6 EMPIRICAL STUDY REGARDING THE CENTRAL AND EASTERN EUROPEAN COUNTRIES' SOUNDNESS OF PENSION SYSTEMS. TRIANGLE ASSESSMENT: SOCIAL, ECONOMIC, AND FINANCIAL FEATURES OF PENSION SYSTEMS

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Abstract

Nowadays, pension systems are the quid pro quo agenda for governments around the globe supported by the need for more comprehensive and accurate stability of pension systems. The common problems and the historical context of the Central and Eastern Europe Countries as the Czech Republic, Slovakia, Poland, Hungary, and Romania are oriented towards the construction of a new pension system in all these countries. This article tackles the soundness of the pension systems sustainability through three perspectives: first, enhancing the financial aspects of pension systems, second, consolidating the new economic context to ensure stable pension systems, third, more comprehensive and specific social aspects of pension systems to decrease the poverty rate of elderly people. The econometric techniques used in this article have revealed the need for complex reform and reshaping of the pension systems in all Central and Eastern European Countries by taking into account the social features, economic aspects, and financial characteristics of pension systems. The conclusions of this study reveal the strengthening of the pension systems by taking into account factors such as judicial reform, reducing economic failures, and enhancing the social and medical issues of pension systems with a direct impact upon the construction of more sound and sustainable pension systems with strong financial background and flexible approach to eliminate the technical disturbances.

Keywords: central and eastern European countries; econometrics; pension reforms; social inclusion systems; sustainability; financial soundness; economic implications; social security

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1. Introduction

United Nations Organization 2030 Agenda for Sustainable Development (2015) established some bold goals regarding broadening the security and well-being of people. To provide basic social and health services, ensure a decent living, abolish poverty, and support social inclusion, the main mechanisms used by states are social protection systems and pension systems (Chen, Eggleston & Sun, 2018; Chepngeno-Langat, 2019; Walsh et al., 2021; Lee, 2022; Gong et al., 2022).

Social protection systems uphold the fulfillment of the primary needs of human beings as health care and financial security. Pension systems are an essential component of social protection systems providing the financial flow needed for a decent living for elderly people. The main benefits provided by public pension systems are old-age pensions, disability pensions, and survivor pensions.

Central and Eastern European (CEE) countries founded their social protection systems on the principle of intergenerational solidarity and the contribution of the employed population. Improvements in life expectancy, decreasing birth rate, and migration to Western European countries induced a growing old-dependency ratio and a continuous increase in pension expenditures.

To protect the financial sustainability of pension systems, all CEE countries made changes to the parameters of the pension system including increasing the standard retirement age, expanding the minimum contribution period, restricting early retirement, encouraging the postponement of retirement, and increasing the pension contribution rate (OECD, 2021). Hinrichs (2021) finds these measures useful for maintaining the financial sustainability of the pension systems, but they may increase the poverty risk of the elderly.

At the same time, the multi-pillar pension system proposed by the World Bank was implemented by all CEE countries. Ebbinghaus (2021) points out that the structure of pension systems impacts the reproduction of financial inequality, but the income redistributions of public pension systems reduce poverty risks among the older population.

The actuality and importance of the research theme start from the idea that pension system sustainability is a highly important topic in the agenda of governmental bodies, international institutions, and academia due to the importance of social protection programs and pension systems in reducing poverty and ensuring the financial resources needed for a decent living in old age. Even if the pension system sustainability topic was approached to a great extent in literature, the specific situation of CEE countries remains slightly researched. Our purpose is to expand the literature regarding the sustainability of pension systems in the case of five CEE countries: the Czech Republic, Hungary, Poland, Romania, and Slovakia.

The financial stability of a pension system is defined by the balance between the income from social contributions and the state social insurance budget expenditures on benefits provided to beneficiaries. Besides the financial aspects, the economic stability of the pension system regards the health status of the economy in proving the resources for fulfilling the economic strength needed for a comprehensive pension system. The social stability of a pension system regards the quality and quantity of the labor force established as an active population in order to sustain the economic and financial soundness of the pension system in proper social conditions.

The objective of the paper is to provide some new empirical evidence for enhancing the actual role and importance of sustainability of pension systems in three fundamental aspects: financial agenda, economic implications, and social protection and security aspects for all elderly persons. The paper addresses the problem of financial, economic, and social sustainability of pension systems in CEE countries researching the nexus between pension expenditures, demographic

trends, labor market situation, health features, earnings, and tax aspects. Using econometric techniques, it attempted to establish the influence of several key indicators that characterize pension systems on the socio-economic background of CEE countries.

The scope of the research is subsumed by the evaluation and assessment of empirical and econometrical features regarding strengthening the sustainability aspects of pension systems in CEE countries revealing interesting insights in three directions economic, financial, and social dimensions. Consequently, it is very important to reshape the pension system in CEE countries based on the new economic, financial, and social aspects after the pandemic crises.

The conclusions reveal the need for judicial, economic, and social considerations in reforming the pension systems to enhance the sustainability of the pension systems. The econometrical models were analyzed and assessed for the sustainability of pension systems in innovation for a sustainable environment revealing the importance of reshaping the entire pension systems, especially in CEE countries where the communist period reflects itself in the economic structure and in the shape of the pension systems agenda.

The paper follows the following structure: the first part introduces the topic and purpose of the research; the second section outlines the relevant literature regarding the financial, economic, and social aspects of pension systems and highlights the current state of the art; the third section presented the research method and data; the fourth section was dedicated to empirical results outcomes; the fifth section debates the discussions and recommendations area; the last section exposed the research conclusions.

2. Literature review

1.1. Assessment of financial aspects of sustainable pension systems

The research of Westerhout et al. (2022) enhances the importance of the PAYG pension system in the uncertain economic and financial environment. Wronski (2023) indicates the role of pension redistribution in reducing wealth inequality, but Lin, Tanaka & Wuc (2021) point out that the PAYG pension system increases the burden on future generations. On the contrary, Laub & Hagist (2017) prove that the latest reforms implemented by Norway, Poland, and Germany had a positive effect on the intergenerational debt burden.

