

EXPLANATORY REGRESSION MODEL OF THE HEALTH BUDGET IN CHILE: ANALYSIS OF THE DISTRIBUTION IN THE HEALTH SERVICES OF CHILE

MODELO DE REGRESIÓN EXPLICATIVO DEL PRESUPUESTO DE SALUD EN CHILE: ANÁLISIS DE LA DISTRIBUCIÓN EN LOS SERVICIOS DE SALUD DE CHILE

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ABSTRACT

This research analyzes the implicit structure of Chile's health budget, considering its distribution to the health services that administer it. For this analysis, data from the general public budget and budgets specifically allocated to programs targeting women, men, children, adolescents, older adults, and various territorial areas were accessed. This methodology employed structural analysis as a foundation and regression models to determine future forecast estimates. The findings included weighting coefficients, coefficients of determination, and predictable error estimates. Furthermore, the longitudinal analysis conducted at the national level showed an increase in revenue allocated to the health budget in Chile over the years. Among the findings, it was determined, from the broadest possible perspective, that the budget allocated to the health sector shows continuous growth in real terms, and that the older adult segment influences budget revenue, although this alone does not explain its variability. Likewise, from the perspective of health insurance, the decrease in the number of people enrolled in the private system is confirmed, which confirms that a transition from the private to the public health services sector has occurred. It was then determined that variables such as the male population, the child population, the adolescent population, the adult population and the elderly population show direct and positive influences on the budget allocation, while the variables beneficiaries of FONASA, which represent the public sector, and beneficiaries of ISAPRE and other beneficiaries, which represent the private sector, show an inverse or negative impact on the budget allocation.

Keywords: Health budget, territorial distribution of the budget, estimates, budget coefficients, budget revenues.

RESUMEN

Esta investigación analiza la estructura implícita del presupuesto de salud de Chile, considerando su distribución a los servicios de salud que lo administran. Para este análisis, se accedió a datos del presupuesto público general y de presupuestos específicamente asignados a programas dirigidos a mujeres, hombres, niños, adolescentes, adultos mayores y diversas áreas territoriales. Esta metodología empleó el análisis estructural como base y modelos de regresión para determinar estimadores de pronósticos futuros. Los hallazgos incluyeron coeficientes de ponderación, coeficientes de determinación y estimadores de error predecible. Además, el análisis longitudinal realizado a nivel nacional mostró un incremento en los ingresos asignados al presupuesto de salud en Chile a lo largo de los años. Entre los hallazgos, se pudo determinar, desde la perspectiva más amplia posible, que el presupuesto asignado al sector salud muestra un crecimiento continuo en términos reales, y que el segmento de adultos mayores influye en los ingresos presupuestarios, aunque esto por sí solo no explica su variabilidad. Asimismo, desde la perspectiva del seguro de salud, se confirma la disminución en el número de personas inscritas en el sistema privado, lo que confirma que se ha producido una transición del sector privado al público de servicios de salud. Se determinó entonces que variables como la población masculina, la población infantil, la población adolescente, la población adulta y la población de adultos mayores muestran influencias directas y positivas en la asignación presupuestaria, mientras que las variables beneficiarios de FONASA, que representan al sector público, y beneficiarios de ISAPRE y otros beneficiarios, que representan al sector privado, muestran un impacto inverso o negativo en la asignación presupuestaria.

Palabras clave: Presupuesto de salud, distribución territorial del presupuesto, estimaciones, coeficientes presupuestarios, ingresos presupuestarios.

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1. INTRODUCTION

The budget can be defined as a numerical plan designed to allocate resources among activities and allows for planning their use in terms of time, space, and material resources. (Burbano, 1998; Villasana, 2007). It also be considered a quantitative expression of the actions that enable a plan to be coordinated and carried out. (De Gregorio, 2007). Therefore, the preparation of the budget arises from a detailed process of analysis, formulation, consultation, and debate among different actors and institutions. (Guerrero, 2023). This process encompasses the evaluation of financial, physical, human, intangible, structural, and cultural resources, among others (Burbano, 1998).

