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REPORT

How Could Pension System Design Features Help Lower Public Pension Spending?

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Public pensions pose major challenges for governments, with costs rising as a result of demographic and economic trends. This study analyses policy implications and recommends reforms to boost private retirement savings.

KEY FINDINGS

Our analysis of data covering 43 pension jurisdictions globally yields several key findings with significant implications for policymakers on how to mitigate the effects of aging populations and other emerging pressures on public pension expenditures. Our analysis finds the following:

- Having basic pensions is costly and puts pressures on public pension spending.
- Raising the retirement age helps reduce public pension expenditure.
- Imposing a minimum age for access to private retirement savings lowers public pension spending.
- Requiring retirees to take a proportion of their retirement savings as income streams has lowered public pension expenditure.
- Having more defined contribution assets in the system reduces public pension expenditure.

POLICY IMPLICATIONS

Our key findings suggest governments and policymakers should consider

- introducing measures to encourage higher private savings to offset demand for public pensions (and resulting pressure on government budgets),
- lifting the official age for retirement and pension eligibility,
- restricting early access to private pensions,

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- encouraging or mandating the receipt of retirement benefits in the form of income streams, and
- including a defined contribution scheme for private retirement savings as part of a comprehensive retirement income system.

The suggestion that governments adopt policies to encourage higher private savings for retirement comes with important qualifications. One caveat is that such policies must ensure that the costs to public finances of any incentives to save for retirement (typically in the form of tax concessions) do not exceed the resulting reductions in government expenditure on state pensions.

EXECUTIVE SUMMARY

Public pensions are typically the most significant items of social expenditure in developed and emerging economies.

Pressure on governments to spend more on pensions has been fuelled by increasingly challenging demographic and economic environments across most developed and emerging economies.

How can governments respond to these challenges? Recent experience and practice suggest that carefully designed reforms to pension systems can go a long way toward mitigating the impact of ageing populations on pension system sustainability. The main objective of this study is to investigate how pension system design features could help mitigate the impact of population ageing on public pension spending, considering country-specific retirement system objectives and constraints. We use a dataset produced by the annual Mercer CFA Institute Global Pension Index[1] (the MCGPI dataset) under a partnership among Mercer, CFA Institute, and Monash University.

[1]This index was known as the Melbourne Mercer Global Pension Index (MMGPI) until it came under the sponsorship of CFA Institute in 2020.

INTRODUCTION

As societies age worldwide, pensions and public policies must adapt
(Amaglobeli, Gaspar, and Dabla-Norris 2020)

Ageing populations—the result of both increasing longevity and declining fertility rates—are increasing pressure on retirement funding systems in most of the world's developed economies and many emerging ones as well. These profound demographic trends have forced governments around the world to consider policy responses to help mitigate the negative impacts on government budgets and retirement system sustainability. In recent decades, many countries have increased incentives to encourage the accumulation of private retirement savings in the hope of partially shifting the burden of retirement funding from governments to individuals. To this end, new policies have been enacted to incentivise individuals to make more pension contributions, to work for longer, and to take retirement benefits in the form of an income stream rather than a lump sum payment.

This paper explores how pension system design and reform could help mitigate the impact of ageing populations on public pension spending in various settings. Given the wide variety of pension systems, policies, objectives, and constraints among various countries, no easy reform solutions exist that would apply equally in all jurisdictions. Based on the empirical evidence collected and analysed for this study, however, we can draw some broad conclusions about the effects and possible benefits of some pension system features.

For this paper, we used a dataset produced by the annual Mercer CFA Institute Global Pension Index (the MCGPI dataset), produced by a partnership among Mercer, CFA Institute, and Monash University. The MCGPI dataset includes publicly available data collected on pension systems and Mercer's consultants' answers to survey questions about their adequacy, sustainability, and integrity. In addition, the dataset contains more than 50 indicators of various system design features and outcome variables. Apart from the MCGPI dataset, we also sourced demographic and GDP data from the World Bank as well as pension assets data from the OECD Global Pension Statistics database.

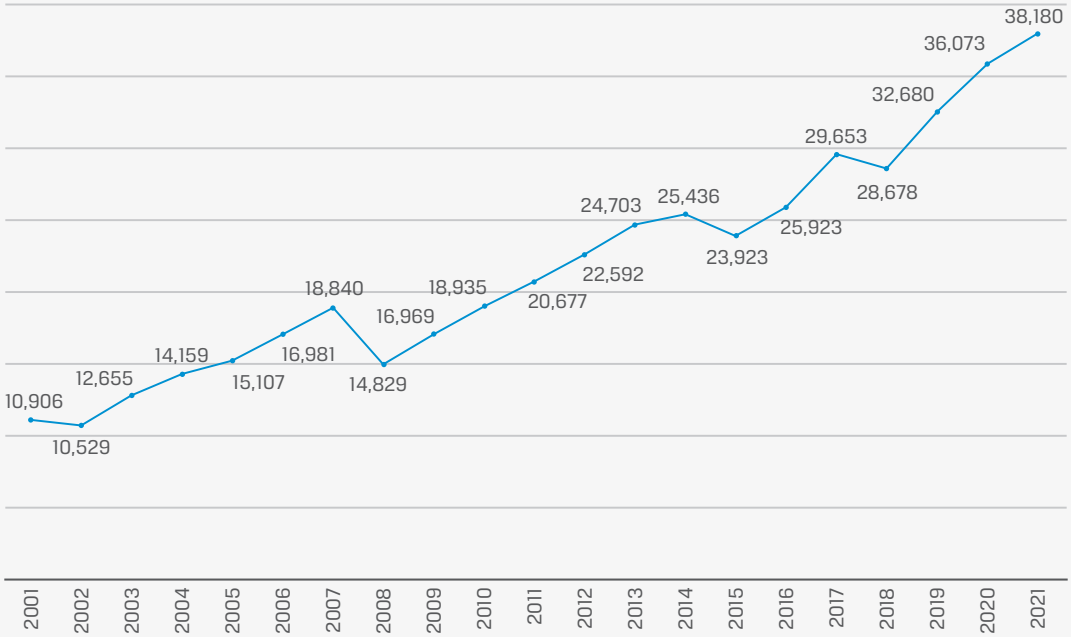
MCGPI Systems

In 2021, the MCGPI covered 43 pension jurisdictions,[2] representing more than 65% of the world's population (Mercer 2021). These systems[3] held approximately USD38 trillion of pension assets in 2021 (see **Figure 1**), representing almost 65% of the USD56 trillion assets in retirement savings plans worldwide (OECD 2021b). In the past 20 years, the size of pension assets in these 43 MCGPI jurisdictions has grown almost four times. To date, asset growth has remained strong through the pandemic (OECD 2022).

[2]The MCGPI started with 11 pension systems in 2009, and it gradually expanded to 43 systems in 2021. In this research project, for the period 2012–2021, we backfilled the data for each of the 43 systems using the same data sources indicated in the annual index reports where possible.

[3]Excluding the Philippines, the United Arab Emirates (UAE), Saudi Arabia, and Taiwan because data on the size of pension assets for 2020 in US dollars were unavailable.

Figure 1. Total Pension Fund Assets of MCGPI Pension Systems, 2001–2021 (USD billions)



Source: OECD, "Pension Funds' Assets" (indicator). https://doi.org/10.1787/d66f4f9f-en.

We investigate how different pension system design features influence the level of public pension spending over time, controlling for the effects of certain socioeconomic and demographic factors. Relevant design features in this context include the provision of a basic state pension, retirement age, timing of access to pensions, defined benefit (DB) versus defined contribution (DC) arrangements, and rules affecting whether benefits are taken as an income stream or in lump sums. We also include in our analysis pension system outcome variables reflecting the size of pension assets, the net replacement rate, and the level of coverage under the private pensions.

We find that various pension system design features significantly affect a country's public pension expenditures:

- Raising the retirement age leads to reduced public pension expenditure.
- Countries that allow early access to private pensions have lower average public pension spending.
- Countries where retirees are required to take a share of their retirement savings as income streams have lower public pension expenditure. Over time, a 1 percentage point increase in the share of retirement benefits that people must take as an income stream reduces the pension expenditure-to-GDP ratio of a system by 0.027 percentage point.
- In our sample group of 43 jurisdictions, we find that higher rates of home ownership are associated with higher public pension expenditure. This finding could be explained in part by the trade-off between home investment and retirement saving, which would tend to leave many home owners relatively more reliant on state pensions.
- Finally, we observe a positive effect on public pension expenditure from having a greater proportion of pension system assets in defined contribution schemes. Over time, a 1 percentage point increase in the share of DC assets in a pension system reduces the ratio of public pension expenditure to GDP in OECD countries by 0.01 percentage point. This effect may increase over time as pension systems mature.

In addition to identifying the effects of various pension design features, our analysis confirms the pressure that population ageing has on public pension expenditure. As shown in previous studies, two key statistical variables—the proportion of the population over 65 years old and life expectancy at age 65—are positively associated with government spending on pensions.

Our findings have significant implications for policymakers concerned with pension system design—in particular for the adoption of design features that can mitigate the effects of unfavourable demographic and labour force trends on public pension spending. The objective of any pension system must be to sustainably finance retirement benefits for both current and future generations. This paper contributes to the debate on pension system features that support these objectives.

The remainder of this report comprises seven sections. Sections I and II describe public pension spending and current demographic pressures. Section III discusses the development of pension markets over the years and changes in relevant pension design features to cope with demographic pressures on pension expenditure. Sections IV and V describe our data and methodology, and Section VI details our findings and their implications. Section VII provides concluding remarks.

I. Public Pension Spending

The OECD defines pension spending as "all cash expenditures (including lump sum payments) on old-age and survivors' pensions. Old-age cash benefits provide an income for persons retired from the labour market or guarantee incomes when a person has reached a 'standard' pensionable age or fulfilled the necessary contributory requirements."[4] A nation's pension spending is commonly measured as a percentage of GDP and includes public and private components. According to the OECD, "Private pension spending includes payments made to private pension plan members or dependants after retirement and covers persons working in both the public and private sectors."[5] In this study, we focus primarily on the public component of pension spending, which is the main source of a retirement income system's pressure on public finances.

Public pension spending is equal to more than 10% of GDP in many countries, particularly in Europe. Among OECD countries, public pension spending increased from an average of 6.6% of GDP to 7.7% between 2000 and 2017 and is still rising. In 2021, among the 43 systems covered by the MCGPI dataset, public pension spending ranged from 0.2% of GDP in the United Arab Emirates to more than 16% in Italy (see **Figure 2**). On average, in 2021, MCGPI systems spent 6.98% on public pensions, with a median of 6.22%.

The International Monetary Fund (IMF) projects that pension spending as a percentage of GDP in advanced and emerging market economies will increase by an average of 1.0–2.5 percentage points (pps) by 2050 (Amaglobeli, Chai, Dabla-Norris, Dybczak, Soto, and Tieman 2019). Given that a few countries are projected to have lower or stable public pension spending relative to GDP, most economies can expect to experience increases of more than 2 pps and in a few cases more than 3 pps. The OECD (2019) provided similar projections for 2050, with average public pension expenditure projected to increase from 8.8% of GDP in 2015–2016 to 9.4% of GDP in 2050.[6]

The IMF projections assumed that all retirement policy reforms legislated at the time of the projections would be implemented. Without these reforms, projected increases in public pension spending would be even greater (Clements, Coady, Eich, Gupta, Kangur, Shang, and Soto 2013). Pension reforms worldwide

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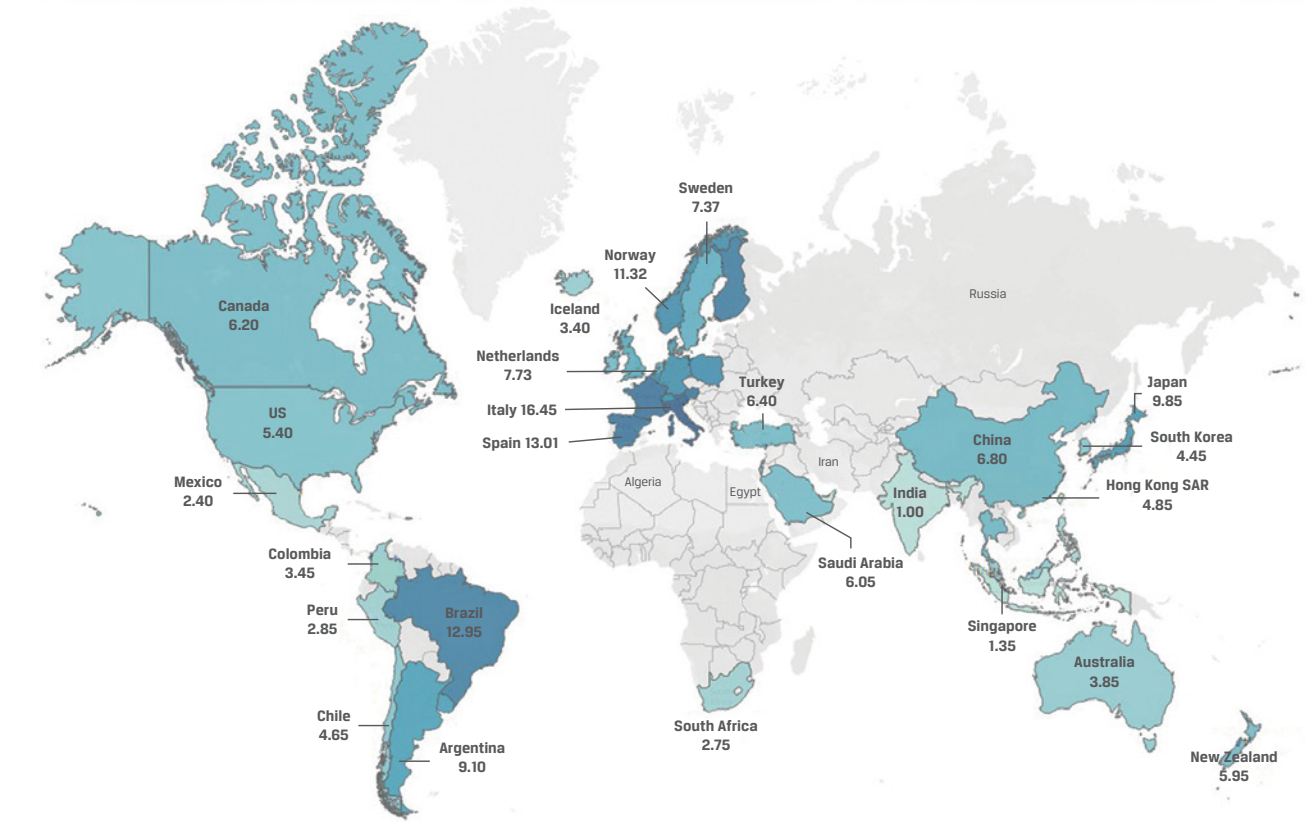
[4]This definition comes from the OECD's "Pension Spending" webpage (https://data.oecd.org/socialexp/pension-spending.htm) and includes the following details: "This category also includes early retirement pensions.... It excludes programmes concerning early retirement for labour market reasons. Old-age pensions includes supplements for dependants paid to old-age pensioners with dependants under old-age cash benefits. Old age also includes social expenditure on services for the elderly people, services such as day care and rehabilitation services, home-help services, and other benefits in kind. It also includes expenditure on the provision of residential care in an institution."

