

**Population Ageing and Regional Economic Dynamics in Colombia:
An Interregional Input-Output Analysis**

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PRELIMINARY AND INCOMPLETE

Abstract: This research addresses how demographic ageing is transforming household consumption in Colombia and quantifies its subsequent economic impacts at the subnational level, specifically asking how shifting consumption patterns among older adults influence sectoral production, employment, and value-added in a territorially uneven economy. To answer this, the study employs a quantitative methodological approach centered on an Interregional Input-Output (IRIO) model developed for Colombia, which simulates current and projected demographic scenarios to capture inter-sectoral and inter-regional linkages. The analysis is grounded in high-resolution microdata from Colombia's Household Budget Survey (ENPH) allowing for a detailed characterization of consumption disaggregated by income level, age group, and region. The novelty of this research lies in its innovative integration of granular, household-level microeconomic data with structural macro-modeling within a subnational multi-regional framework. Unlike national-level studies, this approach generates a unique typology of regions based on ageing intensity and economic vulnerability, providing empirical evidence that is essential for designing regionally differentiated social protection policies and identifying strategic opportunities within the emerging "Silver Economy" in Latin America.

1. Introduction

Colombia is undergoing a rapid demographic transition. While population ageing is a global phenomenon, its manifestation in emerging economies is uniquely challenging due to high levels of informality and significant regional disparities. Moreover, this process takes place in an economy that hasn't yet developed and prospered. The "Silver Economy"—the economic activity generated by the consumption and needs of older adults—remains under-explored in the Colombian context, especially at the subnational scale.

There is a lack of empirical evidence regarding how the transition from "younger" to "older" consumption baskets affects sectoral production across borders. For instance, a shift toward healthcare and services in an ageing Andean city might trigger supply chain reactions (spillovers) in agricultural or industrial regions. Without a multi-regional lens, the "leakages" of value added from peripheral to central regions remain invisible.

The primary objective of this study is to characterize the consumption patterns of the "Silver" segment within the Colombian context. By leveraging high-resolution microdata from the *Encuesta Nacional de Presupuestos de los Hogares* (ENPH), we aim to move beyond aggregate national statistics to understand the specific expenditure profiles of individuals aged 55 and over. This granular approach allows for the identification of how demographic transitions translate into differentiated sectoral demands at the local level.

Building upon this characterization, the second objective is to quantify the direct and indirect impacts of this specific consumption vector on sectoral production and Value Added (VA). Utilizing an Inter-Regional Input-Output (IRIO) framework covering 33 regions, the study maps the transmission of "Silver" demand through the productive structure. This enables us to measure the total economic stimulus generated by the elderly population, accounting for the complex interdependencies between regional industries.

Finally, the research seeks to identify a typology of regions based on their economic relationship with the ageing demographic. By contrasting local retention rates with inter-regional spillovers, we categorize territories according to their "Silver" autonomy versus their structural dependence on external production. This typology serves to highlight spatial inequalities, identifying which regions successfully internalize the Silver dividend and which act as mere conduits for wealth transfer to industrial hubs.

This paper argues that population ageing is not just a demographic challenge for social security, but a reconfigurator of regional economic geography. By integrating micro-level consumption data with a macro-structural IRIO model, we provide a tool for "regionally differentiated" policy making.

2. Methodology

2.1. The Interregional Input-Output (IRIO) Framework

The core of this research is a demand-driven Leontief model. We utilize an IRIO table for Colombia (Haddad et al., 2023), disaggregated into 33 regions (32 departments and Bogotá D.C.) and 54 economic sectors, resulting in a system of 1,782 equations. The fundamental equilibrium is expressed as:

$$x = (I - A)^{-1}y \quad (1)$$

Where:

- x is the vector of total sectoral production.
- $(I - A)^{-1}$ is the Leontief Inverse matrix (L), capturing both direct and indirect inter-industry and inter-regional effects.
- f is the final demand vector, which we specifically shock with household consumption patterns.

2.2. Micro-to-Macro Integration: The "Silver" Demand Vector

A key contribution of this study is the granular construction of the final demand vector. We utilize the National Household Budget Survey (ENPH) to characterize consumption. This survey was implemented in 2016-2017 and covers 87201 households across Colombia and is representative at both the national and 38-city levels (Gilles et al., 2026). It contains detailed information about household composition (number of persons and their gender and age), the head's education level, and household consumption, aggregated into the twelve COICOP divisions.

