Journal of Public Economics 238 (2024) 105199

Contents lists available at ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/jpube

# No country for young people? The rise of anti-immigration politics in ageing societies☆

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ARTICLE INFO

*JEL classification:*
D72
J610
J14
H550

*Keywords:*
Immigration
Ageing
Policy
Voting

ABSTRACT

We investigate the effects of population ageing on immigration policies using a citizen-candidate model of elections. In each period, young people work and pay taxes while old people receive social security payments. Immigrants are all young, meaning they contribute significantly to financing the cost of public services and social security. Among natives, the elderly and the poor benefit the most from public spending. However, since these two types of voters do not internalise the positive fiscal effects of immigration, they have a common interest in supporting candidates who seek to curb immigration and increase the tax burden on high-income individuals. Population ageing increases the size and, in turn, the political power of such sociodemographic groups, resulting in more restrictive immigration policies, a larger public sector, higher tax rates, and lower societal well-being. Calibrating the model to UK data suggests that the magnitude of these effects is large. The implications of this model are shown to be consistent with the patterns observed in UK attitudinal data.

What are the effects of population ageing on immigration policy? Why are anti-immigration politicians and political parties increasingly successful in rapidly ageing countries, which arguably need more legal immigration to mitigate the impact of population ageing on their public finances? This paper addresses these questions using a theoretical model and providing suggestive empirical evidence.

This study is motivated by three key findings from the empirical literature on migration. First, aversion to immigration (Dustmann and Preston, 2007; Facchini and Mayda, 2008; Card et al., 2012) and support for anti-immigration political parties (Van der Brug and Fennema, 2007; Curtice, 2015) tend to be stronger among elderly citizens than people in other sociodemographic groups (Fig. 1).[1] Second, economic hostility towards immigration is primarily motivated by concerns about its effects on public spending policies (Dustmann and Preston, 2006, 2007; Boeri, 2010). This suggests a persistent *perception* among natives of competition with immigrants over welfare benefits and the use of crowded-out public services. Third, immigrants are, on average, net fiscal contributors. The empirical evidence indicates that this is true both in the UK (Dustmann et al., 2010; Dustmann and Frattini, 2014) and the United States (Lee and Miller, 2000; Orrenius, 2017), implying that, at least in the long run, immigrants do not directly draw fiscal resources away from natives.[2] These three empirical regularities lead to a two-fold puzzle. Why is hostility towards immigration motivated by concerns about its fiscal effects in countries where these effects are generally positive in aggregate? Furthermore, why are the elderly – who benefit the most from the fiscal surplus arising from immigration – more averse to immigration-friendly policies than the young? Traditional studies draw linkages between economic aversion to immigration and either its labour market effects (Benhabib, 1996; Scheve and Slaughter, 2001) or its fiscal effects (Scholten and Thum, 1996; Dustmann and Preston, 2006, 2007). However, the elderly are typically no longer labour market participants and are net beneficiaries of the fiscal surplus from immigration via public spending. The existing literature is thus unable to deliver a compelling explanation for their intense hostility to immigration. Other competing economic and non-economic approaches

☆ I am thankful to Antonio Cabrales, Ian Preston and John Roemer for their invaluable advice. I thank Julien Bergeot, V. Bhaskar, Michele Boldrin, Saumya Deojain, Christian Dustmann, Johannes Horner, Suehyun Kwon, Guy Laroque, Gilat Levy, Konrad Mierendorff, Massimo Morelli, Aureo de Paula, Nikita Roketskiy, and Larry Samuelson. I thank seminar and conference participants at UCL and Yale University. I gratefully acknowledge financial support from the Economic and Social Research Council, United Kingdom and UCL, United Kingdom. I thank the Editor and two anonymous reviewers whose detailed comments and suggestions have contributed to improving this manuscript.

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[1] In 2017, 61% of the British citizens over 60 wanted less immigration, while just 45.3% of those under 35 years felt the same way (NatCen Social Research, 2019). In the US, the corresponding values for 2016 were 27.8% and 44.1% (General Social Survey 1972-2016, 2016).

[2] The evidence regarding other European countries is heterogeneous (Boeri, 2010). For an extensive survey on the issues involved in evaluating the impact of immigration on public finances, see Preston (2014).

https://doi.org/10.1016/j.jpubeco.2024.105199
Received 10 August 2022; Received in revised form 17 July 2024; Accepted 31 July 2024
Available online 12 August 2024

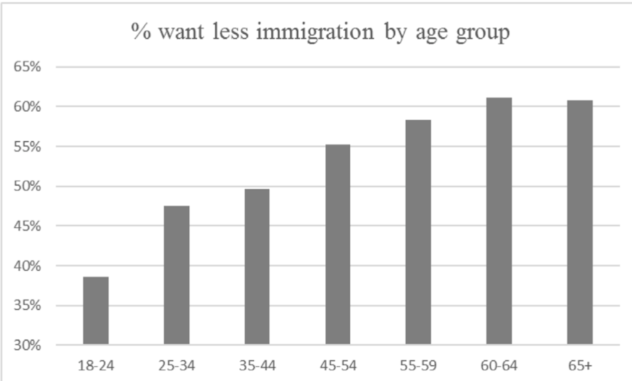


**Fig. 1.** Percentage of respondents wanting the number of immigrants to be reduced by age group, British Social Attitude Survey 2017.

to immigration attitudes – extensively reviewed in the next section – can only partially account for the aforementioned stylised facts.

We propose a channel that can explain this puzzle. Throughout this paper, we provide theoretical and empirical arguments to argue that it is the *key* channel.

We study a dynamic economy in which the resident population in each period consists of two age groups: young and old, and two legal groups: citizens and immigrants. Individuals, both citizens and immigrants, live for two periods at most, differ in their productivity levels (low, medium or high), and derive utility from the consumption of private goods and government services. The citizens also have an exogenous common taste for immigration that captures any non-economic factors affecting their immigration policy preferences,[3] but relative policy preferences are entirely driven by economic factors. All new immigrants are young, have the same average productivity as natives and a weakly higher fertility rate. They cannot vote, but they acquire citizenship (and voting rights) after one period of residency in the host country.

In each period, society chooses through elections a two-dimensional policy consisting of an immigration quota and governmental service provisions. The elderly (both native and naturalised immigrants) receive a public pension. For simplicity, we assume that pension transfers are exogenously determined and financed solely by tax revenues, but both these assumptions can easily be relaxed (see Section 6.1). The government collects revenue through a linear tax on labour income and uses it to finance public spending, resulting in a redistributive welfare system. There is no public debt and the budget is assumed to be balanced in each period. Thus, the policy choice endogenously determines the income tax rate.

Our key innovation is that voters can choose both the immigration policy and the fiscal policy, which determines how society divides the net fiscal benefits of immigration, and that these two choices are bundled together in the electoral platforms of the available candidates. This novel feature generates the following trade-offs.

Firstly, immigration widens the tax base of the receiving country, generating a fiscal surplus, which can be employed to (1a) increase public spending and/or (1b) reduce taxes. Secondly, an increase in public spending can be financed through (2a) higher tax rates and/or (2b) further immigration. Elderly and low-income citizens are less affected by income tax changes than young and high-income citizens. Thus, choices (1a) and (2a) mostly benefit the former sociodemographic groups, whereas choices (1b) and (2b) favour the latter groups.

These trade-offs generate the key intuition underpinning our results: elderly and low-income citizens not only (a) support higher public spending than the young and rich, but also (b) prefer to finance this spending through higher income tax rates rather than through further immigration. These preference patterns imply that politicians seeking to represent the interests of older and poorer citizens propose a platform featuring relatively restrictive immigration policies, high public spending, and high taxes *(anti-immigration candidates)*.

Conversely, young and rich citizens primarily seek to ease their tax burden. Since increased immigration and cuts to public spending both contribute to reducing the tax rate, politicians aiming to represent the interests of these citizens propose less restrictive immigration policies, a smaller government, and lower taxes in their electoral platforms (*pro-immigration candidates*). As a consequence, open immigration policies are always endogenously bundled with a relatively small government.

Note that the model generates no actual competition between immigrants and natives over welfare benefits because the fiscal gains from immigration always outweigh its crowding-out effect on public services (at a given tax rate). Nevertheless, the political process induces *perceived* competition. The mechanism is as follows. Pro-immigration candidates propose more immigration, less public spending, and lower taxes than anti-immigration candidates. Because elderly and poor citizens are almost unaffected by a drop in the tax rate but are strongly harmed by spending cuts, the policy platform of a pro-immigration candidate – if implemented – produces a *negative short-term fiscal effect* on these sociodemographic groups relative to that of an anti-immigration candidate. This prompts elderly and poor voters to behave as though they are competing with immigrants over public benefits. That is, even if they benefit the most from public spending financed through immigration, they support relatively anti-immigration candidates in the elections on the grounds of the negative fiscal effects of pro-immigration policy platforms, in line with the stylised facts.

Demographic shocks tilt the relative power of the two opposing political factions. Specifically, population ageing results in a larger share of elderly voters, fuelling support for anti-immigration candidates. This yields an equilibrium policy of low immigration and high public spending. This mechanism underpins the main analytical results of this paper, which are as follows:

1. A rise in longevity and/or a fall in the birth rate increases the share of elderly voters, determining the electoral success of a relatively anti-immigration politician.
2. The election of an anti-immigration politician leads to a tightening of immigration policy, an increase in public spending, and a sharp rise in the tax rate. Hence, the political process tends to exacerbate the effects of population ageing on public finances.
3. If immigrants have higher fertility rates than natives, a reduction in the immigration flow due to the policy change lowers the country's birth rate, causing further population ageing and an even tighter immigration policy in the following period.
4. The tightening of immigration policy generates a welfare loss for the entire society, although it mostly harms middle- and high-income workers as well as future generations.

Moreover, we provide two sets of quantitative results. First, we calibrate a parametric infinite-horizon version of the model to UK data. This exercise reveals that the magnitude of the analytical effects described above may be rather large. For instance, a 5-year increase in life expectancy at 65 yields a policy allowing for 11.3% fewer immigrants. Second, we show that the patterns of aversion towards immigration observed in the British Social Attitudes Survey (BSA) data from 1995 to 2017 are consistent with the fiscal channel proposed in this paper, whereas they provide little or no support for alternative explanations. Specifically, age is positively correlated with aversion to immigration and support for a large government, even after controlling for cohort effects and non-economic factors such as educational qualifications. Moreover, we show that the perceived negative effects of immigration

[3] These factors include, among others, the effects of immigration on *compositional amenities* documented in Card et al. (2012). We discuss the role played by such factors in Section 6.1.

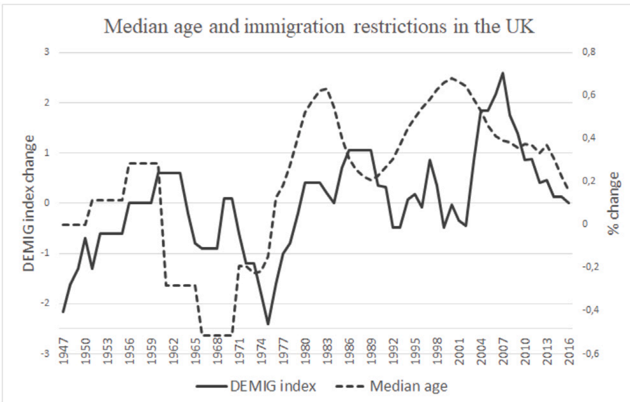


**Fig. 2.** Annual change in the DEMIG immigration policy restrictiveness index vs. percentage change in median age in the UK (5-year moving averages) (DEMIG, 2015; ONS, 2019).

on welfare policies worsen throughout the life cycle, whereas those on cultural, labour market, and other economic outcomes do not.

These results are consistent with the correlation patterns between population ageing and restrictions on immigration observed in the UK during the post-WWII period (Fig. 2) and represent suggestive but consistent evidence in support of the key implication of the proposed theoretical framework. Moreover, they offer a rationale for why ageing countries tend to limit immigration, despite the potential benefits. Ageing societies tend to disregard the wellbeing of young people – natives and immigrants alike – and future generations. Our analysis suggests that this dynamic, which has widespread economic, demographic, and political consequences, is unlikely to change.

In addition to the main results, our model generates predictions regarding the impacts of rising income inequality and economic recession on immigration and spending policies. These predictions align with those in previous theoretical studies (Dolmas and Huffman, 2004) and consistent with the findings in the empirical literature (Barnes et al., 2022).

Lastly, the anti-immigration rhetoric is deemed to be a key feature of the broader and multi-faceted phenomenon of *right-wing populism* in Western democracies (Mudde, 2007, 2016; Guiso et al., 2017). In the discussion section, we argue that our analysis may help in identifying one of the mechanisms underpinning the proliferation and electoral success of right-wing populist parties in recent decades.

## 1. Political economy approaches to immigration attitudes

There is a vast body of theoretical and empirical literature on the determinants of voter's aversion to immigration, which is extensively reviewed in Hainmueller and Hopkins (2014) and Alesina and Tabellini (2023). In this section we discuss the leading theories, focusing on whether their predictions are consistent with the stylised facts that motivate our analysis.

*Cultural and Sociopsychological Theories*. There is substantial empirical and experimental evidence that non-economic motives play a crucial role in shaping attitudes towards immigrants (Brettell and Hollifield, 2007). Firstly, concerns regarding racial and ethnic background (Ford, 2011) as well as immigrant nationality (Hainmueller and Hangartner, 2013) and cultural identity (Bonomi et al., 2021) are deemed to be important determinants in most receiving countries and tend to worsen with the respondent's age (Card et al., 2012). However, in European countries the relationship between age and non-economic hostility to immigrants is largely explained by *cohort effects*, while there is no evidence that it worsens along the life cycle (Calahorrano, 2013; Schotte and Winkler, 2018; McLaren and Paterson, 2020). Secondly, experimental psychological research (Gonsalkorale et al., 2009) shows that, as people age, judgements, cognitive abilities, and evaluations of social reality change, leading to stronger racial prejudice among older adults and possibly anti-immigrant sentiments. Lastly, recent empirical research suggests that cultural, sociopsychological and economic factors are tightly interrelated in shaping hostility towards immigrants (Alesina and Tabellini, 2023) and anti-immigration populism (Gidron and Hall, 2020; Colantone and Stanig, 2019), particularly among elderly citizens. In the light of this evidence, non-economic explanations should be seen as complementary to our analysis in explaining the worsening of attitudes towards immigration during the last three decades. However, these channels alone cannot explain why aversion to immigration is often explicitly motivated by fiscal concerns in attitudinal studies.

*Labour Market Theories*. Several theoretical and empirical studies attempt to explain individual attitudes towards immigrants as the consequence of the (real or perceived) effects of immigration on wages and other labour market outcomes. For instance, Scheve and Slaughter (2001) propose a formal model of immigration's distributional impacts in which an influx of immigrants increases the supply of low-skilled labour, lowering wages for low-skilled natives while possibly raising wages for high-skilled natives. Thus, the model predicts that low-income natives are more averse to immigration than high-income natives. The empirical evidence regarding labour market theories is mixed. Some studies (Scheve and Slaughter, 2001; Mayda, 2006; O'Rourke and Sinnott, 2006) provide indirect support for this labour market hypothesis. Other empirical research challenges these conclusions, providing evidence that labour market effects play little (Card et al., 2012) or no role (Hainmueller and Hiscox, 2007, 2010) in shaping attitudes towards immigration. For the purposes of the current study, the labour economics literature (Dustmann and Preston, 2007) suggests that older people, who are either retired or close to the end of their working lives, are less affected by labour market competition than the young. Therefore, older people have weaker incentives to oppose immigration on the grounds of its labour market effects. This insight, which enjoys strong empirical support, suggests that labour market theories are unlikely to provide a credible explanation for the key empirical puzzle that motivates our analysis.

*Other Economic Theories*. Some empirical research shows that in most receiving countries immigrants possess different skills relative to natives (Peri and Sparber, 2009) and tend to specialise in jobs – such as direct home care and nursing – which are particularly beneficial for elderly natives, potentially affecting their attitudes towards immigration (Grabowski, 2023). Other studies emphasise the role of competition between immigrants and natives in the housing market, which may affect property values and rental prices (Saiz and Wachter, 2011; Sá, 2015) and, in turn, hostility towards immigrants (Adler and Ansell, 2020). Some scholars stress the positive effect of immigration on the returns to capital investment, which favours the wealthy citizens in the receiving country (Ben-Gad, 2018). Lastly, recent experimental evidence suggests that aversion towards immigration may be influenced by misperceptions or a lack of information regarding its economic and demographic effects and can be mitigated by providing information (Haaland and Christopher Roth, 2020; Alesina et al., 2023; Boeri et al., 2023), especially in countries characterised by a relatively low share of immigrants (Facchini et al., 2022). These factors contribute to explaining the determinants of immigration aversion and should be considered as complementary to our analysis. However, they cannot to provide a compelling explanation for the stylised facts that motivate the present study, in particular the fact that aversion to immigration is stronger among the elderly than the young.

*Fiscal Theories*. The empirical research provides compelling evidence that concerns regarding the perceived effects of immigration on public finances, public spending, and taxes represent the most important determinant of economic hostility towards immigration (Dustmann and Preston, 2006, 2007; Boeri, 2010). Thus, it is not surprising that fiscal theories of immigration aversion have become increasingly popular during the last two decades (see Preston, 2014, for a survey). These studies emphasise the importance of intergenerational aspects related to the pension system (e.g., Razin and Sadka, 1999; Kemnitz, 2003; Leers et al., 2003; Krieger, 2003; Ben-Gad, 2018), and immigrant fertility (Bohn and Lopez-Velasco, 2019) in explaining the determinants of political views towards immigration policies. Most of these papers assume a unidimensional policy space, in which voters choose the immigration quota but not the fiscal policy.

A key finding in the literature is that the assumption of a unidimensional policy space generates inconsistent predictions. This issue is described by Haupt and Peters (1998) and Facchini and Mayda (2009). They study a simple economy characterised by a linear income tax and assume that revenues are provided to all citizens as lump-sum rebates. In this setting, the unidimensionality requirement can be satisfied in two ways. Either the level of public spending or the income tax rate must be exogenously determined. According to Facchini and Mayda (2009), these two alternative assumptions correspond, respectively, to the classes of *tax adjustment models* (*TAM*s; e.g., Scholten and Thum, 1996) and *benefit adjustment models* (*BAM*s; e.g., Razin and Sadka, 1999, 2000). These two model types deliver opposite predictions regarding the relationship between age, pre-tax income, and attitude towards immigration. If immigrants are net fiscal contributors, *TAM*s show that elderly and low-income citizens are more hostile to immigration than younger and richer citizens; the opposite is true for *BAM*s.

The intuition that underpins these seemingly contradictory results is as follows. If public spending is exogenously determined, the effect of a rise in the tax base is a fall in the tax rate. Conversely, if the tax rate is unaffected by voter choice, the effect is a rise in public spending per capita. In the former case, immigration mainly benefits young and high-income citizens; in the latter case, elderly and low-income citizens enjoy the largest share of the gains. In both models, the endogenous effects of immigration are weakly negative on taxes and weakly positive on public spending when immigrants are net fiscal contributors.[4] Thus, neither of these approaches provides a rationale for the well-documented aversion towards immigration based on its perceived negative fiscal effects.

Preston (2014) argues that the source of this apparent inconsistency lies in how society distributes the gains from immigration, and suggests that this puzzle can be addressed by a model that allows for immigration, public spending, and tax policy to be endogenous. Despite this, most studies are based on unidimensional models for technical reasons: a *Condorcet Winner* – a platform that is preferred to any alternative by a majority of voters – does not typically exist if the policy space is multidimensional (Plott, 1967; Grandmont, 1978). This implies that Black's *median voter theorem* (1948) does not hold. Thus, voting models that allow for multiple endogenous policy dimensions require the use of a different solution concept. Further details on this issue are provided in section SM.3 of the online appendix.

Several alternative approaches that tackle the multidimensionality issue exist and are widely available in the literature on voting (see Dhillon, 2005; Dotti, 2021); e.g., citizen-candidate models (Osborne and Slivinski, 1996; Besley and Coate, 1997), probabilistic voting (Lindbeck and Weibull, 1987; Banks and Duggan, 2005), and models of endogenous political parties (Roemer, 1999; Levy, 2004, 2005). However, the adoption of such approaches in the literature on the political economy of immigration is extremely limited. To our knowledge, the only attempt to depart from unidimensionality in voting models on immigration policies is Razin et al. (2016). They propose an overlapping generations (OLG) model similar to the one used in this paper, in which the native population consists of skilled workers, unskilled workers, and the elderly. They characterise the political coalitions that can prevail among these three types of voters and derive various predictions. However, their approach is unsuitable for answering the questions in this paper, as they assume exogenous tax rates. Thus, the implications of their model, in terms of immigration preferences, are the same as those of a standard *BAM*.

We fill this gap in the literature by using a citizen-candidate model of representative democracy akin to those in the literature, which allows for immigration, public spending, and tax policy to be endogenous to voter choice. The specific choice is a matter of convenience: it ensures tractability, mechanism transparency, and ease of interpretation of the results, without affecting the main trade-offs underpinning our predictions, as illustrated in Section 2.2.

## 2. The model

This section consists of two parts: (1) the economic model of immigration and public spending and (2) a description of the political process.

### 2.1. Economic environment

We propose a model of immigration and public spending akin to those in the literature, particularly that of Razin and Sadka (1999). However, unlike their model, both public spending and immigration are endogenous in our model. We study an economy lasting $T = 2$ periods. This is the most parsimonious modelling choice that preserves all the trade-offs, both static and dynamic, generated by our theoretical framework. In Appendix B, all the results are shown to hold true for any $T > 2$.

#### 2.1.1. Demographic structure

The length of each period $t = 1, 2$ is normalised to 1. Every period features a continuum of individuals, divided into two generational groups: the working-age population ($Y$) of size $yp_t$ and the elderly population ($O$) of size $o_t$. This assumption is meant to represent a society with a large number of citizens. The working-age population consists of $n_t$ natives and $m_t$ immigrants. All newly arrived immigrants are in the working-age group and there is no return migration: the elderly population includes those individuals who were immigrants in period $t-1$. The supply of potential immigrants is large. All these assumptions are very common in the literature (e.g. Scholten and Thum, 1996; Razin and Sadka, 1999). The size of each group is summarised in Fig. 3.

Following Bohn and Lopez-Velasco (2019) we assume that working-age individuals have exogenous fertility rates: $\sigma$ for natives and $\sigma^m = \sigma + \Delta$ for immigrants, with $\Delta \geq 0$ and that, at the end of each period, the immigrants and their children are fully assimilated into the native population (i.e. they become identical to natives of the same age group). Under these assumptions, the size of the working-age native population in period $t$ is given by the formula $n_t = \sigma n_{t-1} + \sigma^m m_{t-1}$.

We depart from the literature in explicitly modelling life expectancy. Specifically, a young individual at time $t < 2$ survives to period $t+1$ with probability $\lambda \in [0, 1]$. Thus, life expectancy at birth is $1 + \lambda \leq 2$ and the size of the elderly population is $o_t = \lambda(n_{t-1} + m_{t-1})$.[5] Note that $o_t$ is an increasing function of life expectancy. At the end of period 2, all agents die with probability 1 and the economy ends. Lastly, the initial condition of the economy (at time $t = 0$) is a working-age population of $n_0$ natives and $m_0$ immigrants.

[4] Some models in the literature (Haupt and Peters, 1998) imply a negative relationship between immigration and public spending for the elderly. However, this relationship is the direct result of a restriction: they assume that the state pension decreases with immigration. Conversely, in our analysis it is an endogenous outcomes of voter choice.

[5] Note that because we assume a continuum of young individuals, the formula for the size of the elderly population cannot be directly derived using a law of large numbers. However, under some non-trivial technical restrictions, one can obtain this formula for $o_t$ by assuming a young population which is the limit of a large but discrete number of individuals. See Judd (1985).

| $t=0$ | | $\rightarrow$ | $t=1$ | | $\rightarrow$ | $t=2$ | |
|---|---|---|---|---|---|---|---|
| $yp_0$ | $(Y)$ | survive: $\lambda\ yp_0$ | $o_1=\lambda\ yp_0$ | $(O)$ | die: $o_1$ | $\times$ | |
| | | born: $n_1=\sigma n_0+\sigma^m m_0$ | $yp_1=n_1+m_1$ | $(Y)$ | survive: $\lambda\ yp_1$ | $o_2=\lambda\ yp_1$ | $(O)$ |
| | | | | | born: $n_1=\sigma n_1+\sigma^m m_1$ | $yp_2=n_2+m_2$ | $(Y)$ |

**Fig. 3.** Size of each generation.

#### 2.1.2. Citizenship and voting rights

In keeping with the literature (Dolmas and Huffman, 2004; Ortega, 2010; Razin et al., 2016) we assume that only the $n_t$+$o_t$ *citizens* (i.e., the young natives plus all the elderly) vote — recent immigrants do not. Immigrants acquire citizenship after being resident in the country for one period, and this privilege extends to their children; i.e. an "immigrant" is defined solely by their legal status. All our results hold qualitatively under alternative assumptions about acquisition of voting rights, as illustrated in Section 6.1.

