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## Article

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## COMPLEX PENSION PRODUCTS: A MULTIDIMENSIONAL APPROACH<sup>1</sup>

JOANNA RUTECKA-GÓRA <sup>2</sup>, SYLWIA PIEŃKOWSKA-KAMIENIECKA <sup>3</sup>, JOHN A. TURNER <sup>4</sup>

### Abstract

The study analyzes and assesses the economic and linguistic complexity of individual retirement products in Poland. For this purpose, an original multidimensional approach was used and various research methods were applied. We analyzed 75 out of 86 individual pension products (IKEs and IKZEs) offered in Poland in the first half of 2017, covering our analysis of nearly 90% of Poland's market of individual pension products. We performed the nonparametric Spearman's rank correlation analysis, we used hierarchical cluster analysis, analysis of variance, and a chi-square test to verify if there was a statistical relationship between the clusters and the type of financial provider and the type of individual pension product (IKE or IKZE). We also built also a map of the products that shows their economic and linguistic complexity. We find that high-fee products tend to have the most complex fee systems, suggesting that the complex fee system may be a strategy used by the providers of individual retirement products. Our results also indicate that individual retirement products are too complex for most individuals.

**JEL classification:** J3, G53, O16

**Keywords:** Supplementary Pension Plans, Individual Retirement Accounts, Linguistic Complexity, Economic Complexity, Investments

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## INTRODUCTION

Well-being in retirement depends on many choices regarding both the final stage of the disposition of wealth at retirement (Clark et al., 2019), and also earlier when people make crucial decisions about saving for retirement (McKenzie & Liersch, 2011). Managing pension savings has economic (e.g. source of contributions, expected value on the savings account) and personal dimensions (e.g. risk aversion, preferences on portfolio composition) (Konicz & Mulvey, 2015). Pension reforms around the world shifted the financial risk onto consumers, increasing the importance of individual choice. With a larger role of defined-contribution (DC) plans in pension systems than defined-benefit plans, future pensioners are exposed to greater risk (Vickerstaff & Cox, 2005; Hinrichs, 2021, Gierusz et al., 2022). Wealth accumulation under DC plans depends on how the participant allocates assets across different investment options (Poterba et al., 2007). The expansion and innovation of financial markets have increased the importance of finance, financial markets, and financial institutions to the workings of the economy (Gerald & Suntae, 2015; Hodula & Ngo, 2022). In aging societies, retirement savings are one of the most important financial assets. Thus, these changes have led to the importance of such factors as cost efficiency in pension plans and their simplicity for participants. Bikker et al. (2012) point out that complex financial products raise costs and affect financial market returns. However, some other authors found that although financial markets are often an example of growing complexity in the modern world, this complexity may lead to innovations in the market (Wieland, 2015; Farmer et al., 2012).

The market for supplementary pension plans is often complicated in its institutional structure and products offered. This complexity might cause problems for individuals when they make decisions about supplementary pension saving, especially when potential savers want to compare individual pension products. Decision-making difficulty occurs because these products come in a wide variety of forms. Potential investors choose from many pension fund options with different risk profiles and complex fees (Harrison et al., 2006; Turner, 2013; Samborski & Turner, 2015; Rutecka-Góra, 2019; Rutecka-Góra et al., 2020; Dziawgo, 2022). For individuals, complexity arises at the extensive margin, which relates to the range of products, and at the intensive margin, which relates to the complexity of each product.

Decision-making in Poland becomes even more problematic given the low level of Poles' financial knowledge and financial literacy. Pieńkowska-Kamieniecka et al. (2021) found that men, people well-educated and living in cities have higher knowledge of pension issues. At the extensive margin, they might

decide not to participate in supplementary pension schemes because they find the decisions to be too complex. At the intensive margin, individuals might purchase inappropriate products that do not fit their needs. A provider might intentionally design complex products and services to make it difficult for potential clients to research across competing products or services. High-fee or high-priced providers sometimes use this strategy (Turner, 2013; Muller & Turner, 2016; Cash & Tsai, 2018). Complexity raises the individual's costs to search for pension products, making it less likely that the potential client will choose a lower-priced competitor.

This study analyses the complexity of individual supplementary pension products in Poland. For economic complexity, we base our analysis on data from the supplementary pension products market in Poland. The assessment of linguistic complexity uses data from the study by Rutecka-Góra et al. (2020) however, we present our synthetic index of linguistic complexity. We also study in more depth the details that increase the economic complexity of retirement contracts.

Following the introduction, Section 2 provides a literature review of supplementary pension schemes and their complexity for individual savers. This section describes the basic characteristics of individual retirement plans in Poland and presents the Poles' levels of financial knowledge and pension awareness. Section 3 describes the data and methodology for analysing the economic and linguistic complexity of individual pension products. Section 4 reports the empirical results, and Section 5 discusses them. Section 6 provides our conclusions.

