

## Annex 1. Data Sources and Technical Assumptions

The following are the data sources, key definitions and technical assumptions:

- *Projection vintages* follow the 2009, 2018, and 2021 versions of the Ageing Report (EC 2009, 2018a, 2021).
- *Population data*—both historical and forecasts—is taken from the UN population database (medium variant).
- *Number of pensioners* for 2007 – (2060) 2070 are taken from the respective Ageing Report vintages and extended backward until 2005 with growth rates of number of retirees from Eurostat.
- *Workers* are defined as the part of the population aged 22 to the calculated effective retirement age. Everyone above the calculated retirement age is considered a pensioner.
- *An effective retirement age* is calculated by distributing the number of pensioners for each year to the population of that year starting from age 100 until all pensioners have been accounted for. This retirement age is extended backwards with growth rates of statutory retirement ages from the OECD for 1950–2005 and kept constant for (2060) 2070–2100. The model’s sensitivity was tested to the labor market exit age as reported in the respective vintage of the Ageing Report, supplemented with the historic data taken from the OECD, yielding very similar results.<sup>1</sup>

---

<sup>1</sup>While a change in the retirement age will adjust the lengths of working and retirement lives, it will not alter the annual contributions and benefits that we take as given from the Ageing Report vintages and will have very little impact on lifetime contributions and benefits of cohorts. For example, higher retirement age generally implies longer years of contributions and more cohorts at any given year, but also lower annual contributions per cohort per year with little effect on a sum of contribution rates for each cohort over their lifetimes. Similarly, higher retirement age would imply both lower years over which benefits are received as well as higher benefits per cohort per year, leaving the lifetime sum of benefit rates for each cohort broadly unchanged.

- *Pension contributions* for 2007 – (2060) 2070 follow the respective Ageing Report vintages while netting out any state transfers and third-party contributions as defined in the 2018 and 2021 Ageing Report vintages. These pension contributions are extended backward with growth rates of total social contributions from the OECD for 1965–2016. Where OECD data was not available, pension contributions are assumed constant as a share of GDP prior to 1970 and after (2060) 2070 until 2100.
- *Pension expenditures* for 2007 – (2060) 2070 follow the respective Ageing Report vintages. These are extended backward with growth rates of actual pension spending data from Eurostat for 1990–2007 and from the OECD for 1980–90, and forward for (2060) 2070–2100 with growth rates of old-age dependency ratio.
- *Cohorts* are defined by their birth year.
- *Distribution of pension contributions* to different cohorts for a given year are assigned based on an interaction term between the size of the respective cohort in total workers and country-specific age-income profiles over the working life of a worker. The latter are derived from the Eurosystem Household Finance and Consumption Survey microdata (wave 3) and are kept constant before the age of 20 and after the age of 67 when smaller sample size can give rise to a selection bias. Cohort pension contributions and cohort pension expenditures are calculated by adding all contributions and expenditures over the lifetime of a cohort (22–100).
- *Distributions of pension expenditures* to different cohorts for a given year are assigned based on the size of the respective cohort in the total number of pensioners that underlies reported baseline results. As a robustness test, pension expenditures were further distributed based on a notional age profile, constructed by dividing spending after retirement by a cohort-specific index of compounded real GDP growth rates. By distributing pension spending from older to younger retirees this adjustment allows for declining spending profile as retirees get older since pensions in payment in most countries are indexed with less than nominal wage growth. The resulting PM values show minimal changes for mature pension systems and for all European countries covered decline toward zero in the long term.<sup>2</sup>
- *Linear interpolation* is applied to data between 5-year forecasts of the Ageing Report.
- *The proportionality measure* for a given cohort is calculated by dividing lifetime cohort benefits received by lifetime cohort pension contributions paid.

---

<sup>2</sup>The age distribution of pension spending remains relatively stable over time and across cohorts. Since the total annual pension spending in our model is constant, given by the Ageing Report vintages, the impact on the PM is minimal for mature pension systems and noticeable only for less mature pension systems at their transition period. For mature pension systems the historical impact (for older cohorts) is on average less than 0.15 index points. For all countries the impact declines in the long term, averaging at about 0.05 for younger cohorts.

## Annex 2. Data and Calculated Proportionality Measures

**Annex Table 2.1. Pension Expenditures based on Ageing Report 2021**  
(Percent of GDP)

	1970	1980	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
AUT	.	.	12.6	13.5	13.9	13.5	15.1	15.1	14.7	14.6	14.3	14.0	14.4	15.0
BGR	.	.	.	.	9.9	8.4	8.5	8.6	9.3	9.8	9.7	9.8	10.5	10.4
CYP	.	.	.	5.6	7.2	9.0	10.0	10.2	10.1	10.7	10.9	10.9	11.1	11.3
CZE	.	.	6.5	8.0	8.6	8.1	8.8	9.8	11.4	11.8	10.9	11.1	11.5	11.5
DEU	.	10.9	10.0	10.9	10.6	10.4	11.5	12.0	12.2	12.5	12.4	12.2	12.6	13.1
ESP	.	6.3	8.0	8.8	10.1	12.4	12.3	12.8	13.0	11.7	10.3	10.6	10.9	10.9
EST	.	.	.	6.5	9.0	7.6	6.9	6.5	6.1	5.8	5.4	5.8	6.1	6.0
FIN	.	7.4	9.7	9.8	12.1	13.1	13.7	12.8	12.7	13.5	14.4	15.1	15.9	16.5
FRA	.	10.6	11.9	12.6	14.3	14.9	15.6	15.2	14.3	13.4	12.6	13.4	14.0	14.7
GRC	.	5.1	9.4	10.4	14.6	15.5	13.8	14.0	13.6	12.0	11.9	12.5	12.2	12.0
HRV	.	.	.	.	10.7	10.3	11.0	10.4	9.9	9.7	9.5	9.9	10.0	10.0
HUN	.	.	.	9.1	12.0	8.4	8.3	9.7	11.2	11.9	12.4	12.4	12.9	13.1
IRL	.	4.1	3.9	3.7	6.8	4.7	5.9	6.9	7.5	7.5	7.6	8.6	9.0	9.2
ITA	.	8.9	11.8	13.8	15.0	15.5	17.3	17.8	16.2	14.1	13.6	13.7	13.8	14.1
LTU	.	.	.	8.1	8.5	7.2	7.9	8.4	8.2	8.1	7.5	7.4	8.0	8.2
LUX	.	11.4	10.3	9.4	8.8	9.4	11.4	13.0	14.8	16.7	18.0	18.6	20.0	21.5
LVA	.	.	.	10.4	9.8	7.1	6.9	6.6	6.3	6.2	5.9	6.1	6.5	6.5
MLT	.	.	.	6.4	10.2	7.1	6.6	6.6	8.1	10.1	10.9	10.3	10.1	10.8
NLD	.	8.6	9.0	6.7	6.8	6.9	8.1	9.1	8.9	8.9	9.1	9.4	9.8	10.2
NOR	.	.	9.8	8.8	8.1	11.1	12.3	12.6	12.7	13.2	13.6	14.1	15.0	15.9
POL	.	.	6.1	12.7	11.6	10.8	11.0	10.5	10.7	10.8	10.5	10.7	10.8	10.4
PRT	.	4.4	5.8	9.3	12.7	12.8	14.2	14.4	12.6	10.5	9.5	9.8	9.7	9.7
ROU	.	.	.	6.4	9.5	8.9	12.9	14.2	14.8	13.6	11.9	12.6	12.8	12.8
SVK	.	.	.	7.1	8.3	8.6	10.2	11.6	13.4	14.5	14.2	13.9	14.7	14.8
SVN	.	.	.	11.1	11.4	10.0	10.8	13.6	15.7	16.1	16.0	16.2	16.9	16.9
SWE	.	9.2	10.1	9.4	8.4	7.7	7.4	7.0	7.0	7.4	7.5	7.9	8.5	8.9

Sources: Ageing Report vintages; Eurostat; and OECD.

