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On the effectiveness of quasi-universal transfers to older households: the case of Poland

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Abstract
One of the key challenges associated with current demographic trends is to provide adequate financial support to older households, which are more vulnerable to health problems and longevity risks, without jeopardizing fiscal sustainability or harming macroeconomic performance. Among possible policies, quasi-universal transfers have recently attracted interest in several countries. In this paper, I study the long-term equity-efficiency tradeoff of these programs and their modifications and compare their impact to that of more standard elderly-oriented policies with similar fiscal costs. My analysis is based on a general equilibrium overlapping generations model that incorporates different family types, individual risk associated with earnings, health and mortality, and stochastic out-of-pocket expenses. According to the model simulations, the quasi-universal transfer to retired households can significantly improve the financial situation of a median pensioner but generates an aggregate welfare loss (under the veil of ignorance). The estimated welfare loss remains robust across various model assumptions, indicating that the positive insurance effect of the quasi-universal transfer is more than offset by the cost of inefficient redistribution from future to current cohorts, even in economies with low provisions for old age insurance. Finally, the quasi-universal transfer outperforms a minimum pension increase by improving the financial situation of a median retiree and reducing relative poverty among pensioners, while being less harmful to economic efficiency.

Keywords Quasi-universal transfers · Older households · Health risk · Welfare · Inequality · Models with heterogeneous agents

1 Introduction

Population aging is leading to an increased number of the relatively poor elderly, who also face a high risk of deteriorating health and associated large out-of-pocket medical payments. Therefore, one of the key challenges in relation to current demographic trends is to provide adequate financial support to older population without jeopardizing fiscal sustainability

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or harming macroeconomic performance. In most countries, the two major state programs that provide the greatest support to older households are social security and public health insurance. In addition, governments implement smaller-scale programs aimed at the most vulnerable among the elderly. Income criteria are commonly used to determine eligibility. Means-testing aims to curb fiscal costs while reaching those most in financial need. However, such programs have several drawbacks. Critics point to stigmatization, administrative barriers, and a lack of broad political support (Stuber and Schlesinger 2006; Currie 2006). Means-tested programs can also distort incentives to work and save (Tran and Woodland 2014; Bruckmeier and Wiemers 2018; Bütler et al. 2017).

One alternative to means-testing is a quasi-universal benefit. It uses broad targeting, i.e. its recipients belong to a group that is widely recognized as having a higher risk of low income, but no individual income criteria are imposed and all entitled individuals receive the same value of a benefit. For example, such a program can cover the whole or a large part of the elderly population. Since the beginning of the Covid-19 pandemic, quasi-universal transfers have attracted interest in several countries, providing temporary support to older households. In 2021, Canada introduced a one-time payment of $500 for older senior citizens. Similar benefits were provided in Israel. A notable example of a permanent quasi-universal transfer is the *13th Pension*, introduced in 2019 in Poland. The advantages of quasi-universal transfers in achieving fiscal redistribution objectives are also recognized by international institutions like the International Monetary Fund (see e.g. Coady and Le, 2020).

This paper aims to study the long-term aggregate, redistributive, and welfare effects of this type of programs, and compare them to those of more standard elderly-oriented policies with similar fiscal costs. It also investigates how simple modifications to the program design can affect its cost and effectiveness. Finally, it explores how the existing low provisions for old age insurance impact the performance of quasi-universal transfers. To this end, I develop a general equilibrium overlapping generations model. In the spirit of İmrohoroglu et al. (1995), I assume individual earnings shocks and no private insurance market against these shocks. I allow for different types of families and introduce separate earnings and health shocks for all adults in the household. The model thus takes into account not only the key risks faced by households, such as uncertainty of future income, health, lifespan, and the size of medical expenses, but also makes these risks dependent on family composition. By doing so, the model incorporates a family insurance channel, takes into account major gender differences observed in the data, separate pension schemes for men and women, as well as survivors' pension benefits. A general equilibrium framework allows to capture the tradeoff between equality and macroeconomic efficiency.

In contrast to most previous studies that focus on the US, I adopt the perspective of an economy with features specific to most European countries. These include very low fertility, a moderate level of inequality, and free universal health care. None of these features are observed in the US. The model also reflects an aging economy, where older women are subject to great financial vulnerability, and the public health system is struggling with service delivery issues. Under such conditions, elderly-oriented policies are particularly relevant. In numerical simulations that evaluate the effectiveness of quasi-universal transfers to older households, I use the Polish *13th Pension* as an example. This program gives a once-a-year payment to all pensioners equal to the minimum monthly pension, and its total cost amounts to around 0.5% of GDP.

I find that this type of quasi-universal benefits to older households can significantly improve the financial situation of a median pensioner, thus reducing the gap between the median consumption of working and retired households. However, it is well-known that such redistributive policies tend to harm overall macroeconomic performance, leading to the

so-called equity-efficiency tradeoff. This outcome is partly because the effective return that households receive from such programs is lower than they could earn by saving individually. Moreover, by offering some insurance against old age-related shocks, the program reduces the incentive to save, which translates into a lower value of domestic assets and reduced aggregate output.

The program is welfare-reducing from the ex-ante perspective, which means that the benefit of insurance provided by the program does not compensate for the inefficient redistribution from the current to future cohorts, the latter resulting in increased vulnerability of the young to negative earnings shocks due to lower average income. Changes in equilibrium consumption allocation are the primary driver of the welfare loss, whereas the benefits linked to increased leisure are modest. Compared to other programs of similar size that specifically target low-income pensioners, such as a minimum pension increase, the quasi-universal transfer is more effective in increasing median consumption of retirees and combating relative poverty among this group, while being less harmful to economic efficiency.

According to the model simulations, better income redistribution and a more sizable decrease in economic inequality can be achieved by increasing fiscal costs or using more specific targeting, such as directing the transfer to the oldest-old (those aged 85 and over) while keeping the tax rate unchanged. However, this comes at the cost of higher aggregate welfare loss. On the other hand, setting income limits that determine eligibility would help reduce the negative aggregate effect and significantly mitigate the welfare loss, but the average redistributive impact would be much lower.

I check the sensitivity of my findings by comparing them to alternative methods of financing quasi-universal transfers to older households. Compared to the baseline assumption that relies on labor income taxation, taxing consumption mitigates efficiency and welfare losses, but is also less effective in reducing consumption inequality. Using capital taxation generates aggregate distortions that outweigh any positive redistributive effects. Improvement in ex-ante welfare can be achieved by financing these programs from the current pension fund, which lowers an average 'regular' pension but avoids increased taxation. However, in this case, the welfare improvement comes solely from the reduction in pension uncertainty and is marginal.

Finally, assessing the consequences of the quasi-universal transfer for economies with different levels of old age insurance shows that the estimated welfare effects remain robust across various model assumptions. This result emphasizes the crucial role of inefficient redistribution from workers to pensioners, while the insurance effect of the program is limited. In response to the program, households primarily adjust their asset holdings over the life cycle, thereby mitigating the program's impact on inequality.

This paper is related to the literature on the macroeconomic and redistributive impact of non-exclusive programs aimed at older households. A number of papers discuss universal or non-contributory pensions, and stress the need to expand pension coverage in developing economies (see, among others, Willmore, 2007; Melguizo et al., 2017; Dethier et al., 2010; Shen and Williamson, 2006). Another body of the literature focuses on programs that address the health needs in old age, including long-term care (De Nardi et al. 2016a, b; Swartz 2013; Villalobos Dintrans 2018). My paper is also linked to the stream of research which uses a general equilibrium framework with heterogeneous agents and idiosyncratic uncertainty to examine the welfare and redistributive effects of government policies for older households. The primary focus of this literature is on the US and its social security program. In general, removing social security has been found welfare-improving (see among others Conesa and Krueger, 1999; Huggett and Parra, 2010; Storesletten et al., 1999; and İmrohoroglu et al., 1995 for certain specifications). However, some more recent studies show

that incorporating transition costs or aggregate risks in the analysis can lead to the opposite conclusion (Nishiyama and Smetters 2007; Harenberg and Ludwig 2019). New research on the effects of other elderly-oriented policies in the US also indicates that their elimination would be costly or even welfare-deteriorating (see among others Kaymak and Poschke, 2016; Conesa et al., 2018).

An important feature of my paper is that it departs from the conventional practice of modeling households as single units and instead takes into account different family compositions. Several studies evaluate pension systems within the life-cycle models with diverse family structures. Braun et al. (2017) incorporates the risk of loosing a spouse in their rich general equilibrium OLG model. They examine the effects of Medicare, Medicaid, and Supplemental Security Income in the US and obtain substantial long-term welfare gains from these programs. Fehr et al. (2017) study the economic consequences of abolishing the pay-as-you-go pension system in Germany, taking into account the family's insurance role and transitional dynamics. Their results show significant efficiency losses resulting from the elimination of the pension system, which are particularly profound for one-person households. Life-cycle models with married and single households were also used to quantify the effects of removing survivors and spousal benefits from the US pension system. The prevailing consensus is that eliminating auxiliary benefits tied to marriage would result in overall welfare improvements for the majority of the US population and lead to a significant increase in labor force participation among married women (Borella et al. 2023; Groneck and Wallenius 2021; Nishiyama 2019; Kaygusuz 2015). Groneck and Wallenius (2021) also examine the redistributive effects of such a reform for pensioners, demonstrating that replacing spousal and survivor benefits with a minimum old-age benefit would slightly reduce inequality among older adults. Finally, I allign with the literature which recognizes the importance of health and medical expenditure shocks faced by older households in shaping their economic decisions (De Nardi et al. 2010; Yogo 2016; Capatina 2015).

