



Research article

The impact of pension fund assets on economic growth in transition countries, emerging economies, and developed countries

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Abstract: In this study, the authors aim to analyze the impact of pension asset investments on the economic growth of selected non-OECD countries, taking into account the controlling effect of gross fixed capital formation, domestic credit to the private sector, inflation, public debt and population. To conduct the econometric analysis in this study, the authors relied on secondary data published in the annual reports of the OECD, the World Bank and the IMF. Based on the econometric results of this study, the authors conclude that the investment of pension fund assets has positively impacted the economic growth of selected non-OECD countries (2002–2018). This study is of scientific importance because it provides detailed empirical evidence regarding the investment of pension funds in international financial markets and the effects of these investments on the economic growth of non-OECD countries. Moreover, the authors of this study through this scientific paper provide new scientific evidence to governments and policymakers in these countries on how to design appropriate strategic investment policies so that pension funds invest their pension assets at a safe rate of return from investments to ensure economic growth and efficiency in the capital markets. Given that most non-OECD countries are emerging and transition economies, the importance of this study lies in the fact that the authors, through empirical findings, highlight the importance of pension fund investments in global financial markets and the effects of these investments on the economic growth of these countries.

Keywords: economic growth; pension funds; investments; fixed capital; loans; inflation; public debt; population

JEL Codes: G20, F43, G23, G11, G15, G18, E31, E22, H63, J11, C33

1. Introduction

In recent years, the scientific findings of various authors show that the structure of the pension system reflects the private savings of the population and, through investment in the assets of pension funds, shows the total position of foreign assets of a country. In their study, Staveley-O'Carroll and Staveley-O'Carroll (2017) analyzed the impact of the pension system structure on the allocation of international financial capital. The empirical findings of this study show that government-managed pension systems affect private savings and international capital allocation. Investing in pension fund assets affects the net position of foreign assets but also the portfolio risk profile in the country of origin.

In their studies (Patel, 1997; Schmidt-Hebbel, 1999; Dell'Ariccia et al., 2007; Catalan, 2004; Borsch-Supan et al., 2005; Sun & Hu, 2014; Mazreku et al., 2020; Sy, 2017) have analyzed various aspects of management of financial institutions (pension funds), the performance of pension funds, asset investments, productivity, corporate governance, pension reforms, the performance of capital markets and the effects on the economic growth of various developed and developing countries. In his study Patel (1997) analyzed aspects of reform policies in India's pension system. According to this study, the pension system in India is facing large challenges due to the very large population. Therefore, in this country, it was necessary to undertake various reforms in the pension system to provide at least a minimum pension. One of the most important reforms undertaken in India's pension system is the radical change of the existing legislation and the regulatory framework, which also includes investment rates.

According to Schmidt-Hebbel (1999), pension reforms in Chile have improved labour market performance and increased savings, investment and factor productivity, contributing positively to the country's economic growth. Pension reforms are a very important element of market-based development, and such reforms allow the public sector to focus on fighting poverty and correcting externalities. (Dell'Ariccia et al., 2007) analyzed the effects of banking crises on the growth of various industrial sectors and the effects of these banking crises on various financial institutions. This study found that the sectors of the real economy that depend more on the value of external financing, capital formation and the number of financial institutions grew relatively less than sectors less dependent on external financing.

According to (Catalan, 2004), pension reforms in financial systems promote the development of stock markets through a corporate governance channel. So, pension funds become large shareholders of various firms and therefore have incentives to monitor managers and improve investor protection. In their study, Borsch-Supan et al. (2005) analyzed the impact of pension reforms on the performance of capital markets in France, Germany and Italy. According to the results of this study, the ageing population will change the savings behaviour and will cause an increase in savings between 2015 and 2025. A large part of the savings will flow through the stock and bond markets, changing the nature of the markets of the capital, especially in countries with a lower stock market capitalization rate.

According to the econometric findings by Sun and Hu, 2014, pension funds significantly impact the financial development of underdeveloped countries. A 1% increase in pension fund assets can promote corporate governance, information disclosure and transaction efficiency. Mazreku et al. (2020) suggested that the growth of the gross domestic product, return on investment, pension contributions, and investment of net assets have positively impacted the performance of pension funds in Kosovo, Albania and North Macedonia. They note that the exchange rate did not affect the performance of

pension funds. Therefore, these three countries need to undertake reforms in order to establish efficient pension systems. Sy (2017) analyzed the role of African pension funds in supplementing existing fiscal resources for infrastructure and the effects of mobilizing internal resources to finance the development of the African continent. They note that pension reforms will be necessary to improve the performance of unsustainable pension schemes but will also affect the availability of pension funds for investment, including infrastructure.

As noted, these studies show that investments in pension fund assets positively impact the economies of different countries, and these investments can lead to deeper and more efficient capital markets and hence economic growth. Therefore, this paper aims to analyse the impact of investments in pension fund assets on the economic growth of non-OECD countries. Our focus will, however, be on both the OECD and non-OECD countries since we have noted that most of the studies by other authors have been directed to OECD member countries, and there have been fewer studies on non-OECD countries. The aim is to fill this gap by adding to the existing literature by analyzing 30 selected countries from these 2 areas over a period of 16 years, from 2002 to 2018. Moreover, we also aim to provide empirical and scientific evidence for the impact of pension asset investments and other macroeconomic factors on the volatility of economic growth of these countries. This part represents an added value in this study because the application of econometric models with a dynamic time delay can provide accurate forecasts of macroeconomic phenomena, which will contribute positively to the design of investment and macroeconomic policies by the policy makers of these OECD members and non-member countries.

The main contribution of this study is that different from other studies such as for example those by Schmidt-Hebbel (1999) or Bijlsma et al. (2018); we have applied various statistical tests and included a large number of non-OECD countries; specifically, the GMM model, the GEE model and the ARCH-GARCH econometric analysis. The application of these statistical models has provided new scientific empirical findings supporting the effect of investment in pension funds on the economic growth of different countries. This helped us provide support and higher relevance to econometric results and findings, which enabled us to make valid recommendations to the governments on how to manage pension funds and what investment policies should be implemented in their pension systems in order to contribute positively to the economic growth of these countries.

2. Literature review

The idea of studying the performance of pension funds, the investment of assets of these pension funds and the effects on the economic growth of different countries of the world has been the focus of many studies by other authors.

According to Sunet et al. (2020), the sustainability of pension funds in China will inevitably face challenges. The level of contribution per capita will be low for a long time, and the eradication of poverty mainly affects the current short-term deficit but not the accumulated medium-term deficit. The higher the payment, the better the stability of pension funds in the short and medium term. Draženović et al. (2019), in their study, analyzed the efficiency of the mandatory pension fund in Croatia. The efficiency of pension systems in the world, also in Croatia, has a significant impact on economic growth and social cohesion. The results of this study show that mandatory pension funds operate similarly due to legal investment constraints, the interconnection of pension funds, the minimum guaranteed return and the lack of competition in the pension market in Croatia.

The study by Mohieldin et al. (2019) analyzes the evolution of the Egyptian financial system and the main trends in financial development in Egypt. According to the empirical findings of this study, there is a strong positive correlation between real economic growth and financial development measured by the money supply in GDP. Market capitalization and the number of bond issuers in financial markets are also positively correlated with real GDP per capita. According to Kidd & Tran (2018), investing in tax-funded old-age pensions is essential to a successful market economy. According to this study report, if Uganda were to increase its investment in old-age pensions, the cost would be relatively small (up to 0.4% of GDP), but the impacts on labour productivity and economic growth would be very large meaningful.

In their study, Bertranou et al. (2018) analyzed the privatization of pension funds and the reversal of pension reforms in Argentina. According to this study, the privatization of pensions had created an overall positive effect, with increased coverage, improved sufficiency and financial sustainability. The favourable performance of the Argentine economy since the 2001–2002 crisis and the additional revenues from general taxes allocated specifically to the pension system have provided the necessary fiscal space for the government to improve the social protection of its citizens. Stewart et al. (2017) argued that in some pension systems, a significant increase in long-term asset allocation is hindered by pension fund managers managing settlement risk. Greater diversification of pension funds can be observed to a large extent in domestic assets but also in foreign investment. Therefore, according to the findings of this study, the frequent change of fund providers and portfolios may limit the ability of the pension fund to invest in the long run.

In their study, Park & Stańko (2017) have analyzed the macro and micro dimensions of oversight of large pension funds and the effects on the economies of different countries. The macro dimension focuses on the potential adverse impact of such funds on financial markets. In contrast, the micro dimension refers to the possibility that the mismanagement and improper functioning of pension funds could negatively affect the economic well-being of many pension beneficiaries. According to Altiparmakov & Nedeljkovic (2016), no significant empirical evidence has been found that the privatization of pension funds in Latin America and Eastern Europe has been accompanied by higher economic growth. The positive effects of economic growth are not particularly likely in countries applying financial debt-free privatization.

The contributions of pension funds from Nigeria's private and public sectors have increased greatly and constituted a large investment fund in the capital and money markets. This phenomenon increases liquidity in the economy, creates employment opportunities, and improves the business climate. With good portfolio risk management by financial managers of pension funds, pension contributions can positively impact gross domestic product (Farayibi, 2016). According to Arestis et al. (2015), financial development and economic growth have a high positive correlation. Such a correlation between financial development and economic growth exists in economies with high initial incomes per capita, while in countries with low initial incomes per capita, such a correlation has no statistical significance. In his study, Casey (2014) analyzes the reforms European Union governments undertook in their pension systems. These pursued reforms and policies succeeded in meeting their objectives only because the national accounts system does not recognize how most fiscal gains match future fiscal obligations.

According to Acuña et al. (2014), the creation of a private pension system in Peru has contributed positively to the economic recovery in 1993. This study identified that the accumulation of pension contributions positively impacted the country's economic development; on the other hand, it has

positively affected productivity and economic growth. Based on the study by Thomas et al. (2014), a negative correlation was found between the share of pension fund assets invested in shares and the stock market volatility in OECD countries. This study's probit and log binary models further substantiate the argument that pension funds can alleviate stock market volatility as institutional investors. In their study, Croce et al. (2011) have analyzed the role of pension funds in financing various green economy projects. With assets of \$28 trillion, pension funds play an important role in financing such projects, contributing positively to economic growth. Despite the interest of pension funds to invest in such projects, the allocation remains very low. This is due to the lack of support for environmental policies, market liquidation, and lack of knowledge and expertise in green economy projects.

According to Altiparmakov (2011), the rate of return on investment of private pension funds in Serbia has been below the implied rate of return on public pension funds. High operating and underdeveloped costs in the capital markets are identified as the main factors contributing to the failure of private pension funds to meet pension reform expectations. According to the study of Alonso et al. (2010), the investment of pension fund assets significantly impacts the development of a country's infrastructure, generating a complementary link in securing workers in a profitable and limited risk portfolio. Their study (Cuevas et al., 2008) analyzed the correlation between pension reform and sovereign risk. According to the results of this study, pension reforms require the implementation of fiscal space that helps offset their short and medium-term transition costs. Governments undertaking various pension systems reforms must be careful in their policy actions to compensate for some or all of the costs of pension reforms and their effects on the level of financial debt.

In their study, Kroszner et al. (2007) have studied the effects of financial crises on the growth of industrial sectors, and the results of this study show that these sectors depend more on the added value of external finance, capital formation and the number of institutions in the industrial sectors that are less dependent on external financing. According to De-Mesa and Mesa-Lago (2006), the costs of pension reforms in Chile have been quite high and have exceeded capital accumulation. These high fiscal costs have had a negative impact on national savings, but pension reforms in Chile have contributed positively to the development of capital financial markets and the diversification of investment portfolios. James (2005)'s study states that countries that successfully implement reforms in the social security system manage to gain a higher rate of return on investment. According to this study, if the government of a country decides that the assets of pension funds be invested in treasury bills, these funds may affect the increase in the government deficit.

In their study, Preda et al. (2004) analyzed the pension system reforms in Romania during the transition process. According to this study, some of the main problems faced by the pension system in Romania during these years are inequality in the calculation of pension benefits, delays in reforms, legislative instability, the decrease in the number of contributors and the alarming increase in the number of pensioners. To overcome these problems, the authors of this study recommend that Romania develop a medium- and long-term strategy regarding older people, establish an electronic database of population data, and establish efficient monitoring, analysis, and policy system. in the field of pensions. Disney (2004)'s study analyzed how governments of OECD countries have coped with public pension fund programs and their adverse impact on the level of pension contributions and employment levels by economic activity. The results of this study also consist of various economic theories that high taxes applied to wages can greatly damage the employment prospects in OECD countries.

According to the study of Bosworth and Burtless (2004), in OECD countries, a large part of the accumulation of assets in pension funds within the national social security systems is compensated in the government sector by deficits in other budget accounts. In their study, Coronado et al. (2003) suggest that in the process of investing in pension fund assets, there are costs associated with these investments in private equity markets. Such a cost is incurred due to investment decisions, which are politically influenced. These authors point out that investing in social security assets with private securities may jeopardize the efficiency of capital markets, especially given the size of such an investment. Studart (2000) argued that the macroeconomic environment affects the perception of various stakeholder risks in general and specifically affects the perceived value of discounting and the risk of equity in the pension fund portfolio. The market organization determines the degree of liquidity of long-term negotiable securities and thus determines the degree of freedom that a shareholder has in regulating his portfolio.

Barr (2002)'s study analyzed the main variables which affect the successful implementation of pension reforms in various pension schemes. The main variable affecting pension reforms is effective governance which is a necessary precondition in the successful implementation of pension reforms. According to this study, pension reforms in terms of economic well-being positively impact poverty alleviation and consumption alleviation. Guercio and Hawkins (1999) argue that pension funds play an active role in corporate governance. Based on the results of this study, a large heterogeneity is found between pension funds and their impact on targeted firms, in line with strategic investment changes. The findings of this study emphasize that pension funds are most successful when they monitor and promote all changes made to previously targeted firms.

According to Bailliu and Reisen (1998), a significant positive correlation was found between the development of funded pension plans and total savings. This study suggests that funded pension schemes should be mandatory so that the coverage of pensions of the working-age population is comprehensive and discouraged from lending to accumulated pension assets. In his study, Singh (1996) analysed pension reforms' impact on economic growth. This author has critically looked at the pension that the World Bank implemented in the 90s. In his study, the author suggests that all pension reforms should help older people by facilitating savings during their active years of work and these pension reforms positively redistribute income to those who are poor during all their life. In their study, Lakonishok et al. (1992) analyzed the correlation between institutional investors and stock price. According to the findings of this study, institutional investors do not destabilize stock prices. Such empirical evidence is evidenced by the fact that institutional investors pursue a wide range of investment strategies and securities trading has no impact on stock value.

Qiu and Li (2021)'s study have systematically reviewed and summarized economic measurement methods such as the classic issues of GDP, the measurement of economic well-being and the measurement of sustainable development. Through this study, these authors have analyzed several measurement dilemmas hidden in GDP statistics and have explored the feasibility and necessity of measuring economic well-being and sustainable development. Demirtaş & Keçeci's (2020)'s study analyzed the efficiency of private pension funds using dynamic data analysis. According to the results of this study, the authors conclude that the efficiency of private pension funds can be improved by taking into account the effects of interrelationships of successive periods, and the implications arising from the results of this study are important for company policies in different sectors of the economy. According to Matei (2020), financial development produces positive effects on economic growth only in the short-term horizon and exerts a positive effect on economic activity up to a certain threshold, and after that, the correlation becomes negative.

The structure of this paper is organized as follows. In the second section, we present the literature review regarding the investment of assets in pension funds and the effects of these investments on economic growth. In the third section, we analyse the structure of assets in pension funds in the selected countries of the study, the nominal annual growth rate of assets in pension plans, the total amount of assets in pension plans, pension fund coverage and the evolution of the pensionable coverage plan. In the fourth section, we analyze the performance of investments in pension fund assets, annual investment rates in financial pension plans, nominal and real investment rates in pension fund assets and the allocation of assets in the funded pension plans. In the fifth section, we describe the methodology of scientific research, the specification of the econometric model and the explanation of other scientific methods which will be applied to derive the results of this study. In the sixth section, we present the results from the comparative analysis of the selected countries. In the seventh section, we present all the empirical findings of this study through econometric models and statistical tests, which have been applied to derive the results that are real and comparable even with the studies of other authors. Finally, we present this study's discussions, conclusions, recommendations and practical implications.

3. Meta-analysis: recent development in the performance of public-private pension systems in non-OECD countries

This section will analyse some important indicators of the performance of public and private pension systems in non-OECD countries from 2008 to 2018. Through this data, we will present statistics regarding the recent developments for the assets of private and funded pension plans and the coverage and evolution of these private and funded pension plans for the countries selected in this study that are non-member countries of the OECD.

According to data in the OECD annual reports on the performance of pension markets in 2008, non-OECD countries have shown a remarkable recovery in the performance of pension funds, although these pension funds in countries such as Hong Kong, Peru and Bulgaria had negative investment returns of over 20% in nominal terms in 2008 (OECD, 2008). Chile, Israel and Pakistan have shown a fairly significant recovery in 2009 in terms of pension fund performance. In 2009, Chile and Pakistan had largely offset all losses from the 2008 financial crisis, while pension funds in Israel had fully recovered the losses of the pension markets experienced due to the financial crisis (OECD, 2009).