## LITERATURE REVIEW

### RESEARCH BACKGROUND

With the development of the Polish financial market over time it has offered increasingly diverse financial products that can improve people's financial situations in old age. However, the complexity of these products for participants might diminish the positive economic results of these advances (Cwynar, 2020). Only a few empirical analyses cover the functioning of supplementary pension provision in Central and Eastern European countries (e.g. Szczepeński, 2010; Rutecka-Góra et al., 2020; Chłoń-Domińczak et al., 2020). This is due to problems with microdata availability on the functioning of supplementary pension systems and individual pension decisions made by participants in the system.

Some studies assess the financial literacy and motivations of pension participants, specifically looking at pension planning and attitudes about security in old age (e.g. Pieńkowska-Kamieniecka et al., 2021; Rutecka

-Góra & Pieńkowska-Kamieniecka, 2023). However, these studies do not address the complexity of financial market products concerning the financial knowledge of individual savers.

The complexity of individual pension products can be analysed in several dimensions (Turner, 2013; Rutecka, 2014; Muller & Turner, 2016; Rutecka-Góra et al., 2020). These dimensions include the complexity of the supplementary pension system’s architecture; the variety of available financial instruments within a scheme; the financial mechanisms of pension products; the complexity of the language and structure of contracts; the fee structures; and the tax incentive system.

**INDIVIDUAL PENSION PLANS IN POLAND’S OLD-AGE PENSION SYSTEM**

Supplementary old-age pension schemes in Poland consist of individual and collective schemes. Both types of schemes are very important for providing individuals with adequate benefits in old age because the public DC pension system offers relatively low replacement rates amounting to 38.2% and 32.1% for men and women respectively (Szczepański et al., 2022).

In this paper, we focus on information complexity in the supplementary individual pension plans in Poland. Third-pillar individual pension saving schemes take the form of individual retirement accounts (IKE in Polish) and individual retirement security accounts

(IKZE in Polish), which were introduced in 2004 and 2012, respectively. All individual pension product contracts are voluntary. An individual can have only one IKE plan and only one IKZE plan. There is no official data on how many individuals have both IKE and IKZE accounts. Official statistics report only that at the end of 2002 the coverage rate was 4.78% for IKE and 2.84% for IKZE (Commain et al., 2023). The key differences between IKE and IKZE plans are their tax treatment and contribution limits. In IKE plans, the tax treatment is TEE, meaning that contributions are taxed but investment earnings and benefit payments are tax-exempt. In IKZE, the tax regime is EEt, meaning that contributions and investment earnings are exempt and that benefit payouts are taxed at a reduced rate, as indicated by the lowercase t. Thus, IKZE plans receive more favorable tax treatment than IKE plans. IKE plans, however, have a considerably higher contribution limit than IKZE plans. The cap on annual contributions in IKE plans is 300% of the monthly average wage (20,805 PLN in 2023, or about 44,749 USD). In IKZE plans, the cap is 120% of the monthly average wage (8,322 PLN, or about 1,900 USD) (more: Rutecka-Góra & Rutkowska-Tomaszewska, 2023).

The complexity facing pension participants arises in part because Poland has five different types of pension investment providers, each providing different types of investments. The types of pension providers and investments are explained below.

**Table 1: IKEs and IKZEs assets by pension fund provider at the end of 2017**

	Life insurance companies	Investment fund companies	Banks	Pension fund companies	Brokerage house companies	Total
Number of companies	16.00	20.00	8.00	14.00	8.00	66.00
Assets (mIn PLN)	3,137.27	3,166.80	1,379.36	1,687.95	296.80	9,668.18
% of assets	32.45	32.75	14.27	17.46	3.07	100.00
Average assets per company (mIn PLN)	196.08	158.34	172.42	120.57	37.10	146.49

Source: The Polish Financial Supervision Authority (UKNF) [https://www.knf.gov.pl/knf/pl/komponenty/img/IKE\\_IKZE\\_12\\_2017\\_61392.pdf](https://www.knf.gov.pl/knf/pl/komponenty/img/IKE_IKZE_12_2017_61392.pdf) (Accessed: 02.01.2024).

In all of the investment products available to participants in IKE and IKZE plans, the investment risk is borne entirely by the participant. Table 1 provides data

on the different types of pension providers. Table 2 summarizes the different types of fees.

**Table 2: Types of fees charged by different types of pension providers**

Type of fee	Life insurance companies	Investment fund companies	Banks	Pension fund companies	Brokerage companies
Account opening fee	X	X			
Fee on contributions	X	X		X	
Management fee	X	X		X	X
Loyalty fee discount		X		X	
Handling (transaction) fee		X			
Asset transaction fee					X
Early termination fee	X	X	X	X	X

Source: Authors' research.

**LIFE INSURANCE COMPANIES**

The IKE and IKZE market is dominated by life insurers and investment fund companies. These firms manage roughly 85% of the individual retirement accounts. Individual retirement accounts (IKE) and individual retirement security accounts (IKZE) offered by life insurance companies are unit-linked life insurance policies that combine the insurance and saving functions.

All of the products we analysed allow pension savers to choose funds from an array of insurance capital funds (UFKs) with different risk profiles. The insurance products have an extensive fee system that makes it difficult for most people to compare their fees. The fee system includes an account opening fee, a fee on contributions, a management fee sometimes charged by the insurance company and the investment fund companies that manage the fund, and a liquidation fee if the participant terminates the contract within twelve months of its start. The institutions also can collect other fees related to the high volatility of the investment portfolio, but also a conversion fee and a fee if the participant changes the premium allocation.