My paper adds to the literature by quantifying the impact of quasi-universal transfers within a general equilibrium framework with a rich description of individual risk. In contrast to many prior studies, it does not evaluate the overall pension system but focuses on an additional policy aimed at strengthening the current pension system and its redistributive role. The proposed reform is not revenue-neutral. Instead, it entails an intergenerational transfer from workers to pensioners. I compare the welfare and aggregate effects of quasi-universal transfers with their redistributive power, as well as the effects of such transfers with other elderly-oriented policies. The novelity of my approach compared to studies with a similar modeling framework is that I also examine changes in the aggregate level of inequality, not only inequality among pensioners, and use a wide set of measures. Finally, I build a model of a European economy, which includes careful calibration in line with empirical evidence and with the support of additional micro-level analysis. Since the related literature is dominated by studies on the US economy which incorporate specific features of the US pension system, this paper analyzes the effects of introducing quasi-universal transfers in an environment where such redistribution might be more justifiable and likely to receive social support.

The rest of the paper is structured as follows. In Section 2 I present the general equilibrium model developed for this paper. Section 3 discusses the calibration procedure and evaluates the model's ability to match non-targeted statistics. Section 4 presents the main results. It describes and compares the long-term impact of a quasi-universal transfer to retired households and its simple modifications, and evaluates its performance against standard policies aimed at providing support to vulnerable older households. It also quantifies the effects of redistribution under different financing methods and model assumptions. The last Section contains concluding remarks.

2 The model

To assess the long-term impact of quasi-universal benefits to older households, I develop a general equilibrium overlapping generations model of a small open economy. The model is populated by heterogeneous individuals, who form households and are perfectly altruistic towards their spouses. Throughout the life cycle, households decide how much to consume, save, and determine the amount of labor supplied by adult household members.

There are several sources of uncertainty in the model. First, individuals face idiosyncratic earnings shocks, which are moderately correlated between household members. Second, in the spirit of Braun et al. (2017), individuals face the risk of health deterioration and health-dependent mortality as they age. Thus, a household composition might change due to the death of a household member. Similar to De Nardi et al. (2010), the model also features the risk of high medical expenses of older households. There is an obligatory pay-as-you-go pension system. Pension payments depend on individuals' average lifetime earnings. Under certain conditions, pension benefits can be inherited by the spouses.

Demographics

The economy is inhabited by overlapping generations of households. The time is discrete and households can live at most for J periods. The number of households changes at a constant rate n. A new household is composed of two individuals who are the same age $j = j_{\text{born}}$ but different genders $i \in \{f, m\}$. The age of a household equals j, that is the age of its members.

Mortality risk

When individuals reach a certain age j_{surv}, they face a mortality risk with the conditional survival probability $s^i(j, h^i)$ that varies with gender, age, and health status h^i. Consequently, households older than j_{surv} might have different compositions d, where $d = 1$ refers to a couple, $d = 2$ indicates a widower, and $d = 3$ corresponds to a widow. Let us define household health status $H \equiv (h^m, h^f)$. The household conditional survival probabilities can be described as

$$S(d, j, H) = \begin{cases} 1 - (1 - s^m(j, h^m))\left(1 - s^f(j, h^f)\right), & d = 1 \\ s^m(j, h^m), & d = 2 \\ s^f(j, h^f), & d = 3 \end{cases} \tag{1}$$

while, for surviving households, the transition matrix of household composition d is given by

$$\Upsilon = \begin{bmatrix} s^m(j, h^m)s^f(j, h^f) & s^m(j, h^m)\left(1 - s^f(j, h^f)\right) & s^f(j, h^f)(1 - s^m(j, h^m)) \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\text{where } \Upsilon(l, k) = \mathbf{P}(d' = k \mid d = l; j, H), \quad \text{for } l, k = 1, 2, 3. \tag{2}$$

Note that, for widows and widowers ($d > 1$), the composition of their households cannot change.

Health risk

All individuals are born in good health and remain so until the age of $j_{\text{health}} - 1$. Afterwards, they face uncertainty about their health status, which can be either good ($h^i = 1$) or poor ($h^i = 0$). The initial distribution of health status, i.e. distribution among individuals aged j_{health}, depends on their earnings shocks (e^i) from the previous period. Formally, for a $(j_{\text{health}} - 1)$-year-old, the probability of being in good health in the next period is defined by $\eta^i(e^i) \in [0, 1]$. For individuals aged j_{health} or older, such probability no longer depends on their productivity, but it can be expressed as a function of their current health condition, age, and gender. I denote

this function as $\zeta^i(j, h^i) \in [0, 1]$. I make a technical assumption that $h^i \equiv 0$ for a former household member who is no longer alive. The above means that widowers (households with composition $d = 2$) have $h^f = 0$, and widows (households with composition $d = 3$) have $h^m = 0$. The formula below summarizes the probability of being in good health in the next period, given relevant characteristics:

$$\mathbf{P}\left(\left(h^i\right)' = 1 \mid h^i, j, e^i, d'\right) = \begin{cases} 0, & d' \notin \tilde{D}^i \\ 1, & j < j_{\text{health}} - 1 \text{ and } d' \in \tilde{D}^i \\ \eta^i(e^i), & j = j_{\text{health}} - 1 \text{ and } d' \in \tilde{D}^i \\ \zeta^i(j, h^i), & j \geq j_{\text{health}} \text{ and } d' \in \tilde{D}^i \end{cases} \tag{3}$$

$$\tilde{D}^f = \{1, 3\},\ \tilde{D}^m = \{1, 2\},$$

where d' indicates household composition in the next period.

Working life

Individuals supply labor until reaching a gender-specific retirement age j^i_{ret}. Over the working period, their productivity is a product of an age-dependent deterministic component $\bar{e}^i(j)$ and a stochastic component e^i. The latter is determined by a realization of a household earnings shock $E \equiv (e^m, e^f)$, which follows an age-invariant bivariate Markov process. Given its productivity shock, a household decides how to allocate the available time for each working-age member between work and leisure. Household gross labor income (excluding pensions) can be summarized by the following formula:

$$\begin{aligned} Z_1(d, j, E, [l_m, l_f], w) = I(j < j^m_{\text{ret}}) I(d < 3) \left(l_m w \bar{e}^m(j) e^m\right) \\ + I(j < j^f_{\text{ret}}) I(d \neq 2) \left(l_f w \bar{e}^f(j) e^f\right), \end{aligned} \tag{4}$$

where w stands for the wage rate per efficiency unit of labor, l_m, l_f denote time allocated to work for male and female household member, respectively, and $I(j < j^m_{\text{ret}})$, $I(j < j^f_{\text{ret}})$, $I(d < 3)$, $I(d \neq 2)$ are binary indicator functions.[1] The formula above indicates that working men live only in households with composition $d < 3$ and age $j < j^m_{\text{ret}}$, contributing $z^m(j, e^m, w) = l_m w \bar{e}^m(j) e^m$ to household (gross) labor income. Similarly, working women are members of households with composition $d \neq 2$ and age $j < j^f_{\text{ret}}$, in which case the contribution to household labor income is $z^f(j, e^f, w) = l_f w \bar{e}^f(j) e^f$.

Pensions

Individuals who are at the retirement age or older are no longer working but are entitled to pension benefits, which are calculated based on their average lifetime earnings $\bar{z}^i$ and a gender-specific replacement rate θ^i. The household pension benefits can be described as

$$\begin{aligned} Z_2\left(d, j, \bar{Z}\right) = I(j \geq j^m_{\text{ret}}) I(d < 3) \max\left(\theta^m \bar{z}^m, \bar{z}_{\min}\right) \\ + I(j \geq j^f_{\text{ret}}) I(d = 1) \max\left(\theta^f \bar{z}^f, \bar{z}_{\min}\right) \\ + I(j \geq j^f_{\text{ret}}) I(d = 3) \max\left(\theta^f \bar{z}^f, \bar{z}_{\min}, \varrho \theta^m \bar{z}^m\right), \end{aligned}$$

where $\bar{z}_{\min}$ is the minimum pension, ϱ represents the portion of a partner's pension benefits that a woman can choose to receive as a survivor pension after his death, and $\bar{Z} \equiv \left(\bar{z}^m, \bar{z}^f\right)$

[1] An indicator function equals 1 if the expression inside its bracket is true and 0 otherwise.

denotes the average lifetime labor income of household members.[2] Similar to Eq. 4, retired men live only in households with composition $d < 3$ and age $j \geq j^m_{\text{ret}}$, and their pension benefits equal $\max(\theta^m \bar{z}^m, \bar{z}_{\min})$. In the case of a retired woman, there are two options. If she is a part of a two-person household ($d = 1$), her pension is $\max(\theta^f \bar{z}^f, \bar{z}_{\min})$. If she is a widow ($d = 3$), she can choose between her own pension and a part of pension benefits of her deceased spouse.[3][4]

Out-of-pocket medical expenses

Starting at the age of j_{health}, households face out-of-pocket medical expenses, the value of which is a product of a deterministic component $\hbar$ and a stochastic shock ε. The former depends on household age, composition, health status, and the average wage in the economy, while the latter is defined as a transient *iid* shock:

$$\Theta \equiv I(j \geq j_{\text{health}})\hbar(j, d, H, w)\varepsilon.$$

Additional transfer income

Retired households can receive additional income from government transfer programs, the value of which can vary with household characteristics. In general, these additional payment can be expressed as

$$\Gamma \equiv \iota(j, d, \bar{E}, \Theta, z_{\text{me}}),$$

where z_{me} represents a median salary after deducting pension contributions.

Preferences

Individuals are perfectly altruistic towards other household members, and utility is derived at the household level. It depends on household consumption without out-of-pocket medical expenses (c) adjusted for household size, and the amount of time allocated to labor by specific household members:

$$u\left(c/\chi(d), [l_m, l_f]\right) = \log\left(c/\chi(d)\right) - \xi_m \frac{l_m^3}{3} - \xi_f \frac{l_f^3}{3}, \tag{5}$$

where function $\chi(d)$ defines the equivalence scale, and $l_m \equiv 0$ for households with $j \geq j^m_{\text{ret}}$ or with d=3. Similarly, $l_f \equiv 0$ for households with $j \geq j^f_{\text{ret}}$ or d=2.