[5]OECD "Pension Spending" webpage (https://data.oecd.org/socialexp/pension-spending.htm).

[6]The OECD average is higher than the average of the MCGPI system. The OECD markets consist of more developed European markets compared with the MCGPI systems, which also cover many Asian and Latin American markets. According to the World Bank's DataBank, the GDP of the OECD countries in 2015–2016 was around USD48 trillion in current prices. Therefore, the total public expenditure on pensions was estimated to be around USD4.2 trillion for that period in OECD nations (see https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=OE).

Figure 2. Public Pension Spending as a Percentage of GDP in Selected Pension Systems (in 2021 or the latest year available)



Note: Darker colour reflects a higher level of public pension spending.

Sources: Map image from Mapbox OpenStreetMap. Data sources are shown in Appendix B.

have focused on adjusting retirement ages, encouraging labour force participation in older age groups, and adjusting benefits and contributions for private pensions to encourage their growth.

According to the OECD (2017, pp. 142–43), public pensions make up an average of 18.4% of total government spending in OECD member countries. In countries with relatively high public pension spending, this percentage can account for between one-quarter and one-third of total public expenditure. If current projections about public pension spending are realised, the additional pressures on government budgets could adversely affect public savings generally and economic growth. Whether changes to pension system design can help reduce public pension spending therefore has considerable implications for both economic and social policies.

II. Demographic Pressures on Public Pension Expenditure

Like other types of social welfare expenditure, public pension spending is primarily demand driven. The level of spending is thus mainly determined by demographic factors, including population ageing, labour force structure, economic conditions that affect people's incomes, and policies that affect eligibility requirements and payment architecture.

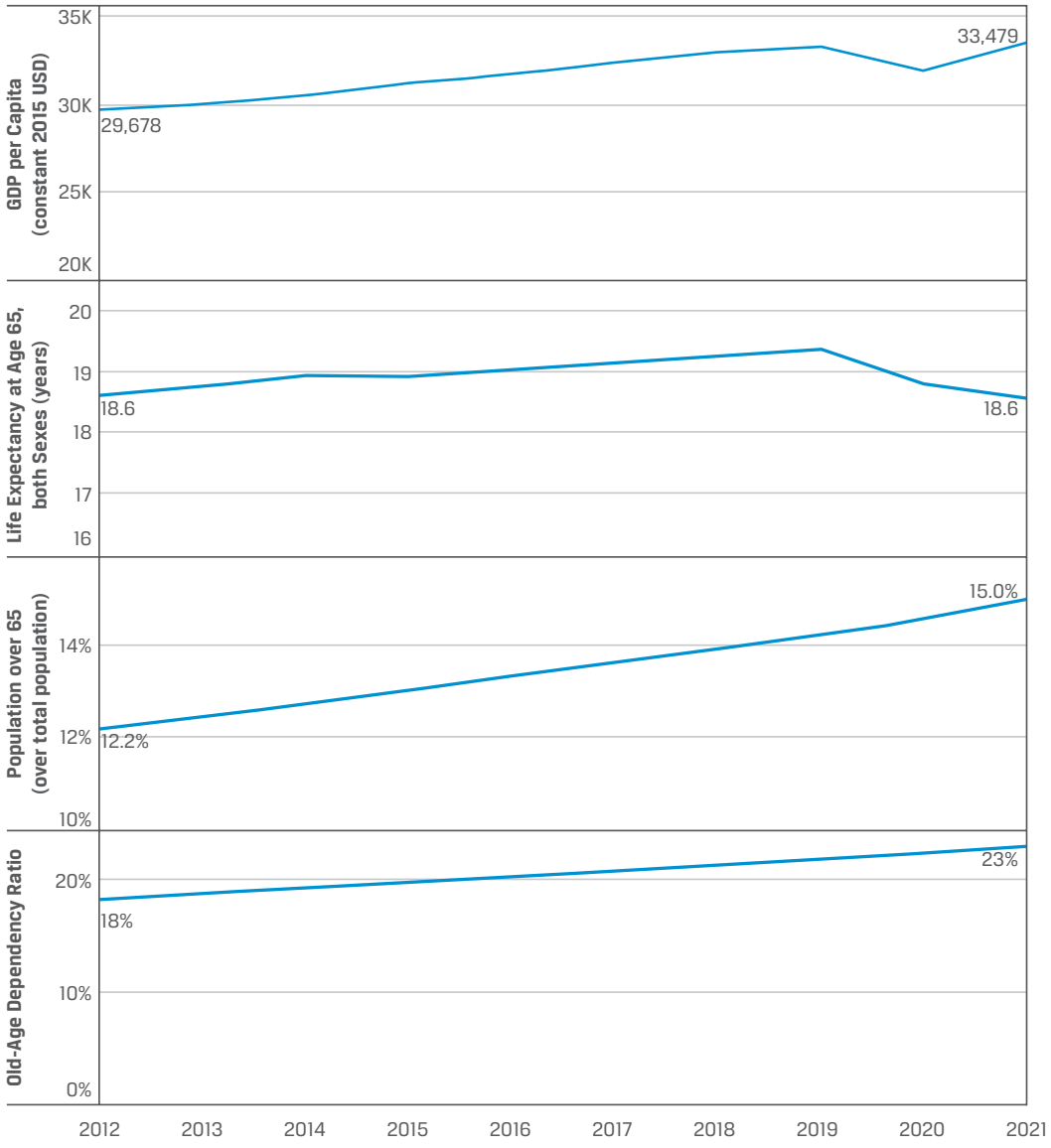
In recent decades, the trend for ageing populations in developed and emerging economies—a key cause of increased public pension spending—has resulted from a combination of declining fertility rates and

improved longevity. Most systems covered by the MCGPI dataset have experienced steady growth in key indicators of an ageing population during the past decade. These key indicators include life expectancy at birth, life expectancy at age 65, the proportion of the population over 65, and the old-age dependency ratio.

As shown in **Figure 3**, which focuses on MCGPI jurisdictions, the proportion of the population over 65 rose from an average of 12% in 2012 to 15% in 2021. In the same period, life expectancy at age 65 increased from an average of 18.6 years in 2012 to 19.3 in 2019 (although it fell back to 18.6 in 2021, possibly due to COVID-19 deaths in 2020 and 2021). Because 65 is the typical retirement age in many jurisdictions, it means, on average, individuals can expect to live more than 18 years after retirement—and significantly longer in some jurisdictions (more than 22 years in Japan and Hong Kong SAR; and more than 21 years in Australia, New Zealand, South Korea, France, Switzerland, and Spain).

Another indicator of an ageing population is the old-age dependency ratio, also known as the old-age to working-age demographic ratio. The World Bank calculates this metric as the ratio of older dependents

Figure 3. Ageing Populations in Jurisdictions Covered by the MCGPI Dataset, 2012–2021



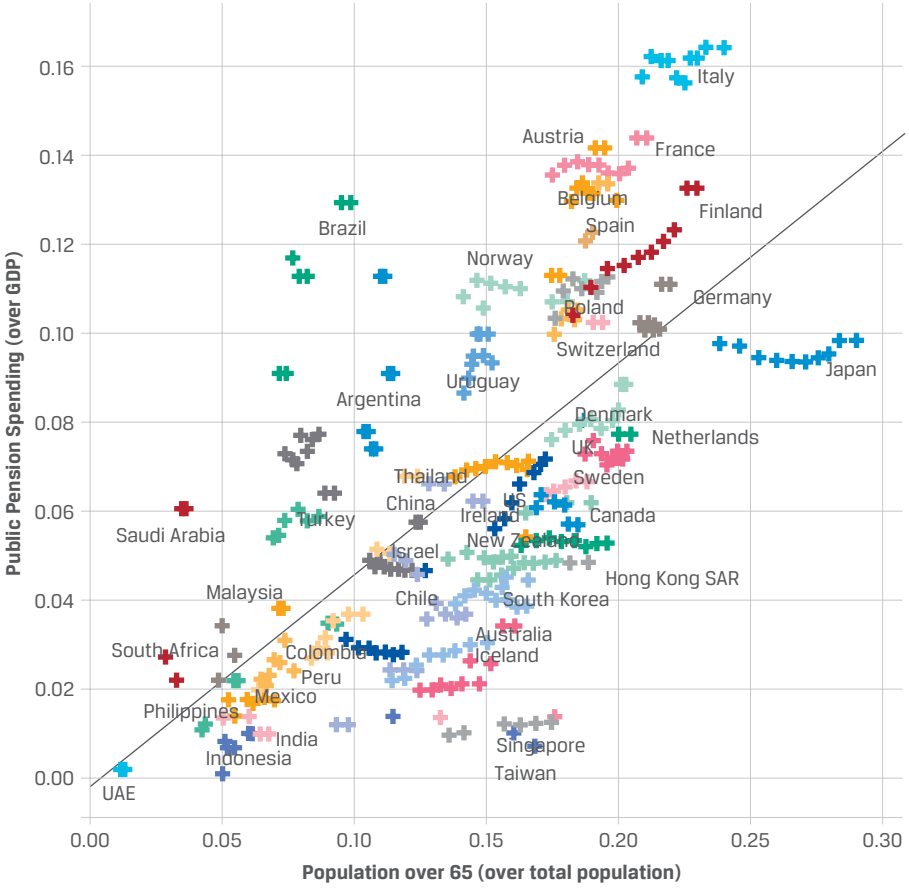
Sources: World Bank, UN Mortality Statistics, World Bank, and Archived United Nations Population statistics, respectively.

(people older than 65) to the working-age population (aged 15–64).[7] The old-age to working-age ratio is determined primarily by rates of mortality, fertility, and migration. When longevity improves and fertility rates stay low, we see an increasing proportion of older people and, hence, more pensioners relative to the working-age group. In the past 10 years, in MCGPI systems, the old-age dependency ratio has increased from an average of 18.2% to 22.9%. This means there are fewer working individuals to support each retiree, intensifying the pressure on pension spending, especially for pension systems that rely primarily on unfunded, pay-as-you-go public financings.

GDP per capita in MCGPI jurisdictions has grown steadily in the past decade, except for a dip in 2020 caused by COVID-19. Such increases in average GDP per capita may help reduce pressure on public pension spending and offset the impact of adverse demographic trends.

As previously noted, the proportion of the population above age 65 is among the most critical drivers of pension expenditure. In **Figure 4**, a clear trend line depicts the correlation between the proportion of the population over 65 and the pattern of public pension spending.[8] As also shown in Figure 4, however, significant variation occurs among MCGPI jurisdictions around the fitted trend line, indicating that other factors are also at play in determining pension spending outcomes.

Figure 4. Ageing Population and Pension Public Expenditure



Sources: Mercer; Standard & Poor's; OECD; World Bank. See Appendix B for details.

[7]Data are reported as the proportion of dependents per 100 working-age population. See the "Metadata Glossary" webpage at the World Bank's DataBank: https://databank.worldbank.org/metadataglossary/africa-development-indicators/series/SP.POP.DPND.OL.

[8]The name of each pension system is labelled for the data point of 2021 or the latest year available. Each system is represented by one colour.

Although a higher proportion of older people in the population will likely be associated with higher numbers of people receiving public pensions, eligibility criteria for public pensions and other design features of pension systems vary significantly among countries—and can be subject to adjustment over the years. In the next section, we explore how pension systems have evolved and how specific design features have been changed over time in response to the effects of a population ageing.

III. Pension Systems: Size and Design Features

This section examines how pension systems in MCGPI jurisdictions have developed and changed over recent decades in the face of demographic pressures, in particular ageing populations. It also describes the design features that can potentially affect a country's level of public pension spending.

Size of Pension Systems

In this subsection, we discuss the pension assets over GDP measure and rates of private pension membership.

Pension Assets over GDP

Pension systems worldwide are at varying stages of maturity—in terms of both total system size and rates of private pension membership. Pension system size—measured by the ratio of total pension assets, both public and private, to a country's annual GDP—ranges from less than 2% in Indonesia to more than 200% in Denmark, Iceland, and the Netherlands. Pension assets include pension funds' assets, book reserves, and pension insurance contracts. In most pension systems, pension funds' assets account for the large majority of total system assets. In some countries, however, including Denmark, Sweden, and the United States, pension insurance contracts account for a third to more than half of the pension assets.

As pension systems have matured and as more individuals worldwide have embraced the idea of saving for retirement, a significant accumulation of wealth in pension assets has occurred. By 2021, MCGPI systems' pension assets totalled USD38 trillion and represented 57% of GDP, on average, among 43 jurisdictions. As shown in **Figure 5**, MCGPI pension systems have evolved faster than non-MCGPI systems[9] over the past decade. And in many systems, pension assets have increased faster than GDP—which by definition means that the pension assets-to-GDP ratio has also grown (OECD 2021a).