**INVESTMENT FUND COMPANIES**

Individual pension products offered as investment funds by investment fund companies (TFI) operate similarly to insurance capital funds. A saver can choose more than one fund. The contributions, after fee deductions, are used to purchase units of investment funds with various risk profiles. The number of available funds varies considerably among institutions, up to as many as thirty.

Products offered by investment fund companies have an even more complex fee system than products offered by insurance companies. In addition to a fee on

contributions, a management fee, and a liquidation fee, some providers charge a fee for opening an account. Some charge a handling fee based on the difference between the purchase or sale price of the unit and its current value. The handling fee means that the participant buys (or sells) the units of the investment/insurance fund at a price that is higher (or lower) by a certain percent than the current value of a unit. It may apply only to purchase or only to sale or to both.

Some institutions also have loyalty programs that offer lower fees. The reduction in fees depends not only on the saving period or tenure with the plan, but also on the amount savers spend in fees and premiums and on the saver's age. Loyalty programs with these complex structures can make it even more difficult for individuals to understand and compare the fees for these products.

**BANKS**

Savings accounts offered by banks as IKEs or IKZEs are among the most conservative of the investment products. They are offered with a variable interest rate. However, the methods of setting the interest rate and of calculating the interest require savers to understand various capitalisation practices (e.g., annual capitalisation versus daily capitalisation). These products do not have distribution and management fees, except a possible fee for terminating a contract within twelve months since its start (Rutecka-Góra, 2021).

**PENSION FUND COMPANIES**

Pension fund companies (PTE) offer IKEs and IKZEs for investing the pension savings contributed by individuals. Almost all pensions fund companies offer only one voluntary pension fund with an active allocation

strategy. The system of fees is much less complex than for those charged by life insurance companies and investment fund companies. Pension fund companies charge a fee on contributions and asset management fees, both fixed and variable.

**BROKERAGE COMPANIES**

The most complicated and most flexible mechanism available for IKEs and IKZEs is a security account in a brokerage house. It allows the participant to invest pension savings directly in publicly traded securities and fit the investment portfolio to individual needs. However, this option is for people with high levels of financial knowledge and competence. The cost can also be high. The individual is charged for transaction costs relating to buying and selling assets. A saver can avoid those fees by investing in fixed-rate or inflation-based government bonds through a brokerage house. In this case, the cost structure includes an account management fee and sometimes a liquidation fee.

**DATA AND METHODOLOGY**

**DATA**

We analyse 75 out of 86 individual pension products (IKEs and IKZEs) offered in Poland in the first half of 2017. These products were offered by 10 life insurance companies (14 products), 15 investment fund companies (30 products), 9 banks (9 products), 8 pen-

sion fund companies (12 products), and 6 brokerage houses (10 products). The 75 products included 43 IKEs and 32 IKZEs, covering nearly 90% of Poland’s market of individual pension products. Products for which contract terms were unavailable online or by email with providers were excluded.

**LINGUISTIC COMPLEXITY**

We assess the linguistic and economic complexity of individual retirement products. For linguistic complexity, we studied three dimensions of key documents: the transparency level, FOG index, and difficulty class.

First, the transparency level (Table 3) measures how text formatting influences the reader’s perception of a text’s complexity. We used a transparency measure proposed by Rutecka-Góra et al. (2020) as well as Hadryan and Rutecka-Góra (2023). It takes into account formatting features of written contracts. For example, a text is less complex if the font size is at least 10 points and if paragraphs have a maximum of 15 lines. The measure also applies to the analysis of graphics (e.g. headings, graphs, tables), metatext (e.g. table of contents, summary), and direct phrases (e.g. sign the contract). The maximum number of points is five (one point in each of the above areas), which would mean that product documentation is fully transparent.

**Table 3: Transparency level measure**

Total points granted (for font size, structure, graphics, metatext, and direct phrases)	Level of text transparency
0-1	Very low
2	Low
3	Medium
4	High
5	Very high

Source: Authors’ research based on Rutecka-Góra et al. (2020) as well as Hadryan and Rutecka-Góra (2023).

Among the analysed products, only two received five points (high transparency). The rest scored three or less, with most scoring less than three, which means low or very low transparency.

The second measure of linguistic complexity we used is the FOG index (Gunning, 1952). This index measures the complexity of text based on sentence length and word difficulty. In Polish, words considered difficult are those consisting of four or more syllables (In English, the FOG index considers words of three or more syllables as difficult). The FOG index score indicates how many years of education are necessary to understand a text. It is calculated according to the following formula (Gruszczyński & Ogrodniczuk, 2015):

$$T = 0.4 * (T_w + T_s) \tag{1}$$

$T_w$  is the average number of words in a sentence, and  $T_s$  is the percentage of difficult words in a text.

