


## Article

# Public Pensions and Implicit Debt: An Investigation for EU Member States Using Ageing Working Group 2021 Projections

Georgios Symeonidis , Platon Tinios and Michail Chouzouris

Department of Statistics and Insurance Science, School of Finance and Statistics, University of Piraeus, Karaoli ke Dimitriou 80, 18534 Piraeus, Greece; ptinios@unipi.gr (P.T.); mchouzouris@unipi.gr (M.C.)

\* Correspondence: george.simeonidis@gmail.com

**Abstract:** Implicit pension debt is attracting increasing attention worldwide as a driver of fiscal dynamics, operating in parallel to the (explicit) National Debt. A prudent examination of a state's fiscal prospects should ideally encompass both, with due attention paid to the special features of each kind of debt. The explosion of government deficits as a result of the COVID-19 pandemic only adds to the urgency of understanding the scale and nature of issues around accounting for contingent liabilities. The reports of the EU Ageing working group, produced and published every three years are used to derive estimates of the stock of outstanding implicit pension debt from flows of projected deficits. This can be performed for all European member states. This paper uses the last two rounds of the Ageing Report (2021, 2018) and derives conclusions on the evolution of pension debt and its correlation to the external debt. The paper concludes that producing comparable estimates of IPD should become an important input in EU policy discussion.

**Keywords:** implicit pension debt; explicit debt; pension reform; ageing report

**JEL Classification:** H. Public Economics—H5 National Government Expenditures and Related Policies—H55 Social Security and Public Pensions



**Citation:** Symeonidis, Georgios, Platon Tinios, and Michail Chouzouris. 2021. Public Pensions and Implicit Debt: An Investigation for EU Member States Using Ageing Working Group 2021 Projections.

*Risks* 9: 190. <https://doi.org/10.3390/risks9110190>

Academic Editor: Cassandra Cole

Received: 8 September 2021

Accepted: 21 October 2021

Published: 26 October 2021

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction: Pensions, Implicit Debt and Long-Term Fiscal Planning

In June 2015, the Greek government only had enough cash to pay either the senior international bondholder, the International Monetary Fund (IMF), or the monthly pensions for July of the current year. This was a face-down between an explicit, legal, obligation and an implicit, moral one. The IMF payment had to wait; moral considerations prevailed, at least temporarily<sup>1</sup>.

Greece was an early victim of a long-term fiscal dilemma to be faced by all ageing societies. Long-term contingent commitments must be factored in to the (already high) measured explicit bond debt. Long term planning has to encompass all current commitments pre-empting the distribution of future output. When delivery of promises falls due, countries could find themselves in a similar situation to Greece's in 2015—weighing the relative urgency and costs of legal and political obligations. To plan for such an eventuality, the economic characteristics of both kinds of commitments need to be considered. The most significant type of economic characteristic and the starting point of any discussion is the relative and absolute size of total commitments.

Greece might have avoided eventual bankruptcy if it had kept track of the accumulation of future commitments before it became too late. It could have been attained if the readily available projections of future flows of pension deficits could have been expressed in units that could be compared to the stock of outstanding national debt. This paper demonstrates that such an exercise is feasible using published information of pension projections covering the period to 2060. Moreover, estimates may be produced for all EU member states. We use this information together with plausible assumptions to produce estimates of implicit pension debt for all 27 member states of the EU.

There are, of course, a great many future commitments—in the sense of future developments predetermined by decisions already taken. Climate change and natural resource depletion are topical candidates, as are environmental clean-up costs of fossil fuel extraction. Pensions come at the top of any list of contingent obligations: A pension system is a formal mechanism for handing out promises of future payments, backed up by—either—earmarked assets (in the case of prefunded systems)—or—legal assurances (Pay-As-You-Go (PAYG)). Pension benefits are, moreover, a prime component of the cost of ageing, set to increase due to demographics. The demographic challenge coincides with a period—namely the next three to four decades—where debt sustainability and its dynamics are already a source of worry.

Pensions are therefore a prime candidate for a long-term fiscal planning exercise. This should encompass *both* implicit and explicit obligations, which could interact in complex ways; these need to be measured against a consistent notion of fiscal effort. Strictly speaking, debt sustainability should be composed of the study of *two* differential equations operating *simultaneously*, not one.

Such a mathematical approach constitutes an unattainable ideal. However, this does not mean that these matters should be swept under policy rugs. Our paper thus attempts to provide results for both types of debt and sound a warning bell as regards pension economics of the 27 member states of the European Union (EU27). It does so by attempting to quantify the issue and point out which countries could be most at risk and would need to address the joint nature of explicit and implicit debt with greater urgency.

A paper quantifying implicit debt linked to ageing could also serve another function. Sometime after the mid-2010s, the EU policy agenda started to shift towards issues such as green growth or technological transformation. This overshadowed extent concerns on ageing. A possible justification for this shift could be that definitive solutions to ageing, even if not actually implemented, had at least been set in train, in the sense that political decisions had been enshrined in legislation. The pressure to address new challenges only increased after the 2020 pandemic. It would be useful, therefore, to work towards an indicator to capture how far long-term issues have been addressed, and in this way to give a sense of effort still pending. Aggregating future expected cash shortfalls—in the manner this paper proposes to do—could be a useful step. The importance of implicit pension debt is stressed across the globe. In [Chen and Turner \(2014\)](#) authors argue that the difference in financing between mandatory and voluntary individual accounts in urban and rural areas in China is not due to a greater ability to manage individual account plans in rural areas than urban areas. Primarily, it is due to the differences in the amount of implicit pension debt for pay-as-you-go pensions in the two areas.

The paper starts by examining the theory behind the notion and calculation of implicit debt and relating it to fiscal effort. It proceeds by examining official pension system flow projections released in May 2021, for pension system expenditure and revenue produced by the EU member states and published by the Commission. These estimates are adjusted to reflect a consistent, roughly comparable, notion of additional tax effort for all member states. Our estimates can, in turn, be manipulated to compute a stock of implicit debt valued at a given point, the start of the pandemic of 2020. This is done in a manner analogous to [Symeonidis et al. \(2020\)](#). [Deboeck and Eckerfelt \(2020\)](#) also analysed the 2018 data. Our approach thus adds another data point to the ongoing discussion. Moreover, in contrast to the aforementioned studies, we make assumptions that allow us to produce estimates for all member states. These can then be compared both to productive capacity and to outstanding explicit debt in the end of 2019, so as to have an opinion on relative magnitudes. Our estimate can also be compared to implicit debt calculated using identical methodology for the 2015 EU projections. This allows us to check, to an extent, complacent claims that implicit debt is falling and what that could mean for the pending reform agenda.

## 2. Theory Underpinning Methodologies of Calculation

Both explicit debt and pensions are serviced by national productive capacity and both are deducted from production, before that is available for other uses. These are outflows from production, in a way that is very similar to debt service.

This similarity is often ignored, appealing to legal differences between bonds and pension promises. While debt is certain and contractual<sup>2</sup>, pensions are contingent and uncertain. Regardless of this aspect, pensions are like bonds: a contributor earns the right to a lifelong income stream<sup>3</sup>. This analogy argues for the two types of debt to be expressed in common units at a point of time. Feldstein (1974), used life cycle consumption theory to derive a concept of social security wealth juxtaposed to measured wealth; his measure included valuation of the flow of PAYG pensions as a stock.

Understanding, valuing, and communicating outstanding promises are issues important for firms, but also for sovereign states.

As far as firms are concerned, employer-sponsored plans, especially if underfunded, could operate as cheap employment remuneration and could disguise a firm's true performance. The International Financial Reporting Standards-19<sup>4</sup> sets out how firms should report and service outstanding debt commitments (Tinios 2011). Pension obligations are treated as loans granted to the firm by the workforce, the future beneficiaries. This loan must be serviced and represents a current charge on the operating account. All quoted firms in the EU need to account for pension commitments. However, no such disclosure obligation exists for State pensions, whether funded or unfunded (PAYG). The equivalent stock measure (Public Sector Accounting Standards 39<sup>5</sup>), is only used sporadically by European countries, such as Austria, Spain, and Sweden (Schmidhuber and Hilgers 2019).

