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Research paper

Fertility and welfare under Demeny voting ☆

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ABSTRACT

This paper analyzes the welfare implications of children's enfranchisement within a political economy framework that emphasizes the trade-offs in public policy when the electorate includes different age groups. We derive the political equilibrium under Markov strategies and compare welfare under standard suffrage and suffrage that includes children, for both PAYG and fully funded social security systems. The franchise that maximizes welfare across demographic groups depends on the fertility rate in the economy. Policies chosen when all demographic groups have voting rights are Pareto-improving compared to those chosen under the standard voting rights system, which excludes children from the electorate, when the fertility rate is low, and Pareto-reducing when the fertility rate is high. This result is driven by the surplus or shortage of funds available to finance pensions, depending on the ratio of workers to retirees in the economy. The model produces a negative association between tax revenues and fertility rates, as well as between public pension spending and the share of parents, consistent with OECD data. The counterfactual analysis based on the model calibrated to match the distribution of the number of children per household in OECD countries indicates that children's enfranchisement would improve the welfare of all generations in most OECD countries.

1. Introduction

Throughout history, democratic development has progressed alongside the gradual expansion of suffrage.[1] As new groups gain the vote, they strengthen democracy by bringing the concerns of previously excluded populations into the political sphere (Wall, 2014). In turn, democracy itself contributes to economic development (Barro, 1996; Przeworski et al., 2000; Przeworski, 2007).

One of the remaining restrictions on enfranchisement is age. The idea of extending voting rights to children, known as Demeny voting after Demeny (1986), was proposed decades ago. However, empirical research highlights significant resistance from current voters to the enfranchisement of younger groups (Koukal et al., 2024; Birch et al., 2015) and raises concerns about the political maturity of young voters (Bergh, 2013). Declining fertility rates have recently sparked renewed interest in the enfranchisement of

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[1] Przeworski (2009) provides a structured examination of the extension of suffrage around the world, from the establishment of representative institutions to the present.

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children (Aoki and Vaithianathan, 2009; Birch et al., 2015; Boffa et al., 2023; Bonatti and Lorenzetti, 2023; Chan and Clayton, 2006; Daiute, 2008; Davidson, 2014; Hinrichs, 2002; Wall, 2014; Wolf et al., 2015). Related studies explore whether and why suffrage should be extended to younger age groups, or even restricted for older populations (Parijs, 1998; Lau, 2012; Ishida and Oguro, 2018). Nevertheless, formal theoretical studies on the impact of children's enfranchisement on welfare and its implications for fertility are scarce, leaving the normative implications of extending enfranchisement to children largely unexplored.

The purpose of this paper is to evaluate the welfare costs and benefits of children's enfranchisement within a simple political economy model that examines the public policy trade-offs across different generations. We highlight these trade-offs by distinguishing between the expenses incurred by working-age individuals for child-rearing and education, and the expenses related to public pensions or private saving used to finance retirement. For this purpose, we consider an overlapping generations model economy populated by individuals whose lifetime consists of childhood, youth and old age and where a democratically elected government seeks to maximize the welfare of its electorate, which includes different age groups. Public spending is financed by tax revenues, meaning that, in a given period, lower income taxes, and consequently higher spending on child-rearing, result in lower pensions or lower savings for retirement, all else being equal. As predicted by basic public choice theory, in such a setup, the policies chosen by a democratically elected government tend to favor social groups with voting rights.

We derive political equilibrium outcomes under Markov strategies and compare welfare across different suffrage schemes. We conduct the analysis in a baseline model that highlights the trade-off in the allocation of funds across generations, with an exogenously given fertility rate, and in a model with an endogenously determined fertility rate and an endogenous segmentation of the population into parents and nonparents. We show that the results are consistent across the pay-as-you-go (PAYG) and fully funded social security systems.

First, we show, in a baseline model with exogenous fertility, that the franchise that maximizes welfare across demographic groups depends on the fertility rate in the economy. At low fertility rates, policies that account for the welfare of all demographic groups are Pareto-improving compared to the policies adopted under the standard voting rights system, where children are excluded from the electorate. Welfare is higher in an economy with children's suffrage because the positive spillover effects of increased spending on child-rearing are internalized during policy-making. Higher investment in children results in higher human capital accumulation, which compensates for the reduced funds available to finance retirees when there are fewer workers in the economy. At high fertility rates, the standard voting rights system, which excludes children from the electorate, delivers higher welfare to each demographic group. This outcome arises because there are sufficient funds to finance pensions when there are more workers than retirees in the economy. Under a fully funded social security system, this result continues to hold for a range of parameter values, but children's enfranchisement can be Pareto-improving for all generations at any fertility rate, since the elderly are less dependent on public support.

Next, we examine the impact of introducing Demeny voting in a model with endogenous fertility decisions, distinguishing between young individuals who become parents and those who do not. The welfare outcomes of the baseline model are robust to these extensions. A compensation in the form of a one-off transfer from current young to current old is sufficient to ensure that the welfare of all generations does not decrease during the transition after the introduction of children's suffrage. In addition, the share of parents in the population and the fertility rate depend on child care costs. The model produces a negative association between tax revenues and fertility rates, as well as between public pension spending and the share of parents, consistent with OECD data.

This paper is the first, to the best of our knowledge, to conduct a welfare analysis of children's enfranchisement in an infinite-horizon political economy framework. It contributes to the literature on the intergenerational conflict over public goods provision, fertility decisions in a political economy framework, and franchise extension in representative democracy. The intergenerational conflict over public goods provision stems from age-dependent preferences. As individuals age, they become less likely to support increased government spending on education and childcare, while favoring higher allocations for pensions (De Mello et al., 2017; De Walque, 2005; Epple et al., 2012). Older individuals also tend to be more politically engaged (see, for example, (Henn et al., 2005; Goerres, 2007)). Consequently, the larger and more politically active group of older voters prompts political parties to prioritize senior citizens' preferences over those of younger voters (Berry, 2014; Parijs, 1998; Galasso and Profeta, 2002, 2004; Pampel, 1994; Slavov, 2006; Uhlenberg, 2009). In addition, the data suggest that higher government-provided old-age pensions and lower levels of childcare subsidies are strongly correlated with a reduction in fertility (Ehrlich and Kim, 2007; Boldrin et al., 2015; Koka and Rapallini, 2023).

We address the practical challenges of implementing children's enfranchisement by assuming that parents fully understand their children's preferences and vote altruistically on their behalf, effectively voting as their children would if capable. This approach aligns with existing theories and evidence that demonstrate the correlation of preferences across dynasties and the altruism parents show toward their children (Becker, 1974; Doepke and Zilibotti, 2017; Chowdhury et al., 2022) and with one of the approaches to children enfranchisement discussed by related studies (Wall, 2014; Wolf et al., 2015; Boffa et al., 2023). Alternatively, considering the age span of each generation is around thirty years, extending franchise to children can be interpreted withing a model studied in this paper as analyzing the impact of lowering the voting age threshold, another approach to children enfranchisement discussed by related studies (Wagner et al., 2012; Birch et al., 2015; Chan and Clayton, 2006).

The findings of this paper suggest that, while children's enfranchisement was not optimal decades ago when fertility rates were relatively high,[2] it can be a welfare-improving policy nowadays in countries with low or negative population growth rates. The

[2] The global fertility rate was 5 children per woman in the 1950s. Since then, the number has halved to below 2.5 children per woman in the 2020s. Data source: UN, World Population Prospects (2024).

model, calibrated to match the distribution of the number of children per household in OECD countries, explains a significant fraction of variation in tax revenues and public pensions spending in OECD countries. The counterfactual analysis indicates that the welfare of each generation – children, the young, and the elderly – would improve with children's enfranchisement in most of the 35 OECD countries considered.

The remainder of the paper is organized as follows. Section 2 presents the baseline model of children's education and public pension benefits, characterizes economic and political equilibrium, and welfare implications of children's suffrage. Section 3 extends the baseline model to include endogenous fertility. Section 4 shows that the main results are robust under a fully funded social security system. Section 5 calibrates the model and conducts numerical analysis using data from OECD countries. Section 6 concludes. All proofs are relegated to Appendix.

2. Baseline model

We consider an overlapping generations model of an infinite-horizon economy populated by individuals whose lifetime consists of childhood, youth and old age. Young individuals work and rear children. Child rearing is costly but parents enjoy utility from having children. Old individuals retire and consume pension benefits provided by the government. That is, the economy is characterized by a pay-as-you-go (PAYG) social security system. The main results are robust to a fully funded social security system as discussed in Section 4.

The purpose is to highlight the main trade-offs of introducing Demeny voting. These trade-offs result from the different preferences of individuals over different periods of their lifetime, which imply that different segments of population would disagree on public policies. Specifically, if child-rearing is costly, young individuals would prefer higher social support for children, while retired individuals, whose children have already grown up, would prefer higher social support for the elderly.

To summarize these trade-offs, we assume, in the spirit of Barro and Becker (1989), that young individuals' earnings are split between their consumption and child care. Child care requires investment in education, e_t, which is necessary to build children's human capital, h_{t+1}. Acquiring human capital is essential for work in adulthood, and individuals derive utility from their children's level of human capital. Specifically, the lifetime utility of a young individual in period t is as follows: $U_t^y = \ln(c_t^y) + \gamma \ln h_{t+1} + \beta \ln(c_{t+1}^o)$, where c_t^y and c_{t+1}^o are consumption levels in period t, when young, and $t+1$, when old, h_{t+1} is their children's level of human capital, γ is the relative weight on the utility from children, and β is a discount factor.

In this setup, human capital summarizes different aspects of child rearing, including nutrition, health care, and education. Combining the ideas in Ono (2015), Uchida and Ono (2024) and Kaganovich and Zilcha (1999, 2012), we assume that human capital of children born in time t, h_{t+1}, evolves according to

$$h_{t+1} = A G_t^{\xi} \mathbf{h_t}^{\eta} e_t^{\delta}, \tag{1}$$

where e_t is child-rearing cost, A is a scaling parameter, G_t is government spending on education, and $\mathbf{h_t}$ is the aggregate human capital available in period t. Thus, h_{t+1} is human capital received by children as a result of parents investment of e_t.

We assume labor is fixed and abstract from physical capital to focus on intra-period intergenerational trade-offs in the use of current public funds, where the age distribution of the electorate is important, as well as on the associated quantity versus quality trade-off in child-rearing decisions, which is developed in the next section where fertility is endogenized. Adding physical capital would have nontrivial consequences for the existence and multiplicity of equilibria (see, for example, (Ortigueira and Pereira, 2022)). Moreover, numerical simulations of the model with physical capital included suggest that its introduction would render public pensions redundant, as individuals would be able to accumulate sufficient savings for retirement.

The problem of a young individual can be summarized as follows:

$$\max_{c_t^y, e_t, c_{t+1}^o} U_t^y = \ln(c_t^y) + \gamma \ln h_{t+1} + \beta \ln(c_{t+1}^o) \tag{2}$$

$$s.t. : c_t^y + e_t = (1 - \tau_t - \iota_t) h_t, \tag{3}$$

$$c_{t+1}^o = b_{t+1}, \tag{4}$$

$$h_{t+1} = A G_t^{\xi} \mathbf{h_t}^{\eta} e_t^{\delta}, \tag{5}$$

where τ_t is the payroll tax rate, ι_t is the general income tax rate, and b_{t+1} is the pension benefit received in period $t+1$ by individuals who were young in period t and retire in period $t+1$.

Population growth or fertility rate in period t is $\mathbf{n_t}$.[3] It is exogenous in the baseline model but endogenized in the next section. Throughout the paper, we denote aggregate variables, such as aggregate human capital stock and aggregate population growth rate, $\mathbf{h_t}$ and $\mathbf{n_t}$, with bold font, differently from individual-specific human capital h_t and fertility rate n_t (the latter is developed in more detail in the next section).

The next period aggregate human capital is given by the average of the individual human capitals. In the baseline model, the aggregate and individual-specific human capitals are equal: $\mathbf{h_{t+1}} = h_{t+1}$, because all young individuals have children. This assumption is relaxed in the next section.

[3] The fertility rate $\mathbf{n_t}$ is defined as follows: suppose the size of the young population in period t is N_t^y, the size of the elderly population in period t is N_t^o, and the size of the population of children in period t is N_t^c; then, $N_t^y = \mathbf{n_{t-1}} N_t^o$, $N_t^c = \mathbf{n_t} N_t^y$.

We assume perfectly competitive markets and a production function linear in labor, so that the wages in period t are given by the marginal product of labor, which is the level of human capital or productivity in period t, $\mathbf{h_t}$.

The elderly do not make any decisions and consume the public pensions provided by the government, so that the utility of the elderly in period t is given by $U_t^o = \ln(b_t)$.

Given that children are raised by young adults who decide on their child-rearing expenses, there is no explicit decision-making by the individuals who are children in period t.[4] Nevertheless, children in t become adults in $t+1$, and the policies chosen in period t affect their well being in the adulthood.