In selected non-OECD countries, investment losses in 2008 were lower than in the 2009 recovery. At the end of 2009, pension fund assets in Bulgaria, Estonia, Hong Kong, Israel, Jamaica, Pakistan, Slovenia and Thailand were above their levels in December 2007. Stock market ratings in 2008 fell dramatically due to the worsening financial crisis, but in 2009 pension markets began to recover. Between March and June 2010, stock indices rose by more than 35% in the US, 30% in the EU and 25% in developing countries (OECD, 2010). During 2011, non-OECD countries continued to show positive performance in pension funds, which means that these countries have continued the further economic recovery caused by the financial crisis of 2008. At the end of 2010, total assets in the pension funds of selected non-OECD countries were above the level of these pension fund assets in 2007. The performance of pension funds in Colombia, Latvia, Ukraine, Peru and Romania was relatively better than in other countries of the OECD because the pension systems of these countries were relatively new and had experienced relatively rapid growth in investment and these pension systems operated in a market environment characterized by low prices and a very good level of investment (OECD, 2011).

Pension fund markets in non-OECD countries, although relatively small compared to OECD countries (US \$0.9 trillion vs the US \$19.2 trillion in 2019), are still growing rapidly in recent years. Among these countries, Hong Kong remains one of the non-OECD countries with the highest ratio of total pension assets to GDP at 32.5% in 2011. The other three countries with the ratio of total pension assets to GDP in the range of 10 to 20% are Colombia with 17%, Peru with 16.9% and Brazil with 13.8%. It is worth noting that during 2011, pension assets in non-OECD countries grew much faster than in the economies of OECD countries (OECD, 2012). In 2012, selected non-OECD countries had a weighted average value of the ratio of pension assets to GDP of 33%, compared to 77% for the OECD area. Only six selected non-OECD countries have a ratio higher than 20%. These countries are South Africa (82% of GDP), Namibia (78.2%), Hong Kong (34.3%), El Salvador (28.9%), Bolivia (27.7%) and Jamaica (22.1%). In some non-OECD countries, pension assets represented 10%–20% of GDP. These countries are Brazil, Colombia, Croatia, Kenya, Kosovo, Lesotho, Peru and Uruguay (OECD, 2013).

In 2013, a significant part of pension funds was accumulated in non-OECD countries but remained small compared to OECD countries. For example, in terms of the ratio of pension assets to GDP, the weighted average in non-OECD countries was 38.3% in 2013, compared to 84.2% for the OECD area. As in OECD countries, bonds and stocks were the main asset classes in which pension funds were invested in non-OECD countries. Pension funds in Costa Rica invested all their assets in treasury bills and bonds due to a wide range of products and high returns. The capital was predominant in pension fund portfolios in three countries, accounting for more than 50% of total investments: Namibia, Kosovo and Hong Kong (OECD, 2014).

Pension funds are the main tool for pension levels in most non-OECD countries. In Latvia, investment management companies can manage accumulated assets through a mandatory state-funded pension scheme. In Mauritius, pension schemes are offered by insurance companies. Insurance companies in Mauritius can also manage voluntary occupational pension insurance contributions. Malta's pension funds had an average negative annual return from December 2010 to December 2014. Despite weak returns and declining pension fund assets during the financial crisis, average annual returns in most countries remain positive, except in Estonia (−1.7%) and Bulgaria (−0.8%) (OECD, 2015).

According to OECD data for 2015, the amount invested by pension funds in 45 non-OECD countries, including the BRICS countries (Brazil, Russia, India, China and South Africa), reached 1.3 trillion dollars. The ratio of assets invested to GDP varies from 0.1% in Albania and 96.8% in South Africa. This ratio remains lower than 20% in 31 of the 45 reporting countries that are non-OECD countries. Real returns were below 0% in ten reporting countries, including Russia (−2.0%), Brazil (−4.9%) and Hong Kong (−5.8%). The lowest return in 2015 was recorded in Malawi (−7.8%). Thus, pension funds in 21 of the 31 non-OECD reporting countries achieved real positive returns in 2015, reaching 13.5% in Serbia (OECD, 2016).

Pension fund assets have grown faster than GDP in the sum of non-OECD countries. These pension fund assets have grown faster than GDP in 65 of the 73 reporting countries. Private pensions have expanded rapidly around the world, especially in countries where pension assets already represented the highest share of GDP. Liechtenstein and Malta experienced some of the largest increases in private pensions in their pension systems. Liechtenstein had a growth of 44 percentage points of GDP from 2007 to 2016, and Malta had a growth of 39 percentage points of GDP from 2011 to 2016 (OECD, 2017). The number of pension assets compared to the size of the domestic economy provides an important indicator of private and public pension systems at the national level. On average, pension assets accounted for 50.7% of GDP in the OECD area and 19.7% of total GDP in non-OECD

reporting countries. The weighted average was even higher, 133.6% in OECD countries and 41.3% in non-OECD countries (OECD, 2018).

Table 1 presents data on total assets in public and private pension plans in non-OECD reporting countries. This data includes 52 non-OECD countries, covers the time period (2008–2018) and is expressed in millions of dollars.

Table 1. Total assets in public and private pension plans in non-OECD reporting countries.

State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Albania	1	2	3	1	3	4	5	7	10	16	21
Armenia	..	..	..	..	..	..	26	65	131	219	329
Bolivia	3,740	4,456	5,387	..	..	..	..	..	..	..	..
Botswana	..	..	..	..	..	6,731	..	..	..	8,310	7,358
Brazil	176,57	279,06	319,78	308,27	315,15	273,96	411,79	310,80	439,50	487,61	449,31
	1	1	5	3	3	5	0	6	7	8	5
Bulgaria	1,660	2,326	2,714	3,042	3,848	4,807	5,089	5,248	5,834	7,813	7,881
China	27,961	37,096	42,413	56,659	76,650	98,896	125,65	146,74	159,35	197,80	215,52
(People's Republic of)						8	6	7	1	6	
Colombia	31,403	32,783	44,179	54,006	68,221	66,911	63,742	51,968	64,578	77,643	72,228
Costa Rica	2,018	2,369	2,833	3,507	4,355	5,453	5,846	9,017	9,950	10,805	11,527
Croatia	4,566	6,018	6,840	7,395	9,353	10,982	11,157	11,291	12,428	15,532	16,110
Dominican Republic	1,371	1,897	2,408	3,055	3,829	4,543	6,897	7,386	8,505	9,174	11,282
Egypt	3,969	..	..	..	..	5,081	5,552	5,512	2,665	3,598	3,965
El Salvador	4,471	5,015	5,474	6,093	6,835	7,321	7,993	8,514	9,251	9,985	10,648
Ghana	..	..	..	..	..	..	808	1,231	1,617	2,496	2,700
Gibraltar	..	..	..	35	39	42	11	..	..	..	..
Guyana	110	126	134	148	169	195	201	220	228	245	298
Hong Kong	60,531	67,536	78,246	79,645	90,496	103,04	110,22	115,24	123,10	148,28	148,70
India	..	..	3,347	2,848	5,450	6,819	11,465	16,253	23,472	..	..
Indonesia	7,904	11,496	13,983	15,058	15,900	12,930	14,963	14,506	17,035	18,843	18,029
Isle of Man	..	..	..	..	..	..	..	..	5,106	14,290	13,065
Jamaica	2,448	2,490	3,026	3,276	3,137	2,864	2,958	3,292	3,537	4,230	4,750
Kazakhst an	..	..	..	..	..	..	..	..	..	..	24,869
Kenya	3,504	4,140	5,346	5,419	6,380	8,072	8,344	7,957	9,588	10,463	11,452
Kosovo	946	1,267	1,328	1,291	1,510	1,982	1,934

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State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Lesotho	272	308
Liechtenstein	2,131	2,647	3,696	3,748	3,925	4,434	4,275	4,974	5,219	6,075	5,968
Malawi	..	..	..	..	..	409	525	456	523	727	944
Malaysia	..	..	..	..	..	..	..	277	338	549	648
Maldives	..	..	..	53	108	165	..	311	392	475	568
Malta	..	..	..	45	759	1,692	2,599	3,425	4,116	5,596	..
Mauritius	..	..	..	..	227	265	..	482	528	633	..
Mozambique	..	..	..	..	..	..	..	..	..	..	91
Namibia	..	..	9,636	8,532	10,088	9,877	10,117	..	10,008	12,496	11,628
Nigeria	8,290	10,142	13,418	15,435	20,042	25,801	27,178	26,913	20,213	24,560	28,136
North Macedonia	116	205	270	340	457	608	664	724	841	1,136	1,228
Pakistan	9	12	16	20	33	58	102	146	..	211	189
Panama	108	..	161	216	..	333	384	427	478	537	557
Papua New Guinea	..	..	..	..	..	3,549	..	..	..	3,734	3,825
Peru	15,888	23,979	31,083	30,371	37,982	36,521	38,360	36,386	41,177	49,078	46,283
Romania	330	842	1,455	2,053	3,051	4,513	5,471	6,254	7,666	10,677	12,176
Russia	..	..	..	..	..	117,179	70,850	65,767	87,038	96,907	81,456
Serbia	74	108	125	154	190	238	238	260	281	366	389
Singapore	..	..	..	159,255	187,819	199,671	208,113	211,578	226,914	268,449	285,802
South Africa	211,9	253,9	331,5	298,39	323,38	306,10	317,52	259,62	302,97	..	..
Suriname	..	..	..	..	..	..	..	..	310	452	467
Tanzania	..	..	..	..	..	2,986	3,889	4,115	4,155	4,444	..
Thailand	13,333	15,506	19,165	19,532	22,847	22,965	25,529	24,667	27,334	33,373	35,094
Trinidad and Tobago	4,103	4,991	5,374	4,612	5,062	..	..	..	..	..	..
Uganda	..	..	..	..	..	..	..	..	2,228	..	..
Ukraine	80	..	144	174	..	..	..	..	..	88	98
Uruguay	2,872	5,104	6,694	7,765	10,146	10,508	10,957	10,613	12,483	16,295	15,438
Zambia	..	..	..	..	..	..	876	581	..	..	..
Total selected	591,5	774,2	958,8	1,099,4	1,237,1	1,367,8	1,521,7	1,374,5	1,652,6	1,566,2	1,562,9
non-OECD	29	91	58	35	92	07	11	33	26	02	79

Note: “..”—countries do not have a pension system divided into public and private pension funds.

Source: (OECD, 2021).

Based on the data presented in this table 1, we can conclude that the countries which have the highest value of total assets in pension plans in 2018 are: Brazil (\$449,315 million), Singapore (\$285,802 million), China (\$215,526 million), Hong Kong (\$148,705 million) and Russia (\$81,456 million). The ratio of pension assets to GDP has increased in non-OECD countries with a weighted average of 41.5% in 2018 compared to 35.2% in 2008. Pension assets reached the level of GDP in some non-OECD countries OECD members in 2018, such as Liechtenstein (95.6%) and South Africa (95.1%) (OECD, 2019). Table 2 presents data on total assets in public and private pension plans as% of GDP in the 52 non-OECD reporting countries.

Table 2. Total assets in public and private pension plans in non-OECD reporting countries.

State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Albania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Armenia	..	..	..	..	..	..	0.3	0.6	1.2	1.9	2.6
Bolivia	22.4	26.9	28.7	..	..	..	..	..	..	..	..
Botswana	..	..	..	..	..	46.9	..	..	..	45.5	40.8
Brazil	13.3	14.6	13.9	13.1	13.4	12.1	18.9	20.2	22.9	24.6	25.5
Bulgaria	3.2	4.3	5.3	5.7	7.0	8.3	9.8	10.6	11.5	12.6	12.5
China (People's Republic of)	0.6	0.7	0.7	0.7	0.9	1.0	1.2	1.4	1.5	1.6	1.7
Colombia	14.5	13.4	16.2	17.0	18.1	18.0	20.0	20.3	22.4	25.1	24.0
Costa Rica	7.0	7.6	7.4	8.4	9.5	11.0	11.6	16.6	17.7	18.6	20.2
Croatia	6.8	9.2	11.6	12.9	16.2	18.4	21.2	23.2	25.4	26.6	27.3
Dominican Republic	2.9	3.9	4.6	5.4	6.5	7.4	10.6	10.9	11.9	12.3	14.2
Egypt	2.3	..	..	..	..	1.9	1.9	1.8	1.8	1.8	1.6
El Salvador	24.9	28.5	29.7	30.0	32.0	33.3	35.4	36.3	38.3	40.1	40.9
Ghana	..	..	..	..	..	..	1.7	2.6	3.2	4.3	4.4
Gibraltar	..	..	..	1.9	1.9	1.7	0.4	..	..	..	..
Guyana	5.8	6.2	5.9	5.7	5.9	6.5	6.5	6.9	6.5	6.8	8.0
Hong Kong	27.5	31.6	34.2	32.0	34.4	37.4	37.8	37.2	38.3	43.5	40.9
India	..	..	0.2	0.2	0.3	0.4	0.6	0.8	1.0	..	..
Indonesia	1.6	1.8	1.8	1.7	1.8	1.7	1.8	1.7	1.8	1.9	1.8
Isle of Man	..	..	..	..	..	..	..	..	85.0	..	..
Jamaica	19.7	20.9	22.5	22.8	22.1	21.2	22.0	23.8	25.7	27.7	30.2
Kazakhstan	..	..	..	..	..	..	..	..	..	..	16.3
Kenya	11.0	11.0	13.6	12.4	12.9	14.7	14.0	13.0	13.7	13.2	12.9
Kosovo	..	..	..	..	14.2	17.2	19.6	20.4	23.6	25.8	25.0
Lesotho	..	..	..	10.7	11.6	..	..	..	..	..	..
Liechtenstein	37.2	50.3	59.2	62.6	63.6	66.7	69.3	81.8	86.6	95.6	..
Malawi	8.8	9.6	9.6	9.7	11.7	13.7
Malaysia	0.1	0.1	0.2	0.2
Maldives	2.0	3.7	5.0	..	7.6	8.9	9.8	10.7

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State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Malta	0.5	8.0	16.0	25.2	32.6	37.7	41.3	..
Mauritius	..	..	..	..	2.0	2.1	..	4.2	4.4	4.6	..
Mozambique	..	..	..	..	..	..	..	..	..	..	0.6
Namibia	..	..	77.4	77.1	80.2	84.4	84.4	..	82.2	87.8	91.3
Nigeria	2.8	3.4	3.6	3.8	4.3	5.0	5.1	5.6	6.0	6.5	6.7
North Macedonia	1.2	2.1	2.9	3.5	4.6	5.4	6.4	7.3	8.3	9.4	10.0
Pakistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	..	0.1	0.1
Panama	0.4	..	0.5	0.6	..	0.7	0.8	0.8	0.8	0.9	0.9
Papua New Guinea	..	..	..	..	..	18.0	..	..	..	18.4	18.2
Peru	14.0	19.0	20.8	17.4	19.0	18.7	19.9	20.3	21.1	22.8	21.1
Romania	0.2	0.5	0.9	1.2	1.7	2.3	3.0	3.6	4.3	4.8	5.2
Russia	..	..	..	..	..	5.3	5.1	5.8	6.1	6.1	5.5
Serbia	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.8
Singapore	..	..	..	59.5	63.1	66.2	69.3	71.0	75.0	77.2	80.1
South Africa	83.3	74.7	80.0	80.4	84.5	90.7	96.6	99.7	95.1	..	..
Suriname	..	..	..	..	..	..	..	..	11.7	14.7	13.6
Tanzania	..	..	..	..	..	6.5	8.1	9.4	8.3	8.3	..
Thailand	4.8	5.3	5.3	5.5	5.7	5.8	6.4	6.5	6.7	7.1	7.0
Trinidad and Tobago	14.6	25.8	24.0	17.9	19.7	..	..	..	..	..	..
Uganda	..	..	..	..	..	..	..	..	9.2	..	..
Ukraine	0.1	..	0.1	0.1	..	..	..	..	..	0.1	0.1
Uruguay	11.0	14.0	16.6	16.7	18.9	19.1	20.0	21.8	23.0	27.6	27.1
Zambia	..	..	..	..	..	..	3.4	3.5	..	..	..

Note: “..”—countries do not have a pension system divided into public and private pension funds.

Source: (OECD, 2021).

Referring to the table above, we can conclude that the five countries which have the highest percentage of pension assets in relation to GDP are: Namibia (91.3%), Singapore (80.1%), El Salvador (40.9%), Hong Kong, Congo (40.9%) and Botswana (40.8%). Whereas the five non-OECD reporting countries that have the lowest percentage of pension assets in relation to GDP are: Serbia (0.8%), Mozambique (0.6%), and Malaysia (0.2%). Albania (0.1%), Pakistan (0.1%) and Ukraine (0.1%). Pension assets are also unevenly distributed within the regions. South Africa had the largest amount of pension assets in Africa, exceeding \$ 0.2 trillion and was one of two African countries, along with Namibia, that had pension assets of more than 50% of GDP. In Latin America, Brazil and Chile have the largest amount of pension assets in dollar terms (OECD, 2019). Figure 1 graphically presents the total public and private pension assets in 2008 and 2018 for non-OECD reporting countries.

