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Pension knowledge in Chile and regional development characteristics

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Abstract
Pension systems increasingly require active involvement from their participants for retirement planning. This leads to the need for a proper level of financial literacy to foster decision-making. Based on the Chilean Social Protection Survey and the Regional Development Index data, specific characteristics related to the region of residence, such as the quality of life, access to job opportunities, and available connectivity tools, are seen to have a positive impact on pension knowledge. Hence, these regional level results provide inputs to policymakers for developing appropriate policies regarding pension knowledge.

1. Introduction

In recent decades, pension systems have been a crucial factor in the social agendas of many countries. Due to longer life expectancies and low levels of density contributions, structural reforms are observable, which points toward more privately financed systems that come with the need for a greater degree of worker responsibility with regard to their retirement. This stands in contrast to the evidence which shows low levels of trust among many parts of society in the different pension systems and the institutions that manage them (OECD, 2019). The increasing responsibility imposed on individuals regarding their financial decisions enhances the need for greater financial literacy (Lusardi and Mitchell, 2014). Moreover, low levels of financial literacy have been shown to be associated with decreased probabilities in stock market participation (Van Rooij *et al.*, 2011), a lower capacity to save and accumulate wealth (Behrman *et al.*, 2012), and a reduced ability to plan retirement (Lusardi and Mitchell, 2007, 2011*a*, 2011*b*; Carmel *et al.*, 2015).

Since the works of Lusardi and Mitchell (2007, 2011*a*, 2011*b*), which focus on the planning stage of retirement, the positive relationship between greater financial knowledge and correct financial decision-making has been increasingly documented. However, scant understanding of financial matters has been observed among many parts of society. Specific groups particularly affected by this are the young, the elderly, women, people with less formal education, and minorities. It can thus be assumed that more vulnerable groups, whose characteristics have not been duly considered when structuring education programs, subsist within society. The line of research, which is focused on the social determinants of financial knowledge, opens up the possibility of deepening our understanding of learning beyond individuals' characteristics by incorporating the features of their communities and the environment in which they develop. Recent research has broadened the analysis of the determinants of financial literacy levels by incorporating social factors and by showing that the environment in which individuals develop also plays a fundamental role in developing this ability. Therefore, various financial activities and learning processes on this topic form part of a social context

(Henchoz, 2016). Characteristics of the region of residence, such as the level of financial stress (Bumcrot, Lin and Lusardi, 2013), the area's level of education (Lachance, 2014), and the degree of trust in financial institutions (Ricci and Caratelli, 2017) need to be recognized as important background information when evaluating the degree of financial literacy.

In Chile, the individual capitalization system adopted in 1981 has had a positive impact on the development of capital markets and economic growth (Corbo and Schmidt-Hebbel, 2003; Ruiz, 2018). However, deficiencies in coverage and the quality of pensions led to its reform in 2008. During this process, profound changes were introduced into the system. These changes were adopted in order to enhance the principle of solidarity, increase coverage for independent workers, reduce costs, promote voluntary savings, and boost competition within the system through the bidding mechanisms which guarantee that new affiliates are linked to the best bidder for two years. However, the system faces significant challenges which have become apparent due to growing dissatisfaction with the current quality of pensions (Benavides and Valdés, 2018). In this context, financial skills, together with the management of information regarding the pension system, influence financial decision-making and pension planning. This relation has been documented through various aspects, such as the level of savings (Fajnzylber et al., 2009; Landerretche and Martínez, 2013), the retirement decision (Miranda, 2012), and the choice of pension fund administrators (AFPs) (Berstein and Ruiz, 2005).

This paper aims to (a) propose a measure to evaluate the level of pension knowledge in Chile, (b) describe differences in the levels of pension knowledge in the different regions in Chile, and (c) analyze whether these different levels of knowledge are associated with the social conditions that prevail in the country's different administrative regions. It is worth noting that a deeper understanding of regional differences is crucial in order to implement further educational programs and effective communication strategies which aim to improve general financial literacy and have a positive impact on pensions. This measure – and further analysis – is also useful for several countries that have a similar private pension system in Latin America and Central and Eastern Europe.

Public initiatives designed to foster a knowledge of the pension system in Chile are set out in the National Pension Education Program. One of its elements was the creation of the Pension Education Fund[1] which financed 389 initiatives amounting to around $16,237 million Chilean pesos[2] (equivalent to US$ 21.1 million as of November 30, 2020) between 2009 and 2019, taking the approach of a more generalized policy. However, it appears that misinformation, a negative view of the system, and distrust in the AFPs continue to prevail among society as has been shown by the Presidential Advisory Commission on Pensions (2015). Moreover, several initiatives have been formed which actively oppose the current pension system and therefore further add to its unpopularity.[3] In addition, Chile allowed three early pension withdrawals in order to provide people with immediate economic resources to cover basic needs for the COVID-19 crisis during the 2020–21 period. Most workers made use of these withdrawals – a policy considered harmful to future pensions – but which reveals the preference to use these illiquid assets in the present, especially during economic shocks (Bateman et al., 2023). A solid pension system requires people to have a knowledge of how important savings contributions are to their future pensions.

The purpose of this paper is to explore the relationship between regional development conditions and financial literacy, particularly with respect to pension knowledge in Chile, and to identify certain groups that require special consideration. In order to do so, we use the Social Protection Survey (EPS) conducted in 2015, since it includes information regarding participants' demographic and socio-economic characteristics as well as questions concerning their knowledge of the pension system. Given the purpose of this study, the restricted access version of this survey was requested which includes the respondent's region of residence. This enabled us to merge personal characteristics

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[1]Established by law 20.255 (Social Security reform, 2008).

[2]According to the information published by the Social Security Under-secretariat (2020).

[3]The slogan 'No + AFP' was popular among social movements during the protests of 2006 and continues to be used today.

with those of the corresponding region through the 2015 Regional Development Index (IDERE) database, which measures regional development from a multidimensional perspective (Vial, 2016). Based on a multilevel regression model, we found evidence that those regions which enjoy a greater quality of life, superior access to job opportunities, and advanced connectivity tools, show a greater knowledge of pensions. The latter results are maintained when we control for geographical area and for connectivity, using the size of municipalities.

The rest of this paper is organized as follows. Section 2 outlines the Chilean pension system. Section 3 provides the relevant literature on financial literacy and describes the core differences found in Chile at a regional level. Section 4 describes the sample and data, and outlines the derivation of the variables. Section 5 describes the methodology. Section 6 presents the results, and finally, section 7 concludes.

2. Chilean pension system

In 1981, the pay-as-you-go pension system was changed to the current private individual capitalization system. The latter is based on individual savings and is privately managed by AFPs. This change has had a positive impact on the development of local capital markets and economic growth (Corbo and Schmidt-Hebbel, 2003; Ruiz, 2018). However, deficiencies in coverage and the quality of pensions remain. Consequently, in 2008 substantial reform was proposed which aimed to strengthen the principle of solidarity, increase overall coverage, and enhance competition between the managing funds that form part of the pension system. All pension fund members are obliged to contribute 10 percent of their monthly income, a rate which is well below the Organization for Economic Cooperation and Development (OECD) average of 19 percent (OECD, 2019). Currently, the system is based on three pillars: the pillar of mandatory contributions managed by private institutions, the pillar of voluntary contributions also managed by private institutions, and the pillar of solidarity guaranteed by the government. Since 2018, mandatory contributions have been individual for payroll employees and self-employed workers who work based on fees. Furthermore, charges for the administration of the funds (in the range of 0.69–1.45% of salaries) must be paid. These expenses, together with a compulsory survivor and disability insurance, lead to total charges of between 2 and 3 percent of taxable income.

AFPs offer five different types of pension funds which are labeled alphabetically according to the following range: A (riskier), B (risky), C (balanced), D (conservative), and E (more conservative). The differentiation is based on the respective risk exposure, which depends on the proportion of funds that can be invested in equity markets. The upper limits for these investments are 80, 60, 40, 20, and 5 percent, respectively. As a pension fund member approaches the legal retirement age, individual savings are transferred to less risky funds. This shift in investments is conducted according to an expected life cycle. Based on this scheme, the income received after retirement is determined by the personal contributions and the return generated by the investments in personal accounts during a working life.

The legal retirement age is 60 for women and 65 for men. However, the decision to retire is voluntary. When a person decides to retire, they must choose between three different types of payout plans: phased withdrawal (PW), life annuity, or a combination thereof. In the case of programmed withdrawal, pension benefits are paid by the AFP. Furthermore, the amount is based on the balance in the personal account, its profitability, and the life expectancy of the depositor and of the potential beneficiaries of survivorship pensions. Therefore, people maintain the longevity and capital market risks on PW. In the case of annuities, a contract is signed with an insurance company which ensures payment of a fixed monthly income for life in exchange for the accumulated funds held in the personal account with the AFP. With this modality, the longevity and investment risk in capital markets are assumed by the life insurance company (LIC). The regulator requires the use of the electronic quotation system of inquiries and offers of pension amounts (SCOMP), allowing the depositor to compare offers between insurers and AFPs, which increases the system's competitiveness, reduces insurance premiums, and provides transparency between offers (Morales and Larraín, 2017). LIC offers are sorted by the pension offered, and the offer includes the risk classification of the LIC. Hence, people

face various decisions regarding their retirement planning; first, while accumulating personal investments, and later when opting for a specific retirement modality. Greater financial literacy therefore appears useful in order to obtain superior payouts.

The pillar of voluntary contributions allows workers to supplement their pension provisions through Voluntary Pension Savings that can be set up in banks, insurance companies and AFPs. Some advantages of this method are tax incentives and bonuses. In 2008, the Collective Voluntary Pension Savings program was presented, enabling employers to offer voluntary savings plans to their workers, thereby encouraging this type of saving. For this case, greater financial literacy is also expected to lead to improved pension planning.

