THE EFFECTS OF PENSION REFORMS ON THE INCOME DISTRIBUTION OF RETIREES

INTRODUCTION AND SUMMARY

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ABSTRACT

The *International Social Security (ISS) project* compares the experiences of a dozen developed countries to study *Social Security Programs and Retirement Around the World.* The project was launched in the mid 1990s and was motivated by decades of decline in the labor force participation rate of older men. The first phases of the project documented that social security program provisions can create powerful incentives for retirement that are strongly correlated with the labor force behavior of older workers. Since then, countries have undertaken numerous reforms of their social security programs, disability programs, and other public benefit programs available to older workers. In a second stage of this project, we found that these reforms substantially reduced the implicit tax on work at older ages and that stronger financial incentives to work were positively correlated with labor force participation at older ages. In a third stage, we exploited time-series and cross-national variation in the timing and extent of reforms of retirement incentives and employed micro-econometric methods in order to show that the rising participation rates since the end of the 1990s have been caused by the pension reforms, in particular by the sharply increased financial incentives to work at older ages.

The pension reforms from the 1980s through 2020 may therefore be celebrated as a success story in fostering old-age labor force participation, which is important in the face of rapid demographic aging. However, there may be negative side effects. The main question to be answered by this eleventh phase of the project is whether the reforms have increased income and wealth inequality for retirees by harming low-income workers who cannot offset benefit cuts by saving and cannot work longer due to bad health. Based on a counterfactual analysis that employed structural retirement models to draw causal inference, our main conclusion is that income inequality among retirees has not generally increased due to the reforms. In six of the ten countries in this study, pension reform actually decreased income inequality.

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1. Project Overview

Over its twenty-five year history, the International Social Security (ISS) project has used the vast differences in social security programs across countries as a natural laboratory to study the effects of retirement program provisions on the labor force participation of older persons and other questions related to the older workforce. Motivated by the decline in older men's labor force participation during the 20th century and the possibility that the spread of public pensions contributed to this development, the project's early analyses (Gruber and Wise, 1999, 2004, and 2007) documented the strong relationship across countries between social security incentives and older men's labor force participation that existed in the late 1990s, confirmed this relationship in microeconomic analysis, and estimated the labor market and fiscal implications of social security reforms. Later volumes have examined the relationship between disability insurance program provisions, health, and retirement (Wise, 2012 and 2016) and explored whether older employment affects youth unemployment (Gruber and Wise, 2010) and whether older workers are healthy enough to work longer (Wise, 2017).

Since the project's inception, there has been a remarkable reversal of employment trends, with astonishing increases in employment at older ages for both men and women in all of the ISS countries. More recent phases of the ISS project have therefore examined potential explanations for these changes in behavior. The volume edited by Coile, Milligan, and Wise (2019) examined cohort changes in health and education. The main finding was a surprisingly weak correlation between the development of old-age labor force participation and factors such as cohort changes in health and education.

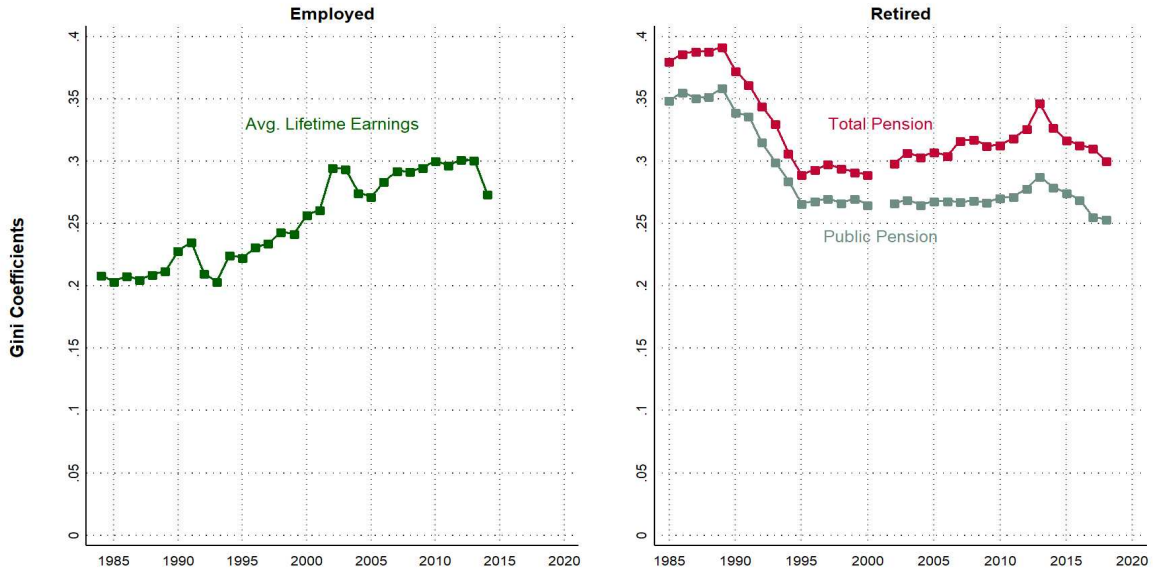
The most recent volumes (Börsch-Supan and Coile, 2020 and 2025) documented the evolution of financial incentives to work at older ages from 1980 to the present in the wake of the pension reforms that most countries enacted since the late 1990s. The main finding was a strong correlation between changes in financial incentives and changes in old-age labor force participation. By exploiting the cross-country differences in social security policy across the participating countries and the inter-temporal changes in policy that have been adopted within these countries over almost four decades, we could show that the increase in labor force participation among older individuals was causally related to the stronger financial incentives to working longer.

