# Increasing the Retirement Age:
# Policy Effects and Underlying Mechanisms

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Online Appendix

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# A. Supplementary graphs and tables

Figure A.1: Distribution of the number of births data by year

(a) Births by month of birth

(b) Births by distance to the SRA reform
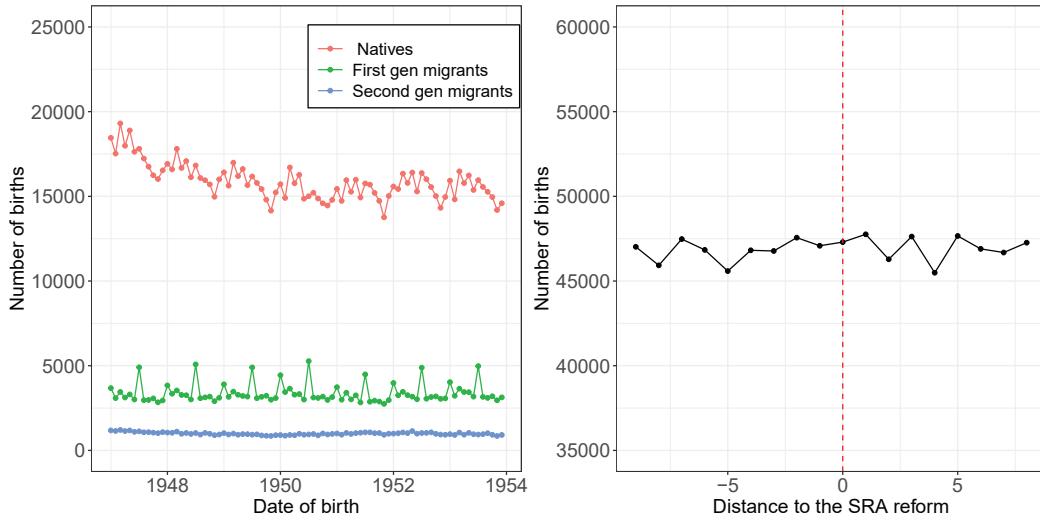


NOTE: Panel (a) presents the number of births recorded by date of birth, broken down by migration status (born in the Netherlands (and the parents as well), first and second generation migrants). Panel (b) presents the number of birth by distance to the SRA change for the pooled estimation sample (see subsection II.B for a description of the estimation samples).

Figure A.2: Balancing tests for the different estimation samples
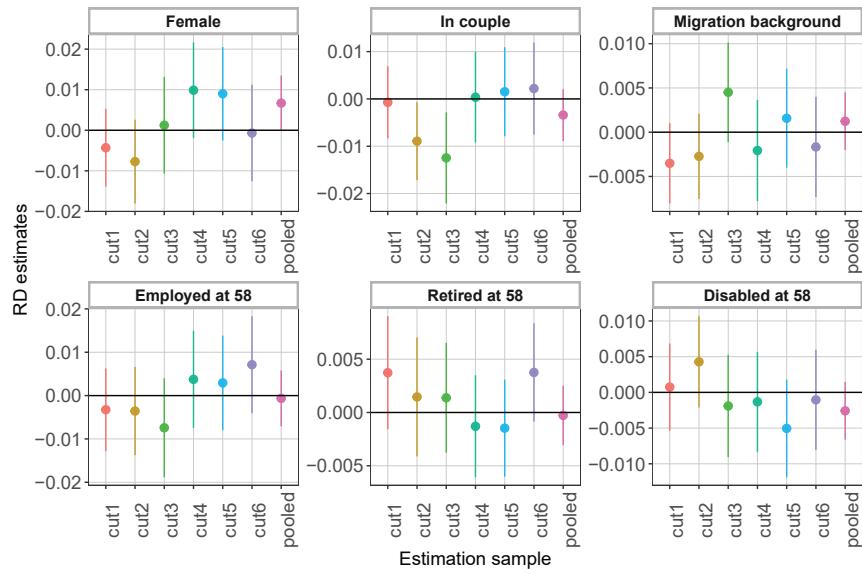


NOTE: This figure presents the $\beta$ coefficients from the estimation of equation (1) for our different estimation samples and for pre-treatment variables we do not expect to be affected by the reforms of interest. Lines around the point estimates present the 95% confidence intervals.