The role of government in the public sector goes beyond fiscal policy (Dornbusch and Rudieger, 1994); it includes monetary and exchange rate policies, as well as the establishment and enforcement of rules governing private economic activity (Villasana, 2007). The Chilean context, the principles of the state financial management system are established in Decree-Law No. 1,263 (Horngren, 1996). This legislation not only establishes budgetary rules but also assigns responsibility for overseeing public management to the Office of the Comptroller General of the Republic (Article 65 of Decree-Law No. 1,263).

The public budget (Mankiw, 1998) fulfills fundamental economic functions. It serves above all as a mechanism for defining national priorities and allocating resources to production, investment, and public consumption (Carriel, 2014). At the same time, it offers incentives and serves as an instrument for regulating the private sector (Sachs, 1994). Furthermore, fiscal policy, influenced by the budget, demonstrates the principle of causality (Bunge, 1959), playing an important role in achieving macrosocial objectives. It materializes the implementation of the structural approach and method, based on a systemic paradigm that distinguishes two interdependent and mutually necessary pillars. On the one hand, it addresses the epistemological aspects of the economic schools that describe the structural method based on the descriptive and synthesis stages.

On the other hand, the macroeconomic principles derived from the vision and methodology that provide the analytical and synthetic character are addressed (Cárdenas, 2015), whose main thesis stems from the macroeconomic and eclectic characterization that allows for valid analyses to be carried out systematically, with the aim of increasing knowledge, in this case, of the budgets allocated to health services in Chile.

The public budget, according to the structuralist approach, seeks to separate the effect of the economic situation (economic cycles) from the long-term determinants in public finances (Cárdenas, 2015), as is the case with the financing of the health sector, whose main objective is to guarantee its sustainability with structural income and not with transitory or cyclical income (Bunge, 1959), which is why studying the behavior of the funds allocated to health services is a relevant challenge to face.

In particular, as global income increases, the proportion of the health sector, measured as its percentage of GDP, also increases (Samuelson, 1993). However, budget resources are allocated to various uses, not necessarily with the same increasing or decreasing behavior, but rather they can come from diverse sources with random behavior, as is the case in Spain, where they can come from the so-called Satellite Accounts of Public Health Expenditure (CEPS, 2021) or from those reported by the System of Health Accounts (SCS, 2021), which are progressively being incorporated into the OECD Health Statistics for decision-making and, therefore, the applications of funds are adjusted to coincide with EUROSTAT records (Lobo Aleu and Trapero Bertrán, 2023) to better allocate resources and achieve the required structural balances (Cárdenas, 2015).

Similarly, in Chile, the public sector budget has been governed since 2000 by a structural surplus rule, which seeks to achieve a surplus equivalent to 1% of the gross domestic product (GDP), thus ensuring the country's economic and fiscal cohesion. This policy was designed to maintain the level of public spending in accordance with the expected social welfare, operating within a framework of social responsibility (Terán et al., 2017), which is expressed through measurable indicators (Parkin, 1998) consistent with the epistemic model of structuralism, which operates on the basis of some fundamental definitions of a linguistic (budgetary allocation), philosophical (structural equilibrium), epistemological and social (satisfaction of the population's needs) nature (Terán et al., 2017), according to which the components of society are constituted to the extent (correct or incorrect) in which the rules of structural equilibrium are applied (Parkin, 1998), such as those analyzed in this work, derived from the State's budgetary allocations to health services,

considering that the norms are assimilated by the providers and, through them, by individuals in order to achieve similar or equivalent meanings of social benefit (Rodríguez Arias, 2018) as is the one that is produced to segments of the population through health services (Parkin, 1998).

Consequently, and given that the health budget is one of the lines of investment in public health, the Chilean Public Health Observatory (2019) carefully analyzes and monitors it, subject to current regulations (Oliveira, 2021), considering the impact that the wave of international immigrants has had on public health (Minsal, 2021).

These immigrants arrive in the country gradually and progressively, impacting real spending, which increases year after year, thus driving new expenditures and, moreover, forcing the economy to produce more goods and services valued, as indicated by the relevant theory, at base period prices (Polimeni, 1997). This increase reflects both the productivity of capital assets (Robbins and Coulter, 2000) and the social responsibility of the demand from diverse segments (Terán et al., 2017), with distinctive characteristics that require differentiating the allocation of resources to health services (Guerrero, 2023) effectively provided, in many cases, due to budgetary tradition (Terán et al., 2017).