As far as the State system is concerned, expressing PAYG public pensions comparably to prefunded pensions stumbles on theoretical considerations. PAYG is by nature 'myopic'; funds will be collected only when needed. This treats pension promises similarly to current consumption; no forward provision is made, say, for food, even though we are certain to need it. In this way, should we examine obligations existing today, future pensions are bound to be unfunded; uncovered obligations should surprise no one. However, as Barr (2001) states, the issue concerns the future tax capacity of the State<sup>6</sup>. If that is unlimited or, at least not constrained, there should be no need to worry about the existence of future claims on it. If, however, we suspect that either tax capacity is limited or if there are bounds to how far or how quickly taxes can be raised to pay for future pensions, prudence argues for planning ahead. This means being able to aggregate obligations arising from explicit debt with implicit ones generated by pension promises.

This point implies that interpreting valuations of outstanding obligations is not exhausted either by legal or by accounting considerations; instead, it should be a matter of judgment, taking into account future potential and societal priorities. The question of sustainability thus needs to be approached in a wider spirit; quantification should play a key role, though it should ultimately be subject to judgment.

However, it may be, the methodology is clear: Expenditure projections, if available, must be set against expected revenue, in a fashion analogous to how companies record their pension obligations. The crucial decision is how to deal with counterfactuals. The method, essentially, would stand bond finance practice on its head: unlike debt, where the stock of debt leads to a flow of debt servicing, we start by projecting flows, i.e., computing flow deficits/surpluses. We would then need to aggregate by discounting to calculate a stock of outstanding implicit debt. This can be compared to outstanding debt obligations to give an estimate of total commitments. Given the centrality of debt in the motivation of the exercise, maintaining comparability between the two debt concepts—explicit and implicit—should play a role in deciding details of the methodology.

We would therefore need to proceed in two steps:

The first step is to calculate flow excess cash requirements—by subtracting pension promises from earmarked (dedicated) revenue. We here treat expenditure as senior—the opposite of the usual PAYG logic of state pensions. We assume that, once a promise is

legislated, it needs to be kept; this allows us to use the characteristics of the pension system to cost a time structure of promises. The question of which promises can be taken as firm determines the nature of actuarial models to be used. We can understand this process, alternatively, as progressively widening the groups to whom promises are examined. We start from those already collecting a pension; we add to them those currently working; finally, the widest definition includes all those who will work in the future if the system continues in its current form. The latter assumption (open population) is coterminous with a requirement that a system must be sustainable for the foreseeable future, which can be taken as a requirement for the system operator.

Expenditure needs to be balanced with dedicated revenue<sup>7</sup>. That is more uncertain, as it depends on future tax capacity, itself dependant on the existence of other claims, such as explicit bond debt. What we need to capture is how far meeting obligations in the future demands additional fiscal effort. Though ‘extra future effort’ is a matter of judgement, a legal approximation interprets firm commitments of resources as funds not necessitating new legislation to increase revenue. The legal viewpoint could appeal to a government rationality assumption: when a legislature passes a tax to cover a future obligation, its continued collection over time should not be in question. Any foreseeable deteriorations, such as demography must have been factored in<sup>8</sup>.

Can this legal approach accommodate the notion of needing additional fiscal effort? Deciding what does and what does not demand extra effort calls for judgment, which sometimes may override official pronouncements. Otherwise, any shortfall could be made up by fiat—substituting wishful thinking for economics<sup>9</sup>. Similarly, if international comparisons are attempted, coordinated assumptions are called for—otherwise any ‘problem’ could be solved by choosing the right assumptions. We should thus approach the definition of ‘revenue’ with a critical eye.

The second step in the calculation involves aggregation, turning flows into stocks. This process must be guided by the need to examine implicit together with external debt. Discounting is a key influence. On the one hand comparisons with external debt (and dynamic efficiency) argue for positive discount rates. On the other, dealing with the interests of future generations in welfare economics implies lower (or even zero) discount rates<sup>10</sup>. In any case, at this stage of the discussion, it is important to be aware of the salience of discount rates, and hence consider a range of rates.

Operationalising the concept of implicit debt, R. Holzmann argues in favour of explicit IPD calculations by expanding generational accounting through modelling pension systems. He also considers the use of implicit debt as a measure of the ambition and effectiveness of pension reform. (Holzmann 1990; Holzmann et al. 2004; Deboeck and Eckerfelt 2020). Franco (1995) considers which promises can be taken as firm and unalterable. He distinguishes three concepts of liability which correspond to three progressively widening actuarial models:

1. Accrued-to-date liabilities (ADL). Obligations granted already for work *already* supplied *plus* pensions due to current pensioners.
2. Closed group liabilities (CGL)—adds to ADL future obligations to those currently working.
3. Open group liabilities (OGL)—adds to CGL all who will work in the future (open population)

The appropriate assumption as to scope depends on who is doing the projection and for what purpose, as these considerations determine the appropriate view as to which decisions can be taken as given exogenously.

For example, Eurostat generalises from National Accounts methodology which necessitates accounting for the implications of observed past events. The new ESA, includes ‘Table 29’, which catalogues estimates for 2015 (Eurostat 2018). This publishes for all EU member states Accrued to Date Liabilities for all unfunded social insurance schemes and for General Government Employees (see Deboeck and Eckerfelt 2020 and the next section).

Arguably, when the projection is conducted by the system operator (the State), interest shifts in the continued operation of schemes; it thus focuses on issues of fairness and

sustainability. This is because the State has an ongoing constitutional obligation to provide social insurance for the foreseeable future, if not in perpetuity. IAA (2018) outlines other limitations of a closed group approach: an inability to assess the full impact of pension reforms, pension scheme maturity, and bias for or against a particular financing approach. Two systems with the same accrued-to-date obligations on a closed-group can have very different sustainability issues, especially if demographics differ. In these cases, *only* OGL should be appropriate.

Variations of this methodology have been applied in many studies, for example: Hagemann and Nicoletti (1989); Van den Noord and Herd (1993); Kuné et al. (1993), Chand and Jaeger (1996); Kane and Palacios (1996), Frederiksen (2001), Kuné (2000), Holzmann et al. (2004), Heidler et al. (2009), Novy-Marx and Rauh (2011), Beltrametti and Della Valle (2011), and Ponds et al. (2012) for a variety of contexts. Of particular importance are studies on the EU which will be compared later on, namely Obořil (2015), Doležal (2012), Kaier and Müller (2013), and Soto et al. (2011). Special attention will be accorded in what follows Deboeck and Eckerfelt (2020), whose starting point, the 2018 EU Ageing Working Group (AWG) projections, coincides with the 2018 calculations of the current study.

Comparisons are difficult, due to divergences in coverage, time frames, discounting but also assumptions on demographics, macroeconomics or future wage growth. An important difference is how future wage growth is treated: Projected Benefit Obligation (PBO) fully accounts for expected increases whereas Accrued Benefit Obligation (ABO) is more conservative, disregards them, and typically yields lower estimates. Differences in inflation assumptions and the range of pension features captured (e.g., disability, survivors, past reforms, indexation) must be added to these. The next section discusses findings of studies of European data conducted in the last decade, in order to gauge the extent to which IPD has been brought under control.

### 3. Using EU Ageing Working Group Projections to Calculate Implicit Debt

The Ageing Working Group (AWG) of the EU was set up by DG ECFIN in 2000 to coordinate long term fiscal policy. After 2001 it was incorporated in the process of the Open Method of Coordination of the Lisbon strategy (Tinios 2012). Representatives of Member States coordinate national projections of ageing-related expenditure linking them to demographic projections, and employing comparable and internationally consistent assumptions. Though emphasis is placed on the largest item, pensions, projections also cover other ageing related public expenditure, namely health care, unemployment, long term care and education; of these, only the last is systematically related to population ageing negatively.

AWG projections have three key characteristics which enable their use in IPD calculations: they come with the authority of system operators (1), who are publicly answerable for the results (2) and who have legal and constitutional responsibility for the continuity of the systems projected (3). The three characteristics together dictate that the logic of the projections is squarely that of *open* groups (OGL) employing PBO methodology—i.e., that systems need to be sustainable for the foreseeable future, taken to be at least 40 years ahead<sup>11</sup>.