Figure A.3: Labor force status: alternative definition with non exclusive states
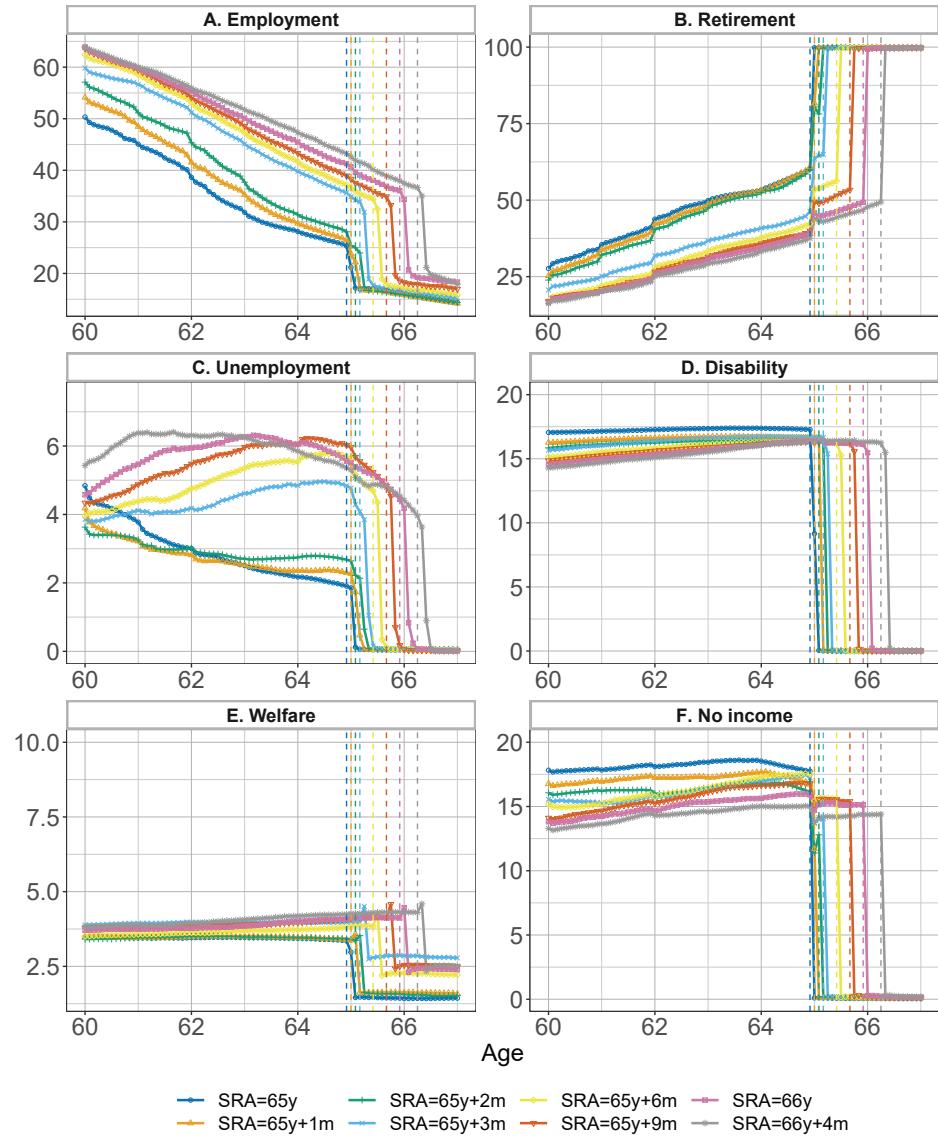


NOTES: This figure presents the average share of the population in different labor market states, by age and SRA-cohort. Individual are classified in a given category if they have a corresponding monthly income above zero.