In general, within the Latin American context, public and private health spending shows some degree of increase, accompanied by an increase in life expectancy (0.023%) and a reduction in infant mortality (0.168%), highlighting the importance of public health spending to improve population health indicators (Ayala-Beas and Rodríguez, 2023). Likewise, when comparing morbidity and self-perceived health status to assess population well-being, a mixed-methods study with 500 participants revealed that 40% of people with chronic diseases rated their health as "good" or "very good," while 20% of people without diagnosed conditions reported "poor" health, showing an apparent contradiction that, nevertheless, concluded that both approaches are complementary, providing a comprehensive assessment of well-being (Carreras, 2020).

Furthermore, by analyzing public health spending using a quantitative and econometric approach to health investment data and sociodemographic statistics over an eight-year period, it is possible to demonstrate that, while investment in health is important, its impact on mortality depends on other social and economic factors (Rodríguez et al., 2020), which underscores the need for more comprehensive policies to improve public health.

Subsequently, and as recently noted, the WHO (2024) proposes various reforms to reduce exclusion and increase health equity (Terán et al., 2017), focusing on universal coverage and people-centered services (Oliveira, 2021), with the aim of improving, for example, primary health care and, consequently, promoting stronger policies to address system fragmentation (Minsal, 2021).

Similarly, an analysis of the financing of the Comprehensive Health Insurance (SIS) in Peru, using quantitative approaches with data from all regions, determined an average reduction of 20% in morbidity rates in the services with the greatest coverage, followed by rural areas with a reduction of up to 30%, while urban areas reported a 15% reduction, confirming that SIS financing had a positive impact on reducing morbidity (Mendoza, 2021).

Therefore, based on the above description, it is evident that budgets are only one part of the public health challenge, since the decisive phase stems from the relationship established between the budget allocated to public health service providers and the behavior of the target population segments that are being served, considering their diverse characteristics (Monterde et al., 2016).

It is in this context that the idea of a Sustainable Financing Framework for Universal Health Coverage emerged (Kutzin, 2013), which forms a framework of budget allocations that provides a comprehensive structure (Polimeni, 1997) to examine health financing mechanisms, such as the one applied in the Chilean context, focusing on three key functions: revenue collection, pooling of funds and acquisition of services (Oliveira, 2021).

Consequently, there is a systematic interaction between the budgetary and population components (Terán et al., 2017), and studying this interaction is crucial for achieving sustainable universal health coverage

(Cristobal, 2020). This is because financing includes the mechanisms by which funds are allocated, collected, and distributed among health services and the services they provide to the target population (World Health Organization, 2021), and its objective is to guarantee sustainability through equitable access for the population (PAHO, 2024).

Furthermore, from the perspective of public spending, it is necessary to understand how and based on what parameters the public health budget is allocated (Ayala-Beas and Rodríguez, 2023). Therefore, it seems necessary to investigate the factors that influence financing in order to verify whether the allocated budget is sufficient given the required coverage and quality of care (Cristóbal, 2020). This gives rise to a number of issues that can and should be studied in depth, such as the work that this study carries out through the study of the structure of the budget allocated to public health (Monteverde et al., 2016).

Therefore, and based on the foundations and evidence described, this work assumes the objective of determining the relationship established between the public budget allocated to health, seeking to identify consistencies or divergences regarding the behavior of a set of population variables with the budget allocations actually made.

2. MATERIALS AND METHODS

This study was conducted using official records of budgetary resources allocated to all health services in Chile, through the application of incremental phased regression statistical methods.

The study was approved by the Ethics Committee of the Polytechnic University of Ecuador (ESPOL) under code FCSH-5-2023. Additionally, the research employed structuralism as a research method (Cárdenas, 2015), as it provides the necessary premises to establish the relationships underlying the budgetary allocation variable with its recipients, in this case, represented by public health services (Terán et al., 2017).

During the 20th century, this method gave rise to an analytical and interpretive tool that allows for the description of diverse phenomena and, due to its depth, facilitates a deeper understanding of them. Consequently, structuralism assumes a methodological foundation that goes beyond the abstract principles underlying reality and is empirically perceptible through the study of real and verifiable records.