## PENSION REFORMS IN EUROPE: HOW FAR HAVE WE COME AND GONE

**Annex Table 2.2. Pension Contributions based on Ageing Report 2021**

(Percent of GDP)

	1970	1980	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
AUT	5.6	7.8	8.5	9.5	8.4	9.4	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
BGR	.	.	.	.	4.2	5.0	5.0	5.3	5.5	5.5	5.5	5.5	5.5	5.5
CYP	.	.	.	4.0	5.6	6.6	7.1	7.7	7.6	7.6	7.6	7.6	7.6	7.6
CZE	.	.	.	7.7	8.4	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
DEU	5.3	7.0	7.3	7.9	7.4	6.3	6.6	7.0	7.0	7.2	7.2	7.2	7.2	7.2
ESP	5.6	10.4	10.9	11.1	10.9	10.0	9.9	10.1	10.2	10.6	10.8	10.8	10.8	10.8
EST	.	.	.	6.9	7.6	6.0	5.5	5.3	5.3	5.2	5.3	5.3	5.3	5.3
FIN	2.5	7.5	10.0	9.3	9.9	9.5	10.0	10.2	10.6	11.2	12.0	12.0	12.0	12.0
FRA	7.4	10.2	11.0	9.8	8.5	9.3	9.4	9.6	9.6	9.6	9.6	9.6	9.6	9.6
GRC	3.2	3.8	4.3	5.0	6.3	7.9	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.1
HRV	.	.	.	.	6.1	5.8	6.1	6.1	6.1	6.0	6.0	6.0	6.0	6.0
HUN	.	.	.	8.3	8.6	7.7	7.5	7.4	7.3	7.3	7.4	7.4	7.4	7.4
IRL	1.6	3.0	3.2	3.2	4.4	3.3	3.3	2.9	2.8	2.9	2.8	2.8	2.8	2.8
ITA	9.0	10.5	11.5	10.0	11.0	10.8	11.0	11.0	11.1	11.1	11.0	11.0	11.0	11.0
LTU	.	.	.	6.3	6.7	3.4	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
LUX	4.0	6.0	5.7	5.7	5.8	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
LVA	.	.	.	8.2	6.4	7.5	6.9	6.7	6.6	6.6	6.7	6.7	6.7	6.7
MLT	.	.	.	6.4	5.9	5.3	5.6	5.4	5.2	5.0	4.6	4.6	4.6	4.6
NLD	4.6	6.0	5.9	5.7	5.2	4.9	5.1	5.2	5.1	5.1	5.1	5.1	5.1	5.1
NOR	4.5	7.3	8.7	8.7	11.5	11.6	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
POL	.	.	.	7.6	5.8	8.0	8.3	8.5	8.5	8.5	8.5	8.5	8.5	8.5
PRT	5.1	7.8	8.7	9.5	10.9	10.9	10.6	9.9	9.4	9.2	9.2	9.2	9.2	9.2
ROU	.	.	.	10.7	7.1	6.7	6.8	6.6	6.5	6.5	6.5	6.5	6.5	6.5
SVK	.	.	.	5.2	4.9	7.4	7.0	7.2	7.4	7.4	7.4	7.4	7.4	7.4
SVN	.	.	.	9.1	9.2	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
SWE	2.4	5.8	6.2	6.3	5.9	5.4	5.4	5.5	5.6	5.6	5.7	5.7	5.7	5.7

Sources: Ageing Report vintages; Eurostat; and OECD.

**Annex Table 2.3. Old-age Dependency Ratio based on Ageing Report 2021**

(Percent)

	1970	1980	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
AUT	22.7	23.5	21.8	22.6	26.3	29.9	40.5	50.6	54.8	59.0	58.3	57.1	58.8	61.1
BGR	14.3	18.0	19.8	24.5	26.8	33.4	37.0	42.5	50.5	53.1	45.8	46.6	49.6	49.4
CYP	17.1	14.2	15.3	15.2	16.4	20.7	26.9	33.0	43.4	52.9	55.8	56.1	57.0	58.1
CZE	18.2	21.5	19.2	19.7	21.9	31.7	36.1	43.4	54.6	57.8	51.0	51.8	54.0	53.9
DEU	21.6	23.9	21.5	23.7	31.3	35.3	47.7	55.8	58.6	61.6	61.6	60.6	62.5	64.8
ESP	15.4	17.5	20.0	24.3	25.2	31.0	41.4	57.2	69.5	65.7	61.4	63.8	65.0	65.1
EST	17.8	19.0	17.6	22.3	26.0	32.3	37.9	42.2	48.2	54.3	47.5	50.3	53.1	52.7
FIN	13.8	17.7	19.9	22.3	25.8	36.9	43.3	43.7	45.7	48.6	49.5	52.2	54.7	56.7
FRA	20.6	21.8	21.2	24.7	26.4	34.1	40.5	45.6	46.3	46.2	48.2	51.2	53.7	56.2
GRC	17.4	20.5	20.4	24.9	28.7	35.0	41.3	53.5	66.0	67.4	65.7	69.2	67.7	66.1
HRV	13.9	17.2	16.9	23.2	26.2	32.4	39.7	45.1	52.6	56.6	58.4	60.9	61.5	61.5
HUN	17.1	21.1	20.4	22.3	24.4	30.4	32.9	37.9	47.0	51.3	49.0	49.2	51.0	52.1
IRL	18.9	18.0	18.0	15.5	16.4	23.4	29.2	37.0	45.6	43.9	43.9	49.7	52.2	53.4
ITA	17.3	20.6	21.5	26.7	31.2	38.3	48.6	63.1	67.6	65.4	63.4	64.0	64.5	65.9
LTU	16.2	17.4	16.3	20.9	25.8	29.3	36.0	39.0	37.8	43.2	41.3	40.8	43.8	45.2
LUX	19.3	20.2	19.3	21.0	20.5	21.8	28.3	34.9	38.7	40.9	42.8	44.4	47.8	51.3
LVA	18.1	19.5	17.8	22.4	27.2	31.3	36.7	39.4	42.5	48.6	42.5	43.5	46.4	46.6
MLT	13.7	14.0	15.2	17.2	23.7	32.5	39.9	44.7	52.0	59.6	64.5	61.0	59.7	63.8
NLD	16.2	17.3	18.4	20.0	23.2	31.8	41.9	49.0	47.9	48.7	51.2	52.7	54.6	57.3
NOR	20.5	23.3	25.2	23.4	22.7	26.8	32.2	37.9	39.8	43.2	44.4	46.2	49.1	51.9
POL	12.7	15.3	15.6	17.9	18.9	28.2	36.3	41.0	55.8	67.2	64.2	65.6	66.0	63.6
PRT	15.7	18.3	20.7	24.0	28.3	35.5	44.7	57.2	66.4	65.9	67.4	69.5	68.7	68.6
ROU	12.9	16.2	15.8	20.1	23.2	30.0	33.6	44.4	51.8	51.3	50.2	53.3	53.8	53.9
SVK	14.3	16.6	16.1	16.5	17.1	24.2	31.6	37.2	49.5	57.2	52.4	51.5	54.3	54.5
SVN	14.9	17.4	15.5	20.1	24.0	32.6	42.7	51.3	61.2	60.9	54.1	55.0	57.4	57.3
SWE	20.9	25.4	27.7	26.8	27.9	33.8	37.0	40.2	40.5	44.2	42.7	45.0	48.3	50.7