By law, Chile's defined contribution pension system is based on mandatory contributions to individual savings accounts, and the funds can be used only for funding pension at retirement. After a conflict between the congress and the executive branch concerning how to provide resources to people to help them meet their basic needs in the COVID pandemic, workers were allowed to take out 10 percent from their pension fund savings accounts exceptionally on July 30th of 2020. The popular measure of withdrawals was repeated on two further occasions during the pandemic. The private pension system has 11 million worker accounts, and the use of withdrawals was roughly 97, 81, and 57 percent, respectively, of account holders before the COVID pandemic early in 2020 (Pienknagura and Evans, 2021). People withdrew US$ 58 billion – representing 20 percent of Chilean gross domestic product (GDP) – thereby depleting the accounts of around 4.2 million workers (Fuentes *et al.*, 2023). Counterfactual simulations show that these withdrawals may decrease the future savings rate by 1.7 percent (Madeira, 2022). The fact that most people did withdraw funds calls into question people's level of financial and pension literacy.

3. Literature review

Financial literacy refers to the ability to process economic information and make decisions based thereon. Research on this topic is quite extensive and various aspects have been explored. Skills and attitudes toward pension systems are only one area of study within this broad field. In what follows, financial literacy literature, pension knowledge, and some of the existing differences in Chilean regions are presented.

3.1 Financial literacy and the local context

Many of the efforts focused on measuring financial literacy have been based on three major questions ('Big Three') designed by Lusardi and Mitchell (2008, 2011*a*, 2011*b*), which deal with the concepts of compound interest, the effects of inflation, and risk diversification. This standardization facilitates comparison over time as well as between countries.[4] Further measurements which do not only consider knowledge but also financial behavior and attitudes were developed by the OECD in the context of the 'International Network of Financial Education' (INFE), and the corresponding results are reported by Atkinson and Messy (2012).

The importance of financial literacy arises from the diversity of potential decisions and citizen behavior. As has been shown, individuals with greater financial literacy are more likely to save part of their income, accumulate greater wealth (Behrman *et al.*, 2012), and show a greater likelihood of participating in the stock market (Van Rooij *et al.*, 2011). Additionally, low literacy is related to decreased retirement planning ability (Lusardi and Mitchell, 2007, 2011*a*, 2011*b*; Carmel *et al.*, 2015). However, the literature shows low levels of financial literacy among vast parts of the general population, especially among the young, the elderly, women, those with less formal education, and minorities (Lusardi and Mitchell, 2014). It thus becomes crucial to develop financial education programs which suit specific audiences and meet the needs of particularly vulnerable parts of society (Lusardi, 2019).

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[4]These topics have been widely used as a measure of financial literacy, leading to an initiative called 'Financial Literacy Around the World' (FLAT World Project).

Although much of the existing literature has sought to ascertain the determinants of financial literacy through individual demographic and socioeconomic characteristics, there is also growing interest in exploring what effect individuals' environment might have (group characteristics). It is important to note that this approach does not set individuality aside but rather puts it into the context in which it evolves (Henchoz, 2016). By doing so, it has become clear that social circumstances influence the development of financial literacy. Lachance (2014) explores this concept by uncovering a significant impact of educational levels, separated by postal codes, on financial literacy. Ricci and Caratelli (2017) point to a positive relationship between the level of trust measured as social capital at the regional level and the decision to enter a private pension system in Italy.

Participation in the labor market can be a tool which supports the development of financial literacy if a worker is confronted with related issues at the workplace. Bumcrot *et al.* (2013) study the heterogeneous development of financial literacy at the state level for the United States. They use a multilevel model which allows them to reveal considerable differences and patterns regarding knowledge at the geographic level, as well as a negative and significant correlation between knowledge and poverty in the corresponding state. Furthermore, Cucinelli *et al.* (2019), through a multilevel model, also find regional differences of the three measurements proposed by the INFE. However, they also mention that for the case of Italy, local aspects such as the current labor market condition, human capital, and poverty, appear to have a significant impact on financial literacy.

Financial literacy has also been studied for the case of Chile. However, regional differences and characteristics have not been investigated vis-à-vis what impact they might have on the development of financial literacy. To date, the only approach adopted is the one which examines characteristics and decisions at an individual level and their impact on financial literacy. For this case, low levels of financial literacy have been found for large parts of society. Hence, similar conclusions regarding the understanding of pension systems can be drawn. Specifically, Hastings and Mitchell (2011) find that financial literacy positively affects voluntary savings. Álvarez and Ruiz-Tagle (2016) carry out a comparable analysis focusing on access to debt, indebtedness, and household delinquency. They conclude that greater financial literacy increases the probability of accessing different types of debt. Garabato (2016) reports a positive relationship between financial literacy and retirement planning. Consistent with international evidence on financial literacy, Skog (2006) alerts to the fact that men with more education and better income usually enjoy higher levels of financial literacy. He also obtains similar findings for people working in formal jobs.

3.2 Pension knowledge

Diaz *et al.* (2021) propose that pension knowledge contributes toward good financial decision-making. They propose that increasing pension knowledge in the population is critical to planning savings for the future, which deepens expected financial literacy effects. The level of pension knowledge has been investigated based on a set of questions which refer to several characteristics of the Chilean pension system. This approach varies in parts among different studies. Arenas *et al.* (2004) and Behrman *et al.* (2012) study the relationship between pension knowledge and pension system contributions. Both researchers find a positive relationship, which in turn leads to a positive effect on wealth accumulation. Through a series of experiments, Fajnzylber *et al.* (2009) find that incorporating personal information has positive effects on voluntary savings. In contrast, however, Miranda (2012) reveals a negative effect on the probability of retiring at the age proposed by the legislator. Lastly, Fuentes *et al.* (2017) find that considering personal information increases the amounts and the probability of making voluntary contributions after one year. This therefore not only highlights the importance of information but also of people's rationality.

Landerretche and Martínez (2013) study the relation between pension knowledge and the level of voluntary savings and assert that the level of knowledge has a positive effect on personal planning behavior. Their approach shows that knowledge may well be transferred through social interaction due to the fact that the presence of a retiree at home has a positive impact on the development of

financial literacy. Previously, Skog (2006) had also shown that knowledge regarding social security is often obtained in social contexts, such as the workplace. Finally, it is worth mentioning that Fajnzylber *et al.* (2009) and Miranda (2012) already recognized the need to control for geographic heterogeneity, due to the unequal access to information between regions with higher and lower population densities, as the latter points out.

3.3 Differences between regions in Chile

The various regions have historically developed differently and unevenly in Chile, with certain regions consistently showing better economic results than others. One important factor which reinforces this development is the high degree of centralization. The vast majority of inhabitants live in the metropolitan region, where much of the country's political and economic power is located (Aroca, 2001). Furthermore, production activity in Chile, which largely consists of mining, only serves to further intensify regional heterogeneity since most mines are located in the north of the country, which has a considerable impact on the economy and on society. Within the northern zone, Antofagasta in particular stands out. Due to its geographical proximity to important mining locations, much of the regional GDP comes from this economic sector. Therefore, a close link between local development and mining can be observed historically (Lardé *et al.*, 2008). At the other end of the country, the picture is very different. The GDP of regions like Aysén and Magallanes has mostly been stimulated by large volumes of per capita public investment (MIDEPLAN, 2010), since their location is rather isolated and more difficult to access.

As Ministry of Social Development (2016) figures show, several region-dependent gaps are observable in Chile with regard to multidimensional poverty. In order to measure this, six dimensions were considered: education, health, work, social security, housing, and environment, as well as networks and social cohesion. As the results show, the Araucanía region presents the highest percentage of poverty (29.2%), followed by Atacama (26.3%), while Magallanes (9.1%) and Antofagasta (17.2%) managed to obtain low levels of poverty.

One of the measurements used to study regional differences in Chile is the human development index (HDI). This index combines three dimensions of development in a single figure: health, education, and income. The United Nations Development Program (PNUD, 2018) finds that the metropolitan region systematically obtains a high HDI compared to the other Chilean regions. Furthermore, this particular region, together with the southern regions (Magallanes and Aysén) and the northern mining regions (particularly Antofagasta) are positioned advantageously compared to the rest of the country. Consequently, the remaining regions of the central southern zone (between O'Higgins and Los Ríos) usually display lower development indicators.

Furthermore, Vial (2019) presents paths of regional development which are in line with the heterogeneous picture outlined by the HDI. According to his investigation, the Magallanes, Valparaiso, Antofagasta, and metropolitan region are relatively better situated than their counterparts. However, the overall picture shows that Chilean regions enjoy positive growth over time while regional gaps tend to decrease.

Thus, for all of these reasons our hypotheses are:

H1: People living in regions which enjoy a greater quality of life and superior access to job opportunities show a greater knowledge of pensions.

H2: Regions with advanced connectivity tools increase people's pension knowledge.

4. Data

Most of the data used by this study were extracted from the sixth version of the EPS conducted in 2015. In addition, the restricted access version of this survey was requested, which includes the interviewee's region of residence. The EPS is a longitudinal panel-type survey that contains labor, pension,

educational, health, social security, income, and household information, among others. In its original version in 2002, the University of Chile participated in cooperation with the University of Pennsylvania, together with specialists in statistics from the University of Michigan. The survey is representative of the population over eighteen years of age and pension system affiliates. In order to conduct the study, a two-stage stratification design was applied which divides new affiliates and the unaffiliated, with the county of residence being used as the unit which serves to form clusters stratified by region. A comparison between regions thus becomes feasible. The data used throughout this paper have previously been adopted for studies developed by Behrman *et al.* (2012), Landerretche and Martínez (2013) and more recently by Garabato (2016) in order to examine financial literacy in Chile. Furthermore, EPS data were also used by the Presidential Advisory Commission on the Pension System (2015) to analyze the local pension system and the subsequent development of its reform in 2008.

