

Grechyna, Daryna; Vaithianathan, Rhema

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## Fertility and Welfare under Demeny Voting

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## Fertility and Welfare Under Demeny Voting

*Daryna Grechyna, Rhema Vaithianathan*

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Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email [office@cesifo.de](mailto:office@cesifo.de)

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# Fertility and Welfare under Demeny Voting

## 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. Public spending is financed by tax revenues, meaning that higher spending on child-rearing results in lower pensions, and vice versa. We derive the political equilibrium under Markov strategies and compare welfare across various suffrage schemes and demographic groups. 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. Public investment in child care can change the fertility rate and shift the economy toward a new optimal franchise.

JEL-Codes: H210, J130, D600, D720.

Keywords: demeny voting, children's enfranchisement, fertility, public policy, welfare.

*Daryna Grechyna\**

*Departamento de Teoría e Historia Económica  
Facultad de Ciencias Económicas y  
Empresariales, University of Granada / Spain  
dgrechyna@ugr.es*

*Rhema Vaithianathan*

*Centre for Social Data Analytics, School of  
Social Sciences and Public Policy, Faculty of  
Culture and Society, Auckland University of  
Technology / New Zealand  
rhema.vaithianathan@aut.ac.nz*

\*corresponding author

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# 1 Introduction

Throughout history, democratic development has progressed alongside the gradual expansion of suffrage.<sup>1</sup> 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, no country has yet granted children the right to vote. Several factors hinder the realization of this idea. First, children are considered not to be mature enough to vote (Wolf et al., 2015). Although this problem could be solved by delegating children's votes to their parents, the practical implementation of such a delegation system is difficult (Wall, 2014; Wolf et al., 2015). Second, existing voters and political elites are resistant to changing the status quo through the voluntary transfer of power via the enfranchisement of new population groups. The extension of the franchise is unlikely to occur unless the disenfranchised group presents a credible threat (Conley and Temimi, 2001; Przeworski, 2009) or a majority of the elite decides to shift away from special-interest politics toward increased provision of public goods (Lizzeri and Persico, 2004).

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 trade-offs in public policy when a democratically elected government seeks to maximize the welfare of its electorate, which includes different age groups. 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 during retirement. 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, 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.

This paper is the first, to the best of our knowledge, to conduct the welfare analysis of

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<sup>1</sup>Przeworski, 2009 provides a structured examination of the extension of suffrage around the world, from the establishment of representative institutions to the present.

children’s enfranchisement in an infinite-horizon political economy framework. We derive political equilibrium outcomes under Markov strategies and compare welfare across different suffrage schemes. We conduct the analysis first in a baseline model that highlights the trade-off in the allocation of funds across generations, with an exogenously given fertility rate, and second in a model with an endogenously determined fertility rate and an endogenous segmentation of the population into parents and nonparents.

We show 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.

We also 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, as well as the impact of public policies aimed at reducing child care costs. The welfare outcomes of the baseline model are robust to these extensions. In addition, the share of parents in the population and the fertility rate depend on child care costs. Therefore, by reducing these costs, the government can influence the fertility rate in the economy, which in turn determines the optimal franchise—either granting voting rights to adults and children, or only to adults—depending on the resulting fertility rate. 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.

This paper 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 and 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 (Boldrin et al., 2015; Koka and Rapallini, 2023).

Declining fertility rates have recently sparked renewed interest in models of fertility decisions within a political economy framework (Fanti and Gori, 2014; Hirazawa et al., 2010; Ehrlich and Kim, 2007) and the enfranchisement of 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). Studies on the latter explore whether and why suffrage should be extended to younger age groups, or even restricted for older populations (Parijs, 1998; Lau, 2012), with proposals such as allocating parliamentary seats based on life expectancy (Ishida and Oguro, 2018). 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).

We omit the discussion on how the children vote is decided and focus on analyzing the welfare outcomes of Demeny voting by assuming that children are perfectly informed and rational utility-maximizing voters, same as the young and the elderly. The findings of this paper suggest that, while children's enfranchisement was not optimal decades ago when fertility rates were relatively high,<sup>2</sup> it can be a welfare-improving policy nowadays in countries with low or negative population growth rates.

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

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<sup>2</sup>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).

political equilibrium, and welfare implications of children's suffrage. Sections 3 and 4 extend the baseline model to include endogenous fertility and endogenous fertility with government-funded childcare, respectively. Section 5 discusses the compensation schemes necessary for Pareto-improving introduction of children's suffrage. Section 6 concludes. All proofs are relegated to the 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.

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 has already grown up, would prefer higher pension benefits,  $b_t$ .

To summarize these trade-offs, we assume that young individuals' earning are split between their consumption and child care.<sup>3</sup>

Child care is costly, and requires in particular 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. In this setup, human capital summarizes different aspects of child rearing, including nutrition, health care, and education.

The lifetime utility of a young individual in period  $t$  is as follows:

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

$$s.t. : c_t^y + e_t = (1 - \tau_t)\mathbf{h}_t, \quad (2)$$

$$c_{t+1}^o = b_{t+1}, \quad (3)$$

$$\mathbf{h}_{t+1} = h_{t+1} = A\mathbf{h}_t^\eta e_t^\delta, \quad (4)$$

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<sup>3</sup>In the spirit of Barro and Becker, 1989.



where  $c_t^y$  and  $c_{t+1}^o$  are consumption levels in period  $t$ , when young, and  $t + 1$ , when old,  $\mathbf{h}_t$  is the aggregate stock of human capital available in period  $t$ ,  $\gamma$  is the relative weight on the utility from children,  $\beta$  is a discount factor,  $\tau_t$  is the income tax rate, and  $b_{t+1}$  is the pension benefit enjoyed in period  $t + 1$  by individuals who are young in period  $t$  and retire in period  $t + 1$ .

Population growth or fertility rate in period  $t$  is  $\mathbf{n}_t$ .<sup>4</sup> 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).