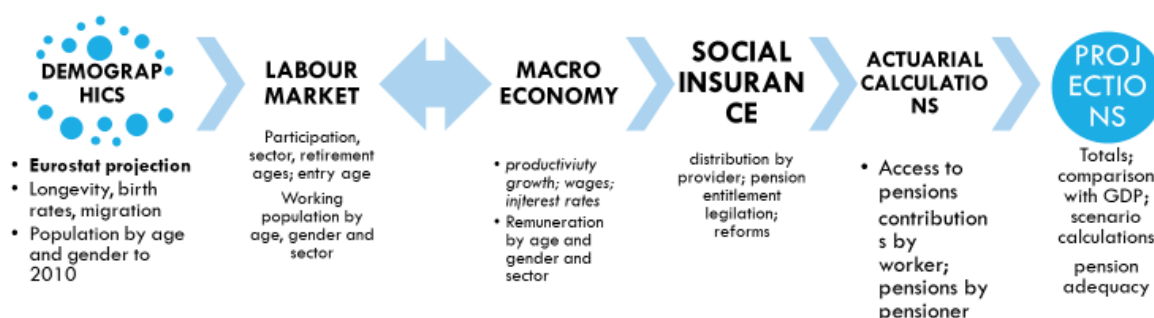
The political rationale of the Open Method of Coordination is for member states to engage in a structured exchange with their peers on how they each propose to meet agreed targets—in this case, adequacy and sustainability of pensions. The AWG projections, as a basic input in this procedure, could be interpreted as providing a kind of ‘a statement for the defence’—i.e., how far does the system operators themselves think that conflicting considerations and outstanding questions have been addressed to date, taking into account all actions and legislation already taken (James 2012).

Projections are published every three years, containing expenditure and (earmarked) revenue. These can be manipulated to yield flow estimates of annual cash shortfalls, a quantity roughly equivalent to debt servicing of explicit measured debt. They can then



be aggregated and discounted to yield estimates of the IPD for all countries participating in the AWG exercise.

Figure 1 outlines the logic of the AWG projections. The key drivers are demographics for each country, relying on a common source, Eurostat; these are supplemented by labour and macroeconomic assumptions (provided centrally by the EU Commission and agreed with the member states), before handing over the modelling of each pension system to the Member State (MS) responsible for its operation. It is these projections which, after being peer reviewed by other MS and the Commission, are published centrally by the EU. The projection cycle means that if data are published in May of year  $n$ , institutional and legal detail corresponds to the situation in December of year  $n - 1$ , and pension system data to December of year  $n - 2$ .



**Figure 1.** A schematic representation of AWG methodology.

‘System revenue’ is defined by the AWG as already legislated revenue legally earmarked to finance pensions. The *published* information consists of revenue totals. However, [Deboeck and Eckerfelt \(2020\)](#), investigating the 2018 round, used its—publicly unavailable—constituent parts. These distinguish employers’ and employees’ contributions, government grants and other dedicated revenue. In order to calculate their net concept of debt, they subtract from expenditure flows *only* sums corresponding to contribution revenue, while they disregard other system revenue which the member states themselves had used as offset. In this way, their restrictive definition of system revenue will, arguably, yield a pessimistic picture of future challenges, given that it disregards sources of revenue which are *already* used to finance pensions. If our theoretical criterion is tax capacity, it is reasonable to assume that in those cases government grants are an established feature of the budget, continued payment in the future will have been anticipated. Exclusion of government grants will in this case will underestimate tax capacity, thus providing fiscally safer results for the respective member states. [Deboeck and Eckerfelt \(2020\)](#) acknowledge this difficulty by excluding Belgium altogether, while Denmark and Finland are dropped as outliers. On other countries where budget relief has recently been legislated, without budgeting the needed fiscal space, unrealistically low IPDs may be found.

When attempting to reproduce [Deboeck and Eckerfelt’s \(2020\)](#) results for the 2021, quite apart from the practical consideration that the breakdown of revenue into components is *not* publicly available, we need an assumption that (a) allows the full sample of countries to be used and (b) leads to results roughly comparable to debt servicing of government bond.

If we follow [Barr \(2001\)](#) to focus on tax capacity, it is reasonable to depart from this restrictive definition of revenue and encompass all revenue cited by the MS or at least those parts which can be said not to entail extra tax effort. In other words, it is preferable to depart from a *legal* definition of earmarked revenue, to one which attempts to capture added fiscal effort—whether *new* taxes or other revenue need to be imposed. The notion of tax capacity, moreover, allows us to approach outlying cases and hence to arrive at IPD estimates for all member states participating in the AWG exercise.

If we are to produce estimates for all member states, adjustment is necessary for four cases<sup>12</sup>: First, in Denmark, first pillar pensions have historically always been financed out of general revenue. As this is not earmarked in law, the totality of pension flows appears as unfunded. However, it is reasonable to presume that an amount regularly budgeted for decades would pose no challenge to taxable capacity. This should certainly apply to the base year proportion of GDP devoted to pensions; this can reasonably be judged as part of system revenue equivalent contribution. At the other extreme, Greece assumes that all social pensions are to be covered by an ad hoc government grant. This interprets a legal requirement passed in 2016 but never to date implemented: government grants after 2016 are financed out of borrowing, as was the case for over a decade (Tinios 2020). If we are to be consistent with a tax capacity definition, we need to revise published AWG revenue projections for Denmark upwards and for Greece downwards. Indeed, we assume that DK only must finance sums over and above current levels of first pillar finance (as percentage of GDP); for Greece, we subtract government grants from total revenue. The third case is Finland. The Finnish first pillar system, centred on a social pension as in Denmark, is now complemented by a funded component. The AWG adds this to system revenue without any adjustment to the general revenue contribution, with the result that the country shows a large surplus (over 3% of GDP) for the entire period, an extent of savings which defies belief. To correct this, we assume that 2018 fiscal effort remains constant as a percent of GDP, leading to smoother, though still positive flows. Finally, Belgium does not report any system revenue. In a similar vein, we impute a constant percentage GDP, that of the base-year, to correspond to a given fiscal effort.

These, admittedly broad assumptions, allow us to impute results for all EU member states who provided data, and add to the ongoing discussion from Symeonidis et al. (2020) and Deboeck and Eckerfelt (2020).

Looking at the projections in greater detail, there are three key drivers (Table 1):

1. **Demographics:** Eurostat 2019 projections show dependency ratios deteriorating sharply in the period to 2040.
2. **Labour:** the total employment rate in the EU rises from 71.1% in 2016 to 75.8% in 2070. This is due to women and older workers being assumed to work more (6.9 and 12.6 percentage points, respectively) and hence acts to counterbalance demographics.
3. **Productivity growth:** rises after 2025 anticipating technological changes as well as catching up, especially in the decade to 2030.

As stated earlier, the Ageing Working Group was set up at the turn of the century to focus on longevity, as the key demographic challenge. To allow such a focus it was necessary to adopt, to the extent possible, neutral assumptions on net migration. The volatility of migration flows, the balance between intra-EU and third-country migration combines with political sensitivities to make taking a credible account of the impact of migration an even more difficult undertaking. In the event, the 2021 report assumes that annual net migration inflows will fall gradually over the very long term. They are projected to decrease from about 1.3 million people in 2019 to about 1 million in 2070 (0.2% of the EU population). However, there are large differences between Member States. According to (EPC 2020) the methodology used in projections for migration is far more reliable in 2021 comparing to 2018 round, making the methodology more robust. However, the authors maintain that the impact of migration on future pension finances in the EU should be a subject meriting a dedicated report that further clarifies and allows for better assumptions in the near future.

Labour and productivity counterbalance the deterioration in demographics to lead to overall positive GDP average growth. Inflation is constant at 2%. Looking at differences by decade, the most challenging period is that between 2030 and 2040. The demographic deterioration is pulling things down, caused by the retirement of the baby boom generation and the impact of two generations' worth of low fertility. Moreover, the assumed aid coming from the rise in productivity growth (due to technology advances) has not yet kicked in. In contrast, things are well on the way to improvement by 2050.

**Table 1.** The three drivers of the AWG projection by decade, EU averages.

	2020	2030	2040	2050	2060
<b>Old-age dependency ratio (20–64) (%)</b>	34.4	43.1	51.4	56.9	59.2
<b>Employment rate (20–64) (%)</b>	73.1	74.0	75.0	75.9	76.3
<b>Labour productivity growth (%)</b>	1.0	1.4	1.8	1.8	1.7

Source: (EPC 2020).

Averages disguise considerable variability between member states, which is ultimately responsible for the emerging structure of IPDs. Table 2 summarises variability in the key drivers in the crucial two decades to 2040. We cite divergences in the key representative indicators of life expectancy, female participation and labour productivity. An idea of the dispersion in EU experience, which powers divergences, is gleaned by citing averages of the five top and bottom performers.

