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Municipal Water Affordability Programs Absent a National Mandate: A Comparative Analysis of Volumetric Allowances in Colombia

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ABSTRACT *Municipal volumetric allowances improve the affordability of water services for low-income individuals. But what characterizes municipal governments that adopt and implement volumetric allowances absent a national mandate to do so? Analysis of data from 25 municipalities in Colombia using Qualitative Comparative Analysis shows that three factors are closely related to program adoption and implementation: public utility ownership, program design flexibility that allows municipalities to accommodate their spending capacity, and geographical proximity to early adopters. These findings contribute to our understanding of the diffusion of municipal water affordability policies in the absence of national guidelines, as well as the importance of policy design in their emergence and continuity.*

Keywords: comparative urban policy; Latin America; customer assistance programs; lifeline blocks; Qualitative Comparative Analysis (QCA); public utility; decentralization

1 Introduction

Providing affordable water and sanitation services is a persistent global challenge. Affordability has proven difficult to achieve despite growing awareness of its importance in water and sanitation policy design. As Cook et al. (2020) argue, an affordability policy must help utilities and regulators finance improved access to the water network, signal the efficient use of water, and help poor households so that they are better off. This balancing act is easier said than done. The strategies governments use to improve affordability range from less effective redistribution mechanisms, such as increasing block tariffs (Fuente et al. 2016), to non-tariff customer assistance programs, including payment flexibility, fixed rebates, and

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free water (Cook et al. 2020). This article focuses on targeted volumetric allowances, a non-tariff strategy also known as lifeline rates. The literature on volumetric allowances primarily focuses on national-level mandates or case studies of municipal government initiatives, and has not examined these policies comparatively from a subnational perspective. A subnational view on water allowances encourages us to raise questions, such as the one motivating this article: what characterizes municipal governments that adopt and implement volumetric allowances in the absence of a national mandate?

To answer this question, I build on the policy diffusion literature. Policy diffusion is broadly defined as "one government's policy choices being influenced by the choices of other governments" (Shipan and Volden 2012, p. 788). Diffusion is characterized by initially slow policy adoption which is followed by an uptick and tapering which create an S-shaped pattern (Starke 2013), spatial proximity (Weyland 2006; Abel 2021), similarities among the components of policy even when some differences emerge (Weyland 2006), and the privileging of structural explanations (Marsh and Sharman 2009; Mukhtarov 2022). In this vein, combining insights from the policy diffusion and water policy literatures, this article offers a typology of the characteristics of municipal water lifeline policy adopters.

To develop this typology, I employ crisp-set Qualitative Comparative Analysis (QCA) to analyze an original dataset for 25 Colombian municipalities. Colombia lacks a national mandate or policy guidelines for water allowances; however, 11 municipalities have adopted similar programs. The dataset is complemented with nine municipalities that have made inroads but not adopted the policy, and five non-adopters.

This article's main contribution is to offer a typology that extends the current emphasis in the policy diffusion literature on "the features of a policy that make it more or less suitable for diffusion" (Mukhtarov 2022, p. 294) by analyzing the characteristics that make a place more suitable for adopting a policy. Analyzing the adoption of water allowance policies in Colombian municipalities, the typology shows that three factors are closely related to program adoption and implementation: public utility ownership, program design flexibility that allows municipalities to create policies that accommodate their spending capacity, and geographical proximity to early adopters.

In the next section, I examine the literature on volumetric allowances and policy diffusion, showing that our understanding of these programs has been limited by a lack of comparative analysis at the subnational scale. An emphasis on the subnational level allows us to understand what characteristics, if any, are common among municipalities that adopt these programs in the absence of a national mandate (as is the case in Colombia). The third section outlines the methods used to gather and analyze data. A fourth section describes the findings. The final section presents a discussion and conclusion, emphasizing the implications of the findings for providing more affordable water (and, at times, also sanitation) services in decentralized countries.

2 In-Country Diffusion of Water Allowances

2.1 Water Allowances as an Affordability Strategy

Affordability is defined as "a function of the necessary expenditure for drinking water as a proportion of a household's economic resources" (Pierce et al. 2020, p. 4). Unaffordable water services may force individuals to consume less water than is needed

for health and hygiene, or to forgo other essential goods and services to procure water (Martins et al. 2019; Pierce et al. 2020).

Volumetric allowances enable governments or utilities to provide consumers with a predetermined amount of free or discounted water each payment cycle, covering basic household needs. Any consumption exceeding the volumetric allowance is typically charged at the standard tariff rate. Governments usually cover the cost of the program by transferring resources to utility companies. The amount of water provided seeks to ensure that recipients have sufficient water to meet basic drinking, cooking, and hygiene needs. Basic water requirements are estimated to range between 50 and 100 liters per person per day (Gleick 1996; Howard and Bartram 2003). Targeted volumetric allowances strike a balance between maintaining economic scarcity signals and efforts to target the poor (Cook et al. 2020).

In their review of customer assistance programs in industrialized countries, Cook et al. (2020) found that only two of 17 countries surveyed use targeted volumetric allowances (Spain and France). Similarly, in their review of 45 low- and middle-income countries, the authors found that "free or discounted volumetric allowances were used in 23 per cent of cases", all of which were targeted (meaning that they excluded programs where discounted volumetric allowances were available to all customers) (Cook et al. 2020, p. 333). Based on their findings, targeted volumetric allowance policies are twice as likely to be found in countries in the Global South as in those in the Global North.

Among southern countries, Chile implemented one of the best-known cases of targeted volumetric allowances. The country instituted a water subsidy system in 1998 which uses means-testing based on the self-reported socioeconomic status of individual households (Contreras et al. 2018). The program targets three beneficiary groups: first, households with water bills exceeding 3 per cent of their income (which get a discount of between 25 per cent and 85 per cent of their water bill for the first 15 m^3 consumed in a month). Second, it targets the poorest 40 per cent of elderly households. Lastly, it is also aimed at impoverished households participating in a national program (these receive 100 per cent subsidy for the first 15 m^3 of water) (Contreras et al. 2018). The national government funds the program.