Similar to Ono (2015), we assume that human capital of children born in time  $t$ ,  $h_{t+1}$ , evolves according to (4), where  $A$  is the technology,  $e_t$  is child-rearing cost, 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  $e_t$ . 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.

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  $U_t^o = \ln(b_t)$ .

The government collects taxes from the working population to finance pensions. The government budget constraint in period  $t$  reads as follows:

$$\tau_t \mathbf{h}_t \mathbf{n}_{t-1} = b_t, \quad (5)$$

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

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<sup>4</sup>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,  $N_t^y = \mathbf{n}_{t-1} N_t^o$ ,  $N_t^c = \mathbf{n}_t N_t^y$ .

$b_t$ .

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 tax rates and public pension benefits  $\{\tau_t, b_t\}_{t=1}^\infty$  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 is balanced every period:  $b_t = \tau_t \mathbf{h}_t \mathbf{n}_{t-1}$ .*

Economic equilibrium allocations are listed in the 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 constraint, are as follows:

$$\begin{aligned} V^y &= \ln(c_t^{y*}(\mathbf{h}_t, \tau_t)) + \gamma \ln(h_{t+1}^*(\mathbf{h}_t, \tau_t)) + \beta \ln(\tau_{t+1} \mathbf{h}_{t+1}(\mathbf{h}_t, \tau_t) \mathbf{n}_t), \\ V^o &= \ln(\tau_t \mathbf{h}_t \mathbf{n}_{t-1}), \\ V^c &= \beta [\ln(c_{t+1}^{y*}(\mathbf{h}_{t+1}(\mathbf{h}_t, \tau_t), \tau_{t+1})) + \gamma \ln(h_{t+2}^*(\mathbf{h}_{t+1}, \tau_{t+1})) + \\ &\quad \beta \ln(\tau_{t+2} \mathbf{h}_{t+2}(\mathbf{h}_{t+1}, \tau_{t+1}) \mathbf{n}_{t+1})], \end{aligned}$$

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 political elections process, we consider probabilistic voting as in Lindbeck and Weibull (1987). Every period, the individuals who have the right to vote participate in voting over their preferred public policies. A democratically-elected government maximizes the welfare of electorate.

We focus on Markov-perfect equilibria (similar to Gonzalez-Eiras and Niepelt 2008; Ono, 2015; Song 2012; Song et al. 2012) where voters condition their strategies on payoff-relevant state variable, which is the level of human capital characterising the young generation. Every period, eligible voters vote on the tax rate, which determines the size of the pensions for the elderly and the allocations for the young, including the funds available

for investment in children.<sup>5</sup> 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 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). Specifically, the political equilibrium in this model economy can be defined as follows:

**Definition 2 (Political equilibrium)** *Political equilibrium is given by a policy function,  $\Upsilon$ ,  $\tau_t = \Upsilon(\mathbf{h}_t)$ , such that: (i)  $\Upsilon$  is a solution to the government's problem for a given expectation of  $\tau_{t+1} = \tilde{\Upsilon}(\mathbf{h}_{t+1})$  and (ii)  $\tilde{\Upsilon} = \Upsilon$  holds.*

Next, we characterize the government policy 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, taxes and pensions, 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:

$$\max_{\tau_t} W_t^{NS} = V_t^y + 1/\mathbf{n}_{t-1} V_t^o, \quad (6)$$

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.<sup>6</sup>

**Lemma 1 (Democratic government's policy without children suffrage)** *In the considered model economy without children suffrage, the political equilibrium for any  $\mathbf{h}_t > 0$  is characterized by the tax rate given by:*

$$\tau_t^{NS} = \frac{1}{1 + \mathbf{n}_{t-1} + \mathbf{n}_{t-1}\delta(\gamma + \beta)}. \quad (7)$$

Consider now an economy where children have the right to vote and can perfectly identify their optimal future consumption choices, given the public policies. We omit the discussion on how the children vote is decided and assume that children are perfectly informed and rational utility-maximizing voters, same as the young and the elderly.

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<sup>5</sup>Equivalently, the voters could vote on the size of the pensions, and the tax rate would be determined from the government budget constraint.

<sup>6</sup>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  $N_t^y = \mathbf{n}_{t-1} N_t^o$ .

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  $t$ . Nevertheless, children in  $t$  become adults in  $t + 1$ , and the policies chosen in period  $t$  affect their well being in the adulthood.

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:

$$\max_{\tau_t} W_t^S = V_t^y + 1/\mathbf{n}_{t-1}V_t^o + \mathbf{n}_t\beta V_{t+1}^y, \quad (8)$$

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.<sup>7</sup>

**Lemma 2 (Democratic government's policy with children suffrage)** *In the considered model economy, the political equilibrium with children suffrage for any  $\mathbf{h}_t > 0$  is characterized by the tax rate given by:*

$$\tau_t^S = \frac{1}{1 + \mathbf{n}_{t-1} + \mathbf{n}_{t-1}\delta(\gamma + \beta) + \mathbf{n}_{t-1}\mathbf{n}_t\beta\delta(1 + (\eta + \delta)(\gamma + \beta))}. \quad (9)$$

## 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  $\mathbf{n}_{t-1} = \mathbf{n}_t = \mathbf{n}$ .

Equations (7) and (9), which define the optimal tax rates chosen by a democratic government without and with children's suffrage, suggest that the tax rate with children's suffrage is always lower than that without children's suffrage. Lower taxes 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 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:*

$$W^{j,i} = \alpha^j \ln(1 - \tau^i) + \beta^j \ln \tau^i + C^{j,i}, \quad (10)$$

---

<sup>7</sup>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  $N_t^c = \mathbf{n}_t N_t^y = \mathbf{n}_t \mathbf{n}_{t-1} N_t^o$ .

where  $W^{j,i}$  denotes the welfare of generation  $j$ ,  $j \in \{y, o, c\}$ , and  $i$  is the suffrage scheme,  $i \in \{NS, S\}$ , where  $NS$  and  $S$  denote franchise without and with children, respectively.