**Table 2.** EU variability in key projection drivers: top and bottom performers.

			2020–2040	Counties
Population	Life expectancy	average TOP5	5.14	BG, HU, LT, LV, RO
		average BOTTOM5	2.43	SE, NL, IT, IE, ES, CY
Labour force	Female participation rate	average TOP5	6.99	EE, EL, LT, LU, MT
		average BOTTOM5	−1.69	BG, CY, DE, NL, PT
Productivity	Labour productivity (per hour) growth rate	average TOP5	1.80	CY, EL, IT, LU, PT
		average BOTTOM5	−1.64	EE, IE, LV, PL, RO

Source: (EPC 2020).

In terms of demographics, longevity is increasing strongly across Europe, while dependency ratios are deteriorating rapidly. A key countervailing influence comes from rises in labour participation. These are motivated by women's greater involvement in paid labour (larger in the current laggards, EL and IT), which together with a rise in employment of older workers, lead to large jumps in total participation rates. Productivity growth reflects some catching up after low performance in the decade following the 2009 debt crisis plus an assumed process of convergence. However, it is not enough to counter negative demographics leading to *negative* GDP growth rate for the first decade.

Though it is hard to generalise, the overall impression is that assumptions probably err on the side of optimism. While the demographic drivers cannot be disguised, they are assumed to be softened by gains in female participation, older workers, convergence between member states and technology evolution. IPD estimates must therefore be assumed to be at the lower end of possible calculations.

A word of caution is warranted about the effect of the pandemic. This found the projection cycle half-way, which explains why its long-term impact is largely absent from the baseline projections. GDP, labour participation and pension system data are those of base year 2019, so capture the pre-pandemic situation and macroeconomic expectations. Similarly, demographic projections were completed in early 2020 and therefore contain no impact on life expectancy and other demographic parameters. However, in the published report, the AWG includes two post-pandemic scenarios, a lagged recovery scenario, which presumes a limited impact on potential growth after the initial 'hit', and an adverse structural scenario, where the pandemic affects productivity growth in the long term. While the impact of those scenarios on IPDs are not analysed, the report itself notes the



high dispersion and different resilience of the member states, especially in the adverse structural scenario.

Proceeding to our calculations and starting from the contribution and benefit expenditure for the years 2020–2060, we derive the difference (Contributions–Benefits) for each year, which is a measure of cash shortfalls<sup>13</sup>. As both revenue and expenditure are used, this exercise is squarely in the logic of Open Groups calculation involving future generations and calculations up to 2060. We calculate these differences for the 2018 and 2021 rounds of the AWG. In order to compare the two rounds, we ignore information for the years before and including 2019, for the purposes of comparability as well as to be able to compare with point estimates of bonds outstanding (explicit debt).

The publication released by the AWG in May 2021 enables us to compute assumed cash shortfalls—by the simple expedient of subtracting projected expenditure from revenue—which presumably will have to be made up by the government in due course. It is interesting—and a comment on political sensitivities—that this simple arithmetical calculation is not to be found in the AWG publication itself. This calculation was presented by (Symeonidis et al. 2020) and published around the same time in an institutional paper by the Commission (Deboeck and Eckerfelt 2020), for the first time about two years subsequently to the publication of the Aging Report 2018 and using the 2018 projection. The presentation and paper were independently created by the two teams of authors, but coincided, a fact that may indeed prove the increasing interest of the implicit debt in government economies.

The results are on a nominal basis. The AWG figures include an assumption of 2% inflation common for all countries through the projection period, which buoys revenue and allows the simulation of the impact of different pension indexation provisions. If we compare explicit bond debt with pensions, the influence of inflation would be a key differentiating factor: rising inflation would reduce the burden of debt service while (through indexation) it would increase the pension bill. It would therefore affect the relative dynamic behaviour of the two different kinds of debt—implicit and explicit.

Actuaries habitually express magnitudes in real terms. We therefore have expressed all values in constant 2019 prices and then used discounting. However, given that inflation is assumed to be common across the EU27, our choice to use real magnitudes is simply equivalent to using a discount rate higher by 2%. Deboeck and Eckerfelt's (2020), in contrast use nominal amounts, a choice which allows easier comparisons with debt service. However, as inflation is common for all at 2%, it operates in the same way as a higher discount rate. Thus, 5% discounting of nominal magnitudes (D&E's choice) is equivalent to discounting real magnitudes by 3%.

To aggregate flows into a stock of IPD, we discount using a *range* of discount rates. To maintain comparability, we illustrate using discount rates used in the literature viz. 0%, 2% (Baseline), 3%, 4%. The influence of discounting would be evident where there is a succession of deficits and surpluses, in which case this time structure will be weighted in a different way depending on which rate is used. Higher discount rates would reduce the influence of distant surpluses or deficits<sup>14</sup>. In contrast, in countries where deficits do not display variability, the impact would be more uniform.

An important issue is how far revenue corresponds to tax capacity. The Member States in supplying information to the AWG were instructed to apply a strict legal definition—i.e., whether a revenue item had been legislated as due to the pension system. This creates a difficulty if we are to interpret this as tax capacity, exemplified by the two polar cases—Denmark and Greece<sup>15</sup>, referred to already. Denmark's social pension has always been financed by general revenue while Greece's new 'national pension' is financed by borrowing by the central government. To safeguard our interpretation of constant tax capacity we undertook two opposite adjustments: We supposed that Denmark's tax capacity remains at the share of GDP devoted in 2019 to finance universal pensions (9.8% of GDP for 2018 Round, 9.2% for Round 2021). Greece was assumed not to receive government grants (5.8% of GDP for the year 2019 in Rounds 2018, 2021), retaining only social security contributions and other fund income. Finland's data is adjusted in line with Denmark (3%

of GDP for 2018 data, adjusted by the state in 2021), while a flow of revenue equivalent to 2019 expenditure is imputed for Belgium.

The histograms in Figure 2, using a 3% discount rate, show the result of the IPD calculation for the 2021 projection round. However, it may be, the IPD calculated certainly is of a size that cannot be ignored. For a minority of countries (DK, MT, LV, FI, NL, DE, PT, and CY) IPDs are below 20% of GDP. For a further seven countries they are between 30% and 100% of GDP (LT, ES, EE, SE, CZ, BE, and PL). For the rest of the countries the IPD is more than 100% of GDP, including EU27, while for Greece (adjusted) and Romania the amounts are well above 200% and 300%, respectively.

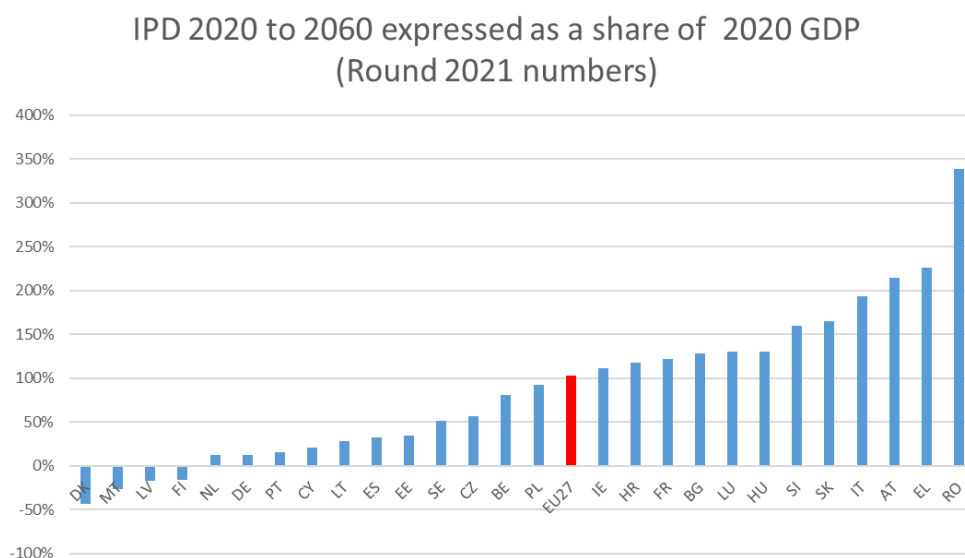


Figure 2. IPD 2020–2060 expressed as a share of GDP, 2020.

The figure shows the tax capacity adjusted data for the four countries already mentioned. The impact of the correction is shown in Table 3: Denmark's computed IPD falls from the outlier figure of 320% of GDP to a surplus of 43% (universal pensions do not fully keep up with GDP growth) for Round 2021. Greece moves from a small gap of 27% to a sizeable financing gap (226%).

