



Composite Indicators as Allocation Tools in Intergovernmental Finance: Evidence from Uruguay*

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Abstract

Intergovernmental transfers are central to fiscal federalism, fostering territorial equity across regions with diverse socio-economic conditions. This paper examines Uruguay, where transfers remain partly based on a composite index created more than two decades ago using a limited set of indicators. Using recent census and administrative data, we reassess the statutory allocation formula and evaluate an alternative multidimensional framework based on Principal Component and Factor Analysis. The results show that updating the existing formula generates significant reallocations, while the expanded indicator set and data-driven weighting methodology produce even larger redistributive effects, improving the equalization capacity of the transfer system.

Keywords: Fiscal federalism, Intergovernmental transfers, Fiscal equalization, Composite indicators.

JEL Classification: H77, H71, C38, R51.

1. Introduction

Intergovernmental transfers are a central instrument in decentralized fiscal systems, shaping the capacity of subnational governments to provide public services, address territorial disparities, and preserve social cohesion. In countries with marked regional heterogeneity, intergovernmental transfers play a critical role in correcting horizontal imbalances and ensuring that citizens have comparable access to public services regardless of their place of residence. However, transfer systems are often based on historical formulas and political compromises rather than on updated assessments of socio-economic conditions, leading to persistent inefficiencies and inequities in the territorial allocation of resources (Muñoz, 2017).

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Over the last decades, the literature on fiscal federalism has emphasized the importance of well-designed intergovernmental transfers for achieving allocative efficiency, fiscal discipline, and equity (OECD, 2025; Martínez-Vázquez, 2025; Boadway and Shah, 2009; Oates, 1999). While normative principles for transfer design are well established, many countries still rely on formulas weakly grounded in empirical evidence and seldom updated to reflect changes in territorial socio-economic patterns. This undermines the capacity of fiscal systems to respond to challenges such as spatial inequality and rising demand for local public services.

Existing empirical evidence suggests that the equalization capacity of Uruguay's intergovernmental transfer system has long been limited. Using panel data, Muinelo-Gallo *et al.* (2016) find that transfers have not significantly contributed to regional income convergence and may even reinforce existing disparities. Although these findings do not isolate the role of the statutory allocation formula, they indicate that the system has historically exhibited a weak equalizing effect. This pattern is consistent with broader regional evidence: for Latin America, Muñoz *et al.* (2016) document persistent subnational fiscal disparities and show that intergovernmental transfers often fail to operate as genuine equalization instruments.

In this context, the use of composite indicators as allocation tools has gained attention as a way to reduce discretion, increase transparency, and incorporate regional disparities into fiscal decision-making. Composite indices are particularly attractive in decentralized systems because they synthesize multidimensional information into operational rules that can be easily communicated and updated. However, their construction raises methodological challenges related to variable selection, standardization, weighting, and aggregation, all of which may substantially affect the resulting distribution of resources (Jiménez-Fernández, 2022).

This paper analyzes the case of Uruguay, where a significant share of transfers from the central government to departmental governments is allocated through a composite index defined in the early 2000s. The current rule is based on four equally weighted indicators –population, land area, housing deprivation, and inverse income per capita– and relies on outdated data sources. Despite profound socio-demographic and economic changes since its adoption, the structure of the index has remained virtually unchanged. As a result, it is unclear whether the current allocation mechanism still reflects territorial needs and fiscal capacities.

The objective of this paper is not to reassess the normative rationale behind the original allocation formula. Rather, it examines whether, under current socio-economic conditions and using updated information, the existing rule continues to function as an effective equalization mechanism. The analysis focuses on the contemporary performance of the allocation system and on the potential contribution of data-driven methodologies to improving its transparency, adaptability, and alignment with current territorial disparities.

Using newly available census and administrative data, this paper evaluates the performance of the current transfer formula and explores two alternative paths for improving its alignment with territorial realities. The first updates the indicators underlying the statutory allocation rule while preserving its original normative structure and equal weighting scheme.

The second revises the weighting methodology through the construction of data-driven composite indices based on multivariate statistical techniques. Specifically, we employ Principal Component Analysis (PCA) and Factor Analysis (FA) to derive weights from the statistical structure of the data. Unlike the existing formula, which relies on fixed and normative weights, these methods provide a flexible framework that can adapt to evolving territorial patterns while reducing arbitrariness in the assignment of fiscal weights.

The analysis proceeds in three stages. First, we replicate the legally defined distribution rule using updated data to isolate the effects of refreshing the underlying information while maintaining the original allocation logic. Second, we estimate alternative composite indices and compare their implied territorial distributions with both the current allocation and the updated legal formula, allowing us to distinguish the effects of updated data from those of a different weighting methodology. Third, we conduct robustness checks to evaluate methodological sensitivity and temporal stability under alternative specifications.

The results show that the existing transfer rule fails to capture important dimensions of territorial inequality. The data-driven indices produce substantial reallocations of funds across departments¹, revealing implicit redistribution patterns embedded in the current formula. More importantly, they offer a transparent and replicable mechanism for updating transfer systems in line with observable territorial conditions, providing a concrete pathway toward evidence-based fiscal decentralization.

This paper contributes to the literature on fiscal federalism and intergovernmental finance in three ways. First, it provides an empirical assessment of a long-standing transfer formula in a Latin American decentralized system, showing how static allocation rules may become misaligned with territorial realities over time. Second, it introduces a data-driven methodology for constructing fiscal allocation indices based on multivariate statistical techniques, offering an alternative to purely normative or politically negotiated weighting schemes. Third, it links the design of composite indicators to broader issues of governance, transparency, and accountability in multi-tier fiscal systems, illustrating how statistical tools can enhance institutional quality in intergovernmental relations. By connecting fiscal federalism theory with empirical implementation, the paper highlights the potential of composite indicators as practical instruments for reforming transfer systems under growing spatial inequality and fiscal pressure.

2. Institutional Background: Intergovernmental Transfers in Uruguay

Uruguay is a unitary but highly decentralized country in fiscal terms, where departmental governments play a significant role in the provision of public services and local infrastructure. Despite its relatively small geographical size, Uruguay exhibits pronounced territorial heterogeneity in demographic density, income levels, and access to urban services. These disparities justify the existence of intergovernmental transfer mechanisms aimed at promoting horizontal equity and compensating for uneven fiscal capacity across departments.

The intergovernmental fiscal system in Uruguay is based on a combination of shared taxes, conditional transfers, and unconditional transfers (Lorenzo *et al.*, 2022; Viñales, 2020, 2023; Muinelo-Gallo *et al.*, 2019). A central component of this system is defined in Article 214 of the Constitution, which establishes that a fixed share of national revenues must be allocated to departmental governments. This constitutional provision provides the legal foundation for the main vertical transfer mechanism in the country and embeds intergovernmental revenue sharing into the institutional structure of the state.

The operational design of this mechanism was later specified in Article 642 of Law 17.296² (National Budget Law for 2001-2005), which introduced a composite index to determine the horizontal distribution of the constitutional transfer pool among departments. The law defines four allocation criteria: population, land area, inverse GDP per capita, and the proportion of households with housing deprivation, with equal weights assigned to each component. Although the law formalizes the variables to be considered, it does not establish a precise method for standardization or aggregation.

The social indicators used in the legal formula are based on census data from 1996, and the index has not been structurally updated since its introduction. As a result, the distribution of intergovernmental transfers continues to reflect socio-economic conditions that no longer correspond to current demographic patterns, levels of urbanization, or income distribution. Over the last two decades, Uruguay has experienced substantial changes in population concentration, internal migration, housing conditions, and regional labor markets, yet the transfer formula remains effectively frozen in its original design.

This institutional rigidity has two direct implications. First, the existing distribution rule may generate misallocations by underfunding departments that have become socially or economically vulnerable while overcompensating others whose relative position has improved. Second, the lack of periodic revision weakens the transparency and credibility of the transfer system, as fiscal flows appear disconnected from observable socio-economic realities. In the absence of explicit updating mechanisms, the index increasingly operates as a politically entrenched rule rather than as a genuine equalization instrument.

Another salient feature of the Uruguayan system is the dominant role played by Montevideo, the capital and largest metropolitan area, which concentrates a large share of national population and economic activity. Montevideo constitutes a clear statistical outlier within the territorial structure of the country, posing a challenge for formula-based allocation rules. Its inclusion or exclusion from the index can significantly affect the relative distribution across remaining departments, raising important methodological and policy questions regarding the treatment of extreme values in equalization frameworks.

Beyond Article 214, Uruguay also operates other intergovernmental instruments, such as the Fondo de Desarrollo del Interior (FDI)³, which finances infrastructure projects through conditional transfers. However, unlike the constitutional transfer scheme, these programs are project-based and discretionary in nature, and therefore do not replace the role of formula-based equalization transfers in providing stable and predictable financing for departmental governments.

Recent policy-oriented research has explicitly identified the need to modernize Uruguay's intergovernmental transfer system, emphasizing its fragmentation, lack of transparency, and weak equalization role. In particular, the current design has been criticized for relying on outdated allocation criteria and for failing to reflect territorial disparities in fiscal capacity and expenditure needs (Martínez-Vázquez *et al.*, 2020).