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

$$\Delta W^j = W^{j,S} - W^{j,NS} = \alpha_j \ln \frac{1 - \tau^S}{1 - \tau^{NS}} + \beta_j * \ln \frac{\tau^S}{\tau^{NS}}, \quad (11)$$

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

**Lemma 4 (Properties of the difference of welfare functions)** *The difference of the welfare functions  $\Delta W^j$  is a function of  $\mathbf{n}$  defined for  $\mathbf{n} \in [0, \infty)$ , taking value 0 for  $\mathbf{n} = 0$ , approaching  $-\infty$  when  $\mathbf{n} \rightarrow \infty$ , increasing at  $\mathbf{n} = 0$ , concave for  $\mathbf{n} \in [0, \mathbf{n}^*]$  and convex for  $\mathbf{n} \in [\bar{\mathbf{n}}, \infty)$  where  $\bar{\mathbf{n}} > \mathbf{n}^*$ .*

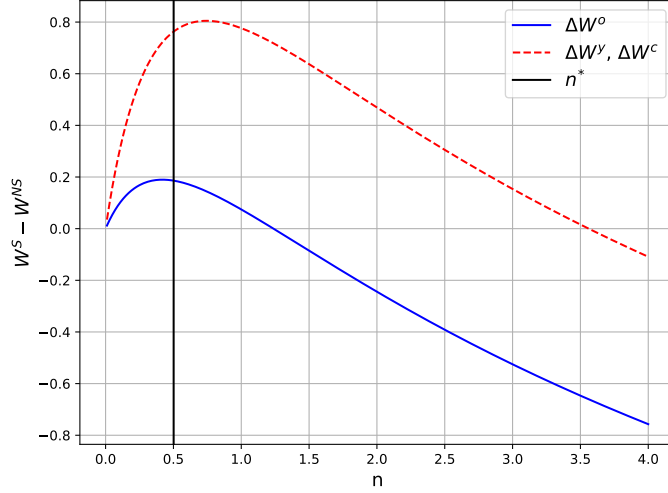
**Corollary 1 (Implications of children suffrage for welfare)** *At the steady state, for each of the generations, the difference between the welfare functions with and without suffrage is:*

- positive for  $\mathbf{n} \in [0, \mathbf{n}^*]$ , meaning that introducing children 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  $\mathbf{n}^{**} > \bar{\mathbf{n}}$ , 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 Corollary 1 is as follows. Welfare is higher in an economy with children's suffrage when fertility rates are low because public policy, by lowering 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 taxes.

Figure 1 presents a graphical illustration of Corollary 1 for an example of a model economy with  $\gamma = 0.5$ ,  $\beta = 0.9$ ,  $\delta = 0.4$ ,  $\eta = 0.2$ , and  $A = 10$ , for different levels of fertility rate  $\mathbf{n}$ . The threshold  $\mathbf{n}$ , below which Demeny voting is welfare-improving

Figure 1: Welfare difference with and without child 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  $\mathbf{n}$ .

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 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.

As with any change in public policy, a reduction in 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 Section 5.

### 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,  $\psi$ , where  $\psi$  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.<sup>8</sup> We incorporate the possibility of government support for child care by introducing a flat child-care cost,  $g$ , associated with having children. In this section, we assume that  $g$  is fixed, but government investment in child care can reduce  $g$ , thereby lowering overall child care costs and influencing parenting decisions, as discussed in more detail in the next section.

Thus, the young individual who decides to have  $n_t$  children and has child productivity  $\psi$  loses  $gn_t/\psi$  units of time that could otherwise be devoted to labor and incurs a total child-rearing consumption cost of  $gn_te_t/\psi$ .<sup>9</sup>

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. 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:

$$V_t^{yc} = \max_{c_t^{y,c}, n_t, e_t, c_{t+1}^o} \ln(c_t^{yc}) + \gamma \ln(n_t h_{t+1}) + \beta \ln(c_{t+1}^o) \quad (12)$$

$$s.t. : c_t^{yc} + \frac{gn_t}{\psi} e_t = (1 - \tau_t) \mathbf{h}_t (1 - \frac{gn_t}{\psi}), \quad (13)$$

$$c_{t+1}^o = b_{t+1}, \quad (14)$$

$$h_{t+1} = A \mathbf{h}_t^\eta e_t^\delta. \quad (15)$$

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

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<sup>8</sup>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.

<sup>9</sup>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. The presence or absence of dependence on  $g$  for either of these costs does not impact the main results.

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:

$$V_t^{ync} = \max_{c_t^{ync}, c_{t+1}^o} \ln(c_t^{ync}) + \gamma \ln(\mathbf{h}_{t+1}) + \beta \ln(c_{t+1}^o) \quad (16)$$

$$s.t. : c_t^{ync} = (1 - \tau_t) \mathbf{h}_t, \quad (17)$$

$$c_{t+1}^o = b_{t+1}, \quad (18)$$

$$\mathbf{h}_{t+1} = \int_{\bar{\psi}}^{\infty} h_{t+1}^*(\psi) f(\psi) d\psi. \quad (19)$$

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,  $\tau_t$  is the 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  $t + 1$ , 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:

$$V_t^{yc} \geq V_t^{ync}. \quad (20)$$

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

Equation (20) determines the threshold level of  $\psi$ , denoted as  $\bar{\psi}$ , above which young individuals choose to become parents.<sup>10</sup> 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*

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<sup>10</sup>Note that the individual-specific fertility,  $n_t$ , is a continuous variable that is determined by  $\psi$ . As is common in the literature, it can be interpreted as the average fertility per individual type, where the type is characterized by  $\psi$ .



non-parents,  $\{\{c_t^{*ync}(\psi), c_t^{*o}(\psi), \}_{1}^{\bar{\psi}}\}_{t=1}^{\infty}$  such that, given a sequence of tax rates and public pension benefits  $\{\tau_t, b_t\}_{t=1}^{\infty}$ , per-child cost  $g$ , 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 constraint is satisfied, 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 constraint is as follows:

$$b_{t+1} = \int_1^{\bar{\psi}} \tau_{t+1} \mathbf{h}_{t+1} \mathbf{n}_t f(\psi) d\psi + \int_{\bar{\psi}}^{\infty} \tau_{t+1} \mathbf{h}_{t+1} \mathbf{n}_t \left(1 - \frac{gn_t^*(\psi)}{\psi}\right) f(\psi) d\psi. \quad (21)$$

Economic equilibrium allocations are characterized below.