While this may be seen as a great success of economic policy that strengthens old-age labor force participation in times of rapid demographic aging, there may be negative side effects. This is the topic of this volume. We are especially interested in studying whether the nature of the reforms (e.g., the way in which a benefit formula was changed) led to bigger impacts on low-income vs. high-income retirees. Moreover, one might suspect that workers with low earnings suffer more from benefit cuts than workers with high earnings since low-

earnings workers had fewer opportunities to accumulate savings that could compensate for benefit cuts. Low earnings workers may also be harmed more by increases in the statutory retirement age since low earnings are generally correlated with worse health. Workers with bad health may then be forced to retire before the statutory retirement age which generally implies lower pension benefits. Hence, the reforms may have increased income and wealth inequality for older individuals.

Put more precisely, the research questions in this volume are whether inequality for retirees increased by more than it did for employees, and if so, whether this was caused by pension reform. Evidence drawn from readily available data does not provide a clear picture. Most countries have experienced an increase in earnings inequality from the mid-1980s to the 2020s. See the left panel in Figure 1, which presents the development of the Gini coefficients[1] over time for Germany. We see the same development for workers in the Netherlands and the UK, while earnings inequality remained flat in Japan and slightly declined in Belgium (see the country chapters). The inequality of pension income, however, *declined* in all of these five countries. The right panel of Figure 1 shows again Germany as an example. This is a surprising result worth digging deeper.

Figure 1: Inequality of earnings and pension benefits in Germany, 1985-2020



Source: German Socio-Economic Panel (SOEP). Total pension income includes public and occupational pensions.

[1] The Gini coefficient is defined as follows: A value of 0 implies that the wealth is evenly distributed across all individuals, a value of 1 that one individual of the sample owns all financial assets. Hence, the closer the Gini coefficient gets to 1, the more unequal wealth is distributed.

In the analyses presented in the country chapters, we employ microdata to determine whether this relative decline in pension inequality can also be observed in more detailed data and use counterfactual simulations as key instruments to establish whether it was caused by the pension reforms. These simulations predict how pension benefits had developed if these reforms had not taken place, compared to the actual development of pension benefits. The simulations require structural models of retirement behavior, which are in the core of the country chapters in this volume.

An important goal of the project is to present results that are as comparable as possible across countries. Thus, while model estimation and analyses were conducted for each country by analysts in that country, the papers are prepared according to a detailed template that we developed in close consultation with country participants. The country teams are:

Belgium	Giulia Klinges, Alain Jousten and Mathieu Lefèbvre
Canada	Kevin Milligan and Tammy Schirle
Denmark	Paul Bingley, Nabanita Datta Gupta, Malene Kallestrup-Lamb, and Alexander O.K. Marin
France	Antoine Bozio, Maxime Tô and Julie Tréguier
Germany	Axel Börsch-Supan, Johannes Rausch and Luca Salerno
Italy	Agar Brugiavini, Raluca Elena Buia, Giacomo Pasini, and Guglielmo Weber
Japan	Takashi Oshio, Satoshi Shimizutani and Akiko Oishi
Netherlands	Adriaan Kalwij, and Arie Kapteyn
Spain	Cristina Bellés-Obrero, Manuel Flores, Pilar García-Gómez, Sergi Jiménez-Martín, and Judit Vall-Castelló
United Kingdom	James Banks, Carl Emmerson and David Sturrock

The selection of these countries at the start of the project was guided by four main criteria. On the one hand, they should represent different pension systems that have emerged from diverse cultural-historical backgrounds and have experienced substantial reforms over the recent three decades. On the other hand, the countries should be comparable with regard to stages of the demographic transition and of economic development with its associated job composition and quality of work. Third, the countries were selected by the quality of the data that is required to precisely describe the incentives exerted by their pension systems and measure them over a relatively long time horizon, spanning the period during and after significant pension reforms. Fourth and maybe most importantly, the ten countries have excellent research teams well experienced in this type of analyses.