As shown in **Figure 6**, the pension assets of the top 10 MCGPI pension systems amounted to more than 100% of the sum of their respective jurisdictions' GDP in 2021. The top three—Denmark, Iceland, and the Netherlands—each had pension assets worth more than twice their annual GDP.

Private Pension Membership

Private pension membership is measured by the proportion of the working-age population who are members of private pension plans, including pension plans for public sector employees and the military. Although private pension plans are typically occupation-based arrangements, they can also be voluntary personal plans. In many jurisdictions, coverage goes beyond traditional full-time workers to the casual and self-employed. Private pension membership is an important indicator of system sustainability in the global pension index.

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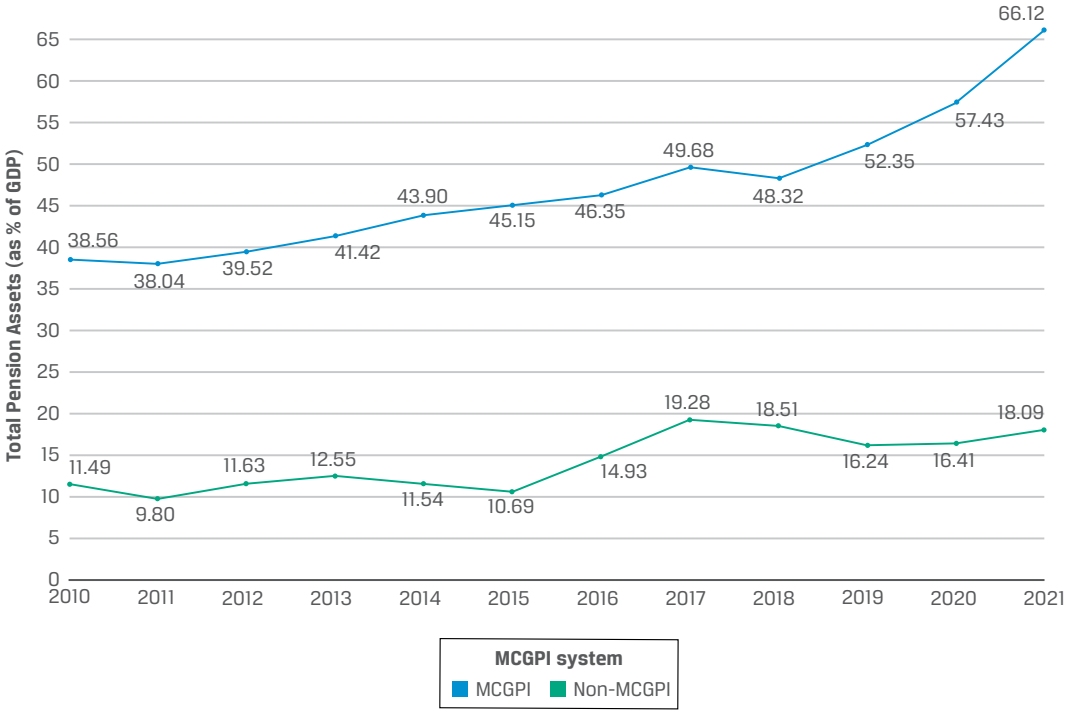
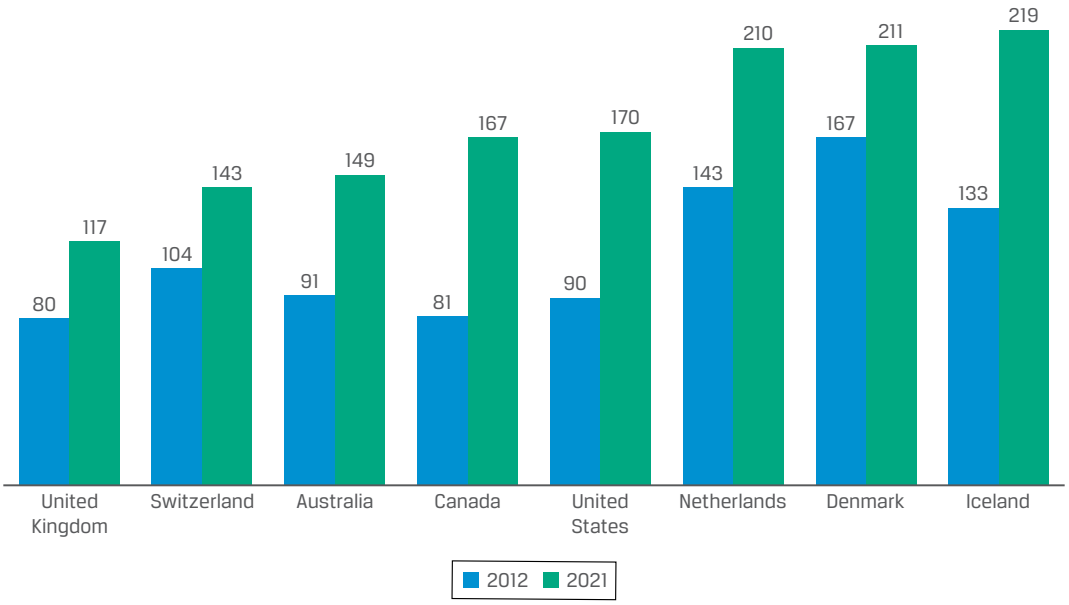
[9]Non-MCGPI systems covered in the OECD's pension indicator database include Albania, Angola, Armenia, Bolivia, Botswana, Bulgaria, Costa Rica, Croatia, the Czech Republic, the Dominican Republic, Egypt, El Salvador, Estonia, Georgia, Ghana, Gibraltar, Greece, Guyana, Hungary, the Isle of Man, Jamaica, Kazakhstan, Kenya, Kosovo, Latvia, Lesotho, Liechtenstein, Lithuania, Luxembourg, Macau (China), Malawi, Maldives, Malta, Mauritius, Mozambique, Namibia, Nigeria, North Macedonia, Pakistan, Panama, Papua New Guinea, Portugal, Romania, Russia, Serbia, the Slovak Republic, Slovenia, Suriname, Tanzania, Trinidad and Tobago, Uganda, Ukraine, Zambia, and Zimbabwe. MCPGI systems have accumulated significantly more pension assets as a percentage of GDP compared with non-MCGPI systems, indicating a bias of the MCGPI dataset toward larger pension systems as well as those with more information available about system features for the analysis of adequacy, sustainability, and integrity needed for the global pension index ranking.

Figure 5. Average Total Pension Assets in All Retirement Vehicles (including pension funds, book reserves, and pension insurance contracts), 2010–2021



Sources: Data source for 2010–2020: OECD. Stat pension indicators database. Data source for 2021: OECD (2022).

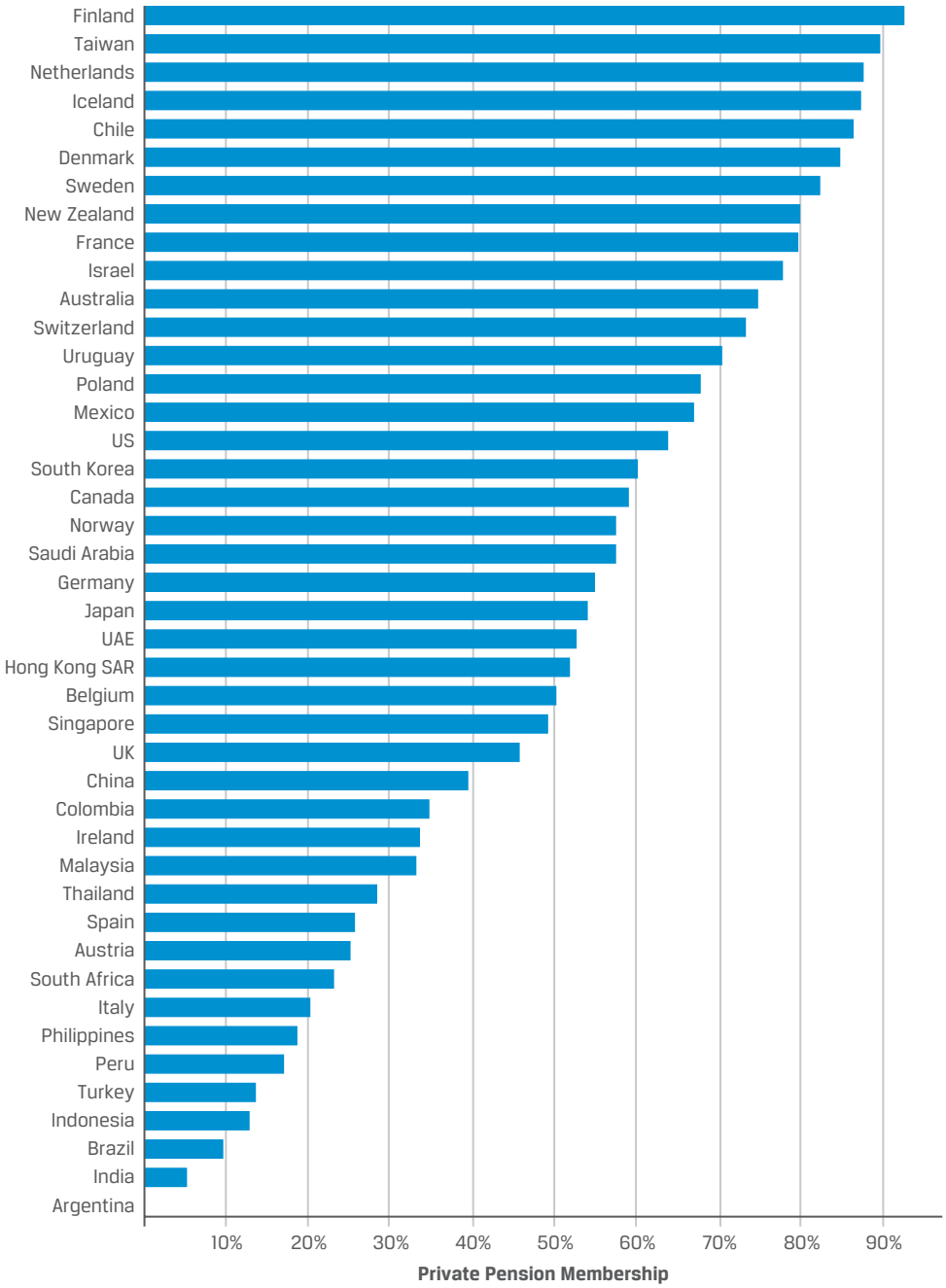
Figure 6. Top 10 Pension Systems (total pension assets as a percentage of GDP), 2012 and 2021



Sources: Mercer; OECD. See Appendix B for details.

The level of private pension membership varies. The countries or regions with the biggest pension systems also typically have a relatively high proportion of their working-age populations covered by private pension plans. These countries or regions tend to actively promote private pension savings by mandating contributions, providing tax incentives for voluntary contributions, and building fund management capacity. In our sample group, Finland, Taiwan, the Netherlands, Iceland, Chile, and Denmark had the highest levels of private pension coverage, at more than 85% of their populations. In contrast, Argentina, India, and Brazil had less than 10% of their populations covered by private pension schemes (see **Figure 7**). As might be expected, countries or regions with high private pension membership tend to have relatively lower demand for public pension spending.

Figure 7. Percentage of Population with Private Pensions in MCGPI Jurisdictions: 2021 or Latest Available



Sources: Mercer; OECD. See Appendix B for details.

Pension Design Features

Retirement income systems typically have multiple tiers, including mandatory public pension provisions, mandatory earnings-related public and/or private pension schemes, and voluntary earnings-related private pension schemes (OECD 2021b). Pension reforms in many countries have resulted in mandatory private pension systems evolving to become the main system pillar—taking pressure off the public system and likely having a positive effect on the long-term sustainability of public finances. Pension reforms can take different forms and occur at different speeds in different countries, however, because of varying demographic environments and needs as well as differing maturity levels of pension systems.

There is, hence, no single best model for a pension system; much depends on each country's blend of demographic, cultural, political, and economic circumstances. System design varies substantially when it comes to details such as funding, accumulation, and decumulation. Systems also differ according to whether pension provision is integrated into or separate from the broader social security system.

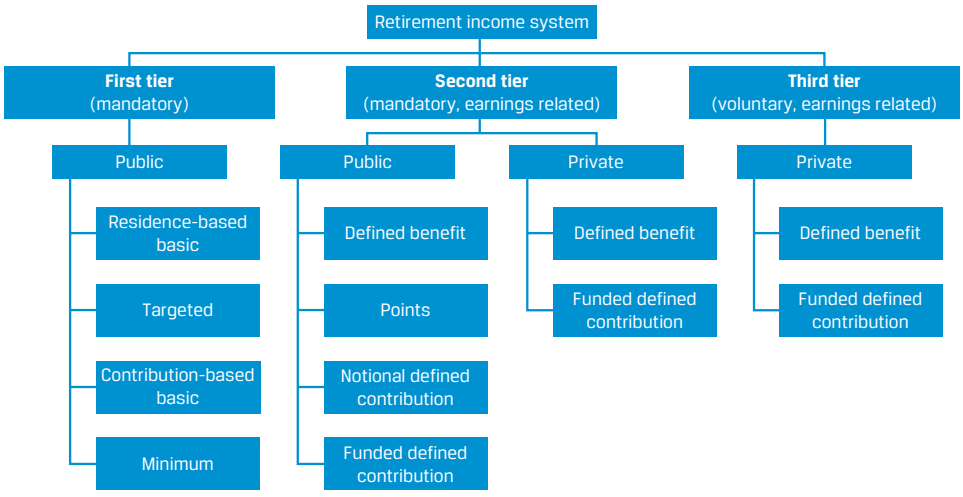
Yet all jurisdictions—notwithstanding their individual demographic and economic circumstances—face the same overall challenge: how to design a system that provides financial security for retirees without putting too much pressure on public expenditure.

