driven by large cities or any single region.

By municipal size (population terciles). Within small, mid-size, and large municipalities, the ordering of upstream levers is invariant: own-revenue effort is the primary predictor of services in every tercile (effort » execution scale). Services→human-capital is the largest path overall (especially mid-size), services→economy is strongest in small municipalities, and the direct capex→economy path is larger in big municipalities.

By fiscal effort (owntaxes terciles). The lever ranking is again invariant (effort » execution scale). The effort→services path peaks in the middle tercile (capacity and "room to improve"), is smaller at very low effort (capacity constraints), and very high effort (saturation). Capex→economy (direct) is materially larger in middle/high-effort groups, consistent with stronger investment pass-through when managerial effort is in place.

The model's logic is systemwide: at any size and effort level, municipalities that exhibit fiscal effort and protect operations and maintenance, convert available resources –including transfers– into poverty-relevant service conditions more effectively; capex primarily influences the economy directly and more strongly where scale/effort are present.

Source: Based on Annexes 4, 5, and 6.

4.3. Interpretation

The model results align with LMAD's theory of change: municipal governments advance local development through services. In what follows, services denote the poverty-relevant services composite (defined in section 3.1.2). Path coefficients reflect directed influences within the maintained model and are interpreted within departments.

Downstream: services → development

Figure 1 (and Table 1) indicates that services is a strong predictor of human-capital outcomes and positively influences the local economy. The magnitude of the services → human capital path is substantially larger than the services → economy path, underscoring the central role service conditions play in human development.

At the same time, other predictors matter for the economy beyond services alone:

i. Population is a large positive predictor of the economy (scale effects).

ii. Density (agglomeration) exerts a negative direct influence on the economy, partly offset by a positive indirect pathway via services. In practical terms, agglomeration raises productivity only when service conditions keep pace; otherwise, congestion dominates.

Upstream: revenues & expenditure → services

The model indicates that municipal own-source revenue effort is the dominant predictor of services. In the main specification that decomposes execution:

i. Opex *per capita* positively influences services (operations and maintenance keep services running).

ii. Capex *per capita* is not a reliable direct predictor of services, but it directly influences the economy (investment and supply-chain linkages).

The execution-scale robustness (Annex 2), where opex and capex are replaced by executed expenditure *per capita*, reaches the same substantive conclusion: own-source effort remains the stronger predictor of services, while execution scale exerts a smaller, positive influence. This pattern is informative: municipalities that have developed revenue-raising capacity also tend to convert available funds, including transfers, into service conditions more effectively.

Agglomeration and service provision

In the services equation, density and density squared both enter positively. This indicates that the marginal influence of agglomeration on services strengthens over the observed range (a convex pattern), consistent with lower unit costs and operational efficiencies at higher densities. This should not be read as "supply cannot catch up with demand"; rather, it means that, within the data range, additional density is increasingly helpful for achieving higher service conditions.

What this means for reading the model

i. Management quality first. Within departments, own-source effort is the primary predictor of services.

ii. Operations matter. Opex supports service provision; capex contributes directly to the economy.

iii. Scale helps but is secondary upstream. Execution scale improves services, but its path coefficient is considerably smaller than that of own-source effort.

iv. Agglomeration is a lever –if services keep up. Density helps the mediator (services), yet it can depress the economy unless accompanied by service expansion.

These are directional influences within the specified SEM, not counterfactual causal claims. They refine the decentralization narrative: municipalities that combine fiscal effort with operational capacity are better positioned to translate resources into improved service conditions and, downstream, into stronger human-capital and economic outcomes.

Heterogeneity checks by population and by fiscal effort confirm the invariant lever ranking (effort » scale) in the services equation; services transmit downstream in all groups, while the direct capex→economy path is larger in big and higher-effort municipalities.

From a policy reading perspective (directional, not counterfactual), decentralization functions best where municipalities combine fiscal effort (a strong predictor of services) with operational capacity (opex), while capital investment primarily influences the economy directly. Transfers remain important but appear more effective where own-source effort and operations are in place to convert resources into improved service conditions. In essence, what has been found is the Bolivian equivalent of municipal empirical regularity that can be called Flypaper-with-effort (see the box dedicated to it).