Brosig & Hinrichs (2022) show the improvement in the financial sustainability of the pension system across the European Union (EU) but accentuate the need for benefits' adequacy, which may not be expressed only in terms of replacement rate (Chybalski & Marcinkiewicz, 2016).

Koomen & Wicht (2022) proved the relationship between a fully-funded pension system and current account balance. On the one hand, tax system, economic freedom, and government quality were found to have a positive influence on social security budget revenues (Németh, Németh & Vékás, 2019; Barrios et al., 2020; Popa et al., 2022; Kudrna, Tran & Woodland, 2022). On the other hand, Ștefan (2015), Cristescu (2019), and Dumiter & Jimon (2022) established the influence of demographic and labour market features on social expenditures.

Rotschedl (2015) points out that education has a greater influence than life expectancy and income structure in ensuring the sustainability of the PAYG pension system. Lancia & Russo (2016) observed the political power of the elderly which can determine the decrease in education investment and the increase in pension transfers. Hammer, Christl & De Poli (2023) observed different approaches among EU countries regarding pension provisions, Southern European countries having an old age orientation, and Northern European countries supporting low-income populations. According to Shahid (2014), the benefits provided by pension systems express the generosity and respect of human beings. Indeed, Alonso-Ortiz (2014) found pension system

generosity to be an important factor in determining the structure of pension system budgets, but Halaskova (2018) highlighted the influence of country-specific features of each pension system.

The empirical results presented above and detailed in Appendix 1 reveal that financial sustainability is an important feature of a functional, strategic, and soundness pension system overall mechanism. Based on these findings, the first research hypothesis is:

> *H.1: Strengthening the financial soundness of pension systems, by increasing the income from social contributions to the state budget with a direct effect on increases in pension amounts will generate, ceteris paribus, a positive impact on elderly persons' standard of living in CEE countries.*

1.2. Economic implications for increasing the soundness of pension reforms

Several studies are focused on the demographic factors that influence the pension system. According to Han (2013), migration negatively influences bismarkian pension systems. Fenge & Peglow (2018) and Jimon, Dumiter & Baltes (2021) found migration and fertility to positively affect pension system sustainability. Di Liddo (2018) highlights that only highly skilled immigrants enhance the sustainability of pension systems. Hoang (2022) pointed out that migration is increasing competitiveness and is a driver for pension system reforms. Olivera (2019) found little influence of mortality on pension wealth inequality.

Other studies approached the influence of labour market features on pension systems. Haan & Prowse (2012), Cipriani (2018), and Heer & Trede (2023) enhance the need for postponement of retirement to achieve pension system sustainability. Dieppe & Guarda (2015) highlight the need for increased labour force participation. Jun (2020) indicated that working life would increase only if there is perceived a greater utility in terms of benefits and income. Sanchez-Marcos & Bethencourt (2018) found that eliminating some pension benefits will increase the female labour supply.

Falkstedt et al. (2014), and Sundstrup et al. (2018) show that working conditions could be a driver for disability, early retirement, or unemployment. Also, Staubli & Zweimüller (2013) and Engels, Geyer & Haan (2017) point out that increasing the retirement age may lead to unemployment. On the other hand, Wang (2015) established the influence of the pension systems in increasing fertility and decreasing unemployment.

In terms of the provision of pension systems, Mitchell, Clark & Lusardi (2022) indicate the stability of the real incomes of retirees, Xinbang et al. (2022) reveal the positive influence on the consumption level of the elderly, and Cammeraat (2020) found evidence that social expenditure is reducing poverty and inequality.

After analysing carefully the economic implications of pension systems presented in Appendix 2, the results obtained by the authors suggest that the economic aspects of pension systems are more complex and vary on the pension system structure in each country. Based on these findings, the second research hypothesis is:

> *H.2: The happiness of elderly persons is increased, ceteris paribus, by a comprehensive upward trend of GDP, with direct effects upon the stability of the economic environment, which will consolidate the economic sustainability of pension systems in CEE countries.*

1.3. Social underpinnings towards a more comprehensive social security system

Several studies proved that retirement and pension system distribution improved the physical and mental health of the elderly (Coe & Zamarro, 2011; Eibich, 2015; Cheng et al., 2018; Chen, Wang & Buscha, 2019; Pak, 2021; Mostert et al., 2022; Herl et al., 2022). On the contrary, Fe & Hollingsworth (2016), Heller-Sahlgren (2017), and Fitzpatrick & Moore (2018) reveal that

retirement has a negative impact on the physical and mental health of the elderly, increasing the sedentarism and social isolation risk.

Carrino, Glaser & Avendano (2020) and Barschkett et al. (2022) associated the increase in retirement age with depressive symptoms. Different results were exposed by Silver, Dass & Laporte (2020), who found that post-retirement employment increases health and reduces depressive symptoms. Also, Hallberg, Johansson & Josephson (2015), and Krumins et al. (2019) showed that early retirement can decrease the mortality risk, and Kang, Park & Ahn (2022) and Brown & Fraikin (2022) established that pension system provisions are reducing poverty. Shin (2012), Ju et al. (2017), and Cheng et al. (2018) sustained that retirement has a positive influence on satisfaction and quality of life.

The empirical results of the studies presented above and detailed in Appendix 3 reveal the importance of strengthening the social security systems at the country level by improving the quality of the social security checks and balances and widening the whole range of social services in order to increase the social soundness of the pension systems. Based on these findings, the third research hypothesis is:

> *H.3: The poverty amplitude that affects elderly people can be reduced, ceteris paribus, by strengthening the social aspects and features of pension systems in the context of overall social reforms of pension systems in CEE countries.*

3. Research methodology

2.1. Empirical models construction and specifications

The research design enriched in this study is structured in sequential steps. These steps are constructed to ensure the research methodology's clarity. First, descriptive statistics is analysed to establish the correlation between the variables and the soundness of the empirical research. Second, plots between HDI, Happiness Index, Poverty, and the macroeconomic variables will be conducted to establish the complex relationship manifested between these variables. Third, the 2 Stage Least Square Analysis regression with fixed and random effects is performed to establish the complex relationship oriented towards a more sustainable pension system in the background with social, economic, and financial aspects.