Household decision problem

A household of composition d, age j, with accumulated assets a, and average lifetime earnings $\bar{Z}$, observes its current health status H, current productivity status E, and the realization of the out-of-pocket medical shock ε. Each period, a household allocates its resources between

[2] If there is aggregate productivity growth in the model, the wage per efficiency unit of labor increases over time, resulting in a trend in individual earnings. The value of the average lifetime earnings is adjusted by this trend, which can be interpreted that workers' pension contributions are indexed by the aggregate productivity growth rate. For a retiring individual with a given realization of earnings shocks: $e^i(j_{\text{born}})$, $e^i(j_{\text{born}+1})$, $\ldots$, $e^i(j^i_{\text{ret}-1})$ and previous labor supply choices $l_i(j_{\text{born}})$, $l_i(j_{\text{born}+1})$, $\ldots$, $l_(j^i_{\text{ret}-1})$, their average lifetime earnings at retirement take the form $\bar{z}^i = (1 - \tau_{l_p})(j^i_{\text{ret}} - j_{\text{born}})^{-1} * (z^i(j_{\text{born}}, e^i(j_{\text{born}}), l_i(j_{\text{born}}), w) + z^i(j_{\text{born}+1}, e^i(j_{\text{born}+1}), l_i(j_{\text{born}+1}), w) + \cdots + z^i(j^i_{\text{ret}-1}, e^i(j^i_{\text{ret}-1}), l_i(j^i_{\text{ret}-1}), w))$, where τ_{l_p} is the pension contribution rate, and w represents the current wage level.

[3] If a man dies before reaching the retirement age, his future pension cannot be inherited ($\theta^m \bar{z}^m \equiv 0$).

[4] In reality, both men and women can receive survivor pensions after the death of their spouses. As men, on average, have much higher retirement benefits and shorter lifespans than women, and the survivor pensions are lower than the actual pensions of the deceased, they are of limited relevance and, thus, not considered in the model.

consumption and next period assets, and selects the optimal labor supply $[l_m, l_f]$ for all working-age household members. Thus, its budget constraint is the following:

$$(1 + (1 - \tau_a)r)\, a + (1 - \tau_{l_p} - \tau_{l_\Gamma})Z + \Gamma + \flat = a' + c(1 + \tau_c) + \Theta, \tag{6}$$

where $Z \equiv Z_1\left(d, j, E, [l_m, l_f], w\right) + Z_2\left(d, j, \bar{Z}\right)$, and r is the rate of return on assets. τ_{l_p} describes the pension contribution rate, τ_c, τ_a, τ_{l_Γ} stand for the additional tax rates, and total labor income tax rate satisfies $\tau_l = \tau_{l_p} + \tau_{l_\Gamma}$. Accidental bequests, denoted by $\flat$, are equally distributed over all surviving households.

A household solves

$$V(j, d, a, \bar{Z}, E, H, \varepsilon) = \max_{\substack{c>c_{\min}, a'>0, \\ l_f \in [0,1], l_m \in [0.1]}} \{u\left(c/\chi(d), [l_m, l_f]\right) +$$

$$\beta S(d, j, H) \sum_{d'=1}^{3} \mathbf{P}(d' \mid d; j, H) \mathbf{E}\left[V(j+1, d', a', \bar{Z}', E', H', \varepsilon') \mid \bar{Z}, E, H, \varepsilon\right]\}$$

subject to Eqs. 1, 2, 3, 5, and 6. The expectations operator $\mathbf{E}$ is taken over $\bar{Z}'$, E', H', ε'.

Government

The government collects pension contributions to fund retirement benefits and can also redistribute income through transfer programs. To finance these programs, it can impose taxes on labor income (τ_{l_Γ}), consumption (τ_c), or capital income (τ_a).

Firms

Identical, perfectly competitive firms produce a final homogeneous good Y according to the Cobb-Douglas technology with constant returns to scale:

$$Y \equiv K^{\alpha}(GL)^{1-\alpha}.$$

Aggregate productivity G increases at a constant annual rate g. Firms rent domestic labor L and domestic and foreign capital K. Profit maximization implies that factor prices are equal to their marginal products:

$$\partial Y/\partial L = w \quad \text{and} \quad \partial Y/\partial K = r + \delta,$$

where δ stands for the capital depreciation rate.

Interest rate

The model describes a small open economy, where the domestic real interest rate is a sum of the world interest rate r^* and a risk premium. Following Schmitt-Grohé and Uribe (2003), the risk premium reacts to changes in the country's net foreign debt according to the following formula:

$$r = r^* + \phi\left(\exp\left(\frac{K - A}{Y}\right) - 1\right),$$

where A stands for aggregate domestic assets held by households and $(K - A)$ can be interpreted as the economy's net foreign liabilities.

Steady-state

In the steady-state equilibrium of the model, households choose their optimal consumption level, firms make optimal production decisions, the government follows a given fiscal rule, and the domestic interest rate is tied to the world interest rate and the economy's net foreign assets position as described above. All variables are time-invariant, and all aggregate values, factor

prices, and household distribution are consistent with optimization by individual agents. The formal definition of the steady-state equilibrium is presented in the Supplementary Appendix. The model is solved numerically by backward recursion from the final period. To ensure computational tractability, all continuous variables, i.e. earnings, pension benefits and the asset stock are discretized.

3 Calibration

I calibrate the model to Poland, a European economy with low fertility, a universal health care system, and a moderate level of inequalities. Indeed, according to the *World Population Aging*(2020), Poland has one of the fastest aging populations in Europe. Polish women retire at 60, five years earlier than men, and much earlier than women in most developed countries. Thus, with the existing gender wage gap and contribution-based pension system, future pensions of currently working Polish women are expected to be very low (OECD *Pensions at a Glance,* 2019). Moreover, as the health system in Poland is predominantly focused on hospital care, outpatient medicines account for most of out-of-pocket spending (Polish *Country Health Profile*, 2019). Poland also has one of the highest out-of-pocket pharmaceutical expenditures among European countries. To reflect all these features in the model, and in particular to properly allow for health-related risks of Polish households, I perform an additional empirical analysis using micro-level data from the Polish Household Budget Survey (HBS) and SHARE project (Börsch-Supan 2020).

Since I am interested in long-term effects of the analyzed benefits, my calibration strategy is to take a perspective of a young household, whose members are currently entering the labor market. To this end, I use recent data or projections on the Polish general economic conditions, the evolution of an individual income process, distribution of health status and out-of-pocket medical expenses, and the expected demographic structure. While calibrating the parameters, I use macroeconomic statistics and evidence established in the empirical literature. If these are not available, I perform additional analysis using micro-level data on Polish older population.

In the model, I assume an obligatory pay-as-you-go pension system, where a pension depends on individual contribution, and the retirement age is set according to the Polish statutory pension age. Widows have an option of choosing between their own pensions and a fraction of retirement benefits of their deceased husbands. Thus, the pension system in the model reflects the main characteristics of the current pension system in Poland.

As a result, my model economy exhibit the following key features:

- fast speed of population aging and low fertility,
- the large gap between the life expectancy of men and women,
- low statutory retirement age of women,
- low pension replacement rates, especially for women,
- relatively high burden of out-of-pocket medical expenses (high incidence of catastrophic health expenditure, abbr. CHE) in comparison with other European countries.

For all calibration purposes, I use data from before the COVID-19 pandemic. This is because our current knowledge about the long-term (or even the medium-term) effects of the pandemic is very limited. Moreover, since this paper studies stationary equilibria, I need to assume stable economic conditions, and the most recent data were greatly influenced by the pandemic shock.

Given the available data, I can calculate two-year health-dependent survival probabilities and transitions between the health statuses. Thus, I set the model period to two years. In the

baseline model, households do not receive any payments from the transfer program ($\Gamma \equiv 0$). Below, I discuss the calibration process in more detail. Additional information is provided in the Supplementary Appendix.

Demographics and health

When a new household enters the model, it consists of two 20-year-old individuals. The mortality risk first occurs at age 45, and a person can live for a maximum of 80 years. Thus, the maximum household age is 100. The old-age dependency ratio in the model equals 40.2%, which matches the Eurostat projections for Poland for 2040. An annual household growth rate n is set at -0.56%, according to this statistics.

I estimate health-dependent survival probabilities and transitions in and out of poor health using SHARE data. The SHARE project concentrates on the older part of the population (individuals aged 50 or older), and mostly on European citizens (Börsch-Supan 2020). It collects longitudinal data on a wide range of socioeconomic indicators, including self-perceived health and the time of death (if one occurred). For more details about the project, please refer to Börsch-Supan et al. (2013).[5]

Survival probabilities

To asses the effects of gender and health status on survival probabilities, I perform logistic regressions using data on Polish individuals older than 55 from the SHARE waves, which cover the years between 2006 and 2017. The dependent variable is binary and takes one if death occurred within two years of the last interview. The specification includes age, age squared, gender, health status, and health status interacted with age. The variable *health status* refers to individuals' self-assessment of their health. It is defined as a binary variable, taking the value of one if a person perceives their health as "poor." As expected, the estimated probability of survival decreases with age and is higher for those in good health. Moreover, women have significantly higher chances of survival than men of the same age and the same level of self-assessed health. Models on different subsamples and a broader set of explanatory variables were also considered (more in the Supplementary Appendix). Based on the estimated parameters from the regression, I calculate four 2-years conditional survival probabilities, i.e. for men with poor health, men with good health, women with poor health, and women with good health. Since I want the average (health-independent) conditional survival probabilities in the model to match the official 2019 life tables of men and women, published by the Polish Central Statistical Office (CSO), the SHARE-based estimates are scaled accordingly. Consequently, the average remaining life expectancy in the model equals 62.22 years for a 20-year-old woman and 54.60 years for a man of the same age.