Flypaper-with-effort

Throughout, flypaper-with-effort is used as a neutral, evidence-based label for transfer systems (or local contexts) in which intergovernmental grants work best when paired with credible local fiscal effort and basic operations and maintenance capacity. A large empirical literature shows: (a) revenue raised locally is spent more on citizen-facing services than equally discretionary grants (Brazilian municipalities: tax-financed increases improve education infrastructure; comparable grant increases do not) (Gadenne, 2016); (b) in Colombia, a given peso of local tax revenue yields broader improvements in public goods than a peso of hydrocarbon royalties, despite earmarks, underscoring the accountability channel of own-revenue finances (Martinez, 2022); (c) negative shocks to transfers can trigger investments in fiscal capacity and higher tax collection –*i.e.*, harder budget constraints raise effort (Brasil) (Ferraz *et al*., 2025); and (d) performance-based grant designs that reward basic financial/administrative performance raise own-source revenue (Mozambique) (Erman *et al*., 2021). Regional syntheses now recommend embedding effort incentives in transfer systems and caution that poorly designed grants can discourage local revenue mobilization—especially where institutions are weaker (OECD, 2024; CAF's RED, 2025, Ch. 5).

For context, recent applied work continues to find classic flypaper patterns –transfers pushing expenditures more than own-source revenue (Hines & Thaler, 1995)– in multiple settings (*e.g.*, Ghana, Indonesia), while also urging designs that reward local effort to avoid soft-budget-constraint behavior. See the Ghana panel study on transfers' dominance in spending and implications for effort, and Indonesian provincial evidence documenting flypaper regularities under autonomy (Dick-Sagoe *et al.*, 2022 Ramadhani *et al.*, 2022). A current survey reviews design trade-offs and the mix (but often negative) effect of transfers on tax effort, reinforcing the case for incentive-compatible grants rather than treating flypaper as a mere anomaly (Lago *et al.*, 2024).

Design implication: embed effort-compatible components in transfer formulas and protect operations and maintenance.

Source: Own.

5. Conclusions

This study examined whether the design elements of decentralization –notably own-revenue effort, operations and maintenance (opex), capital expenditure (capex), and total budget execution– help explain municipal differences in poverty-relevant service conditions (*services*) and their downstream influence on human capital and the local economy. Services were operationalized as an SDG1-based composite, and a theory-driven, recursive SEM was estimated within departments using transformed and standardized variables.

First, results indicate that own-revenue effort is the strongest predictor of services. Execution scale *per capita* exerts a positive but smaller influence. In the composition specification, opex *per capita* –not capex– positively influences services; in the scale specification, executed expenditure *per capita* remains a positive predictor but is clearly secondary to own-revenue effort. These patterns persist when the mediator is redefined as biservices1 (a basic-infrastructure services composite), indicating that the core message does not hinge on deprivation components embedded in the SDG1 measure.

Second, downstream paths align with the LMAD directive that municipal governments promote development through services: higher services influence both human-capital and

economic outcomes, with the services → human-capital path notably larger than services → economy path. In addition, capex *per capita* directly influences the economy, consistent with an investment pass-through operating via works and supply chains rather than exclusively through immediate changes in service conditions.

Third, scale and agglomeration matter in nuanced ways. Population is a strong positive predictor of the economy (scale effects) and, in the main specification, a negative predictor in the human-capital equation (marginal strain in larger municipalities). Density strengthens services (a convex agglomeration pattern) yet exerts a negative direct influence on the economy that is partly offset by its indirect pathway through services –underscoring the need for service conditions to keep pace with urban concentration.

Fourth, these findings are robust to alternative parameterizations of execution (scale vs. composition) and to the alternative mediator definition (biservices1). The ordering of key paths –own-revenue effort » execution scale → services, and capex → economy (direct)— remains stable.

These patterns hold across size and effort groups; the lever ranking is invariant –own-revenue effort » execution scale in the services equation– and downstream transmissions remain stable, which points to systemwide design logic, not results driven by large cities or any single region.

Implications for design. International and Bolivian literatures converge on the view that decentralization performs best when functions, authority, and financing are aligned and when own-revenue autonomy and effort harden budget constraints and strengthen accountability. The estimates are consistent with a "flypaper-with-effort" reading: available resources, including transfers, translate into service conditions more effectively where fiscal effort and operations and maintenance discipline are present, while capex primarily influences the economy directly.

Policy implications: (i) embed effort-compatible transfers (formula/PBGS) so own-source revenue (OSR) unlocks additional grant resources; (ii) protect operations and maintenance (O&M) floors to keep assets working; (iii) pair new capex with credible, funded

O&M plans; (iv) manage agglomeration by ensuring basic network density (water, sanitation, power) keeps pace before adding new capex.

Medium-term phasing of (i) effort-compatible transfers.