This study examines various design features of pension systems that existed and evolved worldwide from 2012 to 2021. Self-evidently, a decade of data will not provide a complete picture of the impact of design reforms in such a long-term business as retirement pension provision. Moreover, reforms and incentives aimed at achieving a major shift in provision from public to private pillars can be costly—therefore partially offsetting resulting savings in public pension expenditure—and can take a long time to implement. Notwithstanding these qualifications, our multi-market dataset provides an extraordinarily detailed and perhaps unprecedented breakdown of various pension system features adopted in different jurisdictions and how they have evolved—including pension asset levels and growth, private versus public pension system coverage, changes in contribution rates, tax incentives, retirement age, and the prevalence of defined benefit and defined contribution pension arrangements. In combination, these insights from our research provide potentially important signals and lessons for policymakers on how judicious pension system design can alleviate the ever-mounting pressure of ageing populations on public pension spending and government budgets.

Although retirement income systems are diverse, their design shares common elements when it comes to mandatory and voluntary tiers, as shown in the OECD's taxonomy in **Figure 8**.

The first tier comprises programs designed to provide pensioners with a minimum standard of living. The OECD includes in this category basic pensions (residence based or contribution based) and targeted and minimum pensions.

Figure 8. Pillars of Retirement Income Systems



Source: OECD (2021b).

The second tier comprises a public mandatory and contributory system—typically related to earnings—and/or a compulsory private and fully funded system. In public systems, mandatory retirement savings are publicly managed. In the public systems of Singapore, India, Malaysia, and Hong Kong SAR (China), for example, a central provident fund (CPF) is the public manager. In private systems, by contrast, retirement savings are managed by private pension funds. Both public and private systems have further categories based on defined contribution or defined benefit arrangements.

In public systems, DB arrangements are commonly earnings related and/or points based. Some public systems have notional individual DC accounts that have an administered rate or a minimum rate of return on accumulated savings. Examples include point-based systems in Germany and France and notional DC plans offered by CPF Singapore, the Employees' Provident Fund (EPF) in Malaysia, and the Provident Funds in India.[10] Different systems have different investment, management, and access arrangements that can affect long-term retirement savings.

The third tier in most systems comprises voluntary private savings. Most pension systems rely on sizeable second and/or third tiers. A few countries, including Denmark and Australia, have robust private systems for the second and third tiers, whereas other mature pension markets—including the United States, the Netherlands, and the United Kingdom—have public systems supported by less extensive but growing voluntary savings in the third tier.

We also note that the integration of retirement income pillars and other social provisions varies from one jurisdiction to another. Singapore and China, for example, have a high level of integration; funds can be moved across the different saving streams for various health care, education, and/or housing purposes. In other jurisdictions, such as Australia, the United States, the United Kingdom, and certain other European countries, pension savings are quarantined from savings for other needs.

Pallares-Miralles, Romero, and Whitehouse (2012, p. 83) observed that "a pension system is sustainable only when it can pay current—and future—benefits over a long horizon under reasonable assumptions without shifting substantial burdens to future generations and without having to cut benefits, increase contributions, or change qualifying conditions."

Broadly speaking, an individual's retirement savings experience has two distinct phases: accumulation and decumulation. Policy issues for the accumulation phase involve contributors and contribution rates, contribution tax incentives, management of accumulated retirement savings, and access to savings. For the decumulation phase, fundamental policy questions surround the setting of a retirement age, retirement benefit payments, old-age pension provisions (including the level of benefits, indexation, and means testing), the existence (or lack) of a requirement to convert savings into an income stream, and tax arrangements.

For this study, we investigate how pension policies (and resulting system features) separately targeting the accumulation and decumulation phases affect public pension spending. Specific policies examined are detailed in the following.

Policies Targeting the Accumulation Phase	Policies Targeting the Decumulation Phase
• Mandatory contribution rate • Management of accumulated retirement savings (DB vs. DC schemes)	• Pension eligibility and pension types • Income stream requirements for retirement benefits • Income stream tax incentives • Retirement age • Early access to retirement savings

[10]See the Pension Funds Online "Country Profiles" webpage: www.pensionfundsonline.co.uk/content/country-profiles/.

This section explains the pension design features and other demographic and labour market indicators pertinent to this study.

State Pension Programs

The OECD (2021b) describes the first-tier programs that provide pensioners with a minimum standard of living as the first layer of protection for the elderly. These programs can be a universal non-means-tested basic pension or non-basic pensions (either targeted pensions or minimum pensions) (see Figure 8). In most systems, these old-age pension programs exist to provide a cushion if contributory pensions and personal savings fail to provide individuals with sufficient retirement income.

Basic pension programs provide safety-net income and are based on either residence or contribution criteria. Basic pensions can be paid to everyone meeting some residence criteria irrespective of the contribution history or solely based on the number of years of contributions, independent of earnings and other resources.

Targeted plans' benefit level depends on income from all sources and/or assets. By design, benefits are higher for poorer retirees in such a plan. Unlike means-tested schemes under the targeted approach, minimum pensions typically define a minimum level for total lifetime entitlements based on contributions. The value of benefit takes into account only pension income from a specific contributory scheme or to all schemes combined; that is, it does not consider other income, such as income from personal savings and other assets. Half of OECD member countries, for example, have a minimum pension benefit based on their main contributory scheme, at 27% of the average earnings (OECD 2021b).

Many countries have multiple programs that can be additive in some cases and substitutes in others. As such, in this study, we differentiate pension systems into two groups: those with and without basic pensions, with an expectation that those providing basic pensions would have to spend more for public pensions than their counterparts.

Currently among the MCGPI jurisdictions, basic pension programs are available in Argentina, Canada, Denmark, Hong Kong SAR, Iceland, Ireland, Japan, South Korea, Mexico, the Netherlands, New Zealand, the Philippines, and the United Kingdom.

State Pensions Compared

Australia provides means-tested social assistance for retirees through the age pension. It is an unfunded model, providing taxpayer-financed income support to retirees in need, but without a designated national fund requiring contributions from future beneficiaries. The current working population therefore bears the cost. According to the report of the Retirement Income Review of the Australian Government by Callaghan, Ralston, and Kay (2020), the annual cost of the age pension grew from AUD24 billion in 2000 to about AUD46 billion in 2019, or approximately 2.4% of GDP.

New Zealand and the Netherlands both provide a residency-tested basic pension to retirees. In Canada, by contrast, the universal flat-rate pension is supported by a means-tested income supplement. In Denmark, the Danish state pension provides a basic amount and, unlike New Zealand and the Netherlands, supplementary pension benefits as well.

Retirement Ages and Early Access to Retirement Savings

Many jurisdictions worldwide slightly increased the official retirement age in the past decade. Retirement age is typically, but not always, the same as pensionable age. The OECD (2011a) defines pensionable age as the age at which people can first draw full benefits without actuarial reduction for early retirement. In some countries, early retirement without benefit reduction is possible under specific contribution length requirements.

A statutory retirement age—or in its absence, a pensionable age—is one of the key parameters of any pension system, serving as a guide to many people about when they should stop working. Most pension systems have some flexibility on the age at which retirement savings can be accessed, with or without adjustment to the pension level. Policies incentivising people to work longer and those restricting early access to pension savings can also affect the number of pensioners in the system.

Although 65 is a popular retirement age, it is not universal. For instance, Australia has no official retirement age, but the pensionable age is 67. According to the OECD (2011a), many systems have raised the pensionable age in response to increases in longevity. According to the OECD, the average pensionable age in OECD countries will increase by 2.5 years for men and 4 years for women by 2050. In contrast, in many non-OECD countries included in the MCGPI dataset, the pensionable age is still lower than 60, especially for women. In India, for example, the pension age for the earnings-related Employees' Provident Fund scheme is 55 years. In Indonesia, the retirement age is 56, and in Saudi Arabia, 60 for men and 55 for women. Raising the retirement age does not fully relieve the burden of ageing population on pensions, however, because life expectancy has been improving faster than the legislated changes in the retirement age in some OECD markets. Life expectancy after the average pension age is projected to reach 20.3 and 24.6 years (for men and women, respectively) in 2050, which means an increase of about 3.0 years for men and 2.5 years for women between 2010 and 2050, despite legislated changes in retirement ages (OECD 2011a).

In some countries, early access to part or all of the accrued retirement benefit before retirement is permitted, which is not advisable according to the design of an ideal system by Mercer and CFA Institute (2015). Early access to pension savings creates leakages in a system and reduces its sustainability. Ideally, the benefit should be made available only under strictly prescribed conditions of financial hardship, age, death, or permanent disability. Many countries and regions, therefore, have introduced a minimum access age to prevent early access to retirement benefits, while others may use taxation tools to discourage such behaviours. Some MCGPI jurisdictions—for example, Argentina, Austria, the Philippines, South Africa, and Turkey—have no minimum access age, whereas in most other cases, the minimum access age ranges from 55 to 60 years of age. Some exceptions, including Ireland and the United Arab Emirates, even allow access beginning at 50 years of age (Mercer 2021).

Pension policy reforms that increase the pension age to cope with pressure from rapid ageing of the population have also encouraged labour force participation at older ages. More people choose to work beyond their statutory retirement age. As shown in **Figure 9**, the labour force participation rate increased steadily during the past decade among the 55–64 age group, slowing in 2020 and 2021 (possibly in response to the COVID-19 pandemic). The labour force participation rate of the over-65 age group has fluctuated around 17.5%. This group's labour force participation rate also declined in 2020 and 2021.

With increases in life expectancy in recent decades, pressure to make retirement savings last longer has grown. In some countries, this pressure has prompted adjustments to retirement age and pension eligibility as well as to benefit payments, in an effort to mitigate the growing burden of public pension spending.

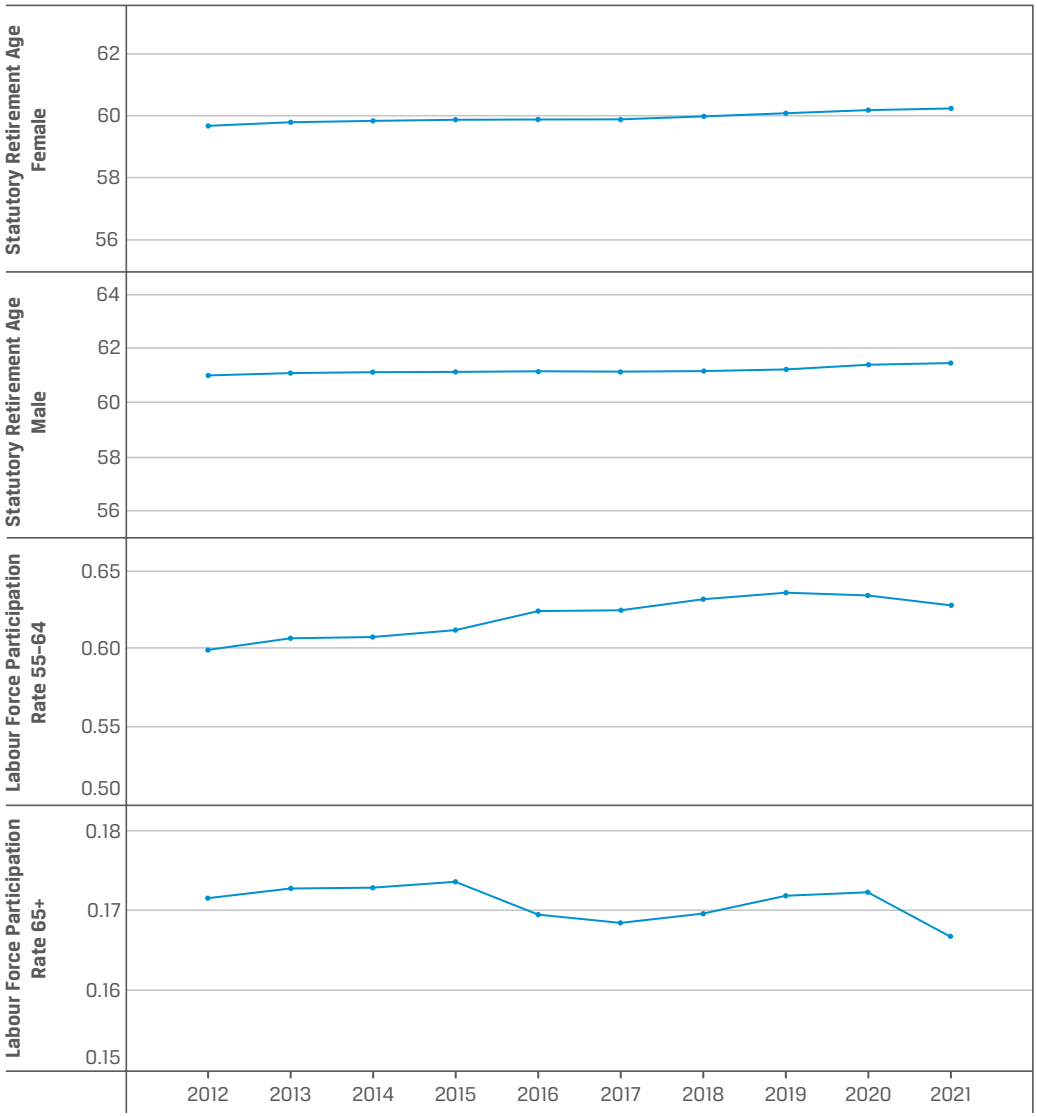
Contributions

Contributions are the primary source of retirement savings accumulation. They may be made by employees, employers, or even the state (in the case of state-funded matching contribution incentives).

In most pension markets, income earners have a legislated mandatory contribution rate. These legislated contributions include mandatory employer and/or employee contributions toward funded public benefits (i.e., social security) and/or private retirement benefits. The exceptions are Argentina, Brazil, and South Africa, which have no minimum mandatory contribution. In Brazil, for example, although there is no general rule about contribution levels, the contribution rate for DC plans is around 4%–6% of the payroll, while the rates for DB plan rates vary. Much higher mandatory rates are applied in some MCGPI jurisdictions, including Italy, which has a rate of 33% for both mandatory employer and employee contributions (see **Figure 10**).