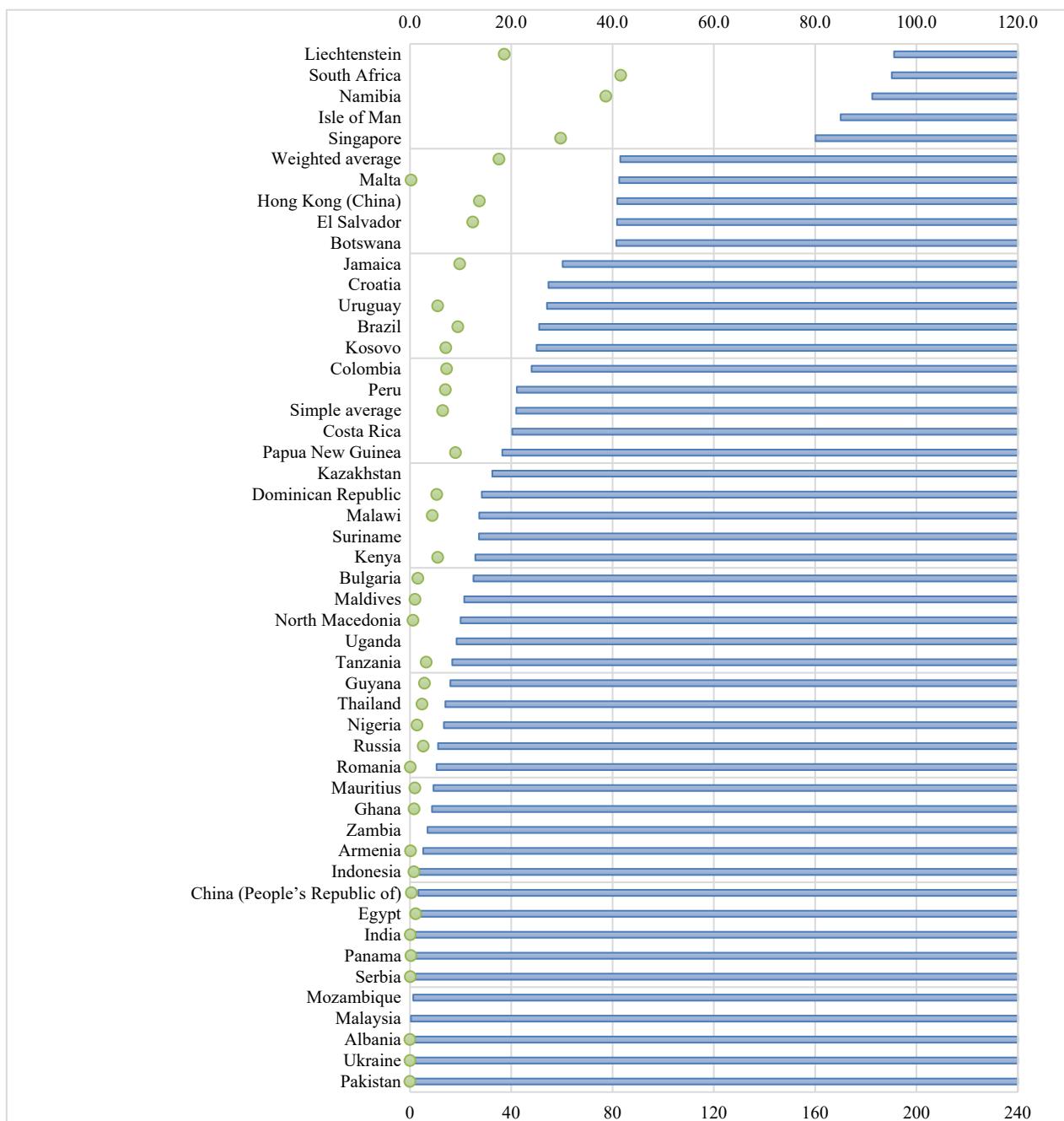


Figure 1. Evolution of public and private pension assets in non-OECD reporting countries.

Source: Data processing by authors (OECD, 2021).

Figure 1 shows the evolution of public and private pension assets, and the values are presented as a weighted average based on the amount of assets in the pension funds. The countries that have the highest weighted average value are Liechtenstein (95.6%), South Africa (95.1%), Namibia (91.3%), Isle of Man (85%) and Singapore (85%). According to OECD estimates, 13 countries from these reporting countries have a weighted average of pension assets in the range 20–40, 9 of them in the range 10–20 and 22 of them have a weighted average of pension assets in the range 0–10.

Figure 2 shows the coverage of public and private pension plans in non-OECD countries by type of pension plan. Graphically, the data are expressed as a percentage of the working-age population.

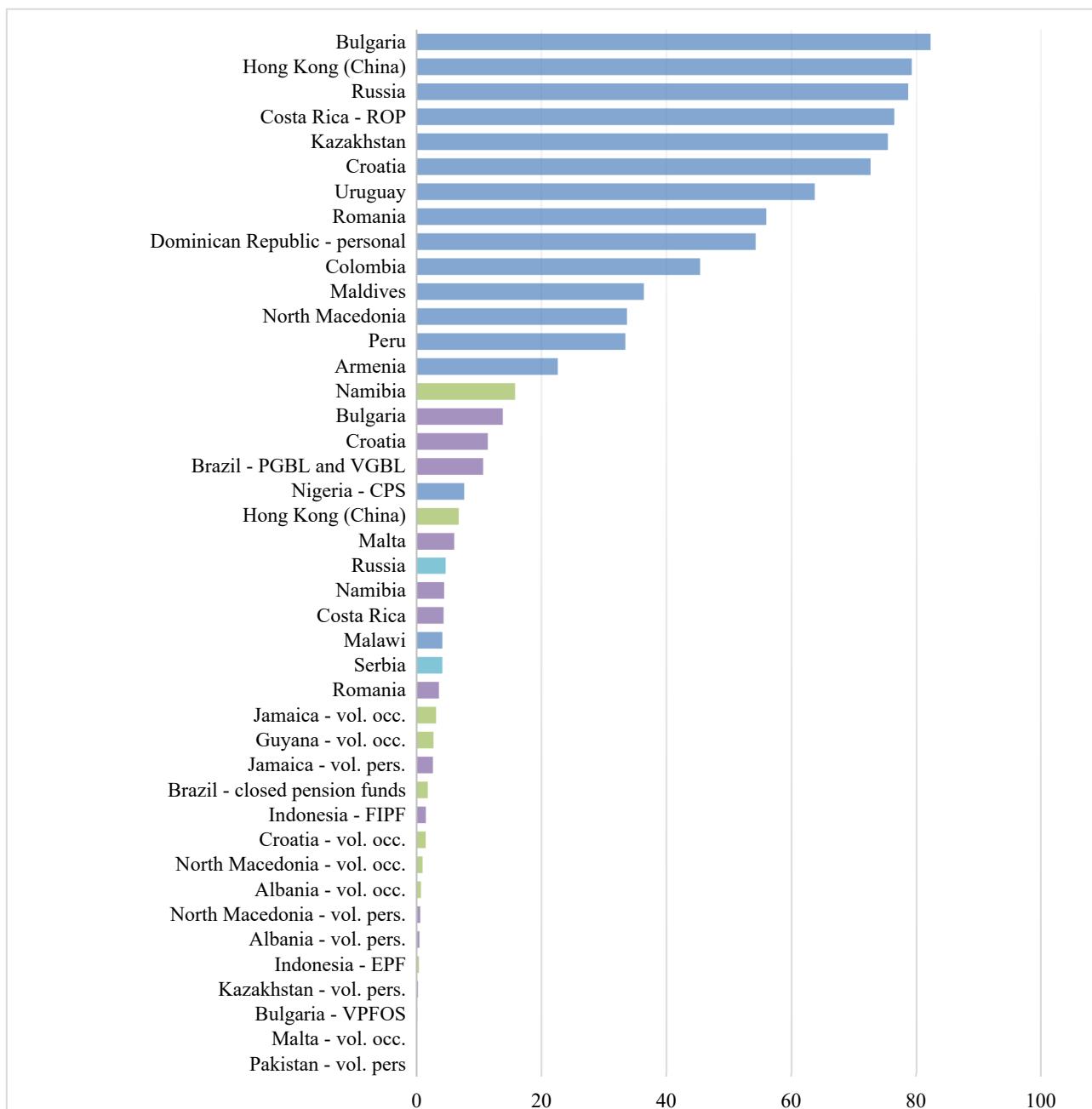


Figure 2. Coverage of public and private pension plans in non-OECD reporting countries.

Source: Data processing by authors (OECD, 2021).

The extent of coverage of voluntary pension plans has remained more or less similar over the last ten years, with some notable exceptions. Figure 3 graphically shows the evolution of pension plan coverage in a sample of selected countries from 2008 to 2018. Graphically, the data are expressed in percentage points of the working-age population.

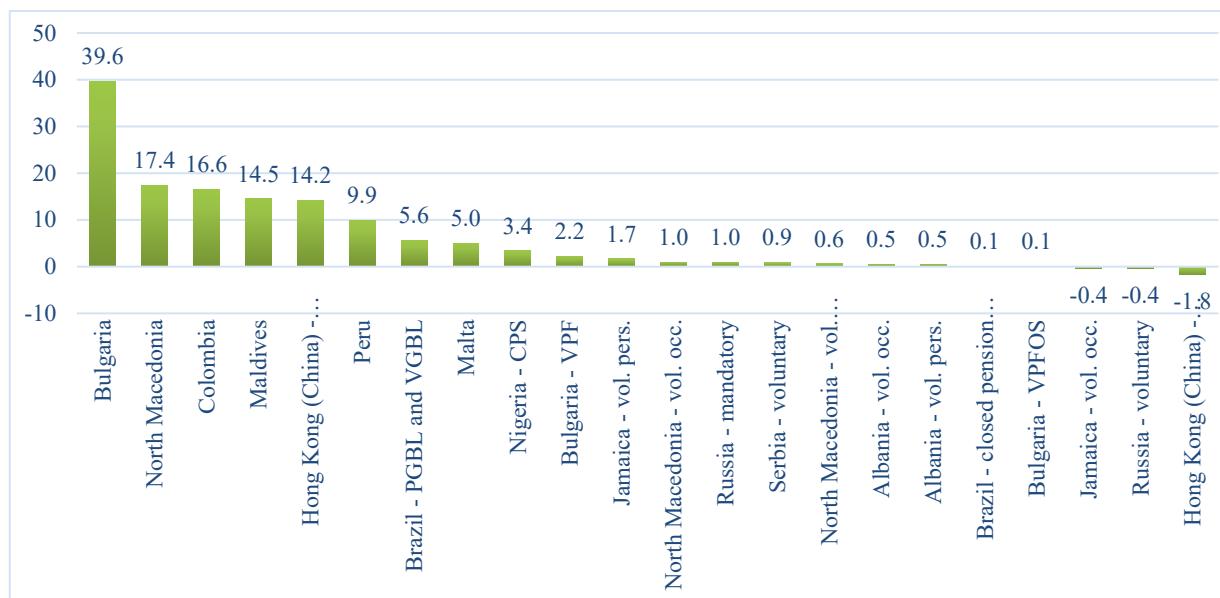


Figure 3. The evolution of pension plan coverage in non-OECD reporting countries.

Source: Data processing by authors (OECD, 2021).

Among the countries that are non-OECD reporting countries, the highest share of the coverage of mandatory pension plans are Bulgaria (39.6%), Northern Macedonia (17.4%), Colombia (16.6%), Maldives (14.5%), Hong Kong (14.2%) and Peru (9.9%). While the countries that have a substantial share in covering voluntary professional plans are: North Macedonia (1.0%), Albania (0.5%), Brazil (0.1%), Bulgaria (0.1%), Jamaica (-0.4%) and Hong Kong Congo (-1.8%). The six countries that participate in the coverage of pension plans are Brazil (5.6%), Malta (5.0%), Bulgaria (2.2%), Jamaica (1.7%), North Macedonia (0.6%) and Albania (0.5%).

The role that public and private pensions can play during retirement depends on the amount of assets accumulated in the pension plans, which depends on the amount of contributions paid to these plans during the accumulation phase (OECD, 2020). Table 3 presents data on contributions to public and private pension plans from 2008 to 2018. This comparative analysis includes 44 non-OECD reporting countries, and the data are expressed as a percentage of GDP.

Table 3. Contributions to public and private pension plans in non-OECD reporting countries.

State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Albania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Armenia	..	..	..	..	..	..	0.3	0.4	0.4	0.6	0.8
Botswana	..	..	..	..	..	2.0	..	..	..	..	..
Brazil	0.3	0.3	0.4	0.4	..	0.4	0.4	0.4	0.4	0.4	..
Bulgaria	1.0	1.0	0.9	1.0	1.0	1.1	1.2	1.4	1.4	1.4	1.4
Colombia	2.1
Costa Rica	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.6	1.4	1.4	1.6
Croatia	1.6	1.6	1.8	1.7	1.9

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State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Dominican Republic	7.1	7.5
Egypt	0.3	..	..	..	..	..	..	..	0.2	0.2	0.2
Ghana	..	..	..	..	..	..	1.3	2.0	..	..	..
Gibraltar	..	..	..	0.2	0.2	0.2	0.0	..	..	..	..
Guyana	..	..	..	..	..	..	..	0.4	0.2	0.2	..
Hong Kong (China)	2.9	3.6	3.1	3.0	3.2	3.4	3.4	3.6	3.9	3.4	3.3
India	..	..	..	0.2	0.1	..	..	..	..	..	..
Indonesia	..	..	..	0.1	..	..	..	0.2	0.2	0.2	0.2
Kazakhstan	..	..	..	..	..	..	..	..	..	..	1.4
Kenya	1.1	1.0	1.2	1.2	..	1.3	1.2	..	1.1	..	..
Kosovo	..	..	..	..	2.3	2.2	2.4	..	2.5	..	..
Liechtenstein	3.5	3.9	5.5	6.2	6.3	6.5	5.9	9.2	6.3	7.1	..
Malawi	..	..	..	..	..	..	1.2	1.3	1.2	1.4	1.9
Malaysia	..	..	..	..	..	..	..	0.1	0.1	0.2	0.2
Maldives	..	..	..	1.5	1.6	1.5	..	1.4	1.4	..	..
Malta	..	..	..	0.5	7.9	10.1	12.1	11.8	11.5	10.1	..
Mauritius	..	..	..	..	0.2	0.3	..	..	0.6	0.3	..
Mozambique	..	..	..	..	..	..	..	..	..	..	0.1
Namibia	..	..	3.6	3.5	3.6	3.6	4.1	..	4.1	..	..
Nigeria	0.8	0.7	1.6	0.6	0.7	0.6	..	0.8	0.6	0.6	0.6
North Macedonia	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0	1.0	1.1	1.1
Pakistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	..	..	..	0.0
Panama	..	..	..	..	..	..	..	..	0.1	..	..
Papua New Guinea	..	..	..	..	..	1.9	..	..	..	..	..
Peru	1.3	1.3	1.2	1.2	1.3	1.4	1.4	1.5	1.4	1.4	1.7
Romania	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	0.8
Russia	..	..	..	0.1	..	0.1	..	0.1	0.1	0.1	0.1
Serbia	..	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
South Africa	4.3	4.5	4.7	4.7	4.9	4.9	5.1	5.3	5.2	5.1	..
Suriname	..	..	..	..	..	..	..	..	0.5	..	..
Tanzania	..	..	..	..	..	2.2	2.4	1.7	2.2	1.8	..
Thailand	0.9	0.7	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.9
Trinidad and Tobago	..	0.6	..	0.5	0.6	..	..	..	..	..	..
Ukraine	0.1	..	0.1	0.0	..	..	..	..	..	..	..
Uruguay	..	..	..	..	..	..	..	..	1.9	1.4	1.9
Zambia	..	..	..	..	..	..	0.4	0.4	..	..	..

Note: “..”—countries do not have a pension system divided into public and private pension funds.

Source: (OECD, 2021).

Referring to the table above, we can conclude that the six non-OECD countries which have the highest percentage of pension contributions in relation to GDP for 2018 are: Dominican Republic (7.5%), Hong Kong (3.3%), Colombia (2.1%), Croatia (1.9%), Malawi (1.9%) and Uruguay (1.9%). The regulation sets a contribution rate in countries with mandatory pension plans and automatic registration. Liability for paying pension contributions may fall on employees (e.g., in Chile, Croatia, Ghana, Kazakhstan, Peru and Romania), on employers (e.g., in Australia, Norway, Slovakia) or on both (e.g., in Estonia, Iceland, Switzerland). This obligation can only apply to certain employees or under certain conditions, and these pension contributions can be supplemented by other state-compliant contributions (e.g., New Zealand) or subsidies (e.g., social quota in Mexico) (OECD, 2019).