The government collects payroll and general income taxes from the working population to finance pension payments and public spending. As is common in the literature, we assume that public pensions and other government spending are financed through separate budgets (see Conesa and Garriga, 2008). The government budget constraints in period t read as follows:

$$\tau_t \mathbf{h_t} \mathbf{n_{t-1}} = b_t, \tag{6}$$

$$\iota_t \mathbf{h_t} = G_t, \tag{7}$$

where $\mathbf{n_{t-1}}$ is the population growth rate in period $t-1$, so that the tax revenues collected from the working (young) population in period t are distributed across the retirees (elderly) population in period t, with each elderly individual receiving a pension benefit b_t. The public spending on education per worker, G_t, contributes to economic development by increasing human capital, as defined by (1).

Given the government policy, the economic equilibrium in this economy can be defined as follows.

Definition 1 (*Economic Equilibrium*)**.** Economic equilibrium is a sequence of allocations $\{c_t^{*y}, c_t^{*o}, e_t^*, h_{t+1}^*\}_{t=1}^{\infty}$, such that, given a sequence of fertility rates $\{\mathbf{n}_t\}_{t=0}^{\infty}$, tax rates $\{\tau_t, \iota_t\}_{t=1}^{\infty}$, and the initial condition $\mathbf{h_0} (> 0)$, (i) in each period, the young maximize their lifetime utility subject to the budget constraints and (ii) the government budget constraints are satisfied: $b_t = \tau_t \mathbf{h_t} \mathbf{n_{t-1}}$, $\iota_t \mathbf{h_t} = G_t$.

Economic equilibrium allocations are listed in Appendix. Given the equilibrium allocations, the indirect utilities of different generations can be expressed as functions of the state and government policy, and, incorporating government constraints, are as follows:

$$\begin{aligned}
&V_t^y = \ln(c_t^{y*}(\mathbf{h_t}, \tau_t, \iota_t)) + \gamma \ln(h_{t+1}^*(\mathbf{h_t}, \tau_t, \iota_t)) + \beta \ln(\tau_{t+1} \mathbf{h_{t+1}}(\mathbf{h_t}, \tau_t, \iota_t) \mathbf{n_t}),\\
&V_t^o = \ln(\tau_t \mathbf{h_t} \mathbf{n_{t-1}}),\\
&V_t^c = \beta[\ln(c_{t+1}^{y*}(\mathbf{h_{t+1}}(\mathbf{h_t}, \tau_t, \iota_t), \tau_{t+1}, \iota_{t+1})) + \gamma \ln(h_{t+2}^*(\mathbf{h_{t+1}}, \tau_{t+1}, \iota_{t+1})) +\\
&\beta \ln(\tau_{t+2} \mathbf{h_{t+2}}(\mathbf{h_{t+1}}, \tau_{t+1}, \iota_{t+1}) \mathbf{n_{t+1}})] = \beta V_{t+1}^y,
\end{aligned}$$

where V_t^j denotes indirect utility of generation $j \in \{y, o, c\}$ in period t, and y, o, and c denote the young, elderly, and children, respectively.

2.1. Political equilibrium

To formalize the electoral process, we adopt probabilistic voting as in Lindbeck and Weibull (1987). We follow Gonzalez-Eiras and Niepelt (2008, 2012), Ono (2015), and Uchida and Ono (2024) in doing so, as majority voting in our overlapping generations model with homogeneous preferences within generations would result in policies reflecting only the median voter's preferences, meaning those of a single generation, which is an unrealistic assumption. In the probabilistic-voting Nash equilibrium, two candidates maximizing their respective vote shares both propose the same policy platform. This platform maximizes a convex combination of the welfare of all voters, with the weights reflecting the group size (Lindbeck and Weibull, 1987; Gonzalez-Eiras and Niepelt, 2008, 2012). Every period, the individuals who have the right to vote participate in voting over their preferred public policies.

We focus on a stationary political equilibrium (similar to Ono (2015), Uchida and Ono (2024), Song (2012), Song et al. (2012)) where voters condition their strategies on the payoff-relevant state variables. Every period, eligible voters vote on the tax rates, which determine the public spending, the size of the pensions for the elderly, and the allocations for the young, including the funds available for investment in children.[5] These decisions by the voters and, therefore, a democratically elected government, take into account the current state of the economy (the current level of human capital and, in case of exogenous time-varying fertility, also the fertility rate) and the effect of current policy on the anticipated future policy (the next period tax rate and, therefore, the next period size of the pensions for the elderly), thus forming expectations of the future policy. Specifically, the political equilibrium in this model economy can be defined as follows:

[4] The specification of utility during childhood as independent of policy implies that the degree of parental investment in children does not influence their well-being during childhood. Including microeconomic aspects of children's welfare, such as the balance between leisure and study time, represents a potential extension of this study but should not alter the qualitative implications of introducing children suffrage for public policies.

[5] Equivalently, the voters could vote on the size of the pensions and government spending, and the tax rates would be determined from the government budget constraints.

Definition 2 (*Political Equilibrium*)**.** Political equilibrium is given by policy functions Γ and Υ, where $\tau_t = \Gamma(\sigma_t)$ and $\iota_t = \Upsilon(\sigma_t)$, with σ_t denoting the payoff-relevant states, such that: (i) Γ and Υ solve the government's problem given expectations $\tau_{t+1} = \tilde{\Gamma}(\sigma_{t+1})$ and $\iota_{t+1} = \tilde{\Upsilon}(\sigma_{t+1})$, and (ii) $\tilde{\Gamma} = \Gamma$ and $\tilde{\Upsilon} = \Upsilon$ hold.

Next, we characterize the government's problem and the resulting political equilibrium policies under different suffrage schemes.

Under the standard voting system, the electorate comprises only adults, both young and elderly. The government's objective can be formulated based on the indirect utilities of the electorate, which are determined by the utilities derived from individual optimal choices, with public policies taken as given.

Specifically, the period t problem of a democratically elected government that maximizes the utility of its electorate, when the electorate consists only of adults, is as follows:

$$W_t^{NS} = \max_{\tau_t,\iota_t}(V_t^y + 1/\mathbf{n_{t-1}} V_t^o), \tag{8}$$

where $1/\mathbf{n_{t-1}}$ is the relative weight of the elderly, determined by the relative size of the elderly population in the economy.[6]

Lemma 1 (*Democratic Government's Policy without Children Suffrage*)**.** *In an economy without children suffrage, the period-t political equilibrium for any $\mathbf{h_t} > 0$, given the population growth rate $\mathbf{n_{t-1}}$, is characterized by the payroll tax rate τ_t^{NS} and the general income tax rate ι_t^{NS} given by:*

$$\tau_t^{NS} = 1/(1 + \mathbf{n_{t-1}} + \mathbf{n_{t-1}}(\gamma + \beta)(\xi + \delta)),\ \iota_t^{NS} = (\gamma + \beta)\xi \mathbf{n_{t-1}} \tau_t^{NS}. \tag{9}$$

Consider now an economy where children have the right to vote. Their vote reflects their preferred public policy, aimed at maximizing their utility, similar to how the votes of adults from different generations represent policies that maximize their respective utilities.

Parents, who care about their children, could cast these votes on their behalf, for example, by being allocated additional votes for each child, as suggested by related studies (Wall, 2014; Wolf et al., 2015; Boffa et al., 2023). Alternatively, considering the age span of each generation is around thirty years, extending franchise to children can be interpreted as analyzing the impact of lowering the voting age threshold, as also suggested by related studies (Wagner et al., 2012; Birch et al., 2015; Chan and Clayton, 2006).

Therefore, the period t problem of a democratically elected government that maximizes the utility of its electorate when the electorate includes children is as follows:

$$W_t^S = \max_{\tau_t,\iota_t}(V_t^y + 1/\mathbf{n_{t-1}} V_t^o + \mathbf{n_t} V_t^c), \tag{10}$$

where $1/\mathbf{n_{t-1}}$ and $\mathbf{n_t}$ represent the relative sizes of the elderly and children's populations, respectively, in period t, with the population of the young used as the baseline.[7]

Lemma 2 (*Democratic Government's Policy with Children Suffrage*)**.** *In an economy with children suffrage, the period-t political equilibrium for any $\mathbf{h_t} > 0$, given the population growth rates $\mathbf{n_{t-1}}$ and $\mathbf{n_t}$, is characterized by the payroll tax rate τ_t^S and the general income tax rate ι_t^S given by:*

$$\tau_t^S = 1/(1 + \mathbf{n_{t-1}} + \mathbf{n_{t-1}}(\xi + \delta)(\gamma + \beta + \kappa \mathbf{n_t})),\ \iota_t^S = \mathbf{n_{t-1}}\xi(\gamma + \beta + \kappa \mathbf{n_t})\tau_t^S, \tag{11}$$

where $\kappa = \beta(1 + (\gamma + \beta)(\xi + \eta + \delta))$.

2.2. Welfare implications of different suffrage schemes

We can now compare welfare across different suffrage schemes. For this purpose, we focus on the steady state, defined as the state of the economy where human capital and fertility remain constant over time: $\mathbf{h^*_{t+1}} = \mathbf{h^*_t} = \mathbf{h}$ and $\mathbf{n_{t-1}} = \mathbf{n_t} = \mathbf{n}$.

Eqs. (9) and (11), which define the optimal public policies chosen by a democratic government without and with children's suffrage, respectively, suggest that the payroll tax rate with children's suffrage is always lower than that without children's suffrage while the general income tax rate with children's suffrage is always higher than that without children's suffrage. Lower payroll taxes and higher government spending lead to higher human capital and greater consumption when young, but the impact on consumption in old age is ambiguous since pensions depend on both payroll tax rates and the level of human capital.

Lemma 3 (*Welfare Functions at the Steady State*)**.** *The steady state welfare of each demographic group can be represented as follows:*

$$W^{j,i} = \alpha_{j1}\ln(1 - \tau^i - \iota^i) + \alpha_{j2}\ln\tau^i + \alpha_{j3}\ln\iota^i + C^{j,i}, \tag{12}$$

where $W^{j,i}$ denotes the welfare of generation j, $\alpha_{j1}, \alpha_{j2}, \alpha_{j3} > 0$ and $C^{j,i}$ are constants determined by model's parameters, $j \in \{y, o, c\}$, and i is the suffrage scheme, $i \in \{NS, S\}$, where NS and S denote franchise without and with children, respectively.

[6] Equivalently, the utility of the electorate is given by $W_t^{NS} = N_t^y V_t^y + N_t^o V_t^o$, where N_t^j is the size of the population $j \in \{y, o\}$ and $N_t^y = \mathbf{n_{t-1}} N_t^o$.

[7] Equivalently, the utility of the electorate is given by $W_t^S = N_t^y V_t^y + N_t^o V_t^o + N_t^c \beta V_{t+1}^y$, where N_t^j is the size of the population $j \in \{y, o, c\}$ and $N_t^c = \mathbf{n_t} N_t^y = \mathbf{n_t}\mathbf{n_{t-1}} N_t^o$.

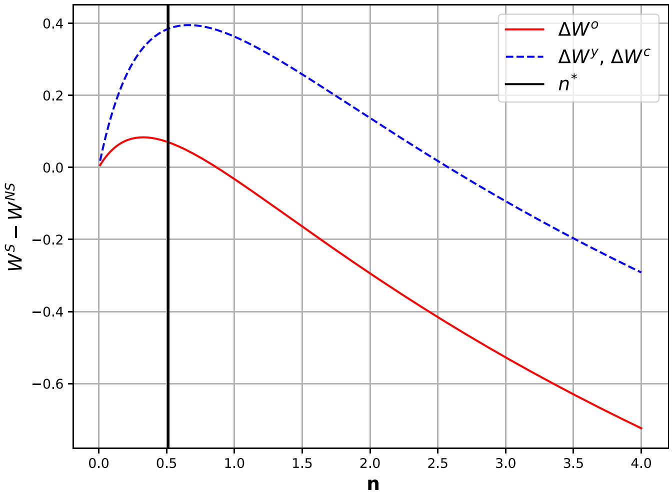

Fig. 1. Difference in welfare with and without children's suffrage as a function of fertility rate.
Note: This figure shows the difference in welfare with and without children's suffrage, $\Delta W^j = W^{j,S} - W^{j,NS}$, for $j \in \{y, c, o\}$, for the young and children (blue) and the elderly (red) generations, as a function of fertility $\mathbf{n}$. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

We analyze the difference in welfare under different tax suffrage schemes for each generation.

$$\Delta W^j = W^{j,S} - W^{j,NS} = \alpha_{j1} \ln \frac{1 - \tau^S - \iota^S}{1 - \tau^{NS} - \iota^{NS}} + \alpha_{j2} \ln \frac{\tau^S}{\tau^{NS}} + \alpha_{j3} \ln \frac{\iota^S}{\iota^{NS}}, \tag{13}$$

where $j \in \{y, o, c\}$.