**Lemma 5 (Economic equilibrium allocations in a model with fertility choice)**

The equilibrium allocations are given by:

$$n_t^* = \frac{\gamma(1-\delta)\psi}{g(1+\gamma)}, \quad e_t^* = \frac{\delta(1-\tau_t)\mathbf{h}_t}{(1-\delta)}, \quad c_t^{yc*} = \frac{(1-\tau_t)\mathbf{h}_t}{1+\gamma}, \quad (22)$$

$$\bar{\psi} = \left( \frac{g(1+\gamma)^{1+\frac{1}{\gamma}}}{\gamma(1-\delta)} \right)^{\frac{1}{1+a}}, \quad s_P = \bar{\psi}^{-a}, \quad (23)$$

$$\mathbf{n}_t = \int_{\bar{\psi}}^{\infty} n_t^*(\psi) f(\psi) d\psi = \frac{a\gamma(1-\delta)}{g(1+\gamma)(a-1)} \bar{\psi}^{1-a}, \quad (24)$$

$$\mathbf{h}_{t+1} = \int_{\bar{\psi}}^{\infty} h_{t+1}^*(\psi) f(\psi) d\psi = A \mathbf{h}_t^{\eta+\delta} \left( \frac{\delta}{1-\delta} (1-\tau_t) \right)^{\delta} s_P(\bar{\psi}). \quad (25)$$

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,  $\tau_t$ .

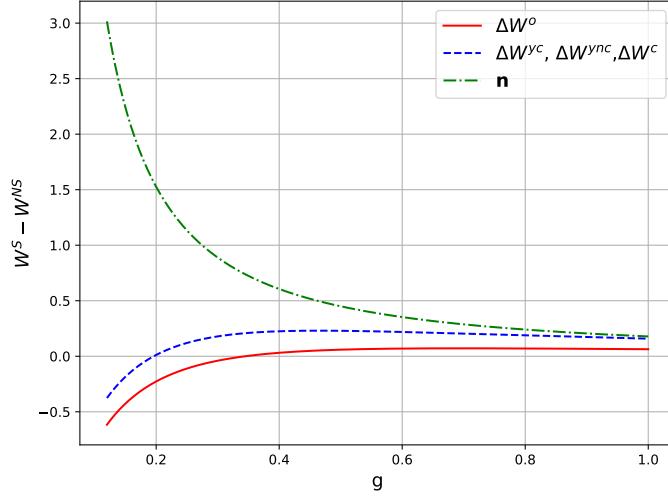
The period  $t$  problem of a democratically elected government that maximizes the utility of its electorate when the electorate includes only adults is as follows:

$$\max_{\tau_t} W_t^{NS} = s_P(\mathbf{n}_t) V_t^{yc} + (1 - s_P(\mathbf{n}_t)) V_t^{ync} + 1/\mathbf{n}_{t-1} V_t^o, \quad (26)$$

The period  $t$  problem of a democratically elected government that maximizes the utility of its electorate when the electorate includes adults and children is as follows:

$$\begin{aligned} \max_{\tau_t} W_t^S &= s_P(\mathbf{n}_t) V_t^{yc} + (1 - s_P(\mathbf{n}_t)) V_t^{ync} + 1/\mathbf{n}_{t-1} V_t^o + \\ &\mathbf{n}_t \beta (s_P(\mathbf{n}_{t+1}) V_{t+1}^{yc} + (1 - s_P(\mathbf{n}_{t+1})) V_{t+1}^{ync}). \end{aligned} \quad (27)$$

Figure 2: Welfare difference with and without child suffrage as a function of child-care cost  $g$



*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  $g$ .

It can be easily shown that the optimal taxes in this case are given by the same equations as in the baseline model, (7) and (9), 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 rate given by (7) in the economy without children suffrage, and by the tax rate given by (9) in the economy with children's suffrage, where  $\mathbf{n}_t$  is defined by (24).*

At the steady state, the welfare functions of different generations in a model with fertility choice take the form outlined in equation (10). As a result, the same implications hold for the steady-state welfare differences.

**Corollary 2 (Implications of children suffrage for welfare with fertility choice)**

*At the steady state in a model with 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  $\mathbf{n}^{**} > \bar{\mathbf{n}}$ , 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.

Figure 2 presents a graphical illustration of Corollary 2 for an example of a model economy with  $\gamma = 0.5$ ,  $\beta = 0.9$ ,  $\delta = 0.4$ ,  $\eta = 0.2$ ,  $A = 10$  and  $\alpha = 2$ , for different levels of child care cost  $g$ , 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 Denemy voting are negative. For higher  $g$ , the fertility rate declines, eventually reaching a level low enough so that switching to Demeny voting results in welfare gains.

The model with fertility choice provides additional insights into the implications of economic conditions for parenting, population growth, public policies, and welfare. Specifically, the population growth rate is now determined by the parameters of the model and the child care cost,  $g$ . The implications are summarized in the following lemma.

**Lemma 7 (Implications of the fertility choice)** *Lower child care cost  $g$  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 government policy can guide the economy toward a specific steady state, including a particular population growth rate, through investments in child care. Such a policy is briefly discussed in the next section.

## 4 Model with Fertility Choice and Publicly-Funded Child-care

The model with endogenous fertility choice provides additional insights into the potential role of child care costs in the welfare implications of different suffrage schemes. Specifically, by adjusting child care costs, the government can influence the total fertility rate and, as a result, guide the economy toward a particular optimal suffrage scheme.