Another well-known case is South Africa's free basic water policy adopted in 2001. The policy is part of the government's strategy to alleviate poverty (Muller 2008) and aims to provide all households, particularly the poorest, with 200 liters of free water per household per day (Smith 2010). As part of the policy design, the national government provided municipalities with various options for implementing free basic water which could be tailored to local conditions and financial capacity. These included having high-volume customers subsidize low-volume users, communal taps in rural areas, and "indigent policies" for poorer towns (Muller 2008). Other notable cases of lifeline programs include Uruguay, while at the subnational level, cities such as Quito, Ecuador, have made strides toward improving affordability through this strategy (Rivero Rosas et al. 2022).

Despite the existence of lifeline programs in multiple countries, there are no comparative studies of their characteristics at the subnational level. This may respond to two factors: first, many countries with a lifeline program have national policies guiding their implementation, even if the program unfolds differently at the municipal level (as in the case of South Africa). Analysis focuses on the national mandate and the range of options

for implementation. A second reason may be that, in the absence of national guidelines, case studies on how programs are designed at the municipal level can offer insights into the peculiarities of adopting these programs. This strategy, while helpful in advancing our understanding of how lifeline programs emerge and take root, does not elucidate the characteristics that make a place more suitable for adopting the policy and therefore understanding what makes municipalities more prone to participating in the program's diffusion.

2.2 Assessing Policy Diffusion

Policy diffusion, along with similar concepts such as transfer, mobilities, and circulation, is employed by policy analysis scholars from diverse disciplinary backgrounds to understand the movement of instruments and ideas (Porto de Oliveira and Osorio Gonnet 2023). Policies diffuse because "when confronted with a problem, decision makers simplify the task of finding a solution by choosing an alternative that has proven successful elsewhere" (Berry and Baybeck 2005, p. 505). The subnational policy diffusion literature has a long history, focused mainly on the United States, with studies of subnational diffusion in other countries emerging more recently (Marsh and Sharman 2009; Abel 2021). I use insights from this literature to develop hypotheses about the adoption of water allowance programs and present these hypotheses in the following paragraphs.

Inferences about whether a policy has diffused usually start with an analysis of the timing of adoption, its spatial patterns, and policy convergence (Weyland 2006; Starke 2013). Diffused policies tend to follow a S-shaped pattern of adoption (Weyland 2006; Starke 2013); in other words, an initial slow pace is followed by an uptick and tapering. Geographical proximity among policy adopters is also used to identify successful policy diffusion (Abel 2021; Kuhlmann 2021). However, some authors argue that spatial clustering is an outdated and limited approach to understanding diffusion, as globalization and reduced barriers to communication and travel have made geographic proximity less relevant (Shipan and Volden 2012). Nevertheless, spatial proximity is commonly identified as a key factor, leading to my first hypothesis:

> H1: Spatial proximity to other adopters characterizes the adoption of a water allowance program

Convergence implies that policies become increasingly similar over time (Marsh and Sharman 2009). Nonetheless, policy configurations can change as they move between places (Porto de Oliveira and Osorio Gonnet 2023). Analyzing the diffusion of pension reform in Latin America, Weyland (2006, p. 19) noted "the spread of similarity amid diversity". Therefore:

> H2: Diverse configurations characterize the adoption of a water allowance program

Porto de Oliveira and Osorio Gonnet (2023) show that the policy sector and other environmental factors impact policy transfer. With that in mind, factors from the water policy literature, such as fiscal constraints and utility ownership, may play a role in the

diffusion of water allowances. Findings suggest that the fiscal conditions of a municipality can lead to mixed results when it comes to affordability (Kim and Warner 2016; Andres et al. 2019): on one hand, high fiscal pressure can lead to subsidy reform; on the other, politically sensitive environments can lead governments to find alternative ways to finance subsidies. Hence:

> H3: Spending capacity does not characterize the adoption of a water allowance program

Literature on the relation between utility ownership structure and affordability has shown inconclusive findings (Bel and Warner 2008; Abbott and Cohen 2009; Romano et al. 2015). An analysis of 500 water systems in the US found that privately owned systems had higher annual bills (Zhang et al. 2022). Similar research in Brazil by Barbosa and Brusca (2015) also found that privately owned utilities charge higher rates. These findings are partially confirmed by González-Gómez and García-Rubio (2018) in their review of 14 peer-reviewed articles on the relation between prices and ownership form. The authors find that private management tends to set higher prices than public sector management; however, they warn that caution is needed when reviewing these findings, as tariffs can be influenced by environmental, urban, political, and ideological factors. In contrast, an analysis by Rozo Vengoechea (2019) of 88 municipalities in Colombia found that publicly owned utilities tended to have higher rates than those with private sector participation. Others, such as García-Valiñas et al. (2013), find that public utilities that outsource management set higher prices than private companies. Given these ambiguous findings:

> H4: Utility ownership form does not characterize the adoption of a water allowance program

In contexts of political, administrative, and fiscal decentralization where municipalities decide on urban service provision matters, political leaders tend to interfere to keep water affordable (Herrera and Post 2014). As Carter and Post (2019) also demonstrate, the pressure exerted by popular opinion on political leaders in decentralized settings increases calls for affordability. In addition, mayors in Latin America are reportedly among the most powerful and autonomous political actors (Došek and Eaton 2025). Cities that are the seat of government for their states or departments therefore concentrate political power, leading to pressure to make services affordable, hence:

> H5: Being a seat of government characterizes the adoption of a water allowance program

This study employs a comparative urban policy analysis approach, contributing to a growing body of literature that highlights the merits of analyzing policy at the subnational level to better understand policymaking in decentralized countries (Giraudy et al. 2019; Avellaneda and Bello-Gómez 2024; Béland et al. 2024).

3 Research Design and Methods

In this article, I analyze data from 25 Colombian municipalities to assess the characteristics of municipal governments that adopt and implement volumetric allowances in the absence of a national mandate. My focus is on the characteristics of these municipalities, rather than on the interlinkages between them or the process of diffusion. The research design follows what Yin (2014) terms a single-case design (Colombia) with embedded units of analysis (25 municipalities). Colombia presents a unique opportunity for this analysis, given that 11 municipalities have adopted water lifeline policies, while 9 have attempted to institute the policy. In contrast to the well-known cases of Chile and South Africa, Colombia does not have a national policy mandating free volumetric allowances.