#### 2.1.3. Individual preferences

A citizen $i$ of group $(Y)$ in period $t$ has preferences over the consumption of private goods $C_t^i$, the extent of government services $G_t$, and the share of immigrants in society $M_t = m_t/(m_t + n_t)$, represented by the following utility function:

$$U_t^{i,Y}\left(\left\{C_{t+r}^i, M_{t+r}, G_{t+r}\right\}_{r=0}^1\right) = C_t^i + b(G_t) + c(M_t) + \mathbf{1}\left[t \neq 2\right]\beta\lambda \times \left[C_{t+1}^i + d(G_{t+1}) + c(M_{t+1})\right] \quad (1)$$

where $\beta$ captures the rate at which an individual discounts future utility and the functions $b$, $d$, and $c$ are strictly concave $C^\infty$ functions. The indicator function captures the fact that there is no continuation value after the final period $t = 2$.

The function $c$ represents an exogenous taste for immigration and is the same for all citizens, albeit this assumption can easily be relaxed, as illustrated in Section 6.1. This assumption is non-standard and captures all non-economic factors affecting voter preferences regarding immigration; these factors are widely documented in the empirical literature summarised in Section 2. Its domain is $[0, \overline{M}]$, where $\overline{M} < 1$ is the level corresponding to completely unregulated immigration. We assume $c'(0) \geq 0$ and $c'(\overline{M}) \leq -\kappa$ for sufficiently large positive $\kappa$; that is, the citizens are strongly averse to completely unregulated immigration, but are either indifferent to, or supportive of a small number of immigrants. Note that $c\left(M_t\right)$ need not be negative and/or decreasing over its entire domain. For instance, $c\left(M_t\right) = \alpha_1 M + \frac{\alpha_2}{2}\left(1 - M^2\right)$ with $\alpha_2 > \alpha_1/\overline{M} > 0$ is positive-valued and non-monotonic over its domain, but satisfies the required conditions. Crucially, our setup requires the *marginal immigrant* to impose a taste cost on native individuals only if aggregate immigration is sufficiently large. This is consistent with UK attitudinal data showing that immigration is often perceived as excessively large in size rather than harmful for the country overall (IPSOS, 2022). The presence of $c$ in the utility function does not shape the mechanisms underpinning the predictions of this paper. It serves the purpose of avoiding corner solutions in which all citizens want completely unregulated immigration or no immigration at all. The framework can also be extended to allow for the influence of past immigration on citizens' preferences. In Section 6.1 we further discuss these aspects and the role played by the function $c$. Additionally, we assume that $G_t \in \left[0, \overline{G}\right]$, $b$ and $d$ are increasing, and $b$ satisfies $b'(0) = +\infty$ and $b'\left(\overline{G}\right) = 0$.

For retired individuals in period $t$, the direct utility $U_t^{i,O}$ is similarly constructed, except it is solely a function of consumption, government services, and immigration in the current period:

$$U_t^{i,O}\left(C_t^i, M_t, G_t\right) = C_t^i + d\left(G_t\right) + c\left(M_t\right) \quad (2)$$

where the features of $c$ and $d$ are illustrated in the previous paragraphs.

Young individuals who immigrate in period $t$ consume both private goods and government services in the same way natives do; however, their preference specification is irrelevant for electoral outcomes, as they do not vote in that period. Conversely, naturalised immigrants in their old age do vote and have the same preferences as older natives, as in Dolmas and Huffman (2004) and Ortega (2010). This assumption is strong but can easily be relaxed, as illustrated in Section 6.1.

#### 2.1.4. Production

Each working-age individual $i$ can be employed either in the private or public sector at a wage rate equal to their productivity. They are endowed with 1 unit of time and their labour supply is perfectly inelastic. This latter assumption simplifies the analysis. It does not drive the trade-offs that underpin this paper's predictions and can be relaxed, as detailed in Section 6.1. Individual $i$'s gross income in period $t$ has formula $y_t^i = \xi\omega_t^i$ with time-invariant average $\overline{y}$, where $\xi$ is an aggregate productivity component and $\omega_t^i$ is $i$'s productivity type.

For simplicity, we assume three productivity types: $\Omega = \left\{\omega^{Low}, \omega^{Mid}, \omega^{High}\right\}$, but all our results hold true for a higher number – or even a continuum – of types (see Appendix B). The distribution of $\omega_t^i$ is time-invariant with mean equal to 1 and cumulative distribution function (CDF) $Q_\rho(\omega_t)$, where the index $\rho$ captures the degree of inequality of the distribution in the sense of Ramos et al. (2000) and Dotti (2020). Details are provided in Appendix A.3.

Immigrants possess the same average productivity as natives, which is assumed to be independent of policy choices. This assumption is admittedly restrictive, intended to describe an economy that faces a large supply of rather productive potential immigrants and that cannot effectively select immigrants based on observable characteristics. The consequences of relaxing this assumption are discussed in Section 6.2.

The private sector produces the consumption good using a linear technology, with labour as input. This assumption is common in the literature (e.g., Razin and Sadka, 2000) and is imposed for reasons of convenience. It implies that immigration has no effect on the wages of natives and is very restrictive.[6] However, the empirical literature suggests that the size of this effect is generally fairly small (Preston, 2014), meaning that our assumption represents a reasonable approximation. Moreover, this assumption can be relaxed in a number of ways (details in Section 6.1); all our main results hold true as long as the effect of immigration on wages is not too large in magnitude and not strongly decreasing in income. Given this setup, the total production of consumption goods equals the total gross income of private sector workers.

The public sector produces government services. The uniform quality level of government services $G_t \in \left[0, \overline{G}\right]$ is assumed to be equal

[6] It is justified if one considers that, in a more complex economy, these effects tend to be offset by adjustments in the stock of capital (not explicitly assumed in this analysis) that occurs over the long term. This mechanism is considered to be particularly effective for offsetting the long-run effects of immigration on wages if firms have access to international capital markets (see: Ben-Gad, 2018).

to the share of effective labour hired by the public sector or, equivalently, to the ratio of non-pension public spending to output. This means that government services are a partially congested public good which is crowded-out if the number of young individuals – including immigrants – increases. Examples of public services that display these features include public transportation, public offices, and the police. This assumption is imposed for technical reasons and is admittedly restrictive, but it is not crucial to generate the trade-off underpinning our predictions. Specifically, it ensures that the marginal cost per taxpayer of government services does not mechanically fall with the size of immigration — an issue that arises if one assumes instead that $G_t$ is either a pure private good or a pure public good. The resulting cost of government service provision is $G_t\left(m_t+n_t\right)\bar{y}$.

#### 2.1.5. Social security

We assume the existence of a public pension system, which represents a stylised version of the basic old-age state pension schemes adopted by several European countries, including the UK. In each period $t$ all the elderly citizens, including those who were immigrants in period $t-1$, are entitled to a net pension (denoted by $p_t^i$) provided by the government. Two key assumptions – which are consistent with the features of the aforementioned state pension schemes – underpin our results.

*Defined Benefits (DB).* The net pension amount $p_t^i$ is determined at the end of the individual's working life. Thus, its value depends upon the realisation of economic and demographic variables in period $t-1$, but it is not affected by policy choices that occur after retirement. In particular, it is constant in the size of immigration in the current period. This type of assumption is common in the literature (Scholten and Thum, 1996; Haupt and Peters, 1998) and is crucial for the results of this analysis, because it ensures that the elderly do not mechanically benefit from an open immigration policy by receiving more generous pensions (at least in the current period). As a result, the fiscal gains from immigration are distributed to natives solely through the endogenous political process. Without this assumption, the elderly would enjoy large exogenously determined immigration dividends and behave as in a benefit adjustment model: they would be relatively supportive of open immigration, as illustrated by Haupt and Peters (1998).

*Pay-As-You-Go (PAYG)* . In each period $t$, social security expenditure is financed through the fiscal contributions of working-age individuals – both natives and immigrants – in the same period. The *PAYG* assumption is extremely common in the literature (Scholten and Thum, 1996; Haupt and Peters, 1998; Razin and Sadka, 1999; Razin et al., 2016) and is crucial for our analysis because it generates a fiscal surplus from immigration. The mechanism is simple: more immigration translates into a larger working-age population (net tax contributors on average), but it does not affect either the size of the retired population (net receivers) or the individual pension amount thanks to the *DB* assumption. Thus, an increase in immigration allows for the costs of the pension system to be shared among a larger tax base and results, ceteris paribus, in a lower cost per taxpayer.

The other assumptions about the pension system are not crucial. They are imposed solely for the sake of simplicity and can easily be relaxed. Specifically, in the baseline model we assume that pension expenditure is financed through general taxation and that the size of the pension system – defined as the ratio of expected total pension spending to aggregate output and denoted by $\gamma>0$ – is exogenous to electoral choices. Under these assumptions, the total pension cost has the formula $\gamma n_t\bar{y}$. In Section 6.1, We extend the model, allowing the pension system to be (i) financed through social security contributions rather than general taxation, (ii) endogenous in its size $\gamma$, and (iii) partially funded, provided that a PAYG component is maintained. We show that all our key results still hold true under mild additional restrictions.

Lastly, the reader may wonder why young citizens, who represents a majority of the voting population, are not permitted to appropriate the pension benefits allocated to the elderly through taxation or pension reforms. The argument to justify this restriction is twofold. Firstly, studies on intergenerational transfers (Rangel and Zeckhauser, 2001; Boldrin and Montes, 2005) show that in an infinite-horizon OLG model in which public pensions are the outcome of an intergenerational agreement, the extent to which working-age people can reduce their net transfers to the elderly through taxation is limited. This is because a sizeable reduction in the *net* benefits the young expect to receive in old age would jeopardise the self-enforcing nature of the agreement. Secondly, even if, in principle, net pension benefits may be affected by fiscal and pension reforms, they are unlikely to be very responsive to such policy changes, because PAYG social security transfers are often *de facto* tax-free[7] and pension reforms do not typically affect current retirees (Kashiwase, 2014). Our assumptions on $p_t^i$ are consistent with these stylised facts.

#### 2.1.6. Public finance

The public sector raises revenue through a linear tax $\tau_t$ on labour income and spend it on the provision of government services $G_t$ and pensions for the elderly. We call the vector $\left(G_t,\tau_t\right)$ the fiscal policy in period $t$.

We assume that the government budget is balanced in every period and we do not allow for public debt. This assumption is needed to ensure tractability and is common in similar models (Haupt and Peters, 1998; Razin and Sadka, 1999). The role played by this restriction and the consequences of relaxing it are discussed in Section 6.2. Using the previously stated formulas for the cost of government service provision relative to output $G_t$ and total pension expenditure $\gamma n_t\bar{y}$, the government budget constraint is constructed as follows:

$$\tau_t\geq\frac{G_t\left(n_t+m_t\right)\bar{y}+\gamma\bar{y}n_t}{\left(n_t+m_t\right)\bar{y}}=\frac{Total\ Spending_t}{Total\ Income_t}\tag{3}$$

where the right-hand side of Eq. (3) is the size of the government.

We perform a simple change of variable by defining the variable *laissez-faire*, denoted by $L_t$, as the difference between the maximum level of non-pension public spending to output $\overline{G}$ and the actual level of such ratio in period $t$; i.e., $L_t\equiv\overline{G}-G_t$. This variable change is a matter of convenience — the underlying reasons are made clear in Section 3.

Assuming that the government budget constraint is always satisfied with equality, we can solve (3) for $\tau_t$ and define the tax rate function $\tau\left(M_t,L_t\right)$ as follows:

$$\tau\left(M_t,L_t\right)=\overline{G}-L_t+\gamma\left(1-M_t\right),\tag{4}$$

where we assume $0\leq\overline{G}<1-\gamma$ to ensure that $0<\tau\left(M_t,G_t\right)<1$ for all $\left(M_t,L_t\right)\in\left[0,\overline{M}\right]\times\left[0,\overline{G}\right]$. This restriction is crucial for the results in the next section to hold. If the tax rate hits the upper bound, the predictions of the model become those of a standard benefit adjustment model, as illustrated in the online appendix.

Formula (4) illustrates a key factor that shapes the results of this analysis. That is, working-age citizens can ease their tax burden by voting for a less restrictive immigration policy. The mechanism is simple: more immigration translates into a larger working-age population and, in turn, higher aggregate incomes and tax revenues. However, it does not affect the number of elderly people and – thanks to the *DB* assumption – the total cost of pensions. Thus, an increase in immigration allows for the costs of the pension system to be shared among a larger tax base, resulting in lower tax rates.

Under these assumptions, a working-age individual's private goods consumption is given by their post-tax income, such that $C_t^i=\left[1-\tau\left(M_t,L_t\right)\right]y_t^i$.

[7] For instance, in the UK the state pension amount is lower than the tax-free allowance, implying that only the income in excess of the PAYG pension is taxed. As a result, the median retired individual in the UK pays less than 3.5% of their total income in income tax (ONS, 2019). Moreover, social security for the elderly often includes benefits that are exempt from taxes, such as public health insurance (e.g., Medicare in the US) and subsidised home services.

*2.1.7. Policy space*

Voters face a two-dimensional policy space in each period $t$. Policy platforms consist of an immigration quota $M_t$ and a measure of laissez-faire government $L_t$. Thus, the policy space is the set $X \equiv \left[0, \overline{M}\right] \times \left[0, \overline{G}\right]$ with typical element $(M_t, L_t)$.

*2.1.8. Citizens' objective function*

Let $\varphi = (\beta, \gamma, \lambda, \sigma, \ldots)$ be a vector of common parameters. We derive the objective functions under the assumption that agents possess perfect foresight regarding future equilibrium outcomes.

*Old citizens*. Substituting $p_t^i$ into the utility function of an elderly citizen in (2) we obtain their indirect utility function, which is expressed as $U_t^{i,O}\left(p_t^i, M_t, \overline{G} - L_t\right) = p_t^i + d(\overline{G} - L_t) + c(M_t)$. Since the *DB* assumption means that $p_t^i$ is constant in $(M_t, L_t)$, this formula shows that older citizens' preferences over $(M_t, L_t)$ in period $t$ are independent of their pension levels, income when young, expectations of future policies $(M_{t+1}, L_{t+1})$, and history up to period $t$. Thus, all elderly people – regardless of their productivity when they were young – have the same policy preferences; therefore, we assign the same preference type $\theta_t^i = -1$ to all elderly citizens. Their preferences in period $t$ can be represented by a function $u_t^{i,O} = u_t\left(\left\{(M_{t+r}, L_{t+r})\right\}_{r=0}^{1}; -1, \varphi, z_t\right)$, which has the formula:

$$u_t^{i,O} = d(\overline{G} - L_t) + c(M_t), \tag{5}$$

This representation dramatically simplifies the analysis. Since the productivity type of each elderly citizen is irrelevant for their choices, the state of the economy at the beginning of each period $t$ is fully summarised by a single aggregate variable – the ratio of old to young voters – which is equal to the *citizens' old-age dependency ratio* $z_t \equiv \frac{o_t}{n_t}$.[8]

Note that if immigrants have the same birth rate as natives ($\Delta = 0$), then $z_t$ is constant in $\left(M_{t-1}, L_{t-1}\right)$, implying that voters' trade-offs in period $t$ are unaffected by choices in period $t-1$. As a result, if $\Delta = 0$ the analysis becomes identical to that of a static model.

*Young citizens*. We set a young citizen preference type $\theta_t^i$ equal to their productivity parameter $\omega_t^i \in \Omega$. Then we derive a young citizen's policy preferences at time $t$ as their expected indirect utility $u_t^{i,Y} = u_t\left(\left\{(M_{t+r}, L_{t+r})\right\}_{r=0}^{1}; \theta_t^i, \varphi, z_t\right)$. Using formula (1), this becomes:

$$u_t^{i,Y} = \begin{array}{c}\left[1 - \tau\left(M_t, L_t\right)\right] \xi \theta_t^i + b(\overline{G} - L_t) + c(M_t) + \\ \mathbf{1}\left[t \neq 2\right] \beta \lambda E_t\left[u_{t+1}\left(\left\{(M_{t+r+1}, L_{t+r+1})\right\}_{r=0}^{1}; -1, \varphi, z_t\right) \mid (M_t, L_t), h_t\right]\end{array} \tag{6}$$

where the indicator function ensures that there is no continuation value in period $t = 2$, because the economy ends after that period.

Formulas (5) and (6) illustrate that elderly ($\theta_t^i = -1$) and low-income citizens ($\theta_t^i = \omega^{Low}$) are less affected by changes in the tax rate $\tau\left(M_t, L_t\right)$ than younger and higher-income citizens ($\theta_t^i = \omega^{High}$). As a consequence, the former types of agent prefer policies that finances public spending through higher income tax rates rather than through a larger number of immigrants. This trade-off holds despite the net positive fiscal contribution of immigrants, of which the elderly and the poor are net beneficiaries.

We construct the distribution of citizen types $\theta_t$ in period $t$ (conditional on history $h_t$), which possesses the following CDF:

$$F_{\rho,t}\left(\theta_t \mid h_t\right) = \begin{cases} 0 & if \quad \theta_t < -1 \\ \frac{z_t(h_t)}{1+z_t(h_t)} & if \quad -1 \leq \theta_t < 0 \\ \frac{z_t(h_t) + Q_\rho(\theta_t)}{1+z_t(h_t)} & if \quad \theta_t \geq 0 \end{cases} \tag{7}$$

where $z_t$ is the previously defined citizen's old-age dependency ratio. Lastly, we use (7) to define the totally ordered set of citizens' types at time $t$ as $\Theta_t := \{-1\} \cup \Omega$; i.e., $\Theta_t$ is the set of young citizen's types plus the single type that represents all elderly citizens.

*2.2. Political process*

We adopt a citizen-candidate model of elections with endogenous candidates akin to those in Osborne and Slivinski (1996) and Besley and Coate (1997). Specifically, we propose a version of the citizen-candidate model that adapts the framework in Dotti (2020) to a dynamic economic environment. The specific choice is a matter of convenience: it ensures tractability, mechanism transparency, and ease of interpretation of the results. These advantages will become clear in Section 3.2, in which we illustrate the results for a simple parametric example. However, our choice of model does not shape the main trade-offs underpinning our predictions, which would survive alternative assumptions on the nature of the political process. In particular, a standard probabilistic voting model of elections in the spirit of Banks and Duggan (2005) and Dotti and Janeba (2023) delivers qualitatively similar predictions regarding the effect of population ageing on the immigration policy and the size of government, as shown in section SM.1.10 of the online appendix. However, this alternative approach requires additional restrictions on the economic model and proves less flexible with respect to other predictions and quantitative exercises.

In this section we provide an informal description of the political process. A formal definition of the equilibrium concept is provided in Appendix A.1.

Let $N_t$ denote the set of citizens at time $t$. In each period $t = 1, 2$ the political equilibrium, named Electoral Equilibrium *(EE)*, is the outcome of a two-stage game.

In the first stage, each citizen $i \in N_t$ simultaneously chooses an action, denoted by $a_t^i$; namely, $i$ decides whether they run for election as a candidate by proposing a platform $x_t^i = \left(M_t^i, L_t^i\right)$ in $X$ or remains inactive ($a_t^i = \emptyset$). Each citizen-candidate $i$ can credibly commit to a platform $x_t^i$ only if it is one of their ideal policies.

In the second stage voters observe the set of available candidates and elect one member of this set using the method of majority rule. That is, they select a Condorcet winner over the set of available candidates whenever it exists. After the election, the winning candidate implements her policy platform. If no winning candidate exists in period $t$, then a default policy $x^0$ – which all citizens strongly dislike – is implemented. If there exist multiple Condorcet winners, a selection rule selects the one with the lowest type to be the elected candidate.

Lastly, we restrict our attention to equilibria that satisfy two fairly standard properties.

(i) *Subgame perfection*: equilibrium strategies must be supported by credible beliefs regarding the future behaviour of agents, both on and off the equilibrium path.

(ii) *Markovian strategies*: equilibrium strategies in period $t$ are allowed to be conditional on the state of the economy $z_t$, but not the entire history of the game $h_t$.

Under these assumptions we can show that, even if the *EE* is typically not unique, the equilibrium policy outcome, denoted by $x_t^*$, is the same in all the equilibria. When the cost of running for elections is set equal to zero, our model closely resembles that of Besley and Coate

[8] Since $u_t^{i,O}$ is independent of $\omega_{t-1}^i$, and $Q_\rho\left(\omega_t\right)$ is time-invariant, the dynamic framework essentially becomes equivalent to one in which an entirely new population of citizens replaces the previous population at the end of each period, such that the age distribution of the "new" fictitious population is determined solely by the citizens' old-age dependency ratio $z_t$. Thus, the economy features a unique aggregate endogenous state: $z_t$. Therefore, we do not need to include each citizen's productivity type in the state space. Note that for finite-horizon versions of the model, one also needs to include the period $t$ in the state space, as the voter's dynamic problem is non-stationary. Alternatively, one could redefine the dynamic problem using either the expected old-age dependency ratio of the resident population or the share of elderly citizens in the voting population as the unique endogenous state.

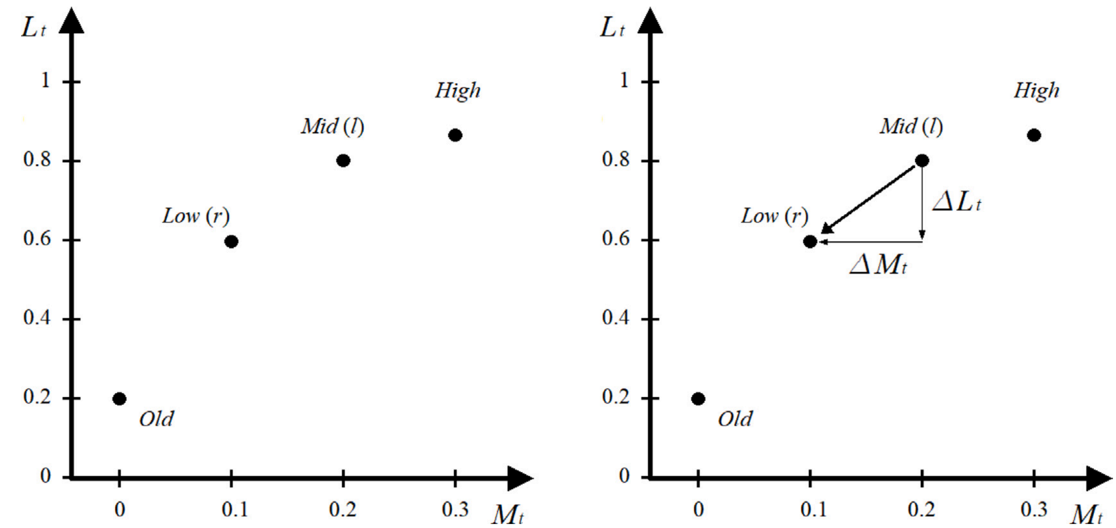


**Fig. 4.** Ideal policies of the four types of citizens and of the two candidates $r, l$ (left) and effect of population ageing/rising inequality on the equilibrium policy (right) in the illustrative example.

(1997). However, our approach differs from theirs because it reduces the set of equilibria by ruling out those in which, even if a Condorcet winner exists among the set of alternatives, it is not selected through the electoral process, as in Epple and Romano (2014) and Dotti (2020).

## 3. Results

In the next section, we provide the reader with an example that illustrates the key mechanism underpinning our main results, which we formally state in Section 3.2.

### 3.1. Illustrative example

We start from a highly simplified version of the model. The purpose of this exercise is to illustrate how the two-dimensionality of the policy space *(2DM)* generates the key trade-off that shapes the predictions of the model, and why such trade-off does not exist if we constrain the analysis to a unidimensional policy space.

In this example, we set $\xi = 1$, $\sigma = 1$, $\lambda = 9/20$, $\Delta = 10/3$ and the parameter capturing the size of the pension system at $\gamma = 0.2$. Moreover, we focus on equilibria featuring two candidates only: a young low-income ($r$) and a young middle-income citizen ($l$). We assume the following set of citizen's types in each period $t = 1, 2$: $\Theta_t^i = \{-1, 0.5, 1, 2\}$, and we label each element of $\Theta_t^i$ with superscripts $Old$, $Low$, $Mid$, and $High$, respectively. We choose a parametric utility function featuring utility from public goods in the form $b(\cdot) = d(\cdot) = \frac{1}{5}\ln(\cdot)$ and a quadratic utility cost $c(\cdot) = -\frac{1}{2}(\cdot)^2$ capturing the citizen's taste for immigration. The initial condition is $M_0 = m_0/(m_0 + n_0) = 3/200$.

Using the definition of $L_t = \overline{G} - G_t$ and the proposed functional forms in formulas (1) and (2), we obtain the following objective functions in period 1:

$$
\begin{aligned}
u_1^{i,Y} &= \left[1 - \tau\left(M_1, L_1\right)\right] y_1^i + \tfrac{1}{5}\ln\left(\overline{G} - L_1\right) - \tfrac{1}{2} M_1^2 + \beta\lambda EV_2^i \\
u_1^{i,O} &= \tfrac{1}{5}\ln\left(\overline{G} - L_1\right) - \tfrac{1}{2} M_1^2,
\end{aligned} \tag{8}
$$

for young and old citizens, respectively, where $\tau(M_1, L_1)$ is as in formula (4) and $EV_2^i$ is the expected utility in period 2. For illustrative purposes we start from version of the model in which voters are fully myopic by setting $\beta = 0$. We relax this assumption later in this section.