Lemma 4 (*Properties of the Difference of Welfare Functions*). *For any $j \in \{y, o, c\}$, the difference of the welfare functions ΔW^j is a function of $\mathbf{n}$ defined for $\mathbf{n} \in [0, \infty)$, taking value 0 for $\mathbf{n} = 0$, approaching $-\infty$ when $\mathbf{n} \to \infty$, increasing at $\mathbf{n} = 0$, and concave for $\mathbf{n} \in [0, \mathbf{n}^*]$.*

Proposition 1 (*Implications of Children's Suffrage under PAYG Social Security*). *At the steady state, for each of the generations, the difference between the welfare functions with and without children's suffrage is:*

- *positive for $\mathbf{n} \in [0, \mathbf{n}^*]$, meaning that introducing children suffrage's improves the welfare of all generations at the steady state for $\mathbf{n} \in [0, \mathbf{n}^*]$;*
- *negative for $\mathbf{n} \in [\mathbf{n}^{**}, \infty)$, where $\mathbf{n}^{**} > \mathbf{n}^*$, meaning that introducing children's suffrage reduces the welfare of all generations at the steady state for $\mathbf{n} \in [\mathbf{n}^{**}, \infty)$.*

The intuition behind the results stated in Proposition 1 is as follows. Welfare is higher in an economy with children's suffrage when fertility rates are low because public policy, by lowering payroll taxes, allows individual parents to increase investment in their children's human capital. This boosts aggregate human capital accumulation and productivity. The productivity gains offset the reduction in funds available for retirees when the workforce is smaller. Conversely, at high fertility rates, a relatively larger workforce compared to the retiree population ensures sufficient funds to support pensions, leading to higher optimal payroll taxes.

Fig. 1 presents a graphical illustration of Proposition 1 for an example of a model economy with $\gamma = 0.5$, $\beta = 0.8$, $\delta = 0.4$, $A = 10$, $\xi = 0.1$ and $\eta = 0.1$, for different levels of fertility rate $\mathbf{n}$. The threshold, below which Demeny voting is welfare-improving compared to the standard voting system, is lower for the elderly generation compared to the generations of the young and children. In this example of a model economy, the overall welfare gain from switching from the standard voting system to Demeny voting is at its maximum when $\mathbf{n} = 0.5$, that is, when the population declines over time, with the elderly comprising twice the size of the youth generation.

Welfare criterion: Golosov et al. (2007) propose two efficiency concepts for environments with endogenous populations: A-efficiency, which restricts the welfare comparison to agents alive under both allocations being compared, and P-efficiency, which treats unborn potential agents symmetrically with the born. The welfare comparisons throughout the paper are conducted under A-efficiency. That is, when comparing two suffrage schemes, we evaluate welfare on the set of agents alive under both schemes.

We justify this choice on institutional grounds. Voting requires living agents. Under standard suffrage, the electorate consists of the living adult population; under Demeny voting, parents cast additional votes on behalf of their existing children. In either case, the political equilibrium is determined by the preferences of agents alive at the time of voting. Under A-efficiency, the welfare comparison includes only the preferences of living agents, in alignment with the political mechanism. A-efficiency has the additional advantage that it does not require specifying the utility of unborn agents, on which the set of P-efficient allocations depends (Golosov et al., 2007).

This choice has limitations, which we acknowledge. A-efficiency assigns no welfare weight to agents who are born under one suffrage scheme but not the other. Under P-efficiency, such agents would receive welfare weight, and the welfare comparison could shift. Since Demeny voting raises investment in children, it would tend to be the suffrage scheme under which more children are born. Under the assumption that being born is preferred to not being born (Golosov et al., 2007, Assumption 4), these additional births would register as welfare gains under P-efficiency. We therefore expect the qualitative pattern of our welfare results, welfare gains from Demeny voting at low fertility and welfare losses at high fertility, to persist under P-efficiency, with thresholds that may shift.

Implications for transition: As with any change in public policy, a reduction in payroll taxes following the extension of suffrage incurs some welfare costs during the transition. Specifically, the elderly generation experiences a net welfare loss in the period when voting rights are extended. A straightforward welfare compensation mechanism, spanning one to several periods, can prevent welfare losses during this transition. Such compensation is discussed in Appendix.

Implications for future generations: At the steady state, the welfare of each generation takes the form given by (12), which is identical in structure across cohorts. Because steady-state policies are stationary, future generations face the same environment as the currently living ones. The welfare comparisons therefore apply to all generations alive at the steady state, not only to the cohort currently in place.

An important caveat is that Proposition 1 is derived under the assumption of full altruism, whereby parents casting proxy votes fully internalize their children's preferences. In reality, parents are likely to only partially account for their children's welfare when voting. Under partial altruism, the equilibrium policy outcomes and the welfare differences across generations would lie between the two extreme cases of no children enfranchisement and full children enfranchisement. In this sense, the effects described in Proposition 1 can be viewed as an upper bound on the welfare gains from children's suffrage.

3. Model with fertility choice

The baseline model can be easily extended to a model with fertility choice. Suppose the young individuals can decide whether to become parents, and how many children to have. Child rearing costs include expenses on education, e_t, and time spent on child care, meaning that the individuals-parents have less time available for work. The young individuals' decisions depend on economic conditions, in particular, public policy and the state of human capital, and on their individual-specific child productivity, ψ, where ψ is drawn from a distribution characterized by the probability density function $f(\psi)$. The individual-specific child productivity reflects individual's efficiency in managing child-related care and expenses.[8] Childcare entails a fixed time cost, ϕ. Following Uchida and Ono (2024), we assume that raising one child requires a fraction ϕ of an individual's time.

Thus, the young individual who decides to have n_t children and has child productivity ψ loses $\phi n_t/\psi$ units of time that could otherwise be devoted to labor and incurs a total child-rearing consumption cost of $\phi n_t e_t/\psi$.[9] Young individuals who decide to become parents derive utility from the human capital of their children as well as from the number of children they have (similar to De La Croix and Doepke (2003)). We denote the variables corresponding to young individuals-parents with superscript yc and the variables corresponding to young individuals-nonparents with superscript ync. Then, young individuals-parents have the following maximization problem:

$$V_t^{yc} = \max_{c_t^{yc}, n_t, e_t, c_{t+1}^o} \ln(c_t^{yc}) + \gamma \ln(n_t h_{t+1}) + \beta \ln(c_{t+1}^o) \tag{14}$$

$$s.t.: \; c_t^{yc} + \frac{\phi n_t}{\psi} e_t = (1 - \tau_t - \iota_t)\mathbf{h_t}(1 - \frac{\phi n_t}{\psi}), \tag{15}$$

$$c_{t+1}^o = b_{t+1}, \tag{16}$$

$$h_{t+1} = A G_t^{\xi} \mathbf{h_t}^{\eta} e_t^{\delta}. \tag{17}$$

Young individuals who choose not to have children consume their income net of taxes while young and rely on public pensions when they are old. To preserve tractability, we assume that young individuals who decide not to become parents, derive utility from the overall level of human capital in the economy, which can be interpreted as overall economic development. In this way, we address arguments suggesting that having children is not essential for individuals to be conscientious about the economy's future. Thus, young individuals non-parents have the following maximization problem:

$$V_t^{ync} = \max_{c_t^{ync}, c_{t+1}^o} \ln(c_t^{ync}) + \gamma \ln(\mathbf{h_{t+1}}) + \beta \ln(c_{t+1}^o) \tag{18}$$

$$s.t.: \; c_t^{ync} = (1 - \tau_t - \iota_t)\mathbf{h_t}, \tag{19}$$

$$c_{t+1}^o = b_{t+1}, \tag{20}$$

[8] We prefer to model parental decisions based on differences in individual-specific child productivity rather than differences in preferences for children, as is conventional in the literature, because we believe this approach is less discriminatory. The results are qualitatively the same if, instead of heterogeneity in individual-specific child productivity, we consider heterogeneity in preferences over children.

[9] The assumption that both the time cost of child-rearing and the consumption cost depend on individual-specific child productivity implies that investment in a child's education does not depend on parental productivity. This assumption facilitates the analysis by precluding dynamic heterogeneity in human capital formation—an issue outside the scope of this paper.

$$\mathbf{h_{t+1}} = \int_{\bar{\psi}}^{\infty} h_{t+1}^{*}(\psi) f(\psi) d\psi. \tag{21}$$

The notation in the above problems is similar to that used in the previous section. Specifically, c_t^j and c_{t+1}^o denote consumption levels in period t, when young, for $\{j \in yc, ync\}$, and $t+1$, when old, τ_t is the payroll tax rate, ι_t is the general income tax rate, b_{t+1} is pension benefit enjoyed in period $t+1$ by individuals who are young in period t and retire in period $t+1$,[10] and h_{t+1} and $\mathbf{h_{t+1}}$ denote individual and aggregate human capital, respectively.

The young individual in period t becomes parent if:

$$V_t^{yc} \geq V_t^{ync}. \tag{22}$$

Assumption 1. Assume individual-specific child productivity follows a Pareto distribution with parameter α, where the lowest individual-specific child productivity is 1, that is, $f(\psi) = \alpha \psi^{-\alpha-1}$, with $\alpha > 1$ and $\psi \in [1, \infty)$.

Eq. (22) determines the threshold level of ψ, denoted as $\bar{\psi}$, above which young individuals choose to become parents.[11] This threshold exists and is unique, as demonstrated in the proof of Lemma 5. The threshold $\bar{\psi}$ also determines the share of young individuals who are parents in the population, s_P, which in turn affects the overall fertility rate, $\mathbf{n_t}$, and the aggregate level of human capital in the next period, $\mathbf{h_{t+1}}$.

Definition 3 (*Economic Equilibrium with Fertility Choice*)**.** Economic equilibrium is a sequence of allocations for parents, $\{\{c_t^{*yc}(\psi), c_t^{*o}(\psi), e_t^*(\psi), h_{t+1}^*(\psi), n_t^*(\psi)\}_{\bar{\psi}}^{\infty}\}_{t=1}^{\infty}$, and non-parents, $\{\{c_t^{*ync}(\psi), c_t^{*o}(\psi), \}_1^{\bar{\psi}}\}_{t=1}^{\infty}$ such that, given a sequence of tax rates $\{\tau_t, \iota_t\}_{t=1}^{\infty}$, per-child cost ϕ, the distribution function $f(\psi)$, and the initial condition $\mathbf{h_0} (> 0)$, (i) in each period, the young maximize their lifetime utility subject to the budget constraints, (ii) the government budget constraints are satisfied: $b_t = \tau_t \mathbf{h_t} \mathbf{n_{t-1}}$, $\iota_t \mathbf{h_t} = G_t$, and (iii) $\mathbf{n_t} = \int_{\bar{\psi}}^{\infty} n_t^*(\psi) f(\psi) d\psi$, aggregate human capital evolves according to $\mathbf{h_{t+1}} = \int_{\bar{\psi}}^{\infty} h_{t+1}^*(\psi) f(\psi) d\psi$, and $\bar{\psi}$ solves $V^{yc} = V^{ync}$, so that young individuals with $\psi \geq \bar{\psi}$ are parents.

The government uses tax revenues to finance public pension benefits. Since young parents' productivity is now influenced by the number of children they have and their child-specific productivity, the government budget constraints are as follows:

$$b_{t+1} = \int_1^{\bar{\psi}} \tau_{t+1} \mathbf{h_{t+1}} \mathbf{n_t} f(\psi) d\psi + \int_{\bar{\psi}}^{\infty} \tau_{t+1} \mathbf{h_{t+1}} \mathbf{n_t} \left(1 - \frac{\phi n_t^*(\psi)}{\psi}\right) f(\psi) d\psi. \tag{23}$$

$$G_t = \int_1^{\bar{\psi}} \iota_t \mathbf{h_t} f(\psi) d\psi + \int_{\bar{\psi}}^{\infty} \iota_t \mathbf{h_t} \left(1 - \frac{\phi n_{t-1}^*(\psi)}{\psi}\right) f(\psi) d\psi. \tag{24}$$

Economic equilibrium allocations are characterized in the following lemma.

Lemma 5 (*Economic Equilibrium Allocations in a Model with Fertility Choice*)**.** *The equilibrium allocations are given by:*

$$c_t^{yc*} = \frac{(1 - \tau_t - \iota_t)\mathbf{h_t}}{1+\gamma}, \; c_t^{ync*} = (1 - \tau_t - \iota_t)\mathbf{h_t}, \; c_t^{o*} = b_{t+1}, \tag{25}$$

$$e_t^* = \frac{\delta(1 - \tau_t - \iota_t)\mathbf{h_t}}{(1-\delta)}, \; h_{t+1}^* = A G_t^{\xi} \mathbf{h_t}^{\eta+\delta} \left(\frac{\delta}{1-\delta}(1 - \tau_t - \iota_t)\right)^{\delta} \tag{26}$$

$$\bar{\psi} = \left(\frac{\phi(1+\gamma)^{1+\frac{1}{\gamma}}}{\gamma(1-\delta)}\right)^{\frac{1}{1+a}}, \tag{27}$$

$$n_t^*(\psi) = \frac{\gamma \psi (1-\delta)}{\phi(1+\gamma)}, \tag{28}$$

$$s_P = \bar{\psi}^{-a}, \tag{29}$$

$$\mathbf{n_t} = \int_{\bar{\psi}}^{\infty} n_t^*(\psi) f(\psi) d\psi = \frac{a\gamma(1-\delta)}{\phi(1+\gamma)(a-1)} \bar{\psi}^{1-a}, \tag{30}$$

$$\mathbf{h_{t+1}} = \int_{\bar{\psi}}^{\infty} G_t^{\xi} h_{t+1}^* f(\psi) d\psi = A G_t^{\xi} \mathbf{h_t}^{\eta+\delta} \left(\frac{\delta}{1-\delta}(1 - \tau_t - \iota_t)\right)^{\delta} s_P(\bar{\psi}), \tag{31}$$

$$b_{t+1} = \tau_{t+1} \mathbf{h_{t+1}} \mathbf{n_t} \left(1 - \frac{\gamma(1-\delta)}{1+\gamma} s_P\right), \; G_t = \iota_t \mathbf{h_t} \left(1 - \frac{\gamma(1-\delta)}{1+\gamma} s_P\right). \tag{32}$$

The population growth rate, $\mathbf{n_t}$, is now determined by the parameters of the model and the child care cost, ϕ. The fertility decision of each young individual is determined by $n_t^*(\psi)$ and depends on individual's ψ; $\bar{\psi}$ is the threshold defining the young who decide to become parents, and s_P is the share of parents in the economy.