- Phase 1--Formula add-on (keep population; add effort). Maintain the base *per capita* allocation for stability, and add a performance leg tied to OSR growth. *Example:* Transfer_i = α·PopShare_i·Fund + β·g(ΔOSR_i/Pop_i)·EfficiencyFund, with caps/floors to protect small municipalities and avoid volatility.
- Phase 2--Protect O&M add-on. Add a service O&M compliance component. Example: Phase 1 formula + γ·O&MShare_i·O&M Fund.
- Phase 3--Broaden the performance. Add a small SDG scorecard (health, education, basic infrastructure; equal or department-specific weights). Example*:* Phase 2 + δ·SDGScore_i·SDGFund.

Contributions. Substantively, the analysis identifies directed influences within a maintained SEM that differentiate upstream levers (effort vs. scale; opex vs. capex) and trace their transmission through services to human capital and the economy –in the spirit of LMAD's service-first directive. Methodologically, it (i) defines a transparent poverty-relevant services composite, (ii) emphasizes within-department municipal variation, and (iii) demonstrates that conclusions hold when services are redefined as basic-infrastructure services.

Limitations and scope. The design is cross-sectional, the estimates are directed influences within a specified model, not counterfactual causal effects, and the results are within-department. Timing differences across indicators and the absence of exogenous shocks limit identification. The focus is intentionally narrow –on own-revenue effort, execution scale, and expenditure composition– rather than an exhaustive test of all "good-design" elements. The study captures a "snapshot" of a dynamic complex process: LMAD's forward mechanisms are emphasized, but feedback among variables may arise in practice.

Future work. Natural extensions include panel designs or policy shocks to fiscal rules and transfer formulas, richer measures of management quality and operations and maintenance practices, and further development of service composites that separate access, reliability, and

quality. Such work would deepen understanding of how effort and operations condition the pass-through from money to poverty-relevant services and, ultimately, to development outcomes.

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Annexes

Annex 1
Descriptive statistics before transformations

Variable	Obs	Mean	Std. dev.	Median	Min	Max
owntaxes (% revenues)	339	3.46	7.17	0.60	0.00	52.30
opexpc (Bs/person)	338	975.04	390.92	894.67	186.67	2657.44
capexpc (Bs/person)	339	812.34	584.09	627.38	103.37	3510.52
execpc (Bs/person)	338	1792.18	841.18	1573.11	288.34	6493.29
services index	339	0.44	0.21	0.41	0.05	0.98
economy index	339	0.34	0.13	0.32	0.04	0.84
humancap index	339	0.54	0.13	0.56	0.14	0.85
population (number)	339	34317	125308	11256	546	1722480
density (people/Km2)	339	49.49	164.40	10.20	0.30	1271.90

Source: Atlas Municipal ODS Bolivia, FAM-ARLAT, INE.

Annex 2
Direct, indirect, and total effects from a model with total executed expenditure *per capita* in the services equation

Structural	Direct effects		Indirect effects		Total effects	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
zr_lservices						
zr_lowntaxes	0.3550	0.000	–	–	0.3550	0.000
zr_lexecpc	0.1324	0.007	–	–	0.1324	0.007
zr_cden	0.3574	0.000	–	–	0.3574	0.000
zr_cden2	0.2428	0.000	–	–	0.2428	0.000
zr_economy						
zr_lservices	0.3239	0.000	–	–	0.3239	0.000
zr_lowntaxes	–	–	0.1150	0.000	0.1150	0.000
zr_lexecpc	–	–	0.0429	0.011	0.0429	0.011
zr_linvestpc	0.1821	0.000	-	-	0.1821	0.000
zr_cden	-0.3113	0.000	0.1158	0.000	-0.1955	0.001
zr_cden2	–	–	0.0787	0.000	0.0787	0.000
zr_lpopulation	0.6792	0.000	–	–	0.6792	0.000

Structural	Direct effects		Indirect effects		Total effects	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
zr_humancap						
zr_lservices	0.7282	0.000	–	–	0.7282	0.000
zr_lowntaxes	–	–	0.2585	0.000	0.2585	0.000
zr_lexecpc	–	–	0.0964	0.006	0.0964	0.006
zr_cden	–	–	0.2602	0.000	0.2602	0.000
zr_cden2	–	–	0.1768	0.000	0.1768	0.000
zr_lpopulation	-0.2182	0.000	-	-	-0.2182	0.000

Source: Own. "–" means no path.

Note: All coefficients are standardized (SD units). The model was estimated with Satorra-Bentler corrections. Goodness of fit: RMSEA_SB/SRMR (0.039/0.021), CFI_SB/TLI_SB (0.989/0.977), chi2_sb ms(10) 15.168, p > chi2 0.126, pclose 0.311, CD 0.686.

