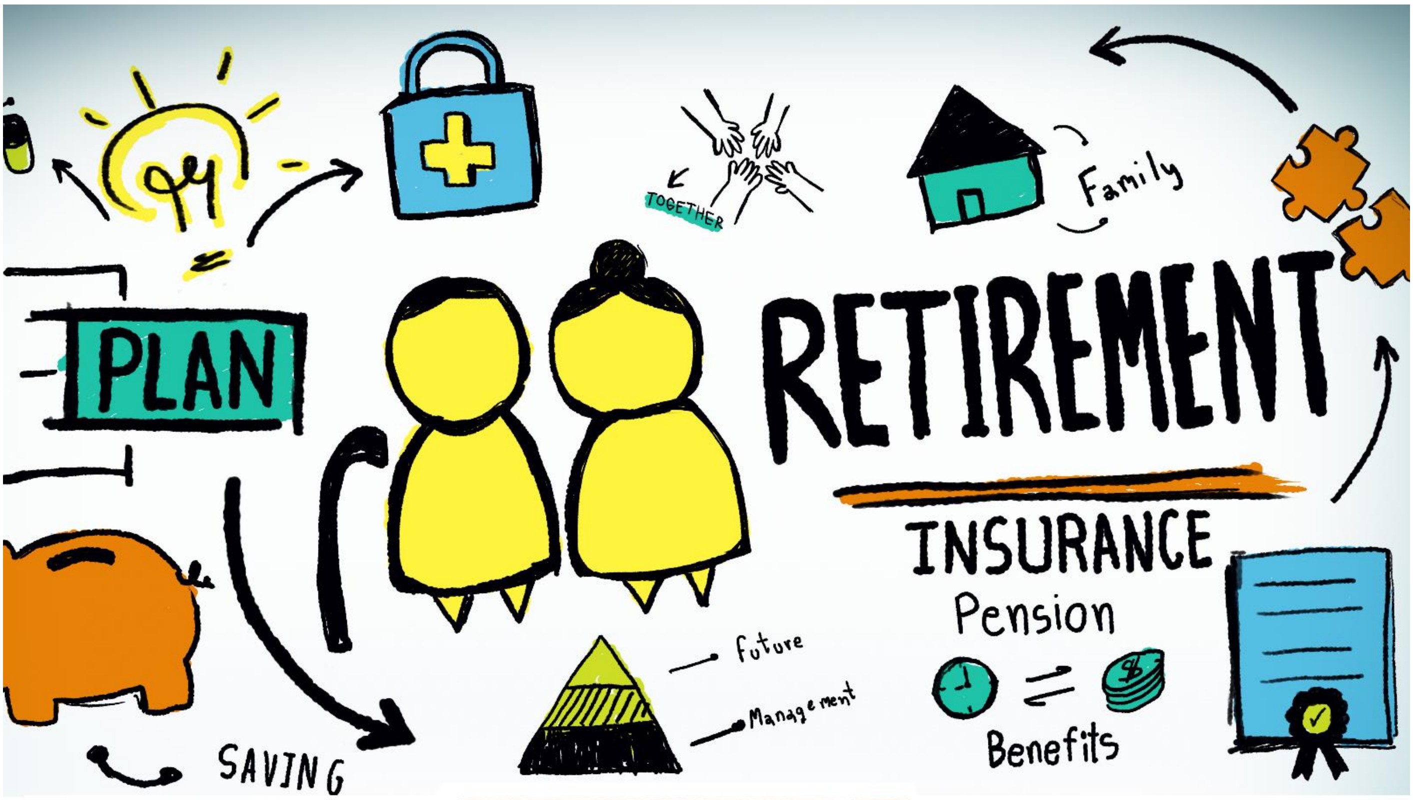
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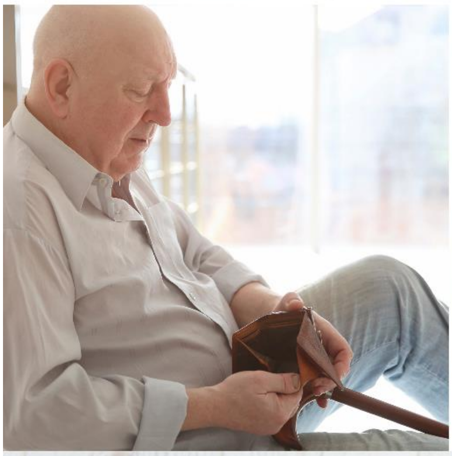

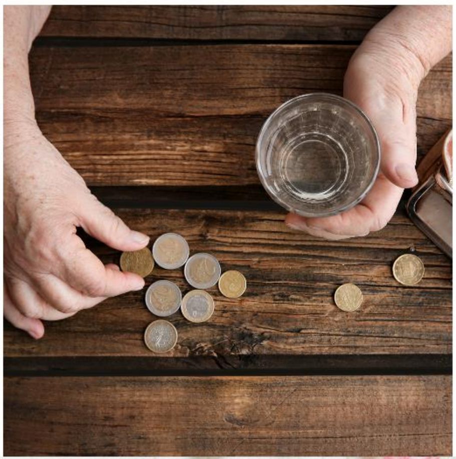

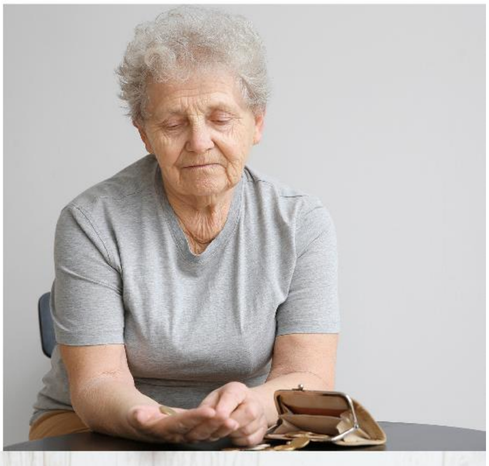

THE EFFECTS OF LONGEVITY ON FINANCIAL VULNERABILITY

Research Challenge Technical Report

Magda Malec
Krzysztof Makarski
Joanna Tyrowicz

THINK FORWARD INITIATIVE

HAPPILLY EVER AFTER… OR UNTIL WE RUN OUT OF MONEY. EFFECTS OF LONGEVITY ON FINANCIAL VULNERABILITY [*]

TECHNICAL REPORT

Magda Malec, Krzysztof Makarski and Joanna Tyrowicz [†]

March 2018

Living longer sounds good news, but it brings about important challenges. This study estimates the effects of longer life expectancy on future poverty and inequality in 6 Central European countries, in which the pension systems were reformed into a defined contribution scheme. Since lower pensions are expected under this new pension system, incentives for additional savings should arise among the working population of today to finance their retirement. The results suggest, however, that many individuals will not foresee or will not be able to do so. Savings will not increase enough, income and consumption inequality will grow and, poverty rates could double when the generation of Millennials retires. Fostering access to saving instruments could then help reducing poverty and wealth inequality in the future.

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[*] This report has been prepared by the authors for the Think Forward Initiative – Research Challenge.

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1. Introduction

Living longer sounds good news, but it brings about important challenges. We all think that we are cautious and take proper care of our relatives and our own future. People make precautionary savings and employ various strategies to make sure they are not out of money when the situation becomes dire. Choices differ between people, depending on financial situation, degree of optimism and attitude towards risk, but we all like to think we came up with a smart way to secure our future.

However, a high fraction of elderly individuals cannot afford necessary out-of-pocket health expenditure towards the end of their life. As argued by Marshal et al. (2011), the elderly from the bottom quartile of income have out-of-pocket expenditure by roughly 30% lower than the median. Since the out-of-pocket expenditures cover items such as prescription drugs, home health care and helpers and physiotherapy, all of which were shown to have substantial effect on longevity (Hemmelgarn et al. 2007, Mohile et al. 2015, Lilley et al. 2016).

How to make the right decision? One way to think about it is to take into account life expectancy: how much longer is my individual birth cohort expected to live? However, with growing longevity, the life expectancy as observed among current elderly individuals substantially understates the life expectancy to be experienced by current young and middle-aged individuals. Within the horizon of the coming 20 years, an average 65 year old will expect to live for 5-7 years longer than a person who turns 65 currently, often in good health. This impressive increase in life expectancy at older ages comes also with improved health and thus potentially brings about quality years of life.