2.2. Dependent variables

The dependent variables taken into account in this study are the following: (i) human development index (HDI), (ii) Happiness index (HPI), and (iii) poverty (POV_t). The first dependent variable, namely the Human Development Index represents a complex variable capable of revealing the economic aspects of sustainable pension systems due to its complexity and measurements scale which suggest that economic aspects of pension systems are very complex and in a dynamic development process. The reason for establishing the Human Development Index as a dependent variable consists of the complex features that are enriched in the composition and structure of the index. Moreover, the connections with the PAYG systems are revealed by the overall economic aspects and social features that connect the development status with the pension system. The second dependent variable, the Happiness Index represents a quid pro quo regarding the assessment of financial aspects of sustainable pension systems. The complex construction of this index represents a good measure for attaining the financial sustainability of pension systems. The main reason for establishing the Happiness index as a dependent variable relies upon the aspects of sustainability and resilience which can also be emphasized on the financial part of a pension system. Consequently, the connection with the PAYG pension system is highlighted by well-being aspects regarding the specific demographic problem of the economies and societies. The third dependent variable, poverty, represents the social aspects of sustainable pension

systems, revealing the important aspects of equivalent income after social transfers expressed in percentage points. These indicators measured both total, female and male gender has a good performance in tracking the social poverty scale in a country.

2.3. Independent variables

Independent variables that are taken into account in this study are the following: (i) employment; (ii) unemployment, and (iii) beneficiaries. The first independent variable, employment represents an important macroeconomic indicator for revealing the total percentage of the population which currently activates on the labor market. The second independent variable, unemployment determined by the total amount of unemployed people as a percentage of the total population reveals the total number of unemployed people who currently do not have a job or are activated on the labor market expressed in percentage points. Third, the beneficiary's independent variable represents the total amount of pensionaries on the annual actual basis which benefits from the pension system. These three independent variables encounter soundness in measuring the sustainability of pension systems by taking into account the most sensitive problems of the employment agenda as well as the number of pension beneficiaries.

2.4. Control variables

The control variables that are taken into account for this study are the following: (i) taxes, (ii) net earnings, (iii) Gross Domestic Product; and (iv) expenditures on pensions. Taxes are very important to control variables because they reveal the total amount of money that a person pays to the state for all the income obtained. This indicator is important for assessing the financial control over the financial sustainability of pension systems. The second control variable, net earnings, represents another financial important issue that suggests the total amount of net money that people encounter for the work they are currently developing. Gross Domestic Product represents an important indicator for revealing the financial soundness of a country and the path for increasing the standard of living. The last control variable, expenditures of pensions represents the percentage points that gather the pension beneficiaries from the total amount of the Gross Domestic Product of a country.

2.5. Data sample description, sources, and specifications

In this study we conduct empirical research for measuring the economic, financial, and social sustainability of pension systems in five CEE countries: Czech Republic, Hungary, Poland, Romania, and Slovakia. Table 1 presents and analyzes the specifications of data and variables, the construction machinery, and data sources. To ensure the time-frame consistency of the empirical data, we have taken into account the time – period from 2010 to 2020 to have a comprehensive, complete, and complex database, without any missing data of a variable in one or more years. This time – period was not updated until 2022 because not all indicators encountered in the database have values. In this sense, for all the variables fulfillment of the completion of the data, the final data set was established for the period 2010 to 2020. The database was constructed by using the following sources: Human Development Reports for the Human Development Index; World Happiness Report for the Happiness Index; and Eurostat database for the poverty index. For the independent and control variables it was used the Eurostat database. The plotting analysis was performed by using Python 3.0 software, meanwhile, the regression analyses were performed by using the EViews 12.0 Academic Edition.

Table 1

Data, variables, and specifications

Variables	Construction mechanism	Unit/Scale	Sources
Dependent variable			
Human Development Index (HDI)	Three key dimensions: A long and healthy life; 2. Access to education; 3. A decent standard of living.	Three measures: Life expectancy. Years of schooling of children at school entry age and mean years of schooling of the adult population. GNI per capita is adjusted for the price level of the country.	Human Development Reports – Human Development Index – Country Insights – Database.
Happiness Index (HPI)	Three main indicators: 1. Life evaluations. 2. Positive emotions. 3. Negative emotions.	Variables included: Happiness score or subjective well-being; GDP per capita; Healthy Life Expectancy, Social Support; Freedom to make life choices; Generosity; Corruption Perception; Positive affect; Negative affect; GINI of household income; GINI index; Institutional trust.	The World Happiness Report – Country Rankings – Database.
Poverty – total (POV_t)	At risk poverty rate – 65 years over, %.	Cut-off point: 60% of median equivalised income after social transfers	Eurostat Database.
Human Development Index (HDI)	Three key dimensions: 1. A long and healthy life; 2. Access to education; 3. A decent standard of living.	Three measures: Life expectancy. Years of schooling of children at school	Human Development Reports – Human Development Index – Country

		entry age and mean years of schooling of the adult population. GNI per capita is adjusted for the price level of the country.	Insights – Database.
Independent variables			
Employment (emp_t)	Employment and activity by sex and age, from 20 to 64 years.	Percentage of total population.	Eurostat Database.
Unemployment (unempl_t)	Unemployment by sex and age, from 15 to 74 years.	Percentage of total population.	Eurostat Database.
Beneficiaries (ben_t)	Pension beneficiaries at 31st december.	Number of people.	Eurostat Database.
Control variables			
Taxes (tx)	Taxes.	Single person without children earning 100% of the average earning, euro.	Eurostat Database.
Net earnings (net)	Net earnings.	Single person without children earning 100% of the average earning, euro.	Eurostat Database.
Gross Domestic Product (GDP)	Gross Domestic Product at market prices.	Current prices, million euro.	Eurostat Database.
Expenditures on Pensions (EXP_p)	Expenditures on pensions.	Percentage of gross domestic product (GDP).	Eurostat Database.