Figure A.4: Average income amounts by age and SRA cohort
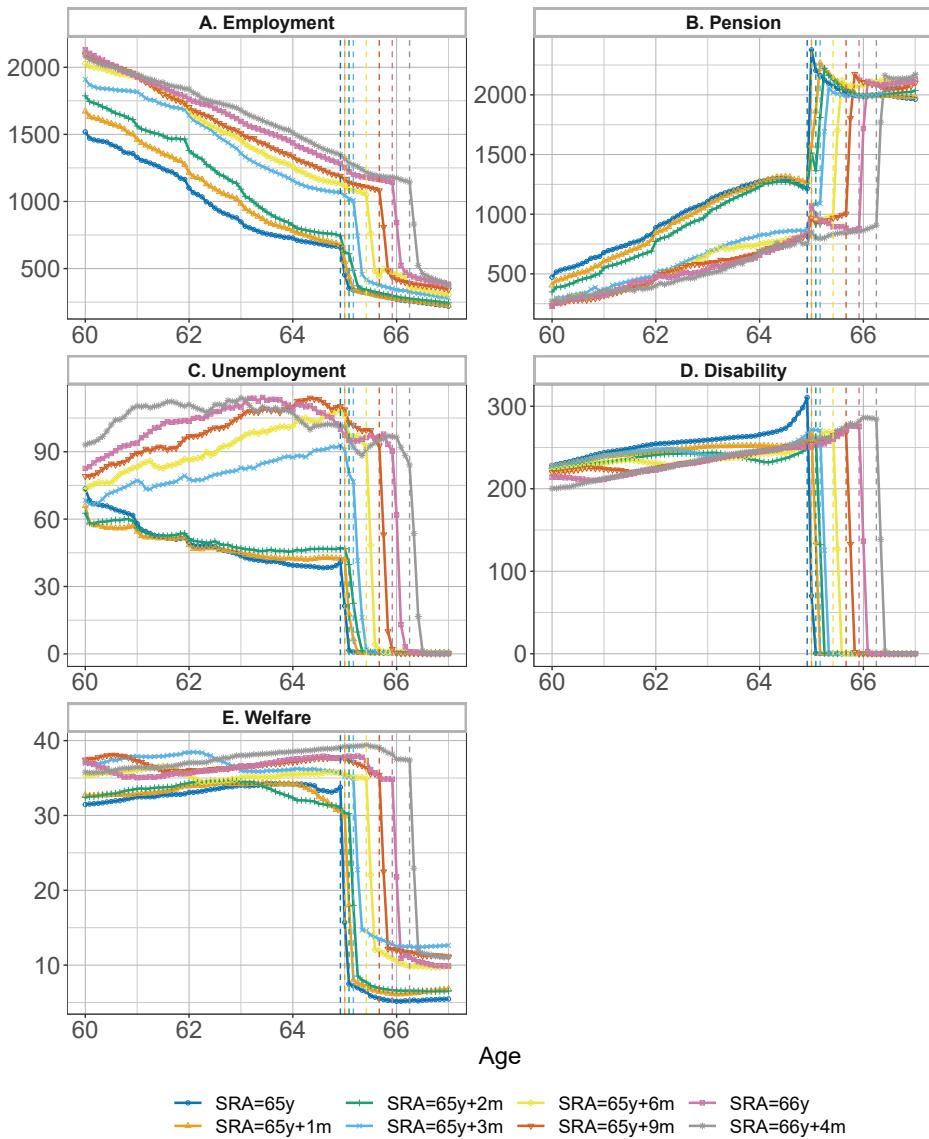
NOTES: This figure presents the average amount for different types of income, by age and SRA-cohort.

## Figure A.5: Full RD for pooled sample: sensitivity analysis



Polynomial degree used in the estimation  —●— 1  —●— 2  —●— 3
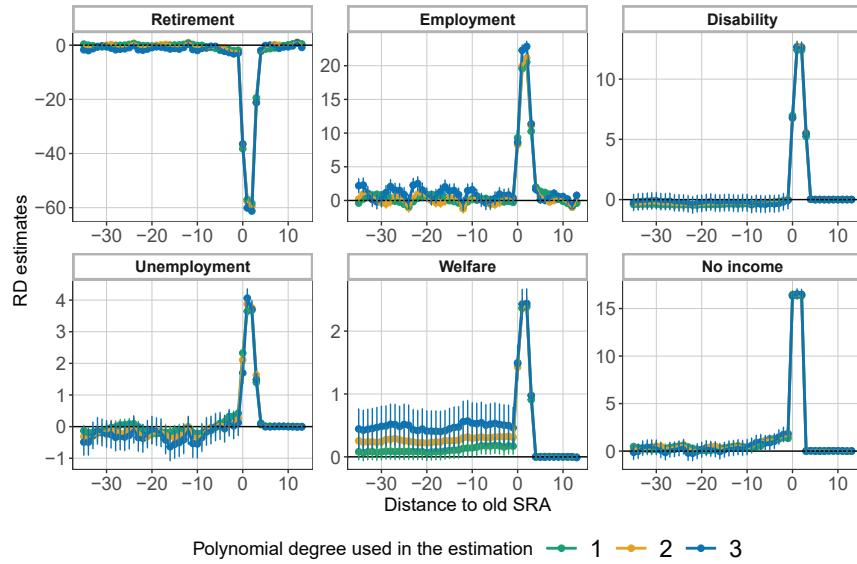
NOTES: This figure presents the estimated $\beta$ coefficients of equation (2) for the pooled RD specification, estimated separately for each month (see Figure 7), using different degrees for the polynomial fits of the control function $f()$.