*Citizen's ideal policies and the median voter theorem.* Given the objective functions in (8), we compute the citizen's ideal policies.

First, note that the citizen's objective function in period 1 is strictly concave (See Lemma 2 in Appendix B.1.) and $X$ is a compact set. Thus, each citizen $i$ possesses a unique ideal policy $(M_t^i, L_t^i)$. The ideal policies in period 1 of each citizen's type and the corresponding fiscal policies $(G_1^i, \tau_1^i) \equiv \left(\overline{G} - L_t^i, \tau_1\left(M_1^i, L_1^i\right)\right)$ are summarised in Table 1. Fig. 4 (left) plots such ideal policies and illustrates the first key feature of the model. That is, the set of citizen's ideal points $I_1 \equiv \{(0, 0.2); (0.1, 0.6); (0.2, 0.8); (0.3, 0.87)\}$ is totally ordered in the $(M_1, L_1)$-space under the product order $\leq$, and such order corresponds to that of the citizen's types in $\Theta_1$. Formally, citizen's preferences over $(M_1, L_1)$ satisfy *quasisupermodularity* in $(M_1, L_1)$ and the *(strict) single crossing property* in $(M_1, L_1; \theta_1)$ (Milgrom and Shannon, 1994), as we will clarify in the next section.

The intuitive consequence of this ordering property is that even if the citizen's preferences over the multidimensional choice domain $X$ do not generally satisfy *single-peakedness* (Plott, 1967; Grandmont, 1978) or other closely related conditions (Gans and Smart, 1996), those over ideal policies in the set $I_1$ do satisfy such property. In turn, this implies that a (multidimensional) *median voter theorem* holds true; that is, a Condorcet winner exists over $I_1$ and is the ideal policy of a citizen possessing the median type given the aforementioned ordering over $\Theta_1$. This pivotal voter result – similar to those in Dotti (2020, 2021) – proves particularly useful to derive and interpret three key model implications, which are summarised below.

*1. Fiscal Effects*. First, we calculate the *short-term fiscal effects* of implementing the policy platform of the pro-immigration candidate $l$ relative to that of the anti-immigration candidate $r$.

We define the short-term fiscal effect for citizen $i$ as the *compensating variation* (with sign changed) corresponding to a change in the fiscal policy from $(G_1^r, \tau_1^r)$ to $(G_1^l, \tau_1^l)$; that is, the adjustment in net income that returns a citizen $i$ to the original utility level after the fiscal policy has changed from $(G_1^r, \tau_1^r)$ to $(G_1^l, \tau_1^l)$, everything else – including the size of immigration $M_1 = M_1^r$ – being unchanged. Note that the fiscal policy $(G_t^l, \tau_t^l)$ may not be (and need not be) feasible given a level of immigration $M_t^r$. In this example the formula for the fiscal effects on individual $i$ in period 1 writes: $FE_{1,2DM}(1, 0.5; \theta_1^i) = \mathbf{1}\left[\theta_1^i \neq -1\right] \times (\tau_1^r - \tau_1^l)\, y_1^i + \frac{1}{5}\ln\left(G_1^l / G_1^r\right)$. The general formula is provided in Section 3.4.

The short-term fiscal effects for each type of citizen are summarised in the first column of Table 2. The results show that – even if the immigrants are net fiscal contributors – the electoral success of the pro-immigration candidate $l$ produces negative fiscal effects on the elderly and low-income citizens. As a consequence, the members of those two

**Table 1**
Ideal policies of different types of citizens and corresponding fiscal policies $(G_1^i, \tau_1^i)$ in the *2DM*, *BAM*, and *TAM* .

| | *2DM* | | *BAM* | | *TAM* | |
|---|---|---|---|---|---|---|
| | $(M_1^i, L_1^i)$ | $(G_1^i, \tau_1^i)$ | $M_1^i$ | $(G_1^i, \tau_1^i)$ | $M_1^i$ | $(G_1^i, \tau_1^i)$ |
| *Old* | (0, 0.2) | (0.8, 1) | 0.2 | (0.2, 0.36) | 0 | (0.2, *any*) |
| *Low* (*r*) | (0.1, 0.6) | (0.4, 0.58) | 0.2 | (0.2, 0.36) | 0.1 | (0.2, 0.38) |
| *Mid* (*l*) | (0.2, 0.8) | (0.2, 0.36) | 0.2 | (0.2, 0.36) | 0.2 | (0.2, 0.36) |
| *High* | (0.3, 0.87) | (0.13, 0.27) | 0.2 | (0.2, 0.36) | 0.3 | (0.2, 0.34) |

**Table 2**
Short-term fiscal effects (in consumption units) of the policy platform of candidate $l$ relative to that of candidate $r$ on citizens of different types in the *2DM*, *BAM*, and *TAM*.

| | $FE^i_{1,2DM}$ | $FE^i_{1,BAM}$ | $FE^i_{1,TAM}$ |
|---|---|---|---|
| *Old* | −0.138 | 0 | 0 |
| *Low* | −0.029 | 0 | 0.01 |
| *Mid* | 0.081 | 0 | 0.02 |
| *High* | 0.301 | 0 | 0.04 |

socioeconomic groups are (a) averse to the immigration-friendly policy platform $(M_1^l, L_1^l)$ and supportive of the anti-immigration candidate $r$ in the elections; (b) motivated by the negative fiscal effects of the immigration-friendly policy platform. That is, the model is consistent with both key findings in the empirical literature that motivate this analysis (see Section 1).

*2. Comparative Statics*. Second, we compare three scenarios, denoted by $S'$, $S''$, $S'''$ in Table 3.

*(a) Baseline scenario (myopic)*. Society $S'$ features $\beta = 0$ and longevity $\lambda = 20/49$, resulting in a distribution of citizen's types with a 30% share of elderly citizens in the population. The median citizen is a young and middle-income individual ($Mid$ type). Thus, the median voter theorem implies that the candidate of $Mid$ type ($l$) is elected and implements her ideal policy $(M_1^l, L_1^l) = (0.2, 0.8)$, resulting in the equilibrium fiscal policy $(G_1^l, \tau_1^l) = (0.2, 0.36)$.

*(b) Population ageing scenario (myopic)*. Society $S''$ features $\beta = 0$ and higher longevity $\lambda = 0.7$, resulting in a larger share of elderly citizens relative to society $S'$: 40% vs. 30%. As a result, the median citizen in society $S''$ is a young and low-income individual ($Low$ type). Thus, the $Low$ type candidate $r$ is elected and implements her ideal policy $(M_1^r, L_1^r) = (0.1, 0.6)$, resulting in the equilibrium fiscal policy $(G_1^r, \tau_1^r) = (0.4, 0.58)$. Similar predictions can be obtained by reducing the birth rate $\sigma$. In sum, population ageing translates into a more restrictive immigration policy $M_1^r$, higher public spending to output $G_1^r$, and higher tax rates $\tau_1^r$. This equilibrium policy change is illustrated in Fig. 4 (right).

*(c) High income inequality scenario (myopic)*. Society $S'''$ exhibits higher income inequality than $S'$. Specifically, the income distribution of working-age citizens in $S'''$ is a mean-preserving spread of that in $S'$. This translates into a larger share of low-income citizens in the voting population. As a result, the median citizen in scenario $S'''$ is a young and low-income individual ($Low$ type). Thus, the $Low$ type candidate $r$ is elected and implements her ideal policy $(M_1^r, L_1^r) = (0.1, 0.6)$, resulting in the equilibrium fiscal policy $(G_1^r, \tau_1^r) = (0.4, 0.58)$. Thus, increasing inequality translates into a more restrictive immigration policy $M_1^r$, higher public spending to output $G_1^r$, and higher tax rates $\tau_1^r$. This equilibrium policy change is illustrated in Fig. 4 (right).

This simple exercise illustrates the key mechanism underpinning the results of this paper, which is the following. The elderly and low-income citizens suffer a negative fiscal effect from the implementation of a pro-immigration policy platform. Thus, they support the anti-immigration candidate $r$, who proposes a more restrictive immigration policy and larger public spending than candidate $l$. Population ageing and rising inequality increase the share of elderly and relatively low-income citizens in the voting population, causing the median of the distribution of citizen's types to move towards a weakly lower-income citizen. This mechanism fuels the electoral success of the anti-immigration politician $r$, resulting in equilibrium in a more restrictive immigration policy, higher public spending to output, and higher tax rates. Note that in both scenario $S''$ and $S'''$ the policy changes induced by the shock are not persistent and fully vanish in period 2.

*3. Dynamics.* Third, we compare the myopic population ageing scenario $S''$ with one featuring forward-looking agents, denoted by $S''''$ in Table 3.

*(d) Population ageing scenario (forward-looking)*. Society $S''''$ is identical to $S''$ in terms of composition. As a result, the median citizen in society $S''''$ is a young and low-income individual ($Low$ type) as in society $S''$. However, citizens in $S''''$ discount future utility at positive rate $\beta = 1$. This implies that the median citizen in period 1 anticipates that a policy $(M_1, L_1) = (0.1, 0.6)$ at $t = 1$ translates into a low dependency ratio $z_2$ and, in turn, lower $G_2$ and larger $M_2$ in period 2. As a result, in scenario $S''''$ the $Low$ type candidate $r$ is elected and implements her (forward-looking) ideal policy $(M_1^r, L_1^r) = (0.05, 0.6)$, resulting in the equilibrium fiscal policy $(G_1^r, \tau_1^r) = (0.4, 0.59)$ in period 1, and this choice spills over into period 2, resulting in an equilibrium policy $(M_2^r, L_2^r) = (0.1, 0.6)$. Thus, $\beta = 1$ translates into a more restrictive immigration policy $M_1^r$ and higher tax rates $\tau_1^r$ in period 1 (*far-sighted aversion*), as well as a more restrictive immigration policy $M_2^r$, higher public spending to output $G_2^r$, and higher tax rates $\tau_2^r$ in period 2 (*snowball effect*) relative to $\beta = 0$.

This last comparison illustrates how the model generates dynamic effects, which exacerbate the effect of population ageing on policy choices, as well as making it strongly persistent over time. Because in our framework immigration is typically beneficial for future generations, this mechanism leads to a paradox: the more forward-looking voters are, the more myopic societal choices are in terms of immigration policy and public spending. Note that in the forward-looking scenario the citizen's objective function may no longer be concave (details in Section 3.5).

*4. Comparison with unidimensional models.* Lastly, we show that our findings are in sharp contrast with the predictions of the two possible unidimensional versions of our model, which correspond to a *benefit adjustment model (BAM)* and a *tax adjustment model (TAM),* similar to those in the literature (see Section 2). The results for the *BAM* and *TAM* are summarised in Tables 1 and 2, in which for ease of comparison, we set the value of the exogenous variables of *BAM* and *TAM* at their equilibrium levels of the *2DM*: $\tilde{\tau}_1 = 0.36$ and $\tilde{G}_1 = 0.2$; and $\beta = 0$.

Recall that the immigrants are net fiscal contributors to the receiving country in our model. There are two possible ways to make the policy space unidimensional:

*(a) BAM*. The tax rate is exogenously fixed at $\tau_1 = \tilde{\tau}_1$. Thus, an increase in the number of immigrants mechanically translates into larger non-pension public spending $G_1$. As a result, the elderly and the low-income citizens – who largely benefit from an increase in $G_1$ – neither advocate a more restrictive immigration policy relative to the young and high-income citizens (as shown in Table 1), nor support a relatively anti-immigration candidate in the elections. That is, the predictions of the *BAM* are inconsistent with the first key finding in the empirical literature that motivates this analysis.

*(b) TAM*. The non-pension public spending to output ratio is exogenously fixed at $G_1 = \tilde{G}_1$. Thus, an increase in the number of immigrants mechanically translates into a lower tax rate $\tau_1$. As a consequence, a less restrictive immigration policy has a weakly positive fiscal effect for *all* types of citizens – including the elderly and the poor – as illustrated in Table 2. This mechanism results in a preference ordering that is consistent with the stylised facts. However, it implies that in the *TAM* the elderly and low-income citizens' aversion towards immigration is necessarily motivated by factors other than its (perceived) negative fiscal effects, such as wage competition (Haupt and Peters, 1998) or non-economic motives. In other words, in the *TAM* the agents have no

**Table 3**
Age and income composition of the electorate vs. electoral and policy outcomes in three scenarios: baseline ($S'$), population ageing – myopic ($S''$), and high inequality ($S'''$), and population ageing – forward-looking ($S''''$).

| | Types Shares at $t = 1$ | | | | $z_1$ | Winner | Winner's | Fiscal | $z_2$ | Policy |
|---|---|---|---|---|---|---|---|---|---|---|
| | $Old$ | $Low$ | $Mid$ | $High$ | | candidate | ideal policy | Policy | | at $t = 2$ |
| $S'$ | 30% | 14% | 42% | 14% | 3/7 | $l$ ($Mid$) | (0.2, 0.8) | (0.2, 0.36) | 0.27 | (0.2, 0.8) |
| $S''$ | 40% | 12% | 36% | 12% | 2/3 | $r$ ($Low$) | (0.1, 0.6) | (0.4, 0.58) | 0.52 | (0.2, 0.8) |
| $S'''$ | 30% | 21% | 28% | 21% | 3/7 | $r$ ($Low$) | (0.1, 0.6) | (0.4, 0.58) | 0.34 | (0.2, 0.8) |
| $S''''$ | 40% | 12% | 36% | 12% | 2/3 | $r$ ($Low$) | (0.05, 0.6) | (0.4, 0.59) | 0.6 | (0.1, 0.6) |

reason to be averse to immigration *because of* its fiscal effect. In fact, they are hostile to immigrants *in spite of* its positive fiscal effect. That is, *TAMs* are consistent with the first key finding in the empirical literature that motivates this analysis but not with the second one.

*(c) 2DM*. As illustrated in paragraphs 1 and 2 of this section, the two-dimensional model can generate trade-offs that are consistent with both key findings in the empirical literature and deliver, in turn, credible comparative statics results. The next section extends and generalises these results.

### 3.2. Equilibrium existence and characterisation

The model presented in Section 2 exhibits the following properties:

(1) The policy space $X$ is a compact set and the partially ordered set $(X, \leq)$ is a complete sublattice of $(\mathbb{R}^2, \leq)$.

(2) The set of citizen types $\Theta$ is a totally ordered set.

(3) Citizens' preferences given history $h_t$ satisfy *quasisupermodularity (QSM)* in $(M_t, L_t)$ and the *strict single crossing property (SSC)* in $(M_t, L_t; \theta_t)$ (proof in Appendix B.1)

The definitions of *QSM* and *SSC* are borrowed from Milgrom and Shannon (1994) and are provided in Appendix A.2. *QSM* and *SSC* are widely used in many subfields of Economic Theory and much less restrictive than the conditions that ensure the existence of a Condorcet winner in a multidimensional policy space, such as the unidimensional single crossing condition (Gans and Smart, 1996) and single-peakedness (Black, 1948). In fact, in our model, voter preferences satisfy *QSM* and *SSC* but, typically, neither single-peakedness nor unidimensional single crossing over $X$. Thus, a Condorcet winner over $X$ generally does not exist (proof in the online appendix).

Moreover, in the remainder of this paper we maintain the assumption that the difference in fertility rates between immigrants and native is not too large: $\Delta \in \left[0, \overline{\Delta}\right]$ for some threshold $\overline{\Delta} > 0$. The formula for the maximum value of $\overline{\Delta}$ is provided in Appendix B.1. This assumption eases the derivation of the results by ensuring that the effect of current policy choices on future equilibrium outcomes is small. We analyse numerically the consequence of relaxing this assumption in Section 4. Let $\theta_t^p$ denote the median type over $\Theta_t$; i.e., $\theta_t^p$ satisfies $\int_{-1}^{\theta_t^p} dF_{\rho,t}\left(\theta_t \mid h_t\right) \geq 0.5$ and $\int_{\theta_t^p}^{+\infty} dF_{\rho,t}\left(\theta_t \mid h_t\right) \geq 0.5$; and $x_t^* = \left(M_t^*, L_t^*\right)$ be the equilibrium policy outcome of the political process. Recall that $z_t$ is the citizen's old-age dependency ratio. Given the three properties (1), (2), and (3) we can state the following result.

**Proposition 1.** *In each period $t$ (i) A EE always exists. In any EE (ii) the policy outcome $x_t^*$ is the ideal policy of the pivotal citizen $\theta_t^p$ and (iii) is unique given history $h_t$. (iv) The pivotal citizen's type $\theta_t^p$ is weakly decreasing in $z_t$.*

**Proof.** See Appendix B.1.

In (i) above Proposition 1 establishes the existence of an *EE* and in (iii), the uniqueness of the equilibrium policy outcome $x_t^*$ (note that the *EE* is typically not unique). A multidimensional *median voter theorem* is stated in (ii): in all *EE*'s the policy outcome is the unique ideal policy of the pivotal citizen; that is, in all equilibria $x_t^* = x_t^p = \left(M_t^p, L_t^p\right)$, where the superscript $p$ denotes the pivotal citizen. This result is crucial to derive the main results of the paper stated in section 3.3.

Lastly, in (iv), Proposition 1 captures a key mechanism underpinning the comparative statics results presented in the next section. Namely, a worsening in the citizen's old-age dependency ratio $z_t$ (due to either a rise in longevity $\lambda$ or a fall in fertility $\sigma$) causes an increase in the share of elderly voters and, in turn, a decrease in the type of the pivotal citizen.

### 3.3. Effect of population ageing, inequality, and productivity shocks

A shock is defined as an unanticipated and permanent change in one (or more) model parameters which occurs in period $t$. We study the effects on the equilibrium policy outcomes of four types of demographic and/or economic shocks, which are defined below.

**Definition 1.**

(a) An *increase in longevity* is a rise in the life expectancy parameter $\lambda$.

(b) A *decrease in fertility* is a fall in the birth rate parameter $\sigma$.

(c) An *increase in income inequality* is a rise in the inequality parameter $\rho$.

(d) An *economic depression* is a fall in the aggregate productivity parameter $\xi$.

The main result of this paper stems from studying the effects of parameter changes of type (a), (b), (c), and/or (d) on the key equilibrium outcomes of this economy. A change in $\lambda$, $\sigma$, $\rho$, or $\xi$ affects the equilibrium outcome in three possible ways: (i) it changes the demographic composition of the voting population and, in turn, the identity of the pivotal citizen (*political effect*), (ii) it directly affects the government budget constraint (a smaller tax base, lower taxable income, etc.) (*budget effect*), and (iii) it affects voter expectations regarding future equilibrium policies, both directly and through the effect of changes in current policy choices (*dynamic effects*).

The assumption $\Delta \in \left[0, \overline{\Delta}\right]$ regarding the fertility behaviour of the immigrants ensures that the effects of type (iii) are relatively small. Thus, in this section we focus on effects of type (i) and (ii), which are static by nature and sufficient to generate the main results. We postpone the description of type (iii) effects to Section 3.5. Our findings are illustrated by the following statement.

**Proposition 2** (*Effect of Population Ageing, Increasing Inequality, and Economic Depression*)**.** *(i) An increase in longevity and/or (ii) an increase in income inequality and/or (iii) a decrease in fertility, and/or (iv) an economic depression translate into (1) a less open immigration policy $M_t$, (2) higher non-pension public spending $G_t$, and (3) a larger size of government $\tau_t$ in all periods $t$.*

**Proof.** See Appendix B.2.

The intuition underpinning results (i), (ii), and (iii) is simple and identical to that of the illustrative example presented in Section 3.1. That is, population ageing and rising income inequality result in a decrease in the income of the median type $\theta_t^p$ (political effect). As the pivotal citizen becomes a less productive individual, the equilibrium policy shifts in favour of elderly and welfare-dependent citizens, penalising younger and more productive individuals.

Regarding the effect of a decrease in $\xi$, the intuition underpinning result (iv) in Proposition 2 is that a fall in aggregate productivity reduces the total fiscal gains from immigration, leading to a lower preferred immigration level for all citizens (budget effect).

### 3.4. Short-term fiscal effects

The second key result of the paper concerns the fiscal effects of a policy platform featuring a less restrictive immigration policy on the elderly and the relatively low-income citizens.

The short-term fiscal effect $FE_t^i$ on citizen $i$ of the platform of a candidate $l$ with type $\theta_t^l$ relative to that of a candidate $r$ with type $\theta_t^r$ in period $t$ is defined as the compensating variation – expressed in unit of consumption and changed in sign – of a change in the fiscal policy from $\left(G_t^r, \tau_t^r\right) = \left(\overline{G} - L_t^r, \tau_t\left(M_t^r, L_t^r\right)\right)$ to $\left(G_t^l, \tau_t^l\right) = \left(\overline{G} - L_t^l, \tau_t\left(M_t^l, L_t^l\right)\right)$ at constant immigration equal to $M_t^r$. In words, it is the net transfer (changed in sign) that returns citizen $i$ to their initial utility level after a change in the fiscal policy from $\left(G_t^r, \tau_t^r\right)$ to $\left(G_t^l, \tau_t^l\right)$.[9] It has formula:

$$FE_t\left(\theta_t^l, \theta_t^r; \theta_t^i\right) = \begin{cases} \left[\tau_t^r - \tau_t^l\right]\xi\theta_t^i + b\left(G_t^l\right) - b\left(G_t^r\right) & for \quad \theta_t^i \neq -1 \\ d\left(G_t^l\right) - d\left(G_t^r\right) & for \quad \theta_t^i = -1 \end{cases} \tag{9}$$

for a citizen of type $\theta_t^i$. Using this formula, we state the following result.

**Proposition 3** (*Short-Term Fiscal Effects*). *In any EE, if there exist two candidates $r, l$ in period $t$ such that $M_t^r < M_t^l$, then there exists a threshold $\tilde{\theta}_t \geq 0$ such that the policy platform of the relatively pro-immigration candidate $l$ has weakly negative short-term fiscal effect on all individuals featuring type $\theta_t^i \leq \tilde{\theta}_t$ – that is, the old and the relatively poor citizens – with respect to the platform of the relatively anti-immigration candidate $r$.*

**Proof.** See Appendix B.2.

Proposition 3 provides the second key result of the paper. That is, the elderly and the low-income citizens suffer a negative fiscal effect whenever a relatively immigration-friendly policy platform is implemented, even if the immigrants are net fiscal contributors. This result follows the fact that a less restrictive immigration policy is endogenously bundled with a less generous spending policy in the platform of a candidate who represents the interests of the young and high-income part of the native population. As a consequence, the elderly and the low-income citizens oppose open immigration on the grounds of its fiscal effects and support anti-immigration candidates in the elections.

### 3.5. Dynamics: Snowball effect and far-sighted aversion

The key trade-offs illustrated in the previous sections are fully static. As such, they hold true in each period $t$ regardless of the extent to which current immigration choices affect future demographics, captured by the parameter $\Delta$. However, if immigrants have higher fertility rates than natives ($\Delta > 0$) – which is consistent with the data from most receiving countries including the UK (ONS, 2019) – the model generates additional dynamic trade-offs. Dynamic incentives do not qualitatively affect the predictions of our analysis, but they exacerbate the magnitude and persistence of the effects of population ageing stated in Propositions 2 and 3. Moreover, they may be sizeable if the time horizon $T$ is extended beyond two periods. Thus, their role is crucial in shaping the results of the calibration exercise and the counterfactual analysis presented in Section 4, which are based on an infinite-horizon version of the model.

A number of previous studies have explored the consequences of forward-looking behaviour on immigration policy. For instance, Dolmas and Huffman (2004) and Ortega (2010) analyse the compositional effects of immigrants' labour market skills on future political outcomes, while Ben-Gad (2018) illustrates how immigration may increase deficit bias among natives and thereby increase support for higher public debt. Conversely, our analysis follows Bohn and Lopez-Velasco (2019) in focusing on the demographic effects of immigration due to difference in fertility rates between immigrants and natives, but delivers opposite and counter-intuitive predictions. Bohn and Lopez-Velasco argue that if citizens accumulate savings when young, then current immigration increases their consumption in old age by affecting future returns to capital investment. This mechanism tends to reduce voter aversion to immigration, resulting in less restrictive immigration policies and, in turn, less severe population ageing in subsequent periods. On the contrary, our theoretical framework predicts that in countries where consumption of retired citizens is financed mainly through a PAYG state pension rather than private savings – as in the UK (ONS, 2019) and other European countries – the role of forward-looking behaviour in shaping the effects of population ageing on immigration policy may be reversed. Specifically, our theoretical framework generates the following dynamic effects.

*(i) Snowball effect*: A permanent sociodemographic shock of type (a), (b), (c), or (d) occurring in period 1 translates into a larger share of retired voters and, in turn, a more restrictive immigration policy and higher public spending. If immigrants have higher fertility rates than natives, restricted immigration in period 1 translates into a larger share of retired voters in period 2, which causes a further tightening of immigration policy in the future. Thus, the equilibrium effects of a demographic shock tend to persist and increase in magnitude over time.