Obviously, unless we are able to fully internalize the consequences of increased longevity, we are all running the risk of saving too little. After all, living 5 years longer than our grandparents is roughly 30% longer retirement period than they had a chance to experience! Consequently, longevity increases financial vulnerability of the elderly: if savings are insufficient to supplement consumption after leaving the labour market, as we age, we run a greater risk of old-age poverty.

This risk will be more acute in the case of countries which implemented a defined contribution pension system. Many Central and Eastern European countries implemented in late 1990s or early 2000s a pension system reform which yields substantially lower pension benefits, relative to those paid contemporaneously to the retirees. These reforms were introduced with the objective to immunize the pension systems against longevity, which makes their fiscal stance more viable in the long run, but at the cost of large decline in pension benefits.

The currently working generations in those countries are then likely to experience two negative surprises at once. First, their pension benefits will be lower than currently observed. Second, their own savings will have to last over a longer life expectancy. As a consequence one should expect high poverty rates among the elderly and pensioners financial vulnerability.

The lower than currently observed pension benefits should trigger adjustments in private voluntary saving behaviour: being smart and forward looking, we should take the necessary steps to account for future financial needs. However, even with lower longevity individuals have been demonstrated to save too little. We think we are going to save more tomorrow, when indulging our today craving for current consumption. A way to address this issue is to provide individuals with smart incentives, instruments that can encourage responsible saving strategies. Against this background, our report provides answers to the following four questions:

- What is the scope of old-age poverty rise due to the increased longevity?
- What are the consequences of longevity for inequality?
- What can be done to contain the old-age poverty?
- How would it affect inequality?

2. What is the scope of old-age poverty rise due to the increased longevity?

2.1 Longevity matters for poverty more in defined contribution systems

Higher life expectancy, that we are all glad to observe in the future, is associated with two important changes. First, a smaller fraction of us will be at risk of not making it to the old age. This improvement owes to healthier life styles, better diagnostics of cardiovascular diseases and more effective treatment techniques for many diseases which in the past resulted in prime age mortality. Second, a larger fraction of us will enjoy more than 20 years after 60th birthday. While in the 1960s only few percent of those who made it to the 60th birthday, blew 80 candles as well, in the years to come this fraction will exceed 70%. In fact, of the generation born around the 2000s, 86% will reach the age of 65 and life expectancy at 65th birthday is projected to be roughly 20 more years for men and 23 years for women.

Longer life means that a larger number of years will be spent in retirement. In pension systems which pay out a fixed share of pre-retirement earnings (the so-called defined benefit systems, DB), longevity implies higher fiscal costs: more pensions will be paid out to each retiree. In pension systems which pay out what was contributed during the working years (the so-called defined contribution systems, DC), longevity implies low pensions. How low they become depends on how the increase in life expectancy is split between years of working longer (and thus contributing more) and years spent in retirement (and thus collecting pension benefits).

For example, an average 30 year old in 2015 expects to live for another 50 years. Of this time, an average representative of the Millennials generation is likely to spend about 25-30 years working and another 25 years in retirement. In a DB pension system, a quarter of a century in retirement means a huge fiscal cost, so perhaps our Millennial should worry about tax raises, but the pension benefit would be the same as we see with our grandparents today: roughly 60% of their average monthly earnings.

Meanwhile, in a DC pension system, such proportion between working years and years in retirement implies that contributing about 20% of wages for old-age benefits, one can expect a replacement rate of no more than roughly 30% of their average monthly earnings. That is pension benefits will be no more than a half of what we see currently, relative to earnings.

In fact, for the generations who reach old age currently, private consumption continues to be high, whereas with the aging increases the role of public consumption of the health care services (Istenic et al. 2017). It is rare at all that the individual consumption would decline substantially around the retirement age. In the future, decline in consumption may come as a shock.

For high earning professionals, effectively holding a well- paid job all their lives, 30% of their average annual earnings can still be enough to support a satisfactory life-style, even if it is then substantially lower than during the years of active professional career. Naturally, the out-of-pocket health care expenditure of several thousand euros per month may be impossible, thus limiting their life expectancy, let alone quality of life towards the old age. Yet, making the ends meet for a greater part of old age seems feasible. However, for many individuals the 30 years of career may comprise some periods of career interruptions (such as job-seeking or inactivity) as well as periods of relatively lower earnings. Given potentially lower labour market attachment and earnings, many individuals will become at risk of poverty.

Once we account for that heterogeneity, we can simulate the future evolution of poverty and old-age poverty in the decades to come, as longevity progresses. We do that for 6 Central European economies, because they all replaced a DB system with a DC one at the turn of the millennia, which means that all of the Millennials will collect pensions from a defined contribution pension system.

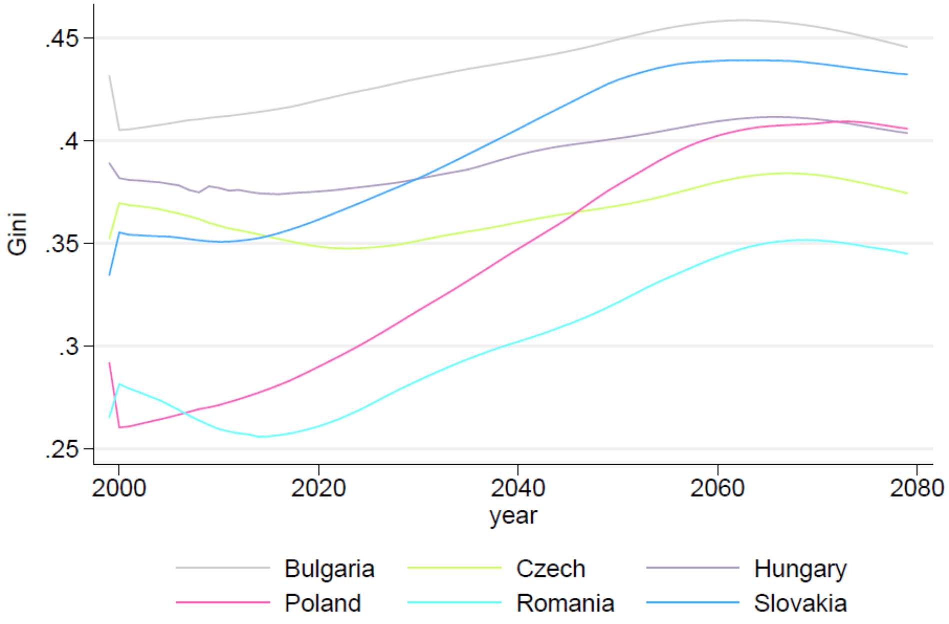
3. What are the consequences of longevity for inequality?

3.1. Stronger incentives contribute to income inequality in DC pension systems

An important consequence of replacing the defined benefit with defined contribution pension systems relates to labour market incentives. With defined benefit systems, there are only direct incentives to work: the wages. The contributions paid on the earned income are effectively a tax: our social selves know that this is social contribution and inter-generation exchange, but our economic selves view social security contribution as a pure tax, because pension benefits do not grow in the contributions. However, with the defined contribution systems, there are also indirect incentives to work, because the more we contribute to the pension system, the higher the future pensions. These stronger labour market incentives are one of the reasons why defined contribution systems are believed to deliver higher economic efficiency.

The extent to which individuals respond to these indirect incentives are heterogeneous. Those individuals, who are free to increase labour supply will likely do so after the reform, in order to fully internalize the benefits of higher pension benefits in the old age from higher contributions during prime-age. Meanwhile, for some individuals higher number of working hours may continue to be impossible despite the favourable incentives. There can also be a group that does not spot the stronger incentives and thus does not adjust behaviour in any way despite a change in pension system. Hence, reforming the pension system increases income inequality via labour supply decisions.

Figure 1. Income Inequality



Note: Income inequality is measured by the Gini ratio. Income definition includes earned income and pension benefits, but excludes capital gains. The computed inequality measure includes weights for population structures.

The stronger labour market incentives, coupled with longevity, have large effects on income inequality. Indeed, in absence of longevity, income inequality could decline, as all individuals are subjected to the stronger incentives of the defined contribution system.