Overall, the Uruguayan case illustrates a common tension in decentralized systems: while legal formulas enhance stability and reduce political discretion, they may become obsolete if not periodically adjusted to reflect changing territorial conditions. This institutional context motivates the present analysis, which evaluates whether a data-driven composite index can serve as a viable alternative to static, legally entrenched allocation rules and whether such an approach can improve the transparency, adaptability, and equity of intergovernmental transfers.

3. Related Literature

This paper draws on two strands of literature: fiscal federalism and intergovernmental transfers, and the methodology of composite indicators in public policy design.

The classical theory of fiscal federalism highlights the role of intergovernmental transfers as a corrective device for both vertical and horizontal fiscal imbalances (Oates, 1999). While vertical transfers aim to close the gap between subnational spending responsibilities and revenue-raising capacity, horizontal transfers are designed to equalize fiscal capacity across jurisdictions with heterogeneous economic bases. Subsequent contributions emphasize that well-designed transfer systems should balance equity, efficiency, and accountability (Boadway and Shah, 2009), while poorly designed schemes may generate perverse incentives, soft budget constraints, or political manipulation (Weingast, 2009).

A large empirical literature studies the impact of intergovernmental transfers on subnational fiscal behavior, highlighting risks such as reduced fiscal effort, overspending, and weak accountability when transfers are not adequately structured (Weingast, 2009). At the same time, equalization systems remain a central pillar of decentralized governance in both federal and unitary systems, particularly where territorial disparities are large and persistent. Martínez-Vázquez and Sepúlveda (2011) document that in Latin America intergovernmental transfers are not only a financing mechanism but also a main policy instrument for mitigating regional inequality, albeit often implemented through highly discretionary or opaque rules.

Within this literature, a growing body of work focuses on the design of equalization formulas and their vulnerability to political capture or obsolescence (Bird and Smart, 2002; Shah, 2007). Formula-based systems are typically preferred over discretionary schemes because they enhance predictability and transparency; however, they risk becoming outdated if indicators are not revised to reflect socio-economic transformations. As territories evolve, static formulas may generate redistribution patterns unrelated to fiscal need or capacity,

leading to inefficiencies and inequities in resource allocation (Boex and Martínez-Vázquez, 2004).

The present study also builds on the literature concerning composite indicators as tools for public policy and governance. Composite indices have been widely adopted in development economics, environmental policy, and regional analysis to capture complex, multidimensional phenomena in a single metric (Nardo and Saisana, 2008; Domínguez-Serrano, 2011). However, their construction raises methodological issues regarding normalization, weighting, aggregation, and robustness (Greco *et al.*, 2018; Horta *et al.*, 2023). While normative approaches assign weights based on expert judgment or political consensus, data-driven approaches rely on the statistical structure of the data, often using Principal Components Analysis or Factor Analysis to derive endogenous weights (Decancq and Lugo, 2013).

There is a body of national-level literature on composite indicators that provides information on development dimensions associated with departmental and regional disparities in Uruguay. One example is the Índice de Desarrollo Regional de Uruguay (IDERE), proposed by Rodríguez *et al.* (2024). A related contribution is Aboal *et al.* (2018), who construct a departmental development indicator incorporating multiple dimensions, including public safety, infrastructure, socioeconomic conditions, health, education, and labor market outcomes.

Rodríguez *et al.* (2017) compute a territorial economic development indicator composed of three elements: GDP per capita, the number of firms per capita, and a Territorial Cohesion Indicator, which summarizes socioeconomic and educational variables. Earlier, Rodríguez-Miranda (2006) proposed an endogenous development indicator, incorporating information on social capital, productive capital, educational capacities, and connectivity.

Horta *et al.* (2017) develop a departmental competitiveness index covering dimensions such as government, firms, productive structure, infrastructure, socioeconomic conditions, natural resources, and demography. This line of work is later reviewed in Horta *et al.* (2023) using the Departmental Competitive Potential Index as a benchmark.

While composite indicators are widely used in development and social policy analysis, their application to fiscal transfer systems remains limited. This paper helps bridge this gap by integrating composite indicator methodologies into the framework of fiscal decentralization. It moves beyond the use of composite indices as descriptive tools and advances their role as functional components in the allocation of intergovernmental resources. In doing so, it contributes to current discussions on the modernization of fiscal frameworks under increasing fiscal pressure, persistent spatial inequality, and growing demands for data-driven governance.

4. Data and Methodology

This section describes the data sources, variables, and empirical strategy used to assess the current transfer allocation rule in Uruguay and to construct alternative data-driven composite indices.

4.1. Data sources

The empirical analysis relies on a combination of census data, national statistics, and administrative records. Population, housing, and demographic indicators are obtained from the most recent Population and Housing Census (2023). Economic indicators are drawn from national accounts and household survey data provided by the National Statistical Office.

To evaluate the legal allocation formula defined in Law 17.296, we reconstruct each of its four components—population, land area, housing deprivation, and inverse income per capita—using the closest available contemporary proxies.

In the fiscal federalism literature, equalization transfers are generally designed to account for two broad sources of territorial disparities: differences in fiscal capacity, which reflect the ability of subnational governments to generate revenues from their own economic base, and differences in expenditure needs, which arise from heterogeneous demographic, geographic, and social conditions affecting the cost of providing public services (Boadway and Shah, 2009; Shah, 2007). The selection of indicators in this study is guided by this conceptual distinction.

In addition to the indicators explicitly mentioned in the law, we construct an extended dataset organized into seven dimensions: population and land area, economic indicators, housing and urban planning, social spending with emphasis on health, waste management and environment, culture and sports, and water and sanitation.

Each dimension comprises multiple indicators intended to capture structural differences across departments. Indicator selection is guided primarily by their relevance for measuring either fiscal capacity or expenditure needs in the context of fiscal equalization, while data availability, reliability, comparability over time, and the possibility of regular updating constitute additional selection criteria (Schuschny and Soto, 2009). Accordingly, indicators should be easily interpretable, derived from reliable, public, and replicable sources, informative about the underlying dimension they represent, useful for policy analysis and decision-making, and, where appropriate, complemented by qualitative information.

Within this framework, the economic dimension is intended to capture differences in fiscal capacity, whereas the remaining dimensions proxy expenditure needs arising from demographic structure, territorial characteristics, housing conditions, social vulnerability, infrastructure requirements, and the cost of providing local public services. This classification provides the conceptual foundation for the expanded indicator set and links the empirical specification to the equalization objectives emphasized in the fiscal federalism literature.

4.2. Replication of the Legal Allocation Formula Using Updated Data

We replicate the legally defined allocation rule using updated data. Because the law does not specify a unique standardization procedure for the underlying variables, we implement two alternative approaches: (i) normalization by proportions and (ii) min-max scaling. Under

both schemes, the four indicators are mapped onto a common scale prior to aggregation, to ensure that differences in units of measurement do not affect the results².

The composite index is then computed as the simple average of the standardized indicators, consistent with the equal-weights assumption embedded in the legal rule. This allows us to assess whether the current allocation of funds reflects the country's updated socioeconomic structure and to distinguish discrepancies arising from changes in the underlying indicators from those resulting from methodological ambiguities in the original design.

— *Standardization via Proportion Scaling*

It is important to note that this method eliminates the absolute scale of the indicators, retaining only their relative information. As a result, the equalization or leveling criteria cannot be directly applied to the resulting index. The proportions are computed as follows:

$$x'_i = \frac{x_i}{\sum(x_i)} \quad (1)$$

where x_i denotes the value of indicator x in department $i = 1, \dots, 19$; $\sum(x_i)$ represents the sum of indicator x across all departments, and x'_i is the standardized value of indicator x_i , which takes values in the $[0, 1]$ interval.

— *Standardization using the Min-Max Method*

This method highlights relative differences within the dataset, placing greater emphasis on equalization or leveling considerations. It is the standardization approach used in the IDERE (Rodríguez *et al.*, 2024). The maximum and minimum values for each indicator are defined based on the observed data:

$$x'_i = \frac{x_i - \min(x)}{\max(x) - \min(x)} \quad (2)$$

where x_i denotes the value of indicator x in department $i = 1, \dots, 19$; $\min(x)$ and $\max(x)$ correspond to the minimum and maximum observed values of indicator x across all departments; and x'_i represents the standardized value of x_i , which lies in the $[0, 1]$ interval.

In both standardization procedures, higher values of the original indicators translate into higher values of the standardized indices. The standardized indicators are then averaged at the departmental level and subsequently expressed as percentages of the national total.

The specialized literature discusses alternative standardization criteria. One example is the use of theoretical or normative standards, in which upper bounds are defined based on plausible maximum values. Other approaches rely on global benchmarks or scaling schemes determined by the empirical distribution of each variable. For instance, in some cases values are adjusted by ± 25 percent—penalizing lower bounds and inflating upper bounds—to prevent the units of analysis from attaining extreme values of 0 or 1 (Rodríguez *et al.*, 2024).

4.3. Construction of alternative composite indices

Unlike the normative weighting scheme in the law, the data-driven approach allows weights to be derived endogenously from the statistical structure of the data (Decancq and Lugo, 2013).

4.3.1. *Composite Indices Expanding the Set of Indicators and PCA Weighting*

Schuschny and Soto (2009) recommend avoiding redundancy in the selection of variables used to construct composite indicators and therefore advocate the use of PCA. This technique identifies orthogonal transformations of the original data, generating a new set of uncorrelated variables known as principal components (Cuadras, 2014).