The total amount of contributions paid to public and private pension plans amounted to less than 0.1% of GDP in Albania and Pakistan, while the value amounted to 10% of GDP in Malta. The evolution of paid contributions to public and private pension plans relative to GDP is heterogeneous in all countries. The largest increase occurred in Malta, where contributions increased from 0.5% of GDP in 2011 to 10.1% in 2017 (OECD, 2020). Table 4 presents the real annual rates of return on investment of all public and private pension plans for the period 2008–2018. The data are expressed in percentages, and this table presents the real annual rates of return for 43 non-OECD countries.

Table 4. Real annual rates of return on investment of pension funds of non-OECD reporting countries.

State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Albania	4.6	4.7	5.8	2.8	3.2	3.8	4.3	3.3	2.7	2.6	2.0
Armenia	..	..	..	..	..	..	-1.7	6.4	10.4	6.7	2.2
Bolivia	-1.9	9.7	0.8	..	..	..	..	..	..	..	..
Botswana	..	..	..	..	..	..	..	..	..	8.5	..
Brazil	..	..	..	..	..	..	..	..	..	..	2.1
Bulgaria	-29.4	7.9	0.5	-3.0	2.9	6.3	6.8	1.9	4.9	3.9	-6.0
Colombia	-2.5	24.3	21.5	-3.7	15.1	-2.2	6.5	-3.7	3.5	8.8	-2.9
Costa Rica	-10.1	4.9	1.1	4.2	5.7	7.9	2.3	12.3	6.4	3.7	3.6
Croatia	..	..	..	..	..	..	9.9	11.3	7.6	1.2	0.2
Dominican Republic	7.2	7.8	4.3	4.4	10.0	9.0	10.3	8.2	8.9	6.3	6.5
Egypt	..	..	..	..	..	..	..	..	-10.1	-8.0	-3.0
El Salvador	-2.2	5.4	2.4	-2.1	4.4	1.5	3.0	1.3	3.2	2.6	3.7
Ghana	..	..	..	..	..	..	3.4	5.4	4.0	..	..
Gibraltar	..	..	..	..	-0.6	0.4	..	..	..	..	..
Guyana	..	..	..	..	..	..	..	2.6	-0.2	3.0	2.7
Hong Kong (China)	..	24.6	4.8	-16.1	8.4	3.0	-3.3	-5.8	-0.3	20.2	-11.6
India	..	..	..	-2.6	0.0	-5.8	11.1	0.0	..	..	..
Indonesia	..	..	..	0.6	6.7	-4.9	6.7	2.8	7.8	7.4	0.6
Kenya	-14.3	1.0	12.4	-24.2	..	9.8	6.6	..	0.9	5.3	..
Kosovo	7.5	6.8	2.1	3.1	5.7	-6.7
Liechtenstein	-8.4	9.5	2.8	-1.3	-1.5	6.7	5.1	7.6	3.3	5.9	-4.9
Malawi	13.3	0.1	-7.8	-4.8	17.8	9.8

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State	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Maldives	10.8	..	7.7	3.7	3.7	6.2
Malta	..	..	..	-4.9	0.6	-0.2	0.3	-2.4	5.0	3.5	..
Mauritius	..	..	..	..	..	..	..	5.1	-1.4	..	..
Namibia	..	..	..	5.0	7.5	11.0	4.7	..	-4.5	3.1	..
Nigeria	..	..	-0.8	-6.3	0.0	4.5	0.0	-0.5	-5.7	0.1	-1.9
North Macedonia	-15.0	16.1	3.9	-1.0	3.0	6.5	7.2	5.8	6.1	2.8	0.3
Pakistan	-26.4	0.3	-3.2	-1.2	9.8	11.2	15.3	9.3	..	-10.2	-6.5
Panama	..	..	..	0.3	1.3	2.0	2.7	4.2	4.2	5.4	..
Papua New Guinea	..	..	..	..	..	..	..	..	..	4.9	-0.2
Peru	-29.8	26.8	17.3	-14.1	9.1	-2.3	3.7	-0.2	5.7	5.2	-4.5
Romania	12.4	11.1	6.6	-0.3	5.2	8.9	7.8	5.0	5.0	1.1	-1.8
Russia	..	..	..	..	..	-0.3	-7.4	-2.0	5.3	2.4	-1.4
Serbia	-13.7	6.8	-2.6	-1.3	-0.5	8.6	8.8	13.5	5.8	3.4	4.5
South Africa	-5.0	-2.4	8.7	2.6	5.0	9.9	8.9	3.7	-1.0	1.3	0.5
Suriname	..	..	..	..	..	..	..	..	..	..	..
Tanzania	..	..	..	..	..	..	..	6.2	0.1	..	..
Thailand	..	2.8	-0.9	-0.7	4.2	0.2	5.2	1.7	3.4	4.5	-1.7
Trinidad and Tobago	..	6.0	..	2.7	3.4	..	..	..	..	..	..
Ukraine	..	..	7.5	5.6	..	..	..	..	..	3.2	4.1
Uruguay	-21.5	30.0	17.0	8.1	11.9	3.1	4.1	1.2	1.0	13.4	-0.1
Zambia	..	..	..	..	..	..	5.7	-5.3	..	..	..

Note: “..”—countries do not have a pension system divided into public and private pension funds.

Source: (OECD, 2021).

The decline in the value of pension assets in 2018 is likely to be attributed to the investment performance of public and private pension plans in 2018. Real rates of return on investment of pension plans were negative in OECD countries (-3.2%) and only below 0% in other jurisdictions (OECD, 2019). In 2018, the seven non-OECD countries that have the highest annual rate of return on pension asset investments were: Malawi (9.8%), Maldives (6.2%), Dominican Republic (6.5%), Serbia (4.5%), Ukraine (4.1%), El Salvador (3.7% and Costa Rica (3.6%), while the countries that have the highest negative rate of return on pension asset investments for 2018 are: Hong Kong (-11.6%), Kosovo (-6.7%), Bulgaria (-6.0%), Pakistan (-6.5%), Liechtenstein (-4.9%), Peru (-4.5%) and Egypt (-3.0%) etc. Poor financial investments in pension funds in 2018 may result from the decline in capital market performance in the last quarter of 2018. Some of the key stock indices have fallen sharply in 2018 compared to 2017, suffering one of the deepest declines since the 2008 financial crisis (e.g., the S & P500 declined by 6.2% in 2018).

Table 5 presents data on the allocation of assets in public and private pension plans in equity. These data are expressed as a percentage of total investments and include the period 2008–2018.

Table 5. Allocation of assets to public and private pension plans of non-OECD reporting countries.

State	Exposure	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Albania	total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Armenia	direct	..	..	..	..	..	..	0.0	0.0	0.0	0.0	0.0
Botswana	direct	..	..	..	..	..	51.0	..	..	..	69.8	67.2
Brazil	total	27.4	32.1	32.8	29.8	..	27.9	25.6	17.3	17.4	16.9	18.4
Bulgaria	direct	10.4	11.3	14.8	11.7	11.0	12.8	16.3	16.2	15.3	17.4	17.4
Colombia	total	24.0	40.3	43.4	33.1	35.1	31.5	27.6	25.4	38.0	40.4	34.0
Costa Rica	total	0.0	0.0	0.0	0.0	0.0	0.3	1.8	3.7	1.6	3.0	6.3
Croatia	total	..	..	..	..	..	..	22.7	23.7	21.9	21.9	21.0
Dominican Republic	total	..	..	..	..	..	..	..	..	..	0.0	1.4
Egypt	total	2.1	..	..	..	..	..	..	..	6.4	1.7	2.1
Ghana	direct	..	..	..	..	..	..	..	..	..	1.7	2.4
Gibraltar	total	..	..	..	51.6	33.9	42.9	37.2	..	..	..	..
Guyana	total	..	..	..	..	..	..	..	23.3	23.4	27.3	37.7
Hong Kong (China)	total	45.5	50.7	55.2	55.0	57.4	60.5	61.1	60.6	59.9	63.4	57.5
India	total	..	..	..	..	..	..	..	..	11.2	..	..
Indonesia	total	..	..	..	..	..	..	..	..	16.2	17.3	16.9
Jamaica	total	..	12.7	14.0	16.0	14.7	15.4	15.7	24.0	28.5	33.5	38.1
Kazakhstan	total	..	..	..	..	..	..	..	..	..	..	2.6
Kenya	direct	32.7	20.2	21.2	23.5	24.3	26.0	26.6	..	16.3	19.8	17.6
Kosovo	direct	..	..	..	..	..	..	..	0.1	0.3	0.3	0.3
Liechtenstein	total	16.7	19.6	26.1	25.1	24.9	26.3	29.4	29.6	30.1	31.7	28.6
Malawi	total	..	..	..	..	..	..	49.8	38.8	38.4	41.8	48.4
Maldives	total	..	..	..	12.2	6.0	3.9	..	5.1	3.8	6.5	5.4
Malta	direct	..	..	..	..	..	8.9	9.4	9.0	11.7	12.3	..
Mauritius	total	..	..	..	..	..	..	..	..	55.0	56.0	..
Mozambique	total	..	..	..	..	..	..	..	..	..	..	45.7
Namibia	total	..	..	62.5	57.3	54.7	66.1	66.6	..	57.8	..	..
Nigeria	direct	20.3	14.7	18.9	14.4	12.8	15.9	13.0	11.1	9.8	10.7	7.9
North Macedonia	total	9.2	6.3	9.7	18.8	18.9	25.2	29.2	30.4	30.6	30.3	29.5
Pakistan	total	14.3	29.1	30.7	28.7	32.2	37.3	44.3	49.3	..	..	45.5
Panama	total	..	..	..	..	..	..	..	..	0.4	..	..
Papua New Guinea	total	..	..	..	..	..	48.7	..	..	..	42.4	42.5
Peru	total	31.1	46.0	46.7	43.6	43.4	42.8	44.7	39.6	38.7	43.0	41.6
Romania	direct	2.0	9.1	12.4	11.9	12.4	16.5	20.4	22.2	21.5	23.0	20.1
Russia	direct	8.4	8.4	9.6	12.5	11.5	7.7
Serbia	total	..	7.2	11.4	5.4	2.9	2.8	3.9	4.1	7.4	8.5	8.6
Singapore	total	0.8	0.1	0.1	0.2	0.2	0.2

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State	Exposure	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
South Africa	direct	15.9	20.8	22.4	21.2	19.9	21.4	21.3	21.1	19.5	18.8	36.6
Suriname	direct	..	..	..	..	..	..	..	..	10.2	7.0	6.3
Tanzania	direct	..	..	..	..	..	..	5.9	11.0	7.2	7.7	..
Thailand	direct	7.4	10.2	13.3	11.3	14.2	13.3	15.4	14.9	16.3	18.4	16.9
Trinidad and Tobago	total	..	24.7	..	26.8	32.3	..	..	..	..	..	..
Uganda	total	..	..	..	..	..	..	..	..	16.8	..	..
Ukraine	total	9.0	..	18.1	18.4	..	..	..	..	..	..	..
Uruguay	total	..	..	..	..	..	..	..	..	0.2	0.2	0.2
Zambia	direct	..	..	..	..	..	..	23.2	22.3	..	..	..

Note: “..”—countries do not have a pension system divided into public and private pension funds.

Source: (OECD, 2021).

In most countries, bonds and stocks are the two main asset classes in which pension funds invested their assets at the end of 2018, accounting for more than half of investments in 39 of the other 46 reporting jurisdictions. Therefore, developments in the bond and capital markets have played an important role in the financial performance of pension plans. The combined percentage of shares and bonds was highest in Chile (99.4%), Dominican Republic (99.2%), Estonia (96.7%), Nigeria (96.4%), Mexico (96.3%), Albania (96%), Maldives (95.9%) and India (95.7%) (OECD, 2019).

Referring to the data presented in Table 5, we can conclude that the 10 non-OECD countries which have the highest percentage of total investments allocated to shares are: Botswana (67.2%), Hong Kong (57.5 %), Malawi (48.4%), Mozambique (45.7%), Pakistan (45.5%), Papua New Guinea (42.5%), Peru (41.6%), Jamaica (38.1%), Guyana (37.7%) and South Africa (36.6%). Government bonds, compared to corporate bonds, represented a large share of combined direct bond holdings in a number of countries, e.g., Government bonds account for 100% of total direct bond holdings in Albania and North Macedonia, 99.6% in Serbia, 96.9% in Hungary, 87.6% in the Czech Republic, 24.8% in Norway and 10.5% in New Zealand.

4. Scientific research methodology and econometric model specification

To meet this study’s main objectives, we have included 30 countries selected within different economies. Of these 30 countries, 20 of them are developing countries, five of them are developed countries, and five countries are economies in transition. Specifically, Argentina, Brazil, China, Costa Rica, Dominican Republic, Egypt, El Salvador, Hong Kong, Indonesia, India, Jamaica, Kenya, Nigeria, Pakistan, Peru, Singapore, Africa, South, Thailand, Uruguay and Panama for developing countries, Bulgaria, Croatia, Liechtenstein, Malta and Romania for developed countries and Albania, Kosovo, North Macedonia, Russia and Serbia as in transition countries. The time period included in this study is of 16 years, between 2002 and 2018. In order to analyze the impact of the investment of pension assets on economic growth in the economies of the countries selected in this study, the effects of some external variables within econometric models have been taken into account. These variables are gross fixed capital formation, domestic credit to the private sector, inflation, public debt and population. 510 observations have been collected through panel data and time series, and through various statistical tests and comparative analyzes, the effect of all independent variables on the dependent variable will

be analyzed. To derive econometric results, econometric models have been applied through statistical tests such as linear regression, random effect, and fixed effect. Specifically, Hausman Taylor Regression, Generalized Estimating Equations (GEE), Generalized Method of Moments - Arellano - Bover and Blundell - Bond estimation (GMM), ARCH-GARCH Model and Nelson's EGARCH Model. We consider the use of such analyzes as an added value to this paper. This is because, through these econometric analyses, accurate predictions are made of the macroeconomic factors which influence the volatility of economic growth, taking into account the investments of pension assets in the international financial markets due to the many movements of the price indices for these pension assets.

We have used secondary data in this study since these statistical data are more reliable and are published by relevant institutions such as the OECD and the World Bank. To explain the correlation between the assets of pension funds and economic growth, the impact of six independent variables (pension fund assets, gross fixed capital formation, domestic credit to the private sector, inflation, public debt and population) that control the level of impact of pension assets on economic growth have been taken into account. To answer this study's research questions and explain the correlation between the investment of pension fund assets and economic growth, we have analyzed seven variables (gross domestic product is a dependent variable or endogenous variable that depends on the impact of other independent variables such as pension fund assets, gross fixed capital formation, domestic loans to the private sector, inflation, public debt and population).

To perform our empirical analyzes and econometric measurements, we applied the panel data, which we coded to the Stata statistical application software. We then compared the main performance indicators of pension funds and economic growth in the 30 OECD non-member countries. For this comparative analysis, linear trends and a critical approach have been applied to the historical method. We specifically carried out these econometric evaluations and hypothesis validation testing through the above statistical tests.

In this scientific research, as a dependent variable, we have used the gross domestic product to measure the economic growth of the countries included in this analysis. Whereas the explanatory or independent variables which explain and control the dependent variable of this study are: pension fund assets, gross fixed capital formation, domestic credit to the private sector, inflation, public debt and population. The econometric model shows that the dependent variable Y (Gross Domestic Product) is expressed as a function of the independent variables:

$$Y = f(X_1, X_2, \dots, X_n) + \varepsilon \quad (1)$$

Where: ε indicates normal distribution.

Gross domestic product = f (Determinants of economic growth and the impact of pension asset investments on GDP).

$$GDP = f(PFA, GFCF, DCPS, INFL, PD, POP) \quad (2)$$

The main hypothesis of this study is:

H1: Pension funds have positively impacted the economic growth of non-OECD countries.

Many countries promote the idea of investing in pension savings as a response to the management challenges that these countries have due to the ageing population and the growing burden of pensions. Considering this fact, pension funds in different countries invest pension contributions in financial capital markets, which positively affects their financial performance. Investments in pension assets on international capital markets can directly stimulate the economic growth of these countries by

providing more funds for investment. Also, these pension asset investments positively affect the private capital markets in terms of better capital allocation and the overall efficiency of institutional investors. As a result of these investments in the pension systems of these countries, the efficiency of companies in various sectors of the economy can be directly increased, improving governance and acting as major shareholders. Seeing the great importance of the investment of pension assets in the economic growth of these countries, the main hypothesis of this study is therefore argued and justified in theoretical and scientific terms. Since the investments of pension assets in the international financial markets have a long-term impact on the economic growth of these countries, this study analyzed the impact of the investment in pension assets on the volatility of economic growth. To analyze how pension asset investments have affected the volatility of economic growth in non-OECD countries, we carried out ARCH-GARCH statistical tests, which are tests that are widely applied in scientific research in the field of economics for forecasts of the macroeconomic phenomena. The measurement of the volatility of economic growth of non-OECD countries is justified by the fact that index movements in international capital markets due to the investment in pension assets can cause an increase or decrease in the volatility of economic growth. Therefore, analyzing the volatility of economic growth in correlation with investments in pension assets and other macroeconomic factors is related to the main hypothesis of this study.

Table 6. Description of variables included in econometric models.