Source: United Nations.

Annex Table 2.4. Calculated Retirement Age based on Ageing Report 2021

(Years)

	1970	1980	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
AUT	56.1	56.1	56.1	56.1	55.8	58.4	59.4	58.8	59.5	59.7	59.5	59.5	59.5	59.5
BGR	.	.	.	.	56.8	58.4	60.1	62.2	63.4	63.2	62.7	62.7	62.7	62.7
CYP	.	.	.	.	62.4	63.5	63.9	62.6	61.2	60.9	63.5	63.5	63.5	63.5
CZE	56.7	54.3	55.3	55.3	57.1	59.1	60.7	62.2	61.9	61.2	61.6	61.6	61.6	61.6
DEU	60.9	60.9	60.9	60.9	60.5	60.7	61.5	60.2	60.8	60.4	60.1	60.1	60.1	60.1
ESP	63.4	63.4	63.4	63.4	63.6	63.7	65.3	65.3	64.3	62.7	63.2	63.2	63.2	63.2
EST	.	.	.	.	55.3	56.6	57.7	59.5	61.9	62.0	62.5	62.5	62.5	62.5
FIN	58.3	58.3	58.3	58.3	59.5	60.3	61.0	61.3	61.4	61.6	61.9	61.9	61.9	61.9
FRA	63.4	63.4	58.5	58.5	58.4	52.4	52.0	51.1	50.9	51.8	51.8	51.8	51.8	51.8
GRC	60.2	60.2	60.2	60.2	60.9	64.1	65.8	66.1	66.3	66.7	66.0	66.0	66.0	66.0
HRV	.	.	.	.	57.0	58.5	59.6	61.2	62.4	62.9	63.1	63.1	63.1	63.1
HUN	53.8	53.8	53.8	53.8	55.8	59.6	60.0	61.1	60.7	60.2	60.7	60.7	60.7	60.7
IRL	62.9	62.9	58.4	58.4	58.6	59.2	59.6	60.2	59.6	59.4	60.8	60.8	60.8	60.8
ITA	59.5	59.5	56.9	56.9	60.5	63.9	65.5	66.9	67.8	68.3	69.0	69.0	69.0	69.0
LTU	.	.	.	.	54.3	57.1	58.2	58.2	59.9	59.5	59.1	59.1	59.1	59.1
LUX	55.9	55.9	55.9	51.6	50.7	50.1	44.6	38.6	33.2	30.1	26.9	26.9	26.9	26.9
LVA	.	.	.	.	57.6	59.1	60.2	60.9	62.1	60.4	61.6	61.6	61.6	61.6
MLT	.	.	.	.	63.1	65.5	66.4	65.6	65.2	65.4	65.1	65.1	65.1	65.1
NLD	59.6	59.6	59.6	59.6	60.5	62.3	63.3	63.0	63.5	64.3	64.6	64.6	64.6	64.6
NOR	62.6	62.6	59.9	59.9	59.7	58.4	57.0	55.0	54.0	51.5	52.1	52.1	52.1	52.1
POL	51.5	51.5	53.6	53.6	56.0	60.1	59.9	60.8	61.1	60.7	61.2	61.2	61.2	61.2
PRT	58.0	58.0	56.7	56.7	59.4	62.2	63.8	64.6	65.5	65.3	65.6	65.6	65.6	65.6
ROU	.	.	.	.	56.0	59.2	59.2	59.4	60.2	61.1	62.4	62.4	62.4	62.4
SVK	56.8	54.4	55.4	55.4	56.3	58.3	57.9	59.3	59.4	58.7	59.3	59.3	59.3	59.3
SVN	.	.	.	.	56.7	58.2	59.1	59.1	58.4	57.2	58.4	58.4	58.4	58.4
SWE	61.8	61.8	59.9	59.9	60.3	59.7	60.0	58.9	59.0	57.2	58.0	58.0	58.0	58.0

Source: IMF staff calculations.

Note: See Annex 1 for definitions.

Annex Table 2.5. Proportionality Measure based on Ageing Report 2021

(By cohort birth year)

	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
AUT	1.99	2.19	2.08	1.98	1.93	2.09	1.84	1.76	1.68	1.72	1.84	1.71	1.72	1.71	1.73
BGR	.	.	.	.	.	.	.	.	.	.	.	1.85	1.86	1.89	2.04
CYP	.	.	.	.	.	.	.	.	.	.	.	1.72	1.71	1.81	1.82
CZE	.	.	.	.	.	.	.	.	.	1.32	1.28	1.35	1.46	1.46	1.47
DEU	1.99	1.91	1.76	1.50	1.63	1.68	1.77	1.75	1.81	2.03	2.04	2.03	2.01	1.99	1.95
ESP	1.43	1.35	1.36	1.38	1.38	1.35	1.25	1.15	1.15	1.14	1.11	1.18	1.25	1.21	1.25
EST	.	.	.	.	.	.	.	.	.	.	.	1.10	1.02	1.05	1.16
FIN	.	.	1.92	1.80	1.74	1.43	1.44	1.46	1.37	1.51	1.44	1.47	1.51	1.53	1.56
FRA	.	.	1.64	1.55	1.44	1.51	1.59	2.00	2.10	1.96	1.99	1.82	1.69	1.74	1.69
GRC	3.62	4.01	4.21	4.54	4.47	3.34	2.59	2.22	1.88	1.76	1.68	1.60	1.61	1.58	1.60
HRV	.	.	.	.	.	.	.	.	.	.	.	.	1.67	1.70	1.61
HUN	.	.	.	.	.	.	.	.	1.17	1.29	1.32	1.55	1.66	1.78	1.85
IRL	2.41	2.38	2.25	2.23	2.21	2.05	1.97	2.12	2.24	2.15	2.25	2.38	2.78	2.97	3.11
ITA	2.00	2.09	2.12	2.08	1.83	1.61	1.58	1.53	1.46	1.38	1.40	1.40	1.33	1.35	1.37
LTU	.	.	.	.	.	.	.	.	.	.	.	1.98	2.21	2.33	2.60
LUX	1.91	1.72	1.83	2.04	1.84	1.70	1.86	1.87	1.85	2.13	2.23	2.54	2.79	3.02	3.27
LVA	.	.	.	.	.	.	.	.	.	.	.	0.93	0.88	0.88	1.06
MLT	.	.	.	.	.	.	.	.	.	.	.	1.91	2.03	2.09	2.15
NLD	1.71	1.53	1.48	1.50	1.44	1.57	1.52	1.59	1.72	1.82	1.89	1.94	1.99	1.92	1.96
NOR	2.10	1.77	1.50	1.36	1.28	1.19	1.23	1.16	1.21	1.25	1.29	1.24	1.29	1.26	1.35
POL	.	.	.	.	.	.	.	.	1.57	1.46	1.45	1.35	1.34	1.41	1.41
PRT	1.73	2.15	2.22	2.16	2.00	1.67	1.43	1.31	1.29	1.15	1.04	1.04	1.04	1.06	1.08
ROU	.	.	.	.	.	.	.	.	.	.	.	2.35	2.17	2.21	2.04
SVK	.	.	.	.	.	.	.	.	.	2.19	2.07	2.09	2.08	2.09	2.26
SVN	.	.	.	.	.	.	.	.	.	.	.	1.80	1.93	1.96	2.07
SWE	3.43	2.71	2.17	1.83	1.47	1.29	1.35	1.36	1.37	1.35	1.48	1.49	1.50	1.42	1.55