As shown in Figure 1, this appears to be the case of Poland, Bulgaria and to a lesser extent also Hungary. The heterogeneous reaction to the stronger incentives contributes to larger income inequality in Czech Republic, Slovakia and Romania. These diverse paths of income inequality reflect the fact that the ability to adjust labour supply across these countries differs.

Longevity leads universally to a substantial increase in income inequality. The Gini ratio for income inequality will increase by at least 4 percentage points and in some countries as much as 14 percentage points. This rise is substantially bigger than experienced by those countries when transitioning from central planning to a market economy. These large income effects contribute to higher poverty for those individuals, whose labour supply did not increase in reaction to the reform. Hence, the overall rise in poverty rates after replacing DB with DC systems stems from two sources: lowering pension benefits under longevity in the DC scheme and growing income inequality.

The reason why the increase in inequality flattens out towards the end of the simulated period is due to the fact that the extension in expected lifetime duration is gradually slower.

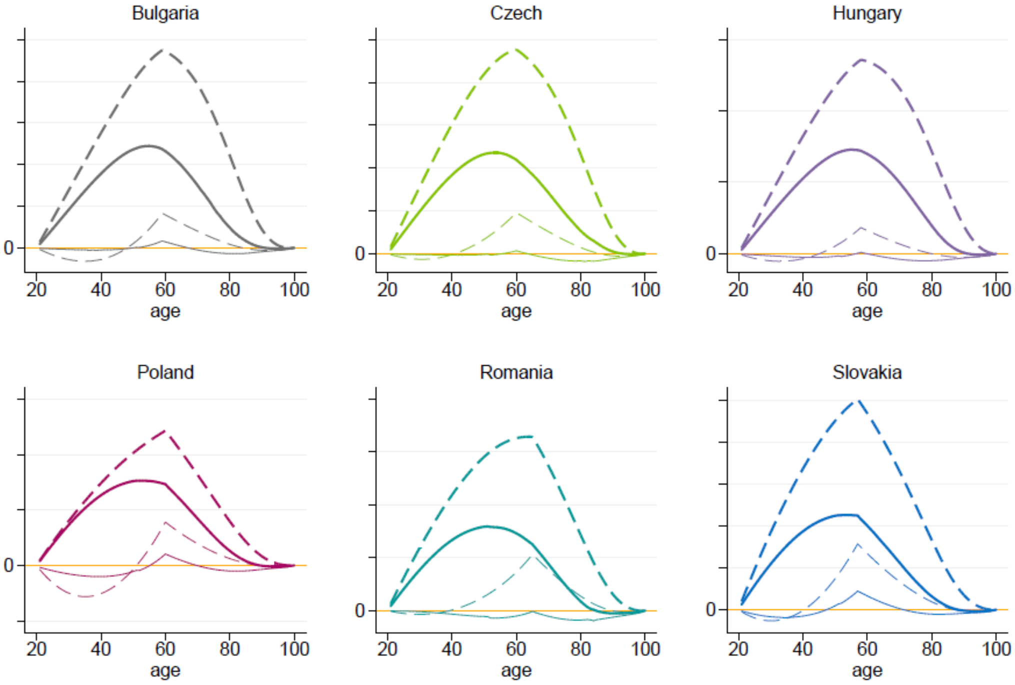
3.2. A rational response to longevity and its consequences for wealth inequality

When expecting low effective replacement rates from the public pension system, accumulating private savings is a way to take precautions. This private and voluntary pension wealth, can then be used to co-finance old-age consumption and thus cushion the decline of living standards at retirement when low pension benefits replace earned income.

The scope and direction of changes in savings patterns will depend on the extent to which one is willing to give up current consumption in exchange for a lower decline in consumption at old age. Some individuals particularly value smooth lifetime path of living standards and are thus willing to accumulate more savings. Some other individuals prefer to take out substantial loans to smooth consumption over lifetime. For others, low consumption in the future is not enough of a driver for current decision making. This is portrayed by solid lines in Figure2. Expecting decline in pensions due to increase in life expectancy, some households accumulate more private, voluntary savings, but for others it is optimal to continue with some level of indebtedness. This is portrayed by dashed lines in Figure 2.

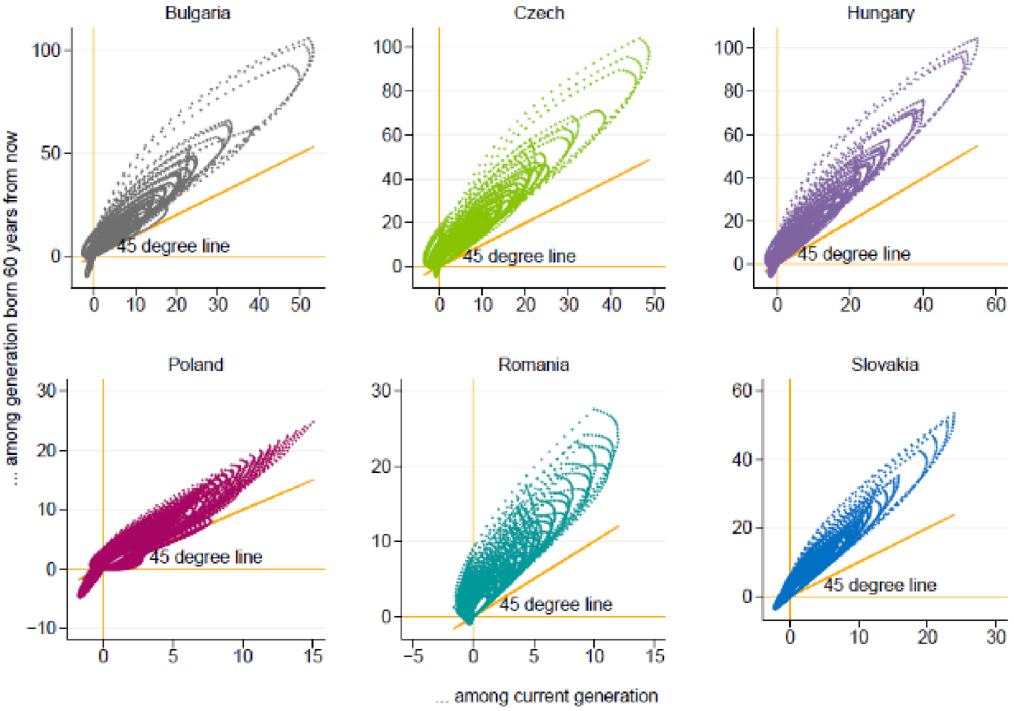
The net effect of these changes depends on the population structure and country specific distribution of preferences. In all six countries majority of social groups will substantially increase savings. However, in Bulgaria and especially in Poland, debt taking intensifies as well.

Figure 2. Evolution of wealth accumulation over the life-cycle



Note: Solid lines portray life cycle savings behaviour of current generation, dashed lines country savings behaviour of people born 60 years from now. Thin lines represent individuals with limited ability to save for old-age consumption, while thick lines represent individuals with ability and preference to save for old-age consumption. The effective retirement age is country-specific.

Figure 3. Distribution of assets …



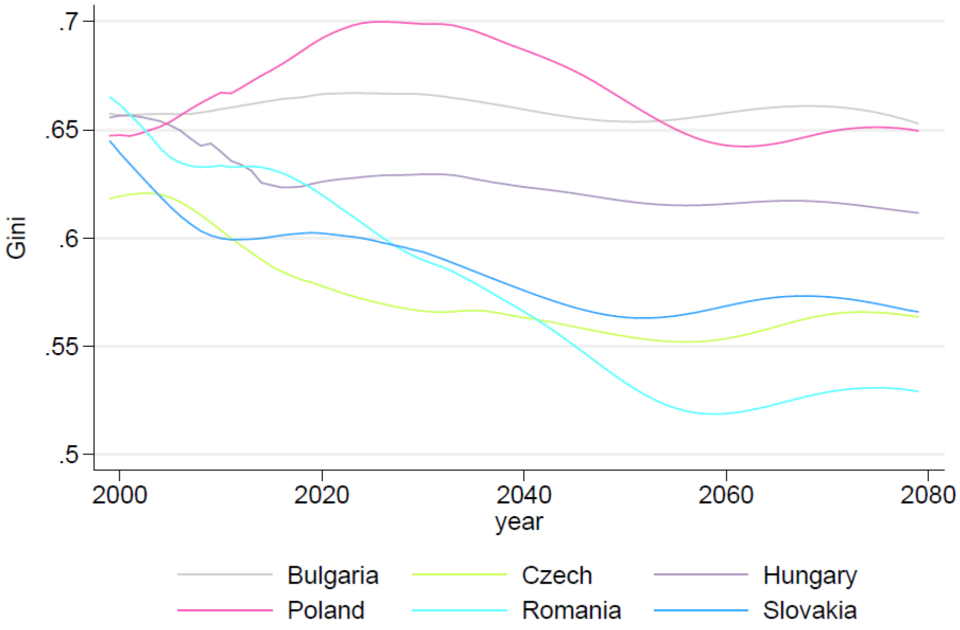
Note: Life cycle savings behaviour of individuals with different levels of abilities and preferences. The scatter plots savings behaviours of social groups within current generation (horizontal axis) and future generation (vertical axis).