The processing and analysis of the available information led to the construction of an Indicator System comprising data for each of the dimensions considered. Based on this system, the indicators were classified into two categories: (i) absolute indicators, which provide information on the level or size of a given variable (e.g., land area, population); and (ii) relative indicators, which are particularly relevant for cross-departmental comparisons and therefore for equalization or leveling criteria (e.g., per capita measures). Applying this framework resulted in the selection of 40 indicators.

An important methodological issue concerns the polarity of each indicator (Horta *et al.*, 2023). Indicators such as poverty or mortality rates increase the value of the index when they are higher (positive polarity), whereas variables such as income or departmental GDP have negative polarity, since higher values imply a lower index score. For the latter, we apply an inverse transformation so that all indicators have positive polarity.

In this study, infrastructure-related indicators (such as cultural and sports facilities) are interpreted as proxies for expenditure needs rather than fiscal capacity. The underlying rationale is that maintaining and operating this infrastructure entails service provision costs that vary across departments and therefore generate different financing requirements. Under this interpretation, higher levels of infrastructure reflect greater expenditure obligations rather than stronger fiscal capacity or discretionary policy choices. Nevertheless, this classification involves a normative judgment, and alternative specifications could reasonably treat these variables differently depending on the objectives of the transfer system.

The combined use of Factor Analysis and PCA allows for the selection of a subset of variables to construct a composite index that efficiently summarizes information from a large set of indicators. This approach helps clarify the dimensional structure of the phenomenon under study and the informational content of the indicator system (Greco *et al.*, 2018).

Indicator weights are constructed following the OECD methodology (Nardo and Saisana, 2008), whereby each indicator is assigned a weight proportional to the share of variance it explains. These weights are derived from standardized, varimax-rotated factor loadings obtained through Principal Component Analysis. For each dimension, components with ei-

genvalues greater than one are retained according to the Kaiser criterion, and each indicator is assigned to the component on which it loads most strongly. The resulting weights are then rescaled to sum to one for inclusion in the composite index, ensuring that indicators contributing more to the common variation receive greater weight.

Regarding aggregation, individual indicators can be combined using linear, geometric, or nonlinear methods, each implying different assumptions and consequences. Linear aggregation rewards indicators proportionally to their weights, while geometric aggregation places greater emphasis on high-performing units, amplifying differences and requiring all indicators to be strictly positive (Horta *et al.*, 2023). In any aggregation scheme, deficits in one dimension can be offset by surpluses in others, so weights effectively act as rates of substitution. When multiple dimensions are equally important, this compensability is often viewed as a key limitation of composite indicators (Horta *et al.*, 2023).

The use of PCA to derive indicator weights offers several methodological advantages in the construction of composite indices. By exploiting the correlation structure of the data, PCA reduces redundancy among highly correlated variables and assigns greater weight to indicators that contribute more to explaining cross-departmental variation, avoiding the need for arbitrary weighting schemes. At the same time, these data-driven weights should not be interpreted as reflecting normative priorities for fiscal equalization. Rather, they summarize the statistical information contained in the selected indicators.

This approach also has important limitations. Because PCA assigns weights according to the variance explained by each component, dimensions that are conceptually relevant for equalization but display limited cross-sectional variation may receive relatively low weights. Moreover, the linear aggregation adopted in this study implies compensability across dimensions, allowing stronger performance in some areas to offset greater needs in others. Finally, PCA-derived weights depend on the statistical properties of the data and may evolve over time as territorial conditions change. For these reasons, the proposed methodology should be understood as a transparent and empirically grounded alternative to normative weighting schemes rather than as a universally optimal allocation rule.

4.4. Sensitivity and robustness analysis

Given the sensitivity of composite indicators to methodological choices, we evaluate the robustness of the departmental Synthetic Index under alternative standardization methods, indicator selection rules, and time windows based on the most recent five years of available data⁵. We assess how these alternatives affect the distribution of departmental shares, focusing on both the magnitude and direction of changes relative to the current allocation scheme.

This study does not aim to cover all possible methodologies for constructing synthetic indices, but to provide a transparent and coherent framework for selecting and justifying key methodological choices, given that these choices can substantially affect results and have important policy implications (Horta *et al.*, 2023).

5. Results

This section presents the empirical findings. We begin by evaluating the legally defined allocation rule using updated data, and then examine the implications of alternative data-driven composite indices for the intergovernmental distribution of resources.

5.1. Replication of the Legal Allocation Formula Using Updated Data

This section evaluates the consequences of updating the inputs of the statutory formula while preserving its conceptual structure. The first column of Table 1 presents the departmental allocation as established by Article 642 of the 2001-2005 Budget Law. The second column reproduces this allocation using the most recent information available for each indicator and the proportion-based standardization procedure, while the third column reports the results obtained using min-max standardization. The remaining columns display the 2023 values of the indicators before standardization.

Table 1
DISTRIBUTION OF TRANSFERS: CURRENT RULE AND REPLICATION USING UPDATED DATA

Department	Current rule	Calculation using proportional standardization (%)	Calculation using min-max standardization (%)	Area (km ²)	Population (persons)	Housing deprivation (%)	Inverse GDP per capita ^(a)
Montevideo	13.43	10.85	2.98	530	1302954	5.84	0.04
Artigas	4.93	5.32	6.67	11928	77487	15.51	0.06
Canelones	8.76	8.13	6.59	4536	608956	11.81	0.08
Cerro Largo	5.03	5.61	6.90	13648	91025	14.65	0.06
Colonia	4.23	3.93	3.12	6106	135797	12.28	0.04
Durazno	4.44	4.88	5.85	11643	62011	15.75	0.05
Flores	2.41	3.29	3.42	5144	26271	12.05	0.05
Florida	3.92	4.23	4.21	10417	70325	11.72	0.04
Lavalleja	3.83	4.10	4.13	10016	59175	11.25	0.05
Maldonado	6.87	4.46	3.63	4793	202951	11.92	0.05
Paysandú	5.57	5.87	7.04	13922	121843	15.84	0.06
Río Negro	4.08	4.14	4.42	9282	57334	16.12	0.03
Rivera	4.58	5.25	6.42	9370	109300	15.90	0.06
Rocha	4.35	4.38	4.39	10551	80707	10.78	0.05
Salto	5.91	6.26	7.80	14163	136197	17.29	0.06
San José	3.63	4.10	4.01	4992	119714	13.27	0.05
Soriano	4.62	4.62	5.28	9008	83685	15.81	0.05
Tacuarembó	5.45	6.03	7.61	15438	96013	17.13	0.06
Treinta y Tres	3.95	4.53	5.53	9529	47706	15.37	0.05

Note: ^(a) Values were multiplied by 1,000 for readability purposes.

Source: Own elaboration.

The first approach (proportion-based standardization procedure) yields results that most closely replicate the original allocation and is therefore adopted as the baseline method throughout this study. Nevertheless, notable differences emerge for some departments, particularly Montevideo, suggesting that additional *ad hoc* criteria may have influenced the original distribution of transfers.

Replicating the legal formula with updated data allows us to isolate the impact of refreshing the information underlying the statutory allocation rule while preserving its original structure and equal weighting scheme. This intermediate exercise provides a benchmark against which the additional effects of adopting a data-driven weighting methodology can be assessed.

The replication exercise reveals that the current transfer allocation rule performs poorly when applied to contemporary socio-economic data. The reconstructed index does not reproduce the actual distribution of transfers observed in practice, deviations cannot be explained solely by data updates but also by ambiguities in the original computational design.

When updated indicators are used, the implied distribution diverges substantially from both the historical baseline and the current official allocation. In particular, departments that have experienced rapid population growth and urban expansion are underrepresented by the legal formula, while others continue to receive transfers based on historical vulnerabilities that are no longer significant.

The discrepancy is particularly pronounced under min-max normalization, which emphasizes the relative distance from the most and least advantaged departments. Under this approach, Montevideo's relative eligibility decreases sharply due to improvements in housing conditions and income levels, while several interior departments gain weight due to persistent deficits in access to services.

These findings suggest that the existing rule is largely decoupled from present-day territorial conditions and operates more as an inert institutional mechanism than as a functional equalization system.

5.2. Composite Indices Expanding the Set of Indicators and PCA Weighting

Tables 2 to 8 report the weights obtained for each indicator across the different dimensions considered, starting with Population and Area. These weights are used solely to correct for information overlap among correlated indicators and therefore do not reflect the theoretical importance of any given variable (Nardo and Saisana, 2008). Accordingly, indicators with higher weights are those that capture greater heterogeneity across departments. Comparing PCA-based weights with uniform weighting provides insight into the relative importance assigned to each indicator by the data themselves.

Figure 1 presents the PCA biplot for the composite indices by dimension, showing how departments are positioned relative to the main latent factors underlying the synthetic index.

The horizontal axis (Dim1) captures most of the cross-departmental variation and is strongly associated with infrastructure-related dimensions, while the vertical axis (Dim2) reflects secondary differences linked mainly to water and sanitation and environmental conditions. Departments located close to each other exhibit similar multidimensional profiles, whereas those far apart –such as Montevideo, which appears as a clear outlier– display markedly different socio-economic and infrastructural characteristics.