Health transitions

The risks of falling into and staying in poor health, expressed by the function ζ^i, are estimated separately for men and women on SHARE data for Poland. Current self-perceived health is

[5] The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARE-LIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782, SHARE-COVID19: GA N°101015924) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

a logistic function of a self-health assessment made two years earlier, a cubic in age, and age interacted with a previous self-health assessment (see the Supplementary Appendix for details). The initial shares of men and women in poor health are approximated by SHARE data from waves 6 and 7, while their relative distribution among income groups comes from the 2019 Eurostat data. In Fig. 1, the empirical fractions of those in poor health are plotted against age and compared with the final fractions in the model. We can see that, on average, women have a greater risk of being in poor health than men, and this risk increases more sharply with age compared to that for men. Both of these features are reflected in the model.

The survival probabilities, the transition matrices between different health statuses and the distribution of the initial health status uniquely determine household composition over age. Figure 2 illustrates the model assumptions on the distribution of couples, widows, and widowers across various age groups and compares them to empirical data from the 2018 Polish Household Budget Survey. In general, the model fits the data reasonably well. Widows account for more than half of households older than 80. The model assumes a higher proportion of one-person households (widows and widowers) among the oldest families and a lower share of couples for younger households compared to the data. The above difference comes from the fact that cross-section amalgamates data from cohorts with varying life expectancies while the model utilizes their latest estimates.

Health expenses

Polish HBS has the best quality data on out-of-pocket medical expenditures in Poland. However, these data are at the household level and lack information on self-health assessments of household members. Thus, once again, I use SHARE data for Poland to calculate separate age profiles of average out-of-pocket health expenditures of individuals with different health statuses (more details in the Supplementary Appendix). These data are also used to

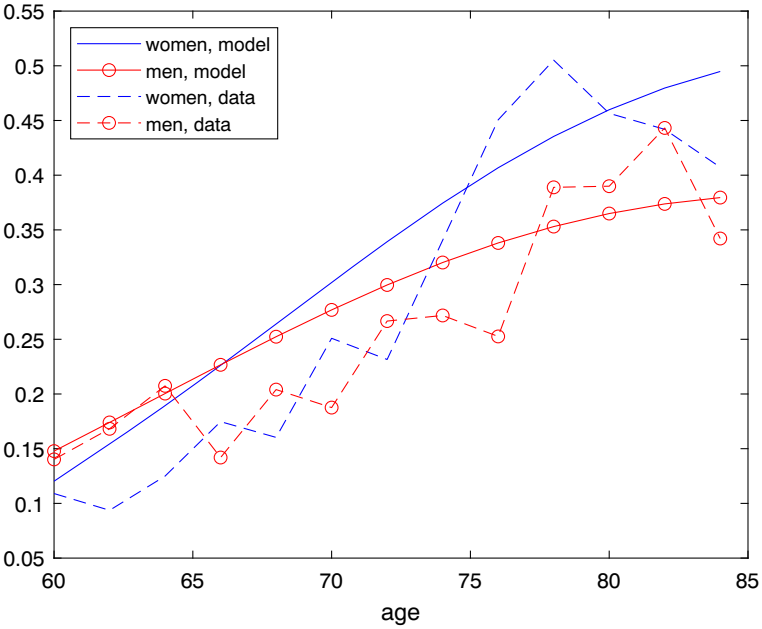

Fig. 1 Share of those in poor health across different age groups. Notes: Author's estimates. Empirical shares are based on SHARE data for Poland from waves 6 and 7

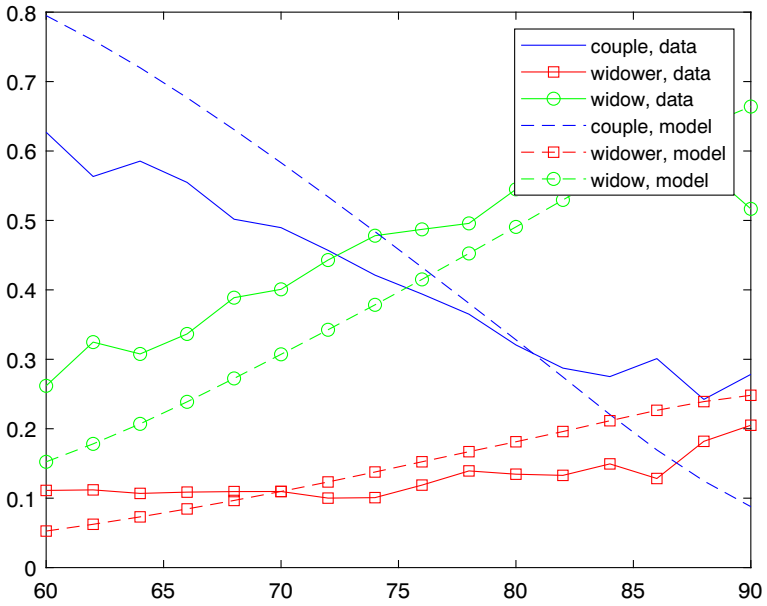

Fig. 2 The distribution of couples, widows, and widowers across different age groups

calculate for the differences in average out-of-pocket medical expenditures between men and women. Then, I rely on the Polish HBS from 2016 to approximate the aggregate amount of out-of-pocket medical expenses and scale the SHARE-based profiles accordingly.

In the model, individuals begin to face the health risk at age 60. Figure 3 presents the final model assumptions and depicts how average out-of-pocket medical expenses of different household types vary with age. Intuitively, poor self-perceived health of a household member translates into higher out-of-pocket medical expenditures. Women have on average around 18% higher health-related spending than men. Empirical data indicate that the average out-of-pocket medical expenses of the Polish older adults increase with age. For individuals in poor health, this increase is observed up to age 90, while average out-of-pocket medical expenses of those in good health stabilize at age 80. There is not sufficient data on individuals older than 90 years, so in the model I assume that out-of-pocket medical expenditure are stable above this age.

I want the model to capture the extent of Polish older households suffering from high health-related spending. As an indicator, I use the share of households with CHE among all households older than 74. The variance of the transitory component of out-of-pocket medical expenses, i.e. var(ε), is calibrated to meet this target. To calculate CHE, I use the "budget share approach" and the most common threshold of 15%. The incidence of CHE occurs when household's out-of-pocket medical expenses are greater than 15% of its total consumption expenditures.

Potential earnings

The shape of the deterministic age profile of earnings is estimated separately for men and women using the 2016 Polish HBS data. I regress the log of individual's monthly earnings on a cubic in age, and a set of dummy controls indicating the level of educational attainment, disability status, full-time job, working in private or public sector, voivodship, type of area,

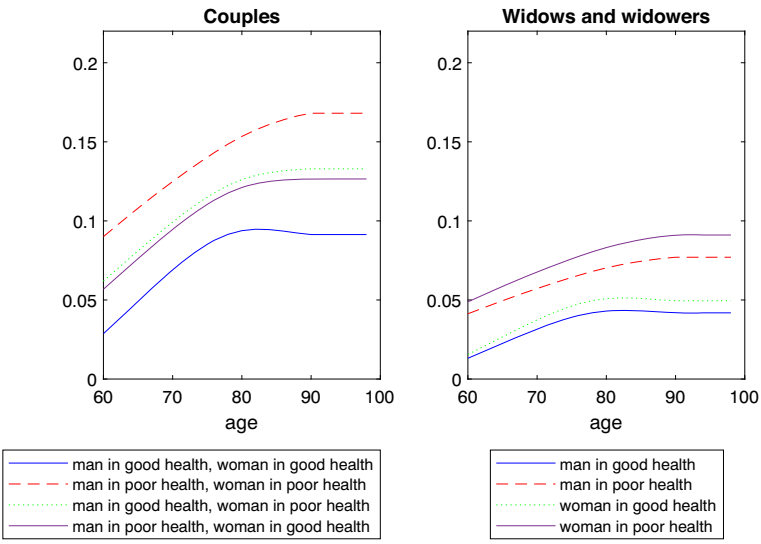

Fig. 3 Average out-of-pocket medical expenses over age, expressed as a share of the average wage, model assumptions

and month that the questionnaire was completed. Then, the estimated earnings-profiles of men and women are normalized to one, and the latter is scaled downward by 4.5% to reflect the gender pay gap in Poland.

Following Storesletten et al. (2004), the logarithm of the individual earning process is a sum of permanent AR(1) and transitory shocks. I allow for these shocks to be correlated between spouses. I set the correlation between the initial earnings shocks of partners at a relatively high level. The above assumption is motivated by assortative mating - a broad concept that in economics means that people tend to select partners with similar socio-economic backgrounds (Schwartz 2013). Within the model, initial productivity serves to signal one's socio-economic status and influences the choice of partners. As educational attainment is one of the most important factors in the mating process and is closely correlated with income (Eika et al. 2019; Greenwood et al. 2014; Schwartz and Mare 2005), I use the empirical correlation in educational levels between spouses as an approximation for the correlation of initial potential earnings between partners. This correlation value is set at 0.54, in line with estimates obtained from the 2017 Polish Household Budget Survey data, using binary variables indicating at least post-secondary education. A similar approach to model the correlation of initial earnings shocks was adopted by Heathcote et al. (2010).

I assume a modest correlation of 0.14 between the subsequent earnings shocks of couples. I set this value to target the correlation of the annual wage growth rate. As estimated by Hyslop (2001), this correlation is weak but statistically significant at the level of 0.15. The same target was used i.a. by Heathcote et al. (2010); Attanasio et al. (2008), and Braun et al. (2017). The annual autocorrelation coefficient is set to 0.9 in line with the estimates for Poland by Kolasa (2017), while for the variance of an individual permanent shock I use the midpoint of available estimates (see i. a. Sommer, 2016). Finally, I calibrate the variance of a transitory component to reflect the 1.2 mean-to-median wage ratio from official CSO statistics in 2022.

Labor choice

In the model, both men and women exhibit elastic labor supply. I assume that, on average, workers spend 40% of their time at work, and women work fewer hours than men. Following OECD statistics, I set the ratio of hours worked by women to men at 86% and calibrate the labor disutility parameters, denoted as ξ_m and ξ_f, to align the model with these targets.