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[10] That is, the economy operates a pay-as-you-go (PAYG) social security system. In the next section, we show that the main results derived under endogenous fertility remain robust for a version of model economy that operates a fully funded social security system.

[11] Note that the individual-specific fertility, n_t, is a continuous variable that is determined by ψ. As is common in the literature, it can be interpreted as the average fertility per individual type, where the type is characterized by ψ.

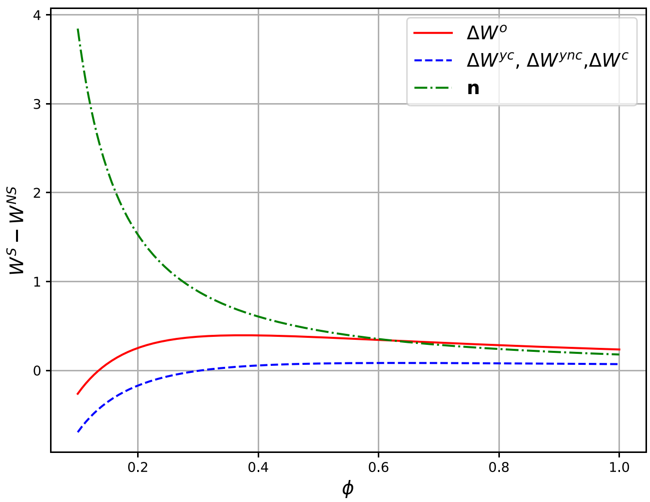

Fig. 2. Difference in welfare with and without children's suffrage as a function of child-care cost ϕ in a model with endogenous fertility.
Note: This figure shows the difference in the welfare at the steady state with and without children suffrage, $\Delta W^j = W^{j,S} - W^{j,NS}$, for $j \in \{y, c, o\}$, for generations of young and children (blue) and generation of elderly (red), as well as the fertility rate, $\mathbf{n}$ (green), as functions of child care cost g. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Given the equilibrium allocations, the indirect utilities of different generations, V_t^{yc}, V_t^{ync}, V_t^o, can be expressed as functions of government policy, τ_t, with the indirect utility of children equal to the discounted indirect utility of young adults in period $t+1$.

It can be easily shown that the optimal taxes in this case are given by the same equations as in the baseline model, (9) and (11), for the economies without and with children's suffrage, respectively. The only difference is that now $\mathbf{n_t}$ is endogenously determined as the population growth rate which results from individual choices of the young.

Lemma 6 (*Political Equilibrium and Government's Policy with Fertility Choice*)**.** *In the considered model economy with fertility choice, the political equilibrium for any* $\mathbf{h_t} > 0$ *is characterized by the tax rates given by* (9) *in the economy without children suffrage, and by the tax rates given by* (11) *in the economy with children's suffrage, where* $\mathbf{n_t}$ *is defined by* (30)*.*

At the steady state, the welfare functions of different generations in a model with fertility choice take the form outlined in Eq. (12). As a result, the same implications hold for the steady-state welfare differences.

Proposition 2 (*Implications of Children Suffrage for Welfare with Fertility Choice*)**.** *At the steady state in a model with endogenous fertility, for each of the generations, the difference between the welfare functions with and without suffrage is:*

- *positive for* $\mathbf{n} \in [0, \mathbf{n}^*]$*, meaning that introducing children's suffrage improves the welfare of all generations at the steady state for* $\mathbf{n} \in [0, \mathbf{n}^*]$*;*
- *negative for* $\mathbf{n} \in [\mathbf{n}^{**}, \infty)$*, where* $\mathbf{n}^{**} > \mathbf{n}^*$*, meaning that introducing children's suffrage reduces the welfare of all generations at the steady state for* $\mathbf{n} \in [\mathbf{n}^{**}, \infty)$*.*

Thus, children's enfranchisement enhances welfare for all generations when fertility is low, whereas restricting the franchise to adults yields higher welfare when fertility is high. The intuition behind this result is similar to that provided in the previous section. With low population growth rates, the tax revenues collected from a relatively scarce population of workers provide lower welfare to the elderly, unless the tax rate is reduced. In such cases, the reduction in the tax rate results in increased spending on children, which boosts productivity and helps mitigate the shortage of funds for public pensions.

The model with fertility choice provides additional insights into the implications of economic conditions for parenting, population growth, public policies, and welfare.

The implications are summarized in the following lemma.

Lemma 7 (*Implications of the Fertility Choice*)**.** *Lower child care cost* ϕ *results in more parents, more children per parent, higher population growth, lower taxes, and higher human capital at the steady state.*

These results indicate that by adjusting child care costs, the government can influence the total fertility rate and, as a result, guide the economy toward a particular suffrage scheme.

Fig. 2 presents a graphical illustration of Proposition 2 for an example of a model economy with $\gamma = 0.5$, $\beta = 0.8$, $\delta = 0.4$, $\eta = 0.1$, $\xi = 0.1$, $A = 10$, and $\alpha = 2$, for different levels of child care cost ϕ, which is inversely proportional to the fertility rate $\mathbf{n}$. For low child care costs, fertility rate is high, approaching three children per young individual when child care costs are at a minimum, in the sense that all young individuals choose to become parents. For such high fertility rates, the welfare gains of introducing Demeny voting are negative. For higher ϕ, the fertility rate declines, eventually reaching a level low enough so that switching to Demeny voting results in welfare gains.

4. Extensions: Model with fully funded social security

The baseline model is developed for a PAYG (pay-as-you-go) social security system, in which contributions from working (young) individuals at time t are used to pay benefits to retirees (old) at the same period. In this section, we show that the main conclusions remain robust under a fully funded social security system. Instead of paying a payroll tax τ_t imposed by the government and used to finance public pensions, the individuals decide on the fraction of their income to save, s_t to finance their retirement. We assume the savings return an exogenous gross interest rate R_t determined by world economic conditions.

The problem of the young individual under fully funded system when the fertility rate is exogenous is as follows:

$$\max_{c_t^y, s_t, e_t, c_{t+1}^o} U_t^y = \ln(c_t^y) + \gamma \ln h_{t+1} + \beta \ln(c_{t+1}^o) \tag{33}$$

$$s.t.: c_t^y + e_t = (1 - s_t - \iota_t) h_t, \tag{34}$$

$$c_{t+1}^o = s_t h_t R_t, \tag{35}$$

$$h_{t+1} = A G_t^{\xi} \mathbf{h_t}^{\eta} e_t^{\delta}, \tag{36}$$

where ι_t is the general income tax used to finance public spending G_t.

For a version of the model with endogenous fertility choice and fully funded social security system, the problem of the young individual who choose to have children is as follows:

$$V_t^{yc} = \max_{c_t^{yc}, s_t, n_t, e_t, c_{t+1}^o} \ln(c_t^{yc}) + \gamma \ln(n_t h_{t+1}) + \beta \ln(c_{t+1}^o) \tag{37}$$

$$s.t.: c_t^{yc} + \frac{\phi n_t}{\psi} e_t = (1 - s_t - \iota_t)\mathbf{h_t}(1 - \frac{\phi n_t}{\psi}), \text{ (35), (36).} \tag{38}$$

The problem of the young individual who choose not to have children is as follows:

$$V_t^{ync} = \max_{c_t^{ync}, s_t, c_{t+1}^o} \ln(c_t^{ync}) + \gamma \ln(\mathbf{h_{t+1}}) + \beta \ln(c_{t+1}^o) \tag{39}$$

$$s.t.: c_t^{ync} = (1 - s_t - \iota_t)\mathbf{h_t}, \text{ (35), given } \mathbf{h_{t+1}}, \tag{40}$$

where $\mathbf{h_{t+1}} = \int_{\bar{\psi}}^{\infty} h_{t+1}^*(\psi) f(\psi) d\psi$. The only government budget constraint in period t is $\iota_t \mathbf{h_t} = G_t$. The economic equilibria of both model versions (without and with fertility choice) are characterized in Appendix. Specifically, similar to the model with PAYG social security, the consumption and education expenses allocations constitute shares of disposable income. The individual-specific fertility rate, $n^*(\psi)$, the share of parents s_P, and the population growth rate $\mathbf{n_t}$ are still defined by Eqs. (28)–(30). Nevertheless, the threshold that defines the young individuals who choose to have children is now given by:

$$\bar{\psi} = \left(\frac{(1 + \frac{\gamma\delta}{1+\beta})^{\frac{1+\beta}{\gamma}} (1+\gamma)^{1+\frac{1}{\gamma}} \phi}{(1+\gamma\delta)^{\frac{1}{\gamma}} \gamma (1-\delta)} \right)^{\frac{1}{1+a}}. \tag{41}$$

As in the PAYG social security model, the political equilibrium under different suffrage schemes coincides across the versions with and without fertility choice. Its properties are established in the following lemma and proposition.

Lemma 8 (*Democratic Government's Policy with Fully Funded Social Security*)**.** *The period-t political equilibrium for any* $\mathbf{h_t} > 0$*, given the population growth rate* $\mathbf{n_{t-1}}$*, is characterized by*

$$\iota_t^{NS} = \frac{\gamma\xi}{1 + \beta + \gamma(\delta + \xi)}, \tag{42}$$

when electorate includes only adults, and by

$$\iota_t^{S} = \frac{\xi(\gamma + n_t\beta(1 + \gamma(\xi + \eta + \delta) + \beta))}{1 + \beta + (\delta + \xi)(\gamma + n_t\beta(1 + \gamma(\xi + \eta + \delta) + \beta))}, \tag{43}$$

when electorate includes adults and children.

By substituting economic equilibrium allocations under political equilibrium taxes with fully funded social security into the indirect utility functions for each generation when the economy is at the steady state, so that $\mathbf{h_t} = \mathbf{h_{t+1}}$, $\iota_t = \iota_{t+1}$, and $\mathbf{n_{t-1}} = \mathbf{n_t} = \mathbf{n_{t+1}}$, the following lemma results.

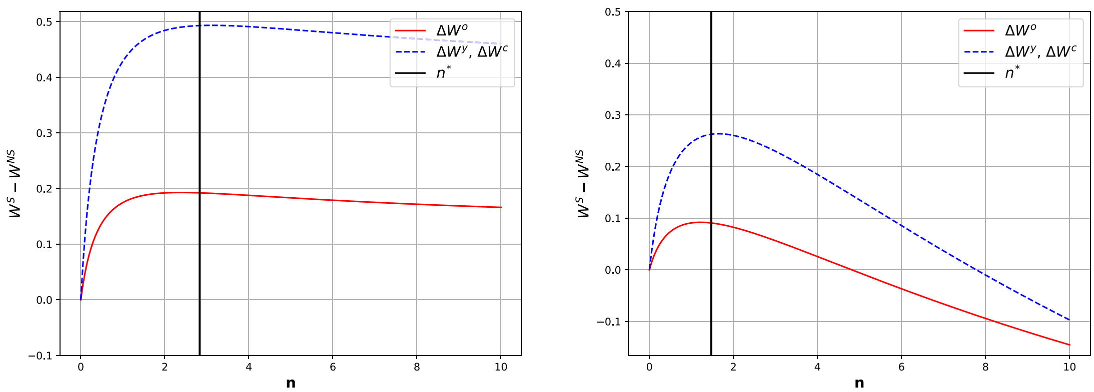

Fig. 3. Difference in welfare with and without children's suffrage as a function of child-care cost ϕ in a model with fully funded social security. *Note:* This figure shows the difference in the welfare at the steady state with and without children suffrage, $\Delta W^j = W^{j,S} - W^{j,NS}$, for $j \in \{y, c, o\}$, for generations of young and children (blue) and generation of elderly (red), as functions of fertility rate, $\mathbf{n}$, for $\delta = 0.4$ and $\delta = 0.04$ on the left and right panel, respectively. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Lemma 9 (*Welfare Functions with Fully Funded Social Security at the Steady State*)**.** *The steady state welfare of each demographic group can be represented as follows:*

$$\bar{W}^{j,i} = v_{j1} \ln(1 - \iota^i) + v_{j2} \ln \iota^i + K^{j,i}, \tag{44}$$

where $\bar{W}^{j,i}$ denotes the welfare of generation j under fully funded social security, $j \in \{y, o, c\}$, $v_{y,1} = v_{c,1} = 1 + \beta + \frac{(1+\gamma+\beta)\delta}{1-(\xi+\eta+\delta)}$, $v_{y,2} = v_{c,2} = \frac{(1+\gamma+\beta)\xi}{1-(\xi+\eta+\delta)}$, $v_{o,1} = 1 + \frac{\delta}{1-(\xi+\eta+\delta)}$, $v_{o,2} = \frac{\xi}{1-(\xi+\eta+\delta)}$, $K^{j,i}$ are constants determined by model's parameters, and i is the suffrage scheme, $i \in \{NS, S\}$, where NS and S denote the franchise without and with children, respectively.