In line with this, the research presented seeks to demonstrate how the structuralist method, based on its descriptive power, leads to the analysis of a fundamental structure that links budget allocations to their recipients in public health. However, given the partial nature of the data, which only includes the health sector, this analysis can be corroborated (Rodríguez Moya, 2019) through subsequent studies of a similar nature.

For this study, background information was extracted from publicly accessible databases listed in the repositories of the Ministry of Health. From these records, it was possible to process, model, and analyze the data to ultimately propose a model that explains the behavior of budget allocations to Health Services governed by the principle of regulation (Oliveira, 2021).

The procedure applied included linear regression techniques using Budgetary Revenues as the dependent variable and the total population (in its various segments) as the independent variable (Welsh and Gordon, 1990).

As mentioned, it is assumed that regression analysis, like other processing and analysis methods derived from multivariate statistics, allows us to infer the existence of a relationship between two or more variables. However, these estimates are not necessarily accurate, since in the face of a complex social reality, the variation of a variable may depend on many other variables, which may not necessarily be analyzed in a given study, but which may be influencing said relationship (Sánchez-Villegas, Martín-Calvo and Martínez-González, 2014), which is why their analysis and interpretation must be moderate and prudent to avoid spurious conclusions.

Based on the above and within the context of structural systems (Dion et al., 2003), the theory provides the tools to analyze correlated parametric systems whose parameters may initially be unknown due to random causes such as life cycle, the size of population segments, and the diversity of alternative morbidities

affecting the population. These properties, regardless of their size or shape, generate complex systems (Doostmohammadian & Khan, 2019) derived from interrelationships and interdependencies established within society.

Consequently, and in accordance with the above, the structural analysis model, as well as the proposed regression analysis method, are relevant because they provide the necessary analytical and interpretive tools to address a topic of study such as the one proposed in this work, based on the most widely used and powerful multivariate statistical techniques that allow for quantitative analysis.

The chosen option allows us to infer the existence and form of a functional relationship between a given dependent variable and an independent variable in the study. This method facilitates the estimation of relationship parameters and slope and intersection indices between correlated variables, shaping a function that links these variables (Solanas & Guàrdia, 2012) and that can be properly interpreted.

Consequently, this work seeks to estimate a sufficiently explanatory relationship model from which the researcher can infer or predict the behavior of the related variables, thus establishing a methodological option for data analysis (Solanas & Guàrdia, 2012) that can be applied in future research of a similar nature.

3. RESULTS

Considering the proposed regression analysis, this study analyzed the longitudinal evolution of household income in 28 health services and investigated its relationship with the different variables examined in each case. Below are some findings from the analyses conducted for each specific objective.

Consequently, and based on the method used, this study provides a general model for the total population that explains 91.3% of the total population, with the Total Population variable representing the same percentage of the budget allocation.

Table 1. Total Population Regression Model (Model Summary).

Mod	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			Durbin-Watson	
					R Square Change	F Change	df1	Sig. F Change	
	0.913(a)	0.833	0.826	6020093.41659	0.833	129.571	1	0.000	1.493
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
	(Constant)	7616321.607	2150717.779		3.541	0.002			
	Total Pop.	36.689	3.223	0.913	11.383	0.000	0.913	0.913	0.913

(a) = Predictor variables: (Constant), Total Population

(b) = Dependent variable: Budget Revenue

Therefore, it can be expressed as follows, in Formula 1:

The model can be represented by the following formula:

$$Y = 7616321,607 + 36,689X_1 \quad (1)$$

Where:

Y : Budgetary Income
X₁ : Total population

Following the preparation of the public budget forms for the 28 Health Services, a notable increase in budget allocation in nominal terms was observed. This growth, when examining the budget in real terms, showed uniform growth throughout the country. Over the last ten years, budget revenues in Chile's health sector have shown a continuous increase in real terms.

A second analysis was then conducted, in this case of the budget revenues of all Health Services, applying the linear regression method, with Budget Revenues as the dependent variable and Total Population as the independent variable. The analysis showed that the variable represents 91.3% of the budget allocation. (see Table 1).