Source: IMF staff calculations.

**PENSION REFORMS IN EUROPE: HOW FAR HAVE WE COME AND GONE**

**Annex Table 2.6. Proportionality Measure based on Ageing Report 2018**

(By cohort birth year)

	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
AUT	1.99	2.19	2.08	1.97	1.92	2.08	1.82	1.72	1.64	1.66	1.78	1.76	1.65	1.65	1.57
BGR	.	.	.	.	.	.	.	.	.	.	.	2.31	2.17	2.22	2.41
CYP	.	.	.	.	.	.	.	.	.	.	.	1.89	1.92	1.80	1.74
CZE	.	.	.	.	.	.	.	.	.	1.28	1.36	1.45	1.49	1.51	1.64
DEU	1.99	1.91	1.75	1.49	1.61	1.66	1.75	1.84	1.76	1.96	1.95	1.92	1.88	1.85	1.80
ESP	1.43	1.34	1.35	1.37	1.38	1.36	1.26	1.26	1.24	1.22	1.17	1.15	1.21	1.18	1.18
EST	.	.	.	.	.	.	.	.	.	.	.	1.36	1.35	1.39	1.52
FIN	.	.	1.97	1.89	1.85	1.56	1.59	1.50	1.49	1.50	1.40	1.40	1.42	1.35	1.37
FRA	.	.	1.73	1.69	1.62	1.75	1.91	1.78	1.79	1.65	1.62	1.57	1.54	1.53	1.53
GRC	3.57	3.88	4.00	4.22	4.08	2.95	2.39	2.14	1.87	1.78	1.71	1.52	1.62	1.58	1.68
HRV	.	.	.	.	.	.	.	.	.	.	.	.	1.23	1.34	1.28
HUN	.	.	.	.	.	.	.	.	1.08	1.22	1.21	1.30	1.36	1.42	1.46
IRL	2.42	2.40	2.29	2.29	2.29	2.15	2.09	2.08	2.17	2.05	2.07	2.11	2.20	2.38	2.53
ITA	2.00	2.09	2.13	2.11	1.87	1.66	1.65	1.61	1.57	1.49	1.50	1.40	1.41	1.42	1.35
LTU	.	.	.	.	.	.	.	.	.	.	.	0.96	0.90	0.87	0.86
LUX	1.91	1.72	1.83	2.05	1.86	1.75	1.95	2.02	2.08	2.14	2.42	2.65	2.90	2.89	2.90
LVA	.	.	.	.	.	.	.	.	.	.	.	0.89	0.81	0.78	0.91
MLT	.	.	.	.	.	.	.	.	.	.	.	2.30	2.44	2.51	2.54
NLD	1.71	1.53	1.46	1.47	1.40	1.50	1.52	1.58	1.61	1.70	1.77	1.70	1.74	1.69	1.63
NOR	2.10	1.78	1.52	1.40	1.33	1.25	1.24	1.20	1.19	1.18	1.17	1.17	1.18	1.28	1.30
POL	.	.	.	.	.	.	.	.	1.63	1.53	1.54	1.43	1.42	1.39	1.38
PRT	1.73	2.15	2.23	2.17	2.01	1.69	1.56	1.46	1.39	1.32	1.36	1.40	1.42	1.41	1.38
ROU	.	.	.	.	.	.	.	.	.	.	.	1.68	1.65	1.87	1.88
SVK	.	.	.	.	.	.	.	.	.	1.53	1.49	1.46	1.52	1.49	1.54
SVN	.	.	.	.	.	.	.	.	.	.	.	1.90	1.91	2.04	2.02
SWE	3.43	2.71	2.16	1.82	1.46	1.27	1.23	1.31	1.23	1.28	1.31	1.40	1.40	1.40	1.52

Source: IMF staff calculations.

**Annex Table 2.7. Proportionality Measure based on Ageing Report 2009**

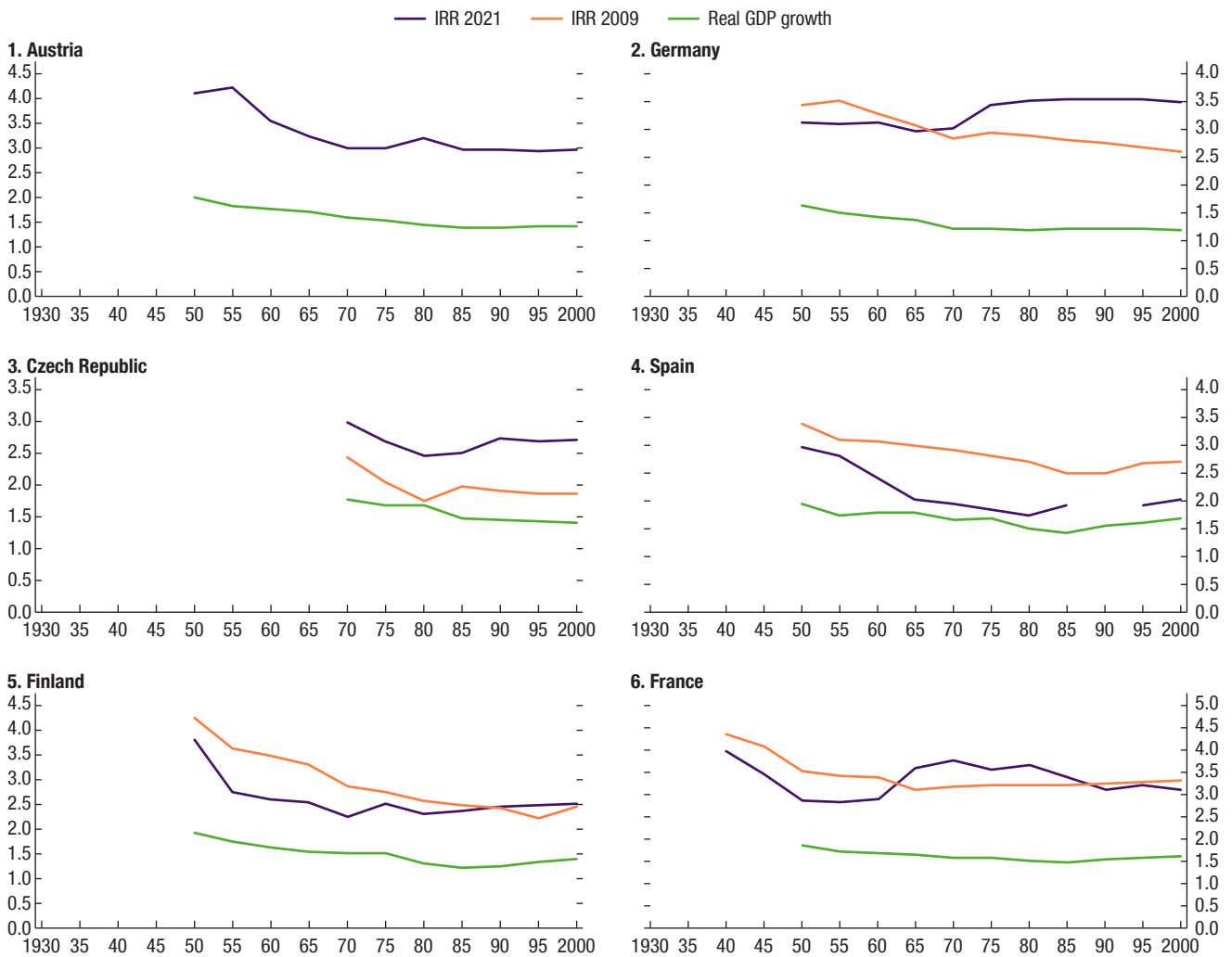
(By cohort birth year)