Table 3. Effect of tax capacity corrections for four countries.

		IPD from 2020 to 2060 (Round 2021 Numbers) in mil. Euros	IPD from 2020 to 2060 (Round 2018 Numbers) in mil. Euros	IPD from 2020 to 2060 (Round 2021 Numbers) as %GDP2019	IPD from 2020 to 2060 (Round 2018 Numbers) as %GDP2020
<b>Greece</b>	IPD on AWG data	−44.217	−7.061	−27%	−4%
	Tax capacity adjusted	−375.388	−331.923	−226%	−200%
<b>Denmark</b> (surplus)	IPD on AWG data	−998.344	−1014.404	−320%	−325%
	Tax capacity adjusted *	134.251	202.815	43%	65%
<b>Belgium</b>	IPD on AWG data	-	-	-	-
	Tax capacity adjusted **	−362.503	−277.541	−80%	−62%
<b>Finland</b>	IPD on AWG data	38.933	316.793	16%	133%
	Tax capacity adjusted ***	-	75.530	-	32%

\* For 2018 (DK), the subsidy has been set at the amount deficit level of the year 2016 (base year of 2018 Round) and kept constant thereafter. Amount is set to 9.829% GDP per year. For 2021 number, the respective contribution level is 9.162% GDP; \*\* Contributions for BE set to 12.62% GDP yearly; \*\*\* Numbers for FI for 2021 need not be adjusted, numbers for 2018 were adjusted by reducing contributions 3% GDP yearly. Source: Authors' calculations.

It is worth noting here that Greece recently voted for a new funded scheme in its first pillar of pensions. As this has been the first attempt for this country, the expected results have not been investigated in academia yet. However, a similar exercise has been attempted in (Symeonidis et al. 2021).

IPD is, as expected sensitive to the discount rate. With 0% discount rate 17 countries are found to have IPD more than 100% of GDP, a number which falls to 14 if 3% is used. Given that the majority of countries have deficits consistently throughout the period, discounting does not change the rank order of countries—which would have been the case had there been more countries where surpluses are interposed with deficits and vice versa. Results are provided below in Table 4.

**Table 4.** The impact of the discount rate—number of countries with IPD > 100%.

	Discount Rate			
	0%	2%-Baseline	3%	4%
Countries with IPD > 100%	17	16	14	10
Median IPD	−263%	−177%	−154%	−160%
Mean IPD	−372%	−246%	−215%	−212%
Coeff.of variation	111.6	101.7	95.9	79.9

Source: Authors' calculations.

How do the results compare to the 2018 round? This round's IPD was computed by Symeonidis et al. (2020), using identical assumptions to the ones used in this paper. The results for the two separate rounds are shown in Table 5. We see that the average IPD for the 2% baseline has risen to 246%, from 149% in 2018 (median from x to y), a difference which is larger still if we take lower discount rates. At the 3% discount the figure is almost double.

**Table 5.** The impact of the discount rate—number of countries with IPD > 100% and comparison between 2018 and 2021 projection rounds.

	2018	2021
Countries with IPD > 100%	9	16
Median IPD	165%	177%
Mean IPD	149%	246%
Coeff.of variation	259.2	101.7

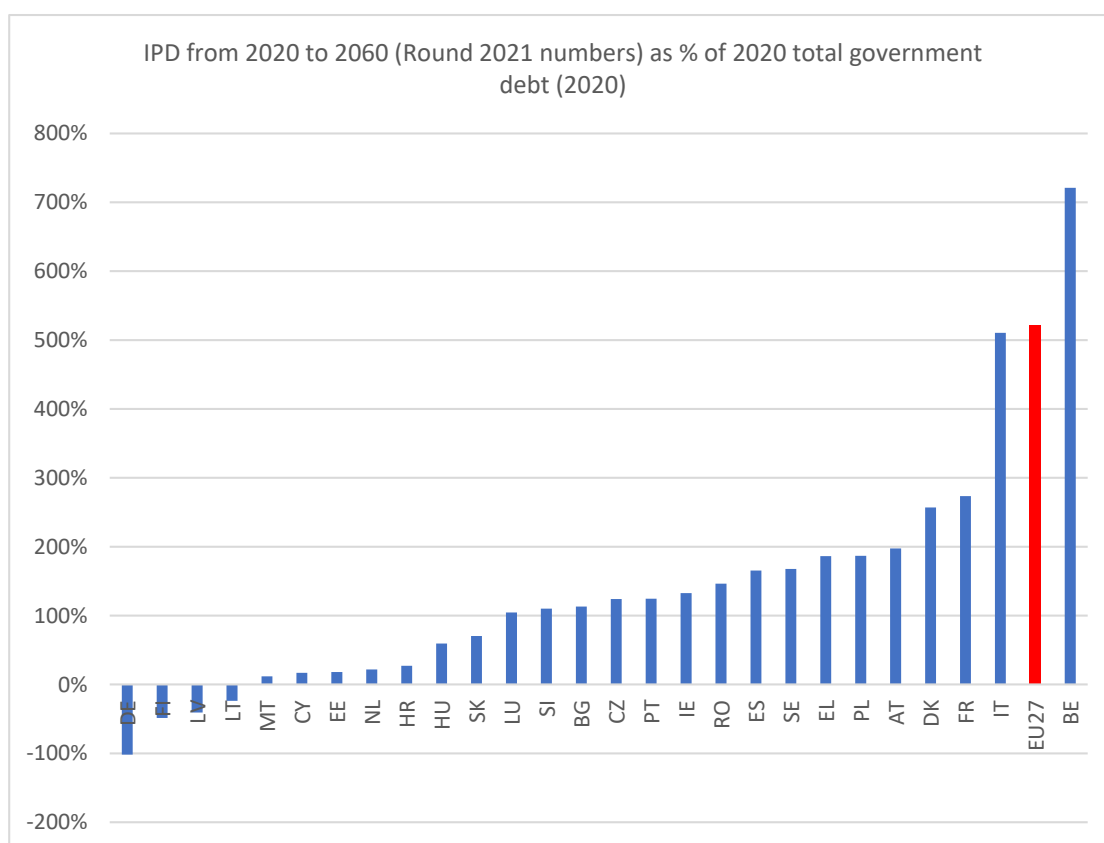
Source: Authors' calculations.

What can account for such a large effect? Comparing the three key drivers, we see that if anything the 2021 projection should be better not worse; labour productivity growth is slightly higher in the newer projection, while demographics are substantially unchanged. The deterioration must therefore be due to the performance of the pension system. A few examples of that are referred to later in the text.

It needs to be stated that the calculations for 2018 are in accordance Symeonidis et al. (2020). As far as the calculation of Deboeck and Eckerfelt (2020), who use the same AWG projections, are concerned, a number of considerations should be borne in mind. Both calculations are OGL and apply PBO. However, their published 'gross IPD' only refers to expenditure and does not subtract expected revenue. Their 'net' IPD only counts employees and employers' social insurance contributions and disregards other sources of revenue—mostly government grants. Our own calculations are limited to using publicly available data, which consists of what governments *themselves* regard as system expenditure. This is certainly more generous, but, as the example of Denmark shows it can be a better measure of future tax capacity, as the point of reference we *actually* employ is whether revenue is