The third aspect of linguistic complexity is the difficulty class, which we measured using the Jasnopis application. Polish linguists and psychologists created this in 2015 (Gruszczyński & Ogrodniczuk, 2015). This measure is much more comprehensive than the FOG index because it includes 20 measures of text complexity and is based on psycho-linguistic studies of Poles. For example, it includes nouns-to-all-words ratio, verbs-to-all-words ratio, nouns-to-verbs-ratio, the average paragraph length, the average word length and the average sentence length. According to its assumptions, individu-

al pension products have ranged in difficulty class from one to seven in relation to the stages of education in Poland required to understand a given text, as ex-

plained in Table 4. Most were rated as six or seven in difficulty.

**Table 4: Difficulty class of the texts determined by the Jasnopis application**

Class	Characteristics	Indicative stage of education
1	Extremely easy text	Primary school grades 1-3*
2	Very easy text	Primary school grades 4-6*
3	Easy text, understandable for the average Pole	Junior secondary school*
4	Somewhat more difficult text	Secondary school*
5	More difficult text	Bachelor's/Engineering degree
6	Difficult text for the average Pole	Master's degree
7	Text very complicated/professional, whose understanding requires specialist knowledge	Doctoral degree or specialisation in the field of the text

\*According to the stages of education in Poland organised before education reform in Poland in 2017

Source: Gruszyński and Ogrodniczuk (2015).

To assess the total value of the linguistic complexity, we added the scores for difficulty class (dc), FOG index, and the transparency level (tl). However, in the case of the transparency level, we first multiplied the scale by -1 to adjust it to the other two parameters. A higher value of the linguistic complexity index (LCI) parameter indicates a less understandable text.

$$LCI = dc + FOG\ index - tl \quad (2)$$

A higher value of the linguistic complexity index means that the pension product text was less understandable for the participant. Considering the ranges of the components of the formulas shown above, we assigned the following interpretation of LCI level as a measure of linguistic complexity:

- less than 10 - very low,
- 10 - 12.99 - low,
- 13 - 15.99 - average,
- 16 - 18.99 - high,
- 19 and more - very high.

### ECONOMIC COMPLEXITY

In our study, the economic complexity index (ECI) is the sum of the ratios for four features: 1) the complexity of the economic mechanism ( $c_{em}$ ); 2) the number of funds available within a given product ( $nf$ ); 3) the complexity of the rules determining the rate of return ( $c_r$ ); and 4) the complexity of the fee system related to a product ( $c_f$ ), counted as the number of fees charged, except a cancellation fee. We exclude the cancellation fee because it is not part of the ongoing fund fee structure.

$$ECI = c_{em} + nf + c_r + c_f \quad (3)$$

In each of the above aspects of economic complexity, we assigned points on the scale according to the criteria shown in Table 5. As with the linguistic complexity index, a higher sum of points indicates a more economically complex retirement product.

**Table 5: The points scale in particular categories of economic complexity index (ECI)**

Complexity of the economic mechanism	Number of funds available	Complexity of the rules determining the rate of return/interest rate	Complexity of a fee system (number of fees charged)
0 - a bank account	0 - 1 fund	0 - fixed rate or a rate based directly on external indexes (clear mechanism, e.g. 40% of index A)	0 - no fees (except cancellation fee)
1 - one pension fund	1 - 2-5 funds	1 - a rate of return resulting directly from the market prices of financial instruments	1 - only one fee (usually management fee)
2 - a portfolio of investment funds	2 - 6-20 funds	2 - rate depending on the decision of financial provider representatives, even if related to some extent to external indices	2 - two fees
3 - a unit-linked life insurance	3 - more than 20 funds available on the market		3 - three fees etc.
4 - an account in a brokerage house (direct investing in financial markets)			

Source: Author's own research.

**STATISTICAL METHODOLOGY**

To better understand the economics of complexity of pension products, we investigate if and how the costliness of individual pension products relates to their economic and linguistic complexities. We also investigate whether there is a relationship between economic and linguistic complexity, which might suggest a marketing strategy of complexity, perhaps to increase participants’ search costs across products.

In our analysis, we first standardised the linguistic and economic complexity measures. We calculated the linguistic complexity index and economic complexity index for each product using the formulas and scales described above. Then we used hierarchical cluster analysis to determine which products were similar and how many product groups we could distinguish. The results demonstrated the possibility of three or four such clusters. In the next step, using the k-means clustering method, we chose a variant with four clusters. Then, using analysis of variance, we checked to see if the clusters differed in terms of the mean values of the variables. Then we did a chi-square test to verify if there was a statistical relationship between the clusters and the type of financial provider and the type of individual pension product (IKE or IKZE).

Finally, we verified if and how the costliness of individual pension products related to their economic and linguistic complexities. We also checked to see if there was any relationship between economic and linguistic complexity. We performed the nonparametric Spearman’s rank correlation analysis. We used the fol-

lowing variables for the analyses of dependence: cost ratio (CR), the economic complexity index (ECI), and the linguistic complexity index (LCI).

The cost ratio is the ratio of fees to contributions. We calculated the cost ratio for five years (see: Pieńkowska-Kamieniecka et al., 2021). We considered three types of fees charged by voluntary pension funds, asset management companies, and life insurance companies. These are fees for opening an account, fees on contributions, and management fees. In the case of banks, where saving is cost-free, we used the cancellation fee charged by banks if the pension account was closed within the first year of its opening. We assessed the costliness of individual pension products by using the level of fees charged by financial institutions in the first half of 2017.