3.3. Country-specific changes in wealth inequality patterns

Two effects are at play. First, savings behaviour changes with longevity, as we discussed above, displaying the life time patterns of saving and dissaving. Second, due to aging, the population structure changes: a higher share of living individuals are those who accumulated savings for co-financing the old-age consumption, whereas a smaller fraction of populations are those individuals who are at the beginning of their working career. The joint realization of these two effects determines changes in aggregate inequality.

Indeed, the direction and path of change in wealth inequality is not preconceived. While the preferences and abilities of individuals do not change in our simulations, longevity translates differently to behaviours, yielding disparity in terms of wealth accumulation. Some social groups increase savings, whereas others do not, which, jointly with changing population structure, drives changes in wealth inequality. The increase in wealth accumulation occurs in many social groups in all 6 countries, but the rate of increase and rate of aging jointly determine the speed and scale of adjustment in wealth inequality (see Figure 4). Wealth inequality increases in Poland, remains stable in Bulgaria and declines in the remaining 4 countries: Czech Republic, Hungary, Romania and Slovakia. Behind growth in inequality lies the persistent indebtedness of some social groups in Poland and to a smaller extent in Bulgaria. Noticeably, indebtedness in the 4 countries is low already with current life expectancy and will further decline with longevity. Meanwhile, in Poland it is high and will increase with longevity.

Figure 4. Wealth Inequality



Note: Wealth inequality is measured by the Gini ratio. Wealth definition includes private voluntary savings, i.e. the share of income not spent on consumption, with accrued interest. Households are allowed to hold negative assets (debt), but are constrained not to leave debt on subsequent generations. The initial ratios were set to match the observed wealth inequality as observed prior to the reform in these economies, weighted for population structures.

An increase in indebtedness and persistently low consumption path show that with longevity, position of the vulnerable groups worsens relative to what is observed currently. Further decline in voluntary savings and high indebtedness raise even more the relevance of social as well as macro-prudential risks. Meanwhile, further increase in wealth accumulation is bound to increase liquidity in the financial system, ushering the risk of excessively lax regulation on credit.

The waves of changes in wealth inequality are associated with the demographic waves: post-war baby boomers, early 1980s fertility boom, etc. These waves result in unequal size of the subsequent cohorts and thus translate to waves in inequality savings as observed in given point in time. Note, that declining or increasing aggregate inequality need not imply that within a given birth cohort wealth disparity widens. Even if the channel was not operational, aging of the societies would yield changes of wealth inequality.

3.4. Longevity affects consumption inequality as well

Households which want to cushion a decline in consumption, observing longer life expectancy, need to increase savings. Even those with low income levels will reduce consumption further. This process implies that increased longevity will be associated with an increased consumption inequality.

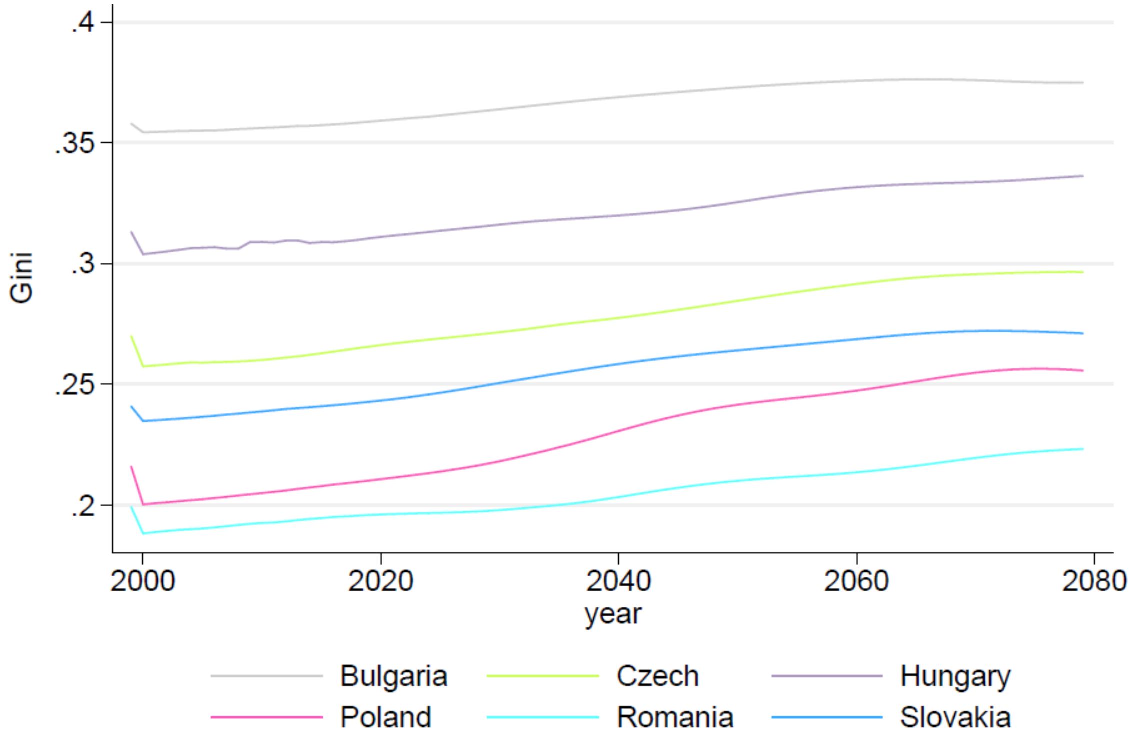
Moreover, the households that decide not to make precautions for the low pension benefits, will experience low consumption during old age. This phenomenon will increase the dispersion of consumption as observed in the economy at any given point in time, thus contributing to increasing measures of consumption inequality measures.

These two effects result in increased consumption inequality in addition to wealth inequality. Consumption inequality increases in the six analysed countries by roughly 3-5 percentage points when measured by Gini ratio (see Figure 5). This magnitude of the effect is substantially larger than an increase in consumption inequality as observed by Spain or Greece during the global financial crisis. Naturally, this increase is gradual, as opposed to changes in inequality caused by business cycle fluctuations and thus may be masked by short-run fluctuations.

Notably, growth in consumption inequality is smaller than the growth in income inequality. This finding stems from the fact that households smooth consumption over lifetime, hence avoiding extreme outcomes such as high consumption in prime-age and low consumption in old age. Even if this smoothing is not possible to the full extent for those households who have constraints on the ability to save, the effects for consumption inequality will be lower than for income or wealth.

Note that in our setup, households are free to reduce consumption as much as they deem optimal, i.e. there is no threshold for subsistence consumption. Neither do we model the actual minimum existence costs, such as those captured by equivalence scales for absolute poverty measures. Therefore, our measure of consumption inequality is the lower bound. If it were the case that in a perfectly elastic world households were choosing consumption levels below those that are feasible in the real world, then the actual increase in consumption inequality will be larger than forecasted here.

Figure 5. Consumption Inequality



Note: Consumption inequality is measured by the Gini ratio. Consumption definition includes all current household consumption. The initial values match consumption inequality as observed in these countries prior to the introduction of the pension system reform from a DB to a DC system. The computed inequality measure includes weights for population structure.