## Figure A.6: Full RD for pooled sample: breakdown by cohort



—●— Cutoff 3  —●— Cutoff 4  —●— Cutoff 5
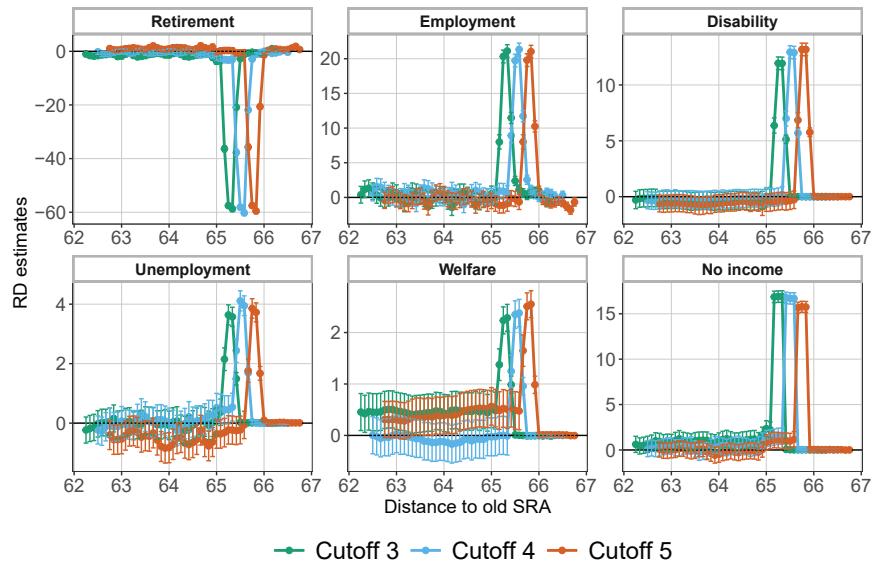
NOTES: This figure presents the estimated $\beta$ coefficients of equation (2), separately for the different cutoffs of the pooled estimation sample.

Figure A.7: Hazard rate at the SRA by sector's characteristics

(a) Hazard rate vs. steepness of the wage profile
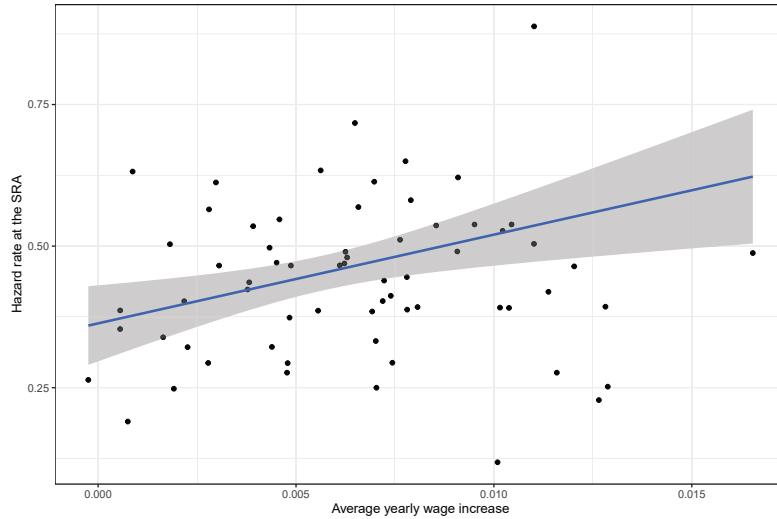


NOTES: This figure compares the hazard rate at the SRA (y axis) to the steepness of the wage profile (x axis) by sector. Both values are computed using individuals born between 1950 and 1955. Hazard rate is computed as the probability to retire at the SRA conditionally on being employed until this point. Wage profiles are computed as the yearly increase in total earnings, when individuals are between 57 and 62 of age.