Correlation analyses were conducted separately for banks, voluntary pension funds, investment management companies, and life insurance companies. We excluded brokerage houses due to the lack of data on investment portfolios and behaviors of individual savers that made costliness assessments impossible.

**EMPIRICAL RESULTS**

Our examination of 75 retirement products finds that the majority of them are very complicated in linguistic and economic terms (Table 6 and Table 7) with average linguistic and economic complexity levels, in points, 19.38 and 7.27, respectively (Table 8). We discuss these results in this section.

**Table 6: Linguistic Complexity Index (LCI) – number of products in each class by type of provider**

Level of complexity (LCI score)	Life insurance companies	Investment fund companies	Banks	Pension fund companies	Brokerage house companies	Total
Very low (less than 10)	0	1	0	0	0	1
Low (10 - 12.99)	0	0	0	0	0	0
Average (13 - 15.99)	2	2	0	5	2	11
High (16 - 18.99)	2	7	0	1	3	13
Very high (19+)	10	20	9	6	5	50

Source: Author’s own research.

**Table 7: Economic Complexity Index (ECI) – number of products in each class by type of provider**

Level of ECI (score)	Life insurance companies	Investment fund companies	Banks	Pension fund companies	Brokerage house companies	Total
Very low (0-2)	0	0	9	0	0	9
Low (3-5)	0	0	0	12	0	12
Average (6-8)	7	26	0	0	0	33
High (9-11)	7	4	0	0	0	11
Very high (12+)	0	0	0	0	10	10

Source: Author’s own research.

**Table 8: General characteristics of the basic values of the linguistic complexity index (LCI) and economic complexity index (ECI) of the individual pension products\***

Specification	Min.	Max.	Av	SD	LI	IFC	BH	B	PFC
LCI	9.63	24.06	19.38	2.94	19.29	20.04	18.8	20.46	17.54
ECI	0.00	18.00	7.27	3.75	8.36	7.37	14.4	1.11	4.42

\*LI - life Insurers, IFC - Investment Fund Companies, BH - Brokerage Houses, B - Banks, PFC - Pension Fund Companies

Source: Author's own research.

When analysing the linguistic complexity of individual pension products by the type of institution, the lowest level (9.63) was for a product offered by an investment fund company, and the highest level was for insurance products (24.06). The average level of 19.38 is a high level of linguistic complexity.

For economic complexity, the lowest value was for a bank product (0.00) and the highest was for brokerage houses (18.00). The average level of economic complexity was 7.27. Thus, we find a higher level of linguistic complexity than economic complexity. The products are more complex in their linguistic presentation than in their economic structure.

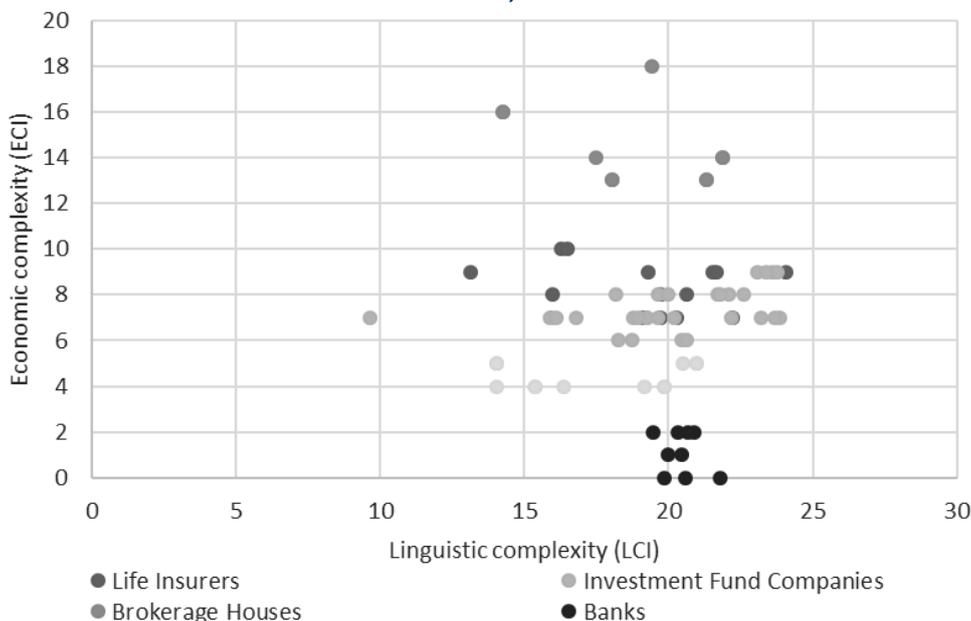
For the linguistic complexity by type of product (IKE, IKZE), the number of points ranged from 9.63 to 23.08 for IKE, and from 13.15 to 24.06 for IKZE. For the economic complexity index of individual pension products, it ranged from 0.00 to 16.00 for IKE, and from 2.00 to 18.00 for IKZE. Thus, the more popular IKE contracts are slightly more readable and less complex. However, both types of retirement products have large variations among the values of the indicators of linguistic

and economic complexity for the same products. This result suggests that much of the complexity is unnecessary.