In such markets as Australia, Denmark, and Switzerland, participation in a pension plan is compulsory, and the mandatory contribution rate serves as the minimum prescribed rate. In Australia, the mandatory contribution of 10% of salary is only for private superannuation. The actual contribution rates by employees and/or their employers can effectively be higher than the legislated rate. In Switzerland, the contributions are to

Figure 9. Trends in the Labour Force Structure of the MCGPI Markets, 2012–2021



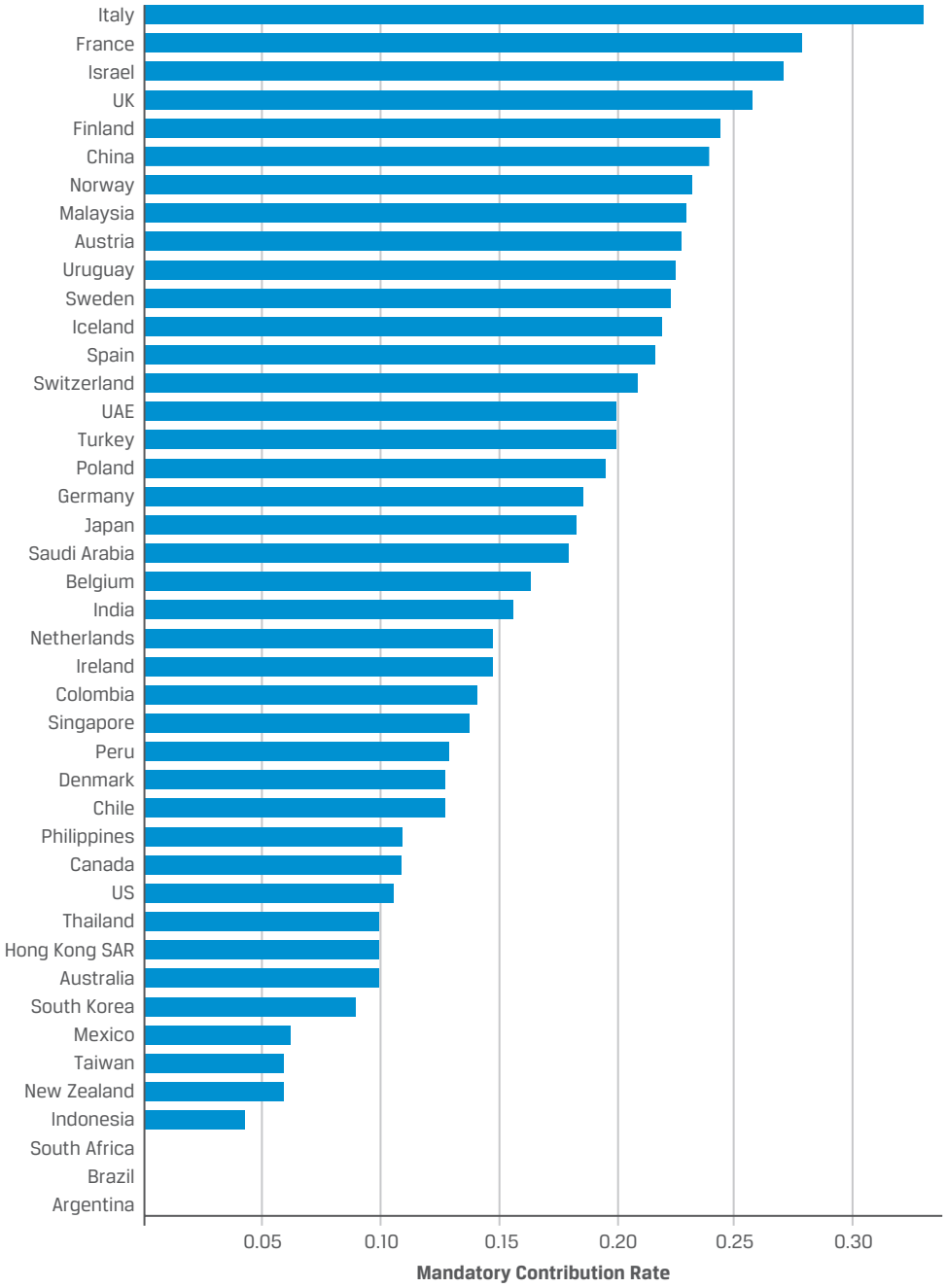
Sources: OECD; ILOSTAT. See Appendix B for details.

both public and private pension schemes. In Switzerland, for the public pension part, employees and employers each contribute 4.2% of salary, and the occupational mandatory contributions vary from 7% to 18%, depending on age groups. Employer contributions must be at least one-half of the total contribution, and employees pay the remaining part. High contribution rates foster the growth of public and private pension assets over the working life of individuals and reduce the reliance on public funding for retirement.

DB/DC Arrangements

Pension arrangements, in both private and public systems, can have defined contributions or defined benefits—or a hybrid of both. Although DB plans have long existed in many systems, DC plans have increasingly replaced them. In some countries, including Japan and Canada, the transition to DC plans in the private system has been gradual. In other countries, such as Australia, DB arrangements have disappeared more quickly because many DB schemes have been closed to new members. In the United States, the share of DB assets in occupational schemes has also declined during the past decade (OECD 2021a). According to the US Congressional Research Service (2021), 68% of private sector workers were covered by DB and/or DC plans in 2021. When the numbers were broken down, just 15% had DB plan access while 65%

Figure 10. Mandatory Contribution Rate in Each Jurisdiction



Source: Mercer data sourced from relevant Mercer consultants.

had DC plan access; some had both. As of 2019, there were 12.6 million active members of private sector DB plans and 85.5 million active members of private DC plans in the United States.[11]

The split of total system assets between DB and DC plans varies widely between countries. In Australia, for example, DC-based assets have been calculated at 87% of total pension assets. By contrast, the share of total assets in Canada, the Netherlands, and Japan is dominated by DB funds (Thinking Ahead

[11]In the United States, a massive shift from DB plans to DC plans has occurred in the last few decades. In 1975, private sector DB plans had a total of 27.2 million active participants, more than double that of private sector DC plans (11.2 million).

Institute 2018). DC plans are growing in relative importance everywhere, however, including in currently DB-dominant systems.

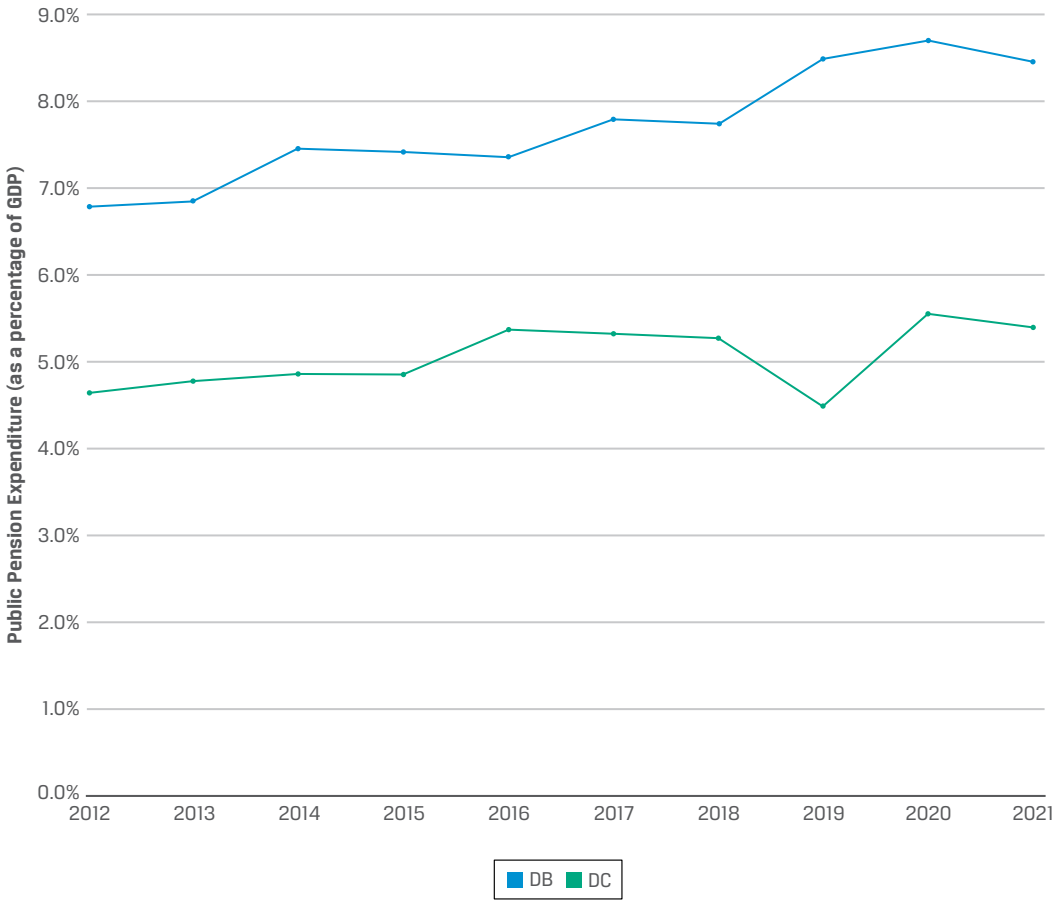
The prevalence and funding status of DB plans can have major implications for public sector finances. If these plans fall short of their requirements to cover retirement benefits to their members—including in the case of plan closures—governments may have to make up the shortfall, adding to the burden on public pension spending.

As shown in **Figure 11**, pension systems dominated by DB schemes on average have had higher public pension spending than those with predominantly DC schemes. The top line, representing average public pension expenditure for MCGPI jurisdictions in which more than half of all pension assets are managed in DB plans, is consistently and significantly higher than the bottom line for MCGPI jurisdictions where DC pension assets are dominant. The widening of the gap between the two lines in the past decade adds to the impression that DB/DC could be a relevant design feature affecting public pension spending.

Income Stream Requirement for Retirement Benefit and Tax Incentives

An ideal retirement system, as described by Mercer and CFA Institute (2015), should allow access to a capital sum of 20%–40% of total retirement savings while ensuring a regular income throughout retirement years. Income products available in each market vary from flexible drawdown arrangements to lifetime annuities. "The benefits provided from the system during retirement should have an income focus but permit some capital payments or withdrawals during retirement, but without adversely affecting overall adequacy" (Mercer and CFA Institute 2015, p. 5).

Figure 11. Average Public Pension Expenditure of DB- and DC-Dominant Systems, 2012–2021



Sources: Mercer; Standard & Poor's; OECD; World Bank. See Appendix B for details.

Among MCGPI jurisdictions, rules differ widely on whether some or all benefits must be taken as an income stream. In some places where there is a choice between taking lump sums and income streams, tax incentives are offered to encourage income streams.

Some jurisdictions require all retirement benefits to be converted into lifetime annuities. These include Chile, Colombia, Finland, Iceland, Israel, the Netherlands, Norway, Peru, Saudi Arabia, Sweden, the United Arab Emirates, and Uruguay. Others require only part of the benefit to be converted into an income stream, with the remainder allowed to be taken in a lump sum. Such jurisdictions include Austria, Brazil, Canada, Denmark, Germany, India, Indonesia, Ireland, Italy, Poland, Singapore, South Africa, and Taiwan. By contrast, jurisdictions with no requirements to take benefits as income streams include Argentina, Australia, Belgium, China, France, Hong Kong SAR, Japan, South Korea, Malaysia, Mexico, New Zealand, the Philippines, Spain, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Among countries with only partial or no income stream requirements, those with tax incentives to encourage income streams include Austria, Brazil, Canada, Germany, India, Ireland, Italy, South Korea, South Africa, Turkey, and the United Kingdom (Mercer 2021).

Other types of tax incentives are used to promote the growth of private pension savings and, as such, are an integral part of pension system design. A variety of tax incentives relating to voluntary contributions, investment income, pension income, and income streams for retirees can affect current and future public pension expenditure. For this paper, however, we focus primarily on tax incentives for taking an income stream in retirement, because this dynamic has a contemporaneous effect on pension expenditure. The other tax incentives affect future public pension expenditure through their impact on pension assets, and we control for pension assets in our model.

Net Replacement Rates

The net replacement rate is defined as the individual's net pension entitlement divided by net pre-retirement earnings, which considers personal income taxes and contributions (OECD 2021b).

Net replacement rates in the MCGPI dataset consider a range of income levels, including 50%, 100%, and 150% of average earnings, each of which are given weightings of 30%, 60%, and 10%, respectively. The weighted net replacement rate will be close to that for a median earner in many cases (Mercer 2022). The net replacement rate is an important indicator of a retirement system's adequacy.

Overall, the research framework to investigate the drivers of public pension spending can be summarised as shown in **Table 1**.

When it comes to public pension expenditure and pension design features, our models might not capture other factors—such as other types of savings and contributions incentives, the existence of other governmental assistance for health and housing for pensioners, and the cultural norms of having family support for retirees. These factors, which can vary by country, are reflected in the country dummy variables' coefficients included in the models.

Table 1. Factors Considered in the Research Framework

Main Independent Variables: Pension Market and System Design Features	Controlling Variables: Demographic and Economic Factors
Basic pensions provision	Population 65+
Retirement age	Life expectancy at pension age
Mandatory contribution rate	Income category of the country/region based on GDP per capita
Lump sum withdrawal allowed	Home ownership
DB/DC share	Labour force participation 55–64
Mandatory income stream requirement	Labour force participation 65+
Tax incentive for an income stream	
Early access to retirement savings	
Pension assets as a percentage of GDP	
Net replacement rate	
Private pension membership	

IV. Data

This research utilises a dataset from the Global Pension Index,[12] a collaborative project among CFA Institute, Monash University, and Mercer (MCGPI). The project started in 2009. As of 2021, the MCGPI database had 13 years of data on various indicators of the adequacy, sustainability, and integrity of pension systems worldwide.

The primary dependent variable of this research is public pension spending measured as a percentage of GDP—one of the indicators for pension system sustainability used in the MCGPI (Mercer 2021).

V. Methodology

Pension systems with a design model leaning toward more private pillars, rigorous tax incentives, strict contribution and accessibility regulations, and limited eligibility for public pensions are widely assumed by policymakers to minimise the burden of public pension expenditure.