*(ii) Far-sighted aversion*. Forward-looking citizens anticipate that a relatively restrictive immigration policy in period 1 results in a larger share of retired voters and, in turn, more generous public spending in period 2, when they will be retired. Thus, the more young voters weight future relative to current utility, the more averse to immigration they become. An increase in longevity $\lambda$ boosts the rate at which young citizens discount their expected utility in old age, making them more forward-looking and, thus, more averse to immigration.

Since immigration is typically socially desirable in our model, these two mechanisms result in a twofold paradox. Firstly, the more long-lived and/or forward-looking agents are, the more present-biased the policy outcome is in terms of immigration policy on a social planner's perspective. Secondly, the more welfare-enhancing immigrants are in the long run thanks to their higher fertility rates, the more population ageing translates into fierce aversion towards immigration which tends to grow over time. These non-standard predictions shed light on the interplay between the demographic structure of society, the features of the pension system, and the immigration policy. Thus, they may have important implications for the design of pension reforms. Lastly, note that the existence of dynamic effects in our model – as well as in other papers cited in this section – crucially depends upon the assumptions regarding the acquisition of voting rights stated in Section 2.1.2. The consequences of relaxing these assumptions are discussed in Section 6.1.

The parsimonious two-period model presented in Section 2 generates both static and dynamic effects. However, it may not be suitable for quantitative analysis because it is non-stationary and cannot capture the full extent of the dynamic effects over time. Moreover, the assumption of a discrete number of productive types in $\Omega$ may generate non-convexities if $\Delta > 0$, resulting in non-trivial technical constraints

[9] Formally, $FE_t^i\left(\theta_t^l, \theta_t^r; \theta_t^i\right)$ is the difference between individual $i$'s expenditure function evaluated at fiscal policy $\left(G_t^l, \tau_t^l\right)$ and that evaluated at fiscal policy $\left(G_t^r, \tau_t^r\right)$ at constant utility level $\bar{u}_t^{i,Y} = \left(1-\tau_t^r\right)y_t^i + b\left(G_t^r\right) + c\left(M_t^r\right) + \beta\lambda E_t\left[U_{t+1}^{i,O}\left(C_{t+1}^i, M_{t+1}, G_{t+1}\right) \mid h_t, M_t^r\right]$ (or $\bar{u}_t^{i,O} = d\left(G_t^r\right) + c\left(M_t^r\right)$ for an old individual) and immigration level $M_t^r$. Note that the fiscal policy $\left(G_t^l, \tau_t^l\right)$ may not be (and need not be) feasible given a level of immigration $M_t^r$.

on the maximum size of the dynamic trade-offs that is tractable in our framework, particularly if the time horizon $T$ is extended beyond two periods. Thus, in the online appendix we investigate analytically the additional properties of an infinite-horizon version of the model featuring a continuum of productive types, which underpins the numerical exercise we illustrate in Section 4. We prove that if $\Delta$ is not too large in magnitude, the model with $T \to +\infty$ is stationary and possesses a unique steady state. Moreover, we show that the key qualitative implications of Proposition 1 to 4 hold true not only in a static fashion, but also dynamically. If the economy is at the steady state and a shock of type (a), (b), (c), and/or (d) occurs in period $t$, the economy converges to a new steady state featuring a more restrictive immigration policy, higher public spending, and a larger size of government. A detailed description of these findings and their proofs is provided in the online appendix.

### 3.6. Welfare analysis

The findings in Proposition 2 do not necessarily indicate that the predicted policy changes are desirable among society as a whole.

In this section, we present a welfare analysis demonstrating that in ageing societies, a marginal tightening in immigration policy from its equilibrium level is typically unambiguously harmful. We use a social welfare function ($SWF$) as a measure of the societal well-being. The $SWF$ is a weighted average of the utility of citizens in period $t$ and the expected utility of the future generation. Let $\Psi_{t+r}(\theta_{t+r})$ denote a function that assigns a weight to individuals of type $\theta_{t+r}$ in period $t+r$.[10]

The $SWF$ in period $t$ is constructed as follows:

$$\begin{aligned} &SWF\left((M_t, L_t); \varphi \mid h_t, s_t\right) \\ &= E_t\left[\int_{-1}^{+\infty} u_t\left(\left\{(M_t, L_t), x^*_{t+1}\right\}; \theta_t, \varphi, z_t(h_t)\right) d\Psi_t(\theta_t) + \right. \\ &\quad +\mathbf{1}\left[t \neq 2\right] \int_0^{+\infty} u_{t+1}\left(\left\{(M^*_{t+1}, L^*_{t+1}), x^*_{t+2}\right\}; \theta_{t+1}, \varphi, z_{t+1}\left(h_{t+1}\right)\right) \\ &\quad \left. d\Psi_{t+1}(\theta_{t+1}) \middle| h_t, s_t\right] \end{aligned} \tag{10}$$

where $x^*_{t+r}$ is an arbitrary policy for $r \geq 2-t$. We study the effect of a marginal change in $M_t$ evaluated at $M_t = M^*_t$ on the above measure of aggregate well-being. The idea underpinning this exercise is simple: if at the equilibrium policy $\left(M^*_t, L^*_t\right)$ the marginal effect of an increase in $M_t$ on the $SWF$ is greater than zero and $M^*_t < \overline{M}$, there exists a policy $(M'_t, L^*_t)$ with $M'_t > M^*_t$ which is welfare-improving.

This means that, in turn, if the immigration policy in equilibrium changes from $M^{**}_t$ to $M^*_t$ with $M^*_t < M^{**}_t$ as a consequence of a marginal change in demographics, the society benefits, *ceteris paribus*, from moving back towards the level $M^{**}_t$; that is, the immigration policy that would have been implemented in the absence of demographic changes. In other words, the society is harmed by the change in the immigration policy at the margin. From this, we can state the following result.

**Proposition 4.** *For any Social Welfare Function $SWF\left((M_t, L_t); \varphi \mid h_t, s_t\right)$ that assigns a strictly positive weight to each native individual with $\theta^i_t > 0$, there exist thresholds $\breve{\omega}_t > 0$ and $\breve{z}_t \in [0,1)$ such that if $\omega^{Low} \leq \breve{\omega}_t$ and $z_t \in [\breve{z}_t, 1)$, then a marginal loosening in the immigration policy is welfare-enhancing.*

**Proof.** See Appendix B.2.

The intuition underpinning this result is as follows. Let $\underline{M}$ denote the immigration policy that solves $c'\left(\underline{M}\right) = 0$. On the one hand, the marginal fiscal benefit from immigration for a working-age individual is constant in $M_t$. On the other hand, the definition of $\underline{M}$ implies that the marginal taste cost of immigration tends to zero as $M_t$ approaches $\underline{M}$. The value of $\theta^p_t$ is equal to $\omega^{Low}$ if $z_t$ is close enough to 1, meaning that the pivotal citizen possesses the lowest income type. If $\omega^{Low}$ is sufficiently close to zero, then the pivotal voter features near-zero taxable income and is, in turn, almost unaffected by a decrease in the income tax rate caused by any increase in immigration.[11]

As a result, if $\Delta$ is small in magnitude the equilibrium quota $M^*_t$ approaches $\underline{M}$; i.e. the share of immigrants in the working-age population that would be preferred by all citizens on the grounds of the mere taste for immigration embedded in the function $c$. This implies that at the equilibrium, the marginal aggregate fiscal gains from immigration for the average working-age citizen are substantial relative to its marginal social costs due to taste. As a result, provided that the social welfare function assigns a positive – even if small – weight to young productive citizens, if the citizens' old-age dependency ratio is sufficiently close to 1, a marginal increase in immigration from its equilibrium level always results in higher social welfare. Note that the opposite is not true: even if $z_t$ is close to zero, a marginal increase in $M_t$ at the equilibrium does not necessarily harm social welfare.

Proposition 4 suggests that societies characterised by a high old-age dependency ratio are likely to implement excessively restrictive immigration policies. Moreover, it implies that a marginal tightening in the immigration policy caused, for instance, by population ageing may be harmful to society. This result is suggestive in the light of the increasingly controversial restrictions to immigration that have been progressively implemented in countries characterised by rapidly ageing populations, such as the UK and Italy.

## 4. Calibration and simulated counterfactuals

The analytical predictions in Section 3 are purely qualitative. As such, they do not provide any insight into the magnitude of the effects. Thus, in this section, we parametrise an infinite-horizon version of the model ($T \to +\infty$) featuring a continuum of productivity types; i.e., $\omega^i_t \in [0, +\infty)$. As illustrated in Section 3.5, all the analytical results presented in Section 3 hold true in this slightly richer model.

We calibrate the model to UK data, and then use the calibrated model to simulate key counterfactuals. While the exact quantitative predictions of this numerical exercise should be viewed as purely illustrative, they suggest that the effect of population ageing and rising inequality on immigration policies may be rather large in magnitude. The results are summarised in this section and extensively presented in the online appendix to this paper.

The following utility functions are employed:

$$\begin{aligned} &U^{i,Y}_t\left(\left\{C^i_{t+r}, M_{t+r}, G_{t+r}\right\}^1_{r=0}\right) \\ &\quad = C^i_t + \delta_1 \ln\left(G_t\right) - \delta_2 M^2_t + \beta\lambda\left[C^i_{t+1} + \delta_1 \ln\left(G_{t+1}\right) - \delta_2 M^2_{t+1}\right] \\ &U^{i,O}_t\left(C^i_t, M_t, G_t\right) = C^i_t + \delta_1 \ln\left(G_t\right) - \delta_2 M^2_t \end{aligned} \tag{11}$$

[10] The weight to type $\theta_{t+r} > 0$ is strictly positive if $\Psi_{t+r}(\theta_{t+r}) > \max\left\{\Psi_{t+r}(\theta'_{t+r}), 0\right\}$ for all $\theta'_{t+r} \in \Theta_t$ such that $\theta'_{t+r} < \theta_{t+r}$. Note that we do not account for the welfare of current potential immigrants. This allows us to abstract from a full description of their utility function. Nevertheless, if immigration choices are endogenous, any potential immigrant should be weakly better off if able to immigrate, because they still have the choice between remaining in their country of origin or to emigrating to a different country. Thus, whenever a tightening in the immigration policy is harmful to citizens, this result should hold true if we account for the welfare of potential immigrants.

[11] This is a sensible scenario if one considers a more realistic tax system in contrast to the simple tax schedule described in Section 3. For instance, if the tax system features a personal allowance, as in the UK, the zero taxable income threshold must be adjusted accordingly. The results hold true under the alternative assumption that $\Omega$ is a continuum featuring a zero lower bound. In such case, $M^*_t$ tends to $\underline{M}$ as $z_t \to 1$, but the welfare implications are identical.

for young and old citizens, respectively. We assume that the pre-tax equivalised income of UK households (among non-retired individuals) possesses a Dagum distribution (generalised log–logistic) and we calibrate the parameters to fit the mean, median, and Gini coefficient in the 2017–2018 UK population (ONS, 2019).

The choice of the Dagum distribution is motivated not only by its superior performance in fitting income distributions relative to other commonly used alternatives (lognormal, gamma, etc.) documented in the literature (Kotz and Johnson, 1982), but also by a desirable property that such distribution possesses with respect to inequality. That is, the relationship between the three parameters of the distribution and the implied Gini coefficient of inequality is given by a function whose functional form is known. Thus, this distribution is deemed to be particularly suitable for Political Economy models in which income inequality plays a key role (Glomm and Ravikumar, 1998).

The parameters capturing demographics such as life expectancy at 65 and the fertility rates of natives and immigrants are all consistent with the corresponding values of 2017–2018 (ONS, 2019), whereas the size of the pension system $\gamma$ is calculated using data on public spending in social security to number of citizens above 65 years old from the 2018 HM Treasury's Public Expenditure Statistical Analysis (PESA) report (HM Treasury, 2018). We use the definition of pivotal citizen from Section 3.2 and data on pre-tax equivalised household income and demographics to identify the income of the decisive voter. Lastly, we calibrate the parameter the remaining taste parameters $\delta_1$, $\delta_2$ to fit the equilibrium conditions of the pivotal voter from the theoretical model, using data on the ratio of working-age immigrants to total resident of working age and non-pension public spending to total income from the same aforementioned sources.

We use the calibrated model to simulate the effects of a permanent increase in life expectancy at 65 (+5 years) and a permanent decrease in the Gini coefficient *of equivalised pre-tax income of non-retired households* (−10%). The simulated counterfactuals imply that, in the UK, an increase of 5 years in life expectancy at 65 years old translates to a new steady-state policy featuring 866,768 fewer resident immigrants of working age—equal to 11.27% of the foreign-born working-age population in the UK in 2017–2018, and a 8.6% increase in (non-pension) public spending per working-age individual. Similarly, a decrease of 10% in income inequality – measured as the Gini coefficient of equivalised pre-tax income of non-retired households – translates to a new policy allowing for 913,800 (+11.88%) additional working-age resident immigrants and a 9.26% reduction in (non-pension) public spending per individual of working age.

It is important to contextualise these results. In the UK, life expectancy at 65 years old has increased by approximately 6.8 years between 1980 and 2018, and the pre-tax equivalised Gini coefficient for non-retired households has risen by 33.2% over the same period (ONS, 2019). Our results suggest that population ageing and rising inequality in the UK over the last few decades may have played a substantial role in shaping the rising levels of aversion towards immigration and the increasingly restrictive immigration policy (see Fig. 3 and DEMIG, 2015). Nevertheless, the reader should be wary about the use of our counterfactual results as means to predict the actual number of immigrants that a given country is expected to receive during a given time frame. This caution is offered because our analysis focuses solely on the demand side, abstracting from the possibility of changes in the supply of potential immigrants, both in quantitative and qualitative terms. For instance, in spite of an increasingly restrictive immigration policy, the UK experienced an unprecedented rise in immigration during the last four decades. This fact should not be interpreted as inconsistent with our model, because the empirical literature suggests that such rise has been mostly driven by socioeconomic factors affecting the supply of immigrants, such as domestic and foreign GDP growth, unemployment rates, and increasing income inequality (Hatton and Williamson, 2005).

**Table 4**
Summary Statistics.

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| *LessImmigr* | 13,398 | 4.162636 | .9659662 | 1 | 5 |
| *IncreaseTax* | 17,895 | 2.439285 | .6045544 | 1 | 3 |
| *RAge* | 23,094 | 50.43306 | 18.31855 | 17 | 99 |
| *HHIncD* | 19,177 | 5.422016 | 3.352886 | 1 | 10 |

Lastly, we use the calibrated model to perform several additional numerical counterfactual analyses, such as studying the steady-state effect of a shock on the fertility rate, and several robustness checks on our main results. These numerical exercises confirm the robustness of our predictions even when some key assumptions are relaxed; for instance, if the difference in the fertility rates of immigrants and natives $\Delta$ grows large. In such a case, the conditions in Proposition 1 may be no longer satisfied, but the main predictions in Propositions 2 and 3 qualitatively hold true for several parametrisations. However, for significantly large values of $\Delta$ multiplicity of the equilibrium policy outcome may arise, the steady-state may not be unique and a shock may cause a transition to a different equilibrium path. The speed of convergence to the steady-state after a shock decreases in $\Delta$ for all of the parametrisations that generate a unique equilibrium path. These exercises are described in detail in the online appendix.

## 5. Empirical evidence

In this section, we investigate the determinants of British adult residents' attitudes towards immigration and public spending using data from the BSA (NatCen Social Research, 2019). Specifically, we use its 1995, 2003, 2008, 2011, 2013 and 2017 rounds, which include a specific question about attitudes towards immigration. Note that the BSA does not cover Northern Ireland.

This type of empirical analysis is not novel. Dustmann and Preston (2007), for instance, use earlier rounds of this survey (1983–1990) to quantify how racial and economic factors shape British attitudes towards immigration. Facchini and Mayda (2008) and Card et al. (2012) perform similar analyses using different datasets. Their findings are consistent with the predictions of our model. In particular, they find that the preferred number of immigrants is (1) negatively correlated with age, and (2) positively correlated with income, as expected.

Our empirical exercise is similar in nature to those in the existing literature. The key difference between past research and this study – which is more limited in scope – lies in the goal of the analysis. While we do not claim to prove the existence of a causal relationship, we aim to provide suggestive evidence for some key implications of the theoretical model.

Our model proposes a channel to explain the strong aversion to immigration exhibited by elderly citizens in survey data. That is, a negative perceived fiscal effect of immigration that occurs after retirement. If this is indeed a key determinant of such attitudes and is substantial in magnitude, then respondents should tend to become more averse to immigration as they grow old: a citizen's preferences on the size of immigration should worsen over their life cycle. As a consequence, the positive correlation between age and aversion towards immigration should survive after controlling for cohort effects and the year of the survey. Conversely, if this correlation is mostly driven by factors that are less likely to vary during the life cycle (e.g., ideological motives) we should expect it to decrease in magnitude – and possibly vanish – after adding such controls. Our goal in Section 5.1 is to test this key implication of the model. Secondly, in Section 5.2 we investigate whether the preferred level of taxation to finance public spending worsens along the life cycle and is negatively correlated with income, as implied by the theoretical framework. Thirdly, in Section 5.3 we study the role played by the "perceived welfare competition" channel proposed in the present paper relative to alternative economic and non-economic explanations in the literature.

The following sections detail the data, methodology, and results of this analysis.

### 5.1. Data and methods

The dataset includes a total of 20,460 observations. The explanatory variables are respondent age (*RAge*) and household income decile (*HHIncD*).[12]

We control for the highest educational qualification attained by the respondent (*HEdQual*), on a scale from 1 (graduate degree) to 7 (no qualification). Dummy variables capture the sex of the respondent (*RSex*), whether they live in a rural area (*ResPres*), and whether they are religious (*Religion*). Additionally, we control for the unemployed status of the respondent (*Unempl*), whether they were born abroad (*BornAbr*), and whether their household includes children (*ChildHh*). The last two variables are not included in the 1995 round of the survey, so the data from that round are only used in specification (2) in Table 2. The dummy variable *Brexit* corresponds to the year 2017 (i.e., the only survey round that was conducted after the referendum on EU membership).

The outcome variable *LessImmigr* captures the respondent's attitude towards further immigration. The question is "Do you think the number of immigrants to Britain nowadays should be increased a lot, increased a little, remain the same as it is, reduced a little or reduced a lot?" The respondent selects a value on a discrete scale from 1 ("increased a lot") to 5 ("reduced a lot").[13] Thus, the variable *LessImmigr* measures the degree of aversion towards open immigration policies. The majority of respondents in all periods exhibit a strong aversion to further immigration.

The variable *IncreaseTax* measures the respondent's attitude towards public spending financed through taxation. It is the outcome variable in the second part of this empirical analysis, whose results are presented in Section 5.2. The question is "Suppose the government had to choose between the three options on this card: reduce taxes and spend less on health, education and social benefits, keep taxes and spending on these services at the same level as now, increase taxes and spend more on health, education and social benefits. Which do you think it should choose?" The respondent selects a value on a discrete scale from 1 ("spend less") to 3 ("spend more").

Summary statistics are shown in Table 4.

It is well known that it is not generally possible to separately identify age, cohort and period effects in linear models (Heckman and Robb, 1985). We address this problem by imposing various restrictions on the nature of the cohort and/or period effects, each corresponding to an empirical specification, all of which are detailed in the next section. All results are robust across various specifications.

We use a standard ordered logit model due to the discrete and ordered nature of each outcome variable. The outcome variable $LessImmigr$ can take values $j \in \{1,2,3,4,5\}$. A latent variable $LessImmigr^*$ is assumed through:

$$LessImmigr^*_{it} = \beta_1 RAge_{it} + \beta_2 HHIncD + \beta_3 HEdQual + \cdots + \epsilon_{it}$$

The probability of observing the outcome $LessImmigr_{it} = j$ conditional on covariates is:

$$Prob\left(LessImmigr_{it} = j \mid X_{it}\right) = \mathrm{F}\left(\alpha_j - LessImmigr^*_{it}\right) - \mathrm{F}\left(\alpha_{j-1} - LessImmigr^*_{it}\right)$$

where $X_{it}$ is the vector of explanatory variables and $\alpha_{j-1}, \alpha_j$ are the endogenous thresholds on the value of the latent variable that correspond to switches from choice $j-1$ to $j$ and from choice $j$ to $j+1$, respectively. The robust standard errors are clustered at the regional level. Specifically, clustering for specifications (1)–(3) and (4) is based on a twelve-region partition. For specification (2), which includes data from the 1995 survey round, clustering is based on a six-region partition due to the use of a different classification prior to 2003.

### 5.2. Determinants of the preferred number of immigrants

Table 5 presents the results of the ordered logit regression with standard errors in parentheses. Table 6 shows the average marginal effects of the regressors of interest with respect to the outcome *LessImmigr* = 5 (i.e., that which corresponds to the strongest hostility towards immigration).

In line with the predictions of the theoretical model, respondent age exhibits a significant positive relationship with aversion towards immigration. Specifically, an additional year of age results in an approximate average increase of 1 percentage point in the probability of outcome *LessImmigr* = 5. Moreover, the parameter on household income decile and the corresponding marginal effect are negative in all specifications and statistically significant in most, meaning that high-income respondents tend to be less averse to immigration than low-income respondents. This is also consistent with the predictions of the model.

Specifications (1) and (2) include time trends and dummy variables for the respondent's cohort, defined as 10-year intervals (1906–1915, 1916–1925, etc.). Specifications (3) and (4) include cohort trends and dummies for the survey year. The coefficient on the dummy variable *Brexit* is negative and statistically significant in all the specifications that include this variable.

For illustrative purposes, we simulate the probability of response *LessImmigr* = 5 by an employed, male, UK-born individual in 2017 evaluated at different ages. Fig. 5 plots the effect of age on the probability of a *LessImmigr = 5* response from a fictitious individual constructed using the estimates in Table 5. Specifically, Fig. 5 (left) illustrates the effect of age for three different cohorts (1906–1915, 1936–1945, 1986–1995) showing that more recent cohorts are more averse to immigration on average. Fig. 5 (right) plots the effect of the dummy *Brexit* on the same fictitious individual, illustrating that attitudes towards immigrants have improved in 2017, possibly due to the referendum result.

Our key finding of this analysis is that the negative relationship between age and attitude towards immigration suggested by the model is supported by this analysis even after controlling for cohort effects and time. In fact, our estimates suggest that cohort effects alone would generate a negative relationship between age and aversion towards immigration. Moreover, time effects do not appear to play a major role in explaining the relationship of interest, with the exception of the *Brexit* dummy variable.

Thus, our empirical analysis provides a strong indirect support for the main fiscal mechanism that shapes voters' preferences in our theoretical model. A much more demanding empirical question is whether population ageing and/or income inequality have an impact on actual immigration policy and, if so, to what extent this is due to a causal link. Boeri and Brücker (2005) attempt to answer this question for 15 European countries using a variety of data sources and approaches.

[12] Only 13,398 observations include information on attitudes towards immigration and only 17,895 observations include information about attitudes towards public spending financed through taxes. The use of household income instead of individual income is justified because the effect of taxes on individual consumption levels typically depends on household income. For instance, for a household in which only one member has positive income, the consumption levels of other family members depends on the income tax rate, even if they do not directly pay an income tax.

[13] For the 2017 round of BSA, the question changed to "Once Britain has left the EU, do you think immigration into Britain should be increased, reduced, or stay at more or less the same level as now?" Due to this change, we control for the dummy *Brexit* in specifications (1), (2) and (3) and exclude the most recent data round (2017) in specification (4).