In the next step, we analysed the scatter diagram of the data showing the linguistic complexity index and the economic complexity index for every retirement product we examined. First, we analysed the linguistic complexity LCI and economic complexity ECI of each individual pension product concerning the type of financial provider (Figure 1).

Our findings show that the pension products offered by banks have low economic complexity but the documents explaining them have a relatively high linguistic complexity. Pension products provided by brokerage houses have a relatively high degree of economic complexity and varying degrees of linguistic complexity. Overall, there appears to be no relationship between economic complexity and linguistic complexity, so economic complexity can be explained with simple language and lack of economic complexity can be explained with complex language.

**Figure 1: Linguistic vs economic complexity of individual retirement products by type of financial providers in Poland, 2017**

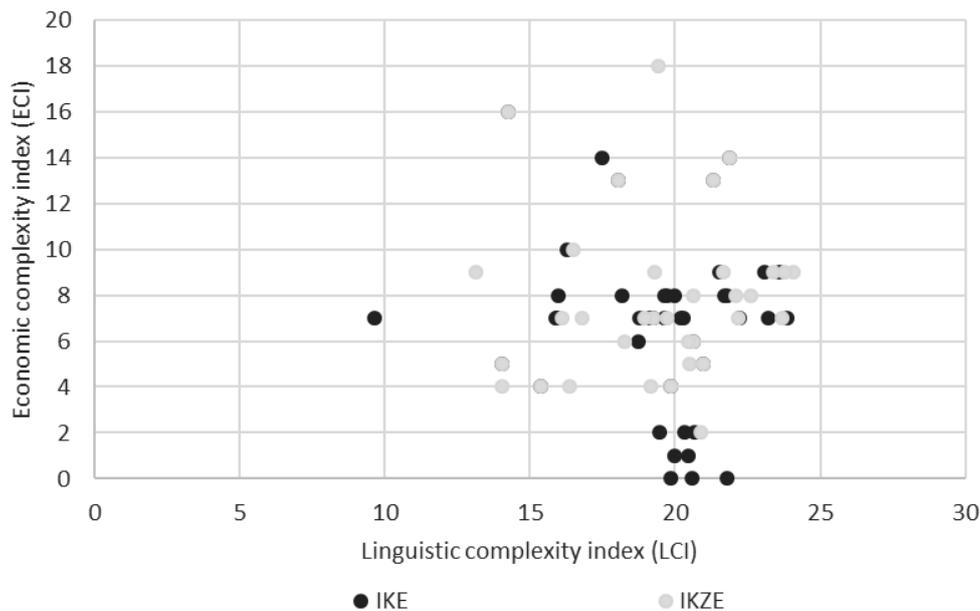


Source: Author's own research.

Figure 2 suggests that the IKE plans tend to have lower economic complexity than the IKZE plans, and there appears to be no relationship between plan type and linguistic complexity. As mentioned earlier, IKE plans have a considerably higher contribution limit than IKZE plans and thus are designed for higher-income

workers, who presumably have higher levels of financial literacy. This finding suggests that more complex plans are provided to workers with lower financial literacy. However, this is not supported by the cluster analysis.

**Figure 2: Linguistic and economic complexity of individual retirement accounts (IKE) vs. individual retirement savings accounts (IKZE) in Poland in 2017**



Source: Author's own research.

In the next stage of our study, we examined whether it is possible to create groups of individual pension products that are similar within groups but differ across groups in their linguistic and economic complexity. The

cluster analysis reveals four groups (Table 9), and the analysis of variance indicates that the average values of variables are significantly different ( $p < 0.05$ ) between them (Table 10).

**Table 9: The results of the clustering pension products into similar groups**

Specification	Cluster 1	Cluster 2	Cluster 3	Cluster 4
LCI	-0.19833	0.29262	-1.48191	0.54475
ECI	1.90401	-1.45025	-0.19574	0.03418
N	10.00000	12.00000	15.00000	38.00000

Source: Author's own research.

**Table 10: The analysis of variance**

Specification	Between Sum of Squares		Within Sum of Squares		F	p-value
	Mean square	df	Mean square	df		
LCI	15.213	3	0.399	71	38.084	0.000
ECI	20.704	3	0.167	71	123.636	0.000

Source: Author's own research.