Variables	Description of the variable	Data source
Dependent variable	Gross Domestic Product (GDP)	OECD and World Bank Annual Reports (2002–2018)
Independent variable	Pension Fund Assets (PFA)	OECD Annual Reports (2002 - 2018)
Independent variable	Gross Fixed Capital Formation (GFCF)	OECD Annual Reports (2002 - 2018)
Independent variable	Domestic Credit to Private Sector (DCPS)	OECD and World Bank Annual Reports (2002 - 2018)
Independent variable	Inflation (INFL)	OECD and World Bank Annual Reports (2002 - 2018)
Independent variable	Public Debt (PD)	OECD and World Bank Annual Reports (2002 - 2018)
Independent variable	Population (POP)	OECD and World Bank Annual Reports (2002 - 2018)

Source: Data processing by authors (2021).

For the specification of this econometric model, to test this hypothesis, we have referred to studies by Acuna et al. (2014), Alonso et al. (2010), Farayibi (2016), Altiparmakov & Nedeljkovic (2016), Borch-Supan et al. (2005), and Morina & Grima (2021). They have analyzed the impact of the investment of pension assets on the economic growth of different countries.

$$GDP_{it} = \beta_0 + \beta_1 PFA_{it} + \beta_2 GFCF_{it} + \beta_3 DCPS_t + \beta_4 INFL_{it} + \beta_5 PD_{it} + \beta_6 POP_{it} + \gamma_{it} \quad (3)$$

Where: GDP—Gross Domestic Product; PFA—Pension Fund Assets; GFCF—Gross Fixed Capital Formation; DCPS—Domestic Credit to Private Sector; INFL—Inflation; PD—Public Debt; POP—

Population; β_0 —presents the constant or value of the variable Y when all values of X are zero; $\beta_1 - \beta_6$ —regression coefficients for relevant independent variables; γ —stochastic variables (other factors not taken into account in the model); i—code; the t—time period (2002–2018).

Gross Domestic Product (GDP) is the market value for all final goods and services produced within a country in a given period of time. This definition focuses on GDP as total expenditure in the economy. Thus, in this dependent variable study, the gross domestic product obtained consists of four main components: consumption, savings, government spending and net exports (Mankiw, 2018).

Pension Fund Assets (PFA) are defined as assets acquired through pension contributions, and which as the main objective of investing in these assets is the financing of the benefits of pension plans (Morina & Grima, 2021). In many countries of the world, pension funds are the main institutional investors, and these financial institutions invest very large amounts of financial assets in the stock markets and the private companies with the highest ratings in the global financial markets. According to OECD statistics, the 300 largest pension funds globally own about \$6 trillion in assets. Therefore, the investment of pension assets in stock markets and in various private and public corporations has been taken as the main independent variable of this study and based on the economic theory; we can conclude that an expected result of this study is that there is a correlation positive between pension fund assets and economic growth in non-OECD countries.

Gross Fixed Capital Formation (GFCF) is defined as the investment or purchase of manufactured assets, which involves the production of such assets by producers minus the assets in possession. These relevant assets relate to assets intended for use in producing other goods and services for more than one year. The term “produced assets” means that only those assets that result from a production process are included. Thus, the purchase of land and natural resources is not included in the formation of gross fixed capital (OECD, 2021). In this study, gross fixed capital formation is taken as an independent variable (control variable) and referring to economic theories, a positive correlation is expected between GFCF and PFA, consequently a positive impact on the economic growth of non-OECD members.

Domestic Credit to Private Sector (DCPS) refers to the financial resources provided to the private sector, such as through loans, securities purchases, trade credits and other accounts receivable that create a repayment requirement. In some countries, these claims include lending to public enterprises (World Bank, 2021). Thus, domestic credit to the private sector represents the third independent variable of this study through which the effect of control over pension fund assets and the impact on economic growth will be measured. The expected results of this study consist of a positive correlation between private sector domestic credit and pension fund assets and visas in view of the positive effect on economic growth.

Inflation (INFL) Economists use the term inflation to describe a phenomenon in which the overall price level rises within a country's economy. The rate of inflation represents the change in percentage to a certain extent of the price level from one period to another (Mankiw, 2018). So, the fourth independent variable in this scientific research is inflation and referring to economic theory, we can conclude that there is a negative correlation between inflation and investment in pension fund assets. This negative correlation also causes negative effects on the value of the gross domestic product within a country's economy.

Public debt (PD) is an obligation of the central government of a country. Public debt can be a domestic debt owed to the inhabitants of a country and external debt financed by foreign lenders. Theoretically, domestic debt carries a lower risk because it can be repaid by raising taxes, reducing costs, and increasing the money supply (Hull, 2018). A well-managed and controlled public debt contributes

positively to the sustainability of a country's pension system. While the high and uncontrolled level of public debt reduces the space for deficits in public social security systems. Therefore, theoretically, there is a correlation between public debt, pension fund assets and economic growth.

Population (POP)—The last independent variable included in this study is population. We can analyze whether demographic factors impact pension fund assets and economic growth through this variable. Theoretically, demographic factors such as education, employment, marital status, income and other factors significantly impact pension plans. Therefore, there is a positive correlation between population (demographic factors), pension assets and economic growth.

5. Linear trend analysis: An empirical comparative approach between asset investments in a pension fund and economic growth in non-OECD countries

In the fifth section of this study, linear trends will be analysed by applying the empirical comparative approach between assets of pension funds and economic growth in non-OECD countries for the period 2002–2018. This comparative analysis will integrate the other independent variables of this study to explain the correlation between independent variables, pension fund assets (main independent and endogenous variables) and economic growth (dependent variables).

Table 7 presents the total and average values for this study's variables, including 30 non-OECD countries for the period 2002–2018. In this table, the variables are expressed in total value: GDP, PFA and Population. While, in average value are presented these three variables: GFCF, DCPS, INFL and PD.

Table 7. The econometric models include the total and mean values of the variables.

Year	GDP (\$)	PFA (\$)	GFCF	DCPS	INFL	PD	POP (<i>in million \$</i>)
2002	4.1×10^{12}	1.1×10^7	20.9	56.2	7.0	55.1	3,562
2003	4.8×10^{12}	5.4×10^7	21.4	45.2	6.4	54.0	3,603
2004	5.7×10^{12}	1.0×10^8	21.7	46.6	7.2	50.6	3,645
2005	6.8×10^{12}	1.6×10^8	22.3	48.3	6.0	46.5	3,686
2006	8.2×10^{12}	2.4×10^8	23.2	52.8	5.8	42.1	3,728
2007	1.0×10^{13}	3.0×10^8	24.1	56.2	5.6	38.7	3,769
2008	1.2×10^{13}	2.5×10^8	25.2	56.8	9.7	38.6	3,810
2009	1.2×10^{13}	3.8×10^8	23.4	58.5	4.8	40.7	3,851
2010	1.5×10^{13}	4.9×10^8	22.9	59.0	5.7	40.9	3,892
2011	1.8×10^{13}	5.9×10^8	22.9	59.0	6.9	41.4	3,933
2012	1.9×10^{13}	7.4×10^8	23.2	60.6	5.6	43.5	3,974
2013	2.1×10^{13}	9.1×10^8	22.8	62.9	5.2	44.6	4,015
2014	2.1×10^{13}	1.0×10^9	22.6	63.3	4.4	46.3	4,056
2015	2.1×10^{13}	1.2×10^9	22.5	64.1	3.9	47.4	4,097
2016	2.1×10^{13}	1.4×10^9	21.9	64.5	4.5	48.4	4,138
2017	2.3×10^{13}	1.6×10^9	21.7	63.0	4.8	48.3	4,180
2018	2.5×10^{13}	1.6×10^9	21.8	63.1	4.1	49.7	4,219

Source: Data processing by authors (2021).

Table 8 presents the results of the analysis of linear trends for GDP, PFA, GFCF, DCPS, INFL, PD and POP. The data cover the time period of 16 years (2002-2018), and these empirical results of the linear trend analysis are generated from the statistical data presented in Table 7.

Table 8. Results of linear trend analysis for the variables included in this study.

Year	Linear Trend of GDP (\$)	Linear Trend of PFA (\$)	Linear Trend of GFCF	Linear Trend of DCPS	Linear Trend of INFL	Linear Trend of PD	Linear Trend of POP (<i>in millions \$</i>)
2002	3.6×10^{12}	-1.9×10^8	22.6	49.1	7.2	46.6	3,563
2003	5.0×10^{12}	-8.8×10^7	22.6	50.2	7.0	46.5	3,604
2004	6.4×10^{12}	1.9×10^7	22.6	51.2	6.8	46.4	3,645
2005	7.8×10^{12}	1.2×10^8	22.6	52.3	6.6	46.3	3,686
2006	9.2×10^{12}	2.3×10^8	22.6	53.4	6.5	46.2	3,727
2007	1.0×10^{13}	3.4×10^8	22.6	54.4	6.3	46.0	3,768
2008	1.2×10^{13}	4.5×10^8	22.6	55.5	6.1	45.9	3,810
2009	1.3×10^{13}	5.5×10^8	22.6	56.6	5.9	45.8	3,851
2010	1.4×10^{13}	6.6×10^8	22.6	57.6	5.7	45.7	3,892
2011	1.6×10^{13}	7.7×10^8	22.6	58.7	5.5	45.6	3,933
2012	1.7×10^{13}	8.8×10^8	22.6	59.8	5.4	45.5	3,974
2013	1.9×10^{13}	9.9×10^8	22.6	60.9	5.2	45.4	4,015
2014	2.0×10^{13}	1.1×10^9	22.6	61.9	5.0	45.3	4,056
2015	2.1×10^{13}	1.2×10^9	22.6	63.0	4.8	45.1	4,097
2016	2.3×10^{13}	1.3×10^9	22.6	64.1	4.6	45.0	4,138
2017	2.4×10^{13}	1.4×10^9	22.6	65.1	4.5	44.9	4,179
2018	2.6×10^{13}	1.5×10^9	22.6	66.2	4.3	44.8	4,220

Source: Data processing by authors (2021).

Referring to the data presented in the table above, we can conclude that for the variables GDP, PFA, GFCF, DCPS and POP, there is a linear upward trend with a positive trend, while for the variables INFL and PD, we have a downward linear trend with a positive trend. In 2002 the initial value of assets in the pension funds of non-OECD countries was 11.8 million US dollars, while in 2018, this value had reached 1.6 billion US dollars. Whereas in terms of gross domestic product value, in 2002, its value was 4.1 trillion US dollars, and in 2018 it had reached the value of 25.4 trillion US dollars.

$$\text{Growth Rate} = (\text{current year} / \text{base year})^{1/n-1} \quad (4)$$

$$\text{Growth Rate}_{(\text{PFA})} = (1.6 \times 10^9 / 1.1 \times 10^8)^{1/17} - 1 = 33.8\% \quad (5)$$

$$\text{Growth Rate}_{(\text{GDP})} = (2.5 \times 10^{13} / 4.1 \times 10^{12})^{1/17} - 1 = 11.1\% \quad (6)$$

Referring to the above calculations, we can conclude that for the period 2002 to 2018, investments in pension fund assets in 30 non-OECD countries have increased by 33.8%, while GDP in these countries increased by 11.1% for the period of 16 years. Based on these calculations, it can be seen that in the 30 non-OECD countries, we have a continuous increase in investments in pension fund assets and, at the same time, an increase in the value of the gross domestic product.

Figure 4 graphically presents the linear trend between economic growth and pension fund assets for the period 2002 to 2018. Referring to the data presented in the figure below, we can conclude that there is a linear upward trend in the value of the gross domestic product and the value of investments in pension fund assets in the 30 non-OECD countries for the period 2002 to 2018. In 2002, the value of the linear trend for pension asset investments was 197 million US dollars, while in 2018, the value of the linear trend had reached the value of 1.5 billion US dollars. On the other hand, the value of the linear trend for the gross domestic product in 2002 was 3.6 trillion US dollars, while in 2018, it was 26.1 trillion US dollars.

Based on these linear trend values, a positive correlation can be observed between these variables and the coefficient of determination $R^2=98.8\%$, which expresses a high level of explanation between economic growth and investment in pension fund assets in non-member OECD countries. It is worth noting that the continued growth in pension fund investments has positively impacted the economic growth of selected non-OECD countries. The positive performance of pension fund investments and the increase in the rate of return on these investments have contributed positively to the economic growth of these countries included in this study. Thus, public and private pension funds in these countries must continuously invest their pension assets in global financial markets for these investments to positively impact the value of the gross domestic product.

Investment risk is a very important factor affecting the correlation between economic growth and investment in pension fund assets. Therefore, according to the results of the linear trend, it can be concluded that the increase of 33.8% in pension asset investments for the 16 years consists of a very high level of risk in investments taken over by pension funds in the 30 selected non-member OECD countries.

A higher level of investment risk has positively impacted the rate of return on investment in pension fund assets and the upward trend in the gross domestic product. Given the fact that the countries selected in this study, most of them developing and transition countries, the development of appropriate investment policies in pension funds and the investment of these pension assets in the global financial markets with the highest rating, consequently will contribute positively to a more realistic and sustainable economic growth in non-OECD countries.

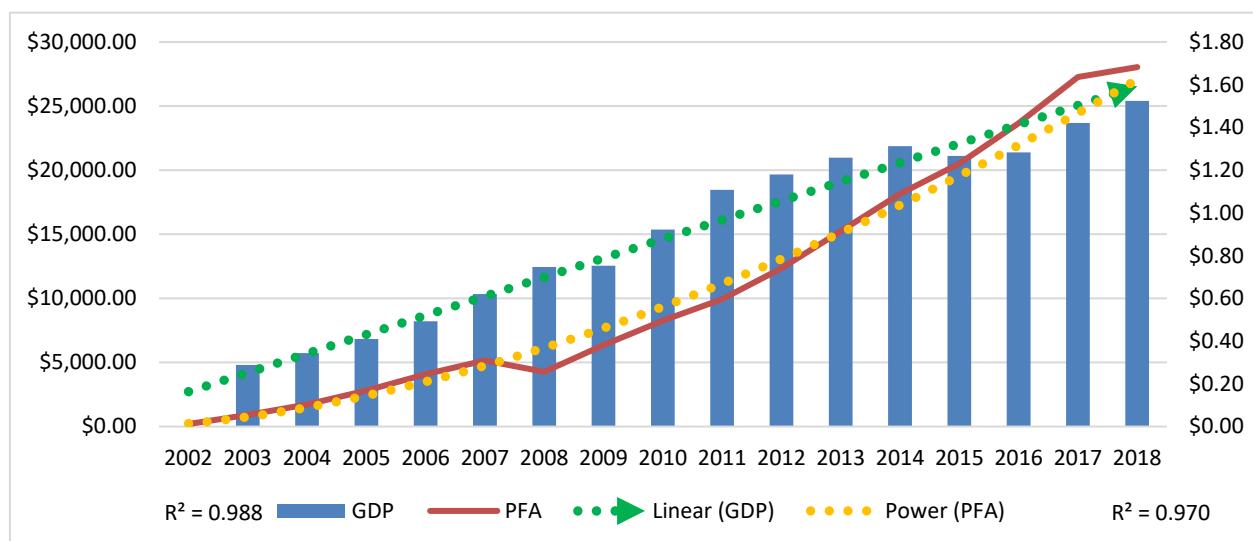


Figure 4. A linear trend between economic growth and pension fund assets in non-OECD countries (In Billion \$). Source: Data processing by authors (OECD, 2021).

A very important variable in this study is the formation of gross fixed capital (GFCF) and referring to figure 5, we can see that GFCF has a linear upward trend for the period analysed. In 2002 the value of the GFCF was 20.9% of GDP, while in 2008, this value had reached 25.2% of GDP for the 30 selected non-OECD countries. So, for 7 years, the GFCF had marked an increase of 4.2%.

In 2018, the value of the GFCF had reached 21.8% of GDP; since 2009, non-OECD countries have experienced a decline of 3.4%. The main focus of this comparative analysis lies in the fact that it will show the trend of gross fixed capital formation and the correlation between GFCF with PFA and GDP in 30 selected countries of this study. So, in this part of the comparative analysis, the linear trend between GFCF in PFA (endogenous variable) and in GDP (dependent variable) will be explained. For the analyzed period (2002-2018), GFCF has a linear upward trend, and the growth rate of this variable is 0.2%. The coefficient of determination between GFCF-GDP is $R^2 = 98.8\%$, indicating a very high explanatory nature level between these variables.