In addition, an experiment was conducted with a wider set of variables in a model that establishes a relationship of 94.8% with budget revenues, with the adult population being the variable with the greatest weight (see Table 2).

Table 2. Regression Model (Model Summary).

Table 2. Regression Model (Model Summary).

Model Summary ^b						
Model	R	R square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson	
2	0.948a	0.898	0.875	7580451.450	1.605	
Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Estandar Error	Beta		
2	(Constant)	- 24978534.922	9782269.101		-2.553	0.018
	PI	363467.113	94650.114	0.341	3.840	0.001
	Pm	-1.777	102.390	-0.015	-0.017	0.986
	Adm	102.206	106.008	0.926	0.964	0.345
	Fon	22.522	53.719	0.265	0.419	0.679
	Pisa	-16.855	50.110	-0.075	-0.336	0.740

(a) = Predictors: (Constant), Pm, Padm, Fon, Pisa,

(b) = Dependent variable: PI

The model for this regression is represented by the following equation (2):

(2)

$$Y = 4768959.340 + 522.635X_1 - 987.823 X_2 - 960.488 X_3 - 1087.302 X_4 + 622.394 X_5 + 1038.229 X_6 + 661.562 X_7 + 1422.622 X_8$$

Where:

Y : Budgetary Income

X₁ : Male Population

X₅ : Child Population

X₂ : FONASA Beneficiaries

X₆ : Adolescent Population

X₃ : ISAPRE Beneficiaries

X₇ : Adult Population

X₄ : Other Beneficiaries

X₈ : Senior Population

The relationship between regional GDP and budget revenues shows a positive correlation over time. In other words, the higher a region's gross domestic product, the greater the allocation of resources to health budgets. Analyzing this relationship at both the global and national levels, we can observe that as gross domestic product increases, so do budget revenues allocated to health services. Therefore, in general, a positive relationship is observed between these two factors, suggesting a certain degree of natural increase in budget allocations to health service.

Furthermore, given the strong correlation established between the Budgetary Revenue variable and most of the variables under study, Table 2 shows that some relationships have a negative sign (Isa; Pm), which is explained as follows: On the one hand, the relationship between Isa and the budget shows an inverse behavior, since, as more people move from private financing (ISAPRE) to public financing (FONASA), and budgets remain at incremental levels—in line with the Health Benefits Programs, which appear to follow the historically increasing growth observed in the total allocated budget—the estimator of the relationship is negative, not positive as might be expected; something similar occurs with the male segment (Pm), which is progressively decreasing in the population.

Consequently, a statistical result was obtained confirming that, in general, there is a direct relationship between budget allocations for services and the variables studied, although some relationships are inverse due to demographic trends, such as the progressive transfer of individuals from private health insurance companies (Isapres) to the public health insurance system (Fonasa).

To reduce the potential effects of multicollinearity among highly correlated demographic variables, grouped regression structures and alternative model specifications were tested.

For this reason, it was decided to test three different models, since using all the variables could generate a degree of distortion due to multicollinearity, given the high correlation between the explanatory variables. Therefore, the following classifications were made:

Model A: Population by Children, Adolescents, Adults, and Older Adults

Based on this classification, the model manages to capture a 92.7% relationship of the behavior of budget revenues, with the child population being the variable with the greatest weight (see Table 3).

Table 3. Regression Model Children-Adolescent-Adult-Adult Senior. Model Summary (A).

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durban Watson
					R Square Change	Change in F	df 1	df 2	Sig. F Change	
A	0.927(a)	0.860	0.835	5865747.790	0.860	35.216	4	23	0.000	1.513
Model	Unstandardized Coefficients			Standardized Coefficients	Correlations					
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	
A	(Constant)	5673065.350	2354510.989		2.409	0.024				

	Child Pop.	430.859	322.230	1.713	1.33 7	0.19 4	0.911	0.26 9	0.104
	Adolescent Pop.	-116.128	299.955	-0.500	-.387	0.70 2	0.912	- 0.08 0	-0.030
	Adult Pop.	-61.856	51.529	-0.910	- 1.20 0	0.24 2	0.907	- 0.24 3	-0.094
	Older Adult Pop.	324.830	155.908	0.654	2.08 3	0.04 9	0.888	0.39 8	0.163

(a) = Predictor variables: (Constant), population. Older adults, Child population, Adult population, Adolescent population.