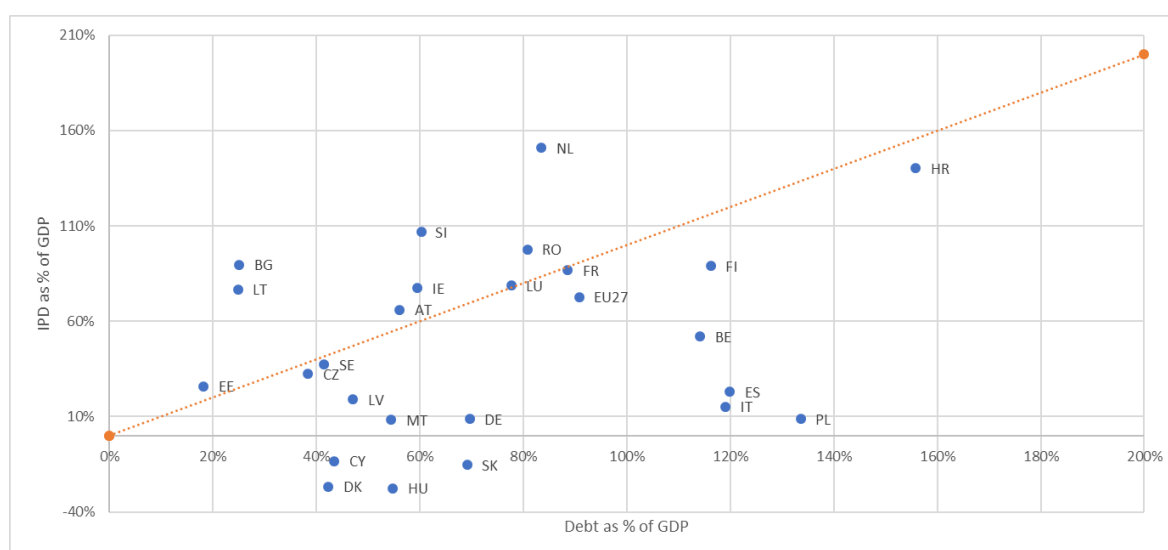
currently being used to fund pensions. Our estimate can thus be interpreted as a lower bound for the necessary additional tax effort needed in the future<sup>16</sup>. To these we must note some other differences: we start our projections for 2020 and disregard previous deficits, to count only future deficits, while our benchmark real discount rate is lower than their Graph III.7<sup>17</sup>; we end our projection in 2060 to maintain comparability with the AWG 2018 projections and we interpolate between the 5-year intervals reported. A final important note is that for internally available data of the authors' home country, all calculations for round 2018 coincide if made with the assumptions of Deboeck and Eckerfelt (2020) and methodology analysed in this paper.

Possibly a more important comparison is that between IPD and outstanding bond debt. We used debt data from Eurostat for 2020 (Eurostat 2021) at the end of the year. For most countries (17 out of 27) IPD using 2% discount is equal to or higher to debt. The necessity to service outstanding pension promises exceeding total outstanding debt implies, at the very least, that the simultaneous examination of debt servicing and pension deficits would be a fruitful exercise. Results are provided in Figure 3 below.



**Figure 3.** IPD 2020–2060 as percentage of total government debt of 31/12/19. Source: Authors' calculations and (Eurostat 2021).

To capture scale effects, IPD as a percentage of GDP is plotted against debt as percentage of GDP in a scatter diagram. Those countries where implicit debt exceeds explicit are below the diagonal. Results are provided in Figure 4 below.

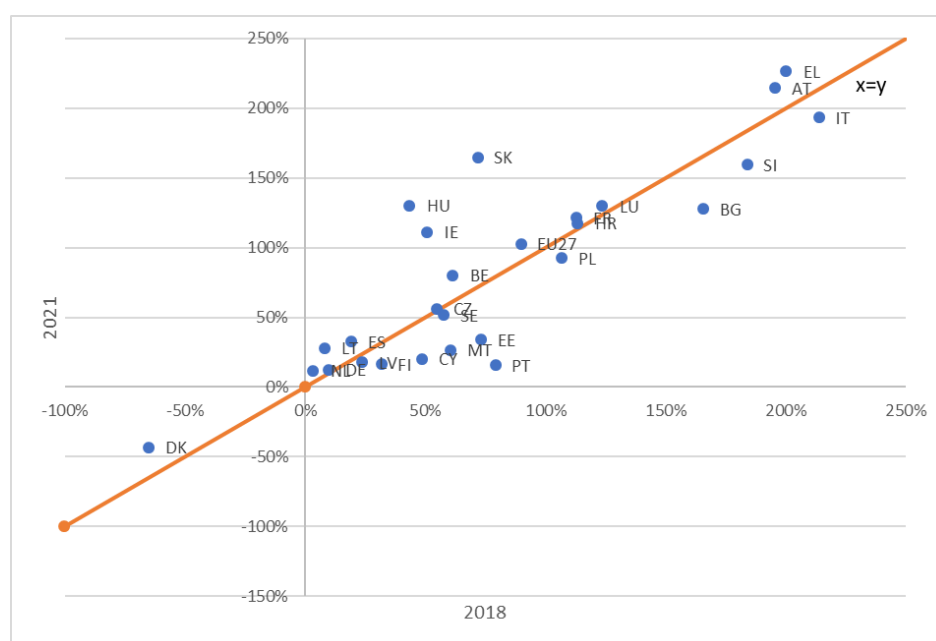


**Figure 4.** IPD plotted against explicit debt, 2020. Source: Author's calculations and (Eurostat 2021).

The final exercise is to track changes between IPD resulting from the last two published AWG exercises—2018 and 2021. Figure 5 is a scatter diagram where IPD 2021 are plotted against IPD 2018. To aid comparisons to Symeonidis et al. (2020) only common years are compared—viz. years from 2020 to 2060; the years preceding the second benchmark date are not included. For the same reason, the GDP projection employed for *both* cases is that of 2020. In that way, we hope to capture changes involving pension reforms and to abstract from differences outside the pension system or the projection period. The 45-degree line divides countries where IPF has risen or fallen as a percentage of 2019 if compared to projections made 3 years earlier. Differences could be due to pension reforms reducing future anticipated deficits. They could also be caused by differences in methodology between waves or due to differences to assumed projected behaviour of expenditure or revenue drivers. However, differences in assumptions between the two points are relatively minor, leaving differences to be accounted for by changes in pension systems. Some Member States, for example, have recently reversed previously legislated reforms. This is the case in Poland, Czechia, Croatia, and Slovakia. This explains the increase for the latter in 2021. In other cases, the impact of legislated reforms was suspended or postponed (e.g., in Spain) or new, temporary possibilities to retire early were created, as in Italy. On the other hand, the effect of a reduction of public pension spending as a share of GDP over the long term is projected in eleven Member States (EL, EE, PT, FR, LV, ES, HR, IT, DK, SE, and PL), as a result of implemented pension reforms can be experienced (Aging Report 2021). Finally, Hungary is one of the countries that would see spending increase by +1.8 pps in the final round, while Romania has enacted reforms in 2018, which explains why in both case the countries appear as outliers.

A definitive answer to whether IPDs are on a downward trend is important for policy. If it were concluded that IPDs are lower this could stand as a signal that addressing the impact of ageing on pensions is finally paying off. It could further act to justify the perceived change in problem solving in EU decisions towards green growth and the future of work. As Holzmann (1990) noted, IPDs can be a powerful shorthand instrument to gauge the efficacy of pension reform.





**Figure 5.** IPD of 2018 and 2021 compared (percentage of 2020 GDP). Source: Author's calculations and (Eurostat 2021).

Our calculation of IPDs for 2018 can be used to address this problem in two ways:

Firstly, we can use the detailed comparisons of IPDs for 2021 and 2018 to test the hypothesis that unfunded expenditure across the EU is on a downward trend. Table 6 shows that in 14 cases IPDs increased by a mean amount of 47 pp, while there was a decrease in 13 countries by 37 pp, which leaves an overall mean of a fall by 9 percentage points. In consequence, a one-tailed t-test does not reject the hypothesis that there was no change or an increase. This impression is confirmed by comparing medians of the two groups (which are not affected by extreme values).

**Table 6.** Hypothesis tests on the direction of change of IPDs between 2018 and 2021.

IPD Evolution between 2018 and 2021							
	# of Countries	Mean (p.p)	Median (p.p)	SD	Coef.of.var	max (p.p)	min (p.p)
Increase	9	47.04	37.62	32.71	69.54	109.13	13.90
Decrease	18	−37.48	−19.06	57.66	−65.00	−99.56	−1.26
Overall	27	−9.31	−8.43	64.43	−14.44	122.57	0.01

Source: Authors' calculations.

Secondly, we may compare our own results with previous published results covering the same countries. The comparison in this case is necessarily more impressionistic as the coverage both in terms of countries and in terms of years differs; both demographic and macroeconomic drivers will also differ making the comparisons far less reliable.

Nevertheless, it is worth delving in four cases using EU data from the last decade—summarised in Table 7. All four have as their starting point AWG projections of slightly different vintages and apply similar methodology to the one employed here. The exception is Soto et al. (2011), who uses older data and a lower discount rate, and applies 'pension adjusted budget methodology' and hence derives much lower estimates. In the three cases of studies published after 2011 average IPDs are considerably larger than computed in this study—by a large margin. This probably refers to a busier reform programme before 2018 and probably signifies a real change.