Prior to conducting this comparative policy analysis, I conducted fieldwork in 2016 and 2017 in Medellín, the first city to adopt a water and sanitation volumetric allowance program in Colombia. Interviews with bureaucrats, politicians, appointed officials, social activists, and utility representatives focused on how and why the program emerged, as well as efforts to secure its continuity. This fieldwork was crucial in building my understanding of volumetric allowance programs, an important step prior to comparative policy analysis "if there is relatively little knowledge about a phenomenon, including a policy area", as conducting case studies allows researchers "to understand context, as well as for descriptive, conceptualization, and hypothesis-generating purposes" (López-Santana and Tanca 2024, p. 573).

3.1 Qualitative Comparative Analysis (QCA)

QCA is a method that uses set theory and Boolean algebra to draw inferences when conducting comparative case studies in small to medium *N* environments. In QCA, causal relations are deterministic, not probabilistic (Medina et al. 2017), as the method "explores the presence of logical implications or set relations in terms of necessity and sufficiency" (Thomann and Maggetti 2020, p. 359). QCA tests which configurations of conditions are sufficient (the outcome occurs whenever the condition is present) and/or necessary (the condition is required for the outcome to occur). I used a QCA add-in for Excel developed by Cronqvist (2019) to generate the truth table for all possible combinations of the conditions under analysis.

3.2 Case Selection

Municipalities were selected for analysis based on two criteria: first, all municipalities that have a lifeline policy or have made efforts to adopt one were included. These municipalities were identified through the analysis of draft legislation and its supporting documents (for example, Minvivienda 2023), through gray literature (for instance, Rozo Vengoechea 2019; Rivero Rosas et al. 2022), and through scholarly literature in both English and Spanish (for example, Vargas and Heller 2016; Calderón Núñez 2020). Twenty municipalities were identified.[1] This non-random approach to case selection is needed to conduct a systematic examination of qualitative similarities and differences in cross-case analysis when studying policy diffusion (Starke 2013).

The second criterion for inclusion was non-adopters. These were selected by identifying the ten largest cities by population size according to projected population for 2024

(DANE 2020). Five of the largest cities had already been selected as they have or have attempted to adopt a lifeline program, so this second criterion added just five more cities, for a total sample of 25. I sought negative cases to see if relevant conditions differed between positive and negative cases. A "diverse cases design" allows for several "potentially relevant independent factors to vary across the selected cases" and is common among qualitative methods for the study of policy diffusion (Starke 2013).

3.3 Data Collection and Calibration

With the cities in place, I proceeded to create an original dataset with the following information: department (Colombia's equivalent to a state or province), population (projected for 2024), city budget for 2024, largest water utility in the municipality and its ownership form, and local legislation authorizing the adoption of a water lifeline policy (if any) (see Tables A1–A3 in Appendix A).

The department in which each municipality is located, along with the projected municipal population, was determined using data from DANE (2020). I knew from fieldwork that the municipalities that had sent representatives to Medellín to learn more about its experience adopting and implementing the program were in the Andean and Pacific regions. Based on this knowledge, I coded the "spatial" condition for cities in these regions as "1", and cities in the Amazon, Orinoquía, and Caribbean regions were coded as "0" in the calibrated data matrix (see Table 1). Cities that function as the seat of government for their departments were marked with a "1", all other municipalities were marked with a "0" in the "capital" column. I found the 2024 budget for each municipality by going to each city council's website and identifying the piece of legislation that authorized the budget for 2024.[2] The annual per capita expenditure for each municipality was calculated by dividing the annual budget by the projected population. Unable to find the average municipal spending per capita in Colombia, I made 2 million pesos (USD 493)[3] the cut-off number to dichotomize the condition. The "expend" condition in Table 1 designates cities with expenditures above 2 million pesos as "1" and those below 2 million as "0".

Colombia allows for multiple forms of utility ownership, including wholly owned by a single state agency, owned in partnership by state agencies, public–private partnerships (PPP), private concessions, and private operators. Municipalities can have more than one utility providing services. This is more common in larger cities where a dominant utility serves the urban area and smaller cooperative water systems may serve peri-urban areas. Municipalities that have water lifeline programs often sign contracts with both large utilities and small systems (for example, Medellín has contracts with EPM and 22 community aqueducts) (Restrepo-Mieth 2019, 2024). I identified the largest water utility in each municipality by reviewing its city hall website. The ownership structure of the utility was determined by examining either the utility's website or documents filed by the utility with Colombia's utility regulator, the Superintendency of Residential Public Services (*Superintendencia de Servicios Públicos Domiciliarios* – SSPD). Municipalities with a utility owned and operated by the government were assigned a "1" in the "PublicUtil" column; all others were assigned a "0".

To identify the legislation authorizing each municipality's effort to, or actual adoption of, a water lifeline policy, I searched through their city hall, city council, and

Table 1. Calibrated data matrix (own elaboration)

	Conditions				Result
City	**Spatial**	**Expend**	**Capital**	**PublicUtil**	**WatProg**
Medellín	1	1	1	1	1
Bogotá	1	1	1	1	1
La Estrella	1	0	0	1	1
Cali	1	1	1	1	1
Zipaquirá	1	0	0	1	1
Pereira	1	1	1	1	1
Pasto	1	1	1	1	1
Chía	1	1	0	1	1
Manizales	1	1	1	1	1
La Ceja	1	1	0	1	1
Yumbo	1	1	0	1	1
Bucaramanga	1	1	1	1	0
El Rosal	1	0	0	1	0
Itagüí	1	1	0	1	0
Cúcuta	1	1	1	0	0
Soatá	1	0	0	1	0
Soledad	0	0	0	0	0
Sevilla	1	0	0	1	0
Tenjo	1	1	0	1	0
Labateca	1	0	0	1	0
Barranquilla	0	1	1	0	0
Cartagena	0	1	1	0	0
Santa Marta	0	0	1	1	0
Ibagué	1	0	1	1	0
Montería	0	1	1	0	0