The sequel of this introductory presents our methodology and summarizes our main results. The country papers themselves present much more detail for each country and, in addition to the common analyses performed by all countries, often present country-specific analysis relevant to each particular country.

2. Common methodology

2.1 Data

All our work is based on microdata drawn from national surveys. Table 1 presents the main datasets in each country with the years covered and the number of individuals.

Table 1: Data sources

Country	Dataset names	Years covered	Number of individuals
Belgium	Survey of Health, Ageing and Retirement in Europe (SHARE)	2004-2020	1,422
Canada	Longitudinal Administrative Databank (LAD)	1982-2019	1,666,005
Denmark	Register data	1985-2022	1,144,799
France	Echantillon Interregime des Cotisants (EIC) 2017 and the Echantillon Interregime des Retraites (EIR) 2016	1988-2016	26,269
Germany	German Socio-Economic Panel (SOEP)	1984-2020	5,648
Italy	Survey of Health, Ageing and Retirement in Europe (SHARE) and Archive of Italian National Institute of Social Security (INPS)	2004-2020	3,883
Japan	The Longitudinal Survey of Middle-Aged and Older Adults (LSMOA) and Comprehensive Survey of Living Conditions (CSLC)	1986-2019	196,375
Nether-lands	Register data Statistics Netherlands	2011-2021	31 million
Spain	Survey of Health, Ageing and Retirement in Europe (SHARE) and Muestra Continua de Vidas Laborales (MCVL)	2004-2020	9,763
United Kingdom	English Longitudinal Study of Ageing (ELSA)	2002-2019	7,847

While individual respondents are our decision unit, we recognize that retirement decisions, life expectancy and other factors are likely influenced by the household context. This is particularly relevant for income. Where partner information is available, we combine

both partners' income and divide the total by 1.7, using the OECD equivalence scale.[2] We do not factor in children, as our sample primarily consists of individuals aged 50 and older, and their children typically are independent and no longer reside with them.

2.2 Key variables

Average lifetime earnings of employees: For employees, we construct average lifetime earnings (ALTE), which we estimate by predicting individual earnings histories and calculating the mean across all periods during which individuals contributed to the pension system. ALTE thus provides an average measure of earnings independent of the time spent in the pension system. We use Mincer-type equations such as

$$Y_{it} = \alpha + \beta_1 age_{it} + \beta_2 age_{it}^2 + \beta_3 exp_{it} + \beta_4 exp_{it}^2 + \beta_5 exp_{it} * educ_i + \beta_6 parttime_{it} + a_i + u_{it}$$

This model incorporates quadratic terms in both age and experience, an interaction effect between experience and education, as well as a dummy variable indicating part-time employment status. The fixed effects comprehensively account for constant, individual-specific attributes.

As elaborated in our previous work, our predictions yield declining earnings profiles in the latter stages of individual's working lives. However, given empirical indications of relatively steady earnings profiles towards the end of the career, we assume flat profiles following the earnings peak of individuals.

Lifetime benefits of retirees: Based on the earnings data, we compute expected lifetime pension benefits with the help of a simulation model that allows us to predict benefits with and without the pension reforms that took place since the 1980s. This simulation model has two elements. The first element summarizes lifetime pension benefits for a given retirement age in the form of the so-called **social security wealth (SSW)**. SSW measures the expected sum of benefits from retirement to end of life, properly discounted. We calculate it based on expected net pension benefits, the probability of retiring at a specific age, and survival probabilities. Expectations are taken at age 60. The definition of retirement is based on benefit receipt. In most Continental European countries, this coincides with labor market exit. In other countries (e.g. the UK) we also consider overlaps between work and benefit receipt.

Social security wealth for individual *i* at planning age *S* is defined as:

$$SSW_k(R,i) = \sum_{t=R}^{T} B_{t,k}(R,i) \cdot \sigma_{S,t}(i) \cdot \beta^{t-S} - \sum_{t=S}^{R-1} c_t \cdot Y_t(i) \cdot \sigma_{S,t}(i) \cdot \beta^{t-S}$$

with

[2] The "old" OECD equivalence scale values the first household member with 1, each additional member of age 14 and above with 0.7 and each member below age 14 with 0.5.