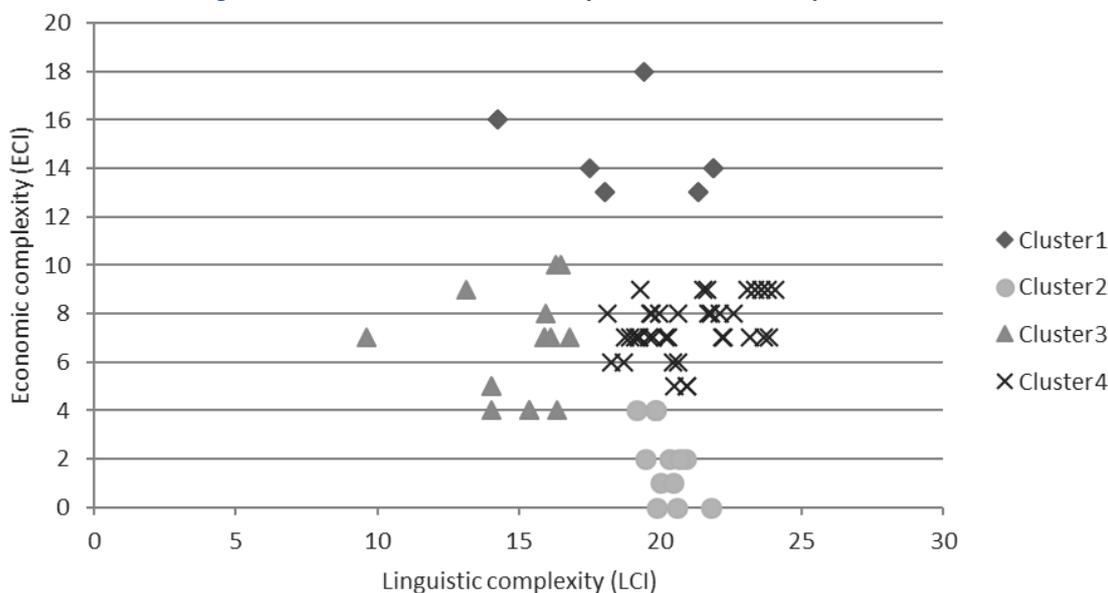
We found that the first group of individual pension products contains IKE and IKZE plans slightly less complicated linguistically and much more complicated economically (low LCI, high ECI) than their average val-

ues. The second group contains products characterised by higher linguistic complexity and much lower economic complexity (high LCI, low ECI). The third group contains simpler individual pension products economi-

cally and especially linguistically (low LCI, low ECI). The fourth group contains products more complex than their average values in both linguistic and economic complexity (high LCI, high ECI).

We also present the results of the cluster analysis on a map. It shows the proximity of the groups of individual pension products (Figure 3).

**Figure 3: The results of cluster analysis for IKE and IKZE products**



Source: Author's own research.

**Table 11: The structure of clusters according to the products offered by various institutions**

The type of the institution	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Banks	0.0%	75.0%	0.0%	0.0%
Brokerage houses	100.0%	0.0%	0.0%	0.0%
Voluntary pension funds	0.0%	25.0%	40.0%	7.9%
Investment fund companies	0.0%	0.0%	33.3%	65.8%
Life insurance companies	0.0%	0.0%	26.7%	26.3%
Total	100.0%	100.0%	100.0%	100.0%

Chi-square = 142.515; p - value = 0.000; V - Cramer = 0.796

Source: Author's own research.

Next, we find statistically significant associations between clusters and the types of financial providers (Table 11).

There is intermediate diversity within investment fund companies and life insurance companies, with both offering pension products in two cluster groups.

By contrast, voluntary pension funds offer products in three different cluster groups, which makes these funds the most diverse financial institution group. In these diverse groups, we argue that complexity may be a strategy adopted by some of the companies.

**Table 12: Distribution of financial institutions by cluster**

Type of financial provider		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
Banks	Number of products	0.0	9.0	0.0	0.0	9.0
	% of products by cluster	0.0%	100.0%	0.0%	0.0%	100.0%
Brokerage Houses	Number of products	10.0	0.0	0.0	0.0	10.0
	% of products by cluster	100.0%	0.0%	0.0%	0.0%	100.0%
Pension Fund Companies	Number of products	0.0	3.0	6.0	3.0	12.0
	% of products by cluster	0.0%	25.0%	50.0%	25.0%	100.0%

Type of financial provider		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
Investment Fund companies	Number of products	0.0	0.0	5.0	25.0	30.0
	% of products by cluster	0.0%	0.0%	16.7%	83.3%	100.0%
Life Insurers	Number of products	0.0	0.0	4.0	10.0	14.0
	% of products by cluster	0.0%	0.0%	28.6%	71.4%	100.0%
All providers	Number of products	10.0	12.0	15.0	38.0	75.0
	% of products by cluster	13.3%	16.0%	20.0%	50.7%	100.0%

Chi - square = 142.515; p - value = 0.000; V - Cramer = 0.796

Source: Author's own work.

When analysing the relation between the clusters and the individual pension products (IKE and IKZE), our study does not find any statistically significant dependencies ( $\chi^2 = 4.149$ ;  $p = 0.656$ ). The linguistic and economic complexity depends only on the type of financial institution offering IKE and IKZE, and not on differences between the two types of plans.

In the final part of our paper, we examine the correlations between the cost ratio, economic complexity index, and linguistic complexity index of individual pension products by type of financial institution (Table 13).