	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
AUT	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
BGR	.	.	.	.	.	.	.	.	.	.	.	1.58	1.48	1.50	1.48
CYP	.	.	.	.	.	.	.	.	.	.	.	3.88	4.24	4.18	4.46
CZE	.	.	.	.	.	.	.	.	.	1.17	1.16	1.31	1.33	1.33	1.33
DEU	2.02	1.97	1.84	1.61	1.68	1.79	1.77	1.73	1.66	1.73	1.74	1.72	1.71	1.70	1.68
ESP	1.33	1.20	1.15	1.13	1.14	1.11	1.18	1.27	1.36	1.44	1.49	1.44	1.46	1.56	1.56
EST	.	.	.	.	.	.	.	.	.	.	.	0.91	0.79	0.73	0.87
FIN	.	.	1.81	1.69	1.63	1.47	1.50	1.51	1.39	1.40	1.37	1.35	1.35	1.27	1.38
FRA	.	.	1.74	1.71	1.52	1.54	1.55	1.47	1.51	1.54	1.56	1.57	1.60	1.63	1.66
GRC	3.28	3.48	3.58	3.87	3.93	3.64	3.90	3.83	3.87	3.97	4.34	4.37	4.81	4.75	5.10
HRV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HUN	.	.	.	.	.	.	.	.	1.57	1.66	1.53	1.63	1.59	1.63	1.67
IRL	2.21	2.11	1.93	1.87	1.83	1.91	2.09	2.15	2.33	2.31	2.44	2.60	2.77	3.05	2.94
ITA	1.90	1.92	1.86	1.73	1.51	1.36	1.39	1.44	1.49	1.52	1.42	1.41	1.40	1.39	1.39
LTU	.	.	.	.	.	.	.	.	.	.	.	1.84	1.86	1.69	1.74
LUX	1.90	1.71	1.83	2.06	1.89	1.80	2.01	2.29	2.33	2.51	2.96	3.81	4.15	4.95	5.85
LVA	.	.	.	.	.	.	.	.	.	.	.	0.92	0.91	0.89	0.85
MLT	.	.	.	.	.	.	.	.	.	.	.	2.28	2.37	2.31	2.39
NLD	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NOR	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
POL	.	.	.	.	.	.	.	.	1.52	1.64	1.67	1.69	1.67	1.73	1.77
PRT	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ROU	.	.	.	.	.	.	.	.	.	.	.	2.64	2.72	2.50	2.49
SVK	.	.	.	.	.	.	.	.	.	2.07	2.12	2.13	2.23	2.15	2.36
SVN	.	.	.	.	.	.	.	.	.	.	.	2.24	2.22	2.20	2.29
SWE	3.54	2.86	2.36	2.07	1.73	1.66	1.61	1.71	1.70	1.62	1.73	1.70	1.68	1.58	1.72

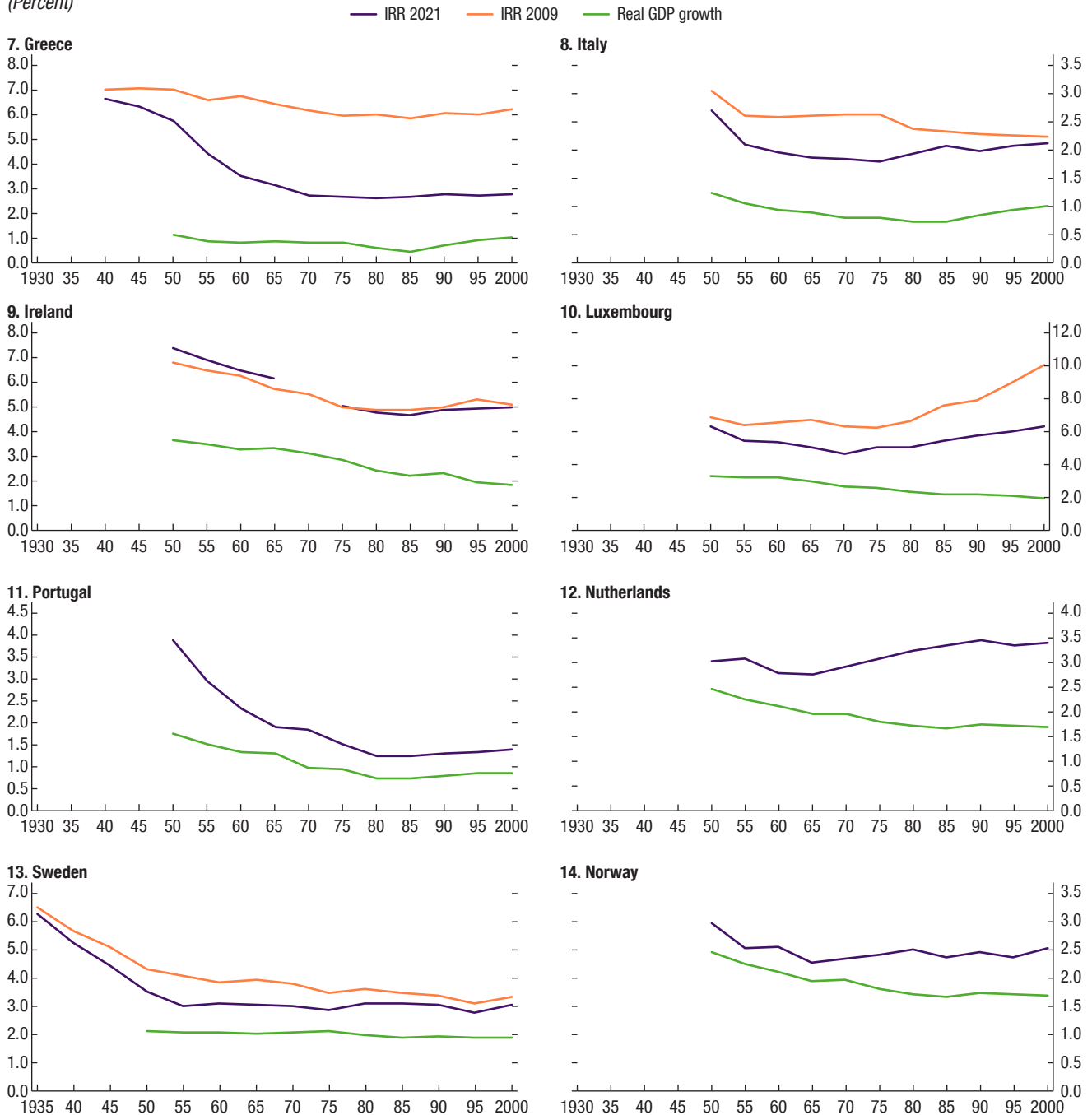
Source: IMF staff calculations.