A second database, which enables the analysis of regional differences, was used to explore social interactions at the regional level. The 2015 IDERE suits this purpose well. This tool, proposed by Vial (2016), allows us to measure development from a multidimensional perspective for the 15 Chilean regions, grouping information from different sources into seven dimensions: health, security, environment, education, economic welfare, economic activity, and connectivity. These indicators are presented in a normalized manner (between 0 and 1, with 0 being the minimum level of development and 1 the maximum) and are available for the years between 2010 and 2019. Hence, an analysis of regional heterogeneity and its development over time becomes feasible.

We decided to use IDERE for this study because it uses information which is taken from reliable sources,[5] is publicly available, and which is regularly updated, making it fairly easy to replicate. In addition, this database provides a greater range of dimensions, and therefore encompasses a wider scope than those incorporated in the HDI.[6] Further details regarding the variables that form the dimensions used in this study and their respective sources can be found in Appendix A. Overall, the joint information from both databases allows us to evaluate characteristics at the individual level, as well as with respect to their region of residence.

4.1 Sample

The sample formed for the purposes of this study contains 10,170 interviewees, who are affiliated with the pension system and who are not yet receiving their proceeds. Table 1 shows the descriptive statistics of the sample. In total, 50.6 percent are male and 56.1 percent are under forty years of age. In total, 49 percent have completed high-school education, and 33.7 percent have a higher education qualification. In total, 41.9 percent of those interviewed are payroll employees, and only 7.2 percent are self-employed. Pensioners were found to be living in 23.6 percent of households.

As regards geographical distribution, 11 percent of the sample live in the northern part of Chile (Large North or Small North), 35.5 percent in the central area (excluding the metropolitan region), and 14.1 percent in the southern area (south and austral). Most interviewees live in regions with a high density of inhabitants per municipality (41.7% in regions with counties averaging over 60,000 inhabitants).

Throughout the following sections, a detailed description of the variables used by this paper and their respective hypothesis is presented. Furthermore, Table 2 presents a summary of these variables and their construction.

4.2 Dependent variable: pension knowledge index

This analysis aims to identify Chileans' level of pension knowledge. In order to do so, we follow the method presented by Landerretche and Martínez (2013). In this case, pension knowledge can be

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[5]Such as the CASEN survey, the Central Bank, the Internal Revenue Service, and the INE, among others.

[6]While the HDI is also available on a regional level for the case of Chile, it only considers three dimensions: health, education, and income.

Table 1. Descriptive statistics

Variable	Mean	SD	Min	Max
Gender				
Female	0.494	0.500	0.0	1.0
Male	0.506	0.500	0.0	1.0
Age				
18–25	0.297	0.457	0.0	1.0
25–39	0.264	0.441	0.0	1.0
40–65	0.424	0.494	0.0	1.0
Over 65	0.015	0.123	0.0	1.0
Education				
Primary education or less	0.174	0.379	0.0	1.0
High school education	0.490	0.500	0.0	1.0
Higher education	0.337	0.473	0.0	1.0
Marital status				
Married	0.450	0.497	0.0	1.0
Single	0.448	0.497	0.0	1.0
Separated	0.103	0.304	0.0	1.0
Employment status				
Payroll employee	0.419	0.486	0.0	1.0
Self-employed	0.072	0.258	0.0	1.0
Unemployed	0.509	0.500	0.0	1.0
Household monthly income quartiles				
First income quartile	0.131	0.338	0.0	1.0
Second income quartile	0.239	0.426	0.0	1.0
Third income quartile	0.299	0.458	0.0	1.0
Fourth income quartile	0.331	0.470	0.0	1.0
Household composition				
Pensioners living in the household	0.236	0.425	0.0	1.0
Opinion on institutions				
AFP opinion (1 = Very positive; 5 = Very negative)	2.312	0.945	1.0	5.0
Inhabitants by municipality				
Less than 20,000	0.022	0.147	0.0	1.0
Between 20,000 and 30,000	0.116	0.321	0.0	1.0
Between 30,000 and 40,000	0.270	0.444	0.0	1.0
Between 40,000 and 60,000	0.174	0.380	0.0	1.0
Over 60,000	0.417	0.493	0.0	1.0
Geographic zone				
North	0.117	0.322	0.0	1.0
Central region	0.355	0.479	0.0	1.0
South	0.141	0.348	0.0	1.0
Metropolitan	0.387	0.487	0.0	1.0
Observations	10,170			

Source: Own elaboration based on EPS (2015) data.

captured by various questions presented in the EPS. We prioritize questions that cover different areas of the system while also focusing on questions that can be evaluated as either right or wrong. Consequently, questions which rely solely on the perception of the interviewee regarding their own knowledge are considered less relevant than those which can be evaluated objectively.

The pension knowledge index (PKI) considers different areas of the pension system: the percentage of contributions to the system, management of information provided by the administrator (statement of accounts and amounts), percentage of commission charged by the administrator, multi-funds and their characteristics, pension modalities, and basic solidarity pension requirements. Therefore, only the final question refers to the solidarity pillar, while all of the others are related to the pillars of contributions. Table 3 provides a description of the questions that make up the index as well as the distribution of interviewees' responses in the sample. Furthermore, Appendix B shows details of how these questions were included in the EPS.

In order to construct the index, one point was assigned for each question that the interviewee answered correctly, and 0 points otherwise. Thus, the index ranges between 0 and 8, where 0

Table 2. Description, construction, and expected sign of variables

Variable		Description	Source	Sign
Dependent variable				
PKI		Points obtained for the correct answers regarding the financial system (0 = Lowest, 8 = Highest)	EPS 2015	
Independent variables on an individual level				
Gender	Male	Dummy. Takes a value of 1 if interviewee is male, and 0 otherwise.	EPS 2015	+
Age	18–25	Dummy. Takes a value of 1 if interviewee is between the age of 18 and 25, and 0 otherwise.	EPS 2015	−
	25–39	Dummy. Takes a value of 1 if interviewee is between the age of 25 and 39, and 0 otherwise.		+
	40–65	Dummy. Takes a value of 1 if interviewee is between the age of 40 and 65, and 0 otherwise.		+
	If all variables take a value of 0, the interviewe is 65 years of age or older			
Education	Primary education	Dummy. Takes a value of 1 if the interviewee has a basic education, and 0 otherwise.	EPS 2015	−
	High school education	Dummy. Takes a value of 1 if the interviewee has a high school education, and 0 otherwise.		−
	Higher education	Dummy. Takes a value of 1 if the interviewee has a higher education qualification, and 0 otherwise.		+
	If all variables are 0, the interviewee has no formal education			
Employment situation	Payroll worker	Dummy. Takes a value of 1 if the interviewee is employed by a third party, and 0 otherwise.	EPS 2015	+
	Self-employed	Dummy. Takes a value of 1 if the interviewee is self-employed, and 0 otherwise.		−
Household composition	Pensioners living in the household	Dummy. Takes a value of 1 if pensioners live in the household, and 0 otherwise.	EPS 2015	+
Marital status	Married	Dummy. Takes a value of 1 if the interviewee is married or in a registered partnership, and 0 otherwise.	EPS 2015	+
	Single	Dummy. Takes a value of 1 if the interviewee is single, and 0 otherwise.		−
	Divorced	Dummy. Takes a value of 1 if the interviewee is divorced or separated, and 0 otherwise.		+
	If all the variables are 0, the interviewee is a widower			
Monthly household income	Income (ln)	Natural logarithm of the average monthly income by household. It incorporates primary work, secondary work, state transfers, pensions, and rental revenue.	EPS 2015	
			Source	Sign
Inhabitants per municipality	0–20,000	Dummy. Takes a value of 1 if the interviewee lives in a region where the municipalities have less than 20,000 inhabitants on average, and 0 otherwise.	INE	−
	20,000–30,000	Dummy. Takes a value of 1 if the interviewee lives in a region where the municipalities have between 20,000 and 30,000 inhabitants on average, and 0 otherwise.		−
	30,000–40,000	Dummy. Takes a value of 1 if the interviewee lives in a region where the municipalities have between 30,000 and 40,000 inhabitants on average, and 0 otherwise.		−
	40,000–60,000	Dummy. Takes a value of 1 if the interviewee lives in a region where the municipalities have between 40,000 and 60,000 inhabitants on average, and 0 otherwise		+
	If all variables are 0, the average number of inhabitants per municipality is over 60,000			
Geographic zone	North	Dummy. Takes a value of 1 if the interviewee lives in a northern region of Chile, and 0 otherwise.	EPS 2015	−
	Center	Dummy. Takes a value of 1 if the interviewee lives in a central region of Chile, and 0 otherwise.		+
	South	Dummy. Takes a value of 1 if the interviewee lives in a southern region of Chile, and 0 otherwise.		+
	If all the variables are 0, the interviewee lives in the capital of Chile			
Index of regional development	Education	Composite index, normalized between 0 and 1, measures the level of education and access to education at the regional level	IDERE 2015	+
	Economic welfare			+

(Continued)

Table 2. (*Continued.*)

Variable	Description	Source	Sign
	Composite index, normalized between 0 and 1, incorporates information regarding poverty, income by household, and the quality of housing.		
Economic activity	Composite index, normalized between 0 and 1, considers the income of pension fund members, employment rate, industry specialization and diversification of the production sector at the regional level.		+
Connectivity	Composite index, normalized between 0 and 1, measures connectivity through the availability of channels of communication and quality of highways and roads.		+

Source: Own elaboration.