(b) Hazard rate vs. impact of the 2010s crisis
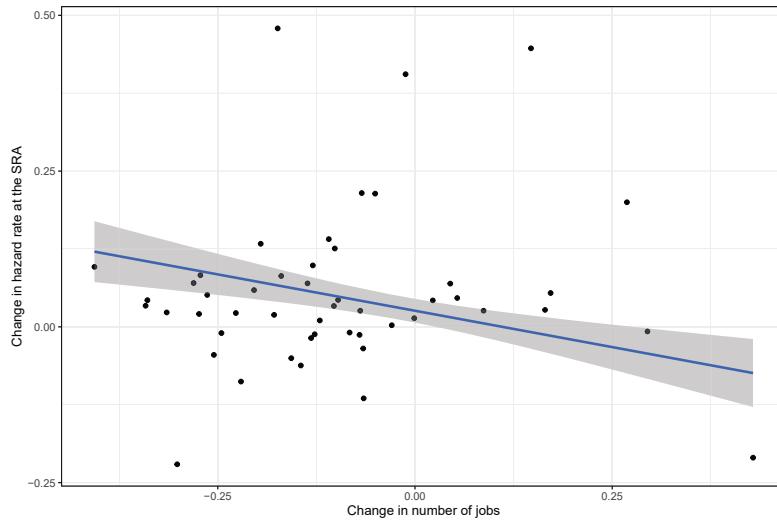


NOTES: This figure compares change in the hazard rate at the SRA (y axis) to the impact of the 2010s economic crisis (x axis) by sector. The change in the hazard rate by sector is computed as the difference between the hazard rate observed before the crisis (years 2007-2009) and at the peak of the crisis (years 2010-2013). The impact of the crisis is computed as the % change in the total number of workers below age 55 by sector, between those two periods.

Table A.1: Descriptive statistics for the different estimation samples

| Estimation sample | $C_1$ | $T_1$ and $C_2$ | $T_2$ | $C_3$ | $T_3$ and $C_4$ | $T_4$ and $C_5$ | $T_5$ and $C_6$ | $T_6$ | $C_{pooled}$ | $T_{pooled}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **SRA** | 65y | 65y+1m | 65y+2 m | 65y+3 m | 65y+6m | 65y+9m | 66y | 66y+4m | | |
| **Demographic variables** | | | | | | | | | | |
| Share female | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Share single | 0.16 | 0.16 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.18 | 0.60 | 0.61 |
| Share foreigners | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| **Employment status at 60** | | | | | | | | | | |
| Wage earners | 0.38 | 0.42 | 0.45 | 0.50 | 0.52 | 0.53 | 0.54 | 0.54 | 0.52 | 0.53 |
| Self employed | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| Unemployed | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 |
| Disabled | 0.12 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.11 | 0.11 |
| Retired | 0.17 | 0.15 | 0.13 | 0.09 | 0.07 | 0.07 | 0.06 | 0.06 | 0.07 | 0.07 |
| **Nb of obs. (in thousands)** | 213.40 | 183.07 | 177.68 | 141.31 | 139.06 | 140.71 | 143.19 | 128.96 | 421.08 | 422.96 |

NOTE: This table presents general descriptive statistics for the different estimation samples used in the analysis. $C_g$ and $T_g$ respectively refers to the control (left side of the discontinuity) and treatment group (right side of the discontinuity) for the estimation sample $g$. See subsection II.B for details on the construction of the estimation samples.

## Table A.2: Full table for robustness analysis

|  | ref | 1a | 1b | 2a | 2b | 3a | 3b | 4a | 4b | 5a | 5b |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L_emp | 0.212 | 0.205 | 0.229 | 0.211 | 0.212 | 0.222 | 0.204 | 0.210 | 0.203 | 0.212 | 0.229 |
|  | (0.003) | (0.002) | (0.004) | (0.004) | (0.002) | (0.004) | (0.003) | (0.003) | (0.005) | (0.002) | (0.003) |
| Cluster | No | No | No | No | Individual | No | No | No | No | No | No |
| Polynomial degree | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Left bandwith | 9 | 9 | 9 | 9 | 9 | 6 | 18 | 9 | 8 | 9 | 9 |
| Right bandwith | 9 | 9 | 9 | 9 | 9 | 7 | 18 | 8 | 8 | 9 | 9 |
| No. obs. | 807484 | 807484 | 807484 | 403772 | 807484 | 583010 | 524417 | 762229 | 717128 | 807484 | 807484 |

NOTES: This table presents the point estimates presented in Figure 6. It shows the treatment effect estimated with a range of alternative specifications. See the main text for a description of the different models.