To analyze the implications of varying child care costs for economic and welfare outcomes, suppose the government, in addition to selecting the optimal tax rate  $\tau_t$ , can choose the optimal child care cost  $g_t$ , which affects the budget constraint of young individuals-parents, as defined in (13). To finance child care costs, the government allocates a fraction of its revenues. Suppose the investment of a fraction  $\zeta_t$  of tax revenues into child care results in a child care cost  $g_t \leq 1$ .

The period  $t$  problem of a democratically elected government that maximizes the utility of its electorate can still be written as (26) or (27) when the electorate includes adults or adults and children, respectively, subject to the budget constraint (21) adjusted by adding the child care investment  $\zeta_t$ . Nevertheless, the functions  $W_t^i$  and  $V_t^j$ , where  $j \in \{o, yc, ync, c\}$  and  $i \in \{NS, S\}$ , now depend on two state variables characterizing the economy in each period: human capital,  $\mathbf{h}_t$ , and the state of child care,  $g_{t-1}$ . This means that the results of Lemmas 1, 2, and 6 cannot be applied to the model in this section.

We solve the government problem of optimal public policy consisting of taxes and childcare investment selection in this economy numerically, first for the suffrage scheme that includes only adults, and second, for the suffrage scheme that includes both adults and children.

The solution features the optimal tax policy which is nonlinear in both state variables, and two expectation-driven public investment in childcare policies: either minimal or no investment, resulting in a childcare cost of  $g_t = 1$ , or the maximum investment necessary to reduce the childcare cost to the level where all young individuals decide to be parents,  $g_t = g_{min}$ .

At the steady state corresponding to  $g_t = g_{min}$ , the economy is characterized by high human capital and low taxes, with all young individuals having children. At the steady state corresponding to  $g_t = 1$ , the economy is characterized by low human capital and

high taxes, with the fraction of young individuals-parents determined by equation (24) with  $g = 1$ . The steady state to which the economy converges, and consequently, the optimal suffrage scheme, depend on the initial conditions of the economy.

Figure 3 in the Appendix shows steady-state welfare for the young, children, and the elderly, both without and with children's suffrage, as functions of the initial conditions. For each generation, welfare is higher under Demeny voting compared to the standard voting system when the fertility rate is low (equivalently, when the childcare cost is high) and lower when the fertility rate is high (the childcare cost is low, and therefore, all the young are parents).

These results are consistent with those outlined in the previous section. The policies under children's suffrage are Pareto-improving for the equilibrium with high  $g$ , or equivalently, a low fertility rate  $\mathbf{n}_t(g)$  and a low fraction of parents in the population  $s_P(\mathbf{n}_t(g))$ . Nonetheless, the introduction of endogenous  $g$  provides additional insights into the public policy trade-offs, highlighting the importance of considering how public policies can influence individual decisions, including fertility decisions, and consequently, the trajectory of the country toward a particular state and optimal franchise.

## 5 Compensation in Transition after the Introduction of Children's Suffrage

This section examines 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 Figure 4 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 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 Figure 4 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.

## 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 government-funded childcare, 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.

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.

This paper does not address the question of how children’s suffrage could be implemented in practice, leaving this for future research. Additionally, the model developed in this paper is highly stylized and 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.

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## Appendix

### Economic equilibrium allocations in the baseline model

Economic equilibrium allocations represent the solution to the young's maximization problem (1)-(4) and are given by:

$$c_t^{*y}(\tau_t) = \frac{(1 - \tau_t)\mathbf{h}_t}{1 + \gamma\delta}, \quad (28)$$

$$e_t^*(\tau_t) = \frac{\gamma\delta(1 - \tau_t)\mathbf{h}_t}{1 + \gamma\delta}, \quad (29)$$

$$h_{t+1}^*(\mathbf{h}_t, \tau_t) = A\mathbf{h}_t^{\eta+\delta} \left( \frac{\gamma\delta}{1 + \gamma\delta} \right)^\delta (1 - \tau_t)^\delta, \quad (30)$$

$$c_{t+1}^{*o}(h_{t+1}, \tau_{t+1}) = \tau_{t+1}h_{t+1}\mathbf{n}_t, \quad (31)$$

$$\mathbf{h}_{t+1} = h_{t+1}. \quad (32)$$

**Proof of Lemma 1.** To characterize political equilibrium in this economy, we conjecture a constant policy function  $\tau_{t+1} = \Upsilon(\mathbf{h}_{t+1}) = B_0$ , where  $B_0 > 0$  is a constant.<sup>11</sup> Under this conjecture, the government problem, with the terms that do not affect the optimality conditions summarized in  $C_1$ , is as follows:

$$\max_{\tau_t} W_t^{NS} = (1 + \delta(\gamma + \beta)) \ln(1 - \tau_t) + 1/\mathbf{n}_{t-1} \ln \tau_t + C_1 \quad (33)$$

The first order conditions yield (7). Therefore,  $\tilde{\Upsilon} = \Upsilon$  holds if  $B_0$  is given by the term on the right hand side of (7). ■

**Proof of Lemma 2.** To characterize political equilibrium in this economy, we again conjecture a constant policy function  $\tau_{t+1} = \Upsilon(\mathbf{h}_{t+1}) = B_1$ , where  $B_1 > 0$  is a constant. 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 (8) is as follows:

$$\max_{\tau_t} W^S = (1 + \delta(\gamma + \beta) + \mathbf{n}_t\beta\delta(\eta + \delta)(\gamma + \beta)) \ln(1 - \tau_t) + 1/\mathbf{n}_{t-1} \ln \tau_t + C_2, \quad (34)$$

The first order conditions yield (9). Therefore,  $\tilde{\Upsilon} = \Upsilon$  holds if  $B_1$  is given by the term on the right hand side of (9). ■

**Proof of Lemma 3.** Results directly from substituting economic equilibrium allocations under political equilibrium taxes into the indirect utility functions for each generation when the economy is at the steady state, so that  $\mathbf{h}_t = \mathbf{h}_{t+1}$ ,  $\tau_t = \tau_{t+1}$ , and  $n_t = n_{t+1}$ .