Table 3. Questions on pension knowledge which constitute the PKI

Area	Concept	Mean	SD
Percentage of contribution	Correctly indicates the range of values in which the percentage of contribution to AFPs is found	0.307	0.461
Statement of accounts	Indicates that they received information regarding the personal account from AFPs	0.457	0.498
Amount	States that they know the amount of funds accumulated in their personal account	0.301	0.459
Percentage of AFP fees	Correctly indicates the range of values in which the percentage of fees charged by the AFPs is found	0.605	0.489
Existence of multifunds	Indicates that they know about the existence of multifunds	0.352	0.478
Number of multifunds	Correctly states the number of funds available within the system	0.185	0.389
Pension payout modalities	Indicates at least two different retirement modalities (either programmed withdrawal, life annuity or a variation of the two)	0.046	0.210
PBS Requirements	Correctly indicates at least two qualifying requirements for the PBS	0.371	0.483
Observations		10,170	

Source: Own representation based on EPS (2015).

represents a low level of PKI and 8 a high level of knowledge. It should be noted that for cases in which interviewees stated that they did not know the answer or decided not to answer, 0 points were assigned. Although the questions have a Kaiser–Meyer–Olkin test of 0.707, it was decided not to group them based on weights (e.g., by principal component analysis) as this would hamper a straightforward understanding.

First, it should be noted that overall PKI is low, since only 30.7 percent of participants correctly answered the question concerning contributions. The expertise which is lacking may therefore undermine the analysis regarding the personal savings decision. Furthermore, affiliates demonstrate greater knowledge of the commissions charged by the AFPs for administering funds, with 60.5 percent of participants giving an answer that was within the correct range of values. Consequently, many interviewees are able to evaluate the competitiveness of their AFP compared to other fund administrators.

The average PKI score is 2.625 points, with a standard deviation of 1.708. The median is 2 (skewness of 0.615). Moreover, 46.6 percent of interviewees were able to provide more correct answers than the average (Figure 1).

4.3 Variables on the individual level (1)

The first category of explanatory variables we consider are those at the individual level (first level), which refer to respondents' demographic and socioeconomic characteristics. This group of variables is in line with the existing literature on financial literacy and pension knowledge. The variables considered are dummy variables.
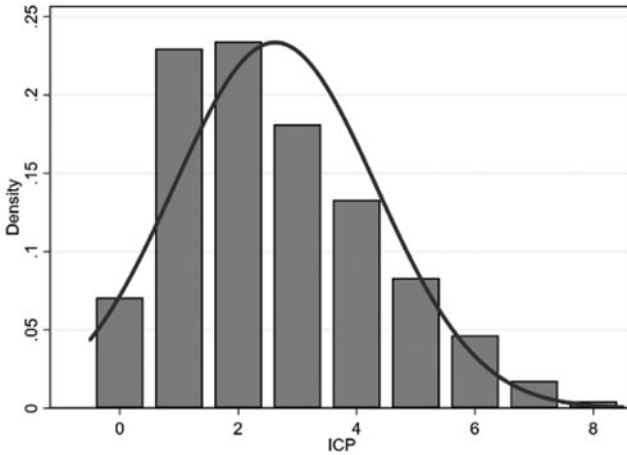
Figure 1. Histogram representing PKIs for the whole sample.
Source: Own representation based on EPS (2015).

As regards demographic characteristics, we expect a positive relationship for the case of men who usually display higher levels of financial literacy (Bucher-Koenen *et al.*, 2017). Furthermore, pension knowledge is expected to increase with age. Consequently, the younger members of society are expected to show the lowest levels of financial literacy, since up to the age of 18 their main source of financial education comes from their parents and school education (Shim *et al.*, 2010), which does not consider the pension system for the case of Chile. Moreover, as they gradually approach retirement age, workers are probably more proactive when it comes to learning about the pension system.

As regards socioeconomic characteristics, financial literacy is expected to be positively related to the level of education. This is mainly because people with lower levels of education are less likely to possess basic financial knowledge, while the opposite is true for those who have completed higher education (Lusardi and Mitchell, 2011*b*). Furthermore, it can be anticipated that the level of income is positively related to knowledge (Monticone, 2011). Finally, it is important to keep in mind that the expected results are consistent with previous studies for the Chilean pension system which, in terms of pension knowledge, also finds positive effects of being an employed worker and of there being a pensioner living in the same household (Landerretche and Martínez, 2013).

4.4 Regional level variables (Z)

For regional level analysis (second level), variables which consider specific characteristics regarding the place of residence are included. The first variable is the size of the municipality, measured as the average number of inhabitants per county that reside in the region. We expect a positive relationship between the size of the county and the level of financial literacy, since a greater population density should be associated with improved access to public services due to their greater scope.[7] In a similar manner, greater geographical proximity of inhabitants implies more potential instances of social interaction.

The next point of interest is the geographical area in which each region is located. In Chile there are 16 regions[8] which, for the purpose of this study, are combined within four different zones: north, center, south, and capital. Figure 3 shows their distribution and the areas they comprise. Consistent with

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[7]As shown for the postal service by Miranda (2012). Similar conclusions can be drawn for financial, educational, health, and other services.

[8]The region of Ñuble emerged in 2017 from parts of the Biobío territory. However, the data used for this paper do not comprise the new distribution. Hence, the regional division for 2015, which entails 15 regions for mainland Chile, is used. Appendix B shows the detailed geographic division adopted in this paper.

the evidence on regional development, we expect residing in the central zone to be negatively related to the development of financial literacy.

In order to further the analysis of the characteristics present at the regional level, we use the 2015 IDERE.[9] We selected four of the seven dimensions that make up the index, and which are presented below:

(1) *Education*: this index is made up of different aspects which represent accessibility to education in the different regions. These include the enrollment rate for kindergarten (age 4–5), secondary education (age 14–17), and higher education (both technical and professional). Additionally, it includes mean years of schooling, the percentage of illiterate people, and the mean score in the Chilean School Quality Measurement System (SIMCE) tests for eighth grade. This indicator reflects the human capital acquired through formal education, which in the literature has been treated as a crucial element in financial literacy studies and is usually seen as a positive factor. Consequently, we expect citizens residing in regions with advanced access to education to display a higher level of pension knowledge. However, it is crucial to remember that pension system education is not included in the national school curriculum.

(2) *Economic welfare*: measurement of this dimension is based on four factors: the percentage of the population who live in poverty or indigence, average regional income per person, the percentage of people living in homes that have the least acceptable conditions, and the percentage of people living in overcrowded places. This dimension reflects the ability to access a good quality of life from an income and housing perspective. Accordingly, we expect a positive relationship between this indicator and pension knowledge. Hereinafter, we refer to this dimension as 'quality of life'.

(3) *Economic activity*: this dimension includes average regional income per member of a pension fund, unemployment rate, sophistication of the manufacturing and services industry (measured in its share of regional GDP), and diversification of the production sector (in comparison to a theoretical and well distributed county). Consequently, it represents access to job opportunities, with the work environment being a key instance of socialization and exchange of knowledge and experiences. We therefore expect this dimension to be positively related to pension knowledge. Hereinafter, we will refer to this indicator as 'job opportunities'.

(4) *Connectivity*: this composite index considers the rate of internet connections per inhabitant, telephone landlines, and the proportion of highways and paved roads compared to the national total. It thus measures the possibility of staying connected both physically and virtually. In a country with a large geographical area, vast parts of which are difficult to reach, this favors access to information, opportunities, goods, and services. Although this indicator does not directly measure social relationships, they are considered indirectly, since tools that facilitate communication and exchange of information are included. We expect people residing in regions with better connectivity to have a higher level of pension knowledge, which should be reflected by a positive relationship between these variables.

Overall, we expect the dimensions of the IDERE to be positively related to pension knowledge. Education in particular should have a positive albeit slight effect, since the Chilean formal education system does not specifically deal with pension systems. Nonetheless, educational instances also provide opportunities for socialization and the chance to obtain knowledge informally. We also expect the quality of life and job opportunities to show a positive relationship with pension knowledge. This should be represented by the fact that people who find themselves in a good economic situation are more likely to be interested in related topics while also having further opportunities to learn about them. Here, the workplace plays a key role. Finally, connectivity can be considered a catalyst

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[9]Further details of the dimensions of each region can be found in Appendix B.
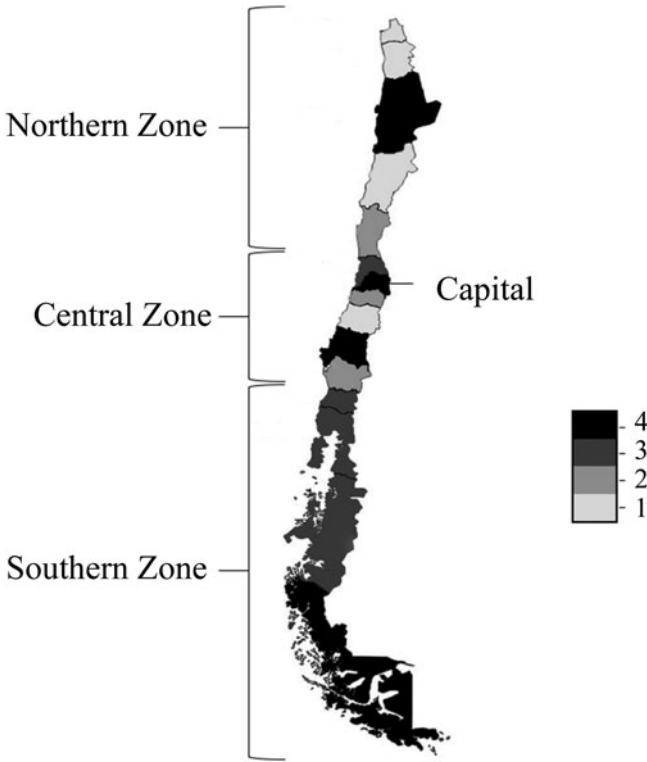
Figure 3. Geographic distribution of average PKI scores, by quartiles.
Note: This figure shows the relative score results by region. The scale was divided into quartiles, with the lightest color (1) representing the poorest results, and the darkest color (4) representing the best results.
Source: Own elaboration based on EPS (2015) data.

for communication and exchange, while it is also easily targetable from an investment and public policy point of view. We expect this factor to have a positive effect on pension knowledge.