Table 2
WEIGHTS RESULTING FROM PCA FOR INDICATORS OF THE POPULATION AND AREA DIMENSION

Indicator	Assigned Component	Scaled weight
Area	1	11.41
Population density	1	29.25
Population	1	29.18
Population growth	2	30.16

Source: Own elaboration.

Table 3
WEIGHTS RESULTING FROM PCA FOR INDICATORS OF THE ECONOMY DIMENSION

Indicator	Assigned Component	Scaled weight
Per capita income	1	17.19
Poverty	1	40.27
Departmental GDP	1	42.54

Source: Own elaboration.

Table 4
WEIGHTS OBTAINED FROM PCA FOR HOUSING AND URBAN PLANNING INDICATORS

Indicator	Assigned Component	Scaled weight
Overcrowding	1	3.12
Population in informal settlements	2	5.72
UBI - Precarious housing	1	13.79
Dwellings in informal settlements	2	19.04
Public open space per capita	3	20.16
UBI - Housing materials	1	19.49
UBI - Habitable space	1	18.70

Note: Unmet basic needs (UBI).

Source: Own elaboration.

Table 5
WEIGHTS OBTAINED FROM PCA FOR SOCIAL SPENDING INDICATORS, WITH
EMPHASIS ON HEALTH

Indicator	Assigned Component	Scaled weight
People covered by the public health system (ASSE)	1	6.09
Children covered by CAIFs (INAU)	3	9.28
Hospitals	3	13.18
Polyclinics	4	13.44
Community dining centers	3	1.23
Traffic mortality	2	4.07
Infant mortality	4	2.03
Birth rate	1	13.34
Mortality	2	11.83
Households with children under 6 years	1	11.91
Households with people aged 65 and over	2	13.59

Note: ASSE is Uruguay's public health provider. INAU is the public agency responsible for child and adolescent protection. CAIF is a nationwide network of early childhood centers that provides care, nutrition, and developmental support to young children and their families, particularly in vulnerable contexts.

Source: Own elaboration.

Table 6
WEIGHTS OBTAINED FROM PCA FOR WASTE AND ENVIRONMENT INDICATORS

Indicator	Assigned Component	Scaled weight
National System of Protected Areas	2	4.09
Waste (tons)	1	24.03
Waste (m2)	2	2.71
Waste (%)	1	24.03
Minor environmental poisoning cases	2	22.37
Environmental poisoning	2	22.78

Source: Own elaboration.

Table 7
WEIGHTS OBTAINED FROM PCA FOR CULTURE AND SPORTS INDICATORS

Indicator	Assigned Component	Scaled weight
MEC centers	2	42.49
Squares and swimming pools	1	19.36
Swimming pools	1	38.15

Note: MEC centers are community-based facilities operated by the Ministry of Education and Culture of Uruguay that promote access to cultural, educational and digital services, particularly in socially vulnerable areas.

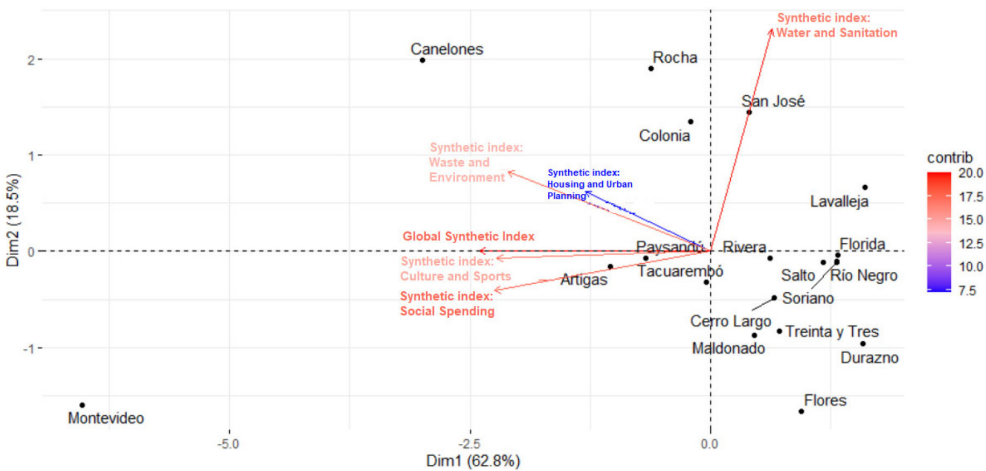
Source: Own elaboration.

Table 8
WEIGHTS OBTAINED FROM PCA FOR WATER AND SANITATION INDICATORS

Indicator	Assigned Component	Scaled weight
Unmet basic needs (UBI) - Sanitation system	1	50
Unmet basic needs (UBI) - Water access	1	50

Source: Own elaboration.

Figure 1
PCA BIPLLOT FOR THE COMPOSITE INDICES BY DIMENSION



Source: Own elaboration.

Table 9 compares the uniform weighting scheme embedded in the original legal design with the PCA-derived weights under the two standardization procedures. While the legal rule assigns equal importance to all dimensions, the data-driven approach reveals substantial heterogeneity in their contribution to cross-departmental variation. Under proportional standardization, Economic Indicators, Culture and Sports, and Water and Sanitation receive the highest weights, indicating that these dimensions account for a larger share of the observed territorial differences. Under min-max standardization, this pattern becomes even more pronounced, with Water and Sanitation and Culture and Sports dominating the synthetic index. These results suggest that, once the information content of the data is considered, territorial disparities are driven primarily by infrastructure-related and economic dimensions rather than by population size or land area, highlighting the limitations of the uniform weighting scheme used in the current allocation formula.

Table 10 decomposes the effects of updating the statutory formula and adopting alternative PCA-based weighting schemes on the distribution of intergovernmental transfers. The first set of results shows the allocation obtained by updating the indicators used in the statutory formula while preserving its original structure and equal weighting scheme. This exercise

alone generates substantial reallocations, with Montevideo and Maldonado experiencing the largest reductions relative to the current distribution, while Flores, Rivera, Tacuarembó, Cerro Largo, and Treinta y Tres gain relative weight.

Table 9
UNIFORM AND PCA-DERIVED WEIGHTS BY DIMENSION OF THE SYNTHETIC INDEX

Summary indicator	Uniform weight (original design)	PCA weight (proportions)	PCA weight (min-max)
Population and Area	14.29	14.13	15.15
Economic Indicators	14.29	18.03	4.50
Housing and Urban Planning	14.29	3.51	5.88
Social Spending (health emphasis)	14.29	12.71	1.55
Waste and Environment	14.29	14.90	10.18
Culture and Sports	14.29	18.40	30.69
Water and Sanitation	14.29	18.32	32.06

Source: Own elaboration.

Table 10
DECOMPOSING THE EFFECTS OF DATA UPDATING AND ALTERNATIVE WEIGHTING METHODOLOGIES ON THE DISTRIBUTION OF INTERGOVERNMENTAL TRANSFERS

Department	Current transfer	Method: Update data		Method: PCA (prop)			Method: PCA (min-max)		
		Index	ΔDiff Current	Index	ΔDiff Update	ΔDiff Current	Index	ΔDiff Update	ΔDiff Current
Montevideo	13.43	10.85	-2.58	13.99	3.14	0.56	8.53	-2.32	-4.90
Artigas	4.93	5.32	0.39	6.09	0.77	1.16	8.31	2.99	3.38
Canelones	8.76	8.13	-0.63	8.94	0.81	0.18	7.88	-0.25	-0.88
Cerro Largo	5.03	5.61	0.58	4.75	-0.86	-0.28	6.59	0.98	1.56
Colonia	4.23	3.93	-0.3	5.78	1.85	1.55	6.09	2.16	1.86
Durazno	4.44	4.88	0.44	3.35	-1.53	-1.09	5.50	0.62	1.06
Flores	2.41	3.29	0.88	3.63	0.34	1.22	1.71	-1.58	-0.70
Florida	3.92	4.23	0.31	3.57	-0.66	-0.35	2.45	-1.78	-1.47
Lavalleja	3.83	4.10	0.27	3.56	-0.54	-0.27	2.97	-1.13	-0.86
Maldonado	6.87	4.46	-2.41	4.61	0.15	-2.26	3.55	-0.91	-3.32
Paysandú	5.57	5.87	0.3	5.52	-0.35	-0.05	7.13	1.26	1.56
Río Negro	4.08	4.14	0.06	4.06	-0.08	-0.02	5.53	1.39	1.45
Rivera	4.58	5.25	0.67	4.73	-0.52	0.15	6.47	1.22	1.89
Rocha	4.35	4.38	0.03	5.61	1.23	1.26	4.57	0.19	0.22
Salto	5.91	6.26	0.35	4.34	-1.92	-1.57	3.77	-2.49	-2.14
San José	3.63	4.10	0.47	4.98	0.88	1.35	3.02	-1.08	-0.61
Soriano	4.62	4.62	0	3.78	-0.84	-0.84	4.13	-0.49	-0.49
Tacuarembó	5.45	6.03	0.58	4.76	-1.27	-0.69	6.79	0.76	1.34
Treinta y Tres	3.95	4.53	0.58	3.95	-0.58	0.00	5.01	0.48	1.06
Transfers reallocated (%)		—	5.9%	—	9.2%	7.4%	—	12%	15.4%

Note: Transfers reallocated (%) measures the share of total transfers that would need to be reassigned to move between allocation schemes (computed as ½ sum of absolute differences in departmental shares).