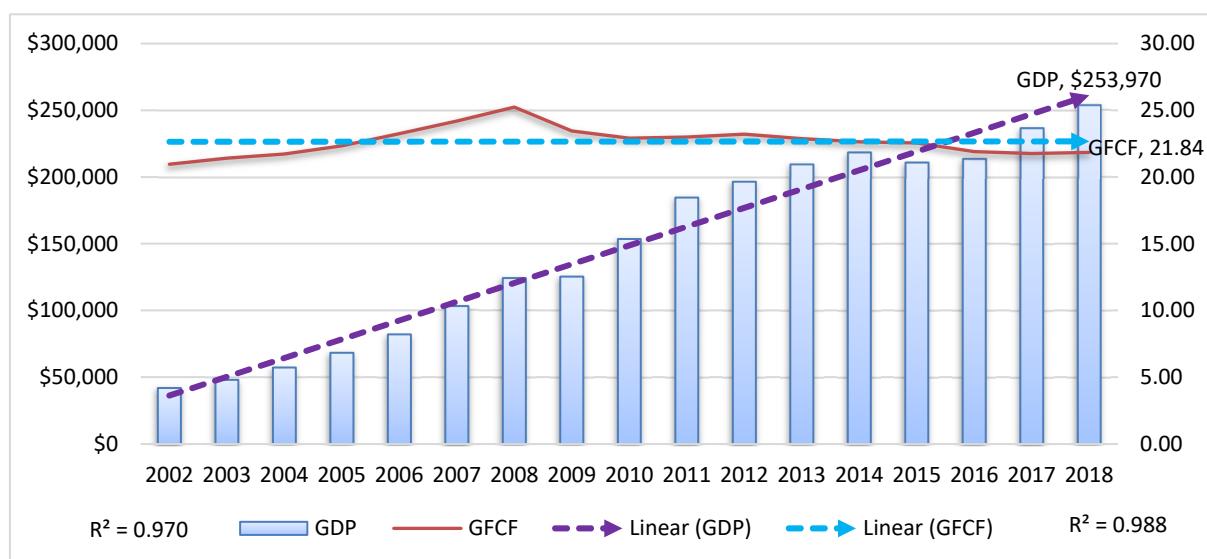


Figure 5. A linear trend between economic growth and gross fixed capital formation in non-OECD countries (GDP in Billions of \$). **Source:** Data processing by authors (OECD, 2021).

The average cumulative trend for GFCF in 2002 was 22.6%, while in 2018, this value reached 22.7%. A modest increase of 0.2% in the value of the purchase of new or existing fixed assets by the business sector, households, and the government has also positively impacted increased investment in pension assets and the economic growth of non-OECD countries. A linear upward trend of the GFCF represents a very important component of economic growth and an added value to the economy. Such a finding stems from the fact that the increase in investment in fixed assets of households, enterprises and governments of non-OECD countries has positively impacted national income and output.

The increase in national income then affects the increase of the value of pension contributions in public and private pension funds and enables these institutional investors to invest these pension contributions in the global financial markets. Such investment brings higher rates of return on investment of pension funds. Thus, the linear upward trend of the GFCF has influenced the increase of production size, national income, increase of investments in pension funds and economic

development by solving the problems with inflation and balance of payments as well as making the economy of these countries free from the burden of foreign debts.

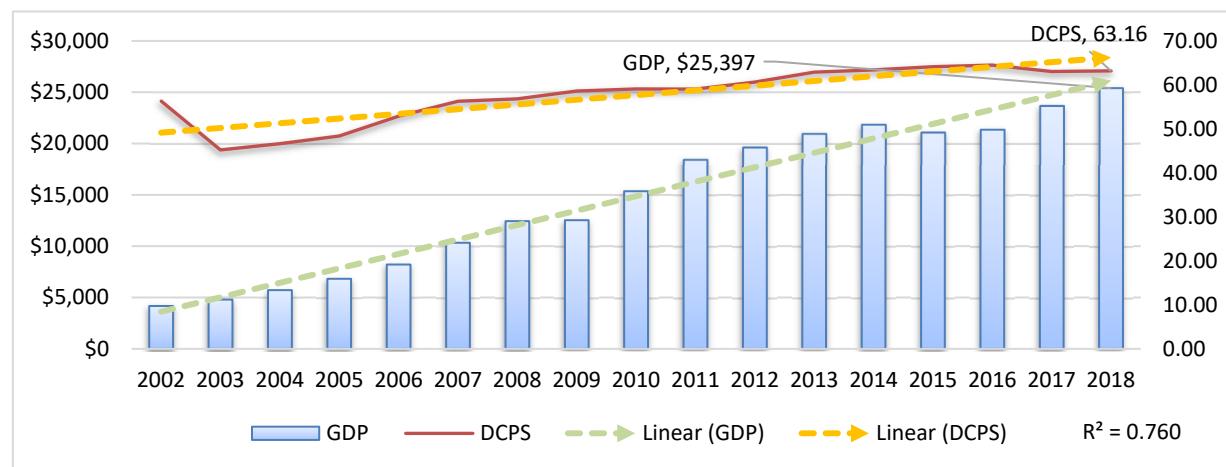


Figure 6. A linear trend between economic growth and domestic credit to the private sector in non-OECD countries (GDP in Billions of \$). **Source:** Data processing by authors (OECD, 2021).

Another very important variable in this study is domestic credit to the private sector (DCPS), and based on figure 6; we see a linear trend with an upward trend for the period 2002 to 2018. In 2002, the value of DCPS was 56.2% of GDP, a value which in 2018 reached 63.1% of GDP. From 2002 to 2018, DCPS marked an increase of 6.8% and the value of the DCPS linear trend from 2002 to 2018 increased by 1.7%. However, what is the impact of the growing linear trend of real sector domestic credit on pension fund asset investments and the economic growth of non-OECD countries?

Based on the empirical results of the trend analysis, we can conclude that there is a high explanatory level between DCPS and GDP which is $R^2=76\%$. A continuous increase of domestic credit in the private sector has positively impacted the growth of investments in pension fund assets and these countries' economic growth. An increase of 6.8% in domestic credit to the private sector in non-OECD countries has positively affected households and enterprises in the real economic sector, increasing the sources of financing through which private investments have also increased, which are critical to higher rates of economic growth and development. More investment from DCPS growth creates a multiplier effect on the economy by generating employment, increasing consumption and increasing national income. An increase in income positively affects the increase of pension contributions, and consequently, pension funds increase their investments in pension assets in view of the positive impact on the economic growth of non-OECD countries.

Following the comparative analysis, the linear trend between inflation and economic growth will be analyzed, elaborating the effects of these indicators on the endogenous variable (investments in pension fund assets).

Referring to Figure 7, we can conclude that there is a downward linear trend in the inflation rate for the period 2002 to 2018. In 2002, the inflation rate in non-OECD countries was 7%, a value which in 2018 has dropped to 4.1%. So, during this period, we have had a decrease of -3% in the inflation rate, and such a downward trend has positively impacted pension fund investments in economic growth. The

coefficient of determination between these two variables is $R^2 = 80.9\%$, which indicates a high level of explanation between inflation, investment in pension funds and economic growth. Considering that during the analyzed period, we have a downward linear trend of the inflation rate in non-OECD countries, then a lower level of inflation has positively affected the value of assets invested in pension funds and their obligations. A lower inflation rate has led to higher interest rates, wage levels and pension contributions. Therefore, the increase of these indicators resulting from the downward linear trend of the inflation rate has positively impacted the growth of investments in pension funds and economic growth.

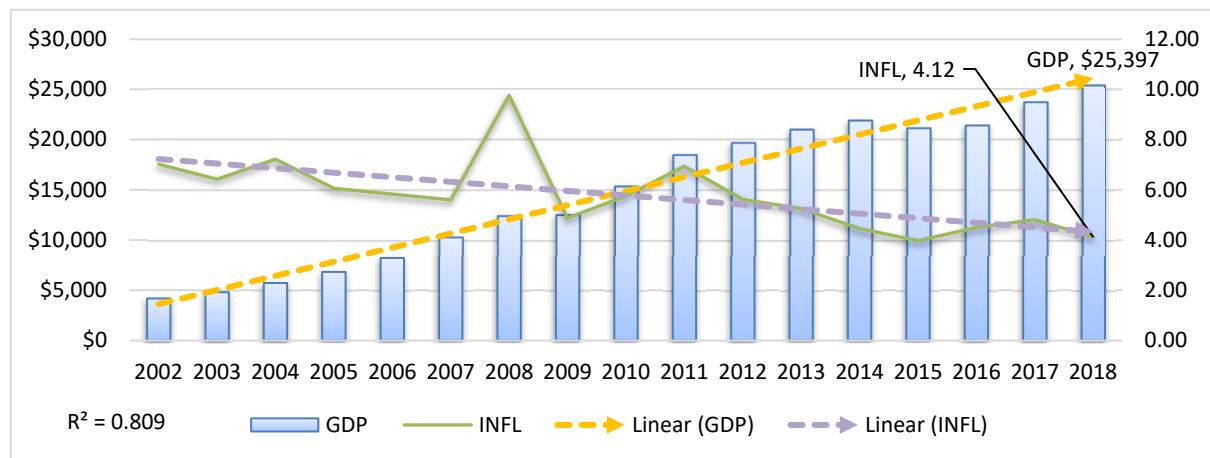


Figure 7. The linear trend between economic growth and inflation in non-OECD countries (GDP in Billions of \$). **Source:** Data processing by authors (OECD, 2021).

Another important indicator analyzed in this study is the public debt of non-OECD countries. According to the data presented in Figure 8, we can conclude that there is a downward linear trend in public debt from 2002 to 2018. In 2002, the value of public debt in non-OECD countries was 55.1% of GDP; in 2018, this value reached 49.7%.

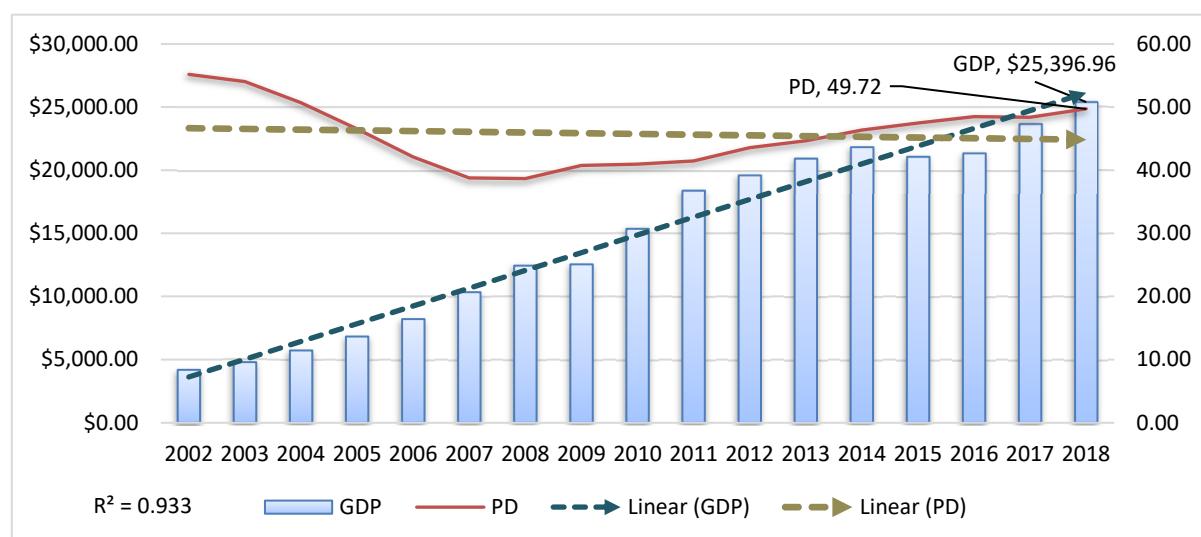


Figure 8. The linear trend between economic growth and public debt in non-OECD countries (GDP in Billions of \$). **Source:** Data processing by authors (OECD, 2021).

During these 16 years, we have decreased -0.6% in the value of public debt as% of GDP. The coefficient of determination between PD and GDP is $R^2=93.3\%$, representing a high degree of explanatory nature between these two variables. The downward linear trend of public debt in non-OECD countries has had different fiscal effects on the economies of these countries. A decrease of -0.6% in public debt has affected the decrease of budget costs, a decrease in tax rates, an increase in government expenditures, an increase in public investments, public loans and an increase of investments in pension fund assets.

The last independent variable in this study that will be analyzed through linear trends is the population of non-OECD countries. Referring to the data presented in Figure 9, we can conclude that there is a positive linear trend between population and economic growth for non-OECD countries from 2002 to 2018. In 2002 the population of non-OECD countries was 3.5 billion inhabitants, while in 2018, the population of these countries reached 4.2 billion inhabitants. During these 16 years (2002–2018), we have had a population increase of 657 million inhabitants in the 30 selected non-OECD countries. The coefficient of determination between population and economic growth is $R^2=97\%$ which shows a very high level of explanatory nature between these two variables.

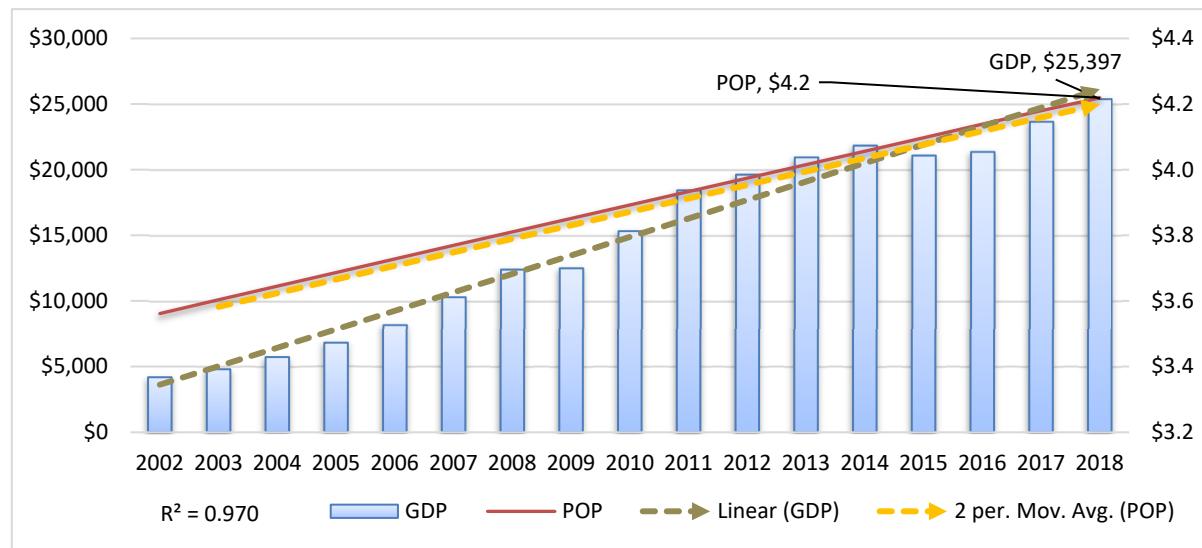


Figure 9. The linear trend between economic growth and population in non-OECD countries (in Billions). Source: Data processing by authors (OECD, 2021)

An increase in population in non-OECD countries has resulted in an increase in tax revenues for the governments of these countries. The increase in tax revenues has led to an increase in the number of taxpayers, and in countries where we have an increase in population, it is likely to have the opportunity to improve the funding levels of their pension plans. Thus, an increase in tax revenues and an increase in the number of taxpayers have positive effects on increasing the value of pension assets because pension funds have more available volume of pension contributions, which can invest in international financial markets in increasing the rate of return on investments of these pension funds.

6. Econometric analysis and study findings

This part of this article will present the results of descriptive statistics, correlation analysis, normal distribution of statistical data of this study, as well as testing of hypotheses through statistical tests and econometric models. All econometric and graphical analyzes were processed in the Stata program (version 16). Table 9 presents all the dexterity statistics for the variables of this study.

Table 9. Descriptive statistics for the variables included in the econometric models.

Variables	Obs.	Minimum	Maximum	Mean	Std. Deviation
GDP	510	4.9×10^{12}	1.4×10^{12}	2.4×10^9	2.12×10^{24}
PFA	510	2.8×10^7	1.7×10^8	3.77	3×10^{16}
GFCF	510	22.66	6.34	11.96	40.22
DCPS	510	58.17	43.84	8.08	1922.25
INFL	510	5.77	6.11	-2.98	37.36
PD	510	45.73	28.95	0.83	838.47
POP	510	1.3×10^8	3.1×10^8	33879	1×10^{17}

Source: Authors' Calculations.

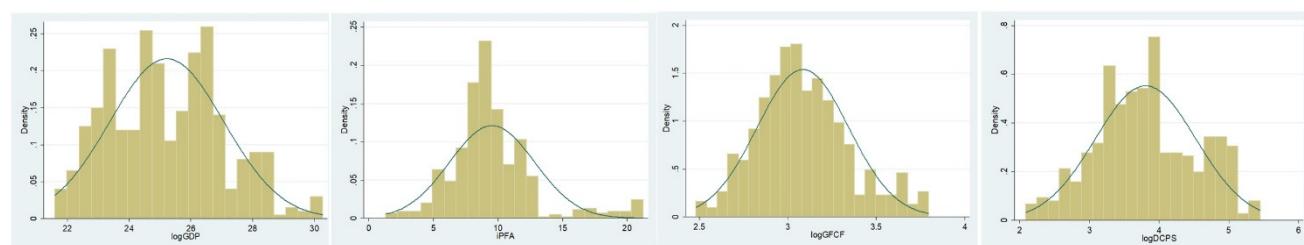


Figure 10. Graphic representation of the normal distribution of GDP, PFA, GFCF and DCPS via histogram. **Source:** Calculations of the authors (2021).