Pension

Poland operates a pay-as-you-go pension system with a notional defined-contribution scheme and age-specific retirement age. Women have the option to retire at 60, which is five years earlier than men. The total pension contribution rate for workers stands at 19.52%. Approximately two-thirds of this contribution is allocated to the 'notional' account, while one-third is directed to the 'individual' sub-account. The latter was introduced in 2011 to replace the mandatory funded scheme (OFE). Additionally, individuals have the choice to allocate 15% of their pension contributions to a private defined contribution scheme instead of the sub-accounts, but this capital must be returned to the individual sub-account ten years prior to retirement.

One key distinction between the notional account and the individual sub-account is that the latter is subject to inheritance. Furthermore, the accounts differ in their indexation methods. Notional accounts are adjusted to account for inflation and the growth of the covered wage bill. In contrast, sub-accounts use medium-term GDP growth for indexation. When individuals retire, their accumulated notional capital is divided by the remaining life expectancy to calculate the monthly pension benefit. This life expectancy is averaged between men and women. Pension benefits are also subject to periodic adjustments based on inflation and wage growth rates.

Additionally, the Polish pension system includes several exceptions. Self-employed individuals are only required to contribute up to 60% of the average wage. There are also more favorable rules for farmers and certain civil workers. Retirees have the option to receive up to 85% of their deceased spouse's pension after relinquishing their own benefits. Lastly, a minimum pension is provided for individuals who have completed the required number of years in the workforce.

Considering the above described complexity of the Polish pension system, the model adopts its simplified version, focusing on the key features. It follows the gender-specific retirement ages and the notional defined contribution (NDC) plan. Workers have their individual notional accounts where their contributions are recorded, and these contributions, along with pension benefits, are indexed based on the average wage growth rate g, which is also the GDP growth rate in the model. Individuals' pension benefits are then proportional to their accumulated contributions. In a steady state with a time-invariant age structure of population and balanced pension system, this proportion uniquely determines the pension contribution rate. In the baseline scenario, I assume that women and men's pension benefits account for 27% and 35% of their average lifetime earnings, respectively. These numbers are consistent with the anticipated future pension benefits of a full-career average Polish earner who starts working in 2018 at the age of 22 (as per OECD *Pensions at a Glance,* 2019) and results in pension contribution rate τ_{l_p} of 13.36%. To ensure that the pension system implemented in the model follows the NDC scheme, I keep this pension contribution rate constant across all simulations presented in the paper and allow for variations in pension replacement rates.

The classic NDC scheme is considered to be quasi-actuarially fair on average (Lindbeck and Persson 2003). However, due to the use of a gender-neutral annuity divisor, it might result in actuarial gains or losses for women and individuals with longer life expectancies

(del Carmen Boado-Penas et al. 2022). In the model, the assumption of separate pension replacement rates for men and women makes the pension system slightly favorable towards women. To eliminate this effect and account for gender differences in longevity, the pension replacement rate for women would need to be set at 66% of that for men, rather than the current 77%. Nevertheless, it's worth noting that my model's assumption aligns with the actual design of the Polish pension system and all countries with NDC schemes apply a gender-neutral annuity divisor. The inclusion of the survivor pension benefits with $\varrho = 85\%$ additionally reduces the actuarial fairness of the system. Finally, the minimum pension payment $\bar{z}_{\min}$ in the baseline economy equals 12.7% of the the average wage.

Taxation

In the baseline scenario, the sole taxation comes from pension contributions. In the main simulations, I assume that transfer programs are funded through a flat increase in the labor income tax rate by τ_{l_Γ}. Alternative methods of financing redistributive programs are explored in Subsection 4.3.

Other parameters

In the utility function and for relevant inequality statistics, I apply an Oxford equivalence scale. It gives a weight ratio of two-person households to a one-person household equal to 1.7. The annual capital depreciation rate $\delta = 8\%$ takes an average value of the estimates used in recent overlapping generations models calibrated for Poland (Rubaszek 2012; Makarski et al. 2017; Kolasa 2021). The aggregate annual productivity growth rate $g = 0.75\%$ is approximated by average Polish TFP growth between 2004 and 2013 (Gradzewicz et al. 2018). The global interest rate r^* reflects the average natural interest rate in the 2010s, estimated for the Euro area using the Holston et al. (2017) model. The remaining three parameters, i.e. the capital share in output $\alpha = 0.32$, discount factor β (set at 0.965 annually), and debt elasticity of the domestic interest rate ϕ, are calibrated to reflect the following targets: consumption share in GDP, interest rate risk premium, and international investment position (see Table 1 for details).

Calibration assessment

Table 2 evaluates the model's performance in matching non-targeted statistics. The model does a good job of replicating the inequality in household disposable income. It also generates a similar age profile of average consumption to the empirical one (see Fig. 4). In the case of assets inequality, the Gini coefficient is slightly overestimated in the model, but the mean-to-median ratio fits the data exactly. Finally, the model captures the incidence of CHE for households aged 65 or older and closely replicates relative poverty within the 65 to 85 age bracket.

4 Results

The calibration of the baseline model described above features a contribution-based pension system, but no additional social policy aimed at older households. I now introduce certain transfer programs to the model and, by looking at how they change the model's steady state, I quantify their long-term impact on the economy. All the programs analyzed in the following two Subsections are financed by a flat payroll tax (τ_{l_Γ}). In line with the main focus of this paper, I start with a basic version of a quasi-universal transfer. Next, I describe some

Table 1 Calibration targets

indicator	value	source
old-age dependency ratio 65+ vs. rest (%)	40.2	Eurostat predictions for 2040
consumption as % of output	74	household consumption in GDP excluding government expenditure, average from 2004-2019, Eurostat data
interest rate risk premium (%)	1.9	the difference between natural interest rates in Poland and in Euro area, 2010-2020 averages from Arena et al. (2020) estimates
net assets as % of output	-57	international investment position to GDP, average from 2004-2019, Eurostat and NBP data
Households with CHE (among those older than 74 years)	22.3	author's estimates based on Polish HBS, 2018, budget share approach with 15% threshold
Mean to median wage	1.23	Polish CSO, October 2022
average time allocated to work to the total available time	0.4	standard in the literature
average number of hours worked (men vs. women, %)	86	OECD average, for total employment and ages between 25 to 54, OECD database

modifications to it and compare the outcomes to more standard elderly-oriented programs. At the end of this Section, I check how the results change with different financing methods and model assumptions.

Table 2 Non-targeted statistics

	data	model
household disposable income		
Gini, workers (Oxford equivalence scale)	27.3[1]	26.7
Gini, pensioners (Oxford equivalence scale)	21.7[1]	19.0
household assets		
Gini, all (no scale)	56.8[2]	57.5
Mean to median assets, all	1.6[2]	1.6
households with CHE		
age $\geq$ 65, threshold = 10%	31.5[1]	30.8
age $\geq$ 65, threshold = 15%	16.9[1]	15.5
age $\geq$ 65, threshold = 20%	9.1[1]	8.3
households in relative poverty		
age 65-85	14.3[1]	14.5

Notes: Author's estimates.
[1] Polish HBS, 2018
[2] Polish Wealth Survey of Households, 2016 (Bańbuła and Żółkiewski 2016).
Relative poverty is a consumption-based indicator calculated with the Oxford equivalence scale and a threshold set at 50% of the mean household equivalised consumption (excluding out-of-pocket medical expenses)

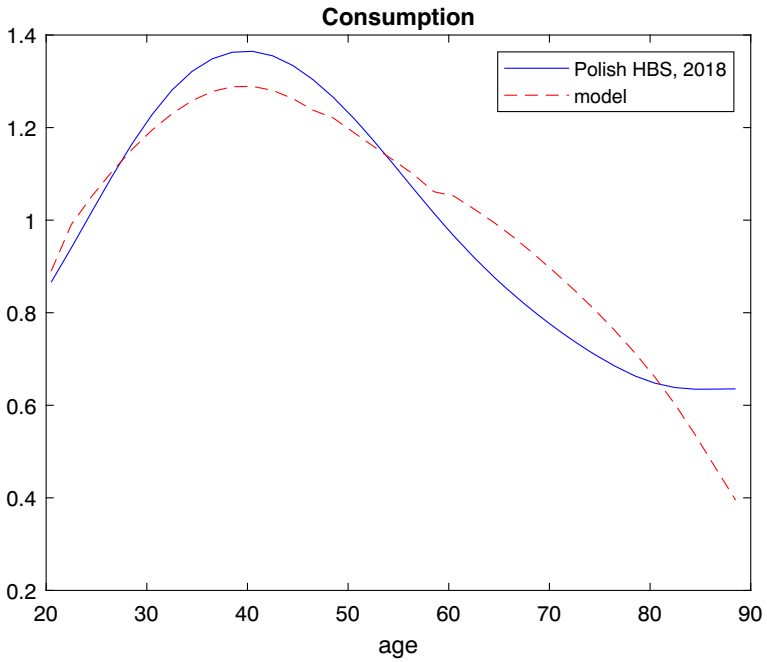

Fig. 4 Average household consumption over age. Notes: Author's estimates. Profiles are scaled to their means. Out-of-pocket medical expenses are included in consumption

4.1 The long-term effects of quasi-universal transfers to elderly

As an example of a quasi-universal transfer to older households, I use the *13th Pension* introduced in 2019 in Poland. This program gives an additional payment, once a year to all pensioners, equal to the minimum monthly pension. In 2020 this benefit was enshrined into the Polish law system by the Thirteenth Pension Act. In 2019 the payment received after taxes was 1/3 of a net median monthly salary. As the program has broad coverage, simplicity, and pays equal transfers to all pensioners, it has all properties of a classic broad quasi-universal transfer aimed at older households.

In the model, I assume that my main (quasi-universal) redistributive program, to which I will refer subsequently as the *13th Pension,* gives all women who have reached 60 and all men aged 65 or more the same transfer in the amount of one-third of the median monthly salary. The above assumptions result in 44% of households having at least one member eligible for the program. The *13th Pension* amounts to 0.6% of total output and its financing requires an additional labor income tax of 1.03%.