5. Methodology

The data used by multilevel regression models are sorted into a hierarchical structure or grouped in such a way that several units form a nested set. This type of model is useful when variables on a group level impact the results observed on an individual level. Hence, the variables are related to each other in some way since they belong to the same group. Therefore, a multilevel analysis appears appropriate when considering social contexts and the subjects that comprise them (Hox, 1995; Leeuw and Meijer, 2007).

We decided to use this type of model for our analysis due to the hierarchical structure of the data, which contains information on 10,170 members of the pension system (individuals, therefore, first level), who reside in 15 regions of Chile (groups, therefore, second level). Moreover, it can be expected that both the characteristics present in interviewees' region of residence and their individual characteristics may affect their behavior, in this case, their level of pension knowledge. Furthermore, the model appears appropriate since the sample was derived by stratification on a regional and county level from the EPS.

First, we constructed an equation that considers the effect related to first level characteristics: singledollar

$$PKI_{ij} = \beta_{0j} + \sum_{k=1}^{m} \beta_k I_{kij} + \varepsilon_{ij} \tag{1}$$

Simultaneously, a different equation, which refers to second level characteristics is adopted:

$$\beta_{0j} = \gamma_0 + \sum_{t=1}^{s} \beta_t Z_{tj} + U_{0j} \tag{2}$$

Accordingly, the overall function is as follows:

$$PKI_{ij} = \gamma_0 + \sum_{k=1}^{m} \beta_k I_{kij} + \sum_{t=1}^{s} \beta_t Z_{tj} + \varepsilon_{ij} + U_{0j} \tag{3}$$

where PKI_{ij} is the dependent variable. This variable describes pension knowledge for ith interviewee in jth region. I_{kij} are the m variables at the individual level, and Z_{tj} are the s variables at the regional level. Finally, ε_{ij} and U_{0j} are the error terms for the individual and regional levels, respectively.

This type of model is also known as a mixed model, since equation (3) can be divided into elements. First, $\gamma_0 + \sum_{k=1}^{m} \beta_k I_{kij} + \sum_{t=1}^{s} \beta_t Z_{tj}$ describes the fixed component while $\varepsilon_{ij} + U_{0j}$ stands for the random component or error. Furthermore, errors are normally distributed, with a mean of 0, and are not correlated. Therefore, the following equation can be derived:

$$Var(\varepsilon_{ij} + U_{0j}) = \sigma_\varepsilon^2 + \sigma_{U_{0j}}^2 \tag{4}$$

The variance can be decomposed into two independent parts: σ_ε^2 is the variance of errors at the individual level (ε_{ij}) and is shared among all regions. $\sigma_{U_{0j}}^2$, on the contrary, refers to the variance of errors at the regional level (U_{0j}) which also stands for the covariance between two interviewees residing in the same region. The correlation between these individuals can be described as follows:

$$ICC = \rho = \frac{\sigma_{U_{0j}}^2}{\sigma_\varepsilon^2 + \sigma_{U_{0j}}^2} \tag{5}$$

Equation (5) is known as the intraclass correlation coefficient (ICC), which is the portion of total variance explained by the variation between the groups. Therefore, it is an estimator of the variance explained by the group structure in the data. The ICC can take values between 0 and 1 and, in social studies, usually takes values within the range of 0.04–0.25, indicating the existence of social grouping. In this context, a multilevel analysis will be useful if the ICC is significant, which indicates similarities between interviewees who reside in the same region. Bumcrot et al. (2013), and more recently Cucinelli et al. (2019), have used this model to study financial literacy from a geographic point of view.

Similar to the previous specification, the explanatory variables have been divided between variables at the individual level, which refer to interviewees' demographic and socioeconomic characteristics, and variables at the regional level (group characteristics), which characterize local differences in the interviewee's region of residence. Table 4 shows the sets of variables used for the estimation.

6. Results

In this section, we first show the observed level of pension knowledge at the regional level. Thereafter, the main results from the multilevel regression specified in equation (3) are presented. It should be noted that the intercept of the regression is random at the regional level. Each estimate considers two sources of variance: on the one hand, variance arising from the interviewees (individual characteristics), and on the other, variance arising from regions (group characteristics).

6.1 Pension knowledge at a regional level

Although the PKI is an individual level indicator, we provide its average value by region in Table 5. There, it can be observed that the region of Magallanes, which corresponds to the southern zone of

Table 4. Variables used for the model

Individual level (*I*)	Regional level (*Z*)
Gender	Average size of municipalities
Age	Geographical zone
Education	Education dimension
Employment situation	Economic welfare dimension
Composition of the household	Economic activity dimension
Marital status	Connectivity dimension
Household income	

Table 5. Average pension knowledge by regions in Chile

	PKI (low = 0, high = 8)		
Region	Mean	SD	Obs.
Arica y Parinacota	2.104	1.698	115
Tarapacá	1.669	1.064	133
Antofagasta	2.799	1.761	308
Atacama	1.906	1.480	191
Coquimbo	2.164	1.280	446
Valparaíso	2.756	1.734	1,080
Metropolitana de Santiago	2.804	1.747	3,931
O'Higgins	2.266	1.673	625
Maule	2.119	1.452	776
Biobío	2.850	1.818	1,134
Araucanía	2.435	1.626	483
Los Ríos	2.669	1.629	163
Los Lagos	2.671	1.693	559
Aysén	2.764	1.509	106
Magallanes	2.925	1.671	120
Total	2.625	1.708	10,170
F-statistic (full sample)	21.87***		

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.
Source: Own presentation based on EPS (2015) data.

Chile, has the highest average score in the country, followed by the region of Biobío in the central zone. At the other end of the scale, the regions of Tarapacá (1.256 points below the score of Magallanes) and Atacama can be found. Both regions are located in the northern part of Chile. These results, in addition to those presented in Figure 2, signal the existence of interregional differences with respect to pension knowledge and its distribution.

The distribution of the average PKI scores across Chile is shown in Figure 3. Here, a geographically dependent trend is observable. In general, northern regions show the poorest performances, with Antofagasta being an exception to this rule. Southern regions, on the contrary, obtained some of the best results at the country level. In the central zone, a greater variety of results in terms of PKI scores becomes apparent. In addition, we provide the analysis of variance (ANOVA) test for the PKI in Appendix B, and we find that – with the exception of gender – the distribution differs among the variables.

6.2 Multilevel regression with individual and regional variables

Preliminary inspection of the data suggests that a relationship between the region of residence and the level of pension knowledge does exist (see Table 5). Hence, we further explore this relationship with respect to specific characteristics present in the different regions of Chile (regional variables), while also controlling for differences at the respondent level (individual variables).
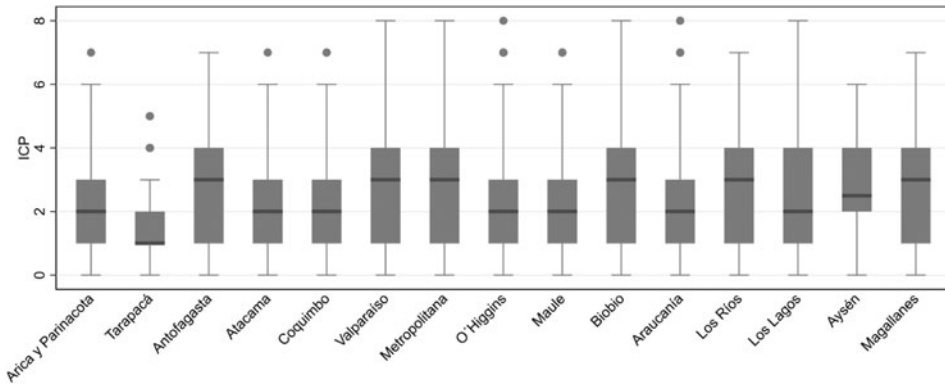
Figure 2. Boxplots of PKIs at a regional level.
Source: Own elaboration based on EPS (2015) data.

Table 6. Correlation matrix for the PKI and studied dimensions

	PKI	Education	Economic welfare	Economic activity	Connectivity
PKI	1	0.113***	0.096***	0.084***	0.108***
Education	0.113***	1	0.755***	0.671***	0.869***
Economic welfare	0.096***	0.755***	1	0.773***	0.910***
Economic activity	0.084***	0.671***	0.773***	1	0.867***
Connectivity	0.108***	0.869***	0.910***	0.867***	1

***p < 0.001, **p < 0.01, *p < 0.05.
Source: Own presentation based on EPS (2015) and IDERE (2015) data.

Before conducting the multilevel regression, the correlations between the PKI and the IDERE are computed. In Table 6, the PKI presents significant correlations with the regional indices, indicating a weak positive relationship between them. Moreover, the correlation between the dimensions of the IDERE is also examined. Results indicate the presence of multicollinearity. Hence, they will be treated in an isolated manner within the model.

Additionally, in order to capture the degree to which pension knowledge can be attributed to regional differences, a simple regression model is built which provides the fixed effects by region. The results of this model are reported in Table 7. There, it can be seen that many regions present PKI scores which are significantly lower than those obtained by the metropolitan region. Therefore, it appears useful to further investigate the pivotal characteristics.

Table 8 shows the results of the linear multilevel regressions conducted for the PKI scores. It can be seen that, based on equation (5), model 0 obtained an ICC of 0.040. Therefore, 4 percent of total variance is due to differences between regions. Furthermore, $\sigma_{U_0}^2 = 0.123$ is statistically significant. Consequently, the ICC is significant and a multilevel model should therefore be used for the proposed analysis.