Source: Own elaboration.

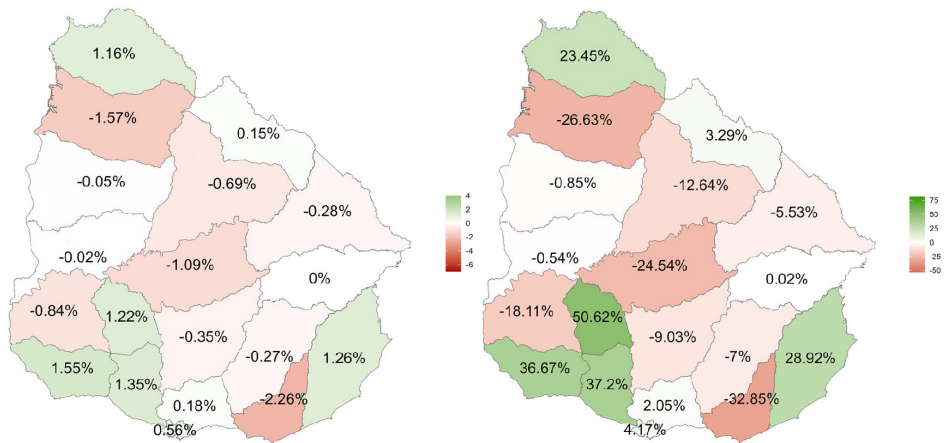
The remaining columns report the additional effects associated with both expanding the indicator set and replacing the original weighting methodology by PCA-based composite indices under proportional and min-max standardization. Under proportional standardization, departments such as Montevideo, Colonia, Rocha, and San José gain relative to the updated statutory formula, whereas Salto, Durazno, Cerro Largo, Florida and Tacuarembó lose weight. Under min-max standardization, the redistributive effects are stronger and more uneven, favoring Artigas, Colonia, Paysandú, Rivera, and Río Negro, while Montevideo, Salto, Lavalleja and Maldonado experience the largest reductions. Overall, the results indicate that redistribution is driven both by the updating of the underlying information and by the choice of weighting methodology, with the latter generating additional and, in some cases, substantially different allocation outcomes.

To quantify the magnitude of these reallocations, we compute the share of total transfers that would need to be reassigned to move from one allocation scheme to another. Updating the statutory formula reallocates 5.9% of total transfers relative to the current allocation. The PCA-based indices imply larger redistributions, reaching 7.4% under proportional standardization and 15.4% under min-max standardization. Comparing the PCA-based allocations with the updated statutory formula further indicates that between 9.2% and 12.0% of total transfers are reallocated due to the expanded indicator set and alternative weighting methodology. These results suggest that methodological choices play at least as important a role as data updating in shaping the territorial distribution of transfers.

Differences between the PCA-based results under proportional and min-max standardization arise from the way in which each method treats cross-departmental dispersion. Proportional standardization preserves relative shares of each indicator and reflects the overall size and weight of departments in the national total, leading to smoother distributions. By contrast, min-max standardization rescales each variable according to its distance from the best and worst performers, amplifying relative gaps. As a result, departments that are farther from the national frontier in key socio-economic or infrastructure dimensions gain or lose more weight under the min-max approach. Consequently, while both procedures rely on the same underlying data and PCA weights, they embody different normative perspectives: proportional standardization favors stability and scale, whereas min-max standardization highlights inequality and equalization, generating larger redistributive effects.

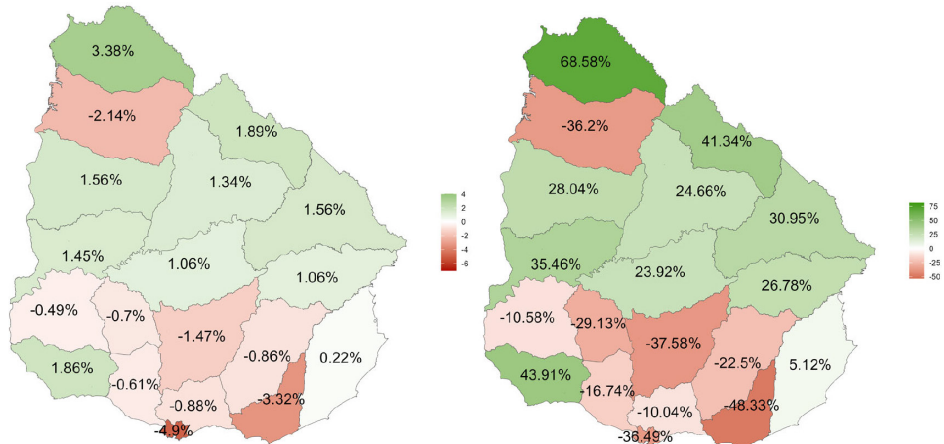
Figures 2 and 3 map the territorial impact of replacing the current transfer rule with the PCA-based composite indices under proportional and min-max standardization, respectively. In both figures, the left panel shows percentage point differences in departmental shares, while the right panel displays relative percentage changes. The maps reveal that proportional standardization produces relatively moderate and spatially smooth reallocations, whereas the min-max specification generates stronger and more polarized redistribution patterns. In particular, interior departments with persistent socio-economic and infrastructure deficits gain substantial shares, while several metropolitan and coastal departments experience marked reductions.

Figure 2
COMPARISON BETWEEN THE CURRENT AND PCA-BASED DISTRIBUTIONS (USING PROPORTIONAL STANDARDIZATION): PERCENTAGE POINT DIFFERENCES (LEFT) AND PERCENTAGE CHANGES (RIGHT)



Source: Own elaboration.

Figure 3
COMPARISON BETWEEN THE CURRENT AND PCA-BASED DISTRIBUTIONS (USING MIN-MAX STANDARDIZATION): PERCENTAGE POINT DIFFERENCES (LEFT) AND PERCENTAGE CHANGES (RIGHT)



Source: Own elaboration.

Tables 11 and 12 report the final synthetic index and the corresponding composite indices by dimension under proportional and min-max standardization, respectively. Together, they show how each department's overall allocation emerges from the combination of the seven dimensions. While the proportional standardization preserves relative shares and pro-

duces smoother cross-departmental differences, the min-max approach amplifies contrasts by highlighting distance from the best and worst performers in each dimension. Despite these differences, both tables reveal consistent territorial patterns, with departments such as Artigas, Paysandú, Rivera, and Tacuarembó scoring relatively high in multiple vulnerability-related dimensions, while Montevideo and some coastal and metropolitan departments display stronger performance in economic and service provision indicators, underscoring the multidimensional nature of territorial disparities captured by the synthetic index.

Table 11
SYNTHETIC INDEX AND DIMENSIONAL COMPOSITE INDICES
(PROPORTIONAL STANDARDIZATION)

Department	Synthetic	Population and Area	Economic Indicators	Housing and Urban Planning	Social Spending (health focus)	Waste and Environment	Culture and Sports	Water and Sanitation
Montevideo	13.99	35.89	3.57	9.49	8.79	14.12	16.69	1.71
Artigas	6.09	0.00	8.89	10.44	5.75	4.24	7.60	4.67
Canelones	8.94	13.25	2.97	6.03	6.25	14.66	11.84	7.67
Cerro Largo	4.75	3.06	7.72	3.89	5.29	4.01	2.51	4.73
Colonia	5.78	3.98	2.73	2.59	5.14	8.60	6.60	7.48
Durazno	3.35	2.23	5.85	1.42	4.30	2.47	3.50	4.16
Flores	3.63	0.71	7.14	1.47	5.08	1.88	5.19	3.23
Florida	3.57	2.33	4.42	2.37	5.07	2.72	2.86	5.85
Lavalleja	3.56	0.00	5.45	2.89	4.09	3.01	4.03	6.74
Maldonado	4.61	11.59	2.50	5.37	4.63	4.73	4.28	3.60
Paysandú	5.52	4.01	5.38	6.34	5.27	8.54	5.95	4.53
Río Negro	4.06	2.99	4.83	2.74	4.03	3.53	4.45	5.31
Rivera	4.73	2.95	7.68	4.90	5.00	2.26	5.28	5.56
Rocha	5.61	3.13	5.06	15.75	5.39	6.22	3.13	7.21
Salto	4.34	4.97	5.53	5.60	4.47	1.26	3.91	5.38
San José	4.98	4.22	3.05	3.46	4.91	7.55	4.50	7.61
Soriano	3.78	0.25	4.37	4.12	4.81	1.92	2.92	5.55
Tacuarembó	4.76	2.81	5.11	5.89	6.25	5.56	2.05	4.80
Treinta y Tres	3.95	1.63	7.76	5.22	5.48	2.71	2.73	4.19

Source: Own elaboration.