## Table A.3: Full table for RD on the average retirement age

|  | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Treatment effect | 1.058 | 0.905 | 0.980 | 0.592 |
|  | (0.159) | (0.253) | (0.193) | (0.306) |
| Including missing | No | No | Yes | Yes |
| Polynomial degree | 1 | 2 | 1 | 2 |
| No. obs. | 614814 | 614814 | 844039 | 844039 |

NOTES: This table present the estimation of equation (1) for the individual retirement age, using the pooled RD estimation sample. Retirement is defined as the last age for which labor income is the main source of income. In columns (1)-(2) we keep only individuals for which we observe employment above age 57. In columns (3)-(4) we include those observations and set their individual retirement age at 57. Column (4) is the specification presented in Figure 8b.

## Table A.4: Comparison with related studies looking at average retirement age[a]

| Study | Country | Reform | Method | Results |
|---|---|---|---|---|
|  |  |  |  | Ave. retirement age per month ERA/NRA/SRA[b] |
| Mastrobuoni (2009) | USA | NRA 62 → 65 | RKD | ♂: +0.8, ♀: +0.6 |
| Manoli & Weber (2018) | AUT | ♂: ERA 60 → 62.5 | RDD, | +0.20 to +0.36 |
|  |  | ♀: ERA 55 → 58.5 | RKD | +0.39 to +0.55 |
| Lalive et al. (2019) | SWI | ♀: FRA 62 → 64 | RDD | +0.41 to +0.65 |
| This paper | NLD | SRA 65+3m → 66+4m | RDD | +0.20 |

NOTES: [a]Exact references for the values reported in this table can be found in Table A.6 in the online appendix. [b]The increase in the average retirement age per month increase in the ERA, NRA or SRA.

Table A.5: Exact references outcomes related studies in Table 6

| Study | Results | | At ERA, NRA or SRA | | |
|---|---|---|---|---|---|
| | Employment rate | Retirement rate | Employment rate | Hazard rate | Bunching |
| Staubli & Zweimüller (2013) | ♂: Table 3, column (2) | Table 3, column (2) | | Figure 4 (A) | |
| | ♀: Table 3, column (6) | Table 3, column (6) | | Figure 5 (A) | |
| Vestad (2013) | Table 2, column 'DD estimate' | × | | Figure 2 | |
| Atalay & Barrett (2015) | Table 3, column 'Full Sample' | × | | ♂: Figure 2, at age 60 | |
| Cribb et al. (2016) | Table 4 | Table 5, "Retired" | | Figure 2, age 59 | |
| De Vos et al. (2019) | Page 22 | × | | Figure 12 | |
| Rabaté & Rochut (2019) | Table 5, column 'Employment' | Table 5, column 'Retirement' | | Figure 2 (a) | |
| Geyer & Welteke (2021) | Table 1, column (1) | Table 1, column (5) | Figure 2 (A) | Figure 4 | Figure 4 |
| This paper | Table 2, column 'Employment' | Table 2, column 'Retirement' | Figure 3 | Figure 3 | Figure 3 |

Table A.6: Exact references outcomes related studies in Table A.4

| Study | Results |
|-------|---------|
| | Average retirement age |
| Mastorbuoni (2009) | ♂: Table 5, column (2), ♀: Table 5, column (2) |
| Manoli & Weber (2018) | ♂: Table 4, 'Short contribution years' |
| | ♀: Table 4, 'Short contribution years' |
| Lalive et al. (2020) | Table 4, columns (1) and (3), panel C |
| This paper | Figure 8 |

# B. Data description

We hereby present the different datasets we used in this analyses. Table B.1 below presents the version of the files we use. In the replication package made available online, we additionally provide links to the documentation by Statistics Netherlands (in Dutch) for each dataset.

### gbapersoontab[1]

Contains demographic background data (e.g. gender, year of birth, migration background) for the universe of the Dutch population, that is all persons who appear in the registered in the population register (Basic Register of Persons, BRP) since 1 October 1994.

### gbaoverlijdentab[2]

Contains the date of death of all persons who have died since 1 October 1994 and were registered in the population register (Basic Register of Persons, BRP) at the time of death. It also contains the date of death of persons who are not residents but were once residents of the Netherlands since 1 October 1994 and whose information about the death is received in the Register of Non-Residents (RNI). The main source of information for this dataset is the municipal registries (Gemeentelijke Basisadministratie Persoonsgegevens, GBA).