■

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<sup>11</sup>Equivalently, we could develop the solution by considering the policy function  $b_{t+1}$  and conjecturing that it is linear in human capital, similar to Ono, 2015.

**Proof of Lemma 4.**

$$\Delta W^j = \alpha_j \ln \frac{1 - \tau^S}{1 - \tau_{NS}^S} + \beta_j \ln \frac{\tau^S}{\tau_{NS}^S}. \quad (35)$$

Denote  $A = 1 + \delta(\gamma + \beta)$ ,  $B = \beta\delta(1 + (\eta + \delta)(\gamma + \beta))$ , then  $\tau_{NS} = \frac{1}{1 + \mathbf{n}A}$  and  $\tau_{NS}^S = \frac{1}{1 + \mathbf{n}A + \mathbf{n}^2B}$ .

The difference in welfare for generation  $j$  becomes:

$$\Delta W^j = \alpha_j \ln \left( \frac{(A + \mathbf{n}B)(1 + \mathbf{n}A)}{(1 + \mathbf{n}A + \mathbf{n}^2B)A} \right) + \beta_j \ln \left( \frac{1 + \mathbf{n}A}{1 + \mathbf{n}A + \mathbf{n}^2B} \right). \quad (36)$$

Function  $\Delta W^j$  is continuous in  $\mathbf{n}$ ,  $\Delta W^j(\mathbf{n} = 0) = 0$ , and approaching  $-\infty$  when  $\mathbf{n}$  tends to  $\infty$ . Next, we aim to show that this function is concave on the interval  $\mathbf{n} \in [0, \mathbf{n}^*]$ .

Consider the first derivative,  $d\Delta W^j/d\mathbf{n}$ :

$$\frac{d\Delta W^j}{d\mathbf{n}} = \alpha_j \frac{B}{A + \mathbf{n}B} + (\alpha_j + \beta_j) \frac{A}{1 + \mathbf{n}A} - (\alpha_j + \beta_j) \frac{A + 2\mathbf{n}B}{1 + \mathbf{n}A + \mathbf{n}^2B},$$

This derivative is strictly positive at  $\mathbf{n} = 0$ :  $\frac{d\Delta W^j}{d\mathbf{n}}(\mathbf{n} = 0) = \alpha_j \frac{B}{A} > 0$ .

Consider the second derivative,  $d^2\Delta W^j/d\mathbf{n}^2$ :

$$\begin{aligned} \frac{d^2\Delta W^j}{d\mathbf{n}^2} &= -\alpha_j \frac{B^2}{(A + \mathbf{n}B)^2} - (\alpha_j + \beta_j) \frac{A^2}{(1 + \mathbf{n}A)^2} - (\alpha_j + \beta_j) \frac{2B(1 + \mathbf{n}A + \mathbf{n}^2B) - (A + 2\mathbf{n}B)^2}{(1 + \mathbf{n}A + \mathbf{n}^2B)^2} = \\ &= -\alpha_j \frac{B^2}{(A + \mathbf{n}B)^2} - (\alpha_j + \beta_j) \frac{A^2(1 + \mathbf{n}A + \mathbf{n}^2B)^2 - (1 + \mathbf{n}A)^2A^2}{(1 + \mathbf{n}A)^2(1 + \mathbf{n}A + \mathbf{n}^2B)^2} - (\alpha_j + \beta_j) \frac{(2B - 2\mathbf{n}AB - 2\mathbf{n}^2B^2)}{(1 + \mathbf{n}A + \mathbf{n}^2B)^2}. \end{aligned}$$

The first two terms are unambiguously negative. The third term is negative when  $2B - 2\mathbf{n}AB - 2\mathbf{n}^2B^2 > 0$ . Solving the inequality for  $\mathbf{n}$ , taking into account that  $\mathbf{n} \geq 0$ , obtain that

$$\frac{d^2\Delta W^j}{d\mathbf{n}^2} < 0 \text{ for } \mathbf{n} \in [0, \mathbf{n}^*], \text{ where } \mathbf{n}^* = \frac{(A^2 + 4B)^{0.5} - A}{2B}. \quad (37)$$

That is,  $\Delta W^j$  is concave on  $\mathbf{n} \in [0, \mathbf{n}^*]$ .

Next, we show that  $\Delta W^j$  is convex on  $\mathbf{n} \in [\bar{\mathbf{n}}, \infty]$ , where  $\bar{\mathbf{n}} > \mathbf{n}^*$ . Bring all the terms of the second derivative  $d^2\Delta W^j/d\mathbf{n}^2$  to common denominator. The denominator is unambiguously positive. The nominator is a polynomial of degree 6 in  $\mathbf{n}$ :

$$\begin{aligned} P(\mathbf{n}) &= -\alpha_j B^2(1 + \mathbf{n}A)^2(1 + \mathbf{n}A + \mathbf{n}^2B)^2 - (\alpha_j + \beta_j)(A + \mathbf{n}B)^2(\mathbf{n}^4A^2B^2 + \\ &+ 2(1 + \mathbf{n}A)\mathbf{n}^2A^2B) - (\alpha_j + \beta_j)(2B - 2\mathbf{n}AB - 2\mathbf{n}^2B^2)(A + \mathbf{n}B)^2(1 + \mathbf{n}A)^2 = \\ &= \beta_j 2B^4A^2\mathbf{n}^6 + f_5\mathbf{n}^5 + f_4\mathbf{n}^4 + f_3\mathbf{n}^3 + f_2\mathbf{n}^2 + f_1\mathbf{n} + f_0, \end{aligned}$$

where  $f_5, f_4, \dots, f_0$  are the coefficients of  $\mathbf{n}^5, \mathbf{n}^4, \dots, \mathbf{n}^0$  from the expanded common nominator of  $d^2\Delta W^j/d\mathbf{n}^2$ . Factoring out  $\mathbf{n}^6$ :

$$P(\mathbf{n}) = \mathbf{n}^6 \left( \beta_j A^2 B^4 + \frac{f_5}{\mathbf{n}} + \frac{f_4}{\mathbf{n}^2} + \frac{f_3}{\mathbf{n}^3} + \frac{f_2}{\mathbf{n}^4} + \frac{f_1}{\mathbf{n}^5} + \frac{f_0}{\mathbf{n}^6} \right). \quad (38)$$