Table 12
SYNTHETIC INDEX AND DIMENSIONAL COMPOSITE INDICES
(MIN-MAX STANDARDIZATION)

Department	Synthetic	Population and Area	Economic Indicators	Housing and Urban Planning	Social Spending (health focus)	Waste and Environment	Culture and Sports	Water and Sanitation
Montevideo	8.53	16.00	2.41	7.37	11.11	17.54	13.25	0.00
Artigas	8.31	3.78	15.04	12.76	10.75	2.01	6.62	4.43
Canelones	7.88	9.82	0.74	5.00	2.80	10.75	15.84	7.98
Cerro Largo	6.59	5.82	10.71	6.00	9.33	2.69	3.25	5.50

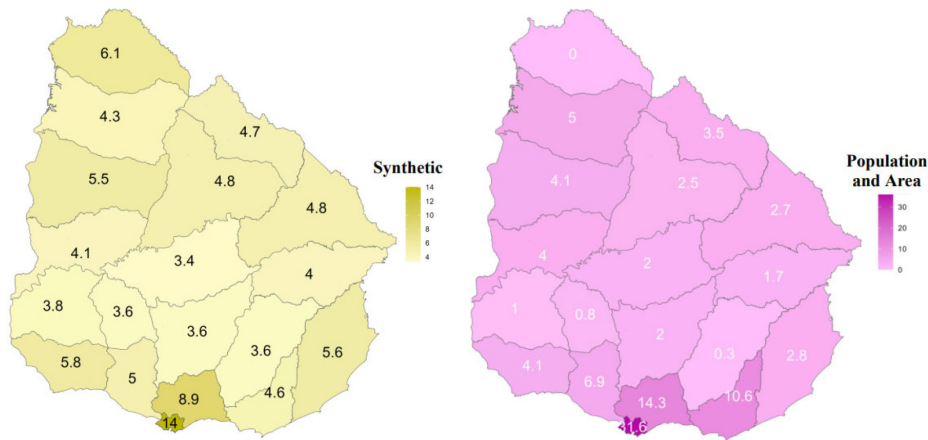
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Department	Synthetic	Population and Area	Economic Indicators	Housing and Urban Planning	Social Spending (health focus)	Waste an Environment	Culture and Sports	Water and Sanitation
Colonia	6.09	2.59	0.00	0.47	4.63	6.17	7.26	7.94
Durazno	5.50	5.31	5.55	5.05	7.07	0.50	3.29	4.64
Flores	1.71	1.43	6.66	0.01	0.79	1.37	5.01	3.58
Florida	2.45	3.80	3.01	0.00	3.04	0.83	3.51	6.13
Lavalleja	2.97	0.00	4.79	1.01	3.85	4.14	2.66	6.66
Maldonado	3.55	9.00	0.10	4.54	0.00	5.30	4.75	1.86
Paysandú	7.13	7.71	6.12	11.90	4.51	5.45	5.19	3.32
Río Negro	5.53	3.74	4.49	4.70	2.95	5.22	4.65	6.23
Rivera	6.47	2.44	10.76	9.09	7.88	8.52	4.65	6.67
Rocha	4.57	5.48	4.63	7.58	6.25	3.08	3.67	6.74
Salto	3.77	8.50	6.26	7.00	4.62	0.00	5.29	3.30
San José	3.02	2.63	0.87	0.69	3.76	8.01	5.06	8.62
Soriano	4.13	0.44	3.47	6.48	4.70	1.93	2.49	5.55
Tacuarembó	6.79	7.45	4.77	7.27	8.57	7.67	0.00	6.11
Treinta y Tres	5.01	4.05	9.62	3.08	3.39	8.81	3.56	4.74

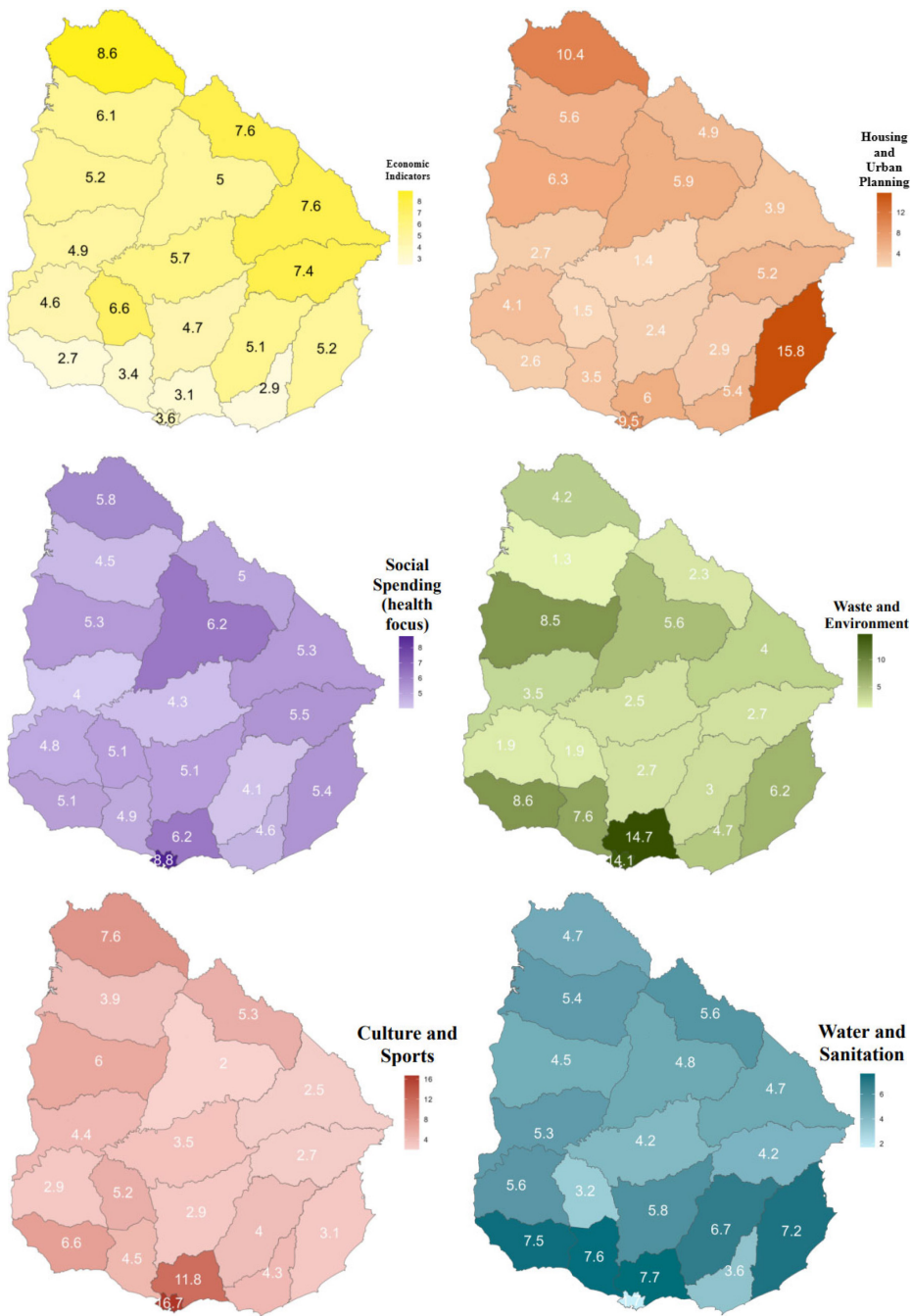
Source: Own elaboration.

Figures 4 and 5 display the spatial distribution of the final synthetic index and its underlying dimensions under proportional and min-max standardization, respectively. Across both specifications, consistent spatial patterns emerge, with several interior departments exhibiting higher values in economic vulnerability, housing deficits, and infrastructure-related dimensions, while metropolitan and coastal areas tend to score lower. These figures visually underscore the multidimensional nature of territorial inequality captured by the synthetic index and the sensitivity of its spatial profile to the chosen standardization method.

Figure 4
FINAL SYNTHETIC INDEX AND COMPOSITE INDICES BY DIMENSION
(PROPORTIONAL STANDARDIZATION)