Based on the histogram's graphical representation, we can conclude that these four variables have a normal distribution of statistical data and the histogram curve is approximately symmetric for all variables of this study. A normal distribution of these variables means that the statistical data of this study are fully measurable and have a high level of accuracy in the collection of these data. The histogram has a mesocourtile curve in all variables with an absolute value of 3.

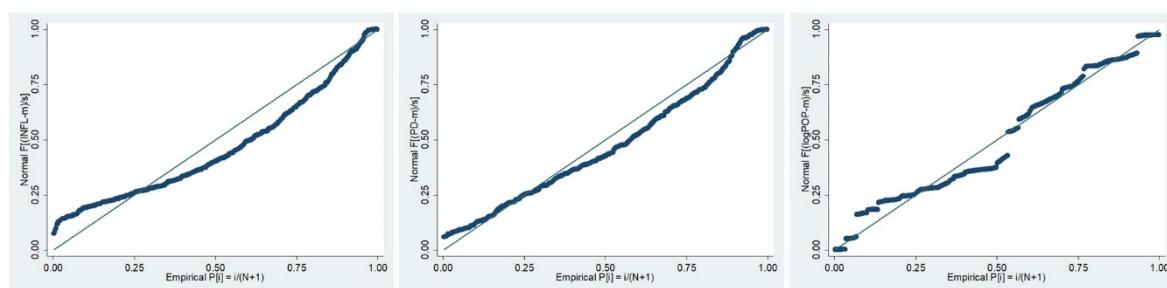


Figure 11. Graphical representation of the normal distribution of INFL, PD and POP via the probability graph. **Source:** Calculations of the authors (2021).

Figure 11 shows the normal distribution of the other three independent variables through the probability graph: INFL, PD and POP. Based on Figure 11, we can see that these three independent variables have a normal distribution and linear relationship since the points are distributed very close to the linear regression line, except for some standard deviations, which are included in the stochastic variable (e) or in the error term.

In this part of the econometric analysis, the Pearson correlation between the dependent variable (GDP) and other independent variables (PFA, GFCF, DCPS, INFL, PD and POP) will be presented. The correlation analysis will verify the strength and direction of the relationship between GDP and other variables of this study.

Table 10. Pearson correlation analysis for the variables included in the econometric models.

Variables	GDP	PFA	GFCF	DCPS	INFL	PD	POP
GDP	1	0.751	0.553	0.610	0.610	-0.537	0.804
PFA	0.751	1	0.792	0.722	-0.414	-0.519	0.581
GFCF	0.553	0.792	1	0.285	-0.210	-0.190	0.590
DCPS	0.610	0.722	0.285	1	-0.345	-0.214	0.207
INFL	-0.563	-0.414	-0.210	-0.345	1	0.206	0.011
PD	-0.537	-0.519	-0.190	-0.214	0.206	1	-0.055
POP	0.804	0.581	0.590	0.207	0.011	-0.055	1

Source: Calculations of the authors (2021).

Referring to the data presented in Table 10, we can conclude that all variables included in this study are correlated with each other, and through correlation analysis will be interpreted the strength and direction of the linear relationship between GDP and the variables of other independent of this study.

We will first interpret the correlation between GDP and PFA. Pension fund assets have a high positive correlation with the gross domestic product ($R=75.1\%$), which means that increased investments in pension fund assets will increase the value of GDP and vice versa. So, based on this positive linear relationship between GDP and PFA, we can emphasize that the increase in the return on investment of pension funds in non-OECD countries has positively affected economic growth in these places.

The Pearson correlation between GDP and GFCF is $R=55.3\%$, so we have a positive average linear relationship between these two variables. An increase in the value of gross fixed capital will positively impact the economic growth of non-OECD countries. It is also worth noting that there is a high positive correlation between PFA and GFCF. The increase in the value of fixed capital will affect the increase of investments in the assets of pension funds and, at the same time, will positively affect economic growth.

Figure 12 graphically presents the Kernel density estimation for the dependent variable (GDP) and the endogenous variable (PFA). Based on the graphical representation of the Kernel density, we can conclude that the dependent variable (GDP) has a high probability density and the endogenous and independent variable (PFA) is likely to be close to the statistical values of GDP. A high probability density between these two variables indicates a strong non-parametric function of this econometric model.

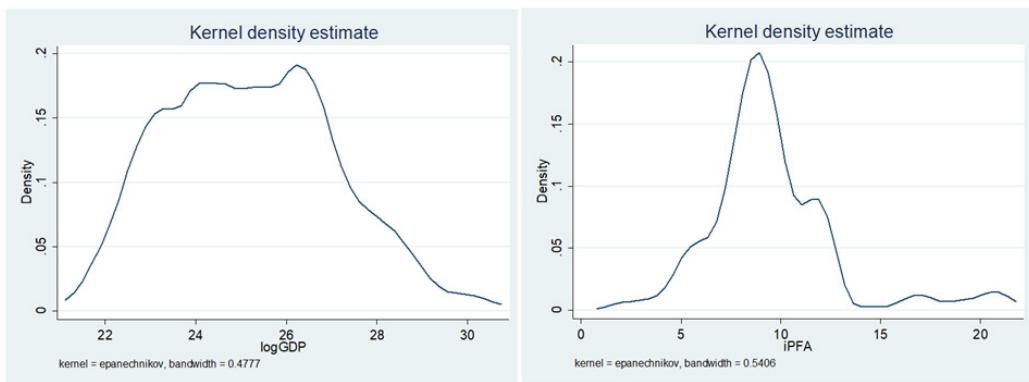


Figure 12. Graphical representation of Kernel density between GDP and PFA.

Source: Calculations of the authors (2021).

Figure 12 graphically presents the Kernel density estimation for the dependent variable (GDP) and the endogenous variable (PFA). Based on the graphical representation of the Kernel density, we can conclude that the dependent variable (GDP) has a high probability density and the endogenous and independent variable (PFA) is likely to be close to the statistical values of GDP. A high probability density between these two variables indicates a strong non-parametric function of this econometric model.

Gross domestic product and domestic credit to the private sector have a positive average correlation $R=66.01\%$. Since for the analyzed period 2002 to 2018, we have a positive linear trend of domestic loans to the private sector; it results that with the increase in the value of DCPS, the value of investments in pension fund assets increases in function of economic growth of countries non-member of the OECD. Such a statement is confirmed by the fact that there is a high positive correlation between PFA-DCPS that $R=72.2\%$.

Gross domestic product has a negative correlation with public debt ($R=53.7\%$) and inflation ($R=56.3\%$). Thus, with the increase of the inflation rate, the value of the assets of the pension funds is devalued, causing a decrease in the performance of the pension funds and negative effects on economic growth. However, it is worth noting that for the analyzed period (2002–2018), we have a linear downward trend of inflation, then this downward trend of the price level has resulted in a linear upward trend of GDP. A decrease of 0.6% in the value of public debt for the analyzed period has positively impacted the value of investments in pension fund assets and economic growth. This statement is correct because we have a negative correlation between PFA and PD.

There is a high positive correlation between economic growth and population size ($R=80.4\%$). So, with the increase of the population, the value of the gross domestic product will increase, as tax revenues increase, pension contributions increase, and as a result of this economic phenomenon, we have a positive effect on the investment of assets in the pension funds of countries non-member of the OECD.

Based on the following data presented in Table 11, the validity of the main hypothesis of this study, that if the investments of pension funds have had a positive impact on the economic growth of non-OECD countries, is confirmed.

$$\begin{aligned} \log GDP_{it} = & \beta_0 + \beta_1 PFA_{it} + \beta_2 GFCF_{it} + \beta_3 DCPS_t \\ & + \beta_4 INFL_{it} + \beta_5 \log PD_{it} + \beta_6 \log POP_{it} + \gamma_{it} \end{aligned} \quad (7)$$

Table 11. Empirical results for the econometric panel models.

Variables	Linear Regression	Random Effects— GLS Regression	Fixed-Effects Regression	Hausman Taylor Regression	GEE Model	GMM Model
GDP	-	-	-	-	-	-
PFA	0.026** (0.019)	0.0168** (0.037)	0.012** (0.047)	0.013** (0.040)	0.016* (0.050)	0.055*** (0.000)
GFCF	0.005 (0.379)	0.015*** (0.008)	0.011** (0.010)	0.012** (0.007)	0.014** (0.013)	0.018*** (0.001)
DCPS	0.627*** (0.000)	0.407*** (0.000)	0.302*** (0.000)	0.311*** (0.000)	0.410*** (0.000)	0.414*** (0.000)
INFL	0.014** (0.028)	-0.019*** (0.000)	-0.018*** (0.000)	-0.018*** (0.000)	-0.018*** (0.000)	-0.017*** (0.000)
PD	0.225*** (0.000)	0.189*** (0.001)	0.166*** (0.000)	0.168*** (0.000)	0.190*** (0.001)	0.350*** (0.000)
POP	0.731*** (0.000)	0.964*** (0.000)	4.528*** (0.000)	4.202*** (0.000)	0.921*** (0.000)	6.500*** (0.000)
Const.	11.306*** (0.000)	8.287*** (0.000)	50.713*** (0.000)	46.512*** (0.000)	8.996*** (0.000)	82.294*** (0.000)
R Square	0.822	0.833	0.803	0.845	0.834	0.853

Note: p-values shown in parentheses: *** indicates statistical significance at the level of 1%; ** indicates statistical significance at the 5% level, and * indicates statistical significance at 10%.

Source: Calculations of the authors (2021).

$$\begin{aligned} \log GDP_{it} = & 82.294 + 0.055PFA_{it} + 0.081GFCF_{it} + 0.414DCPS_t \\ & -0.017INFL_{it} + 0.035PD_{it} + 6.5POP_{it} + 0.177 \end{aligned} \quad (8)$$

According to these econometric results, we can conclude that all the independent variables in this econometric model are important and affect the economic growth of non-OECD countries. What impact do pension fund investment investments have on the economic growth of non-OECD countries? If the other factors are constant, then the value of GDP will be 82.2 trillion dollars (units). If the assets of pension funds increase by 1%, keeping other factors constant, then GDP will increase by 0.055%. This statement is correct because the significance level is less than 0.05 (P-value=0.000<0.05). So, during the period (2002 to 2018), we can conclude that investments in pension fund assets have positively affected the economic growth of non-OECD countries. The positive performance of pension funds directly stimulates economic growth by providing more investment funds, and this positive trend of the rate of return on investment of pension funds contributes positively to improving the overall efficiency of capital markets.

If gross fixed capital formation increases by 1 unit, keeping other factors constant, then GDP will increase by 0.018 units. This statement is correct because the significance level is within the statistical reliability interval (P-value=0.001<0.05). Such a result can also be explained based on economic theory, which explains the correlation between investment and economic growth. A steady increase in gross fixed capital formation has positively impacted the growth of national incomes in the economy. An increase in national income consists of increasing pension savings which could stimulate increased investment in pension funds and economic development of these countries.

If domestic credit to the private sector increases by 1%, keeping other factors constant, then the value of GDP will increase by 0.414%. This statement is correct because the significance level is within the range of statistical significance ($P\text{-value}=0.000<0.05$). A 6.8% increase in domestic credit to the private sector has affected households and real sector enterprises in non-OECD countries to have more funds available to finance their real and financial investments. An increase in these investments has a multiplier effect on economic development and the performance of pension funds. As a result of the multiplier effect of investments in the economy, pension contributions increase in public and private pension systems, allowing pension funds to have more assets available to invest in global financial markets.

If the inflation rate increases by 1 unit, keeping other factors constant, consequently the value of GDP will decrease by 0.017 units. This hypothesis is correct because the significance level is within its standard level ($P\text{-value}=0.000<0.05$). Given that, for the period (2002 to 2018), we have had a downward trend in inflation in non-OECD countries by -3.08% , the modest increases in the inflation rate can be considered to have had a symmetrical effect on the value of pension fund assets and in economic growth.

If public debt increases by 1%, assuming that other independent variables are constant, then the value of GDP will increase by 0.35%. This hypothesis is correct because it also stands in statistical terms ($P\text{-value}=0.000<0.05$). For the period analyzed (2002–2018), public debt has experienced a modest decline of -0.61% , causing various fiscal effects on the pension systems of non-OECD countries.

If the population of non-OECD countries increases by 1%, assuming that other factors are unchanged, then the value of GDP will increase by 6.50 units. This hypothesis is correct because the significance value is within the range of statistical significance ($P\text{-value}=0.000<0.05$). The increase in population in these countries per 657 million inhabitants for the period (2002–2018) has positively affected tax revenues, the number of taxpayers, the value of pension fund assets and the volume of pension contributions.

To provide more support to the econometric results of this study and to validate the main hypothesis of this research, that if investments in pension fund assets have a positive impact on the economic growth of non-OECD countries, some other statistical tests for time series data are applied. The time series statistical tests that will be applied in this study are the ARCH-GARCH model and Nelson's E-Garch model. To execute the ARCH-GARCH model, the data volatility collection or their volatility for the dependent variable (GDP) and the main independent variable (pension fund assets) must be analyzed.

Research on the macroeconomic effects of pension systems has so far mostly focused on the effects of private pension funds' assets on labour markets, financial markets or economic growth. There is no research that studies the relationship between different pension systems and macroeconomic instability. Holzner et al. (2019)'s study conducted at the Vienna Institute for International Economic Studies have analyzed the effect of pension asset investments on macroeconomic instability for OECD countries for the period 1980–2018. Through this study, some empirical evidence was found for the negative effects of public pension expenditures and the positive effects of the benefits of pension funds on the volatility of economic growth. Therefore, starting from this empirical fact, in this study we will analyze the effect of pension asset investments on the volatility of economic growth in non-OECD countries.

Figure 12 shows the volatility (volatility) accumulation for GDP and PFA variables. Based on this figure, it can be seen that time-series data for GDP-PFA variables have volatility accumulation because periods of high volatility are followed by periods of high volatility and periods of low volatility tend to be followed by periods of low volatility.

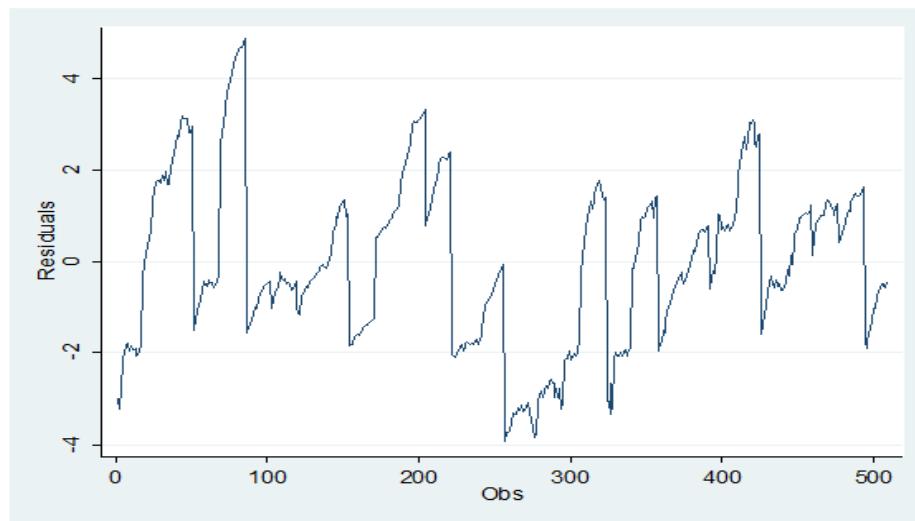


Figure 13. Accumulation of volatility for variables GDP and PFA.

Source: Calculations of the authors (2021).

Since these time series data have an accumulation of volatility, then we must analyze whether these two variables have the conditional effect of heteroskedasticity on the auto-regression model (ARCH effect).

Table 12. Econometric results of simple linear regression.

Ln GDP	Coef.	Std. Error	t	P > |t|	95% Conf. Interval	95% Conf. Interval
PFA	0.053	0.0245	2.18	0.030	0.005	0.101
_cons.	24.741	0.248	99.76	0.000	24.253	25.228

Source: Calculations of the authors (2021).

Based on the econometric results presented in the table above, we can conclude that investments in pension fund assets positively impact the economic growth of non-OECD countries (P-value=0.030<0.05).

H0: There is no ARCH effect.

H1: There is an ARCH effect.

Table 13. Test for the conditional effect of heteroskedasticity on the auto-regression model (ARCH effect).

Lags (p)	Chi2	df	Prob > chi2
1	444.167	1	0.000

Source: Calculations of the authors (2021).

Referring to the results of the conditioned heteroskedasticity test in the auto-regression model, it can be observed that in this econometric model, the ARCH effect exists.

$$Y = C_1 + C_2 X_1 + e \quad (9)$$

$$\log GDP_{it} = C_1 + C_2 PFA + e \quad (10)$$

So, since P-value=0.000<0.05 means that this econometric model has volatility accumulation and ARCH effect. The value of the Chi-Square coefficient is 444.167. Table 14 presents the econometric results of the ARCH-GARCH model. This analysis aims to analyze the volatility between GDP and PFA and other controlling factors that affect the volatility of economic growth in non-OECD countries.

Table 14. Test for the conditional effect of heteroskedasticity on the auto-regression model (ARCH effect).