4. What can be done to contain old-age poverty?

4.1. People do not save enough for retirement

Conventional economic models predict that people smooth consumption over life cycle, hence rational old-age poverty is only consistent with extremely high preference for immediate consumption. However, as has been demonstrated by survey and health studies, people do not save "enough" for retirement. One important source of these insufficient savings is the unforeseen and largely unexpected increase in longevity. The other important source is of behavioural nature: setting and carrying out the savings plan is difficult, requires self-control and consistency over a long horizon (Benartzi and Thaler 2004). Typically, a middle-class individual or a couple saves for retirement in two ways: home ownership and compulsory state-run pension systems.

In the case of housing wealth, self-control is of secondary relevance. Mortgage payments are claimed regularly by the banks who lent the money for buying the property. Whether it is efficient to pay interest on pension savings is naturally an open question, but one does not need to demonstrate self-control and consistency to accumulate wealth that can be used to co-finance consumption during old age.

In the case of the public pension systems self-control is not that relevant either: every month the pay check that arrives from the employer is already net of social security contributions, hence one does not even "feel" accumulating pension wealth. Indeed, public pension schemes are one of the so-called low-willpower savings techniques (Gustman and Steinmeier 1998).

However, with longevity the savings in household and pension wealth are likely to fall short of desirable savings in the old age. The first hurdle occurs already at calculating ex ante, how much saving is desirable. Financial literacy on average is too low to let individuals compute the desirable level of wealth accumulation. Without these tools, individuals go for either of the two extremes: minimum to satisfy the eligibility criteria or maximum allowed by the legal regulations (Benartzi and Thaler 2004). There is no reason for this value to be the optimal level of savings.

The second hurdle concerns self-control and will-power. Choi et al. (2004) show that even people who deem their savings too low and declare a resolution, usually fail to do so: 86% of the individuals failed to save more despite expressing a will to do so within a quarter. Procrastination (sometimes referred to as hyperbolic discounting) is one of the important reasons behind under-saving. People unjustifiably assume that "tomorrow" they will do what they should have done "today" – a mechanism that reflects in time-inconsistent decisions, because, as "tomorrow" comes, it becomes "today".

Another reason why sticking to an original saving plan may be difficult is called status quo bias (Samuelson and Zeckhauser 1988). Retirement plans choices reveal that people are biased to do nothing or maintain current course of action. Therefore, they react too little to information about expanding life expectancy or declining rates of return on accumulated savings. In the face of actuarial information, 75% of people do not increase retirement saving even though they judge their savings to be too low.

Saving more may also be unpleasant. Kahneman and Tversky (1992) argued that people are loss averse – we have a tendency to regret losses much more than we appreciate gains more than regret losses. Since setting more disposable income aside for old-age consumption appears to be a loss of current consumption, people are reluctant to save more.

Given this multiplicity of reasons, one should expect that a substantial fraction of population saves too little relative to their preferred path of life time consumption. Our objective here is to analyse what would happen if suddenly everybody gained ability and taste for responsible old-age savings. We do not change the aggregate preferences in the societies: those societies who are more patient and thus generally have higher savings and investment rate remain so. What we do change, though, is to equalize the access to the instruments which permit smooth lifetime consumption.

4.2. Fostering equal access to saving instruments reduces (old-age) poverty

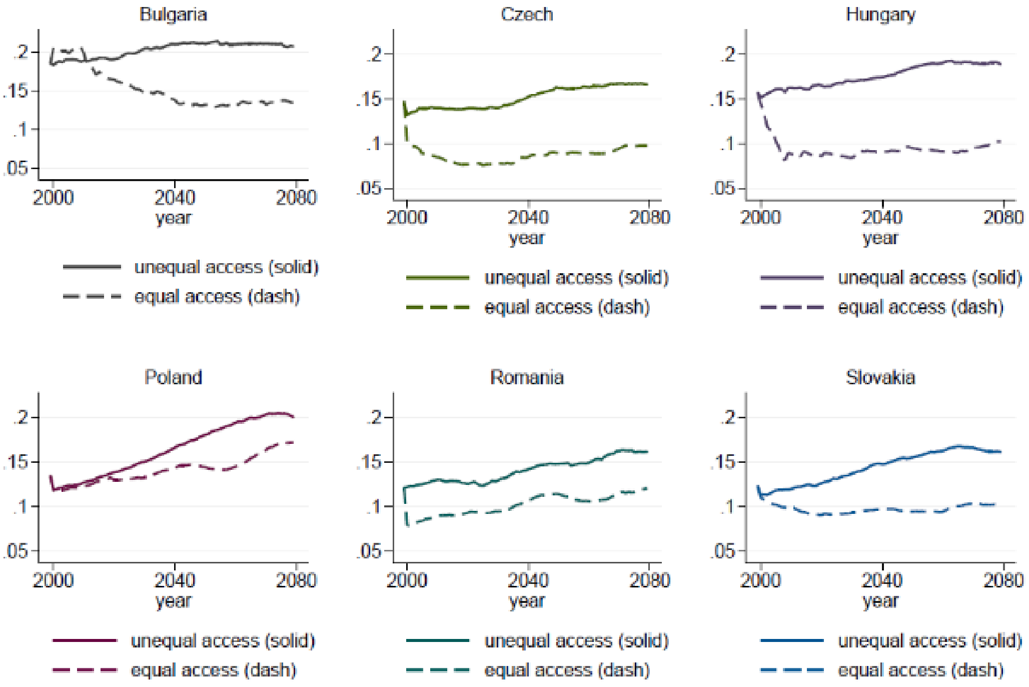
In the six analysed economies, individuals have heterogeneous ability to save – unequal access to financial instruments. Prior to reforming the pension system, we assume that some individuals were able to consistently put aside a higher fraction of their income. Pension system reform provides incentives to both increase hours worked and raise the share of earned income set aside for old-age consumption. These incentives interact with longevity, changing the optimal set of decisions. We run two scenarios. In the first scenario, all individuals live longer and receive pensions from a new pension system with unequal access to financial instruments. In the second scenario, we additionally make access to financial instruments universal for everyone.

The results are shown in Figure 6. Fostering equal access to saving instruments reduces (old-age) poverty in all six analysed countries. Solid lines portray the evolution of old-age poverty if the ability to save remains as unequal as we find in the data in late 1990s in the six analysed economies. The dashed lines show what would happen if suddenly access to financial services was perfectly equal across all the social groups in these six countries. Equal access does not need to imply that everybody saves the same amount, quite the opposite, savings continue to reflect preferences for smooth lifetime consumption as well as expected longevity and macroeconomic tendencies. Effectively, the dashed lines portray the evolution of old-age poverty if there are no frictions, limitations, constraints or privileges in accessing savings instruments.

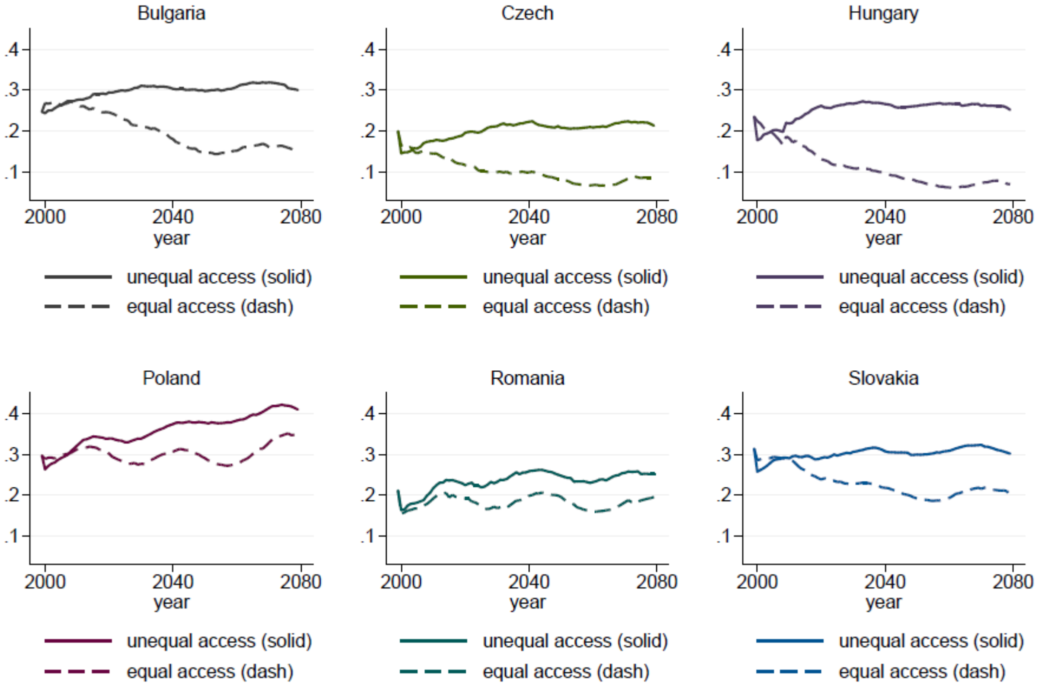
Reduction in poverty is large enough to counterweight otherwise dominant trends related to longevity. The fact that equal access to financial instruments outweighs the effects of demographic processes shows the scope for potential policy to mitigate old-age poverty.