Macroeconomic effects The long-term impact of the *13th Pension* on the main economic aggregates is presented in Table 3. It is instructive to first look at the partial equilibrium effect of the program, i.e. how the *13th Pension* payments affect an economy in which factor prices remain fixed. First, as introducing the program requires an additional labor income tax, households receive lower net wages and pension payments. Second, the expected additional transfers incentivise households to reduce their savings for old age. Labor supply of men and women drops by 0.18% and 0.17%, respectively, while income and substitution effects go in opposite direction. Additionally, total domestic assets in the economy are reduced by more

Table 3 Aggregate effects of the *13th Pension*

	ΔY (%)	ΔC (%)	ΔA (%)
The partial equilibrium effect of the *13th Pension* (fixed factor prices)	−0.18	−0.56	−4.73
Total effect of the *13th Pension*	−0.57	−0.43	−2.29
	ΔL_m (%)	ΔL_f (%)	
The partial equilibrium effect of the *13th Pension* (fixed factor prices)	−0.18	−0.17	
Total effect of the *13th Pension*	−0.21	−0.17	

than 4.7%. In consequance, less capital income is earned by households. Lower household disposable income translates into a decline of 0.56% in total consumption and of 0.18% in output.

Now, let us relax the assumption of fixed factor prices and consider a small open economy. In such a setting, the domestic interest rate responds to changes in domestic assets. Thus, the decline in domestic assets described above raises the domestic interest rate. This means higher costs of capital, translating into lower output and lower wage per efficiency unit of labor. Due to general equilibrium adjustments, the *13th Pension* program leads to an increase of 0.17 pp. in the domestic interest rate. In this scenario, household assets are expected to decline by 2.3%, while aggregate output and consumption drop by almost 0.57% and 0.43%, respectively. The additional labor distortions are of a smaller magnitude. The labor supply of men decreases by 0.21%. There are no additional significant adjustments in women's labor supply, and the total size of distortions is the same as in the partial equilibrium.

While the significant reduction in aggregate assets is observed, the changes in labor supply are moderate. This stems from the fact that the most substantial decrease in savings due to the *13th Pension* is observed for households aged 60 or more, and thus, it does not result in distortions in labor supply. The labor adjustments are most profound for older workers.

Redistribution The *13th Pension* has a significant long-term redistributive impact, which can be attributed to intra-cohort effects. Indeed, in the steady state, households in old age receive transfers for which they contributed earlier in life. On the other hand, the welfare effects, presented in the next paragraph, reflect intergenerational redistribution, efficiency effects due to labor supply reactions, and insurance effects. The latter result from the intra-cohort transfers imposed by the program.

The median consumption of a retired household increases by almost 1.33%, while that of a working household drops by 0.93% (Table 4). As the *13th Pension* is a universal transfer, all recipients receive the same payouts. However, for poorer pensioners, the *13th Pension* payment is a more significant source of additional income, and, thus, the highest increase in consumption is observed for this group. Among households aged 65 or more, those at the 25th percentile of consumption distribution increase their spending on goods and services by more than 2.0%, while consumption of the family in the upper quartile of consumption distribution is only less than 0.9% higher.

As a household's available resources decrease in old age, so does its consumption. Thus, the highest rise in consumption associated with the introduction of the *13th Pension* is found for the oldest-old age group (Table 5). In the long term, a median household aged 85 or more has a 3.9% increase in consumption. Moreover, the increase in median consumption is more significant for retired couples and widows compared to retired widowers.

Table 4 Redistribution due to the *13th Pension*,changes in pp

Gini consumption [1]	−0.34
Theil (consumption) within	−0.12
Theil (consumption) between	−0.13
Q25 consumption, household age < 65	−0.71
Q50 consumption, household age < 65	−0.93
Q75 consumption, household age < 65	−0.91
Q25 consumption, household age >= 65	2.06
Q50 consumption, household age >= 65	1.33
Q75 consumption, household age >= 65	0.89
Gini assets	0.08

[1] Household equivalised consumption (excluding out-of-pocket medical expenses) with the Oxford equivalence scale; Gini and Theil indices on the scale 0-100

The *13th Pension* leads to a moderate reduction in total consumption inequality. Changes in inequality among retired and working households are responsible for around half of the overall decline in inequality. The other half is caused by lower consumption inequality between these groups (see the Theil, 1967 decomposition in Table 4). As a result, the *13th Pension* reduces the Gini coefficient for consumption by around 0.34 pp. in the long term.

The program only slightly affects the distribution of assets. As the expected transfers negatively impact savings of all groups of households, the highest drop in assets is found for the oldest-old and those in the lowest quartile of consumption distribution. Eventually, inequality in assets increases and the Gini coefficient for assets rises by 0.08 pp.

The *13th Pension* is moderately successful in reducing poverty among older households (Table 5). In the long term, it generates a 1.7 pp. decrease in relative poverty within the group aged 65 or more. The highest poverty reduction is found among the oldest-old and widowers. Similarly, the *13th Pension*'s ability to mitigate the financial burden caused by out-of-pocket medical expenses is limited. In the long term, the program decreases the share of those with CHE by less than 0.6 pp. and is most effective for the oldest-old and widows.

Welfare effects

Let us now take a look at the welfare implications of the *13th Pension*. To this end, we will use welfare loss, expressed as the minimum required increase in household consumption at

Table 5 Changes in median consumption, relative poverty and CHE due to the *13th Pension*

	household age						
	65+	65-74	75-84	85+	couples	widowers	widows
median cons.[1] (%)	1.33	0.85	1.61	3.85	1.39	0.91	1.36
CHE[2] (pp.)	−0.58	−0.27	−0.81	−1.58	−0.52	−0.24	−0.78
relative poverty[3] (pp.)	−1.74	−0.63	−1.61	−4.43	−1.64	−2.51	−1.56

[1] household equivalised consumption (excluding out-of-pocket medical expenses) with the Oxford equivalence scale

[2] catastrophic health expenditure, budget share approach, threshold=15%

[3] consumption-based indicator calculated with the Oxford equivalence scale and a threshold set at 50% of the mean household equivalised consumption (excluding out-of-pocket medical expenses)

all ages for which it would be indifferent for the members of a household if they were born in an economy with or without the program. This is calculated under the veil of ignorance, meaning that a household does not know a priori anything about its future life trajectory.

Following Conesa et al. (2009), I decompose the welfare effect into three components - the changes arising from different allocations of: 1/ consumption, 2/ man's labor supply, and 3/ woman's labor supply. Let us denote $W(c^0, l_m^0, l_f^0)$ as welfare under the veil of ignorance for a given allocation (c^0, l_m^0, l_f^0). If (c^0, l_m^0, l_f^0) is an optimal allocation in the baseline economy, and (c^1, l_m^1, l_f^1) is an optimal allocation in the economy with the *13th Pension*, the total welfare effect ζ due to the program fullfiles the following condition:

$$W((1+\zeta)c^0, l_m^0, l_f^0) = W(c^1, l_m^1, l_f^1),$$

while the welfare effect stemming from changes in consumption satisfies

$$W((1+\zeta_c)c^0, l_m^0, l_f^0) = W(c^1, l_m^0, l_f^0).$$

In a similar manner, welfare effects of switching into different allocation of male labor supply (ζ_{l_m}) and female labor supply (ζ_{l_f}) can be calculated from the following equations:

$$W((1+\zeta_{l_f})c^0, l_m^0, l_f^0) = W(c^0, l_m^0, l_f^1),$$

$$W((1+\zeta_{l_m})c^0, l_m^0, l_f^0) = W(c^0, l_m^1, l_f^0).$$

For each component of the welfare effect, we can further disentangle the level and the distribution effect. The former captures the changes in aggregate variables between steady states, while the latter maintains the aggregates unchanged and measures the pure effect of different allocations over the life cycle. The above can by calculated using the following formulas:

$$(1+\zeta_c^d)(1+C^1/C^0) = (1+\zeta_c),$$

$$(1+\zeta_{l_m}^d)(1+L_m^1/L_m^0) = (1+\zeta_{l_m}),$$

$$(1+\zeta_{l_f}^d)(1+L_f^1/L_f^0) = (1+\zeta_{l_f}),$$

where C^0, C^1 denote aggregate consumption, L_m^0, L_m^1 stands for the total hours worked by men and L_f^0, L_f^1 refers to the total hours worked by women in the baseline and the new steady state, respectively.

Once again, let us first consider the partial effect of the *13th Pension* in an economy with a fixed domestic interest rate. In this scenario, the program gives a long-term welfare loss equal to 0.66% of household consumption (Table 6). In dynamically efficient economies, welfare loss is not a surprising result for a program that redistributes income from working to retired households. As it is known from the previous literature, social security decreases welfare in this class of models. Ultimately, the burden of higher taxes faced by young workers, who are particularly vulnerable to earnings shocks, outweighs the positive effect of increasing old age provision. The majority of the welfare loss from the *13th Pension* comes from changes in optimal consumption allocation, estimated at 0.76% of consumption equivalence. Two-thirds of this loss stem from the negative level effect of lower aggregate consumption. The rest is caused by the shift in consumption distribution towards older ages, which is also found to be ex-ante welfare-reducing. The welfare gain due to the increase in leisure is modest, standing at 0.06% and 0.04% for men and women's labor supply, respectively.

Allowing for interest rate adjustments, the total welfare loss due the *13th Pension* rises to 0.81%. The total effect arising from changes in consumtion allocation increases to 0.91%,

Table 6 Welfare loss due to the *13th Pension* under the veil of ignorance, in %

	(fixed factor prices)	general eq.
Total	0.66	0.81
Consumption		
Total	0.76	0.91
Level	0.56	0.43
Distribution	0.21	0.48
Labor supply of men		
Total	−0.06	−0.06
Level	−0.09	−0.12
Distribution	0.03	0.06
Labor supply of women		
Total	−0.04	−0.03
Level	−0.06	−0.07
Distribution	0.03	0.04

even though the level effect is smaller in this case since an increase in the interest rate mitigates the drop in aggregate savings. The distibution effect stemming from consumption more than doubles, as individuals, under the veil of ignorance, find the changes in factor prices resulting in lower wages unfavorable. The welfare gain assiociated with leisure still accounts only for a small part of overall welfare changes.