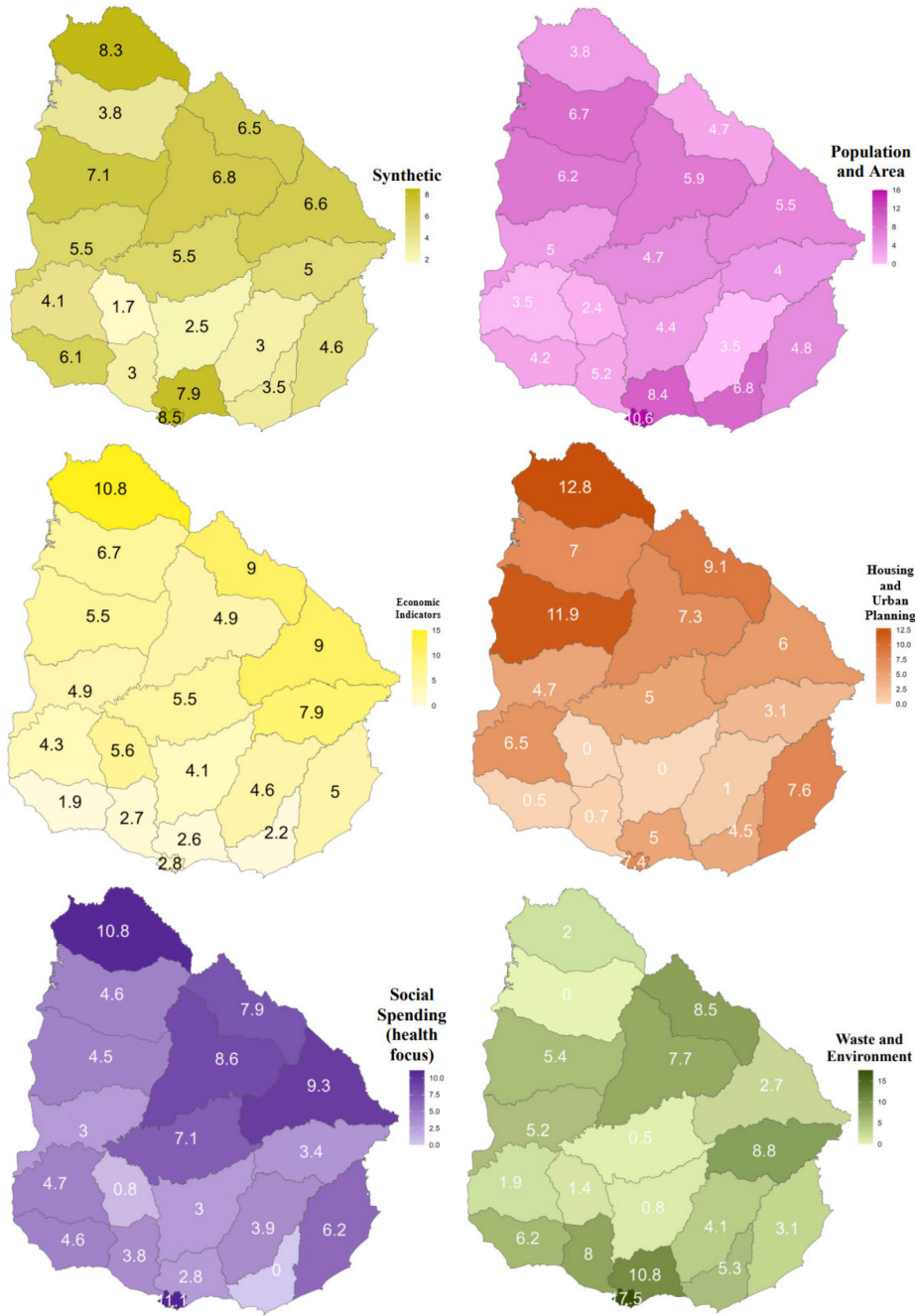


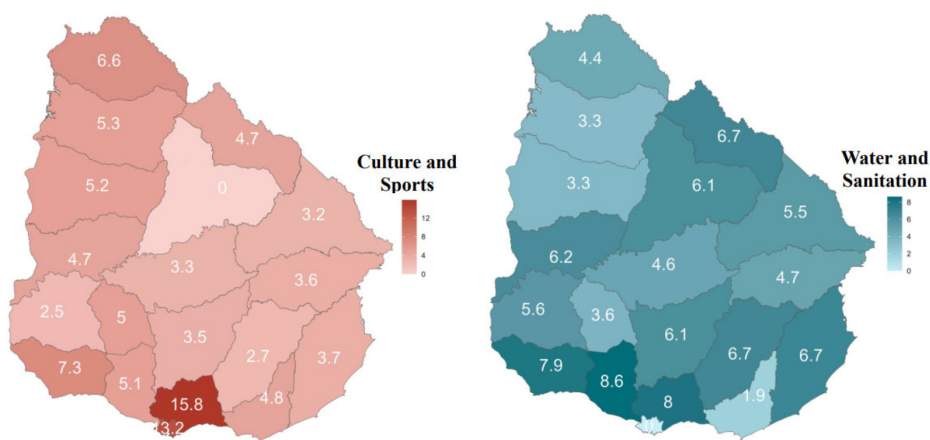
(Continued)



Source: Own elaboration.

Figure 5
FINAL SYNTHETIC INDEX AND COMPOSITE INDICES BY DIMENSION
(WITH MIN-MAX STANDARDIZATION)



(Continued)*Source:* Own elaboration.

5.3. Changes in departmental rankings

Table 13 reports departmental rankings under the current transfer rule, the updated statutory formula, and the PCA-based composite indices. The inclusion of the updated statutory formula makes it possible to distinguish ranking changes associated with refreshing the underlying information from those generated by the adoption of an expanded multidimensional indicator set and alternative weighting methodologies. While Montevideo and Canelones remain among the highest-ranked departments under all specifications, substantial re-ranking occurs among the remaining departments. Updating the data alone already modifies the relative position of several departments, most notably improving the ranking of Paysandú, Salto, Rivera, and Treinta y Tres while reducing that of Maldonado, Colonia, Río Negro and Soriano.

The PCA-based indices introduce further changes, particularly under the min-max specification, where departments such as Artigas, Tacuarembó, Paysandú, and Rivera move considerably higher in the distribution, whereas Maldonado, Salto, and Florida lose relative position. Overall, the results indicate that both the updating of indicators and the adoption of a broader multidimensional framework contribute to reshaping the territorial allocation pattern.

These results suggest that the current allocation rule embeds systematic biases favoring particular territorial profiles. Such biases are not random but appear to be associated with patterns of urbanization, economic concentration, and the limited set of indicators used in the statutory formula. The updated allocation and the alternative composite indices both point toward a redistribution away from some metropolitan and tourist-oriented departments, particularly Maldonado, and toward departments characterized by lower economic capacity and greater infrastructure and service provision needs, such as Artigas, Rivera, Rocha, and,

under some specifications, Colonia. The magnitude of the re-ranking is not marginal: several departments move multiple positions in the allocation hierarchy.

Table 13
COMPARISON OF RESULTS

Department	Current transfer	Rank	Updated data	Rank	PCA (proportions)	Rank	PCA (min-max)	Rank
Montevideo	13.43	1	10.85	1	13.99	1	8.53	1
Artigas	4.93	8	5.32	7	6.09	3	8.31	2
Canelones	8.76	2	8.13	2	8.94	2	7.88	3
Cerro Largo	5.03	7	5.61	5	4.75	9	6.59	6
Colonia	4.23	13	3.93	16	5.78	4	6.09	8
Durazno	4.44	11	4.88	11	3.35	19	5.50	10
Flores	2.41	19	3.29	19	3.63	16	1.71	19
Florida	3.92	16	4.23	14	3.57	17	2.45	18
Lavalleja	3.83	17	4.10	17	3.56	18	2.97	17
Maldonado	6.87	3	4.46	12	4.61	11	3.55	15
Paysandú	5.57	5	5.87	4	5.52	6	7.13	4
Río Negro	4.08	14	4.14	15	4.06	13	5.53	9
Rivera	4.58	10	5.25	8	4.73	10	6.47	7
Rocha	4.35	12	4.38	13	5.61	5	4.57	12
Salto	5.91	4	6.26	3	4.34	12	3.77	14
San José	3.63	18	4.10	17	4.98	7	3.02	16
Soriano	4.62	9	4.62	10	3.78	15	4.13	13
Tacuarembó	5.45	6	6.03	6	4.76	8	6.79	5
Treinta y Tres	3.95	15	4.53	9	3.95	14	5.01	11

Source: Own elaboration.

5.4. Robustness and sensitivity analysis

Tables 14 and 15 compare the temporal behavior of the PCA-based distribution with the actual evolution of intergovernmental transfers over the last five years. Table 14 shows that the PCA-based allocation remains relatively stable over time, with only modest year-to-year variations in departmental shares. This suggests that the synthetic index is not unduly sensitive to short-term fluctuations in the underlying indicators and that the weights derived from the statistical structure of the data evolve gradually rather than abruptly.

The limited variation observed across years indicates that periodic updates could be implemented without generating excessive volatility in transfer allocations. In this context, a five-year revision cycle appears to strike a reasonable balance between maintaining the relevance of the information used in the allocation formula and preserving predictability for subnational governments.

Table 14
SENSITIVITY ANALYSIS USING THE LAST 5 YEARS OF AVAILABLE DATA

Department	PCA distribution (proportions)	t-1	t-2	t-3	t-4	t-5
Montevideo	13.99	13.31	13.92	14.11	14.29	14.25
Artigas	6.09	5.66	5.27	5.36	5.35	5.50
Canelones	8.94	8.80	8.67	8.78	8.88	8.80
Cerro Largo	4.75	4.93	4.99	4.73	4.55	4.91
Colonia	5.78	5.43	5.48	5.28	5.40	5.32
Durazno	3.35	3.67	4.29	3.40	3.65	3.49
Flores	3.63	3.58	3.39	3.63	3.42	3.68
Florida	3.57	4.02	3.37	3.56	3.60	3.52
Lavalleja	3.56	3.80	3.68	3.77	3.84	3.74
Maldonado	4.61	4.45	4.67	4.73	4.70	4.70
Paysandú	5.52	5.26	5.25	5.38	5.18	5.04
Río Negro	4.06	4.65	4.59	4.18	4.30	4.38
Rivera	4.73	4.90	5.10	5.04	5.32	5.29
Rocha	5.61	4.87	4.96	4.80	4.57	4.95
Salto	4.34	4.15	4.27	4.30	4.29	4.19
San José	4.98	5.45	5.30	5.51	5.36	5.31
Soriano	3.78	4.06	3.95	4.15	3.94	3.94
Tacuarembó	4.76	4.49	4.48	4.73	4.69	4.73
Treinta y Tres	3.95	4.52	4.36	4.53	4.64	4.24

Source: Own elaboration.