Figure 6. Consumption Poverty and Consumption Old-Age Poverty

Panel A. Consumption Poverty



Panel B. Consumption Old-Age Poverty



Note: Consumption poverty is measured as a share of households with consumption below 60% of median consumption. Old-age poverty measured as share of old-age poor among poor. The initial values match poverty levels as observed in the six countries prior to the introduction of the pension system reform from a DB to a DC system. The inequality measure includes weights for population.

4.3. Are there effective ways to nudge people into saving more?

Our scenarios show the outcomes equivalent to effectively equalizing ability to save for old-age consumption. Are there effective ways to do that? Evidence from the Save More Tomorrow (SMT) experiment are positive. Benartzi and Thaler (2007) formed savings plans based on better understanding of decision-making process.

The plan is as simple as it gets and assumes commitment to increasing the savings in the future (hyperbolic discounting) and at the moment of the pay raise (loss aversion). The program is administered by employer (self-control) and individuals are automatically enrolled with the opt-out option (procrastination and status quo bias). The effects of SMT are spectacular: 3 years after introducing the plan, the savings rate of the participants was 370% higher than in other plans.

Another way to address the behavioural challenges are the Prize Linked Savings (PLS), that is savings accounts which on top of “boring” interest offer also a lottery-like feature. In each period, one participant gets to accrue a prize equivalent in value to the premium accrual from all the participating accounts. Linking the boring (i.e. old-age savings) with the pleasurable and exciting (i.e. lottery with a high prize) helps to overcome the procrastination and status quo bias, whereas the value of the prize helps to sustain commitment (Kearney et al. 2010).

Well-established PLS include government-run Premium Bonds in the United Kingdom and privately-run Million a Month Account (MaMa) in South Africa. Holders of PLS increase total savings rate by 1% of disposable income, a 38% growth at the mean (Cole et al. 2017).

Also financial engineering comes in handy. Multiplicity of options discourages people from taking up savings decisions (status quo bias) whereas the prospect of readjusting their decisions delays taking up any action (procrastination).

Targeted maturity funds may match maturity of the financial portfolio with the expected timing of retirement, thus embodying the long term commitment (facilitating self-control). They also replace the prospect of repeated decision-making with a prospect of high pay-out at retirement (Sethi et al. 2004).

The advantage of both SMT and PLS is that they are virtually costless to introduce and administer in a sense that even if some administrative costs are higher, they do not entail state subsidies to encourage participation. Naturally, financial incentives prove useful as well, especially when combined with the ability to nudge via modern technologies.

In a voluntary savings program in Kenya, participants received regularly SMS from the government informing them that any deposit made on that given day will be matched with an additional deposit by the government to a private account of each participant. In a control group the same subsidy was offered, but information was distributed through traditional communication channels. Regular texting increased propensity to deposit as well the amount of the deposit even though the subsidy did not depend on the size of the deposit.

Indeed, it appears that many of the savings decisions are actually fast in the language of Daniel Kahneman (2011). In a field study, he finds that 75% of people does not readjust portfolio structure for as long as 10 years even if the original decision was instinctive and unreflective. In fact, financial investment decisions are rarely slow and deliberate, i.e. when taking up financial obligations people are much more reflective than when deciding about the allocation of their assets.

This brings about another potential for technology use: given the ability of social media to design psychological profiles of the users, they are likely to offer better matched portfolio choices. Subject to diligent regulation and supervision, offering portfolios based on profiles could lead to a substantial improvement in assets allocation at virtually no cost, simply by improving the matching in consumer finance.

These and other methods may be used to equalize access to financial instruments across social groups, types of households and for individuals at all income levels. In order to achieve reduction in old-age poverty, the instruments need to encourage saving, align actual savings path with an optimal one and facilitate the execution of the savings plan.

5. How would equal access to saving instruments affect inequality?

5.1. Fostering equal access to saving reduces wealth inequality

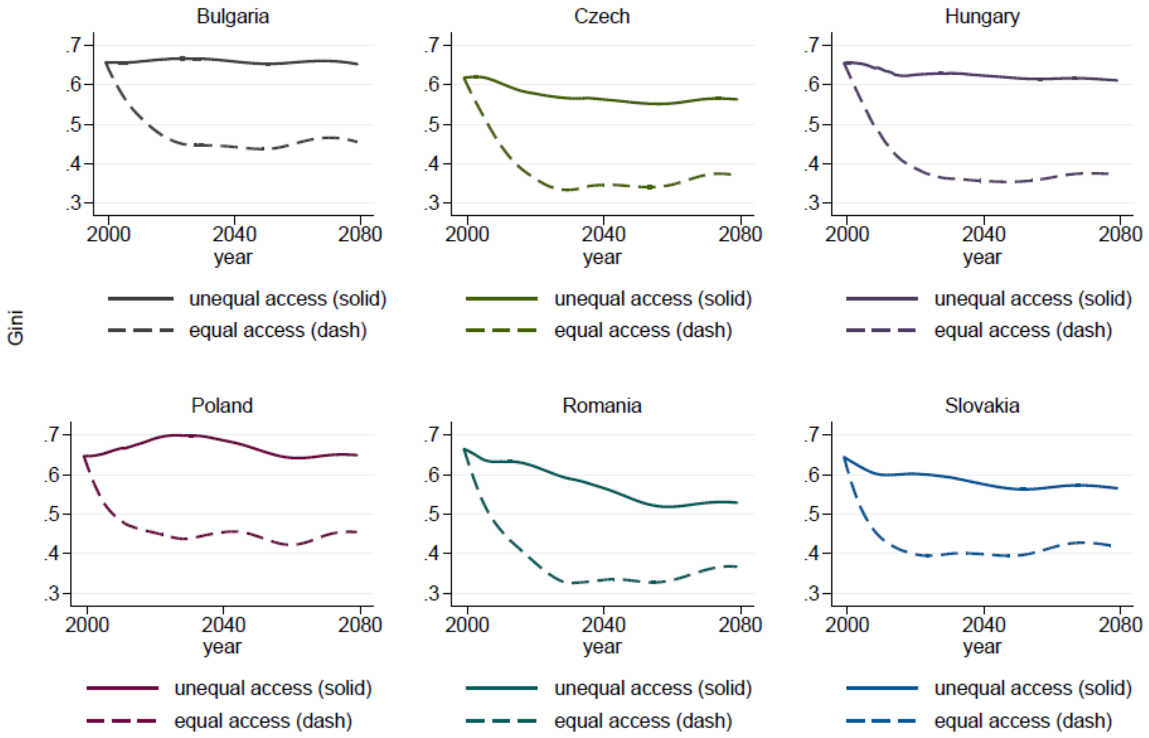
In addition to a lower risk of the old-age poverty, equal access to financial instruments reduces also substantially wealth inequality. By removing barriers to saving – as well as the privileges – we let some of the households to change their behaviour pattern.

In fact, instead of consuming their entire income contemporaneously or even being in debt, some of the households in our simulation scenarios gain both access and taste for saving. Meanwhile, those households who saved a high fraction of income, when no longer in a privileged position of unique access to saving instruments, somewhat increase contemporaneous consumption at the expense of wealth accumulation. As a consequence, the saving behaviour becomes more similar between the household groups, hence wealth distributions become more compressed (See Figure 7 and Figure 8).