utility websites. In Colombia, two pieces of policy precede implementation: an *Acuerdo* (agreement), which is the actual legislation listing what the policy is meant to accomplish, its legal basis, the mechanism to access a program, etc., and a *Decreto* (decree), which spells out how the executive will carry out the *Acuerdo*. I then searched to ensure the program was still active. When information was not available online, I emailed the city hall, the city council, and the utility, filing a document known in Colombia as *Derecho de Petición* (Right to Ask). Any government agency that receives a Right to Ask must respond within 15 business days; otherwise, judicial action may be taken against it. This allowed me to clarify the status of lifeline program attempts at some smaller municipalities, such as Zipaquirá and Itagüi, for which online data was inconclusive. Cities for which an *Acuerdo* was found and for which an active program could be confirmed were classified as having a lifeline program, totaling 11 municipalities (designated with a "1" in the result column). Through document analysis, I identified the year in which the program was implemented, the services included (water alone or both water and sewage), the volume provided for free, the beneficiaries of the program, the mechanisms to access the program, and the target structure (if the program is means tested, targets a particular demographic, or has a geographic target). This data was used to assess convergence in program design and to create a diffusion curve.

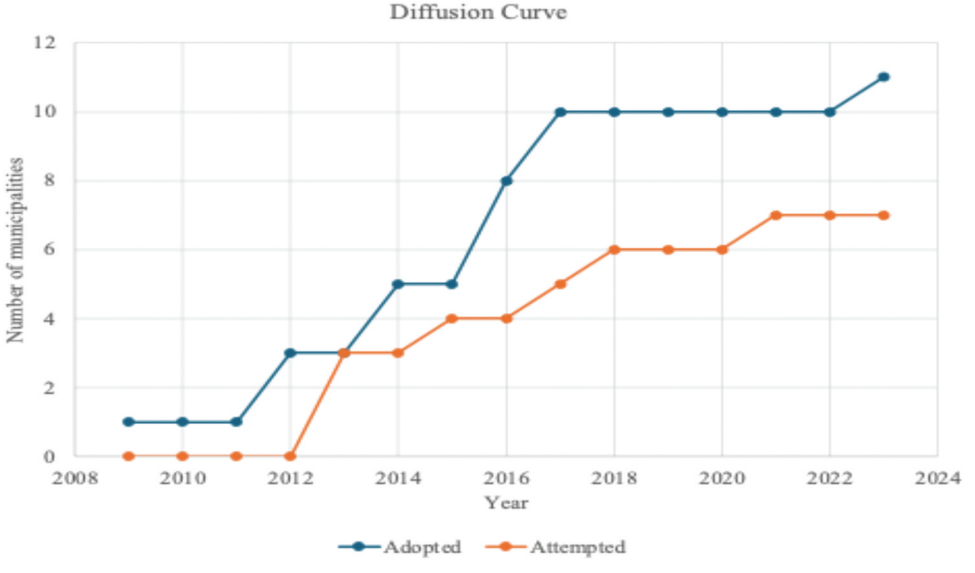
For the remaining 14 municipalities, I searched national, local, and community press and radio station websites, and conducted Google searches in Spanish, to identify additional information about the status of lifeline programs locally. Right-to-Ask requests were filed for all cities. For five cities, it was clear that no progress had been made toward adopting the program, and these were classified accordingly. For nine others, many of which were mentioned during the literature search stage as having the program, no confirmation could be found that the program had been implemented, even if initial legislation had been adopted. These cities were classified as non-adopters and assigned a "0".

4 Characterizing Water Lifeline Programs in Colombia

4.1 Confirming Policy Diffusion

The temporal S-shaped pattern of adoption observed in Graph 1 is typical of policy diffusion processes (Starke 2013). This diffusion curve shows that municipal water lifeline programs began to be adopted as efforts to pass national legislation proved unsuccessful. A proposal under discussion in Congress was thrown out in 2010 due to insufficient votes (Vargas and Heller 2016). Around the same time, Medellín began to experiment with volumetric allowances, first as a municipal program (2009–2011) and then as a policy (adopted in 2011) (Restrepo-Mieth 2019, 2023). Water lifeline policies were adopted shortly thereafter by large municipalities, such as Bogotá (2012), as well as small municipalities, including La Estrella (2012). Ten municipalities instituted the policy during the 2010–2019 decade, while five others considered it during the same

Graph 1. Diffusion curve. Own elaboration



period. Interest in the policy decelerated in the current decade, with only one municipality adopting it and two considering it.

From a geographical perspective, the municipalities that have adopted lifeline policies are concentrated in the country's Andean and Pacific regions, with no municipalities in the Caribbean, Amazon, or Orinoquía regions adopting the program. Further geographical clustering can be identified among most cities that have the program: Medellín and La Estrella are part of the same metropolitan area, while La Ceja is in their area of influence; Bogotá, Zipaquirá, and Chía are in the same metropolitan region; Manizales and Pereira are part of the Coffee Belt; and Cali and Yumbo share a metropolitan area. Pasto is the only city with the program that is not in close geographical proximity to another adopter; however, the city is located in the Pacific region. In sum, the geographical characteristics align with the spatial proximity considerations found in the literature. This finding confirms hypothesis 1: spatial proximity to other adopters characterizes the adoption of a water allowance program.

When it comes to policy convergence, it is worth noting that no two municipalities in Colombia have the same water lifeline policy. The first area in which program design varies is services included: seven limit the program to water, while four provide free allowances for both water and sanitation. A second difference is the monthly amount provided for free: Medellín is an outlier in that it provides 2.5 m^3 per person (so a family of four would receive 10 m^3), whereas all other cities offer somewhere between 5 and 10 m^3 per subscriber, with 6 m^3 being the most common amount. Mechanisms for accessing the program also vary along two fronts: in six cities, subscribers must approach city hall offices to request enrollment in the program, whereas in five cities, subscribers are automatically enrolled using geographic targeting (see the Key criteria column in Table A1, Appendix A).