**Table 13: Dependencies between the cost ratio (CR), the economic complexity index (ECI), and the linguistic complexity index (LCI) of individual pension products (Spearman's rank correlation)**

Institution	Variables	Correlation coefficient	p-value
Banks	CR and ECI	-0.154	0.715
	CR and LCI	-0.619	0.102
	ECI and LCI	-0.283	0.497
Voluntary pension funds	CR and ECI	-0.641	0.034*
	CR and LCI	-0.070	0.838
	ECI and LCI	0.235	0.487
Investment fund companies	CR and ECI	-0.369	0.045*
	CR and LCI	-0.312	0.093
	ECI and LCI	0.454	0.012*
Life insurance companies	CR and ECI	0.841	0.000**
	CR and LCI	0.232	0.425
	ECI and LCI	-0.236	0.417

Significant individual coefficients indicated by \*\*  $p < 0.01$ ; \*  $p < 0.05$

Source: Author's own research.

First, we find statistically significant correlations between costliness and the economic complexity index for almost all analysed financial institutions (except banks). However, Spearman's correlation coefficient indicates that the direction of dependencies can differ. For the companies that manage voluntary pension funds and investment fund companies, there are negative correlations. In contrast, for life insurance companies, the most popular type of provider, a higher cost ratio is linked to products with higher levels of economic complexity. This could result from insurance companies offering funds managed by external investment fund companies. The management fee is sometimes charged by the life insurer and external managers, which increases the cost ratio.

Second, we find no significant correlations between the costliness of individual pension products and the linguistic complexity in any group of providers. This

suggests that financial institutions do not tend to make costlier products less readable. However, it may also signal that pension product providers do not strategize the linguistic complexity of contracts.

Third, we find a significant positive correlation between linguistic complexity and economic complexity in the products offered by investment fund companies.

## DISCUSSION

A Polish saver must be a university graduate to understand pension contracts, with few exceptions. The linguistic complexity makes it difficult for many Poles to make informed choices, given low levels of financial literacy. This problem could explain, at least in part, the low level of participation by workers in the supplementary pension system. We argue that linguistic complexity is not an inherent feature of these plans

and that steps should be taken to provide documents with lower linguistic complexity.

Our results support the findings by Rutecka-Góra et al. (2020) about the high levels of economic complexity in many individual pension contracts. However, we conducted further analysis and calculated an Economic Complexity Index for each pension product.

The most economically complex individual pension plans are managed by life insurance companies and investment fund companies. This result is surprising in that these are the two most popular providers of IKEs and IKZEs. Moreover, the complexity of plans offered by investment fund companies is associated with complex fee systems. Savers might pay fees for the purchase and sale of fund units, management fees, and fees related to contribution amounts, account balances, or the ages of savers. Because Poles are often overconfident concerning their financial knowledge (OECD 2016), they could mistakenly buy inappropriate pension products and end up with inadequate pension benefits.

Our analysis of products managed by investment fund companies finds a positive correlation between linguistic and economic complexity of the products that together with high-cost ratios might result in many low rate-of-return pension plans. However, if we only compare the cost ratio with the complexity of a fee system, we observe that high-fee products have more complex fee systems. This finding confirms the results of other studies (Turner, 2013; Muller & Turner, 2016).

## CONCLUSIONS

In the supplementary system in Poland, where individuals must choose from many products and bear the full cost of mistakes, the risk of a poor decision is high because of the economic and linguistic complexity of the products. However, there is a large variation among the values of the indicators of linguistic and economic complexity for the same products, suggesting that complexity is a strategy adopted by some companies and is unnecessary. Overall, there appears to be no relationship between economic complexity and linguistic complexity, so that economic complexity can be explained with simple language and lack of economic complexity can be explained with complex language. However, we do find a positive correlation between economic and linguistic complexity for products offered by investment fund companies.

In summary, our results can be grouped into three areas. First, we describe the heterogeneity and com-

plexity of pension products by examining three aspects of pension accounts and contracts: cost, economic complexity, and linguistic complexity. We document considerable heterogeneity in all three aspects of pensions. We find that many pensions have complex fee systems and that the level of linguistic complexity differs across the types of pension providers. However, most providers use linguistically complex documents.

Second, we examine the possible causes of these findings. Linguistic complexity could be the result of intentional marketing strategies designed to make it more difficult for average people to search for less costly providers, thereby allowing high-fee providers to stay in business. Our research shows that the most linguistically complex products are provided by banks; however, banks provide the least economically complex products. Thus, economic complexity is not the cause of linguistic complexity, but by increasing linguistic complexity, providers could be causing potential clients to perceive products as being complex. We also find that high-fee products have highly complex fee systems.

Third, we examine the possible consequences of our findings. Most pension funds provide linguistically complex documents. The consequences of linguistic complexity might include a low level of participation in these products and poor decision-making by people who choose products.

While efforts to raise financial literacy are one possible approach to dealing with these issues, an alternative and perhaps more effective approach would be to focus on policies that require providers to simplify pension-related products and make information about them more readable. For example, the current fee structure for many pension products is highly complex. This system could be simplified so that only an asset management fee is charged. The current system involves numerous fees, making it impossible for many savers to compare products in relation to the fees they will be required to pay. Our proposed fee system would make it easier for savers to compare fees among competing products. Moreover, by introducing this proposal with an official ranking of individual pension products - published by the financial supervisory commission - individuals could protect themselves against the problem of choosing inadequate pension products or products misaligned with their needs and goals.

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