Substantially lower levels of wealth inequality in our setup are consistent with prior economic research. First, using the case of Sweden, Domei et al. (2002) and Hurd et al. (2012) show that generosity of the pension system virtually eliminates the need to use voluntary savings as a mechanism to smooth consumption over lifetime. Notably, in countries with generous pension systems, long-term savings is very low even among households with high earnings in both relative and absolute terms. Analogously, low pensions – as in our setup – should foster the need for private voluntary savings, as shown in our model.

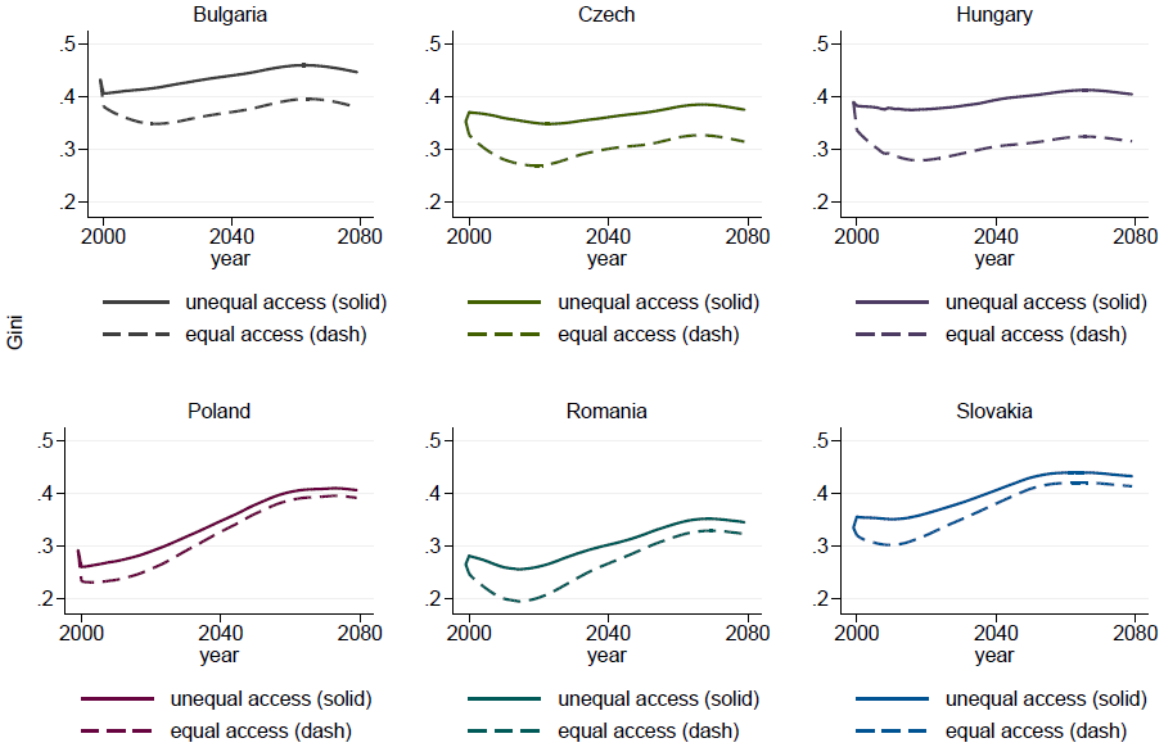
The need to save is then mediated by the ability to do so: level of income, ability to adjust labour supply and access to financial instruments. In our setup, once frictions in access to financial instruments are removed, households adjust both labour supply and saving behaviour, consistent with their preferences. Reduced wealth inequality implies that these adjustment result in assets more evenly spread across social groups and age groups.

Figure 7. Wealth Inequality



Note: Wealth inequality is measured by the Gini ratio. The initial values match consumption inequality as observed in these countries prior to the introduction of the pension system reform from a DB to a DC system. The computed inequality measure includes weights for population structures.

Figure 8. Income Inequality



6. Discussion of the results

Access to old-age saving instrument is a concern in many advanced countries. Even in those countries, where a large fraction of the population has a banking account and uses instruments such as credit cards and deposits, old-age savings instrument may be inaccessible to the population at large. For example, a deposit in a bank account usually does not entail incentives for old-age savings. Moreover, the interest rate to be earned on a deposit is substantially below the economy interest rate, yielding low return to savings and thus reducing savings.

Investing in financial markets in order to construct a portfolio requires skills and effort inaccessible to population at large. Hedge funds, investment funds and ETFs, which could potentially substitute for individual financial portfolios have none of the incentives characterizing *SaveMoreTomorrow* or prize-linked savings. Instead they charge fees, reducing the effective rate of return on savings and thus dis-incentivising old-age savings.

Given these constraints, it is realistic to assume that a fraction of individuals effectively does not have access to old-age savings instruments and only those who pay particular attention to the future actually accumulate wealth to smooth consumption. Our simulations show (a) substantial rise in old-age poverty if we continue with this inequality in access to financial instruments and (b) large potential for improvement in these frictions are removed and access to old-age savings becomes universal. Our results should be viewed as a range for potential outcomes if at least a part of currently underprivileged individuals gained access to old-age savings.

Additional gains could be achieved if the saving instruments offered an annuity. Indeed, a perfect instrument offers convenient saving for old-age consumption and an annuity on these savings, i.e. insurance against outliving one's own savings.

Indeed, dissaving decision is no easier than saving decision. People need to take into account a multiplicity of factors: how fast they want to draw assets, how much they want to leave as bequests, probability of negative health shocks, life expectancy, etc. Given how difficult it is to optimize individually, given the unpredictable nature of all these factors, ability to acquire insurance against making a mistake in judgment is of immediate value (Davidoff et al. 2005). Annuity hedges us against the longevity risk, provides a survivor premium and raises life time consumption for all.

The problem of old-age savings and dissaving in the old age are intimately related. Without accumulated wealth, individuals cannot purchase an annuity. Even with positive but low wealth, and with the expectation of pension benefits, many individuals may prefer to hold a liquid asset (e.g. in case of family emergency) than convert the accumulated savings to annuity.

Despite the benefits of annuity, evidence shows that even affluent individuals tend to acquire too little of it (Schaus 2005), with reasons similar to those which underlie insufficient old-age savings. It is not about preferences or willingness to take the risk of outliving one's own saving, quite the contrary. As discussed by Benartzi et al. (2011), particularly with a defined contribution pension system the actual choices depend on institutional factors.

Framing effect, poor financial literacy and loss aversion greatly contribute to disregarding the annuities. For individuals, transforming pension wealth into a stream of payments until the end of lifetime is viewed as a loss: large sum of money is replaced by a small sum of money (even if spread over many periods). Moreover, annuity reduces risk of outliving one's own savings, but individuals tend to worry about dying sooner: from a perspective of an average retiree, dying sooner than expected is not only a bad luck, but also a bad investment.

7. Summary

Assuring universal access to savings instruments will not only reduce poverty and old-age poverty, but will also contribute to less unequal distribution of assets across social groups and generations.

Our objective in this study was to analyse the effects of longevity on poverty and inequality in six countries Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia. These six countries changed a defined benefit pension system characteristic for most welfare states in the post-war era to a defined contribution pension system. Defined contribution pension system is believed to be more efficient, because it improves the incentives in the economy: benefits will be equivalent to what we contribute to the pension system, hence social security contributions can be viewed as delayed income rather than a tax.

An additional feature of the defined contribution pension systems is that in response to longevity, the actual per period pension benefits will be low. The longer the life expectancy at retirement, the larger the number of periods which need to be financed from the accumulated pension contributions. Although this effect can be partly alleviated by extending the working career beyond the current retirement age, pension benefits from a defined contribution system will be substantially lower than observed currently from a defined benefit system.

- What is the scope of old-age poverty rise due to the increased longevity?
- What are the consequences of longevity for inequality?

Despite the intensifying need to co-finance old-age consumption from private savings, one does not observe increased savings in the six economies which implemented the reform. We replicate the distribution of assets across the types of the households from the pre-reform period and show that the poverty rates will double as the generation of Millennials retires. In fact, old-age poverty will be behind this increase in poverty in all the six countries.