4. Empirical results

3.1. Descriptive statistics analysis

Table 2 presents the descriptive part of the research and shows that the dependent variables as Human Development Index, Happiness Index, and total poverty varies from around 1% in the case of the first dependent variable, to 6% in the second dependent variable and having around 18% for the total poverty. This situation reveals that total poverty is more direct and immediately affected and influenced by the social, economic, and financial sustainability of the pension systems. The total employment in the labor force indicates that a stable and high employment rate preserves the soundness of more sustainable pensions systems in the CEE countries, meanwhile, the unemployment rate differs from the different regions of these countries. Moreover, tax policy and tax agenda constitute a quid pro quo for the soundness of the pensions systems and the net income of the active people represents a very important financial indicator. As for the total pension beneficiaries, this aspect is strongly highlighted by an equilibrated and balanced pension budget and financial status. The overall amount of the GDP represents an interesting feature in consolidating the soundness of a more comprehensible pension system in CEE

countries, meanwhile, expenditures with pensions systems represent the most sensitive variable for attaining and maintaining the long-term sustainability of pension systems in CEE countries. Analyzing the empirical results, it can be observed that the observations are only 55, due to the construction of the database, the limited time period for several variables, and the lack of data for some variables at larger time series periods. The importance of the limited time period for several variables has the justification for a more comprehensive and accurate database with data fulfillment of all variables in the time period taken into account.