The cities where individuals must request the program all follow a means-tested approach using Colombia's System for the Identification of Potential Beneficiaries of Social Programs (SISBEN, for its Spanish acronym). The SISBEN classifies individuals according to their socioeconomic status, assigning them a score in points. In these municipalities, the scores required to qualify vary from 25 points (allowing only the poorest of the poor to apply) to 47.99 points. Most cities in this category combine means testing with geographic or demographic targeting. Common demographic characteristics that qualify include being internally displaced due to violent conflict or having individuals in the household who are elderly, minors, or have a disability. Medellín is the only city that allows demographic targeting alone as a qualifying condition, but limits it to internally displaced populations.

Finally, some cities have included additional key criteria to qualify for the program, such as setting limits on the amount of water a family can consume per month: 11 m^3 in Chía, 13 m^3 in Manizales, and 20 m^3 in Zipaquirá. Additional criteria include enrolling in poverty alleviation programs, limiting the number of people who can enroll, setting caps for family income, and requiring a metered connection to a piped water system,[4] not being in arrears with the utility or having a payment plan set up with the utility to cover accounts that are in arrears.

Despite these differences, all municipalities are following a similar policy configuration that ensures a certain amount of water is provided free of charge to qualifying residents. This is achieved by having the municipal government pay the water service provider the cost of

the water allowance. The approach is also labeled the same across adopters: "*mínimo vital de agua potable*" (minimum vital of potable water). Convergence is evident, even if the initiative appears differently in each municipality, thus confirming hypothesis 2, which posits that diverse configurations characterize the adoption of a water allowance program.

4.2 QCA Findings

The first step in a QCA, after calibrating the data, is to test the relationship between individual factors and the outcome to assess which are necessary conditions. A review of Table 1 shows that "Spatial" and "PublicUtil" are necessary, indicating that the outcome (the presence of a water allowance program) depends on the presence of these conditions. As with the findings from the S-Curve confirming hypothesis 1, the role of spatial proximity is also confirmed through QCA: proximity to other adopters is a necessary condition that characterizes the adoption of a water allowance program.

Based on the literature's inconclusive findings on the relationship between affordability and utility ownership form, I hypothesized that this would not be a factor characterizing the adoption of water allowance programs (hypothesis 4). Nevertheless, an analysis of Table 1 shows that having a public utility is a necessary condition for the adoption of a water allowance program. The 11 municipalities that have water lifeline programs all have publicly owned utilities. While beyond the scope of this paper, it is worth noting that these utilities are run under corporatization schemes: wholly owned by the state and therefore public, yet they are granted financial and administrative autonomy.

The following step in my csQCA was to examine all possible factor configurations through a "truth table" (Table 2). No configuration of conditions created a solution that would be sufficient for the outcome. However, solutions emerged when I made a truth table for the complement of the outcome (the absence of a water allowance program) (Table 3).

Table 2. Truth table for the presence of water allowance programs (own elaboration)

City	Spatial	Expend	Capital	PublicUtil	WatProg
Soledad	0	0	0	0	0
Santa Marta	0	0	1	1	0
Barranquilla, Cartagena, Montería	0	1	1	0	0
La Estrella, Zipaquirá, El Rosal, Soatá, Sevilla, Labateca	1	0	0	1	C
Ibagué	1	0	1	1	0
Chía, La Ceja, Yumbo, Itagüí, Tenjo	1	1	0	1	C
Cúcuta	1	1	1	0	0
Medellín, Bogotá, Cali, Pereira, Pasto, Manizales, Bucaramanga	1	1	1	1	C
Outcome: 1 # Implicants: 0 # Solutions: 0					

Table 3. Truth table for absence of water allowance programs (own elaboration)

City	Spatial	Expend	Capital	PublicUtil	WatProg
Soledad	0	0	0	0	0
Santa Marta	0	0	1	1	0
Barranquilla, Cartagena, Montería	0	1	1	0	0
La Estrella, Zipaquirá, El Rosal, Soatá, Sevilla, Labateca	1	0	0	1	C
Ibagué	1	0	1	1	0
Chía, La Ceja, Yumbo, Itagüí, Tenjo	1	1	0	1	C
Cúcuta	1	1	1	0	0
Medellín, Bogotá, Cali, Pereira, Pasto, Manizales, Bucaramanga	1	1	1	1	C
Outcome: 0					
# Implicants: 3					
spatial	0	Soledad, Santa Marta, Barranquilla, Cartagena, Montería			
expend*CAPITAL	0	Santa Marta, Ibagué			
publicutil	0	Soledad, Barranquilla, Cartagena, Montería, Cúcuta			
# Solutions: 1					
expend*CAPITAL + publicutil					

Table 3 shows that three configurations of conditions created solutions that would be sufficient for the outcome to be absent – in other words, for non-adoption of a water allowance program (lower case in the Implicants section indicates the absence of the condition). First, being in the Amazon, Orinoquía, or Caribbean regions is a sufficient condition for non-adoption, confirming the importance of neighborhood effects. Second, having capital expenditures per capita below 2 million Colombian pesos (COP) (the threshold defined during calibration) and being a department capital is a sufficient condition for non-adoption. Lastly, not having a public utility is a sufficient condition for non-adoption. Through QCA's minimization process, I find that having capital expenditures per capita below COP 2 million and being a department capital, or not having a public utility, is a sufficient condition for non-adoption.

These findings shed light on the analysis of hypotheses 3, 4, and 5. Hypothesis 3 is that spending capacity does not characterize the adoption of a water allowance program, and this indeed appears to be the case: it is not a sufficient condition. A visual inspection of the data in Appendix A reveals a broad range of expenditure per capita among adopters and non-adopters. For example, annual per capita spending among adopters varied from COP 4.2 million (Bogotá) to less than half of that: COP 1.9 million for La Estrella and Zipaquirá. Interestingly, some non-adopters, such as Barranquilla, Cartagena, and Montería, had higher per capita expenditures than some adopters. Hypothesis 5, that being a seat of government characterizes the adoption of a water allowance program, is not a sufficient condition: of the eleven cities that have adopted the policy, only six are capitals of their respective departments. Interestingly, Table 3 shows that having expenditure per capita below COP 2 million and being a department capital combined is a sufficient condition for not having the program. Lastly, while having a public utility is a

necessary condition for implementing a water allowance program, it is not sufficient: non-adopters, such as Ibagué and Soatá, are also served by public utilities.