4.2 Comparison with other elderly-oriented policies

I next look at the effects of selected modifications to the *13th Pension* by narrowing the group of recipients and/or reducing the scale of the program. In doing so, I want to keep the spirit of the *13th Pension*, so I allow only universal transfer payments (the same for all recipients) and impose simple eligibility criteria. I also compare the Polish *13th Pension* with a program that has been a part of the pension systems of several European countries, such as Austria, Portugal or Italy, and which gives each pensioner an additional (13th) payment once a year equal to his/her/their monthly pension amount (I will refer to it subsequently as the *Additional Pension Payment*). Next, I consider standard policies aimed at supporting the most vulnerable older households. I investigate the impact of an increase in the minimum pension, and extended medical coverage for the elderly. All programs are financed by a flat tax rate imposed on labor income τ_{l_Γ}. The size of standard elderly-oriented programs matches those of the *13th Pension*, which means that the tax rate is kept unchanged. Table 7 presents a summary of all the considered policies. Subsequently, I look at whether different methods of financing the *13th Pension* can change the program's outcomes. I end this Section by exploring how different provisions for old age insurance impact the performance of quasi-universal transfers.

4.2.1 Modifications to the *13th pension*

Increase in eligibility age Of all pensioners, the oldest-old are those particularly in need of financial support. Indeed, they may have already spent most of their savings, face the highest out-of-pocket medical expenses, and are likely to live in single-person households.

Table 7 Government polices aimed at older households, introduced in the model

name	description	increase in labor income tax τ_{l_Γ} (in percentage points)	share of households that receive payments from the program
13th Pension program and its modifications			
13th Pension	Each year every pensioner receives an extra payment that equals 30% of the median monthly salary.	1.03	44.42
Standard 13th Pension, 84+	Each year every person aged 84 or more receives an extra payment that equals 30% of the median monthly salary.	0.19	9.32
Enlarged 13th Pension 84+	Each year every person aged 84 or more receives an extra payment that equals 5.5 times the standard *13th Pension*.	1.03	9.32
13th Pension Poor10	Pensioners in the lowest income decile receive an extra payment that equals 30% of the median monthly salary.	0.10	6.29
13th Pension Poorer Half	Pensioners with pension below mean receive an extra payment that equals 30% of the median monthly salary.	0.51	30.40
Additional Pension Payment	Each year every pensioner receives 13 instead of 12 installments of his/her monthly pension.	1.29	44.42
standard polices aimed at older households			
Minimum Pension Increase	There is an increase of the minimum pension from 12.7% to 22.9% of the average wage.	1.03	21.68
Extended Medical Coverage	Households aged 65 and older receive a reimbursement of 40.0% of their out-of-pocket medical expenses.	1.03	45.0

Thus, the first considered modification to the *13th Pension* is to limit the recipients to those aged at least 84. The individual payment is kept at 30% of the median monthly salary. Such an adjustment (which I refer to as the *Standard 13th Pension 84+*) costs substantially less than the original *13th Pension* program. While it has significantly smaller long-term negative

impacts on welfare, aggregate output, consumption and assets, it is also far less effective in reducing inequality, poverty and the incidence of CHE (see Tables 8 and 9).

The limited effectiveness of the *Standard 13th Pension 84+* does not necessary mean that the program is poorly targeted. The aggregate payment may simply be too small to make a significant difference to an average household. Thus, another idea is to keep the same age restriction (84 plus), but increase the program's total expenses to those of the original *13th Pension*. With such an approach, the annual transfer received by the recipients is more than 5.5 times higher than in the case of the original program. Let us refer to these modifications of the *13th Pension* as the *Enlarged 13th Pension 84+*. It is worth pointing out that, even if the median elderly household is younger than 84, i.e. it is not eligible for the program, the *Enlarged 13th Pension 84+* can significantly increase its long-term consumption. Indeed, as the program can be viewed as partial insurance against longevity risk, it allows all households to reduce their savings for old age and increase current consumption. According to the model estimates, consumption of the median elderly household is 2.02% higher due to the *Enlarged 13th Pension 84+*, compared to 1.33% in the case of the original *13th Pension* (Table 9). The *Enlarged 13th Pension 84+* also leads to a more than twofold reduction in relative poverty and consumption inequality (measured by the Gini coefficient) compared the original *13th Pension* program. Moreover, the adjustments in labor supply associated with this program are significantly less pronounced. We observe a stronger impact on the reduction of assets among older (retired) households compared to the *13th Pension*. Consequently, the negative aggregate effect is slightly smaller in this case. However, the *Enlarged 13th Pension 84+* leads to a larger decrease in welfare under the veil of ignorance.

Targeting low-income elderly Next, let us restrict the *13th Pension* recipients to those with pensions below a certain threshold. When keeping the annual payment from the program at 30% of the median monthly salary, such a restriction helps reduce the negative aggregate effect of the *13th Pension*. I consider two eligibility options: the poorest 10% of pensioners (*13th Pension Poor10*), and those with pension below the median (*13th Pension Poorer Half*).

As in the case of the previous modifications, the ones considered here face the same trade-off between lower efficiency loss and a stronger redistributive impact (Tables 8 and 9). Their advantage lies in generating a significantly smaller welfare loss and causing only marginal distortions in labor supply.

Table 8 Aggregate and welfare effects of the selected programs

	ΔY (%)	ΔC (%)	ΔL (%)	ΔA (%)	Welfare loss (%)
13th Pension modifications					
13th Pension	−0.57	−0.43	−0.19	−2.29	0.81
Standard 13th Pension 84+	−0.12	−0.07	−0.02	−0.52	0.19
Enlarged 13th Pension 84+	−0.55	−0.38	−0.08	−2.66	1.02
13th Pension Poor10	−0.06	−0.05	−0.02	−0.25	0.08
13th Pension Poorer Half	−0.30	−0.23	−0.10	−1.21	0.36
Additional Pension Payment	−0.67	−0.51	−0.22	−2.71	1.07
standard policies					
Minimum Pension Increase	−0.61	−0.47	−0.22	−2.35	0.74
Extended Medical Coverage	−0.60	−0.45	−0.18	−2.48	0.86

Table 9 Redistributive effects of the selected programs

	Gini assets (pp.)	Gini cons. (pp.)	hsh. aged 65+ median cons. (%)	hsh. aged 65+ CHE (pp.)	hsh. aged 65+ relative pov. (pp.)
13th Pension modifications					
13th Pension	0.08	−0.34	1.33	−0.58	−1.74
Standard 13th Pension 84+	0.15	−0.13	0.46	−0.25	−0.89
Enlarged 13th Pension 84+	0.72	−0.75	2.02	−1.55	−3.72
13th Pension Poor10	0.03	−0.04	0.09	−0.08	−0.13
13th Pension Poorer Half	0.12	−0.21	0.57	−0.29	−0.76
Additional Pension Payment	−0.01	−0.36	2.02	−0.63	−2.01
standard policies					
Minimum Pension Increase	0.28	−0.44	1.02	−0.60	−1.53
Extended Medical Coverage	0.20	−0.36	1.37	−8.27	−1.45

The additional pension payment I turn now to the long-term effects of the *Additional Pension Payment*. The program is slightly more costly than the *13th Pension*, and its introduction requires an additional labor income tax of 1.29%. Consequently, it also has more negative long-term aggregate effects and results in greater welfare loss (Table 8). It is only slightly more effective in reducing consumption inequality and the incidence of CHE, while significantly narrowing the gap between the consumption of working and retired households (Table 9). Indeed, the *Additional Pension Payment* increases the median consumption of retirees by more than 2%.

4.2.2 Standard policies aimed at older households

As I have shown so far, simple modifications of the *13th Pension* can make the program have a more desirable effect on a selected indicator, but at the cost of worsening some other measures. But how do the *13th Pension* and its modifications compare to standard policies catering to older households? Can they bring a significant improvement where other programs are less successful? In this Subsection, I address these questions by assessing the long-term impact of two popular alternative elderly-oriented policies, using the same modeling framework.

Minimum pension increase One standard way to provide financial support to low-income elderly is to raise the minimum pension. Suppose that such a policy, which I refer to as the *Minimum Pension Increase*, is financed by the same amount of tax revenue as is raised for the *13th Pension*. With other model assumptions unchanged, the *Minimum Pension Increase* improves the disposable income of 21.7% of households (Table 7). However, it leads to a larger drop in household assets and labor supply, and higher asset inequality compared to the *13th Pension* (Table 8). This comes from the fact that the savings of those with low incomes fall more strongly in response to an imposed income redistribution from working to retired households when such a redistribution is financed by an increase in income taxation.

When it comes to the overall welfare, the *Minimum Pension Increase* has a stronger aggregate effect but a smaller redistributive effect than the *13th Pension*. Consequently, the total welfare loss under the veil of ignorance from the *Minimum Pension Increase* is significant

but lower than that from the *13th Pension*. The program's impact on consumption inequality is stronger than that of the *13th Pension*, but significantly smaller compared to the *Enlarged 13th Pension 84+* (Table 9). Moreover, the *13th Pension* outperforms the *Minimum Pension Increase* in reducing relative poverty and raising median consumption for households aged 65 and above.

Extended medical coverage As out-of-pocket medical expenses increase with age, older households are particularly vulnerable to the burden of health-related payments. The next program - *Extended Medical Coverage* - is specifically designed to reduce out-of-pocket medical spending. Assuming that it is financed by the same labor income tax as in the case of the *13th Pension*, it gives every older adult (aged 65 or more) a reimbursement of 40.0% of his/her out-of-pocket medical expenses. The *Extended Medical Coverage* program is effective in its objective and substantially reduces the incidence of CHE (by 8.3 pp.) - to an extent that no other policy considered in this paper has been able to achieve (Table 9). It is also slightly more successful in reducing consumption inequality and increasing the median consumption of retired households compared to the outcome of the *13th Pension*. As households do not need to engage in as much precautionary saving to protect themselves from medical shocks as in the economy without a program, their aggregate assets decline in the long term (Table 8). The side effects are a decrease in aggregate consumption and welfare loss, which are higher than in the case of the *13th Pension*.