The process of micro-to-macro integration involves the following steps:

- Definition of silver economy. While this concept has gained significant traction as a marketing and policy trend, academic literature on the subject remains emergent and often lacks a cohesive theoretical framework. The 'Silver' population is defined in this study as individuals aged 55 and over, capturing the transition towards later-life consumption patterns in the Colombian urban context.
- Identification: To accurately allocate household consumption across generations, this study employs the OECD-modified equivalence scale (de Vos & Zaidi, 1997). Methodologically, a weight of 1.0 is assigned to the household head, while additional adults (aged 14+) and children receive weights of 0.5 and 0.3, respectively. Crucially, the 'Silver' consumption vector is constructed based on the individual's specific role within the household hierarchy: if the elderly person is the designated household head, they anchor the fixed consumption costs (weight 1.0); conversely, if they reside in a multi-generational household headed by a non-elderly member, they are treated as an additional adult (weight 0.5). This approach prevents the artificial inflation of the 'Silver Economy' by respecting the actual economies of scale and distribution of financial responsibility reported in the ENPH microdata, ensuring that the resulting final demand vector reflects the true expenditure attributable to the ageing population.
- Mapping: To integrate micro-level consumption data into the macro-structural model, we developed a Bridge Matrix that maps the Commodity Classification of Individual

Consumption by Purpose (COICOP) used in the ENPH to the sectors defined in the IRIO table. This correspondence procedure involves a cross-classification process where individual expenditure items are allocated to their respective productive sectors. In cases where a single COICOP category draws from multiple industries, we applied distribution coefficients to ensure a precise translation of household demand into sectoral output. The bridging procedure was further refined through a two-step harmonization process. First, we derived an initial correspondence by averaging the 2016 and 2017 bridge matrices from the Global Household Footprint project used in Gilles et al., (2026), which links the 12 COICOP divisions with the OECD-ICIO sectoral classification. To ensure statistical robustness, we focused on sectors with allocation values exceeding a 0.5% threshold. Second, to address the classification mismatch between the ICIO and the specific IRIOT used in this paper, we performed a granular re-allocation. For ambiguous cases where an ICIO sector mapped to multiple IRIOT sectors, we utilized the household expenditure distribution of the Colombian departments (based on the IRIOT regional consumption structure). This hybrid approach—combining global bridge standards with local consumption weights—results in a final demand vector that respects the unique productive and consumption characteristics of the 33 Colombian regions.

2.3. Value Added and Spillover Quantification

To measure the regional dynamics, we transform the output impacts into Value Added using regional sectoral coefficients ($\hat{v}$):

$$va = \hat{v}(I - A)^{-1}y \quad (2)$$

Taking advantage of the interregional nature of our table, we distinguish between two types of impacts: Intra-regional Impact: The value added generated within the same region where the consumption occurs. Inter-regional Spillovers: The value added "leaked" to the rest of the 32 regions due to the demand for intermediate inputs across departmental borders.

3. Results and Discussion

3.1. Spatial Heterogeneity of the Silver Economy

The application of the demand-driven IRIO model reveals that the "Silver Economy" in Colombia is not a spatially uniform phenomenon. Instead, its economic impact is deeply conditioned by the productive complexity of each region. While the consumption of individuals aged 55 and over serves as a significant driver of aggregate demand, the capacity

of local economies to retain this stimulus varies significantly between the country's industrial hubs and its peripheral territories.

3.2. Descriptive Statistics: Silver Consumption Structure

The first stage of the analysis focuses on the composition of the Silver demand vector across different urban contexts. Using the 12 COICOP divisions, we observe a specialized expenditure pattern among individuals aged 55 and over.

Figure 1. Structure of the consumption vectors in Colombia, in COICOP divisions.