Table 2

Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
HDI	55	0.8518	0.0256	0.8050	0.8970
HPI	55	5.9710	0.5743	4.6833	7.0341
POV_t	55	17.6954	12.4004	5.2909	40.5774
emp_t	55	69.4436	4.9782	59.9000	80.3000
unempl_t	55	4.3781	1.9918	1.3000	9.0000
tx	55	4.8054	2.2255	1.3000	10.1000
net	55	1225.14	460.8173	608.41	2242.43
ben_t	55	27.0390	4.6877	21.8800	36.9100
GDP	55	7.6072	4.0521	2.0000	17.6000
EXP_p	55	19.6931	13.0319	6.8764	53.2504

3.2. Plotting charts between the complex relationship of HDI, Happiness index, Poverty, and macroeconomic variables

Figure 1 presents the plotting results between HDI and macroeconomic variables. Analyzing the subgraphs, different patterns, similarities, and interesting correlations can be observed. Subgraphs 1,2, 5, and 7 have similar patterns, revealing that between HDI and taxes, net earnings, GDP, and the total amount of employment can be identified as a strong positive relationship. More specifically, the higher the tax amount and net income of the people, the consistency of the pension beneficiaries and the GDP growth the higher the scale of HDI which will lead to an improvement in the overall development of people. Subgraphs 6 and 8 indicate between total unemployment and expenditures of pensions there are complex features that influence the HDI. Specifically, the unemployment cost of labor will generate an impact on pension expenditures and this will generate a lower rate of HDI. Meanwhile, subgraph 3 signals no important relationship between tax rates and HDI, and subgraph 4 reveals that pension beneficiaries are not directly linked with the HDI, this relationship has been more influenced by other external factors.

Figure 1

Plots regarding the interconnections between HDI and macroeconomic variables

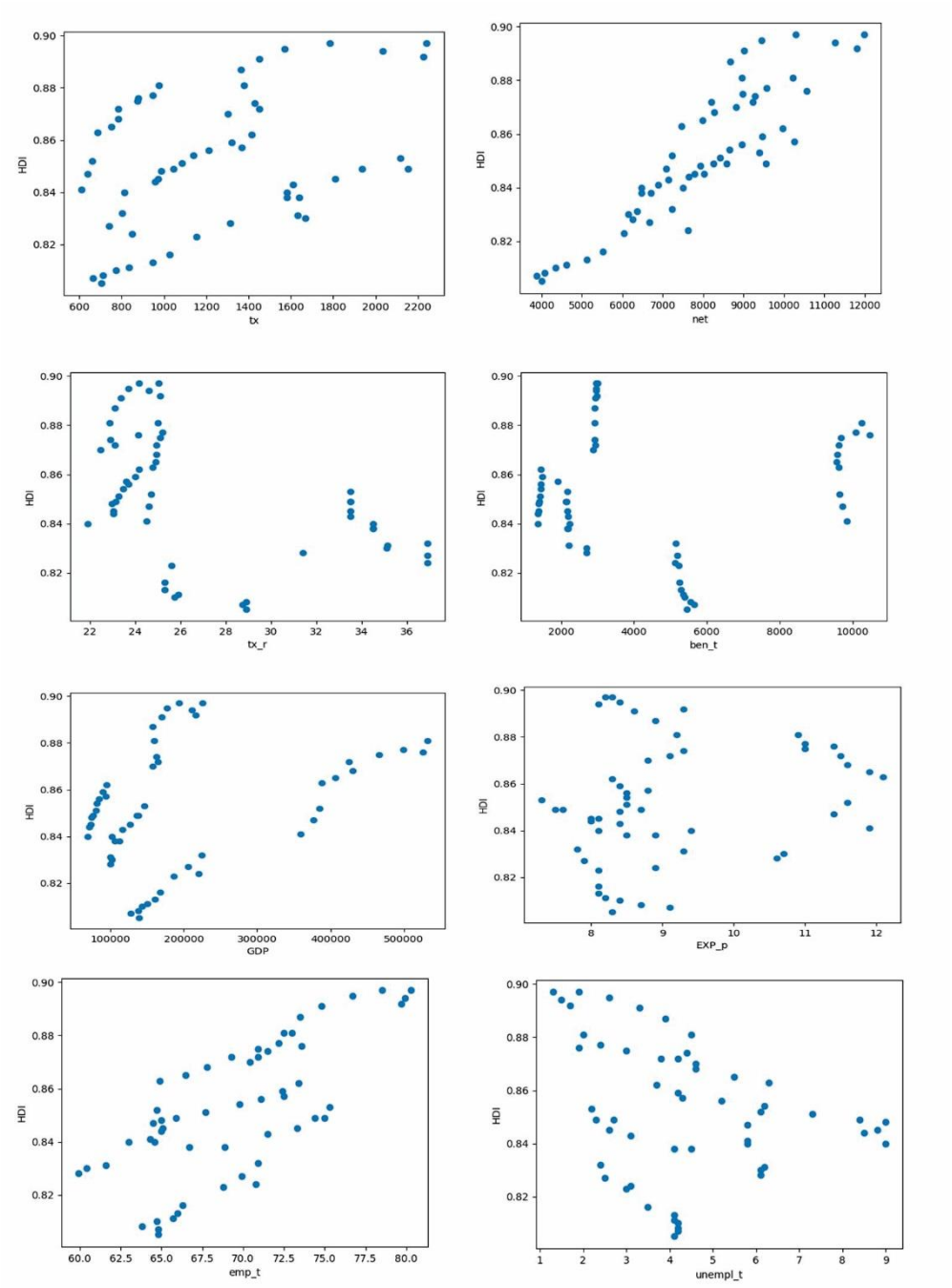
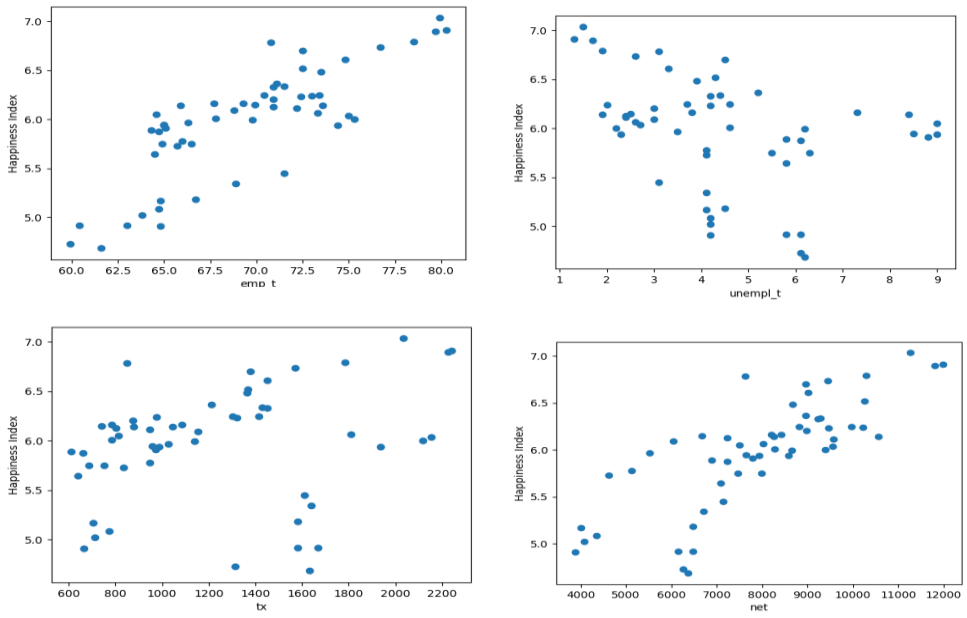