4.3 Financing

So far I have assumed that the *13th Pension* is financed by a flat labor income tax. Now I relax this assumption and allow for alternative financing methods.

Using a flat consumption tax instead of a labor income tax improves the welfare statistics and mitigates the negative aggregate impact of the *13th Pension*, while generating an even larger increase in median consumption of retirees. It is, however, less effective in improving other redistributive measures and results in a greater increase in inequality of assets (see Tables 10 and 11). It is well understood that taxing capital income can significantly distort intertemporal decisions (see for example Chari et al., 2020; Krusell et al., 1996). Thus, when a flat tax on capital income is used to finance the *13th Pension*, households respond to the lower effective return on capital with a significant reduction in their savings. We observe the largest drop in aggregate output (0.87%), consumption (0.86%), and assets (7.08%) associated with the program compared to other financing methods (Tables 10 and 11). The program no longer carries out its redistributive role, and instead of increasing, it decreases the median consumption of retired households.

The last row in Tables 10 and 11 shows the effects of the *13th Pension* when the program is financed from the current pension fund. It means that all taxes are the same as in an economy

Table 10 Aggregate and welfare effects of the *13th Pension* under different financing schemes

source of financing for the *13th Pension*	ΔY (%)	ΔC (%)	ΔL (%)	ΔA (%)	Welfare loss (%)
labor income tax	−0.57	−0.43	−0.19	−2.29	0.81
consumption tax	−0.43	−0.33	−0.17	−1.63	0.61
capital income tax	−0.87	−0.86	−0.14	−7.08	0.66
pension fund	−0.01	−0.03	−0.01	−0.22	−0.05

Table 11 Redistributive effects of the *13th Pension* under different financing schemes

source of financing for the *13th Pension*	Gini assets (pp.)	Gini cons. (pp.)	hsh. aged 65+ median cons. (%)	CHE (pp.)	relative pov. (pp.)
labor income tax	0.08	− 0.34	1.33	− 0.58	− 1.74
consumption tax	0.15	− 0.29	1.44	− 0.46	− 1.61
capital income tax	0.79	0.01	− 1.74	− 0.11	− 0.30
pension fund	0.10	− 0.04	− 0.15	− 0.03	0.07

without the transfer program, and the basic pension benefits are reduced to accommodate the additional payments made on the basis of the *13th Pension*. In this scenario, the aggregate and redistributive impact of the program is very limited. As there is no income transfer from working to retired households, the financial situation of older households does not improve. However, it is the only one of the financing schemes considered in the paper that results in higher ex-ante welfare due to the *13th Pension*. These come from a decline in pension variability, which reduces uncertainty about one's future pension.

4.4 Alternative model assumptions

Fixed labor supply So far, I have assumed a fully elastic labor supply for both men and women. However, in reality, workers do not always have complete control over the amount of time they can dedicate to work. Specifically, the Polish labor market is considered to be only moderately elastic, with more than 3/4 of workers working 40 or more hours weekly. For comparison, the same statistic for the entire European Union is 45.8%, according to Eurostat data from 2022. Therefore, I now assume assume a fully inelastic labor market by positing that all workers allocate 40% of their available time to work, regardless of their productivity shock. To ensure comparability with the baseline model with elastic labor supply, I adjust the gender wage gap, which stands at 0.827 in this scenario, ensuring that the relative labor income of men versus women remains unchanged.

In the economy with inelastic labor supply, there are no labor distortions. Thus, the efficiency losses are less profound (Table 12). The drop in aggregate consumption is now 0.24%, compared to 0.43% in the model with fully elastic labor supply. The ex-ante welfare loss is also slightly lower. Additionally, as households can no longer adjust their working hours to mitigate negative shocks, the protective function of the *13th Pension* - and consequently, its redistributive impact - is slightly higher (Table 13). The median consumption of households aged 65 or older increases by 1.74%, compared to 1.33% in an economy with elastic labor supply.

Table 12 Aggregate and welfare effects of the *13th Pension* under different model assumptions

model assumptions	ΔY (%)	ΔC (%)	ΔL (%)	ΔA (%)	Welfare loss (%)
baseline scenario	-0.57	-0.43	-0.19	-2.29	0.81
fixed labor supply	-0.39	-0.24	0.00	-2.11	0.79
no family insurance	-0.55	-0.40	-0.19	-2.14	0.75
high pension rep. rate	-0.44	-0.38	-0.16	-1.77	0.86
No health shocks	-0.54	-0.42	-0.18	-2.17	0.82

Table 13 Redistributive effects of the *13th Pension* under different model assumptions

model assumptions	Gini assets (pp.)	Gini cons. (pp.)	hsh. aged 65+ median cons. (%)	CHE (pp.)	relative pov. (pp.)
baseline scenario	0.08	−0.34	1.33	−0.58	−1.74
fixed labor supply	0.08	−0.40	1.74	−0.69	−1.72
no family insurance	0.20	−0.32	1.33	−0.64	−1.58
high pension rep. rate	0.04	−0.11	0.94	−0.40	−0.91
No health shocks	0.06	−0.32	1.21	–	−2.21

No family insurance channel In the model, the family insurance channel is incorporated by distinguishing between different family compositions. Consequently, even if one household member faces a negative earnings shock, the overall household income does not deteriorate as much as it would if households were modeled as one-person units. To assess the importance of this insurance channel while keeping the model as close as possible to its baseline version, I only modify the correlation between earnings shocks of spouses, setting it at a value very close to unity. As the simulation shows, such a change in the model does not significantly affect the estimated impact of the *13th Pension*, except for two noteworthy outcomes. First, in the absence of the family protection channel, the insurance value of the *13th Pension* increases, resulting in a reduction of the welfare loss to 0.75% (Table 12). Second, under this scenario, the program generates a stronger effect on the inequality of assets (Table 13). The latter is a consequence of greater variability in household labor income, combined with a heterogeneous response to the program, wherein poorer households reduce their savings more than those in a more favorable financial situation.

High pension replacement rate In the main simulations, I set the pension replacement rates to reflect the Polish pension system, which means that they are notably lower than observed in other developed countries. The central question addressed in this exercise is whether the quasi-universal transfer would carry out its redistributive role in an economy with a more generous pension system. To explore this, I recalibrate the model such that both men and women have the same pension replacement rate equal to 68%, aligning with the average rate within the European Union. To achieve this, I adjust the pension contribution rate and the domestic interest rate accordingly. I then evaluate the effects of the *13th Pension* in this model version. As one could expect, in such an economy, the redistributive effect of the transfer is more limited. The reduction in consumption inequality is three times smaller compared to the baseline model that reflects the Polish pension contribution rates (Table 13). Additionally, the welfare loss due to the *13th Pension* is higher in this alternative scenario (Table 12). This is because, as households save less for retirement, their total asset holdings decrease, shifting the distribution toward younger ages. Consequently, the aggregate effects of the *13th Pension* are slightly weaker compared to the main simulations.

No health shocks and OPM expenses Finally, I examine the role of the *13th Pension* in insuring against health shocks and unexpected health-related expenditures by estimating its impact on an economy without health-related risks and OPM expenses. The aggregate and welfare effects turn out to be very close to those obtained for the baseline model with health risks, with the welfare loss increasing by only 0.01 pp. in this scenario (Table 12). The redistributive impact is also only moderately lower, indicating that transfers crowd out

precautionary savings, thus reducing the insurance role of the program (Table 13). The only exception is relative poverty, which shows a more significant decline due to the presence of the *13th Pension*. However, given the high concentration of households with consumption only slightly below the poverty threshold in the economy without health and medical expenditure shocks, this result lacks robustness across different thresholds. Specifically, if we reduce the incidence of relative poverty for those with consumption below 45% of the mean, the estimated reduction in relative poverty stands at 1.39 pp. and 0.75 pp. for an economy with and without health-related risks, respectively.

Overall, the differences in welfare loss due to the *13th Pension* are relatively small across the considered alternative model assumptions. This reflects the significance of the inefficient redistribution from current to future cohorts. As households respond to it by primarily adjusting their savings over the life cycle, the program's ability to act as insurance is somewhat limited.

5 Conclusion

This paper develops a general equilibrium overlapping generations model of a small open economy to investigate the long-term impact of quasi-universal transfers targeted at older households, using the Polish *13th Pension* as an example. The main advantages of quasi-universal benefits are broad coverage, equality, and simplicity. I find that they can significantly increase the consumption of a median pensioner. However, such transfers are welfare-reducing and have a negative effect on aggregate output, consumption, and assets, and a moderately negative impact on labor supply. As shown in the paper, the negative welfare effects of redistributing from future to current cohorts prevails over the positive insurance effect of the program, even in economies with low provisions for old age insurance. Nevertheless, compared to more conventional elderly-oriented policies of similar scale, such as an increase in the minimum pension, the quasi-universal transfer proves more effective in enhancing the median consumption of retirees and alleviating relative poverty within this group, all while resulting in lower overall aggregate losses.

Naturally, redistributive policies might serve various objectives that cannot be easily summarized with a simple welfare criterion. From the welfare point of view, setting income criteria to determine eligibility is recommended. However, that would lower the program's effectiveness in reducing consumption inequality and poverty. On the other hand, to strengthen the redistributive impact of quasi-universal programs without incurring additional efficiency costs, one possible solution is to increase the payments (within the program's budget) by raising the minimum age requirement. However, such a modification would deepen the ex-ante welfare loss caused by the program.

All but one of the analyzed variants of quasi-universal benefits to older households generate a welfare loss. The only exception is when the program does not require additional taxation but is instead financed with the current pension fund. In such a case, the welfare gain is associated with a reduction in future pension uncertainty. This result brings us to the broader debate on pension inequality. Finding the optimal level of variability in pension benefits is an interesting topic for future research.

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