We run the following regression to understand how different pension design features may affect public pension expenditure:

$$Y_{it} = \alpha + \mathbf{X}'\beta + \mathbf{W}'\Gamma + \alpha_i + \delta_t + \varepsilon_{it}, \quad (1)$$

where Y_{it} is the public pension expenditure of pension system i in year t, $\mathbf{X}$ is a vector of pension design features for system i at time t, $\mathbf{W}$ is a vector of socioeconomic and demographic factors that affect both pension expenditure and pension design features in market i at time t, α_i is the market fixed effect, δ_t is the time fixed effect, and ε_{it} is the error term.

[12]For more information, see the "Mercer CFA Institute Global Pension Index Project" webpage at www.monash.edu/business/mcfs/impact-and-engagement#tabs__2370475-01. See also Mercer (2021).

The pension design features in **X** include the following:

- an indicator for basic pension,[13] which is equal to 1 if the country provides a basic pension to all retirees and 0 otherwise;
- retirement age for males and females;
- an indicator if individuals are allowed to access their private retirement savings early from a certain minimum age (minimum access age) or at any age;
- the proportion of private retirement benefits required to take as an income stream (mandatory income stream);
- an indicator variable if there is a tax incentive for taking an income stream (tax incentive);
- an indicator if lump sum withdrawal from pension savings is allowed;
- mandatory contribution rate;
- private pension membership;
- pension assets as a percentage of GDP; and
- the net replacement rate.

The socioeconomic and demographic characteristics included in the vector **W** are home ownership, income category (high income, upper-middle income, and lower-middle income), labour force participation rates among age groups 65+ and 55–64, life expectancy at 65, and percentage of population aged over 65. Note that home ownership can be considered a relevant pension design feature in some countries. In Australia, for example, pension payments are different for home owners and renters, and home ownership does not affect pension eligibility. In other jurisdictions, a home can be included in asset testing for pension eligibility. Our data show that jurisdictions that provide basic pensions are typically more affluent than those that do not, and they have relatively older populations. To see how this dynamic affects pension expenditure, we interact a dummy variable for basic pension provision with income categories and the percentage of the ageing population.

We estimate the regression Equation 1 using the random effect (RE), feasible generalised least square (FGLS), the fixed effect (FE), and least square dummy variable (LSDV) estimators. The following section discusses only the LSDV estimates.[14] The estimates resulting from other models can be found in Appendix D. To account for autocorrelation and heteroskedasticity, the standard errors are clustered at the market level.

[13]In this empirical study, we design a variable indicating whether basic pensions are provided in the system. For systems reported in the OECD's Pensions at a Glance: OECD and G20 series (OECD 2013a, 2015, 2017a, 2019, and 2021b) and Pensions at a Glance: Asia/Pacific series (OECD 2011b, 2013b, and 2018), we adopt the classification of basic versus non-basic pension programs (including minimum pensions and/or targeted programs) in the first tier by OECD. We use the World Bank classification (World Bank 2012) for those MCGPI systems not included in the OECD's reports.

[14]Under the assumption that the country fixed effects are uncorrelated with the regressors, the pension expenditure follows a random effect model. The parameters can be consistently estimated using both the RE and the FGLS estimators, and the FGLS estimators are more efficient in the presence of heteroskedasticity and/or autocorrelation. If they are correlated, however, it follows that a fixed effect model and the RE or the FGLS estimators are inconsistent, and we have to use the FE or LSDV estimators. Between FE and LSDV estimators, we would prefer the LSDV one because the FE estimator cannot estimate the coefficients of time-invariant regressors. We note, however, that FE is more efficient than the LSDV estimators if FE is the correct model (Cameron and Trivedi 2005). To determine the correct specification, we run a Hausman specification test (Hausman 1978) between the FE (or LSDV) and RE estimators. The null hypothesis is that the RE is the correct model specification. Our test results show that the *p*-value of accepting the null hypothesis is zero. This finding implies that the unobserved country fixed effects are correlated with the regressors and thus that pension expenditure follows a fixed effect model.

VI. Main Findings and Implications

We present the LSDV estimates of regression Equation 1 for all MCGPI jurisdictions and the OECD countries separately in **Table 2**.

Table 2. The Relationship between Pension System Features and Public Pension Spending

	(1) MCGPI Jurisdictions	(2) OECD Countries
Basic pension	0.083 (0.057)	0.226** (0.114)
Share of pension assets in DC		−0.0001** (0.000)
Mandatory contribution	−0.020 (0.026)	−0.004 (0.034)
Retirement age	−0.003** (0.002)	−0.003 (0.002)
Minimum access age	−0.043*** (0.011)	−0.062** (0.030)
Mandatory income stream (%)	−0.016*** (0.006)	−0.027** (0.011)
Tax incentive for mandatory income stream	−0.004 (0.004)	0.001 (0.002)
Lump sum	−0.005 (0.006)	−0.013* (0.007)
Home ownership	0.036*** (0.014)	0.011 (0.009)
Private pension membership	−0.036*** (0.013)	−0.017 (0.013)
Pension asset (% of GDP)	−0.005 (0.004)	0.001 (0.005)
Net replacement rate	0.011 (0.008)	0.005 (0.011)
Share of aged population	0.354** (0.176)	0.112 (0.184)
Life expectancy at 65	0.011*** (0.003)	0.015*** (0.006)
Labour force participation rate (65+)	−0.023 (0.035)	−0.107 (0.071)
Labour force participation rate (55–64)	−0.014 (0.020)	−0.031 (0.030)
Upper-middle income	−0.010 (0.021)	0.094** (0.040)

(*continued*)

Table 2. The Relationship between Pension System Features and Public Pension Spending (*continued*)

	(1) MCGPI Jurisdictions	(2) OECD Countries
High income	0.025 (0.023)	
Basic *x* Life expectancy at 65	−0.007** (0.003)	−0.009* (0.005)
Observations	269	128
Number of jurisdictions	43	24
Market FE	Yes	Yes
Year FE	Yes	Yes
Chi-square	76.63	697.7
Prob. 〉 Chi-square	0.000	0.000
R^2	0.60	0.61

Notes: Robust standard errors in parentheses. For brevity, we do not report the coefficients of the market dummies, but many of them are statistically significant. ***p 〈 0.01. **p 〈 0.05. *p 〈 0.10.

We find that various pension design features significantly affect a system's pension expenditures. Systems that offer some form of basic pension have a higher pension expenditure. On average, providing some basic pension increases the pension expenditure-to-GDP ratio by 23% in OECD countries.

As expected, our results indicate that retirement age is negatively associated with pension expenditures—reflecting the smaller number of retirees to whom the government needs to pay pensions. We find that as the retirement age[15] increases, pension expenditure to GDP declines by 0.3% in MCGPI jurisdictions. Similarly, restricting early access to private pensions through a designated minimum access age helps prevent leakages of private retirement savings and, hence, should be expected to reduce the pressure on public pensions. The LSDV estimate shows that systems requiring a minimum age to access private pensions have a lower pension expenditure on average. Moreover, we find that the effect of a minimum access age on public pension expenditure is greater than the effect of the retirement age—reducing the pension expenditure-to-GDP ratio by 4.3%.

Our results show that systems with a higher share of private pension membership also have lower pension expenditure. On average, pension expenditure for an MCGPI jurisdiction declines by 0.036pp over time for every 1pp increase in private pension membership.

Countries that require retirees to take a large share of their retirement savings as income streams also have lower public pension expenditure. Over time, a 1pp increase in the proportion of the retirement benefit required to be taken as an income stream reduces the pension expenditure-to-GDP ratio by about 0.02% in MCGPI jurisdictions and by 0.03% in the OECD countries.

Providing tax incentives for retirees to take income streams rather than lump sums could conceivably help reduce the public pension burden by prolonging the time it takes for some individuals' retirement savings to be exhausted. In some jurisdictions with a mandatory income stream, tax incentives are provided to compensate retirees for the lack of flexibility in accessing capital lump sums. For systems with partial or no

[15]Because male and female retirement ages are almost perfectly correlated, we use only the male retirement age in regression Equation 1.

mandatory income stream requirements, taxes can be used to incentivise people to take income streams or to increase the income stream component of their benefits split. We find, however, that after controlling for the proportion of retirement assets in mandatory income streams, the tax incentive has no discernible effect on public pension expenditures. In other words, the effect of having tax incentives for income streams has already been captured by size of the income stream requirements out of the total accumulated benefit.

Taken together, our findings suggest that mandating an income stream as a part of the retirement benefit works, whereas providing tax incentives may not. This outcome also confirms other empirical findings that tax incentives are relatively ineffective ways to nudge behaviour.

High rates of home ownership are associated with higher levels of public pension expenditure in our sample. This result could be attributed to several factors. First, to the extent that investment in residential homes involves a trade-off with retirement savings, home ownership will of itself make some people more dependent on the government for income support in retirement. Second, private homes are not counted as assets in eligibility means tests for social assistance programs in some countries. In Australia, for example, residential homes are excluded in the assets test for the age pension. This exclusion provides incentives for retirees to direct their savings into large, more valuable residential properties in order to secure eligibility for the age pension. In a study conducted for the Australian Retirement Income Review, Ruthbah and Pham (2020) argue that under the current system in Australia with no income stream requirement for retirement benefit, people are more confident in taking on mortgages to buy their homes, knowing that they can access a lump sum retirement benefit upon retirement to pay off the debt. To the extent that the exclusion of homes from the pension asset test encourages such behaviour, this dynamic would be expected to add to the burden of public pension expenditure. In our sample group of MCGPI jurisdictions, we found that a 1pp increase in home ownership is associated with an increase in the pension expenditure ratio of 0.04%. In the sample of OECD countries, however, this effect is not statistically significant.

We find that other pension design features, such as higher mandatory contribution rates, provision for lump sum withdrawal of retirement savings, and a higher level of pension assets, do not have any effect on public pension expenditure in the short run.

Demographic features, such as the percentage of population aged over 65 and life expectancy at age 65, also affect public pension expenditure. On average, in jurisdictions that do not provide any basic pensions, for every one-year increase in life expectancy at 65 (which increases the pool of individuals eligible for pensions), pension expenditures increase by 1.1% in MCGPI jurisdictions and by 1.5% in OECD countries. Similarly, for every 1pp increase in the percentage of the population aged over 65, the public pension expenditure-to-GDP ratio goes up by 0.35% over time in MCGPI jurisdictions. Other demographic characteristics, such as labour force participation rates at 65 and above or in the years leading to retirement (55–64), do not significantly affect public pension expenditures.

We also find that the relationship between per capita income and pension expenditure is not linear. Specifically, as jurisdictions move from lower to upper middle-income status, their pension expenditure as a share of GDP increases in OECD countries. As they move to higher-income status, however, we do not find any significant difference.

For systems that provide basic pensions, the increase in pension expenditure (as a share of GDP) resulting from an increase in life expectancy at age 65 is smaller than in systems that do not provide basic pensions. In our sample, average per capita incomes in countries with basic pension provisions are approximately USD6,000 higher than in those without such provisions. We find that among MCGPI jurisdictions, those that provide basic pensions spend 0.7% less of their GDP on pensions as life expectancy of their population goes up by a year compared with those that do not provide any basic pension. In other words, when life expectancy increases, providing basic pensions becomes relatively more costly in poorer economies.

Defined Benefit/Defined Contribution

Another pension design feature with potential implications for public pension expenditure is the distribution of pension assets between DB and DC schemes. With the allocation of total pension assets to DC recently increasing in most countries and the proportion of retirees' assets in DC therefore also increasing, it is generally expected that the burden of public pension expenditure will be reduced.

To test this proposition, we use the proportion of pension assets in DC schemes—DC as a percentage of total assets (as reported by the OECD Pension Statistics database)—as a continuous variable. Because information about the distribution of pension assets between DB and DC schemes over time is available only for OECD countries, including this variable in our analysis significantly reduces the sample size. However, doing so allows us not only to glean differences between countries with different DB/DC distribution profiles but also to ascertain the impact of the shift from DB assets to DC assets observed in many systems over time. Hence, we run a separate analysis on the OECD countries for which DB/DC split data are available, while our main regression results for all MCGPI systems do not include this pension design feature.

To examine the effect of the shift from DB to DC, we run regression Equation 1 with this pension design feature (proportion of pension assets in DC schemes) for the OECD countries. The results are shown in column 2 of Table 2. We find that over time, a 1pp increase in pension assets in DC schemes reduces public pension expenditure in OECD countries by 0.01%. This effect may increase over time as pension systems mature. As pension systems transition from a DB system to a more DC-based system, the current working population may have more DC assets while the retirees may still have more DB assets. Therefore, the structure of DB/DC in the whole system (including assets of the working population and retirees) will not resemble the DB/DC structure within the retiree group. It is one caveat of the way the DB/DC variable is measured and tested here. We use DB/DC structure of the whole system because we do not have the DB/DC structure of the retirees themselves. That would be a better variable because public spending depends on the DB/DC structure of current retirees.

Because we have data on DB/DC allocation for a period of only 10 years, with many missing observations, we cannot estimate the dynamic effects of such distribution on future pension expenditure. Although the magnitudes differ for some coefficients, the signs of all other pension design features are similar to those of MCGPI jurisdictions, suggesting that the interpretation of their effects is the same.

Implications

The following section discusses the implications of our major findings for governments and policymakers concerned with pension system reform. Our findings confirm the adverse impact of ageing populations on public pension expenditure. Both relevant variables—percentage of population aged over 65 and life expectancy at 65—are positively correlated with public pension expenditure.

Among the pension system features and demographic factors examined, based on the level of statistical significance and the sign of the coefficients of the variables, we focus on two groups of factors: those that tend to increase public pension expenditure and those that tend to decrease it. The former group includes the provision of basic pensions and the level of home ownership. The latter group includes share of pension assets in DC plans, retirement age, minimum access age, mandatory income stream, and private pension membership. The results suggest governments seeking to mitigate the burden of increasing public pension spending should consider how to counteract the adverse effects of the factors in the former group and to promote the positive effects of those in the latter group. More detailed policy implications of our findings appear in the following box.