### gbamigratiebus[3]

Contains all migration spells for the full universe of the Dutch population (as defined in the gbapersoontab). For each immigration (resp. emigration) spell, a date of beginning and end is registered, as well as the country of origin (resp. destination). For each individual, we have as many spells as migration events occurring since 1994. The main source of information for this dataset is the municipal registries (Gemeentelijke Basisadministratie Persoonsgegevens, GBA).

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[1]Statistics Netherlands (2022a)
[2]Statistics Netherlands (2022b)
[3]Statistics Netherlands (2022c)

## gbahuishoudensbus[4]

For the full universe of the Dutch population (as defined in the gbaper-soontab), it contains information about the household composition: their place in the household, and the details of the household they belong to (e.g couple or not, married or not, with or without children, etc.). Retrospective information is available, as the data is presented as spells (one additional line when one characteristic of the household changes). The main source of information for this dataset is the municipal registries (Gemeentelijke Basisadministratie Persoonsgegevens, GBA).

## aowuitkering1atab[5]

Contains a monthly record of the old age benefits received by eligible individuals, sourced entirely from registries.

## polisbus[6] and spolisbus[7]

These datasets contain information on the full universe of job in the Netherlands, available from year 2006. There is one line by employment spells, with information on both the individual (wage, hours worked, contributions, etc) and the firm (sector, collective agreement, etc). We use these datasets in combination with the betab[8], from which we additionally obtain the Dutch standard company classification numbers (SBI).

### secm dataset

The secm datasets contain monthly information on the income receive each month from year 1999 for different types of incomes: employment wage (SECMW-ERKNDGAMNBEDRABUS[9]), profit (SECMZLFMNDBEDRAGBUS[10]), other activities (SECMOVACTMNDBEDRAGBUS[11]), unemployment benefits (SECMW-ERKLMNDBEDRAGBUS[12]), disability benefits (SECMZIEKTAOMNDBEDRAG-

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[4]Statistics Netherlands (2022d)
[5]Statistics Netherlands (2022e)
[6]Statistics Netherlands (2022f)
[7]Statistics Netherlands (2022g)
[8]Statistics Netherlands (2022h)
[9]Statistics Netherlands (2022i)
[10]Statistics Netherlands (2022j)
[11]Statistics Netherlands (2022k)
[12]Statistics Netherlands (2022l)

Table B.1: Versions of the datasets used in the analyses

| Content | Name of dataset | Source |
| --- | --- | --- |
| Date of birth and gender | GBAPERSOON2019TAB (V1) | Population registers |
| Death | GBAOVERLIJDENTAB2019TAB (V1) | Death records |
| Migration | GBAMIGRATIE2019BUSV2 (V1) | Migration records |
| Households characteristics | GBAHUISHOUDENS2019BUS (V1) | SSB |
| AOW benefits | AOWUITKERING1ATAB 2007-2020 | SSB |
| Individual income | | |
|   Wage income | SECMWERKNDGAMNBEDRABUSV20191 | SSB |
|   Profits from self-employment | SECMZLFMNDBEDRAGBUSV20191 | SSB |
|   Income from other activity | SECMOVACTMNDBEDRAGBUSV20191 | SSB |
|   Social welfare benefits | SECMBIJSTMNDBEDRAGBUSV20191 | SSB |
|   UI benefits | SECMWERKLMNDBEDRAGBUSV20191 | SSB |
|   DI and sickness benefits | SECMZIEKTAOMNDBEDRAGBUSV20191 | SSB |
|   Other social security benefits | SECMSOCVOORZOVMNDBEDRAGBUSV20191 | SSB |
|   Pension income | SECMPENSIOENMNDBEDRAGBUSV20191 | SSB |
| Activity sector | POLISBUS 2006-2009, SPOLISBUS 2010-2020 | SSB |
| Company classification | BETAB 2006-2020 | SSB |
| Wealth | VEHTAB 2006-2020 | Various |
| Reclassified identifiers | VTVTAB 2020 | SSB |

BUS[13]), other benefits (SECMSOCVOORZOVMNDBEDRAGBUS[14]) welfare (SECMBIJSTMNDBEDRAGBUS[15]) and pension income (SECMPENSIOEN-MNDBEDRAGBUS[16]).

These datasets are constructed by Statistic Netherlands using different administrative data sources (taxes, social security, pension funds). The initial form of the dataset is spell data, and contains a date of beginning, a date of end, and an associated monthly amount. A new line is added for a given individual every time the monthly amount she perceives changes. The secmbus dataset combines the different sources mentioned above in a single dataset containing the main source of income and associated amount for each spell.