(b) = Dependent variable: Budget revenue

Model A for these variables is represented by Formula 3:

$$Y = 5673065.350 + 430.859X_1 - 116.128 X_2 - 61.856 X_3 + 324.830 X_4 \quad (3)$$

Where:

Y : Budgetary Income
X₁ : Child Population
X₂ : Adolescent Population
X₃ : Adult Population
X₄ : Senior Population

The demographic data analyzed for each health service reveal several important trends. First, the total population is growing. However, Chile's elderly population is also growing nationwide, while the child population (ages 0-9) is declining. Interestingly, the Iquique Health Service and the Central Municipal Health Service are the only two services with positive growth rates in the child population, suggesting that they will have a relatively younger population compared to other services. Regarding the adolescent population, only 10 of the health services were found to show declining figures over time.

Therefore, when services are ordered from smallest to largest population, a positive correlation is observed between the total population and budget revenues. However, for services with larger populations and budgets, there are cases where this correlation is not exact, indicating that the total population is not the only factor that correlates with family income. Nevertheless, it remains a variable that correlates significantly with family income. Regarding the child population, it is observed that as the average number of children per service increases, so does the distribution of family income. This confirms the existence of a positive relationship between these variables.

In terms of classification, there is a certain positive relationship between the two variables. However, starting with the Valdivia Social Center, budget revenues become relatively indifferent to this variable as the number of young people per service increases. This indicates that the "adolescent" variable alone does not fully correlate with budget revenues, as it may not be very relevant in determining the budget allocations for some services. In addition to the size of the adult population, there appears to be some correlation between budget revenues and the number of adults, since an increase in the adult population is associated with greater resources. However, beyond a certain threshold, the growth of household income fluctuates, suggesting that this variable alone is not significant or is not significantly related to household income. Besides the size of the adult population, in conjunction with other factors, other factors may also contribute to fluctuations in household income.

When ranking older adults from lowest to highest according to the Health Service, it is concluded that as the number of older adults increases, so does budget revenue. However, beyond a certain threshold, notable fluctuations in budget revenue are observed. This suggests that, although there is a correlation between the number of elderly people and budget revenue, other variables also influence budget allocations. Therefore, this variable alone does not fully explain the variability in budget revenue.

Aysén's health service has the highest per capita budget. This is because it is financed directly from the service itself, unlike in most other regions, where funds are allocated to the municipalities (with the exception of the Magallanes health service). These funds are used for primary care, so Aysén receives \$112,763 per person, compared to \$33,505 per person in the southern metropolitan area.

Model B: Population by beneficiary type: FONASA, Isapre, and others.

According to this classification, the model explains 91.6% of budget revenue behavior, with the predominant variable corresponding to FONASA beneficiaries (see Table 4).

The model for these variables is as follows:

$$Y = 7050219.904 + 46.473X_1 + 20.820 X_2 + 17.012 X_3 \quad (4)$$

Where:

Y	: Budget Income
X ₁	: FONASA Beneficiaries
X ₂	: Isapre Beneficiaries
X ₃	: Other Beneficiaries

Table 4. Regression model by beneficiary type. Model summary (B).

Table 4. Regression model by beneficiary type. Model summary (B).										
					Change Statistics					
Mo d	R	R ²	Adjusted R2	Std. Error of the Estimate	Change in R2	Chang e in F	df 1	df2	Sig. of change in F	Durba n Watso n
B	0.916(a)	0.83 9	0.819	6149735.3188 6	0.839	41.694	3	24	0.000	1.499
Mo d			Unstandardized Coefficients		Stand. Coef.			Correlations		
			B	Std. Error	Beta	t	Sig.	Zero order	Partial	Semi parti al
B	(Constant)		7050219.904	2386835.99 8		2.95 4	0.007			
	Fonasa Pop.		46.473	11.020	0.749	4.21 7	0.000	0.911	0.652	0.34 5
	Isapre Pop.		20.820	20.332	0.140	1.02 4	0.316	0.77 9	0.205	0.08 4
	Other Pop.		17.012	37.959	0.062	0.44 8	0.658	0.75 6	0.091	0.03 7