**Table 5**
Preferred number of immigrants (BSA 1995–2017)

| Ordered logit with cohort dummies (1) – (2) or year dummies (3) – (4) | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| VARIABLES | LessImmigr | LessImmigr | LessImmigr | LessImmigr |
| RAge | 0.0459*** | 0.0452*** | 0.0449*** | 0.0418*** |
| | (0.0112) | (0.00898) | (0.00594) | (0.00617) |
| HHIncD | -0.0238*** | -0.0156* | -0.0238*** | -0.0131 |
| | (0.00910) | (0.00903) | (0.00887) | (0.00888) |
| HEdQual | 0.220*** | 0.217*** | 0.220*** | 0.243*** |
| | (0.0198) | (0.0137) | (0.0202) | (0.0246) |
| RAge_2 | -0.000157 | -9.83e-05 | -0.000153** | -9.38e-05 |
| | (0.000121) | (9.93e-05) | (7.73e-05) | (7.19e-05) |
| RSex | 0.0250 | 0.0595 | 0.0262 | 0.0388 |
| | (0.0542) | (0.0375) | (0.0541) | (0.0667) |
| Unempl | -0.148 | -0.164** | -0.137 | -0.139 |
| | (0.0937) | (0.0698) | (0.0908) | (0.116) |
| Religion | 0.00169 | -0.0936*** | -0.000173 | -0.0378 |
| | (0.0362) | (0.0265) | (0.0357) | (0.0424) |
| ResPres | 0.179*** | | 0.180*** | 0.171*** |
| | (0.0571) | | (0.0568) | (0.0572) |
| BornAbr | -0.871*** | | -0.876*** | -1.010*** |
| | (0.106) | | (0.104) | (0.149) |
| ChildHh | -0.178*** | | -0.189*** | -0.184*** |
| | (0.0432) | | (0.0441) | (0.0544) |
| North_En | 0.284 | 0.218 | 0.283 | 0.308* |
| | (0.191) | (0.205) | (0.189) | (0.178) |
| South_En | 0.100 | -0.00859 | 0.101 | 0.166 |
| | (0.196) | (0.262) | (0.194) | (0.187) |
| year | -0.000723 | -0.0436*** | | |
| | (0.00891) | (0.00456) | | |
| Brexit | -1.246*** | | -1.288*** | |
| | (0.0784) | | (0.108) | |
| Cohort10 | | | 0.235*** | 0.248*** |
| | | | (0.0532) | (0.0678) |
| Observations | 9,353 | 10,303 | 9,353 | 7,101 |
| Pseudo R2 | 0.0774 | 0.0368 | 0.0772 | 0.0556 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Table 6**
Preferred number of immigrants: marginal effects.

| Marginal Effects on Outcome LessImmigr = 5 | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | marginal_eff | marginal_eff | marginal_eff | marginal_eff |
| VARIABLES | y1 | y1 | y1 | y1 |
| RAge | 0.00991*** | 0.0104*** | 0.00971*** | 0.00929*** |
| | (0.00242) | (0.00214) | (0.00129) | (0.00134) |
| HHIncD | -0.00515*** | -0.00360* | -0.00513*** | -0.00290 |
| | (0.00197) | (0.00208) | (0.00193) | (0.00197) |
| RAge_2 | -3.40e-05 | -2.27e-05 | -3.31e-05** | -2.08e-05 |
| | (2.60e-05) | (2.30e-05) | (1.67e-05) | (1.59e-05) |
| Observations | 9,353 | 10,303 | 9,353 | 7,101 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

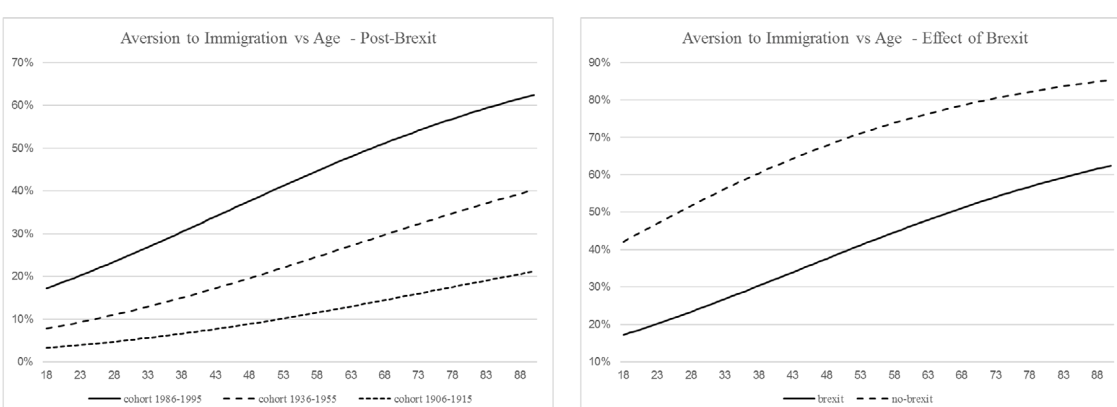


**Fig. 5.** Simulated probability of LessImmigr = 5 vs Age. Effect of cohort (left) and Brexit (right)

**Table 7**
Preferred level of taxation and public spending (BSA 1995–2017)

| Ordered Logit with cohort dummies (1) – (2) or year dummies (3) – (4) | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| VARIABLES | IncreaseTax | IncreaseTax | IncreaseTax | IncreaseTax |
| RAge | 0.0362** | 0.0268*** | 0.0294*** | 0.0258** |
| | (0.0161) | (0.00666) | (0.0111) | (0.0124) |
| HHIncD | -0.0264** | -0.0139 | -0.0275** | -0.0332*** |
| | (0.0119) | (0.00960) | (0.0119) | (0.0111) |
| HEdQual | -0.0608*** | -0.0536*** | -0.0587*** | -0.0511*** |
| | (0.0104) | (0.00833) | (0.0106) | (0.0115) |
| RAge_2 | -0.000480*** | -0.000380*** | -0.000418*** | -0.000438*** |
| | (0.000136) | (5.57e-05) | (7.18e-05) | (7.74e-05) |
| RSex | 0.182*** | 0.191*** | 0.182*** | 0.182*** |
| | (0.0298) | (0.0429) | (0.0299) | (0.0342) |
| Unempl | 0.223** | 0.203 | 0.215** | 0.151 |
| | (0.104) | (0.127) | (0.106) | (0.107) |
| Religion | -0.186*** | -0.235*** | -0.178*** | -0.190*** |
| | (0.0651) | (0.0499) | (0.0663) | (0.0610) |
| ResPres | -0.0157 | | -0.0141 | 0.00116 |
| | (0.0197) | | (0.0198) | (0.0254) |
| BornAbr | -0.370*** | | -0.367*** | -0.199*** |
| | (0.0566) | | (0.0571) | (0.0469) |
| North_En | -0.185*** | -0.0996 | -0.191*** | -0.225*** |
| | (0.0548) | (0.0968) | (0.0558) | (0.0547) |
| South_En | -0.222*** | -0.177*** | -0.224*** | -0.270*** |
| | (0.0446) | (0.00646) | (0.0437) | (0.0431) |
| year | -0.0443*** | -0.0105* | | |
| | (0.00895) | (0.00589) | | |
| Brexit | 1.350*** | | 0.721*** | |
| | (0.0724) | | (0.0914) | |
| Cohort10 | | | -0.227*** | -0.272*** |
| | | | (0.0462) | (0.0614) |
| Observations | 10,380 | 14,358 | 10,380 | 8,087 |
| Pseudo R2 | 0.0368 | 0.0162 | 0.0368 | 0.0201 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Table 8**
Preferred level of taxation and public spending: marginal effects.

| Marginal Effects on Outcome IncreaseTax = 3 | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | marginal_eff | marginal_eff | marginal_eff | marginal_eff |
| VARIABLES | y1 | y1 | y1 | y1 |
| RAge | 0.00848** | 0.00653*** | 0.00689*** | 0.00610** |
| | (0.00378) | (0.00160) | (0.00259) | (0.00290) |
| HHIncD | -0.00617** | -0.00338 | -0.00644** | -0.00785*** |
| | (0.00278) | (0.00234) | (0.00278) | (0.00261) |
| RAge_2 | -0.000112*** | -9.24e-05*** | -9.78e-05*** | -0.000104*** |
| | (3.18e-05) | (1.34e-05) | (1.68e-05) | (1.80e-05) |
| Observations | 10,380 | 14,358 | 10,380 | 8,087 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Their results are mostly in line with the predictions of our model. However, due to the limitations of the existing literature, this remains an open and challenging question for future research.

### 5.3. Determinants of the preferred level of taxation and public spending

In this section we provide evidence in support of the second key implication of our theoretical model. Namely, we show that the preferred level of taxation to finance public spending is positively correlated with age and negatively correlated with income, as predicted by our theoretical model.

The outcome variable *IncreaseTax* measures the respondent's attitude towards public spending financed through taxation. The question is ''Suppose the government had to choose between the three options on this card: reduce taxes and spend less on health, education and social benefits, keep taxes and spending on these services at the same level as now, increase taxes and spend more on health, education and social benefits. Which do you think it should choose?'' The respondent selects a value on a discrete scale from 1 (''spend less'') to 3 (''spend more''). Summary statistics are shown in Table 4. The controls of each specification are the same as those for the corresponding specification in Section 5.2 of the main paper, including dummy variables for the respondent's birth cohort. Table 7 shows the results of the ordered logit regression with standard errors in parentheses. Table 8 shows the average marginal effects of the regressors of interest with respect to the outcome *IncreaseTax* = 3. We find that the relationships between the outcome variable *IncreaseTax* and respondent's age and household income are both statistically significant and exhibit the expected sign. These findings are consistent with the predictions of the model as well as with the findings of Alesina and Giuliano (2011). However, the magnitudes of the marginal effects are relatively modest.

### 5.4. Economic vs. Non-economic determinants of immigration aversion

In this section we provide indirect evidence in support of the welfare competition channel as the main driver of older respondents' aversion towards immigration. We also show that alternative explanations such as labour market concerns and non-economic factors (see Section 1 for a review) are unlikely to play a major role in shaping the relationship between age and hostility to immigration.

We utilise nine questions in the BSA that are meant to quantify the role played by some specific motives in shaping individual aversion to immigration. The variable *AvHealth (AvSchool)* measures the degree of perceived welfare competition between immigrants and natives over public health care services (public education), which corresponds to the key channel proposed in this paper. The question is "Some migrants make use of Britain's National Health Service (schools), increasing the demand on it (them). However many migrants also pay taxes which support the NHS (schools) and some also work in the NHS (schools). Do you think that, on balance, migration to Britain reduces or increases pressure on the NHS (the schools) across the whole of Britain?" The respondent selects a value on a discrete scale from 1 ("reduces pressure a lot") to 5 ("increases pressure a lot"). The other dependent variables measure the respondent's perception of the effects of immigration on other economic and non-economic societal outcomes. Higher values correspond to more negative views. Specifically, the variable *AvEcon1* corresponds to the following question: "Would you say it is generally bad or good for Britain's economy that migrants come to Britain from other countries?" Similarly, the variable *AvCultur1* records the response to the question "Would you say that Britain's cultural life is generally undermined or enriched by migrants coming to live here from other countries?" The variables *AvEcon2*, *AvCultur2* and *AvCultur3* measure similar outcomes as *AvEcon*1 and *AvCultur1* in earlier rounds of the survey. They differ from the latter variables in the phrasing of the question and in the number of available responses. Further details are provided in the replication package of this paper. Lastly, the variables *AvJobs* and *AvCrime* measure the perceived effects of immigration on unemployment and crime, respectively. They correspond to the following questions: "How much do you agree or disagree with each of these statements? (a) "Immigrants increase crime rates" (*AvCrime*); (b) Immigrants take jobs away from people who were born in Britain" (*AvJobs*). The sample size is substantially smaller than in the previous empirical exercises described in Sections 5.2 and 5.3, because the aforementioned survey questions are not included in all rounds of the survey.

The empirical specification is identical to (1) in Section 5.2 of the main paper, including dummy variables for the respondent's cohort. Table 9 shows the results of the ordered logit regression with standard errors in parentheses. All the results are robust to alternative specifications and strongly consistent with the predictions of our theoretical model. They are summarised below.

*Economic factors* (Table 9 — left). The parameters capturing the effect of age on the degree of perceived competition between immigrants and natives over public health care services (1) and public education (2) are both positive and statistically significant. These findings provide suggestive evidence in support of the welfare competition channel proposed by this paper. Moreover, we find no evidence that the perceived effects of immigration on labour market competition (3) and generic economic outcomes (4)-(5) tend to worsen with the respondent's age. The corresponding parameters are either not significantly different from zero, or statistically significant but negative, suggesting that such type of concerns is unlikely to be a key determinant of the correlation of interest.

*Non-economic factors* (Table 9 — right). The parameters capturing the relationship between age and the perceived effects of immigration on cultural aspects of society (1)-(2)-(3) and crime (4) exhibit mixed signs, and none of them is positive and statistically significant. Thus, after controlling for cohort effects, our analysis of the non-economic drivers of immigration aversion delivers no evidence of positive age effects. Therefore, it does not support the hypothesis that the worsening of attitudes towards immigration along the respondent's life cycle documented in Section 5.1 is due to non-economic concerns. This result is strongly consistent with most findings in the recent literature (Calahorrano, 2013; Schotte and Winkler, 2018; McLaren and Paterson, 2020).

## 6. Discussion, robustness, and extensions

In this section, we extend and discuss the findings from Section 3 and illustrate the robustness of our results.

### 6.1. Robustness and extensions

The theoretical model outlined in Section 2 features strong and specific restrictions. However, our results are robust to several alternative assumptions, summarised below. All the results and proofs derived under these alternative assumptions are provided in the online appendix.

We start with some key assumptions concerning the pension system. First, we depart from a pure *PAYG* pension system by adding a funded component, as is increasingly prevalent in European countries (Galasso and Profeta, 2004), in the form of compulsory savings. Second, we replace the assumption that pensions are financed through general taxation with an assumption of a self-sufficient national pension fund financed through social security contributions, resulting in a more realistic description of the UK state pension system. Third, we analyse an augmented model in which the expected size of the pension system (parameter $\gamma$ in the baseline model) is made endogenous to voters' electoral choices in each period, such that the policy space becomes three-dimensional. With some mild technical restrictions, all the results in Proposition 1 to 4 qualitatively hold true in the alternative setups as long as the income distribution of younger citizens exhibits sufficiently high dispersion. Moreover, we show that the incentives generated by these alternative assumptions tend to further inflate public spending and exacerbate the negative effects of population ageing on the equilibrium size of the government illustrated in Proposition 2.

We then consider the consequences of alternative assumptions on the production side of the economy. Specifically, we depart from the baseline model featuring a linear production function and perfectly inelastic labour supply to allow wages and per-capita output to vary with the level of immigration. We study an economy with capital and a Cobb–Douglas production function and introduce a quadratic utility cost of labour. We show that all our results in Proposition 1 to 4 carry over under these alternative assumptions. This extends to the case of heterogeneous wage effects of immigration across different income levels and to an alternative setup in which citizens also vote for the level of uniform public investment in education – as in Dotti (2019) – which determines the average output level in the next period.

Regarding voting rights, we show that the results hold in a qualitative sense if we replace the restriction regarding the naturalisation of immigrants outlined in Section 2 (*ius soli*) with the alternative assumption that immigrants and their children never obtain voting rights (*ius sanguinis*). However, in this modified setup, there are no dynamic effects because current immigration policy choices have no impact on the age profile of the voting population in future periods. This result suggests that the rules restricting possibility of immigrant the naturalisation may affect the natives' attitudes towards immigration.

We also show that all the main results hold true in a model in which young natives and immigrants compete in the housing market, for which the supply side is assumed to be fully inelastic in the short run. However, this competition exacerbates the aversion to immigration of relatively poor young citizens, resulting in a more restrictive immigration policy. These findings are consistent with recent empirical studies on populism, which show that housing prices affect public support for anti-immigration parties (Adler and Ansell, 2020) but provide no evidence that this effect increases with age.

Lastly, we investigate the role played by the assumptions on citizens' taste for immigration. First, in Section 2, we argue that non-pecuniary factors, such as cultural and psychological motives, play an important role in shaping voter attitudes towards immigration. However, our baseline analysis abstracts from these factors by assuming a common taste for immigration given by the function $c$ in (1) and (2). This

**Table 9**
Perceived economic (left) and non-economic (right) effects of immigration (BSA 1995–2003-2011–2013).

| Ordered Logit - Economic Aversion to Immigration | | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| VARIABLES | AvHealth | AvSchool | AvJobs | AvEcon1 | AvEcon2 |
| RAge | 0.0809*** | 0.170*** | -0.0144 | 0.0101 | -0.0734** |
| | (0.0259) | (0.0507) | (0.0304) | (0.0267) | (0.0374) |
| HHIncD | -0.0219 | -0.00569 | -0.0240 | -0.0480*** | 0.0175 |
| | (0.0200) | (0.0205) | (0.0246) | (0.0123) | (0.0129) |
| HEdQual | 0.227*** | 0.157*** | 0.288*** | 0.232*** | 0.236*** |
| | (0.0319) | (0.0223) | (0.0283) | (0.0203) | (0.0266) |
| RAge_2 | -0.000459 | -0.00113*** | 0.000602** | 0.000102 | 0.00103*** |
| | (0.000294) | (0.000415) | (0.000291) | (0.000272) | (0.000312) |
| RSex | 0.0212 | 0.0787 | -0.185 | 0.199** | 0.134 |
| | (0.137) | (0.142) | (0.133) | (0.0928) | (0.135) |
| Unempl | -0.185 | -0.319* | 0.248 | 0.109 | -0.213 |
| | (0.228) | (0.169) | (0.312) | (0.109) | (0.233) |
| Religion | 0.0361 | -0.0323 | -0.0158 | -0.0548 | 0.0586 |
| | (0.0767) | (0.118) | (0.0760) | (0.0709) | (0.0814) |
| ResPres | 0.0696 | 0.0770* | 0.148** | 0.230*** | 0.162* |
| | (0.0719) | (0.0464) | (0.0749) | (0.0729) | (0.0852) |
| BornAbr | -0.413* | -0.483** | -0.818*** | -0.919*** | -1.000*** |
| | (0.217) | (0.224) | (0.183) | (0.122) | (0.149) |
| ChildHh | 0.00638 | -0.0758 | -0.138 | -0.232** | 0.0448 |
| | (0.118) | (0.0861) | (0.124) | (0.0965) | (0.108) |
| North_En | 0.348** | 0.135 | 0.211 | 0.162 | 0.188 |
| | (0.153) | (0.124) | (0.358) | (0.105) | (0.193) |
| South_En | 0.204 | 0.0487 | 0.317 | -0.0422 | 0.0180 |
| | (0.170) | (0.108) | (0.339) | (0.153) | (0.197) |
| year | | | -0.0156 | -0.0427 | -0.0885*** |
| | | | (0.0192) | (0.0309) | (0.0187) |
| Brexit | | | | -1.092*** | |
| | | | | (0.136) | |
| Observations | 1,189 | 1,189 | 1,421 | 4,767 | 1,408 |
| Pseudo R2 | 0.0364 | 0.0372 | 0.054 | 0.0468 | 0.0561 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

| Ordered Logit - Non-Economic Aversion to Immigration | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| VARIABLES | AvCultur1 | AvCultur2 | AvCultur3 | AvCrime |
| RAge | 0.00536 | -0.170** | -0.00130 | 0.0161 |
| | (0.0177) | (0.0786) | (0.0294) | (0.0380) |
| HHIncD | -0.0242** | -0.0444* | -0.0265* | -0.0376*** |
| | (0.0114) | (0.0256) | (0.0138) | (0.0128) |
| HEdQual | 0.257*** | 0.275*** | 0.257*** | 0.227*** |
| | (0.0274) | (0.0441) | (0.0234) | (0.0553) |
| RAge_2 | 0.000212 | 0.00151** | 0.000424 | 0.000257 |
| | (0.000187) | (0.000740) | (0.000340) | (0.000347) |
| RSex | 0.0518 | -0.295** | 0.0247 | -0.417*** |
| | (0.0581) | (0.131) | (0.132) | (0.0937) |
| Unempl | 0.227** | -0.848* | -0.398* | -0.449** |
| | (0.106) | (0.500) | (0.226) | (0.193) |
| Religion | 0.107*** | 0.194 | 0.0118 | 0.114 |
| | (0.0374) | (0.149) | (0.0883) | (0.0894) |
| ResPres | 0.239*** | 0.109 | 0.198*** | 0.142** |
| | (0.0563) | (0.0714) | (0.0687) | (0.0595) |
| BornAbr | -0.805*** | -1.093*** | -0.959*** | -0.637*** |
| | (0.0841) | (0.209) | (0.163) | (0.234) |
| ChildHh | -0.265*** | -0.421** | 0.0385 | 0.00361 |
| | (0.0704) | (0.173) | (0.106) | (0.102) |
| North_En | 0.00748 | 0.296*** | 0.0910 | 0.0706 |
| | (0.128) | (0.106) | (0.185) | (0.243) |
| South_En | -0.0390 | 0.428*** | 0.0690 | 0.310 |
| | (0.142) | (0.130) | (0.181) | (0.247) |
| year | -0.00328 | | -0.0635** | -0.0258 |
| | (0.0308) | | (0.0259) | (0.0197) |
| Brexit | -0.883*** | | | |
| | (0.171) | | | |
| Observations | 4,814 | 848 | 1,415 | 1,412 |
| Pseudo R2 | 0.0396 | 0.0677 | 0.0566 | 0.0469 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

assumption is imposed for transparency and ease of interpretation and clearly illustrates that the key trade-off shaping our results does not depend on differences in taste across age and income groups. However, the assumption is not crucial for our analysis and can easily be relaxed: all the results hold as long as the citizens face the same lower-bound $\underline{M}$ as defined in Section 3.6.

In particular, we can impose alternative assumptions that naturalised immigrants have different tastes for immigration than natives, and that the function $c$ is age-specific. Moreover, we can allow for native citizens (i.e., excluding naturalised foreign-born individuals) to have a taste both for the ratio of recent immigrants to total young people ($M_t$) and for the ratio of older foreign-born individuals to total older individuals ($M_{t-1}$) with no qualitative changes in the model predictions (see online appendix). This should reassure the reader regarding the robustness of our predictions. Second, the recent empirical literature provides some evidence that preferences for redistribution are positively correlated with greater openness to immigration, a finding that is seemingly inconsistent with the implications of our theoretical structure (Alesina and Tabellini, 2023; Bonomi et al., 2021). However, this pattern is shown to be mostly driven by non-economic motives, suggesting that there may be underlying 'traditionalist' views that underpin both cultural and fiscal conservatism. We illustrate the robustness of our predictions to this scenario in the online appendix. We propose an extension of our theoretical model that closely follows Bonomi et al. (2021) in allowing for a positive correlation between non-economic aversion towards immigration and a taste for public spending. Since the citizen-candidate model cannot include a second independent dimension of preference heterogeneity, we rely on a probabilistic voting model to derive the results. We show that, as long as the extent of traditionalist views is independent of age and income, our study's main predictions hold true, regardless of the strength of the aforementioned correlation. This extended model can also generate a positive association between preferences for redistribution and openness to immigration, as documented in the literature.

### 6.2. Discussion

In this paper, we purposely abstract from several factors likely to play a role in shaping voters' immigration policy choices. These aspects deserve further analysis and offer possibilities for future research. We discuss some of the most important factors in this section.

*Anti-immigration politics and right-wing populism*. Our analysis focuses on anti-immigration politicians and the determinants of their success in elections. The political science literature shows that anti-immigration politics is closely related to the wider phenomenon of *right-wing populism* in Western democracies (Mudde, 2007, 2016; Guiso et al., 2017).

Right-wing populist parties are defined in the literature as those that combine vehement anti-elite rhetoric (Acemoglu et al., 2013) with a conservative agenda (e.g., nationalist ideology and restrictive immigration policies). They have enjoyed increasing electoral success in recent years, often at the expenses of traditional conservative parties.

Even if right-wing populism is a heterogeneous and multi-faceted phenomenon, it is possible to identify some common traits. Right-wing populist parties are typically characterised as conservative or reactionary on non-economic policy dimensions, among which immigration is often central (Van der Brug and Fennema, 2007; Rydgren, 2007; Kai, 2008). However, there is consensus in the political science literature that over the last three decades, these parties have shifted to the left from their early libertarian economic positions on economic issues such as healthcare, social services, and social security (Minkenberg, 2000; Mudde, 2007; Harteveld, 2016; Afonso and Rennwald, 2018; Rathgeb and Busemeyer, 2022); *Vox* in Spain is a notable exception. The shift described is consistent with the political trajectories of several parties in Europe typically labelled as right-wing populist, including the *National Front* in France (Ivaldi, 2015), the *United Kingdom Independence Party (UKIP)* (Curtice, 2015),[14] the *Finns Party* in Finland (Arter, 2010), and the *Party for Freedom* in the Netherlands (Eger and Valdez, 2015). There is consistent evidence of this pattern in party manifestos (Rovny and Polk, 2020) and actual policy outcomes (Chueri, 2022). This feature of right-wing populism is also documented in the recent economic literature. For instance, Ferré and Manzano (2022) provide suggestive evidence that right-wing populist parties support higher levels of public spending than traditional conservative parties.

[14] Initially labelled a libertarian party advocating a smaller state, UKIP has consistently proposed a policy platform characterised by a substantial increase in public spending. The party manifesto for the 2015 national elections pledged "an extra 3bn a year into the NHS in England" and "a commitment to spend 2% of GDP on defense initially, looking to increase it substantially after that". These figures far exceeded the pledges of their main rivals, the Conservatives and the Labour Party.

Moreover, the literature provides compelling empirical evidence that elderly and relatively poor voters are more likely to support right-wing populist parties than young and wealthy individuals (Curtice, 2015; Becker and Fetzer, 2017; Van der Brug et al., 2000) and that the voters of such parties tend to be relatively supportive of redistributive policies (Curtice, 2015), as predicted by our theoretical framework. There is evidence of this pattern for UKIP (Goodwin and Milazzo, 2015; Evans and Mellon, 2016; Ford and Goodwin, 2016) and the Brexit Party (Pearce and Chrisp, 2021) in the UK, and the AfD in Germany (Kleinert, 2023). Thus, our predictions are strongly consistent with the findings in the literature on right-wing populism. However, our model cannot explain the key role that traditional conservative parties continue to play, even if they have been losing electoral support and/or acquired populist traits in several European countries. In light of these considerations, an analysis of the role played by anti-immigration politics in the formation, proliferation, and electoral success of right-wing populist parties in several Western democracies represents a promising field of research and a natural extension of the present paper.

*Immigrant heterogeneity*. In our baseline model, we assume that the supply of potential immigrants is large, the average productivity of the immigrant population is fixed, and the labour market is not segmented. These assumptions describe an economy in which (1) the government cannot select immigrants based on their skills, (2) the endogenous self-selection of welfare-dependent immigrants based on the public benefits provided by the receiving country is ruled out , and (3) labour market skills do not qualitatively differ across workers.