For sufficiently large  $\mathbf{n}$ , the leading term dominates all other terms in  $P(\mathbf{n})$ . Specifically, as  $\mathbf{n} \rightarrow \infty$ , all terms of the form  $\frac{f_k}{\mathbf{n}^m}$  (where  $m > 0$ ) approach zero. Since all factors in  $\beta_j A^2 B^4$  are positive,  $P(\mathbf{n}) > 0$  for sufficiently large  $\mathbf{n}$ , implying that  $\Delta W^j$  is convex starting from some  $\bar{\mathbf{n}} > \mathbf{n}^*$ . ■

**Proof of Corollary 1.** Combining the facts that  $\Delta W^j(\mathbf{n} = 0) = 0$ ,  $\frac{d\Delta W^j}{d\mathbf{n}}(\mathbf{n} = 0) > 0$ , and  $\frac{d^2\Delta W^j}{d\mathbf{n}^2} < 0$  for  $\mathbf{n} \in [0, \mathbf{n}^*]$ , where  $\mathbf{n}^* = \frac{(A^2+4B)^{0.5}-A}{2B}$ , we can conclude that  $\Delta W^j$  is positive on  $\mathbf{n} \in [0, \mathbf{n}^*]$  and negative on  $\mathbf{n} \in [\mathbf{n}^{**}, \infty)$  where  $\mathbf{n}^{**} > \bar{\mathbf{n}}$ . Given that  $\mathbf{n}^*$  and  $\mathbf{n}^{**}$  do not depend on  $\alpha_j$  and  $\beta_j$ ,  $\Delta W^j$  is positive on  $\mathbf{n} \in [0, \mathbf{n}^*]$  and negative on  $\mathbf{n} \in [\mathbf{n}^{**}, \infty)$  for any  $j$ , that is, for all generations. ■

**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  $c_t^{ync} = (1 - \tau_t)\mathbf{h}_t$ . The problem of parents, after substituting all the constraints in the utility function, is as follows:

$$\max_{n_t, e_t} \ln \left( (1 - \tau_t)\mathbf{h}_t \left(1 - \frac{gn_t}{\psi} - \frac{gn_t}{\psi} e_t\right) + \gamma \ln(n_t A \mathbf{h}_t^\eta e_t^\delta) + \beta \ln(b_{t+1}) \right) \quad (39)$$

The optimality conditions are as follows:

$$[n_t] : \frac{-(1 - \tau_t)\mathbf{h}_t \frac{g}{\psi} - \frac{g}{\psi} e_t}{(1 - \tau_t)\mathbf{h}_t \left(1 - \frac{gn_t}{\psi} - \frac{gn_t}{\psi} e_t\right) + \frac{gn_t}{\psi} e_t} = \frac{\gamma}{n_t}, \quad (40)$$

$$[e_t] : \frac{\frac{gn_t}{\psi}}{(1 - \tau_t)\mathbf{h}_t \left(1 - \frac{gn_t}{\psi} - \frac{gn_t}{\psi} e_t\right) + \frac{gn_t}{\psi} e_t} = \frac{\gamma\delta}{e_t}. \quad (41)$$

The solution is  $n_t^* = \frac{\gamma(1-\delta)\psi}{g(1+\gamma)}$ ,  $e_t^* = \frac{\delta(1-\tau_t)\mathbf{h}_t}{(1-\delta)}$ , with both optimal choices being functions of  $\psi$ . Substituting back into the consumption constraint,  $c_t^{yc} = \frac{(1-\tau_t)\mathbf{h}_t}{1+\gamma}$ . The indirect utility function for parents takes the following form:

$$V_t^{yc} = \ln(c_t^{*yc}) + \gamma \ln(n_t^* A \mathbf{h}_t^\eta e_t^{*\delta}) + \beta \ln(b_{t+1}) = \quad (42)$$

$$V_t^{yc} = \ln \left( \frac{(1 - \tau_t)\mathbf{h}_t}{1 + \gamma} \right) + \gamma \ln \left( \frac{\gamma(1 - \delta)\psi}{g(1 + \gamma)} A \mathbf{h}_t^{\eta+\delta} \left( \frac{\delta(1 - \tau_t)}{\psi(1 - \delta)} \right)^\delta \right) + \beta \ln(b_{t+1}). \quad (43)$$

This function is monotone and increasing in  $\psi$  ( $dV_t^{yc}/d\psi = (1 - \delta)/\psi > 0$ , 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:

$$V_t^{ync} = \ln(c_t^{*ync}) + \gamma \ln(\mathbf{h}_{t+1}) + \beta \ln(b_{t+1}) = \quad (44)$$

$$V_t^{ync} = \ln((1 - \tau_t)\mathbf{h}_t) + \gamma \ln\left(\int_{\bar{\psi}}^{\infty} h_{t+1}^*(\psi) f(\psi) d\psi\right) + \beta \ln(b_{t+1}). \quad (45)$$

This function does not depend on  $\psi$ , because non-parents do not incur child-bearing cost and do not take advantage of their child specific productivity.