Figure 2 presents the plotting results between the Happiness Index and macroeconomic variables. Within this group of subgraphs, some similarities can be identified. First, subgraphs 1,3, and 4 have similar evolution trends. More precisely, between the Happiness Index and total employment, taxes, and net earnings there can be identified a linear correlation since increasing the taxes, the net earnings, and the total employment, will lead consequently to an increase in the overall beneficiaries of the pension systems. Other similarities can be seen in subgraphs 2, 5, and 8; since the total amount of unemployment has not had a significant impact on the Happiness index, a good tax rate policy might be capable of influencing the Happiness Index in some circumstances, and the pension expenditures have more complex manifestation impact upon Happiness Index. Subgraphs 6 and 7 have also similar patterns which suggest that pension beneficiaries have no direct impact on the Happiness Index, and between GDP and the Happiness Index can be identified as an interesting relationship but must taken into account other complex factors.

Figure 2

Plots regarding the interconnections between Happiness Index and macroeconomic variables



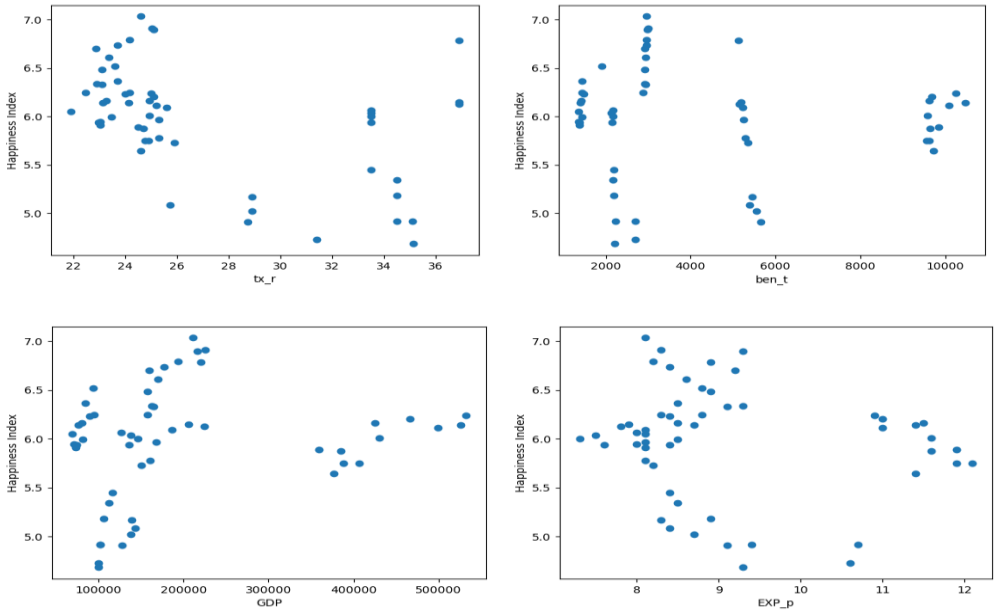
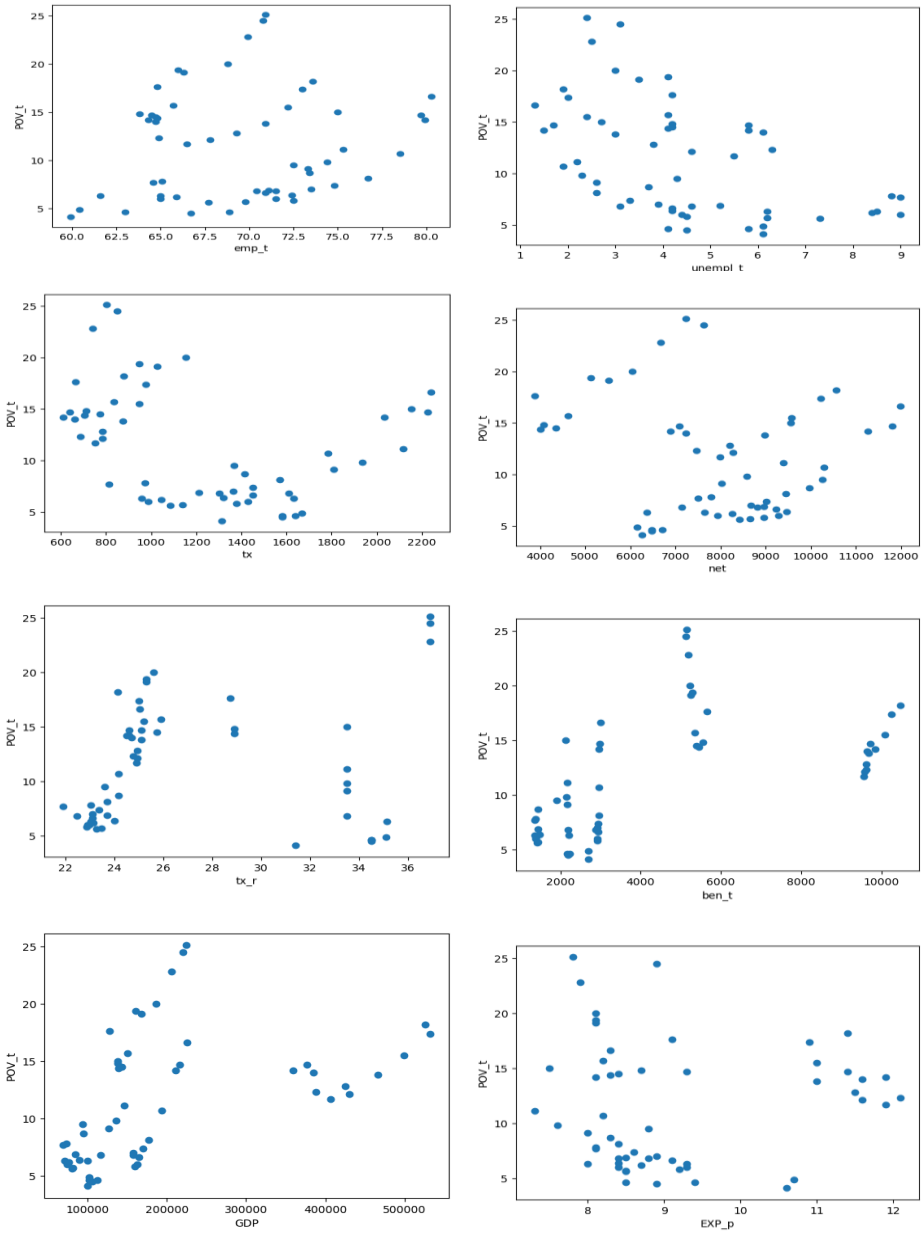


Figure 3 presents the plotting results between Poverty and macroeconomic variables. In this case, several similarities can be identified between the subgraphs. Subgraphs 1,3,5 and 7 have similar trends which are explained by the connections that manifest in practices between total level of employment, taxes, tax rate policy, and GDP. This situation is explained due to the connections between tax rates and sustainable taxes which will engage in an efficient policy of labor force with a high degree of employment. This would have an inverse correlation with the Poverty indicator, all these variables and an efficient mix between them will lead to the decreasing trend of poverty. Subgraphs 2 and 8 are very similar since the total amount of unemployment is correlated with the expenditures of pension systems in the direction of decreasing important amounts mobilized at the social security budget, but other variables are involved in this process. This situation influences poverty levels with many social implications for the sustainability of pension systems. Finally, subgraphs 4 and 6 manifest an interesting connection between net earnings and pension beneficiaries of pension systems, having the explanation that increasing the net earnings of the labor force can lead to an increase in the pension beneficiaries strengthening the financial sustainability of pension systems and with decisive impact in decreasing the poverty levels.

Figure 3

Plots regarding the interconnections between Poverty and macroeconomic variables



3.3. Regression results

Table 3 presents the two-stage least square regression analysis with the comparative method techniques without any effects (2SLS), with fixed effects (FE) and random effects (RE). Regarding the first equation having the Human Development Index (HDI) as the dependent variable, it can be observed that the models are statistically significant with an R-square that varies from 0.94 to 0.99. In the 2SLS, FE, and RE models the significant coefficients are total employment, total unemployment, taxes, total pension beneficiaries, and GDP. Regarding the 2SLS techniques, HDI is positively correlated with total employment and total unemployment and negatively correlated with taxes, pension beneficiaries, and GDP. In the FE method, HDI is positively correlated with total employment, taxes, and pension beneficiaries, and negatively correlated with total unemployment and GDP. The RE method reveals a strong positive correlation between HDI and total employment, taxes, and pension beneficiaries and a negative correlation with total unemployment, net earnings, and GDP.