**Table 7.** Compilation of IPD estimates from previous studies using AWG data.

Comparison of IPD in Different Studies (Percentage of GDP)				
	Soto et al. (2011)	Doležal (2012)	Kaier and Müller (2013)	Deboeck and Eckerfelt (2020)
	pension-adjusted budget balance	PBO	PBO	PBO
Wage growth		3%	1.5%	3%
Discount rate	1%	3%	3%	3%
Time horizon	2060	2060	-	2060
Baseline year	2006	2008	2006	2015
Data	AWG2009	AWG2012	AWG2009	AWG2018
Number of EU countries	8	14	17	25
Mean	44%	239%	264%	263%
Median	43%	179%	257%	-

Source: Literature and Authors' Calculations.

Both exercises lead to a tentative impression that IPDs are indeed falling, though at a decreasing rate. Even so, and even taking member states own interpretations of system revenue at face value, there remains a major challenge—equal to more than doubling the explicit debt burden of 2019. However, this is only an impression. To see how far pension reform has done its work, further work is necessary most notably by isolating the impact of changes in assumptions regarding drivers and hence netting out the impact of pension reforms.

The analysis could be taken further through a more direct discussion of debt sustainability analysis (DSA). One would, as a first step need to ensure that assumptions on GDP growth, interest rates and inflation are consistent. We could use the DSAs available for a subset of states, where available, to track the assumptions used. Key points of interest would be whether (a) GDP allows for a demographic effect pulling downwards and (b) whether tax elasticities assumed make an allowance for the added revenue necessary to cover future pension deficits. Comparing the relative time structure between pension deficits and debt servicing could indicate periods where production would need to cater both for heightened pension expenditure and for debt servicing. Other steps may be more ambitious, such as investigating the impact of inflation, which makes debt servicing easier but (through indexation) could make financing pensions harder. Similarly, wage growth or pandemic scarring could also be investigated. In that context, we should note that interest rate or GDP changes are in principle reversible, whereas a wave of early retirement would have a ratchet effect on future commitments.

#### 4. Conclusions

This paper demonstrated that estimates of implicit pension debt can be readily computed using publicly available projections, produced by the EU member states and published the EU Commission. These can be directly compared with measured national debt to glean an idea of total outstanding obligations; use of earlier reports can give an impression of changes over time—whether the challenges are being addressed. Easy comparisons of such estimates would be a major gain in transparency, of the type that the Open Method of Coordination was meant to promote (Tinios 2012).

The fact that this type of calculation is not discussed more widely is important in itself. It could be a result of complacency about the amassing of future commitments, encouraged by historically low or even negative interest rates. Indeed, our analysis demonstrates that the size of IPD is very sensitive to the interest rates. However, as Goodhart and Pradhan (2020) argue, high nominal interest rates and inflation may well characterize the coming decades. In their analysis, the demographic exceptions behind low interest rates are the two decades since 1990;

the future will be marked by ageing and may well involve features such as the return of the Philips curve. In any case, accumulating debt would be a risky strategy; generating new debt without adequate accounting would be even riskier.

No conclusion can be complete if the impact of the pandemic is not discussed. Changes of the magnitudes afflicting all countries in 2020 alter any projections fundamentally and can radically change any forecasts, frequently in unpredictable directions. The two scenarios of the AWG have already been mentioned. However, the pandemic increase in total debt could also influence developments in complex ways. Though the failure of interest rates to rise in 2020 probably signals a more relaxed attitude to debt, when that debt begins to need to be serviced, matters could change. If that were to coincide with an increased need to pay for pensions, the fiscal pressure could be worse. Especially in times of crises, early retirement may be used as a means of fighting unemployment.

Even before the pandemic, the adopted measures do not necessarily reflect the anticipated results. In Ayuso et al. (2021), the authors studied the examples of four different countries that have introduced automatic indexation of pension ages to life expectancy and one of their conclusions is that retirement age policy outcomes may substantially deviate from the policy goal(s) depending on the design adopted and its implementation.

In any case, it is safe to predict a much-increased need for monitoring of pensions, as well as their links to other ageing-related expenditure, such as long-term care. This could mean concrete changes in the methodology followed by the AWG and probably paying greater attention to explicit risk management.

It would also mean greater effort devoted to producing comparable public estimates of IPD as an important ingredient of public debate. This is becoming more important as policies countering climate change generate their own kind of contingent obligations.

The tentative conclusions of the IPD exercise conducted in this paper only increase the need for vigilance. We found that the projected future implicit pension debt (until 2060), even with relatively optimistic assumptions, indicates an increasing burden that may cause instability at the pension system and hence the macroeconomy. It seems beyond doubt that some of the most egregious cases of IPD were addressed in the years since the start of the crisis—or at least this is signalled by comparisons with older studies; however, large IPDs remain an issue for many countries. It is to be hoped that the new post-pandemic environment will not result in the further postponement of pension reforms.

**Author Contributions:** Conceptualization, G.S. and P.T.; Data curation, G.S.; Formal analysis, G.S.; Investigation, G.S. and M.C.; Methodology, G.S. and M.C.; Project administration, G.S.; Supervision, G.S.; Validation, G.S.; Writing—original draft, G.S.; Writing—review & editing, G.S. and P.T. All authors have read and agreed to the published version of the manuscript.

**Funding:** The publication of this paper has been partly supported by the University of Piraeus Research Center. More specifically, the APC was funded by the University of Piraeus Research Center.

**Conflicts of Interest:** The authors declare that there is no conflict of interest.

## Notes

- <sup>1</sup> Few international precedents for default on the IMF exist; Zaire and Argentina are cases (Ams et al. 2018). Greece did not default but had to enter its third successive bailout, in which (incidentally) the IMF did not participate. See (Tinios 2020) for an overview of pension reform in Greece.
- <sup>2</sup> The legal distinction is not sharp for sovereign debt. A country cannot become bankrupt in the same way as a company. When there is inability to service debt, mechanisms are set off which are not dissimilar to pension reform—reducing entitlements; re-profiling trying to meet obligations with potential GDP linked bonds try to formalize that link (Ams et al. 2018).
- <sup>3</sup> Defined benefit and defined contributions would correspond to different types of bonds. DB pensions are similar to classic debt, as they secure in advance shares of future output. DC pensions would be closer to GDP-linked bonds: Pensioners get more if the economy grows faster.
- <sup>4</sup> IAS 19 is used for all employee benefits except share-based payments, to which IFRS 2 applies <https://www.ifrs.org/issued-standards/list-of-standards/ias-19-employee-benefits/> (accessed on 8 September 2021)
- <sup>5</sup> [http://www.ifac.org/system/files/publications/files/B12-IPSAS\\_39\\_1.pdf](http://www.ifac.org/system/files/publications/files/B12-IPSAS_39_1.pdf) (accessed on 8 September 2021)

- 6 Generational accounting values pension promises in the context of intergenerational justice and provides an alternative motivation to quantify pension promises outstanding.
- 7 Deboeck and Eckerfelt (2020) term this aggregate (counting commitments and not revenue) ‘gross’ IPD, to contrast it to the ‘net’ concept which subtracts revenue items.
- 8 There is an asymmetry, as the same rationality assumption is not invoked for expenditure commitments.
- 9 The process of peer review in the Open Method of Coordination is supposedly designed to deal with this problem. However, it is unclear how far this applied in practice (Tinios 2012).
- 10 Stern (2006) provides a discussion of generational considerations in the choice of discount rates for the case of climate change.
- 11 AWG 2018 takes the projection to 2070; earlier ones stop at 2060. For reasons of comparability our own exercise terminates in 2060.
- 12 See the relevant country fiches for AWG2018 and AWG2015 (EPC 2015, 2018)
- 13 As data are published for five-year intervals, linear interpolation was used to derive annual figures.
- 14 If a country switches between deficits and surpluses this could lead to the ‘reswitching’, or ‘double switching’, a familiar problem in 1960’s capital theory (See Bliss 1975). The ranking of computed IPDs of different countries then would depend on the discount rate.
- 15 For description of the systems see Social Security Systems around the World: Europe, 2018. <https://www.ssa.gov/policy/docs/progdesc/ssptw/2018-2019/europe/index.html> (accessed on 8 September 2021).
- 16 We also calculated IPDs for all EU member states, whereas (Deboeck and Eckerfelt 2020) omitted some countries as outliers.
- 17 As the exact figures are not noted on the diagram, it is not possible to undertake a direct comparison with their findings. However, with the provisos above their Graph III.7 is comparable to our data.