Policy Implications

- Basic pension programs are costly and, in countries with ageing populations, an increasing burden on government budgets. We also find that providing basic pensions in poorer countries with ageing populations is more expensive.
- Home ownership is an important element of financial security in retirement. As our analysis shows, however, markets with higher rates of home ownership tend to have higher public pension expenditures. The pressure on government budgets could be lessened if all types of property—including primary residential homes—were counted in means tests for social assistance programs. In addition, governments and financial institutions should provide incentives and mechanisms, such as reverse mortgages, for people to tap into their home equity to help fund their expenses in retirement, rather than rely solely on government support.
- DC plans and private pension membership should both be prioritised in pensions policy to increase private retirement savings and reduce the burden on public pensions.
- Raising the statutory retirement age will both lengthen the accumulation phase (thus adding to the stock of private retirement savings) and postpone the age at which people without sufficient private savings will seek a public pension. In combination, these effects should significantly reduce pressure on public pension spending.
- Introducing a minimum access age to restrict early access to retirement savings can prevent leakages in the pension system and decrease demand for public pensions.
- Mandating or at least providing incentives for people to receive a significant share of retirement benefits in an income stream will ensure that retirement savings on average last longer into retirement, thus reducing overall demand/need for public pensions.

Examples of recent pension reforms related to the discussed system features show that they are levers to improve systems.

- More than half of all OECD countries will raise the retirement age. Based on current legislation, on average, across the OECD countries by about 2060, the normal retirement age will increase by 1.9 years for men, from 64.2 years currently to 66.1 years (OECD 2019).
- The future normal retirement age will be 71 or more in Denmark, Italy, and the Netherlands (OECD 2019).
- Brazil introduced minimum retirement ages (OECD 2021b).
- Sweden increased the minimum retirement age for public earnings-related pensions and plans to link it to life expectancy beginning in 2026 (OECD 2021b).
- Mexico substantially increased mandatory contributions in its funded defined contribution scheme, which will increase the size of DC assets in its system (OECD 2021b).
- The Netherlands is converting its quasi-mandatory occupational pensions from defined benefit into collective defined contribution schemes, which are funded DC schemes (OECD 2021b).
- Chile, Germany, and Mexico have significantly improved the provisions of old-age safety nets (OECD 2021b).
- Australia has required superannuation funds to offer comprehensive income products for retirement since July 2022. Yet retirees are not required to take retirement benefits as an income stream, and a full lump sum option is still available.

It should also be noted that since COVID-19, some jurisdictions have delayed their planned reforms.

Limitations

One caveat of the fixed effect model that we used is that the estimated results lack external validity; as such, they cannot be generalised to pension systems outside our sample. Given that our sample covers 65% of all pension assets (OECD 2021b), however, the findings still can have significant policy implications for the jurisdictions covered in this analysis.

VII. Conclusion

In recent decades, societies worldwide have faced major challenges from the ageing of their populations. This study lays bare one of the biggest challenges, documenting the clear links between population ageing and public pension spending in the 43 jurisdictions that make up our MCGPI sample group. As life expectancy continues to grow in most countries, governments will face further pressure to ensure that their public pension systems do not become unsustainable and place an excessive burden on public finances. Fortunately, our analysis identifies several different areas in which pension system design can help mitigate these issues. We find strong evidence to support pension market regulators focusing on some key parameters—including retirement age, timing of access to retirement savings, shifting to defined contribution systems, eligibility rules for public pensions, and the tax treatment of retirement income streams and lump sums—that could help promote pension system sustainability.

In addition to the challenge of ageing populations, retirement income systems have also come under pressure from recent adverse economic conditions that have resulted in price inflation, low wage growth, limited opportunities for retirement savings investment, and volatile investment returns. In such an environment, governments face a strong imperative to explore fresh options that will ensure the adequacy and future sustainability of their retirement income systems.

APPENDICES

Appendix A. Further Information on Selected Pension System Features

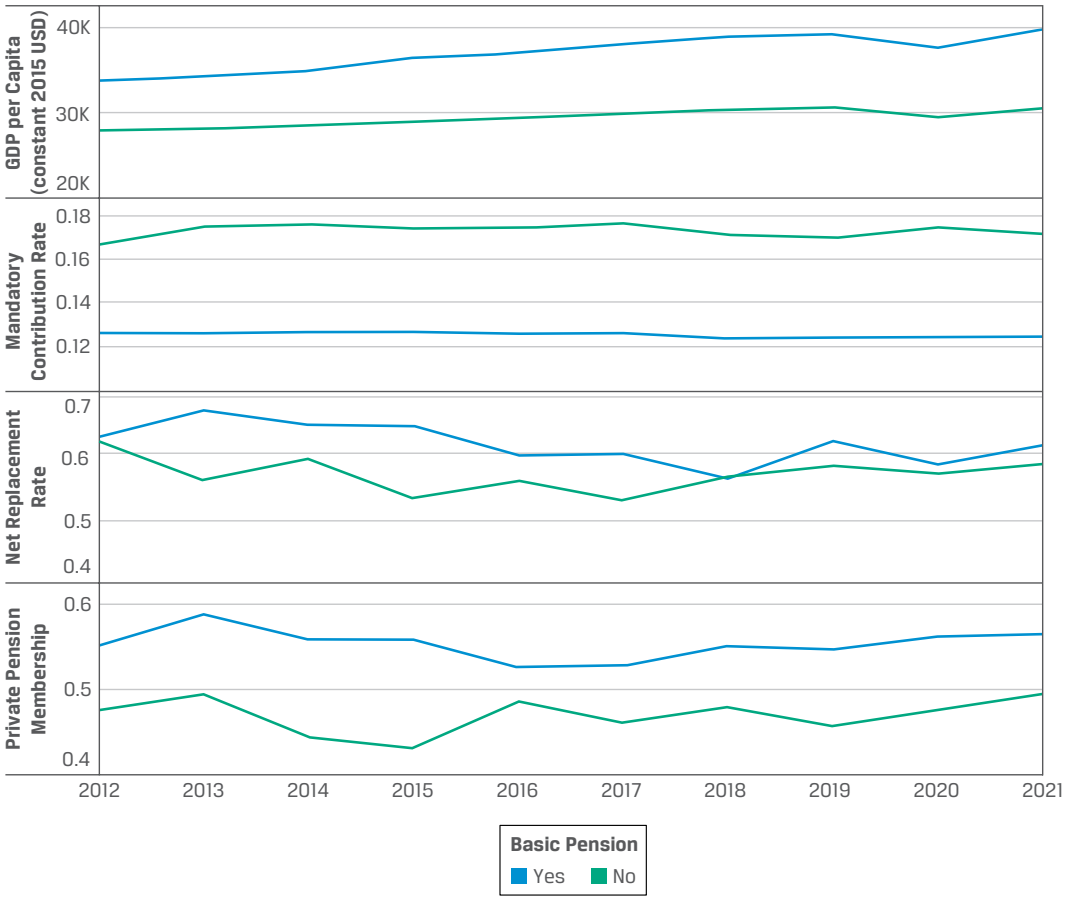
Basic Pension Programs

Typical first-pillar arrangements of a pension system include basic pensions and minimum pensions or other forms of social assistance. Some jurisdictions have basic pensions, a benefit paid to everyone meeting the residence criteria. Although basic pensions can also be based on contributory criteria, their key feature is the independence of earnings. In the absence of or in addition to basic pensions or similar arrangements, pensioners might have access to minimum pensions and/or social assistance at a targeted level. Both systems offer a safety net and pay only those in need.

Basic pension programs and other types of programs are not mutually exclusive, because in some markets, a targeted pension could be provided as a supplement to basic pensions or minimum pensions.

Figure A1 depicts the general profile of markets that provide basic pension programs. The data show that the markets with basic pension programs, on average, have higher per capita income, higher private pension membership, and lower mandatory contribution rates, suggesting more mature pension systems than those markets without basic pensions.

Figure A1. Basic Pension Provision and Other Pension Variables, 2012–2021



Source: See Appendix B for details.

Appendix B. Variable List and Data Sources

Variable Name	Type	Reference to the Question Number in the MCGPI Appendix, Where Relevant	Data Source
Public pension spending	Continuous variable	S6b: What is the level of public expenditure on pensions expressed as a percentage of GDP?[a]	Mercer's dataset, which includes Mercer calculations for Taiwan and the UAE, Standard & Poor's for Colombia, Hong Kong SAR, Malaysia, Peru, the Philippines, Singapore, Thailand, and Uruguay, and data from OECD's "Pensions at a Glance" series OECD, "Pension Spending" (indicator): https://doi.org/10.1787/a041f4ef-en World Bank, "Pensions Expenditure Database 2019" (data for South Africa and Saudi Arabia): www.worldbank.org/en/topic/socialprotection/brief/pensions-data
Basic pension	Indicator (Yes/No)	A classification based on World Bank's and OECD's documents	See Appendix C

(*continued*)

Variable Name	Type	Reference to the Question Number in the MCGPI Appendix, Where Relevant	Data Source
DC% of total assets	Continuous variable	The proportion of total pension assets in DC arrangements	OECD Pension Statistics database of OECD iLibrary: www.oecd-ilibrary.org/finance-and-investment/data/oecd-pensions-statistics_pension-data-en OECD.Stat: https://stats.oecd.org/BrandedView.aspx?oecd_bv_id=pension-data-en&doi=data-00517-en
Mandatory contribution rate	Continuous variable	S4: What is the level of mandatory contributions that are set aside for retirement benefits (i.e., funded), expressed as a percentage of wages? These include mandatory employer and/or employee contributions towards funded public benefits (i.e., social security) and/or private retirement benefits.	Mercer data sourced from relevant Mercer consultants OECD's "Pensions at a Glance" series Countries' pension profiles
Retirement age	Continuous variable	Retirement_age = (StatutoryRetirementAge_Male+ StatutoryRetirementAge_Female)/2	OECD (2021b) Countries' pension profiles
Minimum access age	Indicator (Yes/No)	A5a: Is there a minimum access age to receive benefits from the private pension plans (except for death, invalidity, and/or cases of significant financial hardship)? The answer "Yes" indicates that there is a minimum access age, and "No" means that people can choose to access retirement savings at any age (i.e., no restricted early access to retirement savings).	Mercer dataset in which answers were sourced from relevant Mercer consultants Countries' pension profiles
Mandatory income stream	Continuous	A6a: What proportion of the retirement benefit from the private pension arrangements is required to be taken as an income stream?	Mercer dataset in which answers were sourced from relevant Mercer consultants Countries' pension profiles
Tax incentive for an income stream	Indicator (Yes/No)	A6b: Are there any tax incentives that exist to encourage the taking up of income streams?	Mercer dataset in which answers were sourced from relevant Mercer consultants Countries' pension profiles
Lump sum withdrawal allowed	Indicator (Yes/No)	A variable derived from Question A6a	Mercer dataset in which answers were sourced from relevant Mercer consultants Countries' pension profiles
Home ownership	Continuous variable	A9: What is the level of home ownership in the country?	Mercer dataset in which answers were sourced from relevant Mercer consultants Trading Economics, "Home Ownership Rate – By Country," accessed 13 May 2022: https://tradingeconomics.com/country-list/home-ownership%20rate Eurostat database, "Distribution of Population by Tenure Status, Type of Household and Income Group—EU-SILC Survey," accessed 11 May 2022: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_lvho02 OECD (2014a) Stats NZ (2015)

(*continued*)

Variable Name	Type	Reference to the Question Number in the MCGPI Appendix, Where Relevant	Data Source
Private pension membership	Continuous variable	S1: What proportion of the working-age population are members of private pension plans?	Mercer dataset, which includes data collected from OECD's "Pensions at a Glance: OECD and G20" series, OECD (2014b), and OECD's "Pension Markets in Focus" series
Pension assets (% of GDP)	Continuous variable	S2: What is the level of pension assets, expressed as a percentage of GDP, held in private pension arrangements, public pension reserve funds, protected book reserves, and pension insurance contracts?	Mercer dataset, which includes Mercer calculations for Malaysia, the Philippines, Saudi Arabia, Singapore, Taiwan, and the UAE OECD's "Pensions at a Glance" series Federal Reserve Bank of St. Louis, "Pension Fund Assets to GDP" OECD.Stat, "Funded Pensions Indicators" OECD's "Pension Markets in Focus" series: "Statistical Annex"
Net replacement rate	Continuous variable	A2: What is the net pension replacement rate for a range of income earners?	Mercer dataset, which includes Mercer's model for Taiwan and the UAE OECD's "Pensions at a Glance: OECD and G20" series OECD's "Pensions at a Glance: Asia/Pacific" series OECD (2014b)
Population over 65	Continuous variable	Source: World Bank	World Bank, "Population Ages 65 and Above (% of total population)": https://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS
Life expectancy at 65	Continuous variable	Source: World Bank	United Nations (2019)
Labour force participation (55–64)	Continuous variable	S5a: What is the labour force participation rate for those aged 55–64?	ILOSTAT, "Labour Force Participation Rate by Sex and Age (%)—Annual, 10-Year Bands: 55–64"
Labour force participation (65+)	Continuous variable	S5b: What is the labour force participation rate for those aged 65+?	ILOSTAT, "Labour Force Participation Rate by Sex and Age (%)—Annual, 10-Year Bands: 65+"
Classification of country income level	Categorical variable	Source: World Bank	World Bank's analytical country classifications, World Bank's World Development Indicators: https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html

[a]For the scoring of pension systems in MCGPI reports, the MCGPI considers the public expenditure on pensions expressed as a percentage of GDP, averaged over the latest available figure and the projected figure for 2050. For this study, however, we use only the current public expenditure.

Pension Profiles

The reference for each system includes the review of each system in the Mercer CFA Institute Global Pension Index reports from 2012 to 2021 (available at www.mercer.com/globalpensionindex) and the following specific pension profiles.