R: benefit claiming age

T: maximum life length

k: pathway to retirement

$Y_t(i)$: gross labor income at age t

$B_{t,k}(R,i)$: net benefits from pathway k at age t for benefit claiming age R and legal situation l

c_t: contribution rate to pension and unemployment system at age t for legal situation l

$\sigma_{S,t}(i)$: probability to survive at least until age *t* given survival until age S

β: discount factor $1/(1+r)$.

Pathways to retirement are country-specific and have different benefits and eligibility ages. They may include regular old-age pensions at the statutory eligibility age, various types of early-retirement pensions, disability pensions, and unemployment benefits. In order to compute the expected retirement age and pension benefit we aggregate over all applicable pathways and weigh each pathway with its population share. These weights change over time.

Social security wealth does not only capture the level of benefits but also life expectancy and hence the duration of benefit receipt. It therefore also captures when pension reforms have cut benefits and have increased retirement ages in the same metric. An important aspect to consider here are the large differences of life expectancy by socio-economic status. The country chapters use different data sources to compute survival probabilities by tercile, quartile or decile of average lifetime earnings, depending on the richness of the available data.

Retirement probabilities: The second element of the simulation model is the determination of the retirement age chosen by each worker. This is important since the effects of pension reforms on inequality are likely to depend on their effects on the retirement age. This particularly salient because low-earnings workers tend to have a lower life expectancy than high-earnings workers, such that they are more sensitive to a reduction in the duration of benefit receipt.

The design and the estimation of this retirement model follows our earlier work (Börsch-Supan and Coile 2025). The outcome variable is labor force participation status (*LFP*) in old age. It takes the value 0 when the individual is in the labor force, and value 1 when she is retired. We consider retirement as an absorbing state, implying that individuals are kept in the regression sample only until their first observation in retirement. Subsequently, they are dropped from the sample.

Our main explanatory variable is the incentive variable *implicit tax on working longer (ITAX)*. It describes how an individual's social security wealth would have changed if the individual were to work one year longer rather than to retire immediately. Delaying retirement

by one year results in increased contributions to the pension system, which increases future benefits. This will have a positive effect, while, in contrast, receiving pension benefits for one year less has a negative effect on social security wealth, as does paying one more year of payroll taxes. Our previous work has shown, that the latter effect dominates the former effect in most cases. Hence, after dividing the resulting change in social security wealth by the last earnings, we call this ratio the implicit tax on working longer.

Exogenous variation is needed to causally estimate the retirement probabilities in dependence on financial incentives. Following our earlier work, we use the pension reforms as instruments. The econometric analysis is based on random effects probit models of the following type:

$$P(LFP = 1|ITAX, X) = \Phi(\beta_0 + \beta_1 * ITAX + \beta_2 * EEA + \beta_3 * SEA + \gamma' X)$$

where EEA is a dummy variable indicating whether the individual has reached their earliest eligibility age and SEA is a dummy variable for reaching the statutory eligibility age. X is a vector of control variables such as a set of age dummies, education, occupation, health, home ownership and a part time indicator. Φ represents the cumulative distribution function of the standard normal distribution.

We compute two versions of retirement probabilities. The baseline version takes all explanatory variables as measured in the sample

$$LFP_{it}^{baseline} = f(ITAX_{it}, EEA_{it}, SEA_{it}, X_{it})$$

while the second version replaces ITAX and the statutory eligibility ages by the ITAX value, EEA, and SEA that the individual would have experienced under the rules in existence in the 1980s.

$$LFP_{it}^{1980} = f\left(ITAX_{i,1980}, EEA_{i,1980}, SEA_{i,1980}, X_{it}\right)$$

which we refer to as counterfactual retirement probabilities.

2.3 Counterfactual analyses

Our key methodology to detect causal effects of the reforms on income inequality are counterfactual simulations in which we predict how pension income had developed if no reforms had taken place, compared to the actual development of pension income. All chapters in this volume follow the same four steps: first compute how pension benefits changed due to the reforms, then compute how financial incentives changed during the reform process and how this affected retirement probabilities, assemble these two ingredients to compute SSW, and finally compare the distribution of SSW and its development over time with the distribution of ALTE. We present three scenarios that either differ in financial incentives or in retirement probabilities:

1. **With-reforms**: This corresponds to the benefits and financial incentives with their associated retirement probabilities as they actually evolved over time, i.e., including all the reforms that were implemented since 1980.
2. **Without-reforms I (mechanical effect only)**: In this scenario, we compute the pension benefits as if the reforms had never happened but take the observed retirement behavior as given. In other words, we ignore a potentially different retirement behavior that could have occurred in the absence of reforms.
3. **Without-reforms II (total effect)**: In this scenario, we compute benefits *and* financial incentives as if the reforms had never happened. In other words, we also calculate counterfactual retirement probabilities that reflect retirement behavior in the absence of reforms.