5 Discussion: Examining What Characterizes the Municipal Governments That Adopt and Implement Volumetric Allowances

Three key findings from the diffusion of Colombia's municipal water lifeline policies stand out: the importance of the utility ownership structure, the lack of a relationship between a municipality's annual per capita expenditure and its implementation of a water allowance policy, and the role of geographical proximity.

The presence of a public utility is a necessary condition for implementing a water lifeline policy. This finding contrasts with the mixed evidence on the relationship between affordability and utility ownership in the literature. This conclusion is particularly interesting in light of Rozo Vengoechea's (2019) finding that public utilities in Colombia tended to have higher tariffs than those with private participation. The author also found that municipalities with private sector participation relied on government expenditure for investments and network expansion. This suggests that municipalities in Colombia that want to implement a water lifeline program would have lower expenditures paying the rates of utilities with private sector participation vis-à-vis the rates of public utilities. However, all the municipalities that have adopted water allowances in Colombia have public utilities. I argue that this can be explained by municipalities either being more comfortable paying into public utilities (over which their mayor and city councils have some control) or being indifferent to utility ownership. It can be argued that they are not sensitive to higher public utility rates, as even if paying for the lifeline program is more expensive, the utility's revenue goes towards investments and network expansion (which, according to Rozo Vengoechea, would not be the case under utilities with private participation). In other words, municipalities with publicly owned water service providers who adopt a volumetric allowance are killing two birds with one stone: by paying for water lifeline programs, they are improving affordability for those who need it most and at the same time increasing a utility's revenue (which might make it more feasible for the utility to carry out capital expenditures and service improvements).

A second key finding is that per capita municipal expenditure is neither a necessary nor a sufficient condition for the adoption of volumetric allowance programs. This suggests that adopting the program is a political decision, not a fiscal one. The absence of a national mandate leaves the door open for municipalities to design a water allowance policy that accommodates their spending capacity. This would explain why there is such a wide variety in program design: the absence of a national mandate creates flexibility. This stands in contrast with countries like South Africa, where the national government mandates the program and has tried to insert flexibility by giving municipalities a few predetermined alternatives.

While spending above a certain threshold is not a necessary or sufficient condition for policy adoption, department capitals that do not spend above that threshold do see it as a sufficient condition for not having the program. This suggests that, despite the power and

autonomy afforded by decentralization, fiscal constraints and existing mandates make it politically untenable to expand affordability programs.

Lastly, geographical proximity to adopters is of value when it comes to volumetric allowances. This finding contrasts with the arguments of authors such as Shipan and Volden (2012; cf. Abel 2021), who find limited value in the relationship between geographic proximity and diffusion. However, in contexts where administrative capacity and resources are limited, such as the Global South or small municipalities, learning from neighbors is likely easier than learning from other places (particularly if those neighbors have shown that a policy works under the local regulatory context). For example, in the case of Colombia, cities arranged delegations to visit Medellín in the early days of its program to learn how it had been implemented. According to an interviewee, "we were the pioneers in Colombia in this type of program. We have had visits from other mayors' offices to learn how we implemented the program – Bogotá, Pasto, Manizales" (personal communication, 2017). Geographical proximity to adopters can facilitate the learning of administrative procedures necessary for a successful rollout and understanding the costs associated with different targeting techniques. These findings echo the work of Carolini et al. (2018), who show that proximity, including cultural, technological, and organizational aspects, plays a role in shaping collaboration and learning among water operators.

6 Conclusion

The policy diffusion literature emphasizes understanding the features that facilitate the diffusion of policies. Employing a subnational comparative focus, this article argues that analyzing the characteristics that make a place more suitable to adopt a policy is also an important research avenue, particularly for those looking to impact policy adoption and in search of inputs on what characteristics to be on the lookout for. While these characteristics are likely to vary by sector, insights from policy diffusion, such as neighborhood effects and policy convergence, can serve as a starting point for analysis.

In the case of the water policy sector, the existence of a volumetric allowance that provides poor households with a certain amount of water free of cost every month can significantly impact service affordability. Eleven municipalities in Colombia have adopted such a policy. This research shows that three characteristics are common among the municipalities that adopted a water allowance program in Colombia: first, they all have publicly owned and managed water utility companies. This feature means that, by adopting lifeline programs, municipalities are improving affordability for their poorest residents while also contributing to the financial health of the utility company, which makes it more likely for the company to improve its investments and services. Further research is needed to confirm this. Second, per capita expenditure is neither a necessary nor a sufficient condition for the adoption of water lifeline policies. I argue that municipalities design water lifeline programs that accommodate their spending capacity. This finding should be considered in discussions to create national mandates, particularly if these are unfunded mandates, as this research suggests there is good reason for allowing variability in program design. Additional research on other water affordability strategies used by subnational governments can help assess if the program design flexibility factor is unique to water lifeline programs or if it extends to other strategies. Lastly, geographical proximity may make it easier for municipalities interested in

learning more about a program (particularly small municipalities) to do so. Regional or departmental governments could play a role in helping municipalities come together to learn from those that have implemented the program.

Generalizability is often considered a concern in small-*N* studies. According to Yin (2014), case studies offer an opportunity for analytical generalizations that extend beyond the specific setting of a case. By combining insights from the policy diffusion and water policy literatures with empirical findings, this work enhances our understanding of the significance of place and its characteristics in analyzing water affordability. Furthermore, as López-Santana and Tanca (2024) argue, the comparative method allows policy scholars to provide rich, detailed analyses of specific policy areas and to inductively create classifications by "identifying a combination of variables that might have explanatory power, especially when little is known about a policy area" (p. 573). By identifying these key factors among municipalities in Colombia, this research contributes to the growing body of subnational comparative analysis scholarship, which "is uniquely positioned to generate a kind of 'usable knowledge' for subnational policymakers, advocacy coalitions, and other information users" (Béland et al. 2024, p. 558).