Restriction (1) is strong but is unlikely to markedly affect our analysis. Several papers in the literature examine the political economy of qualitative immigration policies based on skill requirements (Benhabib, 1996; Ortega, 2005). The typical prediction of these models is that an individual is only allowed to legally immigrate if their productivity exceeds a threshold set by the elected government. This increases the average productivity of immigrants. However, for any given threshold, the trade-offs illustrated in our model regarding the number of immigrants preferred by different types of voters should not be greatly affected.

Conversely, restriction (2) represents an important concern, that is extensively studied in the theoretical literature (Borjas, 1999). In our model, allowing for endogenous self-selection of immigrants would have significant consequences: the fiscal effects of immigration would become a function of the endogenous fiscal policy, affecting the citizen's trade-offs concerning immigration. However, the empirical literature suggests that this effect is generally fairly small (Preston, 2014). Thus, for the purposes of this study, we strongly believe that our assumption is a reasonable approximation.

Lastly, if restriction (3) is relaxed, wages become skill-specific (e.g., high- vs low-education jobs), and the skill composition of the immigrant population matters in determining the wages of natives. As long as immigrants are relatively low-skilled on average, our model's implications should not change. That is, the effect of immigration on wages should be more harmful for low-income than high-income natives. Thus, this mechanism reinforces our finding that poorer citizens are more averse to immigration. Conversely, if immigrants are predominantly high-skilled workers, the relationship between native incomes and aversion to immigration may be reversed, and our results regarding the effect of increased inequality may no longer hold. However, this theoretical possibility is largely inconsistent with the empirical evidence reviewed in Section 1.

*Public debt*. Our analysis abstracts from the possibility of positive government deficits. In models of voting over public debt, older voters – who typically care less about the future than the young – have an incentive to support increases in public spending and transfer the burden to future generations through government debt accumulation (Tabellini, 1991; Yared, 2019). This dynamic is consistent with our narrative and strengthens our predictions regarding the effect of population ageing on public spending and the size of government. However, augmenting our model to allow for endogenous public debt would create some non-trivial technical difficulties in preserving the order of citizen's preferences required by our theoretical framework and is beyond the scope of this paper. Such an extension of our model represents an interesting topic for future research.

## 7. Concluding remarks

This paper investigates the interactions between two key demographic, economic, and social processes: population ageing and immigration. The aim is to analyse how demographic changes shape fiscal and immigration policies in democratic countries using the UK as a case study. We detail the effects of increasing life expectancy and decreasing birth rates on voter preferences, policy choices, the political system, and societal wellbeing.

The key novelty of our approach is that we allow voters to choose both the immigration and fiscal policies (i.e., not only the number of immigrants but also how society divides the costs and benefits of immigration). This choice is shown to generate perceived competition between natives and immigrants over welfare benefits – even if no actual competition occurs – because open immigration is endogenously bundled with low public spending in the platforms of pro-immigration politicians. As a consequence, such platforms produce negative short-term fiscal effects on the most welfare-dependent segments of the voting population: the elderly and the poor. In turn, this mechanism causes these types of voters to be strongly hostile to open immigration policies and supportive of anti-immigration candidates.

The first finding of this paper is that population ageing increases the political pressure to restrict the inflow of immigrant workers and inflate the size of government. This finding suggests that the negative effects of population ageing on the public finances due to the increasing costs of the social security system may be exacerbated by endogenous political effects. Direct and indirect effects of the ageing phenomenon may affect the long-run fiscal soundness of the public sector. The second finding concerns the political effects of these sociodemographic shocks. We show that ageing can help explain the success of anti-immigration politicians and parties in recent years. The third finding is that the tightening of immigration policy induced by population ageing and rising inequality is generally harmful, although the harm is most severe for young people and future generations.

Lastly, our analysis shows that the aforementioned demographic, economics and political effects of ageing are likely to worsen over time, since anti-immigration policies tend to further exacerbate population ageing, resulting in a positive feedback mechanism.

This analysis delivers a pessimistic prediction regarding the ability of our societies to adjust to demographic changes and the consequences of such changes for younger generations. Population ageing increases the power of the elderly to shape public policy according to their needs. As a result, young natives and young potential immigrants pay a price. Young natives must bear the financial burden of supporting a growing and long-living elderly population, while young potential immigrants are prevented from searching for better employment and life opportunities by excessively restrictive immigration policies.

This worrisome *no country for young people* scenario warrants further research and constitutes a challenge for policy design. Our findings suggest that a key goal of social security reforms in the immediate future should be to promote the internalisation of the positive fiscal effects of immigration among elderly and low-income citizens. This could be achieved, for instance, by linking the generosity of the social security system to the expected future old-age dependency ratio of the native population. Reforms in this vein have been attempted in several European countries over the last two decades, such as Finland in 2005 and Italy in 2010.

### Declaration of competing interest

Authorisation to use the data for non-commercial use has been granted by UK Data Service (https://beta.ukdataservice.ac.uk/) . The use is authorised as part of the following project on UK Data Service:

Title: No country for Young People?

Project id: 242752 (previously 176898)

Project expiry date: 19 April 2025

Project type: Non-commercial

Project lead: Dotti, Valerio

The author declare that there is no relevant or material financial interests that relate to the research described in this paper other than those stated above. The author also declare that there is no personal relationships with other people or organisations that could inappropriately influence (bias) this work.

### Data availability

The authors do not have permission to share data.

### Acknowledgements

The author Valerio Dotti gratefully acknowledges the support from the Economic and Social Research Council (United Kingdom). Award Title: Multidimensional Voting Models: Theory and Applications;

Award Reference: 1055172.

### Appendix A

Appendix A includes formal descriptions of the equilibrium concept and of the two key properties of citizens' preferences. We maintain the assumption that the difference in fertility rates between immigrants and natives is sufficiently small; i.e. $\Delta \in [0, \overline{\Delta})$ for some threshold $\overline{\Delta} > 0$ whose characterisation is provided at the end of section B of this appendix.

#### A.1. Equilibrium

Let $a_t^i \in A_t^i$ denote the action chosen by citizen $i \in N_t$ in a period $t \in \{1, 2, \ldots, T\}$ and $a_t \in A_t$ be the corresponding action profile of all citizens, where $A_t$ is the set of all possible action profiles. Thus, $A_t$ is the Cartesian product of all sets $A_t^i$ and each element $a_t$ possesses the cardinality of the continuum.

Following Maskin and Tirole (2001) we define a *strategy* $s^i$ for player $i$ as a function that, for all periods $t$ and each history $h_t \in H_t$, selects an action $a_t^i \in A_t^i$. Let $S$ be the set of all possible strategies and $S_t(h_t)$ denote the set of *continuation strategies* with typical element $s_t$. A continuation strategy $s_t^i$ for player $i$ is a function that, for each period $t + r$ (with $r = t - T$) and each history $h_{t+r} \in H_{t+r}$, selects an action $a_{t+r}^i \in A_{t+r}^i$. For instance, for $T = 2$ a continuation strategy in period $t = 1$ can be written in the form $s_1^i (h_1, h_2) = \left(s_1^{i,1} (h_1), s_1^{i,2} (h_2)\right)$. Let $S$ be the set of all possible continuation strategies for all players and $S_t(h_t)$ denote the *set of continuation strategies* with typical element $s_t$ (i.e., the set of all collective strategies in the subgame starting after $h_t$).

In order to define the *expected payoffs* for each player $i$ from playing strategy $s_t^i$, let $a_t^i (s_t \mid h_t)$ denotes the action selected by citizen $i$ in period $t$ given strategy $s_t$ and history $h_t$; i.e., the outcome of function $s_t^i$ in period $t$ given $h_t$, and $x_t^* (s_t \mid h_t)$ be the equilibrium (two-dimensional) policy implemented at time $t$. We define the *objective function conditional on history $h_t$ and strategy $s_t$* of a citizen of type $\theta_t \in \Theta$, denoted by $v_t$, as follows:[15] $v_t (x_t; \theta_t, \varphi \mid h_t, s_t) \equiv E_t \left[ u_t \left( \left\{ x_t, x_{t+1}^* (s_{t+1} \mid h_{t+1}) \right\}; \theta_t, \varphi, z_t(h_t) \right) \mid s_t, h_t, x_t \right]$ for $s_t \in S_t(h_t)$ and $x \in X$. Note that this definition capture the fact that forward-looking agents anticipate the effects of current policy choices $x_t$ on future equilibrium policy outcomes $x_{t+1}^* (s_{t+1} \mid h_{t+1})$.

Using this definition, we can construct the last three key concepts we need, namely:

1. The set of ideal policies of a citizen of type $\theta_t^i$ given $s_t$, $h_t$, which writes $I_t (\theta_t^i \mid s_t, h_t) \equiv \arg\max_{x_t \in X} v_t (x_t; \theta_t, \varphi \mid h_t, s_t)$
2. The set of candidates given $s_t$, $h_t$, defined as follows: $C_t (s_t \mid h_t) \equiv \{ i \in N_t \mid a_t^i (s_t \mid h_t) \neq \emptyset \}$, where $\emptyset$ denotes the choice of being inactive.
3. The set of Condorcet winners given $s_t$, $h_t$, defined as $W_t (s_t \mid h_t) \equiv \left\{ i \in C_t (s_t \mid h_t) \mid \int_{\theta_t \in \Theta} \mathbf{1} \left\{ v_t (x_t^i; \theta_t, \varphi \mid h_t, s_t) \geq v_t \left(x_t^j; \theta_t, \varphi \mid h_t, s_t\right) \right\} dF_t (\theta_t \mid h_t) \geq 0.5 \; \forall j \in C_t (s_t \mid h_t) \right\}$

That is, $W_t (s_t \mid h_t)$ is the set of candidates that are weak Condorcet winners over $C_t (s_t \mid h_t)$. Using these three definition, we can now state the last two key concepts.

1. *Citizen-candidates (CC)*: each citizen can either propose a platform $x_t$ in $I_t (\theta_t^i \mid s_t, h_t)$ or be inactive, i.e. $a_t^i \in A_t^i (s_t \mid h_t)$ where $A_t^i (s_t \mid h_t) = I_t (\theta_t^i \mid s_t, h_t) \cup \{\emptyset\}$; if a candidate $j$ is elected, his/her platform is implemented: $x_t^* (s_t \mid h_t) = a_t^j$.
2. *Majority Rule (MR)*: the winning candidate $w_{s_t|h_t}$ is chosen using a *Condorcet Method*, i.e. $w_{s_t|h_t} \in W_t (s_t \mid h_t)$, where $W_t (s_t \mid h_t)$ is the set of candidates that are weak Condorcet winners over $C_t (s_t \mid h_t)$.

In words, the citizens select one candidate in $C_t (s_t \mid h_t)$ who is a weak Condorcet winner over $C_t (s_t \mid h_t)$. If no candidate is chosen using such method; i.e., $W_t (s_t \mid h_t) = \{\emptyset\}$, then we assume that a default policy $x_t^0$ is implemented, where $x_t^0$ is such that $v_t (x_t^0; \theta_t, \varphi \mid h_t, s_t) = -\infty$ for all $x_t \in X$ and all $\theta_t \in \Theta$. This means that voters strongly dislike outcomes in which no platform is proposed by any citizen, or in which no stable choice is achieved through majority voting.[16] Lastly, we impose the following tie-break rules: *(TB1)* if $W_t (s_t \mid h_t) \subseteq W_t (s_t' \mid h_t)$ then $w_{s_t|h_t} = w_{s_t'|h_t}$; *(TB2)* if $j, k \in W_t (s_t \mid h_t)$ and $\theta_t^j < \theta_t^k$, then $w_{s_t|h_t} = j$. These two rule disciplines the collective choice in the cases in which the set of Condorcet winners $W_t (s_t' \mid h_t)$ is not a singleton. In particular, *(TB2)* addresses those cases in which the median type over $\Theta_t$ is not unique.

These assumptions imply that (1) the citizens collectively choose a candidate who is a (weak) Condorcet winner over $C_t (s_t \mid h_t)$ whenever such a candidate exists,[17] and (2) for any given set of candidates $C_t (s_t \mid h_t)$, the winning policy is the platform of the winning candidate whenever such a candidate exists; i.e., if $W_t (s_t \mid h_t) \neq \{\emptyset\}$, then $x_t^* (s_t \mid h_t) \in I_t \left(\theta_t^j \mid s_t, h_t\right)$ for some winning candidate $w_{s_t|h_t} = j$.

Using this social choice mechanism, we define the *payoff function conditional on history $h_t$ and continuation strategy $s_t$* of a citizen of type $\theta_t \in \Theta$, denoted by $v_t$, as:

$$\Pi_t (s_t^i, s_t^{-i}; \theta_t, \varphi \mid h_t) \equiv v_t (x_t^* (s_t \mid h_t); \theta_t, \varphi \mid h_t, s_t) \tag{12}$$

[15] Note that the notation for the objective function of an individual $i$ becomes $u_t^{i,Type} = u_t (\{(M_t, L_t), (M_{t+1}, L_{t+1})\}; -1, \varphi, z_t)$ for a time horizon $T$.

[16] Note that the default policy $x_t^0$ is not a credible platform for any citizen-candidate, because it is not an ideal policy of any citizen in $P_t$. Nevertheless, it is a possible off-equilibrium policy outcome if either the set $C_t (s_t \mid h_t)$ is empty, or no platform in $C_t (s_t \mid h_t)$ is a weak Condorcet winner. This assumption can be easily relaxed whenever voter preferences satisfy quasisupermodularity and the strict single crossing property, as in the present paper. In particular, all the results hold true as long as either $x_t^0 \leq x_t^m$ or $x_t^0 \geq x_t^m$ holds true, where superscript $m$ denotes an individual possessing the median type in $\Theta_t$. See Dotti (2020, 2021) for details.

[17] The method of majority rule ensures that a Condorcet winner is selected whenever one exists. Alternatively, the same outcome prevails in an election with simple plurality rule and strategic voting if voters do not play weakly dominated strategies.

for $s_t \in S_t(h_t)$ and $x \in X$.

**Definition A.1** (*Electoral Equilibrium*). (1) A citizen-candidate equilibrium *(CCE)* in period $t \in \{1, 2, \dots, T\}$ is a continuation strategy profile $s_t \in S_t$ such that $\Pi_t\left(s_t^i, s_t^{-i}; \theta_t^i, \varphi \mid h_t\right) \geq \Pi_t\left(\tilde{s}_t^i, s_t^{-i}; \theta_t^i, \varphi \mid h_t\right)$ for all $\tilde{s}_t^i \in S_t^i$ and all $i \in N_t$. (2) An electoral equilibrium *(EE)* in period $t$ is a continuation strategy profile $s_t^*$ that (i) is Markovian; i.e., $s\left(h_t\right) = s\left(h_t'\right)$ for all histories $h_t$, $h_t'$ such that $z_{t-1} = z_{t-1}'$; (ii) forms an electoral equilibrium after any history $h_{t+r}$ in each period $t+r$ with $r = 1, 2, \dots, T-t$.

Definition A.1 states that an electoral equilibrium consists of a strategy profile that selects an action profile $a_{t+r}$ in each period $t+r$ given the history up to period $t+r$ and such that each element $a_t^i$ is an ideal policy of a citizen who has decided to be *active*, i.e. such that $a^i \neq \emptyset$. The condition for a strategy profile to be an electoral equilibrium is that there exists no citizen $i$ that (i) possesses a feasible continuation strategy $\tilde{s}_t^i$ that, given the strategies of other players, can induce in each period $t+r$ with $r = 0, 1, \dots, T-t$ a (ii) new winner $w_{t+r}'$ and a (iii) new policy outcome $\left(M_{t+r}', L_{t+r}'\right)$ which make citizen $i$ strictly better off.[18]

The Markovian assumption (i) disciplines the beliefs about future equilibrium outcomes conditional on current choices. It is does not play any role in the analysis of the baseline version of the model described in Section 3, but it is necessary if $\Delta > 0$. Lastly, condition (ii) corresponds to a standard notion of subgame perfection; i.e., agents believe that in any future period $t+r$ an equilibrium is played given any possible history up to such a period. This rules out equilibria supported by non-credible threats regarding off-equilibrium behaviour.

### A.2. Quasisupermodularity and strict single crossing property

Following Milgrom and Shannon (1994), we define two desirable properties for the conditional objective function $v_t$.

**Definition A.2.** The function $v_t$ in period $t$ for given history $h_t$ satisfies:

1. *Quasisupermodularity (QSM)* in $(M_t, L_t)$ if, for any two $(M_t', L_t')$, $(M_t'', L_t'') \in X$, one gets:

$$v_t\left((M_t', L_t'); \theta_t, \varphi \mid h_t, s_t\right) - v_t\left((M_t', L_t') \wedge (M_t'', L_t''); \theta_t, \varphi \mid h_t, s_t\right) \geq 0$$
$$\rightarrow v_t\left((M_t', L_t') \vee (M_t'', L_t''); \theta_t, \varphi \mid h_t, s_t\right) - v_t\left((M_t'', L_t''); \theta_t, \varphi \mid h_t, s_t\right) \geq 0; \tag{13}$$

2. *Strict single crossing (SSC)* in $(M_t, L_t; \theta_t)$ if, for any two $(M_t', L_t')$, $(M_t'', L_t'') \in X$ with $(M_t'', L_t'') \geq (M_t', L_t')$ and $(M_t'', L_t'') \neq (M_t', L_t')$ and any two $\bar{\theta}_t, \underline{\theta}_t \in \Theta$ with $\bar{\theta}_t > \underline{\theta}_t$, one gets:

$$v_t\left((M_t'', L_t''); \underline{\theta}_t, \varphi \mid h_t, s_t\right) - v_t\left((M_t', L_t'); \underline{\theta}_t, \varphi \mid h_t, s_t\right) \geq 0$$
$$\rightarrow v_t\left((M_t'', L_t''); \bar{\theta}_t, \varphi \mid h_t, s_t\right) - v_t\left((M_t', L_t'); \bar{\theta}_t, \varphi \mid h_t, s_t\right) > 0. \tag{14}$$

[18] The notion of equilibrium is almost identical to the one in Dotti (2020). The three main differences are that in the present paper (a) the equilibrium is defined in terms of candidates rather than policy platforms, (b) candidates may run for election even and (b) it is adapted to a two-period model with forward-looking agents. It is also very similar to that in Epple and Romano (2014). It differs from the latter in some minor details and in one key aspect. Namely, the way the set $A$ is constructed and condition (iii) in Definition A.1 together ensure that, in the presence of a Condorcet winner among the set of citizens' ideal policies, the equilibrium of the game is unique and features a single platform, i.e. $A = \{(x^*, Y^*)\}$. Conversely, in Epple and Romano (2014) the equilibrium is typically not unique. In the supplementary material of the latter paper the authors propose an alternative equilibrium concept that delivers a unique policy outcome by introducing two political parties that select candidates. All the results in the present paper hold true if the latter definition of equilibrium is adopted.

*QSM* and *SSC* over the complete sublattice $(X, \leq)$ are desirable properties because they imply that the set of ideal policies $I\left(\theta_t \mid h_t, s_t\right)$ is monotonic nondecreasing in $\theta_t$ over $X$ by theorem 4 in Milgrom and Shannon (1994).

### A.3. Income inequality

We define a partial order over productivity distributions as follows: $\rho' \geq \rho''$ if and only if the CDFs $Q_{\rho'}$ and $Q_{\rho''}$ satisfy *single-crossing below the median* (*SCBM*): $Q_{\rho'}(\omega_t) \geq Q_{\rho''}(\omega_t)$ for all $\omega_t \in \Omega$ such that $0 < \omega_t \leq \hat{\omega}$, for some threshold $\hat{\omega}$ which satisfies $Q_{\rho'}(\hat{\omega}) \geq .5$. Note that the assumption that the mean of the distribution equals 1 for all $\rho$, i.e. $\int \omega_t dQ_{\rho'}(\omega_t) = \int \omega_t dQ_{\rho''}(\omega_t) = 1$, implies that a change in the distribution from $Q_{\rho'}$ and $Q_{\rho''}$ is also mean-preserving. In other words, the two distributions $Q_{\rho'}$ and $Q_{\rho''}$ have the same mean, but the former exhibits a larger share of relatively low-productivity individuals. That is, an increase in $\rho$ implies a more right-skewed productivity distribution, resulting in a comparative statics exercise that follows closely the traditional literature on the political economy of inequality and redistribution (Meltzer and Richard, 1981), in particular Dotti (2020). Moreover, as $i$'s income has formula $y_t^i = \xi\omega_t^i$, a higher value of $\rho$ also corresponds to higher pre-tax income inequality of non-retired individuals. Note that, if the distributions $Q_{\rho'}$ and $Q_{\rho''}$ have median that is lower than the mean, then Ramos et al. (2000)'s single-crossing condition (*RSC*) is sufficient to ensure (*SCBM*) to hold. As a consequence, if the distributions $Q_{\rho'}$ and $Q_{\rho''}$ satisfy the more restrictive assumption (*RSC*), then an increase in $\rho$ can be interpreted in terms of Lorenz order and Gini coefficient of the income distribution of working-age individuals (see Ramos et al., 2000).

## Appendix B. Proofs

Appendix B includes the proofs to the results of the paper. We prove the results for a general support for the distribution of productivity types $\Omega \subseteq [0, \omega^{max}]$, which includes $\Omega = \left\{\omega^{Low}, \omega^{Mid}, \omega^{High}\right\}$ as a special case.

### B.1. Equilibrium existence

**Preliminaries.** First, note that the assumption on the pension system $E_t\left[\frac{Total\ Pension\ Spending_{t+1}}{Total\ Output_{t+1}}\middle| h_t\right] = \gamma\ \forall\varphi \in \Phi$ and all $z_t \in [0, 1)$ implies that the pension $p_t^i$ must have form $p_t\left(\theta_{t-1}^i, \xi, z_t\right) = \tilde{p}_t\left(\theta_{t-1}^i\right)\xi/z_t$ for some nondecreasing function $\tilde{p}_t$ that satisfies $\int \tilde{p}_t\left(\theta_t\right) dQ_\rho\left(\theta_t\right) = \gamma$. Using formula (3) and (6), the objective function $v_t$ of a young citizen (i.e. $\theta_t \geq 0$) writes:

$$\begin{aligned} & v_t\left((M_t, L_t); \theta_t, \varphi \mid h_t, s_t\right) \\ & = \underbrace{\gamma\xi\theta_t + \gamma\xi M_t\theta_t + \xi\theta_t L_t + b(\overline{G} - L_t) + c(M_t) + \beta\tilde{p}_{t+1}\left(\theta_t\right)\xi\bar{\sigma}_t +}_{A((M_t, L_t); \theta_t, \varphi, z_t(h_t))} \\ & \quad + \underbrace{\beta\lambda\, E\left[d\left(\overline{G} - L_{t+1}\right) + c\left(M_{t+1}\right) \mid (M_t, \overline{G} - L_t), z_t(h_t)\right]}_{B_{t+1}(M_t, \varphi, z_t(h_t))} \end{aligned} \tag{15}$$

where $\bar{\sigma}_t$ is the average birth rate in period $t$. Notice that given $M_t$ and $\varphi$ the object $\bar{\sigma}_t$ is known, i.e. $\bar{\sigma}_t = \sigma + \Delta M_t$. Also notice that $B_{t+1}\left(M_t, \varphi, z_t(h_t)\right)$ is independent of $\theta_t$ at time $t$. Using formula (5), the objective function $v_t$ of an old citizen (i.e. $\theta_t = -1$) writes:

$$v_t\left((M_t, L_t); -1, \varphi \mid h_t, s_t\right) = d\left(\overline{G} - L_t\right) + c\left(M_t\right) \tag{16}$$

Using formulas (15) and (16) I can state the following results.