## Annex 3. Internal Rates of Return

**Annex Figure 3.1. Real Internal Rates of Return and Real GDP Growth by Cohort Birth Year**  
(Percent)



**Annex Figure 3.1. Real Internal Rates of Return and Real GDP Growth by Cohort Birth Year (continued)**  
(Percent)



Sources: 2009, 2018, and 2021 Ageing Report; Eurostat; and IMF staff calculations.

Note: Real internal rates of return by cohort birth year. Real GDP growth rates for the same cohorts are averages calculated from the year of entrance into working life to the end of pension period.



**Annex Table 3.1. Real Internal Rates of Return based on Ageing Reports 2009, 2018, 2021**  
(Percent)

	2009						2018						2021					
	1950	1960	1970	1980	1990	2000	1950	1960	1970	1980	1990	2000	1950	1960	1970	1980	1990	2000
AUT							4.15	3.61	3.08	3.28	2.93	2.63	4.13	3.56	2.99	3.22	2.97	2.97
BGR					2.31	2.11					3.70	3.93					3.24	3.50
CYP					7.22	7.09					3.57	3.14					3.68	3.71
CZE			2.43	1.75	1.91	1.87			2.49	2.34	2.55	2.85			2.98	2.44	2.72	2.71
DEU	3.43	3.29	2.85	2.90	2.75	2.60	3.10	3.11	2.95	3.31	3.19	3.03	3.12	3.14	3.02	3.52	3.55	3.50
ESP	3.37	3.06	2.90	2.71	2.48	2.69	2.73	2.08	1.89	1.82	2.16	2.27	2.96	2.42	1.93	1.73	2.05	2.01
EST					0.38	0.59					2.21	2.49					1.67	1.91
FIN	4.26	3.49	2.87	2.58	2.43	2.45	3.86	2.73	2.40	2.29	2.46	2.38	3.80	2.61	2.25	2.32	2.45	2.52
FRA	3.51	3.38	3.17	3.21	3.23	3.33	3.22	3.51	3.26	3.07	3.02	3.00	2.85	2.89	3.77	3.65	3.12	3.10
GRC	7.03	6.76	6.20	6.05	6.10	6.25	5.42	2.96	2.25	2.21	2.39	2.63	5.77	3.55	2.72	2.64	2.77	2.77
HRV											1.92	1.93					2.66	2.46
HUN				2.92	2.63	2.60				2.19	2.42	2.54				2.78	3.27	3.40
IRL	6.79	6.26	5.50	4.89	5.00	5.11	7.29	6.19	5.21	4.33	4.21	4.62	7.39	6.45	5.75	4.77	4.90	4.96
ITA	3.06	2.59	2.64	2.37	2.28	2.25	2.69	1.94	1.80	1.92	1.98	1.91	2.71	1.97	1.83	1.94	1.99	2.12
LTU					2.72	2.15					0.64	0.69					3.55	3.89
LUX	6.87	6.53	6.29	6.63	7.91	10.08	6.44	5.77	5.50	5.58	5.91	5.54	6.31	5.37	4.65	5.04	5.75	6.28
LVA					0.45	0.27					0.78	1.03					0.60	1.11
MLT					3.65	3.49					4.53	4.31					3.99	3.76
NLD							2.89	2.80	2.79	3.15	3.19	2.95	3.02	2.79	2.91	3.23	3.45	3.39
NOR							3.15	2.64	2.38	2.25	2.22	2.44	2.97	2.56	2.35	2.51	2.47	2.53
POL			3.48	2.80	2.18	2.13			3.83	2.90	2.16	1.91			4.09	3.00	2.16	2.06
PRT							3.76	2.37	1.84	1.75	1.92	1.81	3.88	2.32	1.85	1.24	1.30	1.40
ROU					4.14	3.43					3.07	3.34					4.06	3.48
SVK				3.77	3.19	3.07				3.21	2.86	2.73				3.93	3.59	3.74
SVN					3.41	3.46					3.41	3.55					3.45	3.51
SWE	4.33	3.84	3.78	3.60	3.37	3.35	3.49	2.86	2.69	2.82	2.93	3.11	3.52	3.11	3.01	3.11	3.05	3.03

Source: IMF staff calculations.

*This page intentionally left blank*

## References

- Aaron, Henry. 1966. "The Social Insurance Paradox." *Canadian Journal of Economics and Political Science* 32 (3): 371–74.
- Adams, J. Stacy. 1963. "Towards an Understanding of Inequity." *The Journal of Abnormal and Social Psychology* 67 (5): 422–36.
- Alesina, Alberto F., Dorian Carloni, and Giampaolo Lecce. 2013. "The Electoral Consequences of Large Fiscal Adjustments." In *Fiscal Policy after the Financial Crisis*, edited by Alberto Alesina and Francesco Giavazzi, 531–70. Cambridge, MA: National Bureau of Economic Research.
- Alesina, Alberto, Carlo Favero, and Francesco Giavazzi. 2019. *Austerity: When It Works and When It Doesn't*. Princeton, NJ: Princeton University Press.
- Andrle, Michal, Shafik Hebous, Alvar Kangur, and Mehdi Raissi. 2018. "Italy: Toward a Growth-Friendly Fiscal Reform." IMF Working Paper 18/59, International Monetary Fund, Washington, DC.
- Ball, Laurence, Douglas W. Elmendorf, and N. Gregory Mankiw. 1998. "The Deficit Gamble." *Journal of Money, Credit and Banking* 30 (4): 699–720.
- Banerji, Angana, Sergejs Saksonovs, Huidan Lin, and Rodolpe Blavy. 2014. "Youth Unemployment in Advanced Economies in Europe; Searching for Solutions." IMF Staff Discussion Note 14/11, International Monetary Fund, Washington, DC.
- Barr, Nicholas, and Peter Diamond. 2008. *Reforming Pensions: Principles and Policy Choices*. Oxford: Oxford University Press.
- Barr, Nicholas, and Peter Diamond. 2010. *Pension Reform: A Short Guide*. Oxford: Oxford University Press.
- Bassanini, Andrea, and Romain Duval. 2006. "Employment Patterns in OECD Countries: Reassessing the Role of Policies and Institu-