For variables at the individual level (I), which are related to the interviewee's demographic and socioeconomic characteristics, it can be observed that age, level of education, and employment status have a significant and positive effect on the level of pension knowledge. People over the age of 25 appear to be particularly familiar with the pension system. Similar observations can be made for those over the age of 40. Furthermore, being employed and having a higher education qualification also has a positive effect on pension knowledge. The income factor seems to have less of an impact, although it is positive. Consistent with the findings of Landerretche and Martínez (2013), the presence of retirees in the household shows a positive relationship, while single people evidences less pension knowledge. Finally, no significant relationship between gender and pension knowledge is seen to exist,

Table 7. Fixed effects by region

Fixed effects	PKI	
	Est.	SE
Constant	2.997***	0.053
Region (baseline: metropolitan)		
Arica and Parinacota	−0.875***	0.207
Tarapacá	−1.027***	0.210
Antofagasta	0.006	0.165
Atacama	−1.027***	0.164
Coquimbo	−0.717***	0.098
Valparaíso	−0.148	0.092
O'Higgins	−0.625***	0.098
Maule	−0.728***	0.095
Biobío	0.064	0.088
Araucanía	−0.470***	0.105
Los Ríos	−0.199	0.170
Los Lagos	−0.132	0.126
Aysén	0.040	0.207
Magallanes	0.044	0.175
Obs.	10,170	
AIC	40,180.34	

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.
Source: Own presentation based on EPS (2015) data.

a result that differs from the positive relationship for males reported in Landerretche and Martínez (2013). These effects remain stable throughout all of the estimates presented.

When looking at the variables at the regional level (Z), and keeping the variables on an individual level constant, it can be seen that the average number of inhabitants per county in the region affects the level of financial literacy. Regions with fewer inhabitants per county (less than 20,000) present higher PKI scores compared to regions that have more inhabitants in their counties on average (over 60,000). However, this effect is reversed as the number of inhabitants increases, which can be seen for regions with counties that are home to between 40,000 and 60,000 inhabitants, since their performance is worse than those of the more populated counties. The geographical area is also related to the index. Inhabitants of northern regions appear to possess the least pension knowledge compared to the capital.

With the exception of the education dimension, the results for the IDERE confirm the expected relationship between regional characteristics and the PKI. Furthermore, these results hold when controlling for the geographical zone. For the case of the dimension capturing connectivity, they are also maintained when controlling for the size of municipalities. Furthermore, the economic welfare variable appears to be significantly and positively related to the PKI. The magnitude of this effect is also considerable given that two people who live in different regions that differ by one point on the scale for economic welfare will also display a difference of 0.807 points for the PKI on average if all other variables are assumed constant. Similarly, the economic activity dimension is positively and significantly related to the explanatory variable. In this case, the magnitude is even greater since a one point increase in this dimension leads to a 2.534 points increase in the PKI score on average. These results are consistent with the findings of Bumcrot *et al.* (2013), who detect a negative relationship between the level of poverty and financial literacy, similar to Skog (2006), who suggests that many of the learning processes in pension schemes take place in a work context.

The dimension capturing connectivity presents a significant and positive relationship with the PKI. If demographic and socioeconomic variables are kept constant, a person residing in a region with better connectivity will see their level of financial literacy favored by 0.841 points. Among the regional characteristics analyzed, the connectivity dimension is probably the easiest to address from a public policy point of view. Hence, Tables 9 and 10 presents its estimation by components. Here, it can

Table 8. Results of the estimation: multilevel regression examining the PKI

	PKI							
	(0)		(1)		(2)		(3)	
Fixed effects	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Variables at the individual level								
Constant	2.624***	0.101	2.012***	0.257	2.118***	0.262	2.153***	0.262
Gender								
Male			−0.038	0.030	−0.037	0.030	−0.036	0.030
Age (baseline category: more than 65 years)								
18–25			0.026	0.155	0.025	0.157	0.033	0.156
25–39			0.542**	0.177	0.542**	0.179	0.550**	0.178
40–65			0.812***	0.150	0.813***	0.152	0.822***	0.151
Education (baseline category: higher education)								
Primary education			−0.558	0.290	−0.562	0.296	−0.559	0.296
High school education			0.103	0.296	0.103	0.300	0.110	0.300
Higher education			0.851**	0.290	0.853**	0.295	0.857**	0.294
Employment status (baseline category: unemployed)								
Payroll employee			0.568***	0.051	0.568***	0.051	0.568***	0.051
Self-employed			0.077	0.054	0.080	0.055	0.080	0.055
Household composition								
Retirees at home (yes = 1)			0.155*	0.075	0.155*	0.074	0.157*	0.074
Marital status (baseline category: married)								
Single			−0.180***	0.041	−0.178***	0.041		0.041
Separated			−0.073	0.095	−0.073	0.095		0.095
Household monthly income quartiles (baseline category: fourth income quartile)								
First income quartile			−0.743***	0.071	−0.739***	0.071		0.071
Second income quartile			−0.489***	0.061	−0.486***	0.063	−0.493***	0.061
Third income quartile			−0.317**	0.108	−0.315**	0.109	−0.320**	0.109
Opinion on institutions								
AFP opinion			−0.026	0.041	−0.025	0.041	−0.024	0.042
Variables at the regional level								
Inhabitants per municipality (baseline category: more than 60,000)								
0–20,000					0.089***	0.025		
20,000–30,000					0.026	0.152		
30,000–40,000					−0.094	0.139		
40,000–60,000					−0.397*	0.160		
Geographical zone (baseline category: capital)								
North							−0.453**	0.170
Center							−0.119	0.135
South							0.010	0.084
IDERE								
Education								
Economic welfare								
Economic activity								
Connectivity								
Random effects	(0)		(1)		(2)		(3)	
Variance coefficient partition	0.123***		0.070***		0.048***		0.038***	
Variance residuals	2.969***		2.368***		2.368***		2.368***	
Intra-class correlation	0.040		0.029		0.020		0.016	
Log pseudo-likelihood	−69,331.04		−65,481.75		−65,457.96		−65,449.14	
AIC	138,668.10		131,001.50		130,961.90		130,942.30	
	(4)		(5)		(6)		(7)	
Variables at the individual level								
Constant	1.998*	0.916	1.737***	0.299	0.963*	0.487	1.825***	0.274
Gender								
Male	−0.038	0.030	−0.038	0.030	−0.038	0.030	−0.038	0.030
Age (baseline category: more than 65 years)								
18–25	0.026	0.155	0.025	0.156	0.025	0.155	0.025	0.155
25–39	0.542**	0.177	0.540**	0.177	0.539**	0.177	0.540**	0.177
40–65	0.812***	0.150	0.810***	0.150	0.810***	0.149	0.809***	0.150
Education (baseline category: higher education)								
Primary education or less	−0.558	0.292	−0.558	0.290	−0.558	0.290	−0.558	0.290

(*Continued*)

Table 8. (*Continued.*)

	PKI							
	(0)		(1)		(2)		(3)	
Fixed effects	Est.	SE	Est.	SE	Est.	SE	Est.	SE
High school education	0.103	0.296	0.102	0.296	0.102	0.297	0.101	0.296
Higher education	0.851**	0.290	0.850**	0.290	0.851**	0.290	0.849**	0.290
Employment status (baseline category: unemployed)								
Payroll employee	0.568***	0.051	0.568***	0.051	0.569***	0.051	0.568***	0.051
Self-employed	0.077	0.054	0.077	0.053	0.078	0.054	0.076	0.053
Household composition								
Retirees at home (yes = 1)	0.155*	0.075	0.155*	0.075	0.156*	0.074	0.156*	0.075
Marital status (baseline category: married)								
Single	−0.180***	0.041	−0.180***	0.041	−0.179***	0.041	−0.181***	0.041
Separated	−0.073	0.095	−0.074	0.095	−0.075	0.094	−0.074	0.095
Household monthly income quartiles (baseline category: fourth income quartile)								
First income quartile	−0.743***	0.071	−0.741***	0.071	−0.742***	0.070	−0.741***	0.071
Second income quartile	−0.489***	0.061	−0.487***	0.062	−0.488***	0.062	−0.487***	0.062
Third income quartile	−0.317**	0.108	−0.316**	0.108	−0.316**	0.109	−0.316**	0.108
Opinion on institutions								
AFP opinion	−0.026	0.041	−0.026	0.041	−0.026	0.041	−0.026	0.041
Variables at the regional level								
Inhabitants per municipality (baseline category: more than 60,000)								
0–20,000								
20,000–30,000								
30,000–40,000								
40,000–60,000								
Geographical zone (baseline category: capital)								
North								
Center								
South								
IDERE								
Education	0.022	1.157						
Economic welfare			0.583	0.426				
Economic activity					2.370*	1.141		
Connectivity							0.684	0.401
Random effects	(4)		(5)		(6)		(7)	
Variance coefficient partition	0.070***		0.067***		0.054***		0.064***	
Variance residuals	2.368***		2.368***		2.369***		2.368***	
Intra-class correlation	0.029		0.028		0.022		0.026	
Log pseudo-likelihood	−65,481.75		−65,479.72		−65,470.61		−65,477.88	
AIC	131,003.50		130,999.40		130,981.20		130,995.80	

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.
Source: Own elaboration based on EPS (2015) and IDERE (2015) data.

be seen that a difference of 1 for the rate of hardwired broadband accesses per inhabitant entails a difference of 1.076 points in the PKI on average, if all individual characteristics remain constant. The rate of telephone lines per inhabitant also presents a positive effect. However, the proportion of kilometers of highways and paved roads in the region with respect to the national total seems to have no significant effect.

Our results show that the level of pension knowledge is affected by three of the four selected dimensions on regional development: economic welfare, economic activity, and connectivity. Consequently, the majority of our initial hypotheses can be confirmed. The level of pension knowledge (at the individual level) is significantly influenced by the characteristics of the region of residence. Since these characteristics are strongly correlated, people living in a region which provides better conditions are also expected to be able to learn more from their social environment or from the informational tools available to them. Hence, these people enter a beneficial cycle which fosters pension knowledge. The opposite is true for those living in a region that does not provide such conditions.