(a) = Predictor variables: (Constant), Other Population, Isapre Population, Fonasa Population

(b) = Dependent variable: Budget Revenue

(c) = Dependent variable: Budget Revenue

In terms of population coverage, the majority of the population is enrolled in the public health system, with an average coverage rate of 67.93%. This trend is also reflected in the healthcare system, where the majority of beneficiaries are enrolled. At the same time, the number of people enrolled in the private ISAPRE

system has decreased significantly over time, indicating a transition from ISAPRE to FONASA, the public health system.

Based on the analysis, we can conclude that FONASA enrollment has a positive relationship with the budgetary revenues allocated to health services. This is evidenced by the fact that budgetary revenues increase when services are ordered from the fewest to the largest number of FONASA beneficiaries. Conversely, the integration of organizations affiliated with private health systems has a negative correlation with budgetary revenues. Therefore, the data support the conclusion that FONASA affiliation establishes a positive relationship with the budgetary income of health services, while affiliation with private health systems also achieves a direct relationship since the population decreases and the allocated budget also decreases.

Regarding ISAPRE beneficiaries, it can be stated that there is no consistent relationship among all services when ordered from lowest to highest number of beneficiaries. However, in some health services, including Antofagasta, Central Metropolitan Area, Eastern Metropolitan Area, and Southern Metropolitan Area, it is clear that the greater the number of ISAPRE beneficiaries, the greater the number of beneficiaries of the National Health System beneficiaries, the lower the amount of allocated budget revenue. On the other hand, beneficiaries affiliated with other health systems do not appear to have a significant impact on the budgets allocated to health services. The graph representing services ordered from lowest to highest number of beneficiaries under "Other" does not show a clear, positive or negative relationship between these variables.

Model C: Population by Gender, Female - Male.

According to this population classification, the model establishes a relationship of 91.3% with budget revenues, with the female population being the variable with the greatest weight (see Table 5).

Table 5. Regression model by female and male gender. Summary of Model (C).

					Change Statistics					
Mod .	R	R ²	Adjusted R ²	Std. Error of the Estimate	Change in R ²	Change in F	df 1	df2	Sig. of change in F	Durbin Watson
C	0.913(a)	0.834	0.820	6126516.53761	0.834	62.606	2	25	0.000	1.478
Mod .			Unstandardized Coefficients		Stand. Coef.			Correlations		
			B	Std. Error	Beta	t	Sig.	Zero order	Partial	Semi partial
C	(Constant)		7933120.072	2398068.842		3.308	0.003			
	Male Pop.		12.041	76.308	0.145	0.158	0.876	0.910	0.032	0.013
	Female Pop.		59.742	71.380	0.769	0.837	0.411	0.913	0.165	0.068

(a) = Predictor variables: (Constant), Female population, Male population

(b) = Dependent variable: Budget revenue

(c) = Dependent variable: Budget revenue

The model for these variables is as follows, according to formula (5):

$$Y = 7933120.072 + 12.041 X_1 + 59.742 X_2 \quad (5)$$

Where:

Y : Budget Income
X₁ : Male gender
X₂ : Female gender

Regarding the analysis of the health budget allocated by gender, the importance of the female segment (59.74%) stands out, constituting the main variable for health investment, compared to the significantly lower proportion of men (12.04%), who show a considerably smaller allocation of state resources to public health.

Model D: Model with all variables

Finally, the model that considers all variables is presented. This model accounts for 89.4% of the behavior of budget revenues, with the adult population being the variable with the greatest weight (see Table 6). The model for this regression is shown in the following equation (6):

$$Y = 4768959.340 + 522.635 X_1 - 987.823 X_2 - 960.488 X_3 + 1087.302 X_4 + 622.394 X_5 + 1038.229 X_6 + 661.562 X_7 + 1422.662 X_8 \quad (6)$$

Where:

Y : Budget Income
X₁ : Male Population X₅ : Child Population
X₂ : FONASA Beneficiaries X₆ : Adolescent Population
X₃ : Isapre Beneficiaries X₇ : Adult Population
X₄ : Other Beneficiaries X₈ : Elderly Population

Table 6. Regression Model. Summary of Model (D).