- tions.” OECD Economics Department Working Paper 486, OECD Publishing, Paris.
- Batog, Cristina, Ernesto Crivelli, Anna Ilyina, Zoltan Jakab, Jaewoo Lee, Anvar Musayev, Iva Petrova, Alasdair Scott, Anna Shabunina, Andreas Tudyka, Xin Cindy Xu, and Ruifeng Zhang. 2019. “Demographic Headwinds in Central and Eastern Europe.” IMF Department Paper 19/12, International Monetary Fund, Washington, DC.
- Bertocchi, Graziella, Arcangelo Dimico, Francesco Lancia, and Alessa Russo. 2020. “Youth Enfranchisement, Political Responsiveness, and Education Expenditure: Evidence from the US.” *American Economic Journal: Economic Policy* 12 (3): 76–106.
- Blanchard, Olivier J., Jean-Claude Chouraqui, Robert Hagemann, and Nicola Sartor. 1990. “The Sustainability of Fiscal Policy: New Answers to an Old Question.” *OECD Economic Studies* 15: 7–36.
- Blondal, Sveinbjörn and Stefano Scarpetta. 1999. “The Retirement Decision in OECD Countries.” OECD Economics Department Working Papers No. 202.
- Brender, Adi, and Allan Drazen. 2008. “How Do Budget Deficits and Economic Growth Affect Reelection Prospects? Evidence from a Large Panel of Countries.” *American Economic Review* 98 (5): 2203–20.
- Brown, Jeffrey R., Zoran Ivković, and Scott Weisbenner. 2010. “Political Risk and Discount Rates: Evidence from the Croatian Pension System.” NBER Working Paper 10–07, National Bureau of Economic Research, Cambridge, MA.
- Börsch-Supan, Axel. 2000. “Incentive Effects of Social Security on Labor Force Participation: Evidence in Germany and Across Europe.” *Journal of Public Economics*, 78: 25–49.
- Börsch-Supan, Axel. 2006. “What Are NDC Systems? What Do They Bring to Reform Strategies?” In *Pension Reform: Issues and Prospects for Non-Financial Defined Contribution Schemes*, edited by Robert Holzmann and Edward Palmer, 35–55. Washington, DC: The World Bank.
- Börsch-Supan, Axel. 2013. “Entitlement Reforms in Europe: Policy Mixes in the Current Pension Reform Process.” In *Fiscal Policy after the Financial Crisis*, edited by Alberto Alesina and Francesco Giavazzi, 405–35. Cambridge, MA: National Bureau of Economic Research.
- Carone, Giuseppe, Per Eckefeldt, Luigi Giamboni, Veli Laine, and Stéphanie Pamiès Sumner. 2016. “Pension Reforms in the EU since the Early 2000’s: Achievements and Challenges Ahead.” European Economy Discussion Paper 42, European Commission, Brussels.

- Chen, Tingyun, Jean-Jacques Hallaert, Alexander Pitt, Haonan Qu, Maximilien Queyranne, Alaina Rhee, Anna Shabunina, Jérôme Vandenbussche, and Irene Yackovlev. 2018. "Inequality and Poverty across Generations in the European Union." IMF Staff Discussion Note 18/01, International Monetary Fund, Washington, DC.
- Clements, Benedict J., Frank Eich, and Sanjeev Gupta. 2014. *Equitable and Sustainable Pensions: Challenges and Experience*. Washington, DC: International Monetary Fund.
- Congressional Budget Office. 2019. "CBO's Long-Term Social Security Projections: Changes Since 2018 and Comparisons with the Social Security Trustees' Projections." <https://www.cbo.gov/publication/55914>.
- Crivelli, Ernesto, Sanjeev Gupta, Carlos Mulas-Granados and Carolina Correa-Caro. 2016. "Fragmented Politics and Public Debt." IMF Working Paper 16/190, International Monetary Fund, Washington, DC.
- Disney, Richard. 2004. "Are Contributions to Public Pension Programmes a Tax on Employment?" *Economic Policy* 19 (39): 267–311.
- Dolenc, Primož, and Suzana Laporšek. 2012. "Labour Taxation and its Impact on Employment Growth." *Managing Global Transitions* 10 (3): 301–18.
- European Commission. 2009. "The 2009 Ageing Report: Economic and Budgetary Projections for the EU-27 Member States (2008–2060)." European Economy 2, European Commission, Brussels.
- European Commission. 2017a. "An Evaluation of the Scale of Undeclared Work in the European Union and Its Structural Determinants: Estimates using the Labour Input Method." European Commission, Brussels.
- European Commission. 2017b. "The 2018 Ageing Report: Underlying Assumptions & Projection Methodologies." European Economy Institutional Paper 65, European Commission, Brussels.
- European Commission. 2018a. "The 2018 Ageing Report: Economic and Budgetary Projections for the 28 EU Member States (2016–2070)." European Economy Institutional Paper 79, European Commission, Brussels.
- European Commission. 2018b. "The 2018 Pension Adequacy Report: Current and Future Income Adequacy in Old Age in the EU." Volume I. Publication Office of the European Union, Luxembourg.
- European Commission. 2020. "Quarterly Report on the Euro Area." Institutional Paper 135, European Commission, Brussels.
- European Commission. 2021. "The 2021 Ageing Report: Economic and Budgetary Projections for the EU Member States (2019–2070)." European Economy Institutional Paper 148, European Commission, Brussels.

- Égert, Balázs. 2012. “The Impact of Changes in Second Pension Pillars on Public Finances in Central and Eastern Europe.” OECD Economics Department Working Paper 942, Organisation for Economic Co-operation and Development, Paris.
- European Parliament. 2007. “The Role of Minimum Income for Social Inclusion in the European Union.” Policy Department Economic and Scientific Policy, European Parliament, Brussels.
- Eurostat and European Central Bank. 2011. “Technical Compilation Guide for Pension Data in National Accounts,” Eurostat Methodologies and Working Papers, Luxembourg.
- Fornero, Elsa, and Anna Lo Prete. 2019. “Voting in the Aftermath of a Pension Reform: The Role of Financial Literacy.” *Journal of Pension Economics & Finance* 18 (1): 1–30.
- Freudenberg, Christoph, Natalie Laub, and Tim Sutor. 2018. “Pension Decrement Rates across Europe – Are They Too Low?” *The Journal of the Economics of Aging* 12: 35–45.
- Galasso, Vincenzo. 2006. *The Political Future of Social Security in Aging Societies*. Cambridge, MA: MIT Press.
- Gruber, Jonathan, and David Wise. 1998. “Social Security and Retirement: An International Comparison.” *The American Economic Review* 88 (2): 158–63.
- Gruber, Jonathan, and David Wise. 2004. *Social Security Programs and Retirement around the World*. Chicago, IL: University of Chicago Press.
- Holzmann, Robert, Edward Palmer, Robert Palacios, and Stefano Sacchi. 2020. *Progress and Challenges of Nonfinancial Defined Contribution Pension Schemes: Volume 1. Addressing Marginalization, Polarization, and the Labor Market*. Washington, DC: World Bank.
- Holzmann, Robert. 2002. “The World Bank Approach to Pension Reform.” *International Social Security Review* 53 (1): 11–34.
- International Monetary Fund (IMF). 2011. “The Challenge of Public Pension Reform in Advanced and Emerging Economies.” IMF Policy Paper, Washington, DC.
- International Monetary Fund (IMF). 2012. “Fiscal Policy and Employment in Advanced and Emerging Economies.” IMF Policy Paper, Washington, DC.
- International Monetary Fund (IMF). 2017. “Reforming the Greek Pension System.” IMF Country Report 17/41, Washington, DC.