Proposition 3 (*Implications of Children's Suffrage under Fully Funded Social Security*)**.** *At the steady state in this economy with fully funded social security system, for each of the generations, the difference between the welfare functions with and without children's suffrage is:*

- *positive and increasing for $\mathbf{n} \in [0, \hat{\mathbf{n}}^*]$, meaning that introducing children suffrage's improves the welfare of all generations at the steady state for $\mathbf{n} \in [0, \hat{\mathbf{n}}^*]$.*
- *is negative (positive) for $\mathbf{n} \in [\hat{\mathbf{n}}^{**}, \infty)$, where $\hat{\mathbf{n}}^{**} > \hat{\mathbf{n}}^*$, if $(\delta/(1 + \beta + \gamma\delta))^{v_{j1}} \gamma^{-v_{j2}} ((1 + \beta)/(\delta + \xi) + \gamma)^{v_{j1}+v_{j2}} < (>)1$, meaning that introducing children's suffrage reduces (increases) the welfare of all generations at the steady state for $\mathbf{n} \in [\hat{\mathbf{n}}^{**}, \infty)$.*

Proposition 3 suggests that under the fully funded social security, the welfare can be higher under children enfranchisement for all the fertility levels. Specifically, the difference between the welfare functions with and without children's suffrage is likely to be negative, other things equal, for relatively low ξ and δ and relatively high γ. The intuition behind this result is straightforward. Under a fully funded social security system, the elderly depend less on public support, which relaxes the conditions under which optimal policies should prioritize younger generations. A trade-off remains: a higher saving rate or higher private and public spending on education. The former raises consumption in old age, while the latter enhances human capital and thereby indirectly increases future consumption when old. Nevertheless, if the relative efficiency of education spending is low (relatively low ξ and δ) and/or preferences for children are relatively strong (high γ), then a standard suffrage scheme yields higher utility for the elderly at high fertility levels, similar to the case under PAYG social security.

Fig. 3 shows examples of welfare differences for $\delta = 0.4$ and $\delta = 0.04$ in the left and right panels, respectively, with the remaining parameter values set as follows: $\gamma = 0.5$, $\beta = 0.8$, $\eta = 0.1$, $\xi = 0.1$, $A = 10$, and $\alpha = 2$. In the first case, the welfare differences are positive for all values of $\mathbf{n}$, whereas in the second case, the welfare difference becomes negative for all generations starting from some sufficiently high value of $\mathbf{n}$.

5. Quantitative implications

In this section, we calibrate the model with endogenous fertility and evaluate its performance using data on the distribution of children per household across OECD countries. A key challenge in this calibration exercise is that some OECD countries rely heavily on PAYG systems, while others combine or replace them with defined-contribution or fully funded arrangements. In most of the countries, social security systems consist of a combination of PAYG and funded components, with their relative shares often difficult to quantify precisely.

To address this issue, we calibrate the model with endogenous fertility choice under two boundary scenarios for each country: (i) a PAYG system, as defined in Section 3, and (ii) a fully funded system, as defined in Section 4. We then conduct a counterfactual analysis under both scenarios to examine the welfare implications of extending suffrage to children. For countries that primarily rely on PAYG systems, the first scenario is more relevant; for those operating mainly fully funded systems, the second scenario provides a better benchmark. For countries with mixed pension arrangements, the welfare implications are expected to fall between those obtained under the two boundary scenarios.

5.1. Calibration

We calibrate the model's parameters to match the distribution of households by the number of children in 35 OECD countries, using data from the OECD Family Database for 2015.[12] We set the discount factor $\beta = 0.74$, which corresponds to an interest rate of one percent and a time horizon of thirty years. Following Gonzalez-Eiras and Niepelt (2008, 2012) and Uchida and Ono (2024), this time horizon represents the length of each of the three life stages – childhood, youth, and elderhood – within a generation.

The parameters δ, η, and ξ, which represent the elasticities of human capital with respect to its components (education, parental human capital, and public spending), determine the relative importance of public policies in human capital formation and indirectly influence the threshold under which Demeny voting becomes Pareto-improving relative to the standard franchise that includes only adults. Specifically, other things being equal, Demeny voting is more likely to be Pareto-improving the higher are δ, η, or ξ, although the relationship is nonlinear for some parameter combinations. Estimates of these parameters in the literature range between 0.1 and 0.8 (see Restuccia and Vandenbroucke, 2013, 2014; De La Croix and Doepke, 2003; Manuelli and Seshadri, 2014). We set the parameter η, which captures the intergenerational transmission of human capital, to 0.1, and the parameter ξ to a conservative value of 0.03. For higher values of ξ, Demeny voting becomes Pareto-improving for all countries in the sample. The scale parameter A does not affect fertility rates, public policy tools, or welfare outcomes in the model and is calibrated to match the human capital indices of the countries considered.

To determine the remaining parameters (γ, δ, ϕ, and α), we minimize the distance between the four points in the empirical distribution of the number of children per household – specifically, the fraction of households with zero, one, two, and three or more children – and the corresponding points in the model-generated distribution. Given the empirical frequencies of the number of children per household, f_0^{emp}, f_1^{emp}, f_2^{emp}, $f_{3>}^{emp}$, the model-generated frequencies can be computed using the distribution $f(\psi) = \alpha\psi^{-\alpha-1}$ (from Assumption 1) and the number of children as a function of ψ, $n_t(\psi)$, defined by (28). Since fertility in the model depends on a continuous variable ψ that follows a Pareto distribution, we set "cutoff values" that map $n_t(\psi)$ into discrete fertility choices of zero (less than 0.5), one (less than 1.5), two (less than 2.5) and three or more (more than 2.5) children per household, to make the model-generated frequencies comparable to the data, so that:

$$f_0^{mod} = P(n_t < 0.5) = 1 - L^{-a}, \tag{45}$$

$$f_1^{mod} = P(0.5 \le n_t < 1.5) = (L^{-a} - (1.5K)^{-a}), \tag{46}$$

$$f_2^{mod} = P(1.5 \le n_t < 2.5) = (1.5K)^{-a} - (2.5K)^{-a}, \tag{47}$$

$$f_3^{mod} = P(n_t \ge 2.5) = (2.5K)^{-a}, \text{ where} \tag{48}$$

$$L = \max(\bar{\psi}, 0.5K), K = \phi(1+\gamma)/(\gamma * (1-\delta)). \tag{49}$$

where $\bar{\psi}$ is defined by (27) and (41), for the PAYG and fully funded social security system scenarios, respectively.

We do not target any other economic indicators. In the model, the distribution of fertility across households is jointly determined with macroeconomic indicators such as tax rates and public pensions. Thus, we can assess the model's performance by comparing its implied values for these indicators to their empirical counterparts.

Fig. 6 in the Appendix presents the examples of empirical and model-generated distributions of the number of children per household for some of the OECD countries used for calibration, for the PAYG and fully funded social security scenarios, in the top and bottom panels, respectively. Fig. 7 reports the model-implied share of parents alongside the corresponding empirical share of parents for each country, across all calibrated countries, those operating under PAYG scheme, and those operating under mixed or fully funded scheme. Figs. 6 and 7 suggest that the calibrated model closely replicates the targeted moments.

We use OECD data on tax revenues, public pension spending, and government spending on education (all expressed as shares of GDP) for 2015 – the same year as the data on the distribution of children by household – to evaluate the model's performance, as these indicators are not directly targeted in the calibration.

Fig. 4 reports scatterplots comparing the empirical observations of these public policy indicators with their model-generated counterparts. The empirical data is restricted to the sample of countries operating under PAYG or mixed social security systems in the top and bottom panels of Fig. 4, respectively. The data and model-generated values are positively correlated (except for the public spending indicators for mixed or fully funded social security system), suggesting that the mechanisms of the interrelations between childcare costs, fertility, and public policies developed in the model find empirical relevance in the data.

Another way to look at the data presented in Fig. 4 is to consider the relationship between fertility indicators and public policy indicators in the model versus in the data. Table 1 reports the correlations between the share of parents and fertility rate and tax revenues, public pension spending, and government spending on education in the data from the OECD, as well as the corresponding correlations generated by the calibrated model. We distinguish between the PAYG and fully funded model scenarios and compare the

[12] Data source: https://www.oecd.org/els/family/SF_1_1_Family_size_and_composition.xlsx

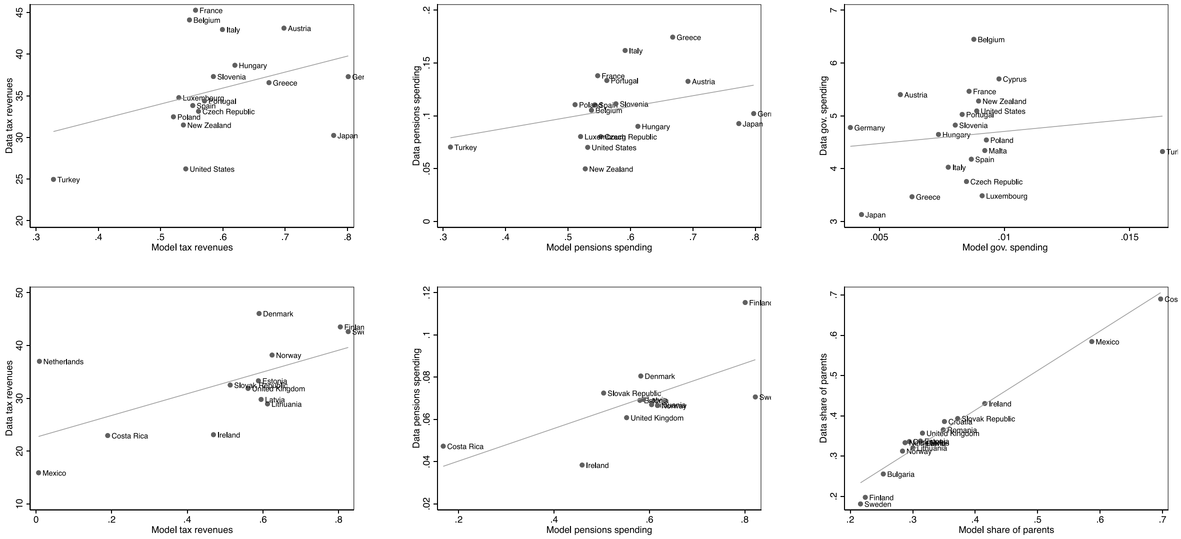

Fig. 4. Public policy indicators: model versus data.
Note: This figure shows the scatterplots of the data versus model-generated values for tax revenues (left graph) and public pensions spending (right graph), where the model parameters are calibrated to match the frequencies of the number of children per household. Data source: OECD statistics.

Table 1
Correlations between fertility and public policy indicators: model versus data.

	(1)	(2)	(3)	(4)
	Data		Model	
Correlations	s_p	$\mathbf{n_t}$	s_p	$\mathbf{n_t}$
		PAYG system (Baseline model)		
Tax revenues	−0.4814	−0.4930	−0.9949	−0.9938
Public pensions spending	−0.3240	−0.4273	−0.9952	−0.9940
Government spending	0.1289	0.1829	0.9772	0.9733
		Mixed system (fully funded model)		
Tax revenues	−0.7982	−0.7420	−0.8533	−0.8237
Public pensions spending	–	–	−0.6850	−0.6601
Government spending	−0.0821	0.0259	−0.8532	−0.8270

Note: This table shows the correlations between fertility and public policy indicators in the data (OECD statistic) and in the model, in Columns (1)–(2) and (3)–(4), respectively.

corresponding model-generated moments with those computed from the data for countries operating mainly under PAYG schemes and those with mixed or predominantly fully funded schemes, in the top and bottom panels of Table 1, respectively. For the PAYG scenario, both the data and the model indicate a negative association between fertility indicators and tax revenues as well as public pension spending. For public spending, the correlations are negative in both the model and the data under the PAYG scenario, but close to zero in the data for countries operating mixed or fully funded schemes, while remaining negative in the model. We cannot compute model-generated public pensions under the fully funded scheme (because the model predicts that the elderly consume only their savings). Thus, the PAYG and fully funded scenarios serve as limiting cases, with actual economies expected to fall somewhere between them.

Next, we use the models to conduct the counterfactual analysis to assess the impact of implementing Demeny voting on the steady-state welfare of different generations in the OECD countries used for calibration.