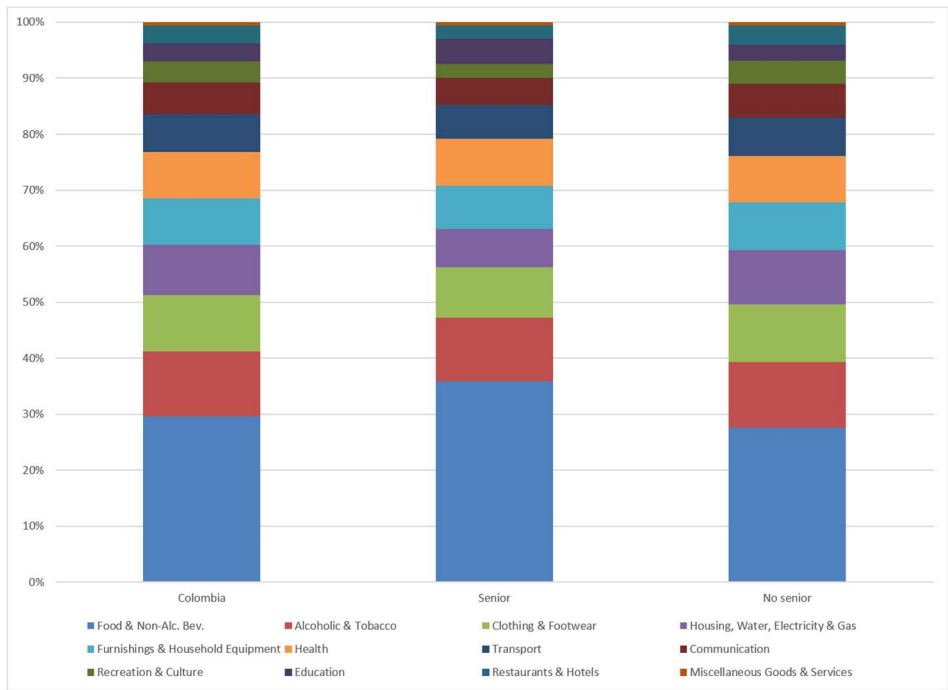
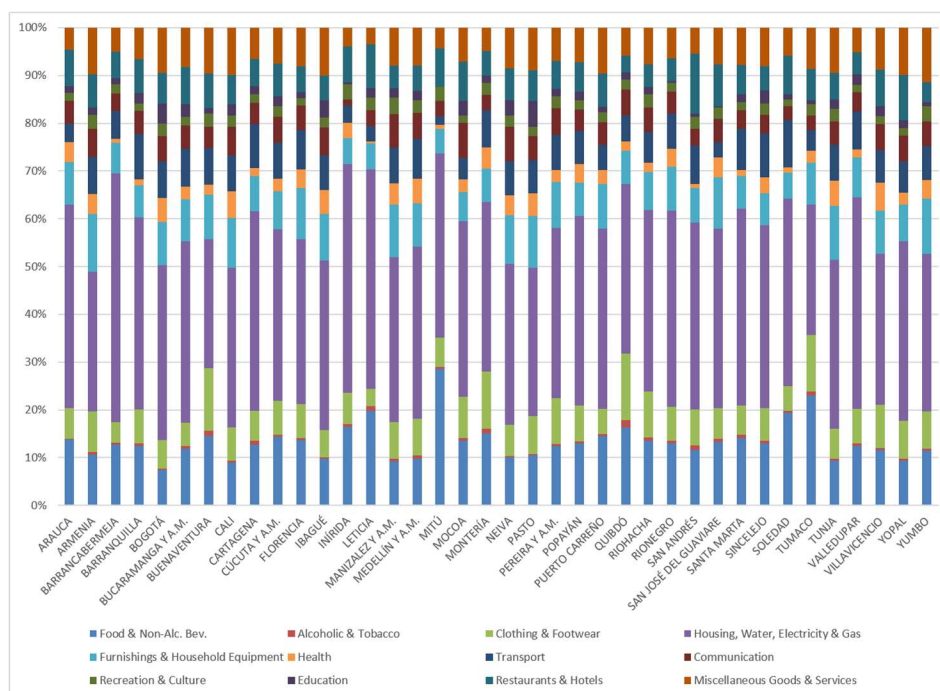


Figure 2. Structure of the consumption vectors of the silver population by cities, in COICOP divisions.

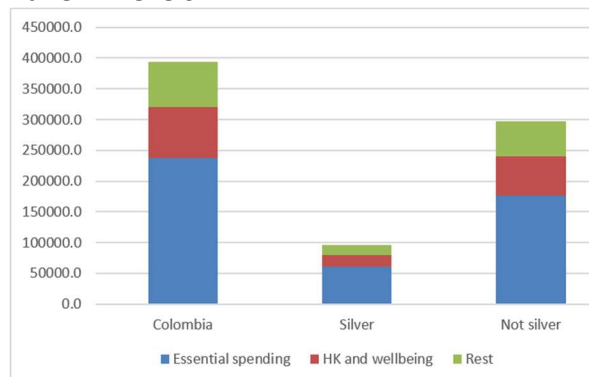


Nationally, Housing (04) and Food (01) represent the largest shares of the budget. However, a comparative analysis between cities reveals significant differences. In higher-income hubs like Medellín, there is a higher relative weight in Health (06) and Recreation (09), whereas in cities like Quibdó and Tumaco, consumption is heavily concentrated in essential non-durables. This "consumption mix" is the primary driver of the sectoral shocks introduced into the IRIO model.