Notes

1. While efforts were made to identify all the municipalities that have the program, the lack of centralized information about the program's adoption means that there might be additional cities that were not identified.
2. The city of Santa Marta did not have the information listed, nor was it available in the press or at the city hall. I use the 2023 budget as a proxy.
3. The 2024 average exchange rate was 1 US dollar = 4,054 Colombian pesos.
4. As of 2023, 97.4 per cent of Colombia's urban population obtained water through piped systems (Minvivienda 2023).

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Appendix A

Table A1. Municipalities that have a lifeline program

Municipality	Department	Population (projected, 2024)	City Budget (COP in 2024)	Annual per capita expenditure (COP)	Largest Utility	Utility ownership for water and sewage
Medellín	Antioquia	26,16,335	87,54,50,69,49,436.00	33,46,095.57	Empresa de Servicios Públicos de Medellín (EPM)	Public (100% city owned)
Bogotá	Bogotá, D.C.	79,29,539	3,32,06,26,33,53,000.00	41,87,666.31	Empresa de Acueducto y Alcantarillado de Bogotá (EAAB)	Public (100% city owned)
La Estrella	Antioquia	77,611	1,48,43,50,82,211.00	19,12,552.12	Empresa de Servicios Públicos Domiciliarios de la Estrella S A. E.S. P. (for rural area, EPM serves urban area)	Public mixed (91% owned by the city)
Cali	Valle del Cauca	22,83,846	53,12,71,36,02,027.00	23,26,213.59	Empresa Municipal de Cali (Emcali)	Public (100% city owned)
Zipaquirá	Cundinamarca	1,60,629	3,14,36,34,50,512.00	19,57,077.80	Empresas Públicas de Zipaquirá - EPZ	Public (100% city owned)
Pereira	Risaralda	4,82,483	12,77,68,54,13,653.00	26,48,145.97	Empresa de Acueducto y Alcantarillado de Pereira S. A.S ESP (Aguas y Aguas)	Public mixed (98.74% owned by the city)
Pasto	Nariño	4,13,484	10,55,66,76,55,296.06	25,53,104.00	Empresa de Obras Sanitarias de Pasto (EMPOPASTO S.A. E.S. P.)	Public Mixed (99.48% owned by the city)
Chía	Cundinamarca	1,63,306	3,26,77,00,76,175.00	20,00,967.98	Empresa de Servicios Públicos de Chia (Emserchia E. S.P.)	Public (100% city owned)
Manizales	Caldas	4,57,022	10,05,21,78,98,352.00	21,99,495.64	Aguas de Manizales S.A. ESP BIC	Public mixed (99.97% owned by a municipal state-owned enterprise)
La Ceja	Antioquia	70,387	1,65,25,07,33,639.68	23,47,745.09	Empresas Públicas de La Ceja E.S.P	Public (100% city owned)
Yumbo	Valle del Cauca	1,08,869	4,53,39,97,04,000.00	41,64,635.52	Empresa Oficial de Servicios Públicos de Yumbo S.A. E.S.P (ESPY) (EMCALI serves some areas)	Public mixed (80% owned by the city, 5% each municipal state-owned enterprises)

Implementation year	Institutionalized policy	Services included	Amount provided for free per month	Mechanism to access the program	Target structure	Key Criteria
2009	Acuerdo 06 2011, Decreto 1889 2011, Modified by Decree 013 2014	Water and sanitation	2.5 m3 per person	Individuals must request it	Means tested or demographic targeting (displaced)	SISBEN less than or equal to 47.99 points,must enroll in one of City Hall's poverty alleviation programs
2012	Acuerdo 489 2012, Decreto 064 2012	Water	6 m3 per subscriber	Automatically applied	Geographic targeting	Strata 1 and 2
2012	Acuerdo 005 2012	Water and sanitation	10m3 per subscriber	Automatically applied	Geographic targeting	Strata 1 and 2
2014	Acuerdo 0370 2014	Water	6 m3 per subscriber	Automatically applied	Geographic targeting	Strata 1 and 2
2014	Acuerdo 07 2014	Water	6 m3 per subscriber	Automatically applied	Geographic targeting	Strata 1, cannot consume more than 20m3 per month
2016	Acuerdo 11 2016, Decreto 786 2016	Water and sanitation	6 m3 per subscriber	Individuals must request it	Geographic targeting and means tested	Strata 1 and 2, SISBEN less than or equal to 36.99 points, limited number of slots
2016	Acuerdo 012 2016, Acuerdo 33 de 2019	Water	5 m3 per subscriber	Individuals must request it	Geographic targeting and either demographic targeting or means tested	Strata 1, SISBEN less than or equal to 35 points, limited number of slots
2016	Acuerdo 97 2016 modified by Acuerdo 185 2021, Decreto 64 2016 modified by Decreto 258 2021	Water	6 m3 per subscriber	Individuals must request it	Geographic targeting and either demographic targeting or means tested	Strata 1, must go through a selection process, cannot consume more than 11m3 per month
2017	Acuerdo 0960 2017, Decreto 0612 2017 modified by Decreto 0643 2017	Water and sanitation	5 m3 per subscriber	Individuals must request it	Geographic targeting and means tested	Strata 1 and 2, SISBEN less than or equal to 25 points, cannot consume more than 13m3 per month
2017	Acuerdo 022 2017 modified by Acuerdo 02 2018, Decreto 013 2018 modified by Decreto 169 2018	Water	6 m3 per subscriber	Individuals must request it	Geographic targeting and either demographic targeting (displaced, minors, elderly, disability) or means tested	Strata 1, 2, and 3, family monthly income must be below 2.5 times the legal minimum wage, special conditions such as minors, disability, victim of conflict, elderly,
2023	Acuerdo 003 2023	Water	6 m3 per subscriber	Automatically applied	Geographic targeting	Strata 1