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

$$V_t^{yc}(\bar{\psi}) = V_t^{ync}. \quad (46)$$

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  $\psi$ ), and is given by<sup>12</sup>  $\bar{\psi} = \left(\frac{g(1+\gamma)^{1+\frac{1}{\gamma}}}{\gamma(1-\delta)}\right)^{\frac{1}{1+a}}$ . The solutions for  $\mathbf{n}_t$  and  $\mathbf{h}_{t+1}$  follow by integrating  $n_t^*(\psi)$  and  $h_{t+1}^*(\psi)$ , respectively, over  $\psi$  from  $\bar{\psi}$  to  $\infty$ , 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:

$$\max_{\tau_t} W_t^{NS} = \int_{\bar{\psi}}^{\infty} V_t^{yc} f(\psi) d\psi + \int_1^{\bar{\psi}} V_t^{ync} f(\psi) d\psi + \frac{1}{\mathbf{n}_{t-1}} V_t^o, \quad (47)$$

where the first term is the sum of the utilities of young parents and the second term is the sum of the utilities of young non-parents. The above equation simplifies to:

$$\max_{\tau_t} W_t^{NS} = s_P(\tilde{V}_t^{yc} + 1/a - \ln \bar{\psi}) + (1 - s_P)V_t^{ync} + \frac{1}{\mathbf{n}_{t-1}} V_t^o, \quad (48)$$

where  $\tilde{V}_t^{yc}$  is  $V_t^{yc}$  with  $\psi$  omitted. To characterize political equilibrium in this economy, we conjecture a constant policy function  $\tau_{t+1} = \Upsilon(\mathbf{h}_{t+1}) = B_0$ , where  $B_0 > 0$  is a constant. 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 (33), after replacing  $C_1$  by  $\tilde{C}_1$ . The first order conditions yield (7). Therefore,  $\tilde{\Upsilon} = \Upsilon$  holds if  $B_0$  is given by the term on the right hand side of (7).

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

$$\max_{\tau_t} W_t^S = (1 + \mathbf{n}_t\beta) \left( \int_{\bar{\psi}}^{\infty} V_t^{yc} f(\psi) d\psi + \int_1^{\bar{\psi}} V_t^{ync} f(\psi) d\psi \right) + \frac{1}{\mathbf{n}_{t-1}} V_t^o, \quad (49)$$

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<sup>12</sup>The expression (46) simplifies to  $-\ln(1 + \gamma) + \gamma \ln n_t^*(\bar{\psi}) = \gamma \ln s_p(\bar{\psi})$ .

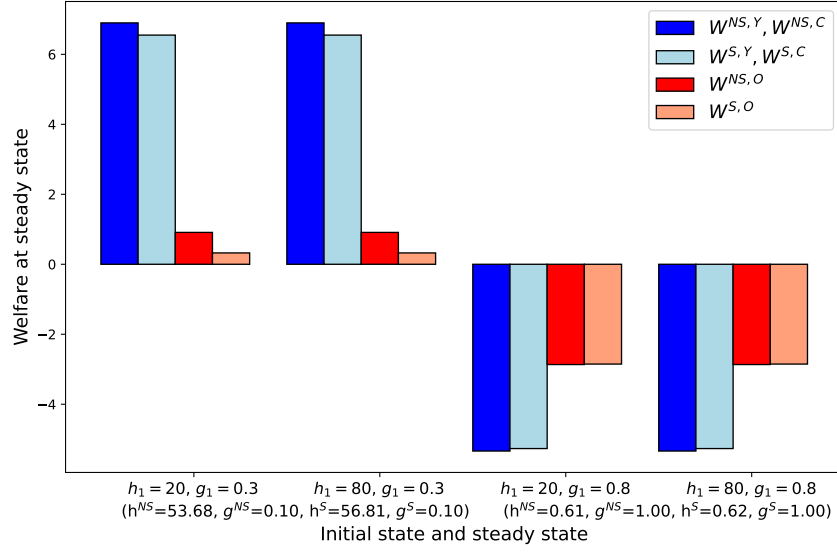
To characterize political equilibrium in this economy, we again conjecture a constant policy function  $\tau_{t+1} = \Upsilon(\mathbf{h}_{t+1}) = B_1$ , where  $B_1 > 0$  is a constant. Under this conjecture, substituting the expressions for  $V_t^{yc}$ ,  $V_t^{ync}$ , and  $V_t^o$ , and collecting the terms that are irrelevant for the government decision-making in  $\tilde{C}_2$ , the government problem is the same as in (34), after replacing  $C_2$  by  $\tilde{C}_2$ . The first order conditions yield (9). Therefore,  $\tilde{\Upsilon} = \Upsilon$  holds if  $B_1$  is given by the term on the right hand side of (9). ■

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

**Proof of Lemma 7.** Results from analyzing the sign of derivatives of (7), (9), (24) and (25) with respect to  $g$  when  $\mathbf{n}_t = \mathbf{n}_{t+1} = \mathbf{n}$  and  $\mathbf{h}_t = \mathbf{h}_{t+1} = \mathbf{h}$ . ■

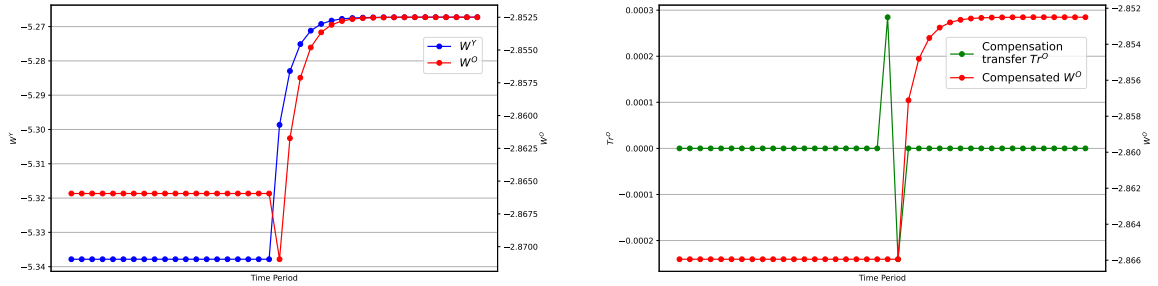


Figure 3: Welfare at the steady state as a function of initial  $g$



*Note:* This figure shows the steady-state welfare for the young and children (blue) and the elderly (red), without children's suffrage (dark) and with children's suffrage (light), as functions of the initial conditions. The steady-state values are indicated under the initial conditions.

Figure 4: 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.