**Lemma 1.** *The function $v_t$ satisfies (i) QSM in $(M_t, L_t)$ and (ii) SSC in $(M_t, L_t; \theta_t)$ for all $\varphi \in \Phi$ and after any history $h_t$.*

**Proof.** Part (i). *QSM* in $(M_t, L_t)$. Consider any two elements $(M''_t, L''_t)$, $(M'_t, L'_t) \in X$. A sufficient condition for *QSM* is Supermodularity (see Milgrom and Shannon, 1994). Thus, for condition (13) to hold true it is sufficient that:

$$v_t\left((M''_t, L''_t) \vee (M'_t, L'_t); \theta_t, \varphi \mid h_t, s_t\right) - v_t\left((M''_t, L''_t); \theta_t, \varphi \mid h_t, s_t\right) \geq v_t\left((M''_t, L''_t); \theta_t, \varphi \mid h_t, s_t\right) - v_t\left((M''_t, L''_t) \wedge (M'_t, L'_t); \theta_t, \varphi \mid h_t, s_t\right) \tag{17}$$

after any history $h_t$. Let $\check{M}_t = \max\{M''_t, M'_t\}$ and $\hat{M}_t = \min\{M''_t, M'_t\}$, $\check{L}_t = \max\{L''_t, L'_t\}$ and $\hat{L}_t = \min\{L''_t, L'_t\}$, such that $(\check{M}_t, \check{L}_t) = (M''_t, L''_t) \vee (M'_t, L'_t)$ and $(\hat{M}_t, \hat{L}_t) = (M''_t, L''_t) \wedge (M'_t, L'_t)$. Using formula (15), for young citizens the condition above can be written as:

$$\begin{gathered}\left(\xi\gamma\theta^i_t + \beta\tilde{p}_{t+1}\left(\theta^i_t\right)\xi\Delta\right)\left(\check{M}_t - M''_t - M'_t + \hat{M}_t\right) + c(\check{M}_t) \\ -c(M''_t) - c(M'_t) + c(\hat{M}_t) + \\ +\beta\lambda\left[B_{t+1}\left(\check{M}_t, \varphi, z_t(h_t)\right) - B_{t+1}\left(M''_t, \varphi, z_t(h_t)\right) - B_{t+1}\left(M'_t, \varphi, z_t(h_t)\right)\right. \\ \left. + B_{t+1}\left(\hat{M}_t, \varphi, z_t(h_t)\right)\right] + \\ +b(\overline{G} - \check{L}_t) - b(\overline{G} - L''_t) - b(\overline{G} - L'_t) + b(\overline{G} - \hat{L}_t) \\ +\xi\theta^i_t\left(\check{L}_t - L''_t - L'_t + \hat{L}_t\right) \geq 0\end{gathered} \tag{18}$$

Firstly, either $\check{M}_t = M''_t$ and $\hat{M}_t = M'_t$, or $\check{M}_t = M'_t$ and $\hat{M}_t = M''_t$ (a). Secondly, either $\check{L}_t = L''_t$ and $\hat{L}_t = L'_t$, or $\check{L}_t = L'_t$ and $\hat{L}_t = L''_t$ (b). Then using results (a) and (b) into formula (18) we get that the left-hand side of (18) always equals zero, which implies that condition (17) is always satisfied for any $\theta_t \geq 0$.

For old citizens, using formula (16) the condition in (17) rewrites:

$$d(\overline{G} - \check{L}_t) - d(\overline{G} - L''_t) - d(\overline{G} - L'_t) + d(\overline{G} - \hat{L}_t) + c(\check{M}_t) - c(M''_t) - c(M'_t) + c(M'_t) \geq 0 \tag{19}$$

Again, using the fact that either $\check{M}_t = M''_t$ and $\hat{M}_t = M'_t$, or $\check{M}_t = M'_t$ and $\hat{M}_t = M''_t$, and that either $\check{L}_t = L''_t$ and $\hat{L}_t = L'_t$, or $\check{L}_t = L'_t$ and $\hat{L}_t = L''_t$, we get that the left-hand side of (19) equals zero, which implies that condition (17) is also always satisfied for $\theta_t = -1$. Thus, condition (17) is satisfied for all possible types $\theta_t \in \Theta$, which implies that $v_t$ satisfies *QSM* in $(M_t, L_t)$.

Part (ii). *SSC* in $(M_t, L_t; \theta_t)$. I need to show that for any $(M''_t, L''_t) \geq (M'_t, L'_t)$ in $X$ with $(M''_t, L''_t) \neq (M'_t, L'_t)$ and any $\bar{\theta}_t > \underline{\theta}_t$ in $\Theta$ the condition in (14) holds true.

First I compare any types of two young citizens, i.e. any two $\bar{\theta}_t > \underline{\theta}_t \geq 0$. A sufficient conditions for (14) to hold true for any two $\bar{\theta}_t > \underline{\theta}_t \geq 0$ is the following.

$$\begin{gathered}v_t\left((M''_t, L''_t); \bar{\theta}_t, \varphi \mid h_t, s_t\right) - v_t\left((M'_t, L'_t); \bar{\theta}_t, \varphi \mid h_t, s_t\right) > \\ v_t\left((M''_t, L''_t); \underline{\theta}_t, \varphi \mid h_t, s_t\right) - v_t\left((M'_t, L'_t); \underline{\theta}_t, \varphi \mid h_t, s_t\right)\end{gathered}, \tag{20}$$

which corresponds to the definition of strictly increasing differences in $(M_t, L_t; \theta_t)$ over $\{\bar{\theta}_t, \underline{\theta}_t\}$. Use the formula (15), and notice that $\left(M^*_{t+1}(z_{t+1}), L^*_{t+1}(z_{t+1})\right)$ is independent of each $i$'s choice because each $i$ possesses zero probability mass. Then, using formula (15) into condition (20), the latter writes:

$$\begin{aligned}&\left(\bar{\theta}_t - \underline{\theta}_t\right)\xi\left[\gamma\left(M''_t - M'_t\right) + \left(L''_t - L'_t\right)\right] \\ &\quad + \beta\left[\tilde{p}_{t+1}\left(\bar{\theta}_t\right) - \tilde{p}_{t+1}\left(\underline{\theta}_t\right)\right]\xi\Delta\left(M''_t - M'_t\right) > 0\end{aligned} \tag{21}$$

which is always true under the assumptions $\gamma > 0$ and $\Delta \geq 0$.

Secondly, I compare each type of young citizen with $\bar{\theta}_t \geq 0$ to each old citizen with $\underline{\theta}_t = -1$. For any old individual, using formula (16) I get:

$$\begin{aligned}&v_t\left((M''_t, L''_t); -1, \varphi \mid h_t, s_t\right) - v_t\left((M'_t, L'_t); -1, \varphi \mid h_t, s_t\right) = \\ &\quad = d(\overline{G} - L''_t) - d(\overline{G} - L'_t) + c(M''_t) - c(M'_t) < 0\end{aligned} \tag{22}$$

where the value of (22) is strictly negative because by assumption $d$ is strictly increasing and $c$ is strictly decreasing for $M_t > \underline{M}$. Thus, condition (14) is always trivially satisfied for any $\bar{\theta}_t, \underline{\theta}_t$ in $\Theta$ such that $\bar{\theta}_t \geq 0$ and $\underline{\theta}_t = -1$, because the condition $v_t\left((M''_t, L''_t); -1, \varphi \mid h_t, s_t\right) - v_t\left((M'_t, L'_t); -1, \varphi \mid h_t, s_t\right) \geq 0$ is never true. Notice that the fact that (22) is always negative also implies that the corresponding alternative condition for *SSC*: $v_t\left((M''_t, L''_t); \bar{\theta}_t, \varphi \mid h_t, s_t\right) - v_t\left((M''_t, L''_t); \bar{\theta}_t, \varphi \mid h_t, s_t\right) \leq 0 \rightarrow v_t\left((M''_t, L''_t); -1, \varphi \mid h_t, s_t\right) - v_t\left((M'_t, L'_t); -1, \varphi \mid h_t, s_t\right) < 0$ is also always trivially satisfied, given that the *only if* part of such condition is always true. Lastly, because condition (14) is satisfied for all $\bar{\theta}_t, \underline{\theta}_t$ in $\Theta$, then $v_t$ satisfies *SSC* in $(M_t, L_t; \theta_t)$. □

**Proposition 1.** *In each period $t$ (i) A EE always exists. In any EE (ii) the policy outcome $x^*_t$ is an ideal policy of the pivotal citizen $\theta^p_t$ and (iii) is unique given state $z_t$. (iv) The pivotal citizen's type $\theta^p_t$ is weakly decreasing in $z_t$.*

**Proof.** Part (i). Suppose an electoral equilibrium in period $t$ does not exists. Construct a strategy profile $s_t$ as follows. In each period $t + r$ for $r = 0, 1, \ldots, T - t$ choose the action profile $a_{t+r} \in A_{t+r}$ such that $a^i_{t+r} = \emptyset$ for all $i \neq j^p_{t+r}$ (where $j^p_{t+r}$ is a citizen with type $\theta^p_{t+r}$) and $x^p_{t+r} \in I\left(\theta^p_{t+r} \mid h_{t+r}, s_{t+r}\right)$. First, notice that in each period $t + r$ we have $W_{t+r}\left(s_{t+r} | h_{t+r}\right) = \left\{j^p_{t+r}\right\}$ because there is a unique candidate in $C_{t+r}(s_{t+r}|h_{t+r})$. Secondly, suppose there exists $i \in N_t$ and $\tilde{s}^i_t \in S^i_t\left(h_t\right)$ with $\Pi_t\left(s^i_t, s^{-i}_t; \theta^i_t, \varphi \mid h_t\right) < \Pi_t\left(\tilde{s}^i_t, s^{-i}_t; \theta^i_t, \varphi \mid h_t\right)$, which is equivalent to $v_t\left(x^p_t; \theta^i_t, \varphi \mid h_t, s_t\right) < v_t\left(w_{\tilde{s}_t|h_t}; \theta^i_t, \varphi \mid h_t, s_t\right)$. Firstly, $\theta^i_t \neq \theta^p_t$ because $x^p_t \in I\left(\theta^p_t \mid h_t, s_t\right)$, thus such type of citizen cannot be made strictly better off. In turn, this implies that in any possible alternative action profile $\tilde{a}_t \in A_t$ there must exist at least one citizen with $\theta^k_t \neq \theta^p_t$ that possesses in his/her set of ideal policies an element $x^k_t \neq x^p_t$ such that $x^k_t$ defeats $x^p_t$ under the majority rule. (A) Say $x^k_t \in I\left(\theta^k_t \mid h_t, s_t\right)$ strictly defeats $x^p_t$. Recall that Lemma 1 implies that $v_t$ satisfies (i) *QSM* in $(x_t)$ and (ii) *SSC* in $(x_t; \theta_t)$. There are two possible cases.

Case 1. $x^k_t \geq x^p_t$ ($x^k_t \leq x^p_t$) and $x^k_t \neq x^p_t$. Optimality and uniqueness of the ideal policy imply $v_t\left(x^p_t; \theta^p_t, \varphi \mid h_t, s_t\right) > v_t\left(x^k_t; \theta^p_t, \varphi \mid h_t, s_t\right)$. *SSC* implies $v_t\left(x^p_t; \theta_t, \varphi \mid h_t, s_t\right) > v_t\left(x^k_t; \theta_t, \varphi \mid h_t, s_t\right)$ for all $\theta_t \leq \theta^p_t$ ($\theta_t \geq \theta^p_t$ ). Because $\theta^p_t$ is the median type, the citizens with $\theta_t \leq \theta^p_t$ ($\theta_t \geq \theta^p_t$) represent at least half of the voting population. Thus, the tie-break rule *TB1* implies $w_{\tilde{s}_t|h_t} = j^p_t$ implying $w_{\tilde{s}_t|h_t} = x^p_t$ and therefore $v_t\left(x^p_t; \theta^i_t, \varphi \mid h_t, s_t\right) \not< v_t\left(w_{\tilde{s}_t|h_t}; \theta^i_t, \varphi \mid h_t, s_t\right)$, which leads to a contradiction.

Case 2. $x^k_t \not\geq x^p_t$ and $x^k_t \not\leq x^p_t$. In this case $x^k_t \neq x^k_t \vee x^p_t$. Case 2.a: $\theta^k_t > \theta^p_t$. Because $X$ is a complete lattice, $(x^k_t \vee x^p_t), (x^i_t \vee x^p_t) \in X$ (see Milgrom and Shannon, 1994). Optimality and uniqueness of the ideal policy imply $v_t\left(x^k_t; \theta^k_t, \varphi \mid h_t, s_t\right) > v_{t+r}\left(x^k_t \vee x^p_t; \theta^k_t, \varphi \mid h_t, s_t\right)$. *QSM* implies $v_t\left(x^k_t \wedge x^p_t; \theta^k_t, \varphi \mid h_t, s_t\right) > v_t\left(x^p_t; \theta^k_t, \varphi \mid h_t, s_t\right)$. *SSC* implies $v_t\left(x^k_t \wedge x^p_t; \theta^p_t, \varphi \mid h_t, s_t\right) > v_t\left(x^p_t; \theta^p_t, \varphi \mid h_t, s_t\right)$, which implies in turn $x^p_t \notin I\left(\theta^p_t \mid h_t, s_t\right)$, which leads to a contradiction. Case 2.b: $\theta^k_t < \theta^p_t$. Similarly to 2.a, optimality and uniqueness of the ideal policy imply $v_t\left(x^k_t; \theta^k_t, \varphi \mid h_t, s_t\right) > v_t\left(x^k_t \wedge x^p_t; \theta^k_t, \varphi \mid h_t, s_t\right)$. *QSM* implies $v_t\left(x^k_t \vee x^p_t; \theta^k_t, \varphi \mid h_t, s_t\right) > v_t\left(x^p_t; \theta^k_t, \varphi \mid h_t, s_t\right)$. *SSC* implies $v_t\left(x^k_t \vee x^p_t; \theta^p_t, \varphi \mid h_t, s_t\right) > v_t\left(x^p_t; \theta^p_t, \varphi \mid h_t, s_t\right)$, which implies in turn $x^p_t \notin I\left(\theta^p_t \mid h_t, s_t\right)$, which leads to a contradiction.

Part (ii) Suppose there is an electoral equilibrium in period $t$ such that $x^*_{s_t|h_t} \notin I\left(\theta^p_t \mid h_t, s_t\right)$. This implies $v_t\left(x^p_t; \theta^p_t, \varphi \mid h_t, s_t\right) > v_t\left(x^*_{s_t|h_t}; \theta^p_t, \varphi \mid h_{t+r}, s_{t+r}\right)$. Definition A.1 implies that any deviation strategy profile $\tilde{s}_t$ with $\tilde{a}^p_t = x^p_t$ for some citizen $j^p_t$ of type $\theta^p_t$ must not be strictly profitable. This is true only if $x^*_{\tilde{s}_t|h_t} \neq x^p_t$, which given $\tilde{a}^p_t = x^p_t$ implies the existence of $k \in C_t\left(\tilde{s}_t|h_t\right)$ such that $\theta^k_t \neq \theta^p_t$ and $v_t\left(x^k_t; \theta_t, \varphi \mid h_t, s_t\right) \geq v_t\left(x^p_t; \theta_t, \varphi \mid h_{t+r}, s_{t+r}\right)$ for a majority of voters. Following the same steps as in the proof to part (i) from (A) onward it is easy to show that such $k$ does not exists. Thus, a deviation $\tilde{s}^p_t$ with $\tilde{a}^p_t = x^p_t$ is strictly profitable for citizen $j^p_t$: $\Pi_t\left(s^p_t, s^{-p}_t; \theta^p_t, \varphi \mid h_t\right) < \Pi_t\left(\tilde{s}^p_t, s^{-p}_t; \theta^p_t, \varphi \mid h_t\right)$. In turn, the strategy profile $s_t$ violates the condition stated in Definition A.1, which implies that it is not an *EE*, leading to a contradiction.

Part (iv). The definition of $z_t$ implies $z_t = \frac{\lambda}{\bar{\sigma}_{t-1}}$. Suppose $z'_t \geq z''_t$ but $\theta^p_t(z'_t) > \theta^p_t(z''_t)$. The pivotal voter $\theta^p_t(z'_t)$ (considering the restriction *TB2*) satisfies $\theta^p_t(z'_t) \in \min\left\{\theta_t \in \Theta_t \mid Q_\rho(\theta^p_t) \geq \frac{1}{2}(1-z_t)\right\}$. The inequality $z'_t \geq z''_t$ implies $Q_\rho(\theta^p_t(z''_t)) \geq \frac{1}{2}(1-z'_t)$. Lastly, because $\theta^p_t(z''_t) \in \Theta_t$ this implies that $\exists \tilde{\theta}_t \in \Theta_t$ such that $Q_\rho(\tilde{\theta}_t) \geq \frac{1}{2}(1-z'_t)$ and $\tilde{\theta}_t < \theta^p_t(z'_t)$. In turn, this implies that $\theta^p_t(z'_t) \notin \min\left\{\theta_t \in \Theta_t \mid Q_\rho(\theta^p_t) \geq \frac{1}{2}(1-z_t)\right\}$, leading to a contradiction. □

Part (iii). The proof requires the following Lemma.

**Lemma 2.** *There exists $\tilde{\Delta} > 0$ such that if $\Delta \in [0, \tilde{\Delta})$, then (i) the function $v_{t+r}\left((M_{t+r}, L_{t+r}); \theta^i_{t+r}, \varphi \mid h_{t+r}, s_{t+r}\right)$ is jointly continuous in $(M_{t+r}, L_{t+r})$, $\theta^i_{t+r}$, $\Delta$, and strictly concave in $(M_{t+r}, L_{t+r})$ for all $r = 1, 2, \ldots, T-t$, and (ii) the equilibrium policy $x^*_{t+r}(z_{t+r})$ is a continuous function of $\Delta$ for all $r = 1, 2, \ldots, T-t$.*

**Proof.** Part (i). Let $R = T - t$. Because the pivotal voter is unique in each period $t+r$ given the state $z_{t+r}$ and continuation strategy profile $s_{t+r}$ from Proposition 1 (ii), we can define a function $\theta^p_{t+r}(z_{t+r})$ that maps $z_{t+r}$ to the corresponding pivotal citizen's type. Suppose $v_{t+r}$ is not jointly continuous in $(M_{t+r}, L_{t+r}), \theta^i_{t+r}, \Delta$ and/or not strictly concave in $(M_{t+r}, L_{t+r})$ for some $r = 1, 2, \ldots, R$ for all values of $\Delta$ such that $\Delta > 0$. For old individuals $v_{t+r}\left((M_{t+r}, L_{t+r}); -1, \varphi \mid h_{t+r}, s_{t+r}\right) = d(\overline{G} - L_{t+r}) + c(M_{t+r})$, thus all these conditions are trivially satisfied given the assumptions on functions $d$, $c$. For a young citizen, start from $r = R$. In such period $z_{t+R+1} = \lambda/\sigma = \bar{z}$ which is invariant in $x_{t+R}$. Thus,

$$v_{t+R}\left((M_{t+R}, L_{t+R}); \theta^i_{t+R}, \varphi \mid h_{t+R}, s_{t+R}\right) = A\left((M_{t+R}, L_{t+R}); \theta^i_{t+R}, \varphi, z_{t+R}(h_{t+R})\right) + \beta\lambda B_{t+R+1}\left(M_{t+R}, \varphi, z_{t+R}(h_{t+R})\right) \tag{23}$$

where $A$ is a jointly continuous function of $(M_{t+R}, L_{t+R}), \theta^i_{t+R}, \Delta$ and strictly concave in $x_{t+R} = (M_{t+R}, L_{t+R})$, and $B_{t+R+1}$ is constant in $M_{t+R}$. Thus, $v_{t+R}$ is a jointly continuous function of $(M_{t+R}, L_{t+R}), \theta^i_{t+R}, \Delta$ and strictly concave in $x_{t+R} = (M_{t+R}, L_{t+R})$. Strict concavity over a compact set implies that the pivotal citizen in period $t+R$ has a unique ideal point, i.e. $I\left(\theta^p_{t+R} \mid h_{t+R}, s_{t+R}\right) = \{x^p_{t+R}\}$, which by Proposition 1 (ii) is also the unique equilibrium policy in all equilibria, i.e. $x^*_{t+R}(z_{t+R}) = x^p_{t+R}$. Moreover, because $v_{t+R}\left((M_{t+R}, L_{t+R}); \theta^p_{t+R}(z_{t+R}), \varphi \mid h_{t+R}, s_{t+R}\right)$ is jointly continuous in $(M_{t+R}, L_{t+R}), \theta^i_{t+R}, \Delta$ and strictly concave in $(M_{t+R}, L_{t+R})$, and $X$ is a convex set, the maximum theorem implies that $x^*_{t+R}(z_{t+R}) = x^p_{t+R}$ is a jointly continuous function of $\theta^i_{t+R}, \Delta$. In turn, this implies that $B_{t+R}\left(M_{t+R-1}, \varphi, z_{t+R-1}(h_{t+R-1})\right) = d\left(L^*_{t+R}\right) + c\left(M^*_{t+R}\right)$ is jointly continuous in $\theta^i_{t+R}, \Delta$. Thus, $v_{t+R-1}\left((M_{t+R-1}, L_{t+R-1}); \theta^i_{t+R-1}, \varphi \mid h_{t+R-1}, s_{t+R-1}\right) = A((M_{t+R-1}, L_{t+R-1}); \theta^i_{t+R-1}, \varphi, z_{t+R-1}) + \beta\lambda B_{t+R}\left(M_{t+R-1}, \varphi, z_{t+R-1}(h_{t+R-1})\right)$ is jointly continuous in $(M_{t+R-1}, L_{t+R-1}), \theta^i_{t+R-1}, \Delta$, and that $v_{t+R-1}\left((M_{t+R-1}, L_{t+R-1}); \theta^p_{t+R-1}(z_{t+R-1}), \varphi \mid h_{t+R-1}, s_{t+R-1}\right)$ is jointly continuous in $(M_{t+R-1}, L_{t+R-1}), \theta^i_{t+R-1}, \Delta$.

Lastly, notice that $\lim_{\Delta\to 0} v_{t+R-1}\left((M_{t+R-1}, L_{t+R-1}); \theta^p_{t+R-1}(z_{t+R-1}), \varphi \mid h_{t+R-1}, s_{t+R-1}\right) = A((M_{t+R-1}, L_{t+R-1}); \theta^p_{t+R-1}(z_{t+R-1}), \varphi, z_{t+R-1}) + \beta\lambda B_{t+R}\left(x^*_{t+R}(\bar{z}), x^*_{t+R+1}(\bar{z}); \theta^p_{t+R-1}(z_{t+R-1}), \varphi, \bar{z}\right)$, where $B_{t+R}$ is constant in each element of $x_{t+R} = (M_{t+R-1}, L_{t+R-1})$ and $A((M_{t+R-1}, L_{t+R-1}); \theta^p_{t+R-1}(z_{t+R-1}), \varphi, g_{t+R-1})$ is jointly continuous and strictly concave in $(M_{t+R-1}, L_{t+R-1})$. Strict concavity implies $\alpha v_{t+R-1}\left(x'; \theta^p_{t+R-1}(z_{t+R-1}), \varphi \mid h_{t+R-1}, s_{t+R-1}\right) + (1-\alpha)v_{t+R-1}\left(x''; \theta^p_{t+R-1}(z_{t+R-1}), \varphi \mid h_{t+R-1}, s_{t+R-1}\right) - v_{t+R-1}\left(\alpha x' + (1-\alpha)x''; \theta^p_{t+R-1}(z_{t+R-1}), \varphi \mid h_{t+R-1}, s_{t+R-1}\right) > 0$ for all $x', x'' \in X$ (condition (A)). Because $v_{t+R-1}$ is jointly continuous in $x, \Delta$, this implies that either (a.) condition (A) is satisfied for all $\Delta \geq 0$ and all $x', x'' \in X$, or (b.) there exists $\tilde{\Delta}_{t+R-1} > 0$ such that if $\Delta < \tilde{\Delta}_{t+R-1}$ (B, $t+R-1$) then $v_{t+R-1}$ is strictly concave in $x$. Set $\Delta$ such that condition (B, $t+R-1$) is satisfied. Then the pivotal voter in period $t+R-1$ has a unique ideal point, i.e. $I\left(\theta^p_{t+R-1} \mid h_{t+R-1}, s_{t+R-1}\right) = \{x^p_{t+R-1}\}$, which is also the unique equilibrium policy in all equilibria given state $z_{t+R-1}$, i.e. $x^*_{t+R-1}(g_{t+R-1}) = x^p_{t+R-1}$. Moreover, because $v_{t+R-1}\left(x_{t+R-1}; \theta^p_{t+R-1}(z_{t+R-1}), \varphi \mid h_{t+R-1}, s_{t+R-1}\right)$ is jointly continuous in $(M_{t+R-1}, L_{t+R-1}), \theta^i_{t+R-1}, \Delta$ and strictly concave in $x_{t+R-1} = (M_{t+R-1}, L_{t+R-1})$, and $X$ is a convex set, the maximum theorem implies that $x^*_{t+R-1}(z_{t+R-1}) = x^p_{t+R-1}$ is jointly continuous in $\theta^i_{t+R-1}, \Delta$. In turn, this implies that $B_{t+R-1}\left(M_{t+R-2}, \varphi, z_{t+R-2}(h_{t+R-2})\right) = d\left(L^*_{t+R-1}\right) + c\left(M^*_{t+R-1}\right)$ is jointly continuous in $\theta^i_{t+R-1}, \Delta$. Thus, $v_{t+R-2}\left(x_{t+R-2}; \theta^i_{t+R-2}, \varphi \mid h_{t+R-2}, s_{t+R-2}\right) = A((M_{t+R-2}, L_{t+R-2}); \theta^i_{t+R-2}, \varphi, z_{t+R-2}) + \beta\lambda B_{t+R-1}\left(M_{t+R-2}, \varphi, z_{t+R-2}(h_{t+S-2})\right)$ is jointly continuous in $(M_{t+R-2}, L_{t+R-2}), \theta^i_{t+R-2}, \varphi, z_{t+R-2}$, and that $v_{t+R-2}\left(x_{t+R-2}; \theta^p_{t+R-2}(z_{t+R-2}), \varphi \mid h_{t+R-2}, s_{t+R-2}\right)$ is jointly continuous in $(M_{t+R-2}, L_{t+R-2}), \varphi, g_{t+R-2}$. Iterate this procedure for each period $t+R-k$ and for $k = 3, 4, \ldots, R-r$, and assume that in each period the condition $\Delta < \tilde{\Delta}_{t+R-r}$ (B, $t+R-r$) is satisfied. Lastly, set $\tilde{\Delta} = \min\left\{\tilde{\Delta}_{t+R-r}\right\}^R_{r=2}$. As a result, if $\Delta < \tilde{\Delta}$, then the function $v_{t+r}$ is jointly continuous in $(M_{t+r}, L_{t+r}), \theta^i_{t+r}, \Delta$ and strictly concave in $(M_{t+r}, L_{t+r})$ for each $r = 1, 2, \ldots, R$. This leads to a contradiction.