Annex 3

Direct, indirect, and total effects from a model with total executed expenditure *per capita* and new biservices1 variable

Structural	Direct effects		Indirect effects		Total effects	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
zr_lbiservices1						
zr_lowntaxes	0.3512	0.000	–	–	0.3512	0.000
zr_lexecpc	0.1144	0.014	–	–	0.1144	0.014
zr_cden	0.3217	0.000	–	–	0.3217	0.000
zr_cden2	0.1567	0.000	–	–	0.1567	0.000
zr_economy						
zr_lbiservices1	0.2552	0.000	–	–	0.2552	0.000
zr_lowntaxes	–	–	0.0896	0.000	0.0896	0.000
zr_lexecpc	–	–	0.0292	0.026	0.0292	0.026
zr_linvestpc	0.1908	0.000	–	–	0.1908	0.000
zr_cden	-0.2702	0.000	0.0821	0.000	-0.1881	0.001
zr_cden2	–	–	0.0399	0.001	0.0399	0.001
zr_lpopulation	0.7155	0.000	–	–	0.7155	0.000
zr_humancap						
zr_lbiservices1	0.6292	0.000	–	–	0.6292	0.000
zr_lowntaxes	–	–	0.2209	0.000	0.2209	0.000
zr_lexecpc	–	–	0.0720	0.018	0.0720	0.018
zr_cden	–	–	0.2024	0.000	0.2024	0.000
zr_cden2	–	–	0.0986	0.001	0.0986	0.001
zr_lpopulation	-0.1099	0.096	–	–	-0.1099	0.096

Source: Own. "–" means no path.

Note: All coefficients are standardized (SD units). The model was estimated with Satorra-Bentler corrections. Goodness of fit: RMSEA_SB/SRMR (0.057/0.025), CFI_SB/TLI_SB (0.985/0.970), chi2_sb ms(10) 16.148, p>chi2 0.095, pclose 0.320, CD 0.619.

Annex 4
LODO results

	b_serv_own	b_serv-exec	b_econ_serv	b_econ_cap	b_hcap_serv
1. Drop: Beni	.3558393	.1303874	.3216312	.1938533	.7281877
2. Drop Chuquisaca	.3390022	.1247511	.2924166	.176927	.7186457
3. Drop Cochabamba	.3209634	.1262375	.3359794	.1801019	.8053517
4. Drop La Paz	.4228061	.1386764	.3123185	.2403111	.7629821
5. Drop Oruro	.3863263	.1401338	.308854	.1855836	.7254024
6. Drop Pando	.3678324	.1163406	.3315579	.1819496	.7411036
7. Drop Potosí	.3241854	.154793	.3171634	.1531309	.6262953
8. Drop Santa Cruz	.3419554	.1324881	.3724329	.1389365	.7338155
9. Drop Tarija	.3517282	.1310683	.3238257	.1852368	.7241094

Source: Own.

Summary of LODO results

Variable	Obs.	Mean	Std. dev.	Min	Max
b_serv_own	9	.3567376	.0321365	.3209634	.4228061
b_serv_exec	9	.132764	.0109526	.1163406	.154793
b_econ_serv	9	.32402	.0222545	.2924166	.3724329
b_econ_cap	9	.1817812	.0280196	.1389365	.2403111
b_hcap_serv	9	.7295437	.0472287	.6262953	.8053517

Source: Own.

Annex 5
Terciles by population

Group	b_serv_own	b_serv_exec	b_econ_serv	b_econ_cap	b_hcap_serv
pop_1	.2754938	.0368443	.4275647	.1269379	.7880141
pop_2	.2251692	.2098523	.3304558	.1952228	.9116238
pop_3	.6228769	.3028171	.2906287	.2646599	.6019846

Source: Own.

Group-specific fit

Group	RMSEA	SRMR	CFI	TLI
Pop1	.0480393	.0442315	.9771919	.952103
Pop2	.0467462	.0258444	.9804516	.9589484
Pop3	.1406851	.0416328	.9311302	.8553734

Source: Own.

Annex 6
Terciles by fiscal effort

Group	b_serv_own	b_serv_exec	b_econ_serv	b_econ_cap	b_hcap_serv
own_1	.2412826	.0652769	.284483	.0865507	.6778196
own_2	.6684076	.2452663	.2902288	.2316035	.8010237
own_3	.4339907	.1462071	.4679544	.2292347	.5867458

Source: Own.

Group-specific fit

Group	RMSEA	SRMR	CFI	TLI
own_1	0.0000	.0317633	1.0000	1.0000
own_2	.0679539	.0340246	.966907	.9305047
own_3	.0949466	.0424052	.9518595	.8989049

Source: Own.