					Change Statistics					
Mod	R	R ²	Adjusted R ²	Std. Error of the Estimate	R ² Change	F Change	df1	df2	Sig. F Change	Durbin Watson
D	0.894(a)	0.799	0.790	7232812.57277	0.799	92.745	8	187	0.000	1.516
Coefficients		Unstandardized Coefficients		Standard Coefficients			95% Confidence Interval for B		Correlations	
Mod		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero order	Partial
D	(Constant)	4768959.340	1224862.899		3.893	0.000	2352634.287	7185284.393		
	Pm	522.635	119.217	5.713	4.384	0.000	287.453	757.817	0.851	0.305

(a) = Predictors:

P.m = Male population

P.fon = FONASA beneficiaries

P.isa = ISAPRES beneficiaries

Foal = Other beneficiaries

Child = Child population

Adol = Adolescent population

Adult = Adult population

Adm = Older adult population

(b) = Dependent Variable: PI

In summary, the analysis with all variables in the regression shows that five of the variables have a direct and positive correlation with the budget allocation, the most relevant being the variable Population of Older Adults, Adm, (1,422,662), on the contrary, only three of the variables register an inverse or negative impact, among which the one that registers the highest index is Other Beneficiaries, Foal (-1,087,302) according to which, an increase in this variable indicates a proportional reduction in the budget allocation.

4. CONCLUSIONS

Based on the regression analyses conducted, we can reach the following conclusions.

First, from a general perspective, it can be seen that the funds allocated to the health sector are continuously increasing in real terms. In addition, there is a direct and positive correlation between regional GDP and financial revenues over time. As a region's GDP increases, so do the funds allocate to the health budget.

The analysis by population segment concludes that, regarding the adolescent population, 10 health services show decreasing numbers over time. However, regarding the child population, its increase in numbers leads to an increase in budget revenues. It is noteworthy that budget increases are relatively indifferent to the number of adolescents per service, and that the increase in the adult population clearly correlates with higher budget revenues. It is also concluded that the number of older adults influences budget revenues, although, on its own, it is fully correlated with said revenues.

In particular, it is concluded that the highest per capita budget allocation occurs in one region (Aysén), since, unlike most other regions, funds are allocated to the municipalities responsible for primary healthcare.

Regarding the preference for public health plans, the number of members enrolled in the private ISAPRE plan has steadily decreased, indicating a clear trend toward enrollment in Chile's public health provider, FONASA. This shift has had a positive impact on household spending on health services. On the other hand, the reduction in ISAPRE enrollment leads to a decrease in public health funding.

The analysis of budget distribution by gender also shows that women play a decisive role in health investments, while men have a relatively smaller and inversely proportional share of the public health budget allocation.

Regarding the analysis of all variables, it was concluded that the variables Male Population, Child Population, Adolescent Population, Adult Population, and Elderly Population show direct and positive estimates of budget allocation, while the variables FONASA Beneficiaries, ISAPRE Beneficiaries, and Other Beneficiaries show an inverse impact on said allocation.

It is worth noting that this study sets a precedent for future research and for the development of a useful modeling framework for health budget planning. The objective is to consider demographic, morbidity, and population segment variables to ensure a more equitable distribution of resources allocated to the different health services.

Finally, of the proposed options (A, B, C, and D), model D was selected for offering the best quality and broadest scope. Although the variables for total population and female population had to be excluded due to multicollinearity issues, the model encompasses the other variables of interest. Furthermore, models A,

B, and C, developed based on only 28 observations and 10 variables, provided less robust response alternatives for the analysis. Consequently, model D was chosen, which was run with 196 observations and 10 variables, achieving robust and sustainable results and providing a sufficient initial overview to analyze, interpret, and understand the factors influencing budget revenues for health services in Chile.

The study focuses on explanatory structural relationships rather than predictive optimization; therefore, advanced validation metrics such as RMSE or cross-validation are proposed for future research

Future studies could complement this econometric approach with geospatial and territorial visualization techniques to identify regional allocation patterns more precisely.

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