Argentina

- www.oecd.org/els/public-pensions/PAG2019-country-profile-Argentina.pdf
- https://ww1.issa.int/node/195545?country=793
- www.iopsweb.org/resources/IOPS-Profile-Argentina_2017.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Argentina.pdf

Australia

- www.oecd.org/els/public-pensions/PAG2019-country-profile-Australia.pdf
- www.pensionfundsonline.co.uk/content/country-profiles/australia/80
- www.oecd.org/els/public-pensions/PAG2013-profile-Australia.pdf

Austria

- www.iopsweb.org/resources/42368749.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Austria.pdf

Belgium

- www.iopsweb.org/resources/42368762.pdf
- www.pensionfundsonline.co.uk/content/country-profiles/belgium
- www.oecd.org/els/public-pensions/PAG2013-profile-Belgium.pdf

Brazil

- www.pensionfundsonline.co.uk/content/country-profiles/brazil
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Brazil.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Brazil.pdf

Canada

- www.canada.ca/en/revenue-agency/services/tax/businesses/topics/payroll/payroll-deductions-contributions/canada-pension-plan-cpp/cpp-contribution-rates-maximums-exemptions.html
- www.iopsweb.org/IOPS-profile-Canada.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Canada.pdf

Chile

- www.oecd.org/els/public-pensions/PAG2021-country-profile-Chile.pdf
- www.iopsweb.org/resources/38675788.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Chile.pdf

China (Mainland)

- www.oecd.org/els/public-pensions/PAG2021-country-profile-China.pdf
- www.iopsweb.org/resources/38766497.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-China.pdf

Colombia

- www.iopsweb.org/resources/ColombiaCountryProfile.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Colombia.pdf

Denmark

- www.iopsweb.org/resources/44962212.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-denmark.pdf

Finland

- www.oecd.org/els/public-pensions/PAG2019-country-profile-Finland.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Finland.pdf

France

- http://www.iopsweb.org/resources/IOPS-profile-France-2017.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-France.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-France.pdf

Germany

- www.iopsweb.org/resources/42368824.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Germany.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Germany.pdf

Hong Kong SAR

- www.iopsweb.org/resources/38765466.pdf

Iceland

- www.pensionfundsonline.co.uk/content/country-profiles/iceland
- www.ssa.gov/policy/docs/progdesc/intl_update/2018-07/index.html#iceland
- www.oecd.org/els/public-pensions/PAG2013-profile-Iceland.pdf

India

- www.iopsweb.org/resources/IOPS-Profile-India-2017.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-India.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-India.pdf

Indonesia

- www.oecd.org/els/public-pensions/PAG2013-profile-Indonesia.pdf
- www.iopsweb.org/resources/IOPS-profile-Indonesia-2017.pdf
- www.oecd.org/els/public-pensions/PAG2017-country-profile-Indonesia.pdf

Ireland

- www.oecd.org/els/public-pensions/PAG2013-profile-Ireland.pdf
- www.iopsweb.org/resources/39574324.pdf

Israel

- www.oecd.org/els/public-pensions/PAG2013-profile-Israel.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Israel.pdf
- www.oecd.org/pensions/private-pensions/49498122.pdf

Italy

- www.oecd.org/els/public-pensions/PAG2013-profile-Italy.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Italy.pdf

Japan

- www.oecd.org/els/public-pensions/PAG2013-profile-Japan.pdf
- www.iopsweb.org/resources/IOPS-profile-Japan-2017.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Japan.pdf
- www.nishimura.com/sites/default/files/tractate_pdf/ja/72129.pdf

Malaysia

- www.pensionfundsonline.co.uk/content/country-profiles/malaysia
- https://ieglobal.vistra.com/knowledge/country-compliance-alerts/2013/8/malaysia-public-pension-update-and-new-minimum-retirement

Mexico

- www.oecd.org/els/public-pensions/PAG2013-profile-Mexico.pdf
- www.iopsweb.org/resources/Mexico-IOPS-Profile-2017.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Mexico.pdf

Netherlands

- www.iopsweb.org/resources/44873609.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Netherlands.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Netherlands.pdf

New Zealand

- www.oecd.org/els/public-pensions/PAG2013-profile-New-zealand.pdf
- www.iopsweb.org/resources/44962401.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-New-Zealand.pdf

Norway

- www.iopsweb.org/resources/39979791.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Norway.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Norway.pdf

Peru

- www.iopsweb.org/resources/44873928.pdf
- https://doi.org/10.1787/e80b4071-en

Philippines

- www.ssa.gov/policy/docs/progdesc/ssptw/2018-2019/asia/philippines.pdf
- www.sss.gov.ph/sss/appmanager/pages.jsp?page=coverage
- www.pension-watch.net/country-fact-file/philippines

Poland

- www.iopsweb.org/resources/44873983.pdf
- https://stat.gov.pl/en/topics/living-conditions/social-assistance/social-assistance-child-and-family-services-in-2020,1,12.html
- www.oecd.org/els/public-pensions/PAG2013-profile-Poland.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Poland.pdf

Saudi Arabia

- www.oecd.org/els/public-pensions/PAG2013-profile-Saudi-Arabia.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Saudi-Arabia.pdf
- www.ssa.gov/policy/docs/progdesc/ssptw/2018-2019/asia/saudi-arabia.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Saudi-Arabia.pdf

Singapore

- https://www.cpf.gov.sg/member/cpf-overview

South Africa

- www.iopsweb.org/resources/IOPS-profile-South-Africa_2017.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-South-Africa.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-South-Africa.pdf

South Korea

- www.oecd.org/els/public-pensions/PAG2013-profile-Korea.pdf
- www.iopsweb.org/resources/IOPS-Profile-Korea-2017.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Korea.pdf

Spain

- www.iopsweb.org/resources/44878367.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Spain.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Spain.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Spain.pdf

Sweden

- www.iopsweb.org/resources/44962427.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Sweden.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Sweden.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Sweden.pdf

Switzerland

- www.iopsweb.org/resources/Switzerland-IOPSWebsite-Country-Profile-2018-Final-2.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Switzerland.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Switzerland.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Switzerland.pdf

Taiwan

- https://english.mol.gov.tw/21004/21015/21065/21071/34277/
- www.bli.gov.tw/en/0010366.html

Thailand

- www.nomurafoundation.or.jp/wordpress/wp-content/uploads/2019/03/NJACM3-2SP19-07.pdf
- www.pension-watch.net/country-fact-file/thailand#:~:text=Those%20aged%20between%2060%2D69,receive%201%2C000%20Baht%20a%20month
- www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-jakarta/documents/publication/wcms_428982.pdf

Turkey

- www.iopsweb.org/resources/IOPS-profile-Turkey-2017.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-Turkey.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-Turkey.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-Turkey.pdf

United Arab Emirates

- https://u.ae/en/information-and-services/jobs/working-in-uae-government-sector/pensions-and-end-of-service-benefits
- www.pension.gov.ae/en-us/Pages/AboutUs.aspx

United Kingdom

- www.iopsweb.org/resources/IOPS-Profile-UK-2017.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-United-Kingdom.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-United-Kingdom.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-United-Kingdom.pdf

United States

- www.iopsweb.org/resources/IOPS-profile-USA-2017.pdf
- www.oecd.org/els/public-pensions/PAG2013-profile-United-States.pdf
- www.oecd.org/els/public-pensions/PAG2019-country-profile-United-States.pdf
- www.oecd.org/els/public-pensions/PAG2021-country-profile-United-States.pdf

Uruguay

- https://doi.org/10.1787/9789264224964-43-en
- www.elibrary.imf.org/view/journals/002/2017/029/article-A005-en.xml

Appendix C. Programs under the First Tier of Pension Systems

Pension system	Modality of Pillars (World Bank 2012)			Details of the First Tier (OECD 2013a, 2013b)			Details of the First Tier (OECD 2018, 2019)			Details of the First Tier (OECD 2018, 2021b)		
	Basic	Min.	Targeted	Basic	Min.	Targeted	Basic	Min.	Targeted	Basic	Min.	Targeted
Argentina	x		x	x			x	x		x	x	
Australia			x			x			x			x
Austria								x			x	
Belgium		x	x		x	x		x			x	
Brazil			x					x			x	
Canada	x		x	x		x	x		x	x		x
Chile			x		x	x			x			x
China (Mainland)			x		x			x			x	
Colombia			x								x	
Denmark	x		x	x		x	x		x	x		x
Finland		x			x				x			x
France		x			x			x			x	
Germany			x			x			x			
Hong Kong SAR			U	x		x	x		x	x		x
Iceland	x		x	x		x	x		x	x		x
India			x					x			x	
Indonesia								x			x	

(*continued*)

Pension system	Modality of Pillars (World Bank 2012)			Details of the First Tier (OECD 2013a, 2013b)			Details of the First Tier (OECD 2018, 2019)			Details of the First Tier (OECD 2018, 2021b)		
	Basic	Min.	Targeted	Basic	Min.	Targeted	Basic	Min.	Targeted	Basic	Min.	Targeted
Ireland	x			x			x			x		
Israel			x	x			x			x		
Italy						x						
Japan	x			x			x			x		
Malaysia									x			x
Mexico	x				x		x	x		x	x	
Netherlands	x			x			x			x		
New Zealand			U	x			x			x		
Norway		x			x				x			x
Peru												
Philippines	x			x	x		x	x		x	x	
Poland					x			x			x	
Saudi Arabia					x			x			x	
Singapore												
South Africa			x			x			x			x
South Korea	x			x		x	x			x		
Spain		x			x			x			x	
Sweden		x			x				x			x

(*continued*)

Pension system	Modality of Pillars (World Bank 2012)			Details of the First Tier (OECD 2013a, 2013b)			Details of the First Tier (OECD 2018, 2019)			Details of the First Tier (OECD 2018, 2021b)		
	Basic	Min.	Targeted	Basic	Min.	Targeted	Basic	Min.	Targeted	Basic	Min.	Targeted
Switzerland		x	x		x	x		x			x	
Taiwan												
Thailand									x			x
Turkey					x			x			x	
United Arab Emirates												
United Kingdom	x	x	x	x	x	x	x			x		
United States			x									
Uruguay			x									

U = universal type.

Appendix D. Results from Other Estimated Models

MCGPI Systems

	(1) RE	(2) FGLS	(3) FE
Basic pension	0.073* (0.042)	0.182*** (0.026)	
Retirement age	0.000 (0.001)	−0.002*** (0.001)	−0.003** (0.001)
Early retirement	0.002 (0.010)	−0.051*** (0.007)	
Private pension membership	−0.048*** (0.012)	−0.019*** (0.006)	−0.036*** (0.011)
Mandatory income stream (%)	−0.007 (0.007)	−0.012*** (0.004)	−0.016*** (0.005)
Tax incentive for mandatory income stream	−0.003 (0.005)	−0.005* (0.003)	−0.004 (0.004)
Home ownership	0.013 (0.015)	0.028*** (0.008)	0.036*** (0.013)
Lump sum	−0.007 (0.005)	−0.001 (0.002)	−0.005 (0.004)
Mandatory contribution	−0.002 −0.029	−0.019 −0.013	−0.02 (0.024)
Pension asset (% of GDP)	−0.007 (0.006)	−0.001 (0.004)	−0.005 (0.006)
Net replacement rate	0.019** (0.009)	0.005 (0.004)	0.011 (0.007)
Share of aging population	0.314*** (0.088)	0.282*** (0.068)	0.354** (0.160)
Life expectancy at 65	0.007*** (0.002)	0.006*** (0.001)	0.011*** (0.003)
Labour force participation rate (65+)	−0.050 (0.035)	−0.017 (0.019)	−0.023 (0.032)
Labour force participation rate (55–64)	−0.017 (0.022)	−0.003 (0.011)	−0.014 (0.018)
Upper-middle income	0.003 (0.012)	−0.034*** (0.004)	−0.036*** (0.003)
High income	0.016 (0.018)	0.000 (0.000)	
Basic × Life expectancy at 65	−0.005** (0.002)	−0.003** (0.001)	−0.007** (0.003)
Observations	269	269	269
Number of jurisdictions	43	43	43
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R^2	0.53		0.60

Note: Robust standard errors in parentheses. ***$p < 0.01$. **$p < 0.05$. *$p < 0.10$.

OECD Countries

	(1) RE	(2) FGLS	(3) FE
Share of pension assets in DC	0.0001 (0.000)	−0.0001*** (0.000)	−0.0001** (0.000)
Basic pension	0.168*** (0.053)	0.168*** (0.051)	0.168*** (0.053)
Retirement age	0.001*** (0.000)	−0.002** (0.001)	0.001*** (0.000)
Early retirement	0.003 (0.006)	−0.058*** (0.013)	0.003 (0.006)
Private pension membership	−0.004 (0.010)	−0.007 (0.007)	−0.017 (0.012)
Mandatory income stream (%)	0.001 (0.013)	−0.021*** (0.005)	−0.027** (0.010)
Tax incentive for mandatory income stream	−0.006 (0.004)	0.001 (0.003)	0.001 (0.002)
Home ownership	−0.023 (0.021)	0.015 (0.011)	0.011 (0.008)
Lump sum	−0.007 (0.011)	−0.009* (0.005)	−0.013** (0.006)
Mandatory contribution	0.056** (0.024)	−0.037* (0.022)	−0.004 (0.030)
Pension asset (% of GDP)	−0.008*** (0.003)	0.005** (0.002)	0.001 (0.005)
Net replacement rate	0.010 (0.011)	0.006 (0.004)	0.005 (0.010)
Share of aging population	0.612*** (0.073)	0.181 (0.118)	0.112 (0.163)
Life expectancy at 65	0.004** (0.002)	0.011*** (0.002)	0.015*** (0.005)
Labour force participation rate (65+)	0.019 (0.027)	−0.111** (0.043)	−0.107* (0.062)
Labour force participation rate (55–64)	−0.176*** (0.032)	−0.022 (0.016)	−0.031 (0.027)
Upper-middle income	0.005 (0.008)		
High income		−0.093*** (0.016)	
Basic × Life expectancy at 65	−0.009*** (0.003)	−0.006*** (0.002)	−0.009** (0.004)
Observations	128	128	128
Number of Jurisdictions	28	28	28
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: Robust standard errors in parentheses. ***$p < 0.01$. **$p < 0.05$. *$p < 0.10$.

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