5.2. Counterfactual analysis

Using the parameters calibrated in the previous subsection, we conduct a counterfactual analysis to evaluate the steady-state welfare of different generations under two voting systems: the standard system, where only adults have voting rights, and the Demeny system, which includes both adults and children in the franchise. The analysis is performed for two model scenarios: a PAYG social security system and a fully funded social security system. Fig. 5 reports the change in the steady-state welfare after the introduction of Demeny voting, $\Delta W^j = W^{j,S} - W^{j,NS}$, for $j \in \{c, yc, ync, o\}$, in darker and lighter colors for the PAYG and fully funded scenarios, respectively.

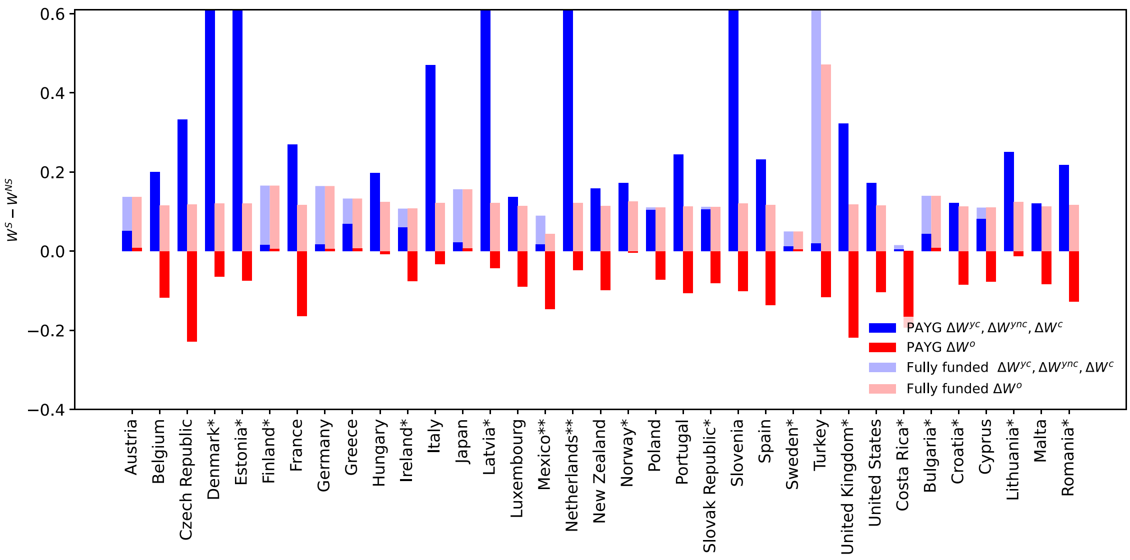

Fig. 5. Difference in welfare with and without children's suffrage: counterfactual analysis.
Note: This figure shows the difference in welfare with and without children's suffrage, $\Delta W^j = W^{j,S} - W^{j,NS}$, for $j \in \{y, c, o\}$, for the young and children (blue) and the elderly (red) generations, in the model with parameters calibrated to the frequencies of the number of children per household, under the PAYG scenario (dark colors) and the fully funded scenario (light colors). Countries marked with * operate a mix of PAYG and fully funded social security systems; those marked with ** rely mainly on fully funded systems; the remaining countries rely mainly on PAYG systems. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

The generations of youth and children benefit from children's enfranchisement in all the considered OECD countries. Additionally, under the PAYG scenario, the elderly generation benefits from the introduction of Demeny voting in seven out of the 35 considered countries: Austria, Finland, Germany, Greece, Japan, Sweden, and Bulgaria. Under the fully funded scenario, all generations would benefit from the introduction of Demeny voting, except in one country, Costa Rica

The welfare implications can be sensitive to the values of the parameters. We have tried several different calibration techniques, still targeting the distribution of children per household in the OECD, but varying some of the parameters in the set (γ, η, δ, ξ, ϕ, and α), while setting the same value for others across the 35 countries. In most of the alternative calibrations, the set of countries where the welfare of all generations would improve after extending the franchise to children is larger than the one presented in Fig. 5.

6. Conclusions

This paper analyzed the welfare implications of children's enfranchisement in a dynamic political economy framework with overlapping generations. The findings, which are robust to endogenous fertility choices and PAYG or fully funded social security, suggest that children's enfranchisement is Pareto-improving when fertility rates are low. In contrast, when fertility rates are high, the standard suffrage scheme, which grants voting rights solely to adults, results in higher welfare than a suffrage scheme that includes both adults and children. These results stem from the relative availability of funds for securing pensions, determined by the balance between the number of workers and retirees in the economy. In the case of worker scarcity, extending the franchise to younger populations, including children, shifts policy priorities from older to younger demographic groups. This leads to increased spending on children, which boosts productivity and helps compensate the shortage of funds for public pensions. Under fully funded social security, Demeny voting can be Pareto-improving for all fertility rates because of the limited dependence of the elderly on public policies.

The findings of this paper provide theoretical support for arguments advocating the extension of suffrage to children in countries experiencing low or negative fertility rates. Such an expansion of suffrage would improve the welfare of all generations in the steady state. Moreover, it can be Pareto-improving during the transition to the steady state with temporary financial support for the elderly, financed by transfers from the newly enfranchised generations.

The model developed in this paper can be extended in several promising directions. For example, a more in-depth analysis of differences in education costs and per-child productivity costs, and their interaction with parent-specific child productivity, could inform the formulation of optimal labor policies aimed at increasing parental productivity and fertility. From a political economy perspective, the model developed in this paper could be extended to include both natives and naturalized immigrants, accounting for their potentially differing preferences in the political domain. The misalignment between the preferences of natives and newcomers – who typically contribute more to population growth – may help explain why children's suffrage is opposed by the current generations.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Characterization of the baseline model

Economic equilibrium allocations represent the solution to the young's maximization problem (2)–(5) and are given by:

$$c_t^{*y}(\mathbf{h_t}, \tau_t, \iota_t) = \frac{(1-\tau_t-\iota_t)\mathbf{h_t}}{1+\gamma\delta}, \tag{50}$$

$$e_t^{*}(\mathbf{h_t}, \tau_t, \iota_t) = \frac{\gamma\delta(1-\tau_t-\iota_t)\mathbf{h_t}}{1+\gamma\delta}, \tag{51}$$

$$h_{t+1}^{*}(\mathbf{h_t}, \tau_t, \iota_t) = AG_t^{\xi}\mathbf{h_t}^{\eta+\delta}\left(\frac{\gamma\delta}{1+\gamma\delta}\right)^{\delta}(1-\tau_t-\iota_t)^{\delta}, \tag{52}$$

$$c_{t+1}^{*o}(\mathbf{h_{t+1}}, \tau_{t+1}) = \tau_{t+1}\mathbf{h_{t+1}}\mathbf{n_t}, \tag{53}$$

$$\mathbf{h_{t+1}} = h_{t+1}^{*}. \tag{54}$$

Proof of Lemma 1. To characterize political equilibrium in this economy, we conjecture policy functions of the form $\tau_{t+1} = \Gamma(\mathbf{h_{t+1}}, \mathbf{n_t}) = B_0(\mathbf{n_t})$, $\iota_{t+1} = \Upsilon(\mathbf{h_{t+1}}, \mathbf{n_t}) = D_0(\mathbf{n_t})$. Under this conjecture, the government problem (8), with the terms that do not affect the optimality conditions summarized in C_1, is as follows:

$$\max_{\tau_t,\iota_t} W_t^{NS} = (1+\delta(\gamma+\beta))\ln(1-\tau_t-\iota_t) + (\gamma+\beta)\xi\ln\iota_t + 1/\mathbf{n_{t-1}}\ln\tau_t + C_1 \tag{55}$$

The first order conditions yield (9). Therefore, $\tilde{\Gamma} = \Gamma$ and $\tilde{\Upsilon} = \Upsilon$ hold if $B_0(\mathbf{n_{t-1}})$ and $D_0(\mathbf{n_{t-1}})$ are given by the terms on the right hand sides of (9). ■

Proof of Lemma 2. To characterize political equilibrium in this economy, we conjecture policy functions $\tau_{t+1} = \Gamma(\mathbf{h_{t+1}}, \mathbf{n_t}, \mathbf{n_{t+1}}) = B_1(\mathbf{n_t}, \mathbf{n_{t+1}})$ and $\iota_{t+1} = \Upsilon(\mathbf{h_{t+1}}, \mathbf{n_t}, \mathbf{n_{t+1}}) = D_1(\mathbf{n_t}, \mathbf{n_{t+1}})$. Under this conjecture, substituting the expressions for V_t^y, V_t^o, and V_t^c and collecting the terms that are irrelevant for the government decision-making in C_2, the government problem (10) is as follows:

$$\begin{aligned} W^S = {} & \max_{\tau_t,\iota_t}(1+\delta(\gamma+\beta+\kappa\mathbf{n_t}))\ln(1-\tau_t-\iota_t) + \xi(\gamma+\beta+\kappa\mathbf{n_t})\ln\iota_t + \\ & 1/\mathbf{n_{t-1}}\ln\tau_t + C_2, \text{ where } \kappa = \beta(1+(\gamma+\beta)(\xi+\eta+\delta)). \end{aligned} \tag{56}$$

The first order conditions yield (11). Therefore, $\tilde{\Gamma} = \Gamma$ and $\tilde{\Upsilon} = \Upsilon$ hold if $B_1(\mathbf{n_{t-1}}, \mathbf{n_t})$ and $D_1(\mathbf{n_{t-1}}, \mathbf{n_t})$ are given by the terms on the right hand sides of (11). ■

Proof of Lemma 3. Results directly from substituting economic equilibrium allocations under political equilibrium policy (payroll and general income taxes) into the indirect utility functions for each generation when the economy is at the steady state, so that $\mathbf{h_t} = \mathbf{h_{t+1}}$, $\tau_t = \tau_{t+1}$, $\iota_t = \iota_{t+1}$, and $\mathbf{n_{t-1}} = \mathbf{n_t} = \mathbf{n_{t+1}}$. ■

Proof of Lemma 4. Denote $A = 1+(\gamma+\beta)(\xi+\delta)$, $B = (\xi+\delta)\kappa = (\xi+\delta)\beta\big(1+(\gamma+\beta)(\xi+\eta+\delta)\big)$. Then, the difference in welfare is:

$$\Delta W^j(\mathbf{n}) = \alpha_{j1}\ln\frac{1+\delta(\gamma+\beta+\kappa\mathbf{n})}{1+\delta(\gamma+\beta)} + (\alpha_{j1}+\alpha_{j2}+\alpha_{j3})\ln\frac{1+\mathbf{n}A}{1+\mathbf{n}A+\mathbf{n}^2B} + \alpha_{j3}\ln\frac{\gamma+\beta+\kappa\mathbf{n}}{\gamma+\beta}.$$

Function ΔW^j is continuous in $\mathbf{n}$, because each term in ΔW^j is a logarithm of a positive function of $\mathbf{n}$; $\Delta W^j(\mathbf{n}=0) = 0$; and $\lim_{\mathbf{n}\to\infty}\Delta W^j(\mathbf{n}) = \lim_{\mathbf{n}\to\infty}(-\alpha_{j2}\ln\mathbf{n} + C_{\bar{j}} + o(1)) = -\infty$, given that $a_{j2} > 0$ for any $j \in \{y, o, c\}$, $C_{\bar{j}}$ is a finite constant. Thus, ΔW^j is negative for all $\mathbf{n}$ starting with some sufficiently large $\bar{\mathbf{n}}^j$.

First derivative: $\frac{d\Delta W^j}{d\mathbf{n}} = \alpha_{j1}\frac{\delta\kappa}{1+\delta(\gamma+\beta+\kappa\mathbf{n})} + (\alpha_{j1}+\alpha_{j2}+\alpha_{j3})\left[\frac{A}{1+\mathbf{n}A} - \frac{A+2\mathbf{n}B}{1+\mathbf{n}A+\mathbf{n}^2B}\right] + \alpha_{j3}\frac{\kappa}{\gamma+\beta+\kappa\mathbf{n}}$. At $\mathbf{n}=0$: $\frac{d\Delta W^j(0)}{d\mathbf{n}} = \alpha_{j1}\frac{\delta\kappa}{1+\delta(\gamma+\beta)} + \alpha_{j3}\frac{\kappa}{\gamma+\beta} > 0$.

Second derivative: $\frac{d^2\Delta W^j}{d\mathbf{n}^2} = -\alpha_{j1}\frac{(\delta\kappa)^2}{[1+\delta(\gamma+\beta+\kappa\mathbf{n})]^2} - \alpha_{j3}\frac{\kappa^2}{(\gamma+\beta+\kappa\mathbf{n})^2} - (\alpha_{j1}+\alpha_{j2}+\alpha_{j3})\frac{A^2(1+\mathbf{n}A+\mathbf{n}^2B)^2+(1+\mathbf{n}A)^2\left(2B-A^2-2\mathbf{n}AB-2\mathbf{n}^2B^2\right)}{(1+\mathbf{n}A)^2(1+\mathbf{n}A+\mathbf{n}^2B)^2}$.