Table 9. Results of the estimation: multilevel regression examining PKI

	PKI											
	(5)		(5.1)		(5.2)		(5.3)		(5.4)		(5.5)	
Fixed effects	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Variables at the individual level												
Constant	1.737***	0.299	0.760***	0.434	2.150***	0.344	2.059***	0.283	1.056**	0.386	1.071*	0.538
Gender												
Male	−0.038	0.030	−0.040	0.030	−0.037	0.030	−0.037	0.030	−0.039	0.030	−0.037	0.030
Age (baseline category: more than 65 years)												
18–25	0.025	0.156	0.029	0.153	0.028	0.156	0.027	0.156	0.022	0.154	0.028	0.155
25–39	0.540**	0.177	0.545**	0.174	0.544**	0.178	0.543**	0.178	0.536**	0.176	0.544**	0.177
40–65	0.810***	0.150	0.811***	0.150	0.814***	0.151	0.813***	0.151	0.804***	0.149	0.815***	0.149
Education (baseline category: higher education)												
Primary education or less	−0.558	0.290	−0.569	0.297	−0.559	0.290	−0.558	0.290	−0.559	0.290	−0.556	0.291
High school education	0.102	0.296	0.090	0.301	0.103	0.296	0.104	0.296	0.096	0.297	0.109	0.296
Higher education	0.850**	0.290	0.835**	0.296	0.851**	0.290	0.852**	0.290	0.845**	0.291	0.856**	0.290
Employment status (baseline category: unemployed)												
Payroll employee	0.568***	0.051	0.567***	0.050	0.568***	0.051	0.568***	0.051	0.567***	0.051	0.568***	0.051
Self-employed	0.077	0.053	0.079	0.054	0.078	0.054	0.078	0.054	0.076	0.053	0.079	0.054
Household composition												
Retirees at home (yes = 1)	0.155*	0.075	0.154*	0.075	0.155*	0.074	0.156*	0.074	0.155*	0.075	0.156*	0.075
Marital status (baseline category: married)												
Single	−0.180***	0.041	−0.182***	0.042	−0.179***	0.041	−0.180***	0.041	−0.183***	0.041	−0.179***	0.041
Separated	−0.074	0.095	−0.071	0.095	−0.072	0.095	−0.072	0.095	−0.076	0.095	−0.070	0.095
Household monthly income quartiles (baseline category: fourth income quartile)												
First income quartile	−0.741***	0.071	−0.743***	0.071	−0.744***	0.071	−0.743***	0.071	−0.738***	0.071	−0.743***	0.072
Second income quartile	−0.487***	0.062	−0.493***	0.061	−0.490***	0.061	−0.490***	0.062	−0.485***	0.062	−0.491***	0.061
Third income quartile	−0.316**	0.108	−0.320**	0.106	−0.317**	0.108	−0.317**	0.108	−0.314**	0.107	−0.318**	0.108
Opinion on institutions												
AFP opinion	−0.026	0.041	−0.027	0.040	−0.025	0.041	−0.026	0.041	−0.026	0.040	−0.027	0.041
Variables at the regional												
Inhabitants per municipality (baseline category: more than 60,000)												
0–20,000												
20,000–30,000												
30,000–40,000												
40,000–60,000												
Geographical zone (baseline category: capital)												
North												
Center												
South												

	(5)		(5.1)		(5.2)		(5.3)		(5.4)		(5.5)	
IDERE												
Economic welfare	0.583	0.426										
Poverty			−1.022**	0.370	−0.242	0.368						
Income			0.213	0.660			−0.155	0.463				
Housing quality			3.002***	0.593					2.109**	0.647		
Housing overcrowding			0.731	0.640							1.681*	0.777
Random effects	(5)		(5.1)		(5.2)		(5.3)		(5.4)		(5.5)	
Variance coefficient partition	0.066***		0.016***		0.068***		0.070***		0.041***		0.044***	
Variance residuals	2.370***		2.368***		2.368***		2.368***		2.370***		2.368***	
Intra-class correlation	0.027		0.007		0.028		0.029		0.017		0.018	
Log pseudo-likelihood	−65,493.03		−65,414.97		−65,480.40		−65,481.37		−65,473.24		−65,456.62	
AIC	131,022.10		130,875.90		131,000.80		131,002.70		130,982.50		130,952.80	

Includes further details on economic welfare.

***p < 0.001, **p < 0.01, *p < 0.05.

Source: Own elaboration based on EPS (2015) and IDERE (2015).

Table 10. Results of the estimation: multilevel regression examining PKI

Fixed effects	PKI									
	(7)		(7.1)		(7.2)		(7.3)		(7.4)	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Variables at the individual level										
Constant	1.825***	0.274	1.538***	0.294	1.666***	0.279	1.900***	0.274	2.003***	0.252
Gender										
Male	−0.038	0.030	−0.039	0.030	−0.039	0.030	−0.038	0.030	−0.038	0.030
Age (baseline category: more than 65 years)										
18–25	0.025	0.155	0.023	0.155	0.024	0.155	0.026	0.155	0.026	0.156
25–39	0.540**	0.177	0.536**	0.177	0.538**	0.177	0.540**	0.177	0.542**	0.177
40–65	0.809***	0.150	0.805***	0.150	0.807***	0.150	0.810***	0.150	0.812***	0.150
Education (baseline category: higher education)										
Primary education or less	−0.558	0.290	−0.559	0.294	−0.557	0.289	−0.555	0.289	−0.558	0.291
High school education	0.101	0.296	0.097	0.299	0.100	0.296	0.103	0.295	0.103	0.297
Higher education	0.849**	0.290	0.847**	0.293	0.849**	0.289	0.851**	0.289	0.851**	0.291
Employment status (baseline category: unemployed)										
Payroll employee	0.568***	0.051	0.568***	0.051	0.568***	0.051	0.568***	0.051	0.568***	0.051
Self-employed	0.076	0.053	0.077	0.054	0.076	0.053	0.076	0.053	0.077	0.054
Household composition										
Retirees at home (yes = 1)	0.156*	0.075	0.156*	0.075	0.156*	0.075	0.156*	0.075	0.155*	0.075
Marital status (baseline category: married)										
Single	−0.181***	0.041	−0.183***	0.041	−0.182***	0.041	−0.180***	0.041	−0.180***	0.041
Separated	−0.074	0.095	−0.076	0.095	−0.075	0.095	−0.074	0.095	−0.073	0.095
Household monthly income quartiles (baseline category: fourth income quartile)										
First income quartile	−0.741***	0.071	−0.739***	0.071	−0.739***	0.071	−0.741***	0.071	−0.743***	0.071
Second income quartile	−0.487***	0.062	−0.485***	0.062	−0.486***	0.062	−0.488***	0.062	−0.489***	0.061
Third income quartile	−0.316**	0.108	−0.314**	0.107	−0.315**	0.107	−0.316**	0.108	−0.317**	0.108
Opinion on institutions										
AFP opinion	−0.026	0.041	−0.025	0.040	−0.025	0.041	−0.025	0.041	−0.026	0.041
Variables at the regional										
Inhabitants per municipality (baseline category: more than 60,000)										
0–20,000										
20,000–30,000										
30,000–40,000										
40,000–60,000										
Geographical zone (baseline category: capital)										
North										
Center										
South										
IDERE										
Connectivity	0.684	0.401								
Internet			2.169	1.149	0.918*	0.37				
Telephone			−1.151	1.016			0.494	0.276		
Highways			−0.370	0.397					0.040	0.435
Random effects	(7)		(7.1)		(7.2)		(7.3)		(7.4)	
Variance coefficient partition	0.064***		0.045***		0.055***		0.065***		0.070***	
Variance residuals	2.368***		2.369***		2.369***		2.368***		2.368***	
Intra-class correlation	0.026		0.018		0.023		0.027		0.029	
Log pseudo-likelihood	−65,477.88		−65,465.08		−65,471.75		−65,478.69		−65,481.73	
AIC	130,995.80		130,974.20		130,983.50		130,997.40		131,003.50	

Includes further details on Connectivity.
***p < 0.001, **p < 0.01, *p < 0.05.
Source: Own elaboration based on EPS (2015) and IDERE (2015).

7. Conclusions

The Chilean pension system has been modified and developed since its introduction. In order to further involve members, pension funds give them the opportunity to choose between different levels of risk and payout methods. Moreover, the principles of solidarity and voluntary savings have been

promoted further. However, the system still leaves room for opportunities that might improve its performance. The current context of small pensions, low levels of contributions and growing public discontent toward the system make this clear. In addition, public pressure to allow the use of pension funds in order to cope with the economic impact of COVID-19 – coupled with the weakness of the political system and of the government – created a context for the withdrawal policies implemented in 2020–21, and highlights the importance of increasing pension knowledge among workers as a way of avoiding these harmful policies in the future.

Our analysis at the individual level shows that older payroll workers, with a higher level of education and with a higher income, also display a higher level of pension knowledge. Furthermore, the presence of a retiree in the household also enhances knowledge of this topic. Hence, the results of Landerretche and Martínez (2013) can be confirmed. Some reasons for this finding might be the direct access to an additional source of information regarding the pension system, or might be due to other household members being more inclined to learn about the system because of their personal relationship with a pensioner.

Moreover, we have shown that a link between the different dimensions of regional development and the level of pension knowledge exists. This means that inhabitants of regions with superior levels of quality of life, greater access to job opportunities, and greater connection capabilities obtain significantly better levels of pension knowledge. Furthermore, the positive relation between regional development and pension knowledge can be maintained when controlling for the geographical area. For the case of connectivity, this can also be maintained when controlling for the average size of municipalities.