Table A2. Municipalities that have made efforts to adopt a lifeline program

Municipality	Department	Population (projected, 2024)	City Budget (COP, 2024)	Annual per capita expenditure	Largest Utility	Utility ownership for water and sewage	Progress made towards water lifeline
Bucaramanga	Santander	619,703	1,567,247,521,219.00	2,529,030.07	Acueducto Metropolitano de Bucaramanga S.A. E.S.P	Public mixed (78.66% owned by Bucaramanga, 15.61% national government, everyone else less than 1% including the cities of Flordiablanca and Girón)	Mentioned in ANDESCO (2019), Minvivienda (2023), and Rivero Rosas et al. (2022). Despite multiple mentions and the adoption of Acuerdo 32 2013 and Decreto 0215 2013, there is no evidence that a water lifeline policy was ever implemented. A 2022 document discussing water and sanitation subsidies for 2022-2026 does not mention the program

(*continued*)

Table A2. (*Continued*)

El Rosal	Cundinamarca	26,052	23,195,941,226.11	890,370.84	Empresa de Acueducto, Alcantarillado y Aseo El Rosal SA ESP	Public (100% city owned)	Mentioned in ANDESCO (2019) and Rivero Rosas et al. (2022). Acuerdo 012 2013 and Decreto 098 2013 established the program but no information could be found to confirm it stayed in place for a period of time or is still going. he municipality and utility did not respond to requests for information.

(*continued*)

Table A2. (*Continued*)

Itagüí	Antioquia	299,348	805,500,707,349.00	2,690,850.47	Empresa de Servicios Públicos de Medellín (EPM)	100% Medellin owned (corporatized - financial and administrative autonomy)	Mentioned in ANDESCO (2019). Acuerdo 015 2013 is the only one that mentions water lifelines but all the content is about strengthening community aqueducts and about accessibility, not affordability. Mayor at the time did not move to implement it. Request for information confirmed that the program does not exist.
Cúcuta	Norte de Santander	812,176	1,726,462,910,053.00	2,125,725.10	EIS Cúcuta S.A. E.S.P. but operator (since 2006) is Aguas Kpital Cúcuta S.A ESP	Private participation through concession	Mentioned in Minvivienda (2023). Acuerdo 026 2021 established the program but no further mention could be found online. The municipality, utility, and operator did not respond to requests for information.

(*continued*)

Table A2. (*Continued*)

Soatá	Boyacá	9,518	14,538,646,789.00	1,527,489.68	EMPOSOATA E.S.P.	Public (100% city owned)	Mentioned in Rivero Rosas et al. (2022). Acuerdo 28 2021 makes reference to Acuerdo 003 2015 and Acuerdo 003 2020 (neither can be found online) and to the need to set aside 37 million pesos to cover the costs associated with the program. However, no corroborating information can be found and the municipality did not respond to requests for information.
Soledad	Atlántico	681,835	1,096,880,855,912.00	1,608,718.91	Triple A (Sociedad de Acueducto, Alcantarillado y Aseo de Barranquilla S.A. E.S.P)	Mixed Private-Public (Sociedad Interamericana de Aguas y Servicios SA – INASSA S.A 82,16%, Barranquilla 14,5%, other privates 3,34%). INASSA is currently not in control due to a corruption trial	Mentioned in Rivero Rosas et al. (2022). No actual policies could be found. News articles suggest that in 2018 the then mayor wanted to provide 6m3 per household per month for strata 1 (Blu Radio, 2018). The program could not be found in the current mayor's government plan.

(*continued*)

Table A2. (*Continued*)

Sevilla	Valle del Cauca	43,794	62,238,695,602.00	1,421,169.47	Acuavalle SA ESP	Public mixed (43.14% owned by the department, 39.23% by CAR del Valle, 17.63% by 35 municipalities)	Mentioned in ANDESCO (2019) and Rivero Rosas et al. (2022). The city website suggests that the program was institutionalized via Acuerdo 019 2017, however, a press release from the Governor's office suggests that the program had been suspended and was going to restart in the second half of 2022 (Gobernación del Valle, 2022).
Tenjo	Cundinamarca	26,834	116,518,736,715.00	4,342,205.29	Empresa de Servicios Públicos de Tenjo SA ESP- EmserTenjo	Appears to be public	Mentioned in ANDESCO (2019) and Rivero Rosas et al. (2022). No reference to the program in city hall and utility websites.

(*continued*)

Table A2. (*Continued*)

Labateca	Norte de Santander	7,189	12,855,639,155.00	1,788,237.47	Administración Pública Cooperativa Siscatagua Labateca A.P.C.	Public (100% city owned)	Mentioned in ANDESCO (2019) and Rivero Rosas et al. (2022). Nothing found about the program in Acuerdo 22 2020 which establishes the subsidies and contributions for water and sanitation services between 2021 and 2025

Table A3. Municipalities that have not adopted the program

Municipality	Department	Population (projected, 2024)	City budget (COP, 2024)	Annual per capita expenditure	Largest utility	Utility ownership for water and sewage
Barranquilla	Atlántico	13,34,509	50,59,89,47,90,670.00	37,91,577.87	Triple A (Sociedad de Acueducto, Alcantarillado y Aseo de Barranquilla S.A. E.S.P)	Mixed Private-Public (Sociedad Interamericana de Aguas y Servicios SA – INASSA S.A 82.16%, Barranquilla 14.5%, other privates 3.34%). INASSA is currently not in control due to a corruption trial
Cartagena	Bolívar	10,59,626	34,18,38,89,09,170.00	32,26,033.44	Aguas de Cartagena S.A. E.S.P. (Acuacar)	Mixed Public-Private (city owns 50.0%, Veolia and Agbar own 45.9%, other privates own 4.1%)
Santa Marta	Magdalena	5,61,281	10,82,19,86,28,673.00	19,28,087.05	Essmar S.A. E.S.P. (Empresa de Servicios Públicos del distrito de Santa Marta)	100% city owned (intervened since 2021 by Colombia's Superintendency of Public Services which hired EPM as manager)
Ibagué	Tolima	5,44,132	9,42,58,92,79,808.00	17,32,280.55	Empresa Ibaguereña de Acueducto y Alcantarillado, IBAL S.A. E.S.P.	Public mixed (100% owned by five municipal entities)
Montería	Córdoba	5,27,456	12,96,27,93,38,209.09	24,57,606.58	Veolia Aguas de Monteria S.A. E.S.P	Private participation through concession