The first two terms of are strictly negative. In the last term, the denominator is positive for all $\mathbf{n} \geq 0$. Denote the numerator by $E(n)$; it is continuous and $E(0) = 2B > 0$. By continuity, there exists a maximal $\mathbf{n}^* > 0$ such that $E(\mathbf{n}) > 0$ for all $\mathbf{n} \in [0, \mathbf{n}^*]$; $E(\mathbf{n}^*) \geq 0$. Hence, ΔW^j is concave on $[0, \mathbf{n}^*]$. ■

Proof of Proposition 1. Results from Lemma 4. ■

Characterization of the model with fertility choice

Proof of Lemma 5. The elderly individuals do not make any decisions and just consume pension benefits: $c_t^o = b_t$. We solve the problem of the young individuals backwards: first, we find optimal allocations for parents and non-parents; second, we identify which individuals will decide to become parents. The problem of non-parents is trivial: consumption in each period is given by the budget constraint, so that $c_t^{ync} = (1-\tau_t-\iota_t)\mathbf{h_t}$. The problem of parents, after substituting all the constraints in the utility function, is as follows:

$$\max_{n_t,e_t} \ln\left((1-\tau_t-\iota_t)\mathbf{h_t}(1-\frac{\phi n_t}{\psi}) - \frac{\phi n_t}{\psi}e_t\right) + \gamma\ln(n_t A G_t^{\xi}\mathbf{h_t}^{\eta}e_t^{\delta}) + \beta\ln(b_{t+1}) \tag{57}$$

The optimality conditions are as follows:

$$[n_t]:\quad \frac{(1-\tau_t-\iota_t)\mathbf{h_t}\frac{\phi}{\psi} + \frac{\phi}{\psi}e_t}{(1-\tau_t-\iota_t)\mathbf{h_t}(1-\frac{\phi n_t}{\psi}) - \frac{\phi n_t}{\psi}e_t} = \frac{\gamma}{n_t}, \tag{58}$$

$$[e_t]:\quad \frac{\frac{\phi n_t}{\psi}}{(1-\tau_t-\iota_t)\mathbf{h_t}(1-\frac{\phi n_t}{\psi}) - \frac{\phi n_t}{\psi}e_t} = \frac{\gamma\delta}{e_t}. \tag{59}$$

The solution is $n_t^* = \frac{\gamma\psi(1-\delta)}{\phi(1+\gamma)}$, $e_t^* = \frac{\delta(1-\tau_t-\iota_t)\mathbf{h_t}}{1-\delta}$. Substituting back into the consumption constraint, $c_t^{yc} = \frac{(1-\tau_t-\iota_t)\mathbf{h_t}}{1+\gamma}$. The indirect utility function for parents takes the following form:

$$\begin{aligned} V_t^{yc} &= \ln(c_t^{*yc}) + \gamma\ln(n_t^* A G_t^{\xi}\mathbf{h_t}^{\eta}e_t^{*\delta}) + \beta\ln(b_{t+1}) = \\ &= \ln\left(\frac{(1-\tau_t-\iota_t)\mathbf{h_t}}{1+\gamma}\right) + \gamma\ln\left(\frac{\gamma\psi(1-\delta)}{\phi(1+\gamma)}AG_t^{\xi}\mathbf{h_t}^{\eta+\delta}\left(\frac{\delta(1-\tau_t-\iota_t)}{1-\delta}\right)^{\delta}\right) + \\ &+\beta\ln(b_{t+1}). \end{aligned} \tag{60}$$

This function is monotone and increasing in ψ, meaning that the higher is individual child-related productivity, the higher is the utility (because the lower is the overall cost) derived from a given number of children.

The indirect utility function for non-parents takes the following form:

$$\begin{aligned} V_t^{ync} &= \ln(c_t^{*ync}) + \gamma\ln(\mathbf{h_{t+1}}) + \beta\ln(b_{t+1}) = \\ &= \ln((1-\tau_t)\mathbf{h_t}) + \gamma\ln\left(\int_{\bar{\psi}}^{\infty} h_{t+1}^*(\psi)f(\psi)d\psi\right) + \beta\ln(b_{t+1}). \end{aligned} \tag{61}$$

This function does not depend on ψ, because non-parents do not incur child-bearing cost and do not take advantange of their child specific productivity.

Next, we combine the solutions to the problem of parents and non-parents to compute the threshold value of ψ, $\bar{\psi}$, above which young individuals become parents.

$$V_t^{yc}(\bar{\psi}) = V_t^{ync}. \tag{62}$$

The expression Eq. (62) simplifies to $-\ln(1+\gamma) + \gamma\ln n_t^*(\bar{\psi}) = \gamma\ln s_p(\bar{\psi})$, where $s_p = \int_{\bar{\psi}}^{\infty} f(\psi)d\psi = \bar{\psi}^{-a}$. The solution exists (because the consumption of young non-parents is higher than consumption of young parents while the consumption of elderly individuals is the same for parents and non-parents), is unique (because V_t^{yc} is monotone in ψ), and is given by $\bar{\psi} = \left(\frac{\phi(1+\gamma)^{1+\frac{1}{\gamma}}}{\gamma(1-\delta)}\right)^{\frac{1}{1+a}}$. The solutions for $\mathbf{n_t}$, $\mathbf{h_{t+1}}$, b_{t+1} and G_t follow by integrating $n_t^*(\psi)$ and $h_{t+1}^*(\psi)$, respectively, over ψ from $\bar{\psi}$ to ∞, given $f(\psi) = a\psi^{-a-1}$. ■

Proof of Lemma 6. Consider first the political equilibrium without children suffrage. The government maximizes the utility of all adults, which accounts to:

$$W_t^{NS} = \max_{\tau_t,\iota_t}\left(\int_{\bar{\psi}}^{\infty} V_t^{yc}f(\psi)d\psi + \int_1^{\bar{\psi}} V_t^{ync}f(\psi)d\psi + \frac{1}{\mathbf{n_{t-1}}}V_t^o\right). \tag{63}$$

To characterize political equilibrium in this economy, we conjecture constant policy functions $\tau_{t+1} = \Gamma(\mathbf{h_{t+1}}) = B_0(\mathbf{n_t})$, $\iota_{t+1} = \Upsilon(\mathbf{h_{t+1}}) = D_0(\mathbf{n_t})$.[13] Under this conjecture, the government problem, with the terms that do not affect the optimality conditions summarized in $\tilde{C}_1$, is the same as in (55), after replacing C_1 by $\tilde{C}_1$. The first order conditions yield (9). Therefore, $\tilde{\Gamma} = \Gamma$ and $\tilde{\Upsilon} = \Upsilon$ hold if $B_0(\mathbf{n_t})$ and $D_0(\mathbf{n_t})$ are given by the terms on the right hand sides of (9).

[13] Differently from the model with an exogenous fertility rate, in this case, $\mathbf{n_{t-1}}$ and $\mathbf{n_t}$ are determined by the model parameters and therefore do not constitute exogenous states.

Consider now the political equilibrium with children suffrage. The government maximizes the utility of all generations, which accounts to:

$$W_t^S = \max_{\tau_t, \iota_t} \left[\left(\left(\int_{\bar{\psi}}^{\infty} V_t^{yc} f(\psi) d\psi + \int_1^{\bar{\psi}} V_t^{ync} f(\psi) d\psi \right) + \frac{1}{\mathbf{n_{t-1}}} V_t^o \right) + \right.$$

$$\left. \beta \left(\mathbf{n_t} \left(\int_{\bar{\psi}}^{\infty} V_{t+1}^{yc} f(\psi) d\psi + \int_1^{\bar{\psi}} V_{t+1}^{ync} f(\psi) d\psi \right) \right) \right]. \tag{64}$$

To characterize political equilibrium in this economy, we again conjecture constant policy functions $\tau_{t+1} = \Gamma(\mathbf{h_{t+1}}) = B_1(\mathbf{n_t}, \mathbf{n_{t+1}})$, $\iota_{t+1} = \Upsilon(\mathbf{h_{t+1}}) = D_1(\mathbf{n_t}, \mathbf{n_{t+1}})$. Under this conjecture, substituting the expressions for V_t^{yc}, V_t^{ync}, and V_t^o, and collecting the terms that are irrelevant for the government decision-making in $\tilde{C}_2$, the government problem is the same as in (56), after replacing C_2 by $\tilde{C}_2$. The first order conditions yield (11). Therefore, $\tilde{\Gamma} = \Gamma$ and $\tilde{\Upsilon} = \Upsilon$ hold if $B_1(\mathbf{n_t}, \mathbf{n_{t+1}})$ and $D_1(\mathbf{n_t}, \mathbf{n_{t+1}})$ are given by the terms on the right hand sides of (11). ■

Proof of Proposition 2. Results from Proposition 1 combined with Lemmas 4, 5 and 6. ■

Proof of Lemma 7. Results from analyzing the sign of derivatives of (9), (11), (30) and (31) with respect to ϕ when $\mathbf{n_t} = \mathbf{n_{t+1}} = \mathbf{n}$ and $\mathbf{h_t} = \mathbf{h_{t+1}} = \mathbf{h}$. ■

Characterization of the models with fully funded social security

Economic equilibrium allocations under fully funded social security system with exogenous population growth represent the solution to the young's maximization problem (33)–(36) and are given by:

$$c_t^{*y}(\mathbf{h_t}, \iota_t) = \frac{(1-\iota_t)\mathbf{h_t}}{1+\beta+\gamma\delta}, \; e_t^*(\mathbf{h_t}, \iota_t) = \frac{\gamma\delta(1-\iota_t)\mathbf{h_t}}{1+\beta+\gamma\delta}, \; s_t^*(\iota_t) = \frac{\beta(1-\iota_t)}{1+\beta+\gamma\delta}, \tag{65}$$

$$h_{t+1}^*(\mathbf{h_t}, \iota_t) = A G_t^{\xi} \mathbf{h_t}^{\eta+\delta} \left(\frac{\gamma\delta}{1+\beta+\gamma\delta} \right)^{\delta} (1-\iota_t)^{\delta}, \tag{66}$$

$$c_{t+1}^{*o}(\mathbf{h_t}, \iota_t) = s_t^* \mathbf{h_t} R_t, \; \mathbf{h_{t+1}} = h_{t+1}^*. \tag{67}$$

Economic equilibrium allocations under fully funded social security system with fertility choice represent the solution to the maximization problems (37)–(40) and are given by:

$$s_t^{yc}(\mathbf{h_t}, \iota_t) = \frac{\beta(1-\iota_t)}{1+\beta+\delta\gamma}, e_t(\mathbf{h_t}, \iota_t) = \frac{\delta(1+\delta\gamma)(1-\iota_t)\mathbf{h_t}}{(1-\delta)(1+\beta+\delta\gamma)}, \tag{68}$$

$$c_t^{yc}(\mathbf{h_t}, \iota_t) = \frac{(1-\iota_t)\mathbf{h_t}(1+\delta\gamma)}{(1+\gamma)(1+\beta+\delta\gamma)}, \; c_t^{oc}(\mathbf{h_t}, \iota_t) = \frac{\beta(1-\iota_t)\mathbf{h_t} R_t}{1+\beta+\delta\gamma}, \tag{69}$$

$$s_t^{ync}(\mathbf{h_t}, \iota_t) = \frac{\beta(1-\iota_t)\mathbf{h_t}}{1+\beta}, c_t^{ync}(\mathbf{h_t}, \iota_t) = \frac{(1-\iota_t)\mathbf{h_t}}{1+\beta}, c_t^{onc}(\mathbf{h_t}, \iota_t) = \frac{\beta(1-\iota_t)\mathbf{h_t} R_t}{1+\beta}, \tag{70}$$

$$G_t = \iota_t \mathbf{h_t} \left(1 - \frac{\gamma(1-\delta)}{1+\gamma} s_P \right), h_{t+1}^*(\mathbf{h_t}, \iota_t) = A G_t^{\xi} \mathbf{h_t}^{\eta+\delta} \left(\frac{\delta(1+\delta\gamma)(1-\iota_t)}{(1-\delta)(1+\beta+\delta\gamma)} \right)^{\delta}, \tag{71}$$

$$\mathbf{h_{t+1}} = \int_{\bar{\psi}}^{\infty} G_t^{\xi} h_{t+1}^* f(\psi) d\psi = A G_t^{\xi} \mathbf{h_t}^{\eta+\delta} \left(\frac{\delta(1+\delta\gamma)(1-\iota_t)}{(1-\delta)(1+\beta+\delta\gamma)} \right)^{\delta} s_P(\bar{\psi}), \tag{72}$$

with $n_t^*(\psi)$, s_P, $\mathbf{n_t}$, and $\bar{\psi}$ defined by equations (28)–(30) and (41), respectively.

Political equilibrium in this economy (with or without fertility choice) is given by a policy function, Υ, $\iota_t = \Upsilon(\sigma_t)$, where σ_t are the payoff-relevant states, such that: (i) Υ is a solution to the government's problem for a given expectation of $\iota_{t+1} = \tilde{\Upsilon}(\sigma_{t+1})$, and (ii) $\tilde{\Upsilon} = \Upsilon$ holds.