Table 3

Comparative two-stage least square analysis

	HDI			**HPI**			**POV_t**		
	2SLS	**FE**	**RE**	**2SLS**	**FE**	**RE**	**2SLS**	**FE**	**RE**
c	0.5232* (0.05)	0.8265* (22.66)	0.6948* (21.53)	-1.8492 (-1.09)	1.8956 (0.88)	-1.5710 (-0.82)	12.7645 (7.84)	35.7341 (5.57)	3.9582 (6.82)
emp_t	0.0042** (0.00)	0.0003*** (0.73)	0.0017** (4.49)	0.1190* (5.79)	0.0740** (2.95)	0.0931** (3.95)	-14.2689 (-7.22)	-2.6091 (-3.48)	-32.1990 (-4.46)
unempl_t	0.0120** (2.28)	-0.0042** (-1.44)	-0.0032** (-1.05)	0.3926* (2.23)	0.4925* (2.84)	0.4587* (2.54)	2.0734 (1.23)	7496.14 (0.14)	24.6340 (0.45)
tx	-0.0065** (-1.22)	0.0051** (1.97)	0.0032** (1.20)	-0.2713* (-1.53)	-0.0958** (-0.62)	-0.3079* (-1.91)	-41.0830 (-2.41)	-52.973 (-1.15)	-75.8880 (-1.56)
net	6.7900 (1.55)	-7.2200 (-1.45)	-2.7200 (-0.07)	-0.0002*** (-1.68)	-0.0007*** (-2.51)	2.1700 (0.01)	287.8194 (-2.06)	207.3621 (2.37)	239.9830 (3.71)
ben_t	-0.0001*** (-0.31)	0.0001*** (0.56)	0.0007*** (3.12)	-0.0300** (-2.55)	-0.0415** (-2.22)	-0.0022** (-0.14)	-5.0358 (-4.45)	5883.85 (1.05)	5217.13 (1.15)
GDP	-0.0024** (-4.82)	-0.0003*** (-0.73)	-0.0006*** (-1.65)	0.0497** (2.93)	-0.0147** (-0.59)	0.0440** (2.04)	57.852 (3.55)	-5130.07 (-0.68)	-1092.22 (-0.16)
EXP_p	1.1900 (9.74)	2.8400 (0.97)	7.5200 (3.31)	-6.6500 (-1.64)	-2.6500 (-1.55)	1.3400 (1.00)	6.3642 (16.33)	-0.7698* (-1.50)	-0.6624* (-1.64)
R-Squared	0.94	0.99	0.98	0.86	0.95	0.90	0.97	0.99	0.99
F / Wald	101.90	229.57	178.05	39.94	29.48	35.35	266.51	1727.14	3765.63

Notes: *p<0.1; **p<0.05; ***<0.01; HDI, HPI & POV_t represent the dependent variables of the regression; t statistics values are presented in parenthesis.

The second regression equation of the two-stage least square analysis having the dependent variable Happiness Index (HPI) reveals strong statistical significance of all three models with an R-squared that varies between 0.86 and 0.95. in the 2SLS, FE, and RE estimation techniques the most statistically significant coefficients are all the coefficients except for the pension expenditures variable. In the 2SLS method, HPI is positively correlated with total employment, total unemployment, and GDP, and negatively with taxes, net earnings, and pensions beneficiaries. The FE method highlights the positive statistical correlation between HPI and total employment & total unemployment, meanwhile, with the other variables it manifested an inverse correlation. The RE method presents a strong positive correlation between HPI and total employment, total unemployment, and GDP, and an inverse relationship with taxes, and pension beneficiaries.

The third regression equation of two-stage least squares analysis having the dependent variable total poverty (POV_t) has a high degree of R-square levels which emerge from 0.97 to 0.99. However, the most important statistically significant coefficient is the pension expenditures both in the FE and RE methods. This fact reveals that POV_t and pension expenditures manifest a strong negative correlation.

5. Discussion and recommendations

The paper investigates the nexus between the financial, economic, and social aspects of sustainable pension systems. The identified problem in the pension systems of the CEE countries consists of the almost 40 years of communist agenda starting from the 1950s until the 1990s. In this socialist period, the sustainable pension systems in CEE countries have encountered many breaks falls, and downward shifts from the free market agenda. In the aftermath of the historical changes manifested in Europe after the 1990s, these five CEE transition economies have undergone substantial sequential quality shifts to strengthen the pension systems. The pandemic period had a strong negative impact on the sustainability of continuing ongoing measures to enhance the soundness of the pension systems in CEE countries. The empirical findings of this study reveal the importance of the three quality features of a sustainable pension system: first financial aspects to consolidate the budgetary constraints; second, the economic aspects to fulfill the overall macroeconomic equilibrium; third, the social aspects in the light of the social security status of the state preserving the rights and benefits for the vulnerable elderly people.

Given these aspects, Gutierrez et al. (2023) emphasize that for an efficient and sustainable pension system, must be taken into account several variables related to self–interest, and values, but also the increasing trend towards a higher degree of satisfaction with public security services, including the overall increase in the citizen's welfare and the satisfactory of public awareness regarding the sufficient public spendings.

Another very interesting aspect is revealed by Kabar & Kalwij (2023) regarding the crucial enactment of the right retirement age of people both for women and men, having a downward trend in the case of women. Brunello et al. (2023) trigger the need for important economic and social reforms in the minimum retirement age of middle-aged employees both for men and women, but especially in the case of women.

Al–Hassan & Devolder (2022) discuss the new challenges of the PAYS pension scheme in the actual European and international environment; the authors identify several risks and threats that underline the financial sustainability of pension systems and come with a trade-off between a formula based on defined benefits and defined contribution. Moreover, Safaralievich (2022) analyzes the importance of pension provisions in the social security systems and recommends an important mix that consists of influence factors of the pension systems and the determining size of the pensions.

Other authors as Aubry (2022) imply the importance of alternative pension systems with strategic investment plans while suggesting that the post-pandemic period has a decreasing trend in the actuarial expectations of the investment plans. Baurin & Hindriks (2022) reveal the aging economy that we face nowadays which may imply that pension benefits gradually readjustment; the authors suggest a two-way policy in this sense: first an accrual rate and the indexation rate for attaining the balance between equality and democracy.

The important features such as demographic trends and business cycles are the pillars of pension reform according to Romp & Beetsma (2022); the authors emphasize that there is needed sustainable pension reforms which must be correlated with demographic shocks and business cycle trends. Hoang & Maher (2022) go further and highlight the fiscal constraints of the public pension contribution with a direct focus on budgetary decisions and prudent pension fund management.