We call the difference between (1) and (2) the *mechanical effect*. Here we are only interested in how benefits and social security wealth would have been if they were calculated under the old legislation but leave out behavioral responses to reforms. The difference between (2) and (3) is the *behavioral effect*, i.e., the response in the choice of retirement age. The difference between (1) and (3) is the *total effect*, including these behavioral responses. Note that only (1) is actually observed while (2) and (3) are counterfactual.

3. Summary of results and conclusions

Based on the counterfactual analyses, our main conclusion is that income inequality among retirees has not generally increased due to the reforms. Rather, we arrive at a very heterogeneous picture across the ten countries involved in this study. In six of these countries, pension reform actually decreased income inequality. In three, the reforms were clearly regressive, in one only slightly so.

In ***Belgium***, the first decile's SSW increases slightly, while the upper deciles' SSW decreases, such that the reforms lead to a reduction in inequality.

In ***Canada***, the reforms have similarly produced greater SSW among individuals from lower deciles. The redistributive effect of the induced retirement changes was fairly small, however, as the actuarial adjustments brought the system closer to actuarial fairness.

In ***Denmark***, raising the eligibility age reduced SSW for lower income groups, while increasing it for the highest income groups due to longer life expectancies and greater capacity to delay retirement.

In ***France***, the reforms had an overall regressive impact, reducing SSW more significantly for lower lifetime earnings deciles than for higher ones. This effect was particularly pronounced for men.

In ***Germany***, our analysis reveals that the aggregate impact of pension reforms has led to an increase in inequality in terms of social security wealth between the 1990s and 2000s

and decreased inequality thereafter. The decrease in inequality is driven by social assistance being a lower bound for benefit size and only partially by pension reforms that affect income groups differently.

In ***Italy***, the 2011 reform negatively affected to a larger extent individuals with larger income, leading to a slight decline in the inequality of SSW relative to the past. It is important to note that this upholds even when considering the different survival probabilities between high and low income.

In ***Japan***, we found that SSW declined for all groups after the social security reforms to reduce generosity; however, the negative impact was larger for higher-income individuals in both absolute and relative terms. The recent less generous social security program has therefore enhanced its redistributive function.

In the ***Netherlands***, inequality among workers has increased while there is no evidence for an increase of the inequality in SSW as a response to a later retirement age.

In ***Spain***, all pension recipients benefited from the reforms as their benefits were about nine percent higher compared to the 1985 system. However, these numbers mask striking differences across income quartiles with a strong income gradient: the richest quartiles have benefitted the most for both men and women.

In the ***UK***, despite a lower Gini coefficient for SSW compared to earnings, we calculate that there is slightly more inequality in SSW between high and low earning men than there would have been under the 1979 system, mainly due to the indexation of the state pension.

While these results appear very heterogeneous, there are three clear patterns. First, in all countries, we find that the behavioral effect is much smaller than the mechanical effect. Hence, the overall redistributive effect of the induced retirement changes was fairly small and led to little or no change in countries where this was the only reform (e.g. in the Netherlands or the UK). Second, if there are large redistributive effects, they have been generated by changes in the level of benefits. They varied strongly across countries. In countries, in which benefits were cut uniformly across all income groups, lower income retirees suffered more than wealthier ones due to their shorter life span. This effect dominates e.g. in Denmark and France. In Spain, where benefits actually rose, the wealthier anyway profited more than the poorer. Third, some countries combined across-the-board benefit cuts with new programs supporting poorer retirees, e.g. Belgium and Germany. This lead to a reduction of SSW inequality in these countries.

In summary, we do not find that increases in the retirement age had large redistributive effects, but that across-the-board benefits cuts increased income inequality among retirees unless they were compensated for by special assistance programs.

In this volume, we have focused on only one dimension of inequality, SSW inequality at older ages, while old-age pension reforms may have consequences on other dimensions of individual well-being. For example, pension reforms that increased the retirement age, by limiting early retirement and encouraging later retirement, may have adversely affect the health of low-skilled workers engaged in physically demanding jobs. These workers could face increased health risks and potentially even higher mortality rates. Our future work will assess the differential impact of these reforms on the health of workers across socioeconomic groups.