Log GDP	Coef.	Std. Error	z	P > |z|	95% Conf. Interval	95% Conf. Interval
Log GDP - PFA	0.025	0.006	3.81	0.000	0.012	0.039
_cons.	24.327	0.058	418.05	0.000	24.213	24.441
HET-FCF	0.225	0.017	13.06	0.000	0.191	0.259
HET-CPS	1.705	0.249	6.84	0.000	1.216	2.194
_cons.	-15.044	0.807	-18.64	0.000	-16.626	-13.462
ARCH L1.	0.512	0.045	11.21	0.000	0.422	0.602
GARCH L1.	0.124	0.024	5.03	0.000	0.075	0.172

Source: Calculations of the authors (2021).

According to the results of the ARCH-GARCH model, we can conclude that the volatility variance measured through GFCF and DCPS is significant. Gross fixed capital formation is a significant variable (P-value=0.000<0.05) and affects the volatility of economic growth. If the GFCF increases by 1 unit, keeping the other factors constant, then GDP volatility will increase by 0.225. Thus, it can be seen that during the period (2002 to 2018) in non-OECD countries, when there is an increase in private investment in the real sector of the economy has been accompanied by an increase in the value of GDP. This increase in the value of GDP is also characterized by the positive performance of pension funds and the positive contribution of these institutional investors to the economic development of these countries.

Domestic credit to the private sector is a significant variable and affects the economic growth volatility of OECD countries. If domestic loans to the private sector increase by 1%, then GDP volatility will increase by 1.7% (P-value=0.000<0.05). In non-OECD countries, when there is an increase in domestic loans to the private sector, these periods are accompanied by an increase in the value of GDP.

The ARCH effect is a significant variable (P-value=0.000<0.05) and explains the volatility of economic growth. The volatility of economic growth (GDP) in past periods affects the volatility of economic growth in the current period. Given that there is a positive, positive correlation between GDP and GDP, then it can be concluded that investments in pension fund assets in the past have an impact on the volatility of economic growth in current periods. So, based on the ARCH effect between PFA and GDP, we can emphasize that the positive financial performance of pension funds in the past periods will positively impact maintaining the macroeconomic stability of non-OECD countries.

The GARCH effect is a significant variable (P-value=0.000<0.05) and explains the volatility of economic growth. Information on GDP in past periods may affect the volatility of GDP in the current period. Information on economic growth in non-OECD countries impacts how pension funds make decisions about investing in pension assets. Periods of financial crises (2007 to 2009) always generate negative information on economic growth, affecting the volatility of the performance of pension funds.

Such an effect is a consequence of the negative information that affects the decline in investments in pension systems. Thus, information on GDP in recent periods also impacts the volatility of pension funds in current periods in non-OECD countries.

Since there is a positive dynamic correlation between PFA and GDP, then the GARCH effect consists of the fact that information on investments in pension fund assets in previous periods has an impact on the volatility of economic growth in current periods. So, in financial systems, when positive pension information is disseminated, then in the current periods, this information will stimulate the growth of pension savings in the function of economic growth.

Table 15 shows the econometric results of Nelson's E-GARCH statistical test. This statistical test will analyse whether there is a leverage effect on the time series data between economic growth, investment in pension fund assets and public debt.

Table 15. Nelson's E-GARCH statistical test results between GDP-PFA.

Log GDP	Coef.	Std. Error	z	P > |z|	95% Conf.	95% Conf.
					Interval	Interval
PFA	0.121	0.033	3.65	0.000	0.056	0.187
_cons.	24.471	0.336	72.64	0.000	23.810	25.131
ARCH L1.	0.038	0.015	2.47	0.013	0.008	0.069
EARCH L1.	0.523	0.103	5.04	0.000	0.320	0.727
E-GARCH (L1)	1.500	0.162	9.23	0.000	1.184	1.822
E-GARCH (L2)	-0.559	0.206	-2.71	0.007	-0.964	-0.154
E-GARCH (L3)	-0.549	0.078	-7.03	0.000	-0.703	-0.396
E-GARCH (L4)	1.029	0.231	4.44	0.000	0.575	1.483
E-GARCH (L5)	-0.485	0.142	-3.40	0.001	0.765	-0.205
_cons.	-0.104	0.029	-3.55	0.000	-0.161	-0.046

Source: Calculations of the authors (2021).

According to the results of this statistical test, investments in pension fund assets positively impact the economic growth of non-OECD countries (P-value=0.000<0.05). The leverage effect is present in all independent variables of Nelson's E-GARCH model.

At constant (L1), we have a positive and significant correlation (P-value=0.000<0.05). So, when investments in pension fund assets in 2017 increased by one unit, GDP volatility in 2018 increased by 1.50 units. This phenomenon shows that investors of pension assets in financial markets should choose a prudent investment strategy because the growth of these investments in 2017 has affected the increase in volatility that represents the sudden rise in prices in the economies of non-member OECD countries.

In the constant (L2), it results that we have a negative and significant correlation (P-value=0.007<0.05). Consequently, when asset investments in pension funds in 2016 increased by one unit, this has affected the reduction of GDP volatility by -0.55 units. This economic phenomenon is positive information for investors because although pension funds have pursued a proactive strategy in investing in pension assets, this strategy has reduced the volatility of price movements in the economies of non-OECD countries.

At constant (L3), we have a negative and significant correlation (P-value=0.000<0.05). When investments in pension fund assets in 2015 increased by one unit, it turned out that GDP volatility has decreased by -0.54 units. Such a phenomenon is a positive signal for investors of pension assets in

financial markets because lower volatility implies greater security in their investments. Whereas, in 2014 (constant L4), we have a positive and significant correlation (P-value=0.000<0.05), which means that investments in pension funds will not be very safe because, in 2015, volatility had increased by 1.02 units. In 2013 pension fund investments were safer than in 2014 because -0.48 units reduced volatility in the economies of non-OECD countries.

Table 16 shows the econometric results of Nelson's E-GARCH statistical test for GDP and public debt variables. The main hypothesis of this econometric model is whether there is a leverage effect between economic growth and public debt. With the increase of public debt per unit in non-OECD countries, we have a decrease in the value of the gross domestic product by -0.17 units (P-value=0.000<0.05).

Table 16. Econometric results of Nelson's E-GARCH statistical test between GDP-PD.

Log GDP	Coef.	Std. Error	z	P > |z|	95% Conf.	95% Conf.
					Interval	Interval
Log PD	-0.170	0.018	-9.03	0.000	-0.207	-0.133
_cons.	26.212	0.076	342.23	0.000	26.062	26.362
ARCH L1.	0.181	0.017	10.28	0.000	0.147	0.216
EARCH L1.	1.082	0.033	32.38	0.000	1.016	1.147
E-GARCH (L1)	1.021	0.036	28.32	0.000	0.950	1.091
E-GARCH (L2)	-0.350	0.018	-19.24	0.000	-0.386	-0.315
E-GARCH (L3)	-0.189	0.020	-9.37	0.000	-0.228	-0.149
E-GARCH (L4)	0.824	0.013	60.58	0.000	0.797	0.850
E-GARCH (L5)	-0.427	0.033	-12.86	0.000	-0.492	-0.361
_cons.	2.025	0.023	-10.47	0.000	-0.281	-0.189

Source: Calculations of the authors (2021).

At constant (L1), there is a positive and significant correlation (P-value=0.000<0.05). So, if the public debt in 2017 increased by one unit, GDP volatility increased by 1.02 units. Such an effect of increased volatility due to increased public debt also affects the investment of pension funds. Therefore, the governments of non-OECD countries should pursue an effective strategy in managing public debt because the increase of this public debt cannot only be a burden for future generations but also affect the growth of unexpected pricing in future periods. As a result of this impact, the level of risk in pension fund investments increases due to the loss of value for money and the increase in unforeseen costs of these pension funds.

At constant (L2) it exists in negative and significant correlation (P-value=0.000<0.05). So, when the public debt of 2016 increased by one unit, then the volatility of economic growth decreased by -0.35 units. Such an effect is positive for pension fund investments because, with the increase in public debt, the volatility of price movements in the economies of non-OECD countries is decreasing. When investors of pension assets in financial markets have a higher level of security for price risk, then even forecasting the rate of return is easier for investors. Thus, efficient management of public debt by governments of non-OECD countries reduces the volatility of economic growth and increases the probability that pension funds will have a higher return on their investment.

At constants (L3 and L5), there is a negative correlation between public debt and economic growth volatility, while at constant (L4), there is a negative correlation. So, according to these econometric

results, we can conclude that pension fund investments, gross fixed capital formation, domestic loans to the private sector and public debt in previous periods impact price volatility in future periods.

7. Discussions

Based on the econometric results of this study, the validity of the main hypothesis of this study can be confirmed, that the investments of pension funds have had a positive impact on the economic growth of selected non-OECD countries. The positive performance of pension funds over the period (2002–2018) has directly stimulated the economic growth of non-OECD countries by providing more funds available for pension asset investments to improve overall efficiency in capital markets.

This study has proven the significant impact of pension fund investments on the economic growth of non-OECD countries. These empirical findings confirm and develop existing scientific views on the correlation between pension fund investments and economic growth (Schmidt-Hebbel, 1999; Mazreku et al., 2020; Draženović et al., 2019; Bertranou et al., 2018; Altiparmakov & Nedeljkovic, 2016; Morina & Grima, 2021; Acuña et al., 2014; Alonso et al., 2010).

Based on econometric results, all independent and control variables in this study are statistically significant and impact pension fund investments and economic growth of non-OECD countries. According to this study, we can conclude that gross fixed capital formation, domestic credit to the private sector, public debt and population growth has positively impacted the economic growth of non-OECD countries. These econometric results are comparable to many studies by other authors that have analyzed the dynamic correlation between pension asset investments, various macroeconomic factors and economic growth (Staveley-O'Carroll & Staveley-O'Carroll, 2017; Dell'Ariccia et al., 2007; Borsch-Supan et al., 2005; Sunet al., 2020; Mohieldin et al., 2019; Kidd & Tran, 2018; Arellano et al., 2015; Cuevas et al., 2008).

Inflation has negatively affected pension fund investments and the economic growth of the countries included in this study. These empirical results are of scientific and practical importance because they help policymakers design appropriate macroeconomic policies to increase investment in pension fund assets and economic development and improve efficiency in capital markets. Given that most of the countries selected in this study are developing countries and countries in transition, the results of this study can be good empirical evidence for the governments of these countries to see the effect and impact of fund investments on pensions, fixed capital investments, domestic private sector lending, inflation, public debt and the population in the economic growth of these countries.

The econometric results of this study can serve in the practical aspect for drafting state strategies on how to change their investment policies in pension funds and how to manage macroeconomic factors (GFCF, DCPS, public debt, inflation) and demographic factors (population) in economic development and maintaining the macroeconomic stability of these countries. The results of this study include a period of time (2002 to 2018), which consists of an appropriate period to draw concrete results and recommendations.

The coefficient of determination in the econometric models of this study was $R^2=82.2\%$, indicating a high level of explainability between the independent and dependent variables. However, despite the high level of explainability between the variables, we identify a limitation to including other variables in this study. A very important variable is market capitalization which refers to the total market value of the unpaid shares of a company. In the absence of data on this variable for the countries selected in this study, this variable was not included in the research. Although there were studies such as that by Madeira (2022),

which studied the impact of the Chilean pension withdrawals during the COVID-19 pandemic on the future savings rate, it is recommended for future studies to include the market capitalization variable and to obtain data for recent years in order to analyze the effect of the COVID-19 pandemic on pension fund investments and economic growth in these countries.

8. Conclusions and recommendations

The purpose of the study was to determine the impact of pension asset investments on the economic growth of non-OECD countries, which can be taken into account in the practice of the financial systems of these countries. Through this study, we conclude that investments in pension fund assets have positively impacted the economic growth of non-OECD countries, considering the effect of gross fixed capital formation, domestic credit to the private sector, inflation rate, public debt and population.

According to the econometric results of this study, all independent variables are statistically significant and affect the economic growth of non-OECD countries. There is a linear upward trend with a positive trend between investment in pension assets and economic growth. According to the trend analysis results in 2002, the linear trend value for pension asset investments was 197 million US dollars, while in 2018, the linear trend had reached a value of 1.53 billion US dollars. If the assets of pension funds increase by 1%, keeping other factors constant, then GDP will increase by 0.05%. According to this result, the more pension funds and other institutional investors in non-OECD countries invest more in pension assets, the financial markets of these countries become more efficient and consequently will grow. The financial performance of pension funds in these countries has positively affected the economic growth of these countries, encouraging more investment of pension assets in the capital markets and influencing the increase of rates of return on financial investments.

Gross fixed capital formation has positively impacted the economic growth of non-OECD countries. A positive correlation and a linear upward trend exist between gross fixed capital formation and economic growth. In 2002 the value of the GFCF was 20.9% of GDP, while in 2008, this value had reached 25.2% of GDP for the 30 selected non-OECD countries. If gross fixed capital formation increases by 1 unit, keeping other factors constant, then GDP will increase by 0.018 units. So, according to this result, we can conclude that the more households and enterprises in the real sector of the economy increase investments in fixed assets, then the more we will have an increase in national income, production and pension contributions. Such an effect directly affects the increase of investments in pension fund assets in efficient financial markets, increase of the rate of return on investments, increase of macroeconomic stability in the financial systems of these countries and sustainable economic development.

Domestic credit to the private sector has positively impacted the economic growth of the countries selected in this study. There is a positive correlation and a linear upward trend between domestic credit to the private sector and economic growth. According to the trend analysis results, in 2002, the value of DCPS was 56.2% of GDP, a value which in 2018 has reached 63.1% of GDP. If domestic credit to the private sector increases by 1%, keeping other factors constant, then the value of GDP will increase by 0.41%. An increase in domestic lending to the private sector in the financial systems of these countries will have a multiplier effect on increasing the funds available to participants in financial markets, increasing real and financial investment, increasing the value of the gross domestic product and increasing pension contributions in order to realize profitable investments in global financial markets.

Inflation has negatively affected the gross domestic product of non-OECD countries. A negative correlation and a downward linear trend exist between the inflation rate and economic growth. Referring to the trend analysis results, we can conclude that in 2002, the inflation rate in non-OECD countries was 7%, a value which in 2018 has dropped to 4.1%. If the inflation rate increases by 1 unit, keeping other factors constant, consequently the value of GDP will decrease by 0.017 units. Taking into account the fact that for the analyzed period (2002–2018), we have a downward trend in the inflation rate, this has affected the increase of the value of pension fund assets, the increase of interest rates, the level of salaries and pension contributions in function economic development, improving living standards and positive performance of the financial system of non-OECD countries.

Public debt positively impacts the economic growth of the countries selected in this study. There is a negative, significant correlation and a downward linear trend between public debt and gross domestic product. In 2002, the value of public debt in non-OECD countries was 55.1% of GDP, while in 2018, this value reached 49.7%. If public debt increases by 1%, assuming that other independent variables are constant, then the value of GDP will increase by 0.3%. A decline in public debt has led to lower budget costs and tax rates. As a result of declining tax rates, government spending, public investment, public credit, and investment in pension funds increase.

Population growth for the period (2002–2018) has had a positive impact on gross domestic product in non-OECD countries. Correlation analysis and trend analysis show a positive, significant correlation and a linear upward trend between population and economic growth. According to the analysis of linear trends, in 2002, the population in non-OECD countries was 3.56 billion inhabitants, while in 2018, the population of these countries reached 4.21 billion inhabitants. If the population of non-OECD countries increases by 1%, assuming that other factors are unchanged, then the value of GDP will increase by 6.5 units. A steady increase in the population in non-OECD countries has led to an increase in tax revenues, an increase in the number of taxpayers and an improvement in pension plans. These positive effects are increasing the value of pension assets, increasing pension contributions and increasing the rate of return on investments of pension funds.

Therefore, based on these findings, we recommend that pension funds in non-OECD countries should develop a strategy to regulate the asset management of pension funds and ensure that pension asset investments are for-profit, liquidity and diversification of investment risk in pension funds. Non-OECD countries need to further develop pension reforms, as they represent a very important element for their financial systems to implement a market-based investment strategy led by the economy's private sector. Such an effect from pension reforms allows the public sector to focus on correcting external influences and combating poverty. We also recommend that the pension funds of these countries should implement some long-term action plans on how to reduce the exposure to risk for the expected future income for the younger generations of the population after the introduction of the defined benefit pension system. This stimulates the workforce to finance their capital investments by borrowing from abroad and using various debt instruments.

Given the fact that most non-OECD countries are developing countries and countries in transition, we recommend that these countries should offer more opportunities to invest in personal pension accounts, encourage corporations to provide more methods for real and financial investment, provide more financial products and improve the investment environment for the efficiency of capital markets. These changes will encourage public and private pension funds and financial markets to interact positively and efficiently. Non-OECD countries should create incentives for pension funds to buy as many securities of new companies in the financial capital markets as possible. These investment

incentives may extend the allocation of pension funds to smaller businesses, which often have little access to capital markets or any other source of long-term financing (private or public).

Conflict of interest

All authors declare no conflicts of interest in this paper.

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