With the incentives inherent in the defined contribution pension system, income and consumption inequality will grow as well. The growth in inequality is larger than these six countries experienced when transitioning from centrally planned to market economies.

- What can be done to contain the old-age poverty?
- How would it affect inequality?

Comparing the model in which many individuals cannot access adequate savings instruments with a model where access to financial instruments becomes universal, we show that both poverty and inequality can be substantially reduced. We show that this result is universal, i.e. holds for all six countries in the sample, regardless of their demographic structure and macroeconomic features. Our key result does not depend on the behavioural reaction to longevity: among the six analysed countries longevity raises wealth inequality in Poland, leaves wealth inequality essentially unaffected in Bulgaria and reduces wealth inequality in four remaining countries. These differentiated patterns owe to the differences in deep economic preferences embedded in these countries, such as preference for leisure and aggregate discounting of the future. Universal access to savings instruments reduces wealth inequality to a comparable extent across all these six countries despite their inherent differences.

The mechanisms behind these processes are both economic and behavioural. Longevity implies lower pensions in the defined contribution system, hence yielding pure economic incentives to raise private voluntary savings. In the case of some social groups the lifetime savings will effectively double. However, behavioural mechanisms at play imply that many individuals will not make an accurate judgment by how much should they increase the savings. Moreover, many individuals will be unable to execute this plan due to a variety of mechanisms such as status quo bias, procrastination, loss aversion and self-control issues.

Appendix. Methodology of the overlapping generations model behind this study

Mechanics of our model

We develop an overlapping generations general equilibrium model, in line with Makarski et al. (2017). The model uses demographic forecasts for evolution of longevity and fertility for each of the analysed six countries. The model follows also European Commission in the country-specific assumptions about the future evolution of the rate of technological progress

Households in our model choose how much time to work (the so-called intra-temporal choice) and how much of the current income to save (the so-called inter-temporal choice). These choices are made in order to maximize lifetime well-being, which increases with consumption, but declines with labour. Consumers in our model generally like their life-time path of consumption to be smooth: high consumption in working period and the extremely low consumption in the old age makes them less happy than a comparable path of consumption which is spread more equally throughout the life time.

Households in our model are heterogeneous in a sense that households may differ in their preference for leisure. Hence, in some cases the labour supply will be such that we assume effectively someone worked full time their whole professional life, while in other cases the actual share of life worked will be lower. The actual amount of time work and the share of population with such preference were calibrated closely to replicate the distribution of working time in the labour market as observed in the Labour Force Survey data in each of the six analysed countries.

Households differ also in how productive an hour of their work is, which reflects the differences in wages as observed in the labour market. We use linked employer employee data from the EU Structure of Earnings Survey for each of the analysed six countries to replicate the distribution of wages as observed in reality.

Our replications are successful in a sense that for every country our model reproduces consumption inequality as observed in the data. Namely, our calibration permits to capture the fact that some households are more affluent than others, in ways that are similar to actual data. Note that in the data one has both prime age and old-age households, which means that the population structure in the survey data that underlies the real world estimates of the consumption inequality is similar to what is produced in our model. We use report by World Bank (2005) as source for information about consumption inequality.

Finally, households differ in access to financial instruments. In our model this is equivalent to households having different time preference in a sense that some households actually save a higher share of their income than others. We calibrate this heterogeneity in such a way that we replicate wealth inequality data as observed in the six analysed countries prior to the reform, see Table 1. We follow Davies et al. (2011) as source for information about wealth inequality.

Table 1. Wealth Inequality (Gini ratio) – data vs model

Country	Data	Model
Bulgaria	0.65	0.65
Czech	0.63	0.62
Hungary	0.65	0.65
Poland	0.66	0.65
Romania	0.65	0.66
Slovakia	0.63	0.64

The key feature of our analysis consists of equalizing the preferences for saving across the households. In the baseline scenario we keep the heterogeneity in saving behaviour as calibrated to the data. In the reform scenario we check what would happen if the ability and preference to save became the same among households.

The households continue to differ in productivity and preference for leisure, but faced with the same inter-temporal options, all households of a given birth cohort will choose to save the same proportion of their income. Note that because of longevity and general economic changes, households of different cohorts may still choose different savings as optimal, because their life expectancy and economic conditions will differ.

The model begins with an economy which has a defined benefit pay-as-you-go system, as all the six analysed countries had a system like that. We then implement a change to a defined contribution pay-as-you-go system, replicating the features of the reforms in all the six countries. All of these countries honoured the pension obligations towards individuals already in retirement and those who were close to retirement, so also in our model the implementation of the reform is gradual.

When they reformed their pension systems, the six countries introduced also a capital pillar to the pension system, but within roughly a decade some of the six analysed countries dismantled the capital pillars, while others reduced its size. For simplicity and due to the low relevance of compulsory capital pillar in the general pension system for the question at hand, we do not replicate this feature in our model. Namely, the new pension system is a defined contribution pay-as-you-go system.

The model is calibrated to replicate the macroeconomic features of the six analysed economies prior to the introduction of the pension system reform. Using data from national accounts we know the investment rate in these economies, which helps us to calibrate the depreciation rate. Using data from the labour force survey, we know the aggregate labour force participation, which helps us calibrate the aggregate preference for leisure. We also use the taxation data from the OECD to adequately calibrate the tax rates for capital, labour and consumption in all six countries to match in the model the share of those tax revenues in GDP to what was actually observed.

Since these countries were undergoing economic transition, the economic situation was quite volatile year on year. To avoid the situation that a specific year affects the original calibrations, we compute 10 year averages for the whole decade prior to the pension system reform in each country. The interest rate was set at 6.5 %, if capable by others parameters.

Our model is a general equilibrium model, which means that all of the macroeconomic variables adjust to changing demographics and behaviour of households. For example, as longevity increases, individual households will decide to save a higher fraction of their income during the prime age, which will result in change of the capital stock in the economy, thus affecting labour productivity and interest rates. Indeed, these variables adjust endogenously in the economy, in response to a new pension system, secular changes and behaviour of the agents.

Also fiscal variables adjust endogenously. We calibrated the taxation in the period prior to the reform, but once the reform from defined benefit to defined contribution is implemented in our simulations, the consumption tax adjusts endogenously to satisfy the government budget constraint. In order to mitigate the potential effects of change in fiscal policy on the analysed processes, we assume that the governments continue with the debt-to-GDP ratios as in the periods prior to the reform, which in most of the six analysed countries was close to roughly 45%.

The government needs to adjust taxes for two main reasons. First, it balances the pension system. We calibrate the pensions from the defined benefit pension system and the replacement rate to match the share of pensions in GDP as observed in the six analysed countries. We calibrate the contribution rate to the compulsory pension system to match the deficit observed in the six analysed countries prior to the reform.

Second, the government balances the government expenditure with the revenues such that the public debt in relation to GDP does not change. The government expenditure was set to match the data from national accounts on government expenditure share in GDP. Throughout the simulations this share does not change, because the interest of the analysis is to isolate the effect of longevity on inequality rather than analyse the potential scenarios of government expenditure.

Table 2. Calibration of parameters

Calibration	Target	Bulgaria		Czech		Hungary		Poland		Romania		Slovakia	
		Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
depreciation rate	investment rate	23.9%	23.8%	30.4%	30.7%	24%	23.7%	20.5%	20.5%	20.9%	20.9%	29.8%	30.3%
labor tax	revenue as % of GDP	7.6%	7%	9.4%	9.4%	15.3%	15.4	5.5%	5.5%	6.5%	6.5%	7.5%	7.7%
consumption tax	revenue as % of GDP	12.5%	12.4%	10%	10.5%	15.3%	15.4%	12.2%	12.2%	10.6%	10.5%	11.6%	11.4%
social security contribution	benefits as % of GDP	5.4%	5.4%	5.7%	5.6%	5.9%	5.9%	6.9%	6.9%	6.8%	6.7%	5.3%	5.3%
preference for leisure	average hours	56.7%	58.2%	52.6%	52.6%	57.6%	58%	56.8%	56.6%	58.8%	58.1%	53.5%	53.4%
reforming from DB to DC		2002		1996		1998		1999		2004		2003	
effective retirement age (OECD)		60		61		59		61		66		58	

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