Table 15
DISTRIBUTION OF TRANSFERS OVER THE LAST FIVE YEARS

Department	2023	2022	2021	2020	2019
Montevideo	13.43	13.59	14.02	14.39	14.37
Artigas	4.93	4.91	4.88	4.88	4.86
Canelones	8.76	8.72	8.68	8.66	8.64
Cerro Largo	5.03	5.04	5.01	5.01	4.99
Colonia	4.23	4.23	4.20	4.19	4.19
Durazno	4.44	4.43	4.41	4.41	4.39
Flores	2.41	2.40	2.39	2.38	2.38
Florida	3.92	3.91	3.89	3.88	3.87
Lavalleja	3.83	3.82	3.80	3.79	3.78
Maldonado	6.87	6.84	6.81	6.61	6.78
Paysandú	5.57	5.56	5.54	5.51	5.51
Río Negro	4.08	4.10	4.08	4.07	4.06
Rivera	4.58	4.60	4.57	4.57	4.56
Rocha	4.35	4.35	4.32	4.31	4.31
Salto	5.91	5.88	5.86	5.85	5.83
San José	3.63	3.62	3.60	3.59	3.59
Soriano	4.62	4.61	4.59	4.58	4.57
Tacuarembó	5.45	5.44	5.41	5.39	5.39
Treinta y Tres	3.95	3.96	3.94	3.94	3.92

Source: Own elaboration.

Excluding Montevideo from the analysis reduces dispersion but does not reverse the main redistributive patterns. The capital city clearly acts as an outlier, yet its exclusion does not eliminate the systematic differences between the statutory formula and the alternative allocation schemes.

Overall, the results suggest that the expanded multidimensional framework combined with PCA-based weighting demonstrates greater internal coherence, stronger conceptual alignment with fiscal equalization principles, and superior sensitivity to territorial heterogeneity.

6. Policy Implications

The empirical findings of this paper have direct implications for the design, governance, and political economy of intergovernmental transfer systems.

First, the evidence suggests that Uruguay's current transfer formula only partially fulfills its equalization objectives. Because the statutory allocation rule relies on a limited set of indicators and outdated information, its ability to reflect contemporary territorial disparities appears increasingly constrained. Over time, allocation mechanisms based on static indicators may evolve from instruments designed to address differences in fiscal capacity and expenditure needs into transfer arrangements only weakly connected to current socio-economic conditions. This can undermine both the legitimacy and effectiveness of the system, as resource flows become increasingly difficult to justify in terms of observable territorial disparities.

Second, the results highlight the potential benefits of incorporating broader and more data-driven approaches into the design of intergovernmental transfer systems. By combining an expanded multidimensional indicator framework with multivariate statistical techniques, policymakers can account for multiple dimensions of territorial disparities, within a transparent and replicable allocation framework. Compared with formulas based on a limited and static set of indicators, such approaches provide greater flexibility to adapt to evolving socio-economic conditions and offer a clearer empirical basis for the allocation of resources. From a policy perspective, this may contribute to reducing the scope for discretionary adjustments and strengthening the transparency and credibility of fiscal governance.

Third, the findings underscore the importance of formalizing updating mechanisms. An effective equalization system should not depend on periodic legislative amendments to remain relevant. Instead, the legal framework should mandate regular recalibration of indicators and weights using the latest available data. Embedding automatic updating procedures would allow the transfer system to adapt dynamically to demographic change, economic restructuring, and emerging social vulnerabilities.

The results also suggest that reforming the transfer system need not be viewed as an all-or-nothing exercise. Updating the indicators used in the statutory formula and revising the weighting methodology represent complementary but distinct reform strategies. The former

preserves the existing allocation logic while improving its empirical relevance; the latter involves a more fundamental redesign of how territorial disparities are measured and incorporated into the transfer system. Distinguishing between these two margins of reform highlights the trade-off between institutional continuity and methodological innovation and may facilitate the political feasibility of future changes.

Fourth, the treatment of large metropolitan areas warrants special consideration. The case of Montevideo illustrates that extreme values may exert disproportional influence over formula-based systems. Transparent rules regarding outlier treatment should be explicitly incorporated into the design of transfer formulas.

Finally, reforming intergovernmental transfers is not merely a technical exercise but also an institutional and political challenge. Transparent, data-driven formulas reduce political discretion but may face resistance from jurisdictions that benefit from the status quo. Successful reform therefore depends not only on technical rigor but also on the ability to balance transparency, institutional continuity, and political feasibility.

More broadly, the Uruguayan case offers lessons for other countries confronting similar dilemmas: how to modernize fiscal architectures without undermining political stability. As subnational governments face growing pressures from aging populations, urbanization, and demands for service provision, transfer systems must evolve from historical agreements into adaptive institutional mechanisms capable of responding to dynamic territorial realities.

7. Conclusion

This paper has examined the design of intergovernmental transfers in Uruguay through the lens of fiscal federalism and evidence-based governance. Using updated data and multivariate statistical techniques, the analysis evaluated the performance of the allocation rule and explored alternative approaches grounded in empirical regularities rather than in normative weighting.

The results indicate that much of the mismatch between current allocations and present-day territorial conditions stems from the use of outdated information. Replicating the statutory formula with updated data generates significant changes in departmental shares, suggesting that the equalization capacity of the existing system has become increasingly constrained over time. This finding is consistent with previous evidence showing that intergovernmental transfers in Uruguay have historically played a limited role in reducing regional disparities.

The analysis also shows that expanding the allocation framework beyond the indicators currently contemplated in the law leads to substantial changes in transfer allocations. By incorporating a broader set of variables related to fiscal capacity and expenditure needs and deriving weights from the statistical structure of the data, the proposed composite indices reveal territorial disparities that remain largely invisible under the statutory formula. While updat-

ing the statutory formula alone would reallocate approximately 6% of total transfers across departments, the expanded multidimensional framework combined with PCA redistributes between 9% and 12% relative to the updated formula, suggesting that methodological choices are at least as important as data updating in shaping the territorial distribution of transfers.

More broadly, the analysis suggests that improving equalization does not necessarily require replacing the statutory framework. Updating the information used in the allocation formula and revising its weighting methodology should be viewed as complementary but distinct reform strategies, each with different institutional, technical, and political implications. While the former can improve the alignment of transfers with current territorial conditions without altering the existing allocation logic, the latter entails a more fundamental reconsideration of how territorial disparities are measured and incorporated into the transfer system.

Beyond the Uruguayan case, the paper contributes to the literature on fiscal equalization by illustrating how composite indicators can move from descriptive tools into operational instruments of intergovernmental finance. In doing so, it bridges the gap between empirical measurement and institutional design. Rather than treating allocation formulas as fixed political settlements, the proposed framework conceptualizes them as dynamic governance tools that must evolve alongside territorial realities.

The analysis highlights key challenges. Data-driven formulas enhance objectivity and transparency but do not eliminate political conflict. Redistribution necessarily creates winners and losers, and resistance to reform is inevitable. Nevertheless, postponing reform carries costs: increasing misallocation, erosion of legitimacy, and deterioration of trust in fiscal institutions.

Future research could extend this analysis by examining the behavioral effects of alternative allocation formulas on local fiscal effort, expenditure efficiency, and regional convergence. Such evidence would provide a more complete assessment of whether reforms to transfer design ultimately contribute to reducing territorial inequalities over time.

Notes

1. Uruguay is administratively divided into 19 departments, which constitute its first-level territorial subdivisions.
2. <https://www.impo.com.uy/bases/leyes/17296-2001/642>.
3. The FDI is established under Article 298 of the Constitution of Uruguay, and its current operational framework is regulated by Law 19.924 (National Budget Law 2020-2024), together with subsequent regulatory provisions issued by the Office of Planning and Budget (OPP) and the Sectoral Commission on Decentralization.
4. Several techniques can be used for data standardization, including rankings, z-scores, min-max normalization, distance to a reference, and relative positions around the mean. The choice among these methods should be guided by the properties of the data and the objectives of the composite index being constructed (Horta *et al.*, 2023).
5. Some indicators are not available for certain years; therefore, the closest available information to the reference year is used, or alternatively, the indicators are held constant throughout the period under analysis.

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Resumen

Las transferencias intergubernamentales son un componente central del federalismo fiscal, ya que promueven la equidad territorial entre regiones con distintas condiciones socioeconómicas. Este trabajo analiza el caso de Uruguay, donde las transferencias siguen basándose parcialmente en un índice compuesto elaborado hace más de dos décadas a partir de un conjunto limitado de indicadores. Utilizando datos recientes de censos y registros administrativos, se reevalúa la fórmula legal de asignación

y se analiza un marco multidimensional alternativo basado en Análisis de Componentes Principales y Análisis Factorial. Los resultados muestran que la actualización de la fórmula vigente genera reasignaciones significativas, mientras que la incorporación de un conjunto ampliado de indicadores y una metodología de ponderación basada en los datos produce efectos redistributivos aún mayores, mejorando la capacidad igualadora del sistema de transferencias.

Palabras clave: federalismo fiscal, transferencias intergubernamentales, igualación fiscal, indicadores compuestos.

Clasificación JEL: H77, H71, C38, R51.