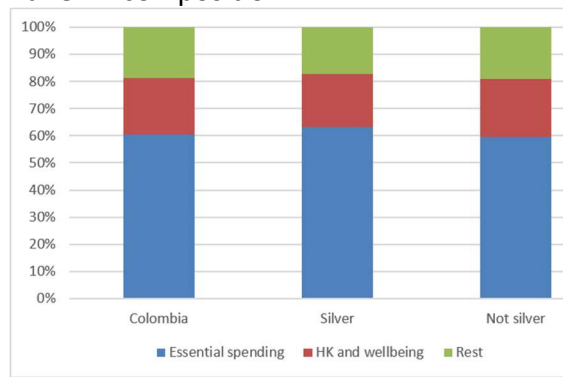
Finally, we show how important silver consumption is.

Figure 3: Consumption vectors in COP billions and composition (percent)

Panel A: levels



Panel B: composition



Note: Essential spending includes Housing, Food, Furnishing and Clothing; Human capital and wellbeing includes Transport, Communication, Education, and Health; Rest includes Recreation and culture, Restaurants and hotels, Miscellaneous goods and services, and Alcohol and tobacco.

3.3. Economic Impact: Value Added Generation

The results of the Leontief demand-pull model show that the Silver Economy is a potent driver of regional production. By shocking the IRIO matrix with the city-specific Silver vectors, we estimated the total Value Added (VA) generated:

- **Regional Magnitude:** In absolute terms, the impact is highest in the country's main metropolitan areas. Bogotá, Medellín, Cali, Bucaramanga, and Barranquilla account for 77.2% of the total value added generated by the silver consumption in the 38 cities of the sample.
- It is also useful to put those numbers in relative terms. In average, the consumption of households in the 38 cities represents 31.3% of total GDP, whereas the part of silver population represents 8.1% of total GDP. In other terms, silver consumption represents a quarter of total consumption.
- The main cities are Bogota (13.0% of its own GDP); Armenia (10.7%); Manizales (9.6%); Pereira (9.0%) and Cúcuta (9.0%). This surely reflects not only consumption behaviour but also the demographic structure of those cities.
- **Sectoral Multipliers:** The sectors that benefit most from this demand are Services and Retail, which traditionally have high labor-intensity coefficients, suggesting that the Silver Economy is also a key supporter of local employment.

3.4. Local Retention vs. Inter-regional Spillovers: A Comparative Analysis

To illustrate these dynamics, we contrast the results of a primary industrial center (Medellín and its metro area) with a vulnerable city in a peripheral region (Quibdó).

- **The Case of Medellín (High Autonomy):** In Medellín, the Silver Economy accounts for approximately 8.58% of the regional Value Added. Notably, the region exhibits a high Autonomy Ratio of 69.3%, meaning that nearly seven out of every ten pesos spent by the elderly population are transformed into local production. This suggests that the local supply chain in Antioquia is sufficiently diversified to satisfy specialized Silver demand, particularly in sectors such as healthcare services, retail, and manufactured goods.
- **The Case of Quibdó (Structural Dependency):** In contrast, Quibdó presents a starkly different scenario. Although Silver consumption exists, the Autonomy Ratio drops to 19.7%. Consequently, more than 80% of the economic impact "leaks" out of the

region through inter-regional spillovers. In this case, the elderly population's income—often derived from national pension transfers—functions as an inadvertent mechanism of wealth transfer toward the country's more developed industrial centers, which provide the goods and services that the local Quibdó economy cannot produce.

4. Conclusions and Policy Implications

This research provides a subnational structural analysis of the Silver Economy in Colombia, moving beyond traditional marketing narratives to uncover the spatial inequalities inherent in demographic transitions.

The application of an IRIO framework, coupled with granular microdata, leads to three fundamental conclusions:

1. **Heterogeneity of Regional Impact:** The Silver Economy is not a monolithic driver of growth. Its capacity to stimulate regional production is strictly dependent on the pre-existing industrial and service complexity of the territory. While in metropolitan hubs like Medellín it accounts for nearly 8.58% of Value Added with high local retention, in peripheral regions its impact is diluted by structural dependencies.
2. **Different regional leakages:** Our findings reveal a stark divide in the Autonomy Ratio. In vulnerable regions such as Quibdó, the Silver Economy functions as a mechanism for inter-regional wealth transfer, where over 80% of the economic stimulus leaks toward developed centers. This suggests that without local productive strengthening, the "Silver" population's income—largely sustained by national transfers—unintentionally subsidizes the growth of the country's most prosperous cities.
3. **Consumption Quality and Development:** The shift from Essential to Wellbeing and Discretionary consumption is a key marker of regional development. Policy interventions should not only focus on pension coverage but also on fostering local supply chains (particularly in healthcare and basic manufacturing) in ageing peripheral regions to improve local value retention.

In summary, for the "Silver Economy" to become a tool for territorial cohesion rather than a driver of divergence, regional planners must align demographic trends with industrial policy, ensuring that the dividend of an ageing population stays close to home.

References

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