Our results indicate that not only individual but also environmental characteristics are important when analyzing Chileans' pension knowledge. On the one hand, there are learning mechanisms driven by social interaction (informal), such as family and work, and on the other those that can be accessed remotely. This means that citizens who find themselves in disadvantaged socioeconomic situations and who reside in regions with fewer opportunities, face greater difficulty when trying to obtain information about the Chilean pension system. Accordingly, education programs on pension schemes should focus on this group. Some ways to enhance pension knowledge might include formalizing the previously mentioned social instances. For example, creating educational programs in the context of work or social platforms may prove useful. Moreover, as we have shown by focusing our analysis on the different components of the dimension of connectivity, improving regional possibilities for internet access also proves useful vis-à-vis developing financial literacy, due to the greater availability of information. Therefore, a regional approach also appears crucial.

The limitations of this study lie in the impossibility of controlling for other factors which impact an interviewee's behavior, circumstances, or opportunities. This includes for example the possibly of the person participating in an educational program or the existence of family, friends, or colleagues who have some type of expertise in the financial or pension system. Due to the nature of the data, we also do not know how long the interviewee has resided in the region in question, making it impossible to include the duration of their exposure to the regional characteristics. As indicated in Section 3, the IDERE was used as an approximation for the differences present in each region of Chile and the associated opportunities of receiving an education. However, other parameters may also serve to conduct a regional comparison, such as the level of financial inclusion (access to financial products or services, number of bank branches or ATMs, etc.) or the level of trust in institutions. Finally, it is important to remember that this paper groups members of pension funds by region. Therefore, future research could take the approach of a different division and investigate pension knowledge at a provincial or municipal level.

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Appendix A: Questions regarding pension knowledge

Table A1. Codification of questions on pension knowledge which constitute the PKI

Area	Concept	Codification
Percentage of contribution	Correctly indicates the range of values in which the percentage of contribution to AFPs is found	1 = Between 10 and 13% 0 = Different value
Statement of accounts	Indicates that they received information regarding the personal account from AFPs	1 = Yes 0 = No; Does not know
Amount	States that they know the amount of funds accumulated in their personal account	1 = Yes 0 = No; Does not know
Percentage AFP fees	Correctly indicates the range of values in which the percentage of fees charged by the AFPs is found	1 = Between 0.2 and 2% 0 = Different value
Existence of multifunds	Indicates that they know about the existence of multifunds	1 = Yes 0 = No
Number of multifunds	Correctly states the number of funds available within the system	1 = 5 0 = Others
Retirement modalities	Indicates at least two different retirement modalities (either programmed withdrawal, life annuity, or a variation of the two)	1 = 2 or more 0 = Others
Basic solidarity pension (PBS) requirements	Correctly indicates at least two requirements to qualify for the PBS	1 = 2 or more 0 = Other

Source: Own presentation based on EPS (2015) data.

The questions used to create the PKI are presented below. The answers 'Do not know' and 'No answer' are available for all questions. The questions are presented according to the dimension they refer to. For some dimensions, more than one question was asked. Table 8 shows the number of possible points per question.

1. Percentage of contribution to AFP

1.1 Do you know what percentage of your taxable income is deducted on a monthly basis as contributions to the pension system?

1.1.1 What percentage?

1.1.2 Where do you think your percentage is located within the overall range for contributions?

Possible answers to question 1.1 are 'Yes' and 'No'; in the case of 'Yes', the question continues by asking the percentage. In the case of 'No', a card with alternatives is shown. Correct answers to both 1.1.1 and 1.1.2 are used for the index.

2. Personal information

2.1 Have you received any statement of accounts from your AFP within the last 12 months?

2.2 Do you know the amount of funds accumulated in your personal account?

Possible answers to question 2.1 are 'Yes', 'No', and 'I have never received a statement of account' (the latter is considered 'No'). Question 2.2 works in a similar way to question 1.1.

3. Administration fees charged by AFPs

3.1.1 Do you know how much your AFP charges for administering your funds?

3.1.2 Where do you think your percentage is located within the overall range for administration fees?

Question 3.1 is conducted in a similar way to question 1.1. Moreover, 'They do not charge' is a possible answer, which is treated the same way as the answer 'No'.

4. Multifunds

4.1 Are you familiar with multifunds or have you heard of them?

4.1.1 Do you know how many different types of funds exist?

4.1.1.1 How many types of funds exist?

4.1.2 Do you know in how many of these funds you can invest your pension savings?

4.1.2.1 In how many types of funds can you invest your pension savings?

Possible answers to question 4.1 are 'Yes' and 'No'; if interviewees answer 'Yes', they are further asked about the number of funds and the number of funds one can invest in.

5. Pension payout modalities

5.1 Do you know about the different pension payout modalities?

5.1.1 Which modalities do you know?

Possible answers to question 5.1 are 'Yes' and 'No'; if interviewees answer 'Yes', they are then asked about the modalities. Possible correct answers to the second question are 'scheduled withdrawal', 'annuity', 'temporary income with deferred lifetime income', and/or 'lifetime income based on programmed withdrawal'.

Appendix B: ANOVA test for the PKI

Table B1. ANOVA test

PKI (min = 0; max = 8)			
Total sample			
Mean	2.625		
SD	1.708		
Variable	Mean	SD	*F*-statistic
Gender			
Female	2.601	1.688	1.87
Male	2.647	1.728	
Age			
18–25	2.046	1.462	204.49***
25–39	2.715	1.700	
40–65	2.997	1.771	
Over 65	2.013	1.334	
Education			
Primary education or less	2.079	1.398	229.59***
High school education	2.509	1.622	
Higher education	3.074	1.860	
Marital status			
Married	2.840	1.755	96.33***
Single	2.366	1.623	
Separated	2.809	1.713	
Employment status			
Payroll employee	3.125	1.783	340.11***
Self-employed	2.432	1.634	
Unemployed	2.240	1.543	
Household monthly income quartiles			
First income quartile	1.976	1.418	190.44***
Second income quartile	2.349	1.521	
Third income quartile	2.581	1.651	
Fourth income quartile	3.121	1.851	
Household composition			
Retirees at home	2.777	1.722	24.91***
Opinion on institutions			
AFP opinion (1 = Very positive; 5 = Very negative)	2.625	1.708	27.43***
Inhabitants by municipality			
Less than 20,000	2.850	1.596	22.67***
Between 20,000 and 30,000	2.457	1.694	
Between 30,000 and 40,000	2.494	1.688	
Between 40,000 and 60,000	2.483	1.625	
Over 60,000	2.803	1.748	
Geographic zone			
North	2.225	1.516	38.03***
Central region	2.564	1.722	
South	2.619	1.653	
Metropolitan	2.804	1.747	
Observations	10,170		

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.
Source: Own elaboration based on EPS (2015) and IDERE (2015) data.

Appendix C: Selected dimension of the index on regional development

Table C1. Dimensions of the index on regional development, and their description and sources

Dimension	Variable	Description	Source (2015)
Education	Schooling	Regional mean years of schooling	CASEN
	Illiteracy	People who cannot read or write compared to the regional total	CASEN
	SIMCE eighth grade languages	Regional mean score in SIMCE test (eighth grade languages)	Agency for Quality Assurance in Education
	SIMCE eighth grade math	Regional mean score in SIMCE test (eighth grade math)	Agency for Quality Assurance in Education
	High school enrollment	High school enrollment rate compared to the national population between 14 and 17 years of age	MINEDUC
	Early childhood education enrollment	Enrollment rate in early childhood education programs compared to the national population between 4 and 5 years of age	MINEDUC
	Enrolled in professional degrees	Rate of people enrolled in professional careers compared to the regional population	CNED
	Enrolled in technical degrees	Rate of people enrolled in technical careers compared to the regional population	CNED
Economic welfare	People living in poverty and indigence	Rate of the regional population who live in poverty and indigence	CASEN
	Income of self-employed workers	Regional average income of self-employed income workers	CASEN
	Housing quality	Rate of people living in homes in acceptable conditions according to the Global Housing Quality Index compared to the regional total	CASEN
	Overcrowding	Rate of people living in overcrowded households compared to the regional total	CASEN
Economic activity	Income per AFP member	Average income of AFP members	SII
	Unemployment	Average mean unemployment	INE
	Specialization in manufacturing and services industry	Share of manufacturing industry and services (financial and business) in regional GDP	Central Bank
	Diversification of the production sector	Difference between the diversification of the regional production sector and that of a theoretical region with a balanced production structure	SII
Connectivity	Broadband connections	Rate of broadband connections per inhabitant	SUBTEL
	Telephone lines	Rate of telephone lines per inhabitant	SUBTEL
	Paved roads and highways	Portion of kilometers of paved roads and highways of national roads and highways	MOP

Note: CASEN is a survey on socioeconomic characteristics; SII is the Internal Revenue Service; INE is the National Institute of Statistics; SUBTEL is the sub-secretary of telecommunications; MOP is the Ministry of Public Works.
Source: Index on Regional Development. IDERE (2019) data.

Table C2. Regional indicators, national mean, and range by geographic region

Geographic region	Region	IDERE (education)	IDERE (economic welfare)	IDERE (economic activity)	IDERE (connectivity)
North of Chile	Arica and Parinacota	0.725	0.428	0.410	0.226
	Tarapacá	0.645	0.540	0.475	0.393
	Antofagasta	0.715	0.617	0.497	0.448
	Atacama	0.596	0.521	0.440	0.210
	Coquimbo	0.635	0.463	0.369	0.223
Center of Chile	Valparaíso	0.716	0.522	0.462	0.430
	O'Higgins	0.582	0.453	0.440	0.253
	Maule	0.584	0.377	0.435	0.164
	Biobío	0.662	0.441	0.409	0.260
South of Chile	Araucanía	0.584	0.332	0.367	0.136
	Los Ríos	0.571	0.453	0.462	0.276
	Los Lagos	0.618	0.453	0.508	0.247
	Aysén	0.481	0.594	0.389	0.243
	Magallanes	0.676	0.704	0.426	0.406
Capital	Metropolitan	0.721	0.595	0.527	0.584
Chile		0.634	0.499	0.441	0.300

Source: Own elaboration based on IDERE (2015) data.