- International Monetary Fund (IMF). 2019. "The Pension System in Luxembourg." IMF Country Report 19/131, Washington, DC.
- Jiménez-Martín, Sergi. 2014. "The Incentive Effects of Minimum Pensions: Extended Version." Working Paper 2014–04, FEDEA.
- Jordà, Òscar, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, and Alan M. Taylor. 2019. "The Rate of Return on Everything, 1870–2015." *The Quarterly Journal of Economics* 134 (3): 1225–98.
- Knell, Markus. 2005a. "Demographic Fluctuations, Sustainability Factors and Intergenerational Fairness – An Assessment of Austria's New Pension System." ONB Monetary Policy & The Economy Q1/05, Oesterreichische Nationalbank, Vienna, Austria.
- Knell, Markus. 2005b. "On the Design of Sustainable and Fair PAYG Pension Systems When Cohort Sizes Change." ONB Working Paper 95, Oesterreichische Nationalbank, Vienna, Austria.
- Knell, Markus. 2010. "How Automatic Adjustment Factors Affect the Internal Rate of Return of PAYG Pension Systems." *Journal of Pension Economics and Finance* 9 (1): 1–23.
- Kohli, Martin, and Camila Arza. 2011. "The Political Economy of Pension Reform in Europe." In *Handbook of Aging and the Social Sciences*, edited by R. H. Binstock and L. K. George, seventh edition, 251–64. San Diego, CA: Academic Press.
- Lindbeck, Assar, and Mats Persson. 2003. "The Gains from Pension Reform." *Journal of Economic Literature* XLI: 74–112.
- Mauro, Paolo, and Jing Zhou. 2020. "r-g<0: Can We Sleep More Soundly?" IMF Working Paper 20/52, International Monetary Fund, Washington, DC.
- Nickell, Stephen. 2003. "Employment and Taxes." CESifo Working Paper 1109, Center for Economic Studies and ifo Institute, Munich.
- Organisation for Economic Co-operation and Development. 2005. "Pensions at a Glance 2005: Public Policies Across OECD Countries." OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development. 2007. "Pensions at a Glance 2007: Public Policies Across OECD Countries." OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development. 2009a. "Pensions at a Glance 2009: Retirement-income Systems in OECD Countries." OECD Publishing, Paris.

- Organisation for Economic Co-operation and Development. 2009b, “The Jobs Crisis: What Are the Implications for Employment and Social Policy?” In *OECD Employment Outlook 2009: Tackling the Jobs Crisis*, 17–115. Paris: OECD Publishing.
- Organisation for Economic Co-operation and Development. 2011a, “Pensions at a Glance 2011: Retirement-income Systems in OECD and G20 Countries.” OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development. 2011b. “Taxation and Employment.” *OECD Tax Policy Studies* 21.
- Organisation for Economic Co-operation and Development. 2013. “Pensions at a Glance 2013: OECD and G20 Indicators.” OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development. 2015. “Pensions at a Glance 2015: OECD and G20 Indicators.” OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development. 2017. “Pensions at a Glance 2017: OECD and G20 Indicators.” OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development. 2019. “Pensions at a Glance 2019: OECD and G20 Indicators.” OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development. 2020. “Guidelines for the OECD Table on Social Insurance Pension Schemes (Table 2900).” OECD Publishing, Paris.
- Organisation for Economic Co-operation and Development and International Monetary Fund. 2015. “Fiscal Policy and Growth: Why, What and How?” OECD Publishing, Paris.
- Palmer, Edward, Sandra Stabina, Ingemar Svensson, and Inta Vanovska. 2006. “NDC Strategy in Latvia: Implementation and Prospects for the Future.” In *Pension Reform: Issues and Prospects for Non-Financial Defined Contribution Schemes*, edited by Robert Holzmann and Edward Palmer, 397–424.
- Queisser, Monika, and Edward Whitehouse. 2006. “Neutral or Fair? Actuarial Concepts and Pension-system Design.” OECD Social, Employment and Migration Working Paper 40, Organisation for Economic Co-operation and Development, Paris.
- Samuelson, Paul A. 1958. “An Exact Consumption-Loan Model of Interest With or Without the Social Contrivance of Money.” *Journal of Political Economy* 6: 467–82.
- Song, Zheng, Kjetil Storesletten, and Fabrizio Zilibotti. 2012. “Rotten Parents and Disciplined Children: A Politico-Economic Theory of Public Expenditure and Debt.” *Econometrica* 80 (6): 2785–803.



- Soto, Mauricio. 2017. "Pension Shock." *Finance & Development* 54 (2): 14–15.
- Szikra, Dorottya. 2018. "Reversing Privatization and Re-Nationalizing Pensions in Hungary." ESS Working Paper 66, International Labor Organization, Geneva.
- Tabellini, Guido. 1991. "The Politics of Intergenerational Redistribution." *Journal of Political Economy* 99 (2): 335–57.
- US Government Accountability Office. 2008. "Entitlement Reform Process: Other Countries' Experiences Provide Useful Insights for the United States." Report to the Committee on the Budget, US Senate, GAO-08–372, Washington, DC.
- US Social Security Administration. 2018. "Social Security Programs Throughout the World: Europe." Washington, DC.
- US Social Security Board of Trustees. 2020. "The 2020 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds." Washington, D.C.
- Velasquez, Agustin, and Svetlana Vtyurina. 2019. "How does Taxation affect Hours Worked in EU New Member States?" IMF Working Paper 19/130, International Monetary Fund, Washington, DC.
- Verbič, Miroslav, and Rok Spruk. 2019. "Political economy of pension reforms: an empirical investigation." *European Journal of Law and Economics* 47: 171–232.
- Wilke, Christina Benita. 2005. "Rates of Return of the German PAYG System – How They Can be Measured and How They Will Develop." MEA Discussion Paper Series, Munich Center for the Economics of Aging, Munich.
- Wong, Boris. 2016. "Formal Sector Labor Supply Responses to the 2008 Chilean Pension System Reform." Manuscript, University of California San Diego, San Diego, CA.
- Zimčík, Petr. 2017. "Tax Wedge in OECD Countries - A New Evidence." Organisation for Economic Co-operation and Development, Paris.