The period t problem of a democratically elected government that maximizes the utility of its electorate can be defined as

$$\bar{W}_t^{NS} = \max_{\iota_t}(V_t^y + 1/\mathbf{n_{t-1}} V_t^o), \text{ and} \tag{73}$$

$$\bar{W}_t^{S} = \max_{\iota_t}(V_t^y + 1/\mathbf{n_{t-1}} V_t^o + \mathbf{n_t} V_t^c), \tag{74}$$

for suffrage schemes that includes adults only and adults and children, respectively, with the indirect value functions computed from respective generations' problems given equilibrium allocations.

Proof of Lemma 8. To characterize political equilibrium in this economy (with or without fertility choice) when electorate includes only adults, conjecture policy function of the form $\iota_{t+1} = \Upsilon(\mathbf{h_{t+1}}, \mathbf{n_t}) = D_0$. Under this conjecture, the government problem (73) given (65)–(67), with the terms that do not affect the optimality conditions summarized in C_{10}, is as follows: $\max_{\iota_t} W_t^{NS} = (1+\beta+\gamma\delta)\ln(1-\iota_t) + \gamma\xi \ln \iota_t + C_{10}$. The first order conditions yield (42). Therefore, $\tilde{\Upsilon} = \Upsilon$ hold if D_0 is given by the terms on the right hand sides of (42). To characterize political equilibrium when electorate includes adults and children, conjecture policy function $\iota_{t+1} = \Upsilon(\mathbf{h_{t+1}}, \mathbf{n_t}, \mathbf{n_{t+1}}) = D_1(\mathbf{n_t})$. Under this conjecture, substituting the expressions for V_t^y, V_t^o, and V_t^c and collecting the terms that are irrelevant for the government decision-making in C_{20}, the government problem (74), given (68)–(68),

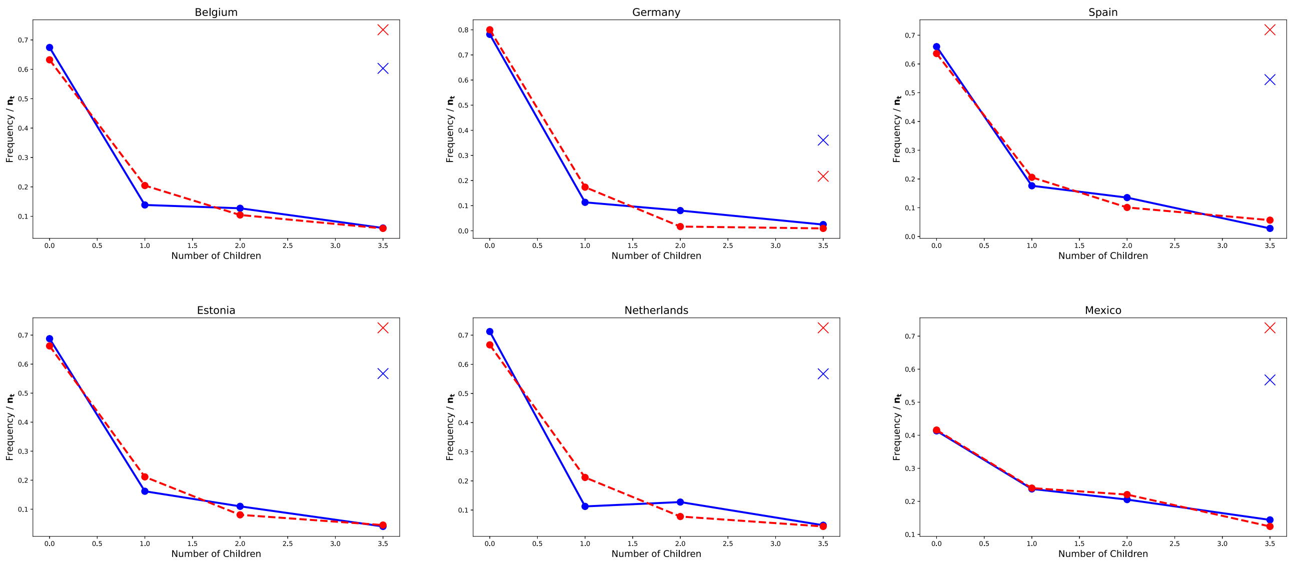

Fig. 6. Empirical and model-generated distribution of the number of children per households and fertility rate.
Note: This figure displays the empirical (blue) and model-generated (red) frequencies of the number of children per household, along with the empirical (blue crosses) and model-generated (red crosses) fertility rates for three randomly selected countries out of the 35 calibrated, under the PAYG and fully funded social security system scenarios in the top and bottom panels, respectively. The calibration selects model parameters for each country to match the frequencies of households with zero, one, two, and three or more children. Data source: OECD Family Database, 2015.

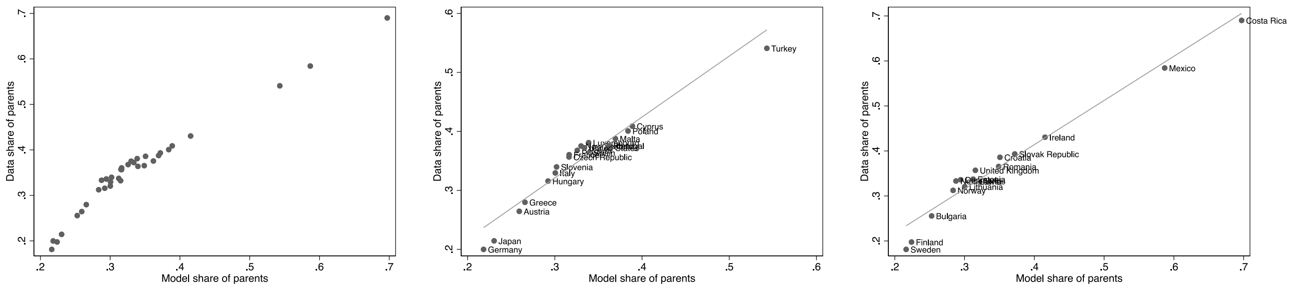

Fig. 7. Model versus data: the share of parents.
Note: This figure shows scatterplots comparing the data and model-generated values for the share of parents across all calibrated countries (left graph), those operating under PAYG scheme (middle graph); and those operating under mixed or fully funded scheme (right graph). The calibration selects model parameters for each country to match the frequencies of households with zero, one, two, and three or more children. Data source: OECD Family Database, 2015.

is as follows: $\max_{\iota_t} W_t^S = (1+\beta+\gamma\delta+\delta(n_t\beta(1+\gamma(\xi+\eta+\delta)+\beta)))\ln(1-\iota_t)+\xi(\gamma+n_t\beta(1+\gamma(\xi+\eta+\delta)+\beta))\ln\iota_t+C_{20}$. The first order conditions yield (43). Therefore, $\tilde{Y}=Y$ holds if $D_1(\mathbf{n_{t-1}},\mathbf{n_t})$ is given by the terms on the right hand side of (43). ■

Proof of Lemma 9. Results directly from substituting economic equilibrium allocations under political equilibrium policy into the indirect utility functions for each generation when the economy is at the steady state, so that $\mathbf{h_t}=\mathbf{h_{t+1}}$, $\iota_t=\iota_{t+1}$, and $\mathbf{n_{t-1}}=\mathbf{n_t}=\mathbf{n_{t+1}}$. ■

Lemma 10 (*Properties of the difference of welfare functions with fully funded security*). *For any $j\in\{y,o,c\}$, the difference of the welfare functions $\Delta\bar{W}^j=\bar{W}^{j,S}-\bar{W}^{j,NS}$ is a function of $\mathbf{n}$ defined for $\mathbf{n}\in[0,\infty)$, taking value 0 for $\mathbf{n}=0$, increasing at $\mathbf{n}=0$, and concave for $\mathbf{n}\in[0,\mathbf{n}^*]$.*

Proof of Lemma 10. $\Delta W^j=v_{j1}\ln\frac{1-\iota^S}{1-\iota^{NS}}+v_{j2}\ln\frac{\iota^S}{\iota^{NS}}$; it is continuous; and $\Delta W^j(0)=0$. The first derivative is: $\Delta W^{j\prime}(n)=\iota^{S\prime}(n)\left(-\frac{v_{j1}}{1-\iota^S(n)}+\frac{v_{j2}}{\iota^S(n)}\right)$; it is positive if $v_{j2}(1-\iota^{NS})>v_{j1}\iota^{NS}$, which holds for $\gamma,\xi+\eta+\delta\in(0,1)$. The second derivative is: $\Delta W^{j\prime\prime}(n)=\iota^{S\prime\prime}(n)\left(-\frac{v_{j1}}{1-\iota^S(n)}+\frac{v_{j2}}{\iota^S(n)}\right)-(\iota^{S\prime}(n))^2\left(\frac{v_{j1}}{(1-\iota^S(n))^2}+\frac{v_{j2}}{(\iota^S(n))^2}\right)$; it is negative given (43), because $\iota^{S\prime}(n)>0$ and $\iota^{S\prime\prime}(n)<0$, for any $n>0$. Thus, $\Delta W^j(n)$ is concave for any $n>0$. The maximum difference is achieved for n^* which solves $v_{j2}(1-\iota^S)-v_{j1}\iota^S=0$.

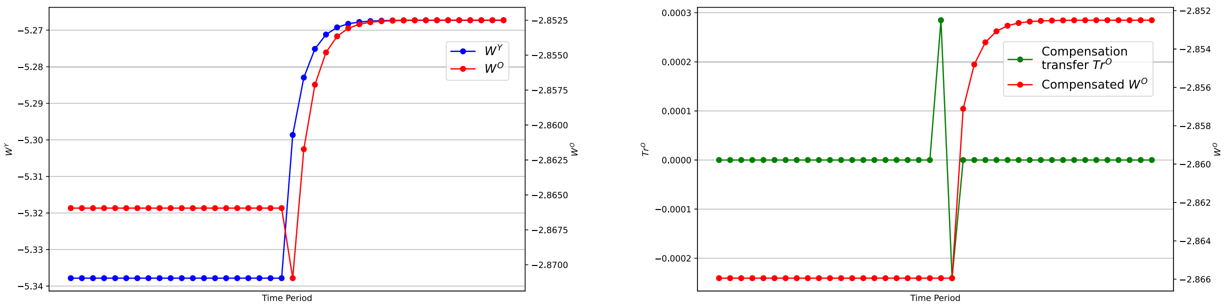

Fig. 8. Impact of the introduction of children's suffrage on welfare and compensation for the elderly.
Note: This figure shows the impact of introducing children's suffrage in an economy operating at steady state on the welfare of the young and children (blue) and the elderly (red) on the left, and the compensation necessary to maintain the elderly equal or better off after introducing children's suffrage (green), as well as the welfare of the elderly with compensation (red) on the right.

$\lim_{n\to\infty} \Delta W^j(n) = \upsilon_{j1} \ln \frac{\delta/(\delta+\xi)}{1-\iota^{NS}} + \upsilon_{j2} \ln \frac{(\xi/(\delta+\xi))}{\iota^{NS}}$. This limit is finite, positive (negative) when $(\delta/(1+\beta+\gamma\delta))^{\upsilon_{j1}}\gamma^{-\upsilon_{j2}}((1+\beta)/(\delta+\xi)+\gamma)^{\upsilon_{j1}+\upsilon_{j2}} > (<)1$. ∎

Proof of Proposition 3. Results from Lemmas 9 and 10. ∎

Compensation in transition after the introduction of children's suffrage

We examine numerically the changes in welfare during the transition to a new steady state following the introduction of children's suffrage. We chose a set of parameters to ensure the steady state with a low fertility rate, that is, the one where Demeny voting is Pareto-improving at the steady state. We simulate the model economy with a standard suffrage scheme, where only adults have the right to vote, over a sufficiently large number of periods until the economy converges to the steady state, and compute the corresponding welfare for each generation. We then introduce a change in franchise, switching to the public policy chosen under a suffrage scheme where both adults and children have the right to vote.

The left panel of Fig. 8 shows the welfare of different generations after the extension of suffrage to children. While the young and children's generations are unambiguously better off after such policy change, the elderly incur a welfare loss in the period when Demeny voting is introduced. This happens because the optimal payroll tax rate chosen by democratically elected government decreases, and therefore, public pensions decrease compared to the previous periods.

To ensure that the extension of suffrage to children constitutes a Pareto improvement, a temporary transfer scheme from the young to the elderly could be implemented. Specifically, a transfer required to maintain the welfare of the elderly unchanged when voting rights are extended to children could be financed through a lump-sum tax imposed on the young in the same period. Alternatively, such a transfer could be financed through public debt (for example, from international markets).

The right panel of Fig. 8 shows the compensation necessary to maintain the elderly at least as well off as before introducing children's suffrage, along with the resulting welfare of the elderly with compensation. A transfer from the current young to the current elderly is sufficient to ensure that the welfare of all generations does not decrease in the period when Demeny voting is introduced, and increases in subsequent periods.

Data availability

No data was used for the research described in the article.

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