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[13]Statistics Netherlands (2022m)
[14]Statistics Netherlands (2022n)
[15]Statistics Netherlands (2022o)
[16]Statistics Netherlands (2022p)

**vehtab**[17]

The vehtab data provide information about the wealth of the full universe of the Dutch household. It is available from year 2006, and contains on a yearly basis the value of asset and debt owned, for different types of wealth (e.g financial assets, business assets, housing). The vehtab data do not cover all wealth in the national accounts, as pension wealth is not included. Depending on the type of wealth, the value is either observed (from tax data) or computed by Statistic Netherlands.

**vtvtab**[18]

These data are used to obtain reclassified anonymous identifiers for individuals that are or have been observed in the municipal records.

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[17]Statistics Netherlands (2022q)
[18]Statistics Netherlands (2022r)

# References

Statistics Netherlands. Gbapersoontab: Persoonskenmerken van personen in de brp. Technical Report GBAPERSOON2020TABV3, Microdata Service of Statistics Netherlands, 2022a.

Statistics Netherlands. Gbaoverlijdentab: Datum van overlijden van personen ingeschreven in het gba. Technical Report GBAOVERLIJDENTAB2020V1, Microdata Service of Statistics Netherlands, 2022b.

Statistics Netherlands. Gbamigratiebus: Migratiekenmerken van personen. Technical Report GBAMIGRATIE2020BUSV1, Microdata Service of Statistics Netherlands, 2022c.

Statistics Netherlands. Gbahuishoudensbus: Huishoudenskenmerken. Technical Report GBAHUISHOUDENS2021BUSV1, Microdata Service of Statistics Netherlands, 2022d.

Statistics Netherlands. Aowuitkering1atab: Kenmerken van aow-uitkeringen. Technical report, Microdata Service of Statistics Netherlands, 2022e.

Statistics Netherlands. Polisbus: Polisbus:banen en lonen van werknemers in nederland. Technical Report POLISBUS, Microdata Service of Statistics Netherlands, 2022f.

Statistics Netherlands. Spolisbus: Banen en lonen volgens polisadministratie. Technical Report SPOLISBUS, Microdata Service of Statistics Netherlands, 2022g.

Statistics Netherlands. Betab: Activiteiten en grootteklasse van bedrijven. Technical report, Microdata Service of Statistics Netherlands, 2022h.

Statistics Netherlands. secmwerkndgamndbedragbus: Personen met loon maand. Technical Report SECMWERKNDGAMNBEDRABUSV20201, Microdata Service of Statistics Netherlands, 2022i.

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Statistics Netherlands. Secmovactmndbedragbus: Personen overige arbeid. Technical Report SECMOVACTMNDBEDRAGBUSV20201, Microdata Service of Statistics Netherlands, 2022k.

Statistics Netherlands. Secmbijstmndbedragbus: Personen bijstand verslagmaand. Technical Report SECMBIJSTMNDBEDRAGBUSV20201, Microdata Service of Statistics Netherlands, 2022l.

Statistics Netherlands. Secmwerklmndbedragbus: Personen werkloosheidsuitkering. Technical Report SECMWERKLMNDBEDRAGBUSV20201, Microdata Service of Statistics Netherlands, 2022m.

Statistics Netherlands. Secmziekteaomndbedragbus: Personen uitkering bij ziekte. Technical Report SECMZIEKTAOMNDBEDRAGBUSV20201, Microdata Service of Statistics Netherlands, 2022n.

Statistics Netherlands. Secmsocvoorzovmndbedragbus: Soc. econ. cat. ov. soc voorzien. Technical Report SECMSOCVOORZOVMNDBEDRAGBUSV20201, Microdata Service of Statistics Netherlands, 2022o.

Statistics Netherlands. Secmpensioenmndbedragbus: Personen met pensioenbedragen. Technical Report SECMPENSIOENMNDBEDRAGBUSV20201, Microdata Service of Statistics Netherlands, 2022p.

Statistics Netherlands. Vehtab: Vermogens van huishoudens. Technical report, Microdata Service of Statistics Netherlands, 2022q.

Statistics Netherlands. vtvpersoontab: Volgtijdelijk vergelijkbare persoon_id's van personen. Technical Report VTVPERSOONTABV20201, Microdata Service of Statistics Netherlands, 2022r.