Wolf (2021) evaluates and assesses the complex relationship between political pressure, pension systems, and risks, especially those encountered in CEE countries. The author examines the last three decades' agenda identifying several underlying risks that the sustainable pension systems must be aware of financial crises, risk–sharing paradigm, financial transfers, and minimum pension guarantees.

This paper's results have taken into account several important studies from the economic literature revealing the substantial need for reforms of pension systems in CEE countries. As in previous studies, this paper suggests a quality institution shift that must be taken by the governments to strengthen the social security system overall. The financial aspects of the pension system in CEE countries must be enacted by increasing the earnings wages and also the checks and balances of citizens. The economic aspects must comply with long-term economic growth, increasing the citizens' standard of living and preserving overall social welfare.

Conclusions

The empirical research enriched in this paper has led to the conclusion that to attain a sustainable pension system it must be enacted a threshold structure: (i) financial features that are responsible for the budgetary resources policy that pensions must offer to the citizens; (ii) economic features which are responsible for the complex and comprehensive business cycle aspects in which the economic fluctuations and disparities must be treated with complex techniques and with actuarial studies; (iii) social features which are responsible for attaining the social security status of the pensions systems and preserving the assurance role of the state.

The econometric tests obtained in this study have generated the following results: (i) the plots presented in Figure 1 reveal that pension systems are influenced by macroeconomic variables and with direct impact on the HDI. The soundness of pension systems must be analyzed both in the context of financial sustainability, taking into account the economic aspects of the economies and also some important social aspects agenda; (ii) the plots presented in Figure 2 highlight some interesting insights generated by the Happiness Index in correlation with the macroeconomic variables, with a direct impact upon pension systems; (iii) the plots presented in Figure 3 have the meaning of linking the social aspects of pension systems, especially the poverty problems which many elderly people face nowadays with direct impact upon the social security system and pension systems.

The econometric results presented in Table 2 and Table 3 reveal that in the context of the CEE countries, the correlation between HDI, Happiness Index, and Poverty indicators with the macroeconomic variables suggests that governments must analyze the pension systems in the context of financial aspects (i.e., taxes policy and tax rates policy) and also linking the pension expenditures policy; second, it must be correlated aspects between net earning and pension

beneficiaries solving the economic problems of pension systems; third, it must be stabilized the social aspects of pension systems by a high level of employment and a lower level of unemployment rate. For all CEE countries, these patterns are important for the financial, economic, and social soundness of pension systems with a direct effect on the standard of living and the overall level of life satisfaction.

In CEE countries, the base of the specific communist paths, the transition period, the emerging status, and the actual catching-up economy status must reveal special features and characteristics for attaining and maintaining sustainable pension systems. These special features can be subsumed as (i) measures for increasing the birth rate; (ii) measures to increase the actual health status of citizens; (iii) increasing the standard of living similar to the one established in the Western states of the European Union; (iv) increasing the social integration in the labor force of the young people (18–24 years); (v) decreasing the unemployment rate and further increase in the total amount of active population; (vi) consolidating the legal pension system environment.

The three-research hypothesis emphasized in the literature section has the following appliance outcome. Hypothesis 1 is confirmed by the econometrical results: the consolidation of the state budget in terms of increasing the number and amount of social contributions and enlarging employment percentage in the total labor force will generate higher amounts of pensions which will lead to the financial consolidation of pension systems. Hypothesis 2 is also confirmed by the empirical outcomes because increasing the GDP trend and enabling long-term sustainable economic growth will lead to a more competitive and stable economic environment which can contribute to the elderly persons' happiness.

Hypothesis 3 is also confirmed by the empirical results because the overall reforms in the pension systems that nowadays are enacted in CEE countries are oriented towards strengthening and improving the social status of pension systems can be a quid pro quo in reducing elderly persons' poverty.

Based on these aspects the policy recommendations: first, the governments must be aware that the social security systems, lato sensu, and pension systems, stricto sensu, must be reshaped and consolidated by the new social characteristics and values; second, regarding the financial aspects of pension system it must be revised and reshaped a new financial pension system scheme having at the background the new financial international features; third, the economic environment after the pandemic period will lead to the reconstruction and reconfiguration of the economic system, both national and international to adapt to the new economic realities.

The theoretical implications of the paper reveal the importance of reshaping the entire pension system in CEE countries because the communist past of these countries and the long transition and emerging period to the market economy have slowed down the necessary reforms of the pension systems. Nowadays, in all CEE it is manifested the need to restructure and strengthen the pension systems having the background of the new challenges ahead of the CEE economies and the aftermath of the post-pandemic period.

The managerial implications of the research outcomes imply a need for reshaping the pension scheme in CEE, in three ways. First, it is needed the update the pension laws in CEE countries facing the new law realities and challenges; second, it is ongoing the process of digitalization of the entire pension system to evaluate and assess the imbalances between the several categories of pensionaries retired at different time periods; third, it is needed to recalculate the pensions points based on the new methodology to enhance the soundness of the pension systems and eliminate the differences between the different times of pensions and social categories structures.

The main added value of this paper is to bring together the three main features of an efficient and sustainable pension system: financial, economic, and social. This integrated approach enriched in the empirical research of this paper considering some of the most important variables and proxies can constitute a quid pro quo for future studies and developments. Moreover, the CEE

countries appliance of this study reveals that between these countries have been enacted some similarities in the pension systems which must be taken into account by the governments regarding the administrative coordination between these states.

The weak points and restrained aspects of this study were the institutional characteristics of a social security system and a pension system which are very difficult to measure and proxied by some variables. Second, the database was very difficult to construct due to a lack of data regarding several characteristics and variables. Third, it was very difficult to encompass all the important variables and features of the CEE countries' pension schemes due to the similarities between these pension system structural schemes.

This study will continue with the enactment in future studies of engaging in an EU study which will analyze the similarities and differences between all pension systems together with the failures and strengths points. Moreover, it can be applied to empirical research based on similar pension systems in different EU regions, with a direct focus on the Euro Zone. Finally, it can be fulfilled an international study regarding the main pension systems structure and characteristics based on the types and continents.

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