## References

- Ams, Julianne, Reza Baqir, Anna Gelpert, and Christoph Trebesch. 2018. Sovereign Default. Paper presented at Conference: Sovereign Debt: A Guide for Economists and Practitioners, Washington, DC, USA, September 13–14. Available online: <https://www.imf.org/-/media/Files/News/Seminars/2018/091318SovDebt-conference/chapter-7-sovereign-default.ashx> (accessed on 8 September 2021).
- Ayuso, Mercedes, Jorge M. Bravo, Robert Holzmann, and Edward Palmer. 2021. Automatic Indexation of the Pension Age to Life Expectancy: When Policy Design Matters. *Risks* 9: 96. [CrossRef]
- Barr, Nicholas A. 2001. *The Welfare State as Piggy Bank: Information, Risk, Uncertainty, and the Role of the State*. Oxford: Oxford University Press.
- Beltrametti, Luca, and Matteo Della Valle. 2011. *Does the Implicit Pension Debt Mean Anything after All?* (No. 118). Turin: Center for Research on Pensions and Welfare Policies.
- Bliss, Christopher J. 1975. *Capital Theory and the Distribution of Income*. New York: Elsevier, vol. 4.
- Chand, S., and A. Jaeger. 1996. *Aging Populations and Public Pension Schemes*. Occasional Paper No. 147. Washington, DC: International Monetary Fund.
- Chen, Tianhong, and John A. Turner. 2014. Social Security Individual Accounts in China: Toward Sustainability in Individual Account Financing. *Sustainability* 6: 5049–64. [CrossRef]
- Deboeck, Ben, and Per Eckerfelt. 2020. Taking Stock of implicit Pension liabilities. In *Chapter III of Quarterly Report on the Euro Area*. Number 2 Institutional Paper 135. October 2020. Luxembourg: Publications Office of the European Union, vol. 19, pp. 43–56.
- Doležal, Vítězslav. 2012. Implicit Pension Debt in the EU Member States. Master’s thesis, Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies, Prague, Czech Republic.
- Economic Policy Committee (EPC). 2015. *The 2015 Ageing Report: Economic and Budgetary Projections for the EU Member States (2013–2070)*. Luxembourg: Publications Office of the European Union.
- Economic Policy Committee (EPC). 2018. *The 2018 Ageing Report: Economic and Budgetary Projections for the EU Member States (2016–2070)*. Luxembourg: Publications Office of the European Union.
- Economic Policy Committee (EPC). 2020. *The 2021 Ageing Report—Underlying Assumptions and Projection Methodologies*. European Economy. Institutional Paper 142. Luxembourg: Publications Office of the European Union.
- Eurostat. 2018. Information on Member States. Pensions Publications. Available online: <https://ec.europa.eu/eurostat/web/pensions/information-member-states> (accessed on 8 September 2021).
- Eurostat. 2021. General Government Gross Debt-Annual Data. Available online: <http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=teina225&lang=en> (accessed on 8 September 2021).
- Feldstein, Martin. 1974. Social security, induced retirement, and aggregate capital accumulation. *Journal of Political Economy* 82: 905–26. [CrossRef]
- Franco, Daniele. 1995. *Pension Liabilities: Their Use and Misuse in the Assessment of Fiscal Policies* (No. 110). Directorate-General for Economic and Financial Affairs. Brussels: European Commission.
- Frederiksen, N. K. 2001. *Fiscal Sustainability in the OECD. A Simple Method and Some Preliminary Results*. Working Paper 3/2001. Paris: Finansministeriet.

- Goodhart, Charles, and Manoj Pradhan. 2020. *The Great Demographic Reversal: Ageing Societies, Waning Inequality, and an Inflation Revival*. London: Palgrave Macmillan.
- Hagemann, Robert. P., and Giuseppe Nicoletti. 1989. *Ageing Populations: Economic Effects and Implications for Public Finance*. Working Paper No. 61. Paris: OECD, Department of Economics and Statistics.
- Heidler, Matthias, Christoph Müller, and Olaf Weddige. 2009. *Measuring Accrued-to-Date Liabilities of Public Pension Systems: Method, Data and Limitations* (No. 37). Freiburg: Diskussionsbeiträge.
- Holzmann, Robert. 1990. The welfare effects of public expenditure programs reconsidered. *Staff Papers* 37: 338–59. [CrossRef]
- Holzmann, Robert, Robert J. Palacios, and Asta Zvinienė. 2004. *Implicit Pension Debt: Issues, Measurement and Scope in International Perspective*. Social Protection, Labor Markets, Pensions, Social Assistance. Washington, DC: World Bank, vol. 403.
- International Actuarial Association (IAA). 2018. *Measuring and Reporting Actuarial Obligations of Social Security Systems*. Ottawa: Social Security Committee.
- James, S. 2012. The Origins and Evolution of the Lisbon Agenda. In *The EU's Lisbon Strategy. Evaluating Success, Understanding Failure*. Edited by P. Copeland and D. Papadimitriou. Basingstoke: Palgrave Macmillan, pp. 8–28.
- Kaier, Klaus, and Christoph Müller. 2013. *New Figures on Unfunded Public Pension Entitlements across Europe: Concept, Results and Applications* (No. 52). Freiburg: University of Freiburg, Research Center for Generational Contracts (FZG).
- Kane, Cheikh, and Robert Palacios. 1996. The implicit pension debt. *IMF, Finance & Development* 33: 36–38.
- Kuné, J. B. 2000. *Issues in Pension Finance*. The Hague: Netherlands Foundation for Pension Studies.
- Kuné, J., W. Petit, and A. Pinxt. 1993. *The Hidden Liabilities of Basic Pension Systems in the European Community*. Working Document No. 80. Brussels: CEPS.
- Novy-Marx, R., and J. Rauh. 2011. Public pension promises: How big are they and what are they worth? *The Journal of Finance* 66: 1211–49. [CrossRef]
- Obořil, J. 2015. Impact of Pension Reform to Implicit Pension Debt: Evidence of Pension Reforms in EU in 1993–2013. Master's thesis, Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies, Prague, Czech Republic.
- Ponds, E., C. Severinson, and J. Yermo. 2012. Implicit debt in public-sector pension plans: An international comparison. *International Social Security Review* 65: 75–101. [CrossRef]
- Schmidhuber, L., and D. Hilgers. 2019. Ipsas: History–Spread–Use. In *European Public Sector Accounting*. Edited by Peter C. Lorson, Susana Jorge and Ellen Hausteijn. Coimbra: Imprensa da Universidade de Coimbra, Coimbra University Press.
- Soto, M., F. Eich, and B. Clements. 2011. *A Fiscal Indicator for Assessing First and Second Pillar Pension Reforms*. Staff Discussion Note, 11, 09–12. Washington, DC: IMF.
- Stern, Nicholas. 2006. *The Economics of Climate Change: The Stern Review*. Cambridge: Cabinet Office and Cambridge University Press.
- Symeonidis, Georgios, Platon Tinios, and Michail Chouzouris. 2020. Public Pensions and Implicit Debt: An Investigation for EU Member States Using Ageing Working Group Projections. Public Sector Economics 2020. November 6, 2020. Zagreb, Croatia. (Video Presentation). Available online: <http://web3.ijf.hr/PSE2020/Symeonidis.mp4> (accessed on 8 September 2021).
- Symeonidis, Georgios, Platon Tinios, and Panos Xenos. 2021. Enhancing Pension Adequacy While Reducing the Fiscal Budget and Creating Essential Capital for Domestic Investments and Growth: Analysing the Risks and Outcomes in the Case of Greece. *Risks* 9: 8. [CrossRef]
- Tinios, Platon. 2011. International accounting standards as catalysts for pension reform: Greek pensions and the public/private boundary. *Journal of European Social Policy* 21: 164–77. [CrossRef]
- Tinios, Platon. 2012. Pensions and the Lisbon strategy. In *The EU's Lisbon Strategy. Evaluating Success, Understanding Failure*. Edited by Paul Copeland and Dimitris Papadimitriou. Basingstoke: Palgrave Macmillan, pp. 111–29.
- Tinios, Platon. 2020. Pensions. In *The Oxford Handbook of Greek Politics*. Edited by Kevin Featherstone and Dimtri Sotiropoulos. Oxford: OUP, pp. 489–504.
- Van den Noord, P., and R. Herd. 1993. *Pension Liabilities in the Seven Major Economies*. Paris: OECD Publishing.