Part (ii). Suppose $x^*_{t+r}(z_{t+r})$ is not a continuous function of $\Delta$ for some $r = 1, 2, \ldots, R$. From part (i) we know that for $\Delta \in [0, \tilde{\Delta})$, $v_{t+r}\left(x_{t+r}; \theta^p_{t+r}(z_{t+r}), \varphi \mid h_{t+r}, s_{t+r}\right)$ is continuous in $x_{t+r}, \Delta$ and strictly concave in $x_{t+r} = (M_{t+r}, L_{t+r})$ for each $r = 1, 2, \ldots, R$, and $X$ is a convex set. Thus, Proposition 1 (ii) implies that $x^*_{t+r}(z_{t+r}) = x^p_{t+r}$ is the unique policy implemented in any equilibrium in each period $t+r$. Moreover, the maximum theorem implies that $x^*_{t+r}(z_{t+r}) = x^p_{t+r}$ is a continuous function of $\Delta$. This leads to a contradiction. □

**Proposition 1.** *Part (iii). In any equilibrium the policy outcome $x^*_t$ is unique given history $h_t$.*

**Proof.** Set the threshold $\overline{\Delta}$ such that $\overline{\Delta} \leq \tilde{\Delta}$ and therefore $\Delta \in [0, \tilde{\Delta})$. Under the Markovian assumption, the state of the economy given $h_t$ is entirely summarised by the states $z_t$, $t$. Then the proof is straightforward from Lemma 2 (i)–(ii). □Note that if the c.d.f. of the productivity distribution $Q_\rho$ is not continuous, $\tilde{\Delta}$ may be very small in magnitude, such that all the dynamic effects illustrated in Section 3.3 may vanish.

### B.2. Comparative statics

**Proposition 2** (*Effect of Population Ageing, Increasing Inequality, and Economic Depression*). *(i) An increase in longevity and/or (ii) an increase in income inequality and/or (iii) a decrease in fertility, and/or (iv) an economic depression translate into (1) a less open immigration policy $M_t$, (2) higher non-pension public spending $G_t$, and (3) a larger size of government $\tau_t$ in all periods $t$.*

**Proof.** We prove this result for any number $T \geq 2$ of periods. Part (i)-(1), -(2). Suppose (i)-(1) or -(2) does not hold true (or both). Consider any $\lambda', \lambda'' \in [\underline{\lambda}, 1]$ such that $\lambda' > \lambda''$. I define the set $\Phi_\lambda(\varphi) := \{\hat{\varphi} \in \Phi \mid \hat{\varphi}_j = \varphi_j \; \forall j \neq 3\}$ and the ordering $\leq_\lambda$ over $\Phi_\lambda(\varphi)$ such that $\varphi' \leq \varphi''$ if and only if $\lambda' \geq \lambda''$. Consider any two elements $\varphi' = (\beta, \gamma, \lambda'', \Delta, \sigma^m, \xi, l, \rho)$ and $\varphi'' = (\beta, \gamma, \lambda', \Delta, \sigma^m, \xi, l, \rho)$ of $\Phi_\lambda(\varphi)$ such that $\varphi' \leq \varphi''$. Lastly, let $z'_t(h_t) = \lambda' / \left[\sigma^m - \Delta(1 - M_{t-1})\right]$ and t $z''_t(h_t) = \lambda'' / \left[\sigma^m - \Delta(1 - M_{t-1})\right]$. Consider any two policies $(M''_t, L''_t), (M'_t, L'_t) \in X$ such that $(M''_t, L''_t) \geq (M'_t, L'_t)$. Then $v^p_t$ satisfies the single crossing property (*SC*) in $(M_t, L_t, \varphi)$ over $\Phi_\lambda(\varphi)$ if:

$$\begin{aligned} &v_t\left((M''_t, L''_t); \theta^p_t\left(z''_t(h_t)\right), \varphi'' \mid h_t, s_t\right) - v_t\left((M'_t, L'_t); \theta^p_t\left(z''_t(h_t)\right), \varphi'' \mid h_t, s_t\right) \geq \\ &v_t\left((M''_t, L''_t); \theta^p_t\left(z'_t(h_t)\right), \varphi' \mid h_t, s_t\right) - v_t\left((M'_t, L'_t); \theta^p_t\left(z'_t(h_t)\right), \varphi' \mid h'_t, s_t\right) \end{aligned} \tag{24}$$

Recall $z_t \in [0,1)$. implies $\theta_t^p > 0$. Using (15) condition (24) rewrites:

$$\begin{aligned}&\xi\left[\gamma\left(M_t''-M_t'\right)+\left(L_t''-L_t'\right)\right]\left[\theta_t^p\left(z_t''(h_t)\right)-\theta_t^p\left(z_t'(h_t)\right)\right]+\\&+\beta\left[\tilde{p}_{t+1}\left(\theta_t^p\left(z_t''(h_t)\right)\right)-\tilde{p}_{t+1}\left(\theta_t^p\left(z_t'(h_t)\right)\right)\right]\xi\Delta\left(M_t''-M_t'\right)+\\&+\beta\lambda''\left[B_{t+1}\left(M_t'',\varphi'',z_t''(h_t)\right)-B_{t+1}\left(M_t',\varphi'',z_t''(h_t)\right)\right]+\\&-\beta\lambda'\left[B_{t+1}\left(M_t'',\varphi'',z_t''(h_t)\right)-B_{t+1}\left(M_t',\varphi'',z_t''(h_t)\right)\right]\geq 0\end{aligned}\tag{25}$$

Recall $z_t \in [0,1)$. Notice that for $\Delta \in [0,\tilde{\Delta})$ the LHS of (25) is continuous in $\Delta$ by Lemma 2(i) and that $\lim_{\Delta\to 0}\left[B_{t+1}\left(M_t'',\varphi,z_t(h_t)\right)-B_{t+1}\left(M_t',\varphi,z_t(h_t)\right)\right]=0$ for all $z_t(h_t)$. Thus, either the inequality above is satisfied for all values of $\Delta \in [0,\tilde{\Delta})$ for any two $\varphi',\varphi'' \in \Phi_\lambda(\varphi)$ and for all $(M_t,L_t) \in X$, or the intermediate value theorem implies that there exists $\mathring{\Delta}_1 > 0$ such that if $\Delta \in [0,\mathring{\Delta}_1)$, then the inequality above is satisfied for any two $\varphi',\varphi'' \in \Phi_\lambda(\varphi)$ and for all $(M_t,L_t) \in X$. Thus, there exists threshold $\mathring{\Delta}_1 > 0$ such that for $\Delta \in [0,\mathring{\Delta}_1)$ the equilibrium policy $(M_t,L_t)$ is weakly increasing in $\varphi$ over $\Phi_\lambda(\varphi)$, and therefore weakly decreasing in $\lambda$. This leads to a contradiction. Thus, setting the threshold $\hat{\Delta}$ such that $\hat{\Delta} \leq \mathring{\Delta}_1$ is sufficient for the result to hold true. Part (i)-(3) is straightforward from (i)-(1), -(2) given that $\tau_t = \tau\left(M_t,L_t\right)$, which by formula (4) is decreasing in both $M_t$ and $L_t$ and constant in $\lambda$, and that $z_{t+1}$ is decreasing in $M_t$, constant in $L_t$ and increasing in $\lambda$.

Part (ii)-(1), -(2). Suppose (ii)-(1) or -(2) does not hold true (or both). First, I prove that the type of the pivotal voter is decreasing in $\rho$. Suppose $\rho' \geq \rho''$ but $\left(\theta_t^p\right)' > \left(\theta_t^p\right)''$. Recall that by definition of the median citizen $F_{\rho',t}\left(\left(\theta_t^p\right)' \mid h_t\right) \geq 0.5$ and $F_{\rho'',t}\left(\left(\theta_t^p\right)'' \mid h_t\right) \geq 0.5$. Secondly, the tie-break rule *(TB2)* and $\left(\theta_t^p\right)' > \left(\theta_t^p\right)''$ together imply $F_{\rho',t}\left(\left(\theta_t^p\right)'' \mid h_t,\rho'\right) < 0.5$ and, in turn, $F_{\rho',t}\left(\left(\theta_t^p\right)'' \mid h_t\right) < F_{\rho'',t}\left(\left(\theta_t^p\right)'' \mid h_t\right)$. Using the definition of $F_{\rho,t}$ in (7) and using $z_t < 1$ (which implies $\theta_t^p = \omega_t^p$), this result implies $Q_{\rho'}\left(\left(\theta_t^p\right)''\right) < Q_{\rho''}\left(\left(\theta_t^p\right)''\right)$. But the definition of inequality implies that $\rho' \geq \rho''$ only if $Q_{\rho'}\left(\theta_t^i\right) \geq Q_{\rho''}\left(\theta_t^i\right)$ for all $\theta_t^i \in \Theta_t \setminus \{1\}$ such that $\theta_t^i \leq \hat{\omega}$. because $\left(\theta_t^p\right)''$ is weakly lower than the median productivity, it satisfies $\left(\theta_t^p\right)'' \leq \hat{\omega}$. This implies $Q_{\rho'}\left(\left(\theta_t^p\right)''\right) \geq Q_{\rho''}\left(\left(\theta_t^p\right)''\right)$ leading to a contradiction. Then it must be true that $\left(\theta_t^p\right)'' \leq \left(\theta_t^p\right)'$. I define the set $\Phi_\rho(\varphi) := \{\hat{\varphi} \in \Phi \mid \hat{\varphi}_j = \varphi_j\ \forall j \neq 8\}$ and the ordering $\leq_\rho$ over $\Phi_\rho(\varphi)$ such that $\varphi' \leq \varphi''$ if and only if $\rho'' \leq \rho'$. Consider any two elements $\varphi' = (\beta,\gamma,\lambda,\Delta,\sigma^m,\xi,l,\rho')$ and $\varphi'' = (\beta,\gamma,\lambda,\Delta,\sigma^m,\xi,l,\rho'')$ of $\Phi_\rho(\varphi)$ such that $\varphi' \leq \varphi''$. Lastly, let $(\theta_t^p)'$ and $(\theta_t^p)''$ denote the type of the pivotal voter under $\rho'$ and $\rho''$, respectively, and note that $\rho'' \leq \rho'$. implies $(\theta_t^p)'' \geq (\theta_t^p)'$. Consider any two policies $(M_t'',L_t''),(M_t',L_t') \in X$ such that $(M_t'',L_t'') \geq (M_t',L_t')$. Then $v_t^p$ satisfies *(SC)* in $(M_t,L_t,\varphi)$ over $\Phi_\rho(\varphi)$ if:

$$\begin{aligned}&v_t\left((M_t'',L_t'');(\theta_t^p)'',\varphi''\mid h_t,s_t\right)-v_t\left((M_t',L_t');(\theta_t^p)'',\varphi_t''\mid h_t,s_t\right)\geq\\&v_t\left((M_t',L_t');(\theta_t^p)',\varphi_t'\mid h_t,s_t\right)-v_t\left((M_t',L_t');(\theta_t^p)',\varphi_t'\mid h_t,s_t\right)\end{aligned}\tag{26}$$

Using (15) condition (24) rewrites:

$$\begin{aligned}&\xi\left[\gamma\left(M_t''-M_t'\right)+\left(L_t''-L_t'\right)\right]\left[(\theta_t^p)''-(\theta_t^p)'\right]+\\&+\beta\left[\tilde{p}_{t+1}\left((\theta_t^p)''\right)-\tilde{p}_{t+1}\left((\theta_t^p)'\right)\right]\xi\Delta\left(M_t''-M_t'\right)\\&+\beta\lambda\left[B_{t+1}\left(M_t'',\varphi'',z_t(h_t)\right)-B_{t+1}\left(M_t',\varphi'',z_t(h_t)\right)\right]+\\&-\beta\lambda\left[B_{t+1}\left(M_t'',\varphi',z_t(h_t)\right)-B_{t+1}\left(M_t',\varphi',z_t(h_t)\right)\right]\geq 0\end{aligned}\tag{27}$$

Recall $z_t \in [0,1)$. Notice that for $\Delta \in [0,\tilde{\Delta})$ the LHS of (27) is continuous in $\Delta$ by Lemma 2 (i) and that $\lim_{\Delta\to 0}\left[B_{t+1}\left(M_t'',\varphi,z_t(h_t)\right)-B_{t+1}\left(M_t',\varphi,z_t(h_t)\right)\right]=0$ for all $z_t(h_t)$. Thus, either the inequality above is satisfied for all values of $\Delta \in [0,\tilde{\Delta})$ for any two $\varphi',\varphi'' \in \Phi_\rho(\varphi)$ and for all $(M_t,L_t) \in X$, or the intermediate value theorem implies that there exists $\mathring{\Delta}_2 > 0$ such that if $\Delta \in [0,\mathring{\Delta}_2)$, then the inequality above is satisfied for any two $\varphi',\varphi'' \in \Phi_\rho(\varphi)$ and for all $(M_t,L_t) \in X_t'$. Thus, there exists threshold $\mathring{\Delta}_2 > 0$ such that for $\Delta \in [0,\mathring{\Delta}_2)$ the equilibrium policy $(M_t,L_t)$ is weakly increasing in $\varphi$ over $\Phi_\rho(\varphi)$, and therefore weakly decreasing in $\rho$. Using $\rho'' = 0$ and $\rho' = 1$ this implies in turn that an increase in income inequality from $Q_{\rho''}$ to $Q_{\rho'}$ corresponds to a lower equilibrium policy $(M_t,L_t)$. This leads to a contradiction. Thus, setting the threshold $\hat{\Delta}$ such that $\hat{\Delta} \leq \mathring{\Delta}_2$ is sufficient for the result to hold true. Part (ii)-(3) is straightforward from (ii)-(1), -(2) given that $\tau_t = \tau\left(M_t,L_t\right)$, which by formula (4) is decreasing in both $M_t$ and $L_t$ and invariant to changes in the productivity distribution at constant mean productivity, and that $z_t$ is decreasing in $M_t$, constant in $L_t$ and invariant to changes in the productivity distribution at constant mean productivity.

Part (iii)-(1), -(2). Suppose (iii)-(1) or -(2) does not hold true (or both). Consider any $\sigma',\sigma'' \in [0,\sigma^{max}]$ such that $\sigma'' > \sigma'$. I define the set $\Phi_\sigma(\varphi) := \{\hat{\varphi} \in \Phi \mid \hat{\varphi}_j = \varphi_j\ \forall j \neq 4\}$ and the ordering $\leq_\sigma$ over $\Phi_\sigma(\varphi)$ such that $\varphi' \leq \varphi''$ if and only if $\sigma' \leq \sigma''$. Consider any two elements $\varphi' = (\beta,\gamma,\lambda,\sigma'',\Delta,\xi,l)$ and $\varphi'' = (\beta,\gamma,\lambda,\sigma',\Delta,\xi,l)$ of $\Phi_\sigma(\varphi)$ such that $\varphi' \leq \varphi''$. Lastly, let $z_t'(h_t) = \lambda/\left[\sigma'+\Delta M_{t-1}\right]$ and t $z_t''(h_t) = \lambda/\left[\sigma''+\Delta M_{t-1}\right]$. Consider any two policies $(M_t'',L_t''),(M_t',L_t') \in X$ such that $(M_t'',L_t'') \geq (M_t',L_t')$. Then $v_t^p$ satisfies *(SC)* in $(M_t,L_t,\varphi)$ over $\Phi_\sigma(\varphi)$ if

$$\begin{aligned}&v_t\left((M_t'',L_t'');\theta_t^p\left(z_t''(h_t)\right),\varphi''\mid h_t,s_t\right)-v_t\left((M_t',L_t');\theta_t^p\left(z_t''(h_t)\right),\varphi''\mid h_t,s_t\right)\geq\\&v_t\left((M_t'',L_t'');\theta_t^p\left(z_t'(h_t)\right),\varphi'\mid h_t,s_t\right)-v_t\left((M_t',L_t');\theta_t^p\left(z_t'(h_t)\right),\varphi'\mid h_t,s_t\right)\end{aligned}\tag{28}$$

Using (15) condition (28) rewrites

$$\begin{aligned}&\xi\left[\gamma\left(M_t''-M_t'\right)+\left(L_t''-L_t'\right)\right]\left[\theta_t^p\left(z_t''(h_t)\right)\sigma''-\theta_t^p\left(z_t'(h_t)\right)\sigma'\right]+\\&+\beta\left\{\tilde{p}_{t+1}\left(\theta_t^p\left(z_t''(h_t)\right)\right)-\tilde{p}_{t+1}\left(\theta_t^p\left(z_t'(h_t)\right)\right)\right\}\xi\Delta\left(M_t''-M_t'\right)+\\&\beta\lambda\left[B_{t+1}\left(M_t'',\varphi',z_t'(h_t)\right)-B_{t+1}\left(M_t',\varphi',z_t'(h_t)\right)\right]+\\&-\beta\lambda\left[B_{t+1}\left(M_t'',\varphi'',z_t''(h_t)\right)-B_{t+1}\left(M_t',\varphi'',z_t''(h_t)\right)\right]\geq 0\end{aligned}\tag{29}$$

Firstly, the first two lines of (29) are strictly positive given that $\tilde{p}_{t+1}$ is weakly increasing. Secondly, recall $z_t \in [0,1)$ and notice that for $\Delta \in [0,\tilde{\Delta})$ the LHS of (29) is continuous in $\Delta$ by Lemma 2(i) and that $\lim_{\Delta\to 0}\left[B_{t+1}\left(M_t',\varphi,z_t(h_t)\right)-B_{t+1}\left(M_t'',\varphi,z_t(h_t)\right)\right]=0$. Thus, either the inequality above is satisfied for all $\Delta \in [0,\tilde{\Delta})$ , for any two $\varphi',\varphi'' \in \Phi_\sigma(\varphi)$ and for all $(M_t,L_t) \in X$, or the intermediate value theorem implies that there exists $\mathring{\Delta}_3 > 0$ such that if $\Delta \in [0,\mathring{\Delta}_3)$, then the inequality above is satisfied for any two $\varphi',\varphi'' \in \Phi_\sigma(\varphi)$ and for all $(M_t,L_t) \in X$. Thus, there exists threshold $\mathring{\Delta}_3 > 0$ such that for $\Delta \in [0,\mathring{\Delta}_3)$ the equilibrium policy $(M_t,L_t)$ is weakly increasing in $\varphi$ over $\Phi_\sigma(\varphi)$, and therefore weakly increasing in $\sigma$. This leads to a contradiction. Thus, setting the threshold $\hat{\Delta}$ such that $\hat{\Delta} \leq \mathring{\Delta}_3$ is sufficient for the result to hold true. Part (iii)-(3) is straightforward from (i)-(1), -(2) given that $\tau_t = \tau\left(M_t,L_t\right)$, which by formula (4) is decreasing in both $M_t$ and $L_t$ and constant in $\sigma$, and that $z_{t+1}$ is decreasing in $M_t$, constant in $L_t$ and decreasing in $\sigma$.

Part (iv)-(1), -(2). Suppose (iv)-(1) or -(2) does not hold (or both). Consider any $\xi',\xi'' \in (0,+\infty)$ such that $\xi'' > \xi'$. I define the following notation. $\Phi_\xi(\varphi) := \{\hat{\varphi} \in \Phi \mid \hat{\varphi}_j = \varphi_j\ \forall j \neq 6\}$ and the ordering $\leq_\xi$ over $\Phi_\xi(\varphi)$ such that $\varphi' \leq \varphi''$ if and only if $\xi'' > \xi'$. Consider any two elements $\varphi' = (\beta,\gamma,\lambda,\Delta,\sigma^m,\xi',l)$ and $\varphi'' = (\beta,\gamma,\lambda,\Delta,\sigma^m,\xi'',l)$ of $\Phi_\xi(\varphi)$ such that $\varphi' \leq \varphi''$ and any two policies $(M_t'',L_t''),(M_t',L_t') \in X$ such that $(M_t'',L_t'') \geq (M_t',L_t')$. Then $v_t^p$ satisfies *(SC)* in $(M_t,L_t,\varphi)$ over $\Phi_\xi(\varphi)$ if

$$\begin{aligned}&v_t\left((M_t'',L_t'');\theta_t^p\left(z_t(h_t)\right),\varphi''\mid h_t,s_t\right)-v_t\left((M_t',L_t');\theta_t^p\left(z_t(h_t)\right),\varphi''\mid h_t,s_t\right)\geq\\&v_t\left((M_t'',L_t'');\theta_t^p\left(z_t(h_t)\right),\varphi'\mid h_t,s_t\right)-v_t\left((M_t',L_t');\theta_t^p\left(z_t(h_t)\right),\varphi'\mid h_t,s_t\right)\end{aligned}\tag{30}$$

Using (15) condition (30) rewrites:

$$\begin{aligned}&\left[\gamma\left(M_t''-M_t'\right)+\left(L_t''-L_t'\right)\right]\theta_t^p\left(z_t(h_t)\right)\left(\xi''-\xi'\right)+\\&+\beta\left\{\tilde{p}_{t+1}\left(\theta_t^p\left(z_t(h_t)\right)\right)\left(\xi''-\xi'\right)\right\}\Delta\left(M_t''-M_t'\right)+\\&\beta\lambda\left[B_{t+1}\left(M_t'',\varphi'',z_t(h_t)\right)-B_{t+1}\left(M_t',\varphi'',z_t(h_t)\right)\right]+\\&-\beta\lambda\left[B_{t+1}\left(M_t'',\varphi',z_t(h_t)\right)-B_{t+1}\left(M_t',\varphi'',z_t(h_t)\right)\right]\geq 0\end{aligned}\tag{31}$$

Notice that $z_{t+1}$ is constant in $\xi'$. This implies that $B_{t+1}\left(M_t'',\varphi'',z_t(h_t)\right) - B_{t+1}\left(M_t'',\varphi',z_t(h_t)\right) = d\left(\overline{G}-L_{t+1}^*(z_{t+1}(h_{t+1}''))\right)+c\left(M_{t+1}^*(z_{t+1}(h_{t+1}''))\right) - d\left(\overline{G}-L_{t+1}^*(z_{t+1}(h_{t+1}''))\right)-c\left(M_{t+1}^*(z_{t+1}(h_{t+1}''))\right)=0$, where $h_t''$ denotes the history after policy choice $M_t''$. Thus, the inequality in (31) is always satisfied. Thus, the equilibrium policy $(M_t, L_t)$ is weakly increasing in $\varphi$ over $\Phi_\xi(\varphi)$, and therefore weakly increasing in $\xi$. This leads to a contradiction. Part (i)-(3) is straightforward from (i)-(1), -(2) given that $\tau_t = \tau\left(M_t, L_t\right)$, which by formula (4) is decreasing in both $M_t$ and $L_t$ and constant in $\xi$, and that $z_{t+1}$ is decreasing in $M_t$, constant in $L_t$ and constant in $\xi$. Lastly, define $\hat{\Delta} = \min\left\{\mathring{\Delta}_1, \mathring{\Delta}_2, \mathring{\Delta}_3, \tilde{\Delta}\right\}$ and note that $\hat{\Delta} > 0$. Then setting the threshold $\overline{\Delta}$ such that it satisfies $0 < \overline{\Delta} \leq \hat{\Delta}$, then for any $\Delta \in [0, \overline{\Delta}]$ all the statements in parts (i)-(ii)-(iii)-(iv) hold true. □

**Proposition 3** (*Short-Term Fiscal Effects*). *In any EE, if there exist two candidates $r, l$ in period $t$ such that $M_t^r < M_t^l$, then there exists a threshold $\tilde{\theta}_t \geq 0$ such that the policy platform of the relatively pro-immigration candidate $l$ has weakly negative short-term fiscal effect on all individuals featuring type $\theta_t^i \leq \tilde{\theta}_t$ – that is, the old and the relatively poor citizens – with respect to the platform of the relatively anti-immigration candidate $r$.*

**Proof.** A citizen's objective function in period $t$ is strictly concave by Lemma 2 and $X$ is compact. Thus, each citizen has a unique ideal policy. Preferences satisfy *QSM* in $x_t$ and *SSC* $\left(x_t, \theta_t\right)$ by Lemma 1 and $(X \leq)$ is a lattice. Thus, the ideal policy $x_t^i$ is weakly increasing in the citizen's type $\theta_t^i$ by Theorem 4 in Milgrom and Shannon (1994). As a consequence, $M_t^r < M_t^l$ implies $\theta_t^r < \theta_t^l$ and, in turn, $L_t^r \leq L_t^l$. The short-term fiscal effect of the platform of candidate $l$ relative to candidate $r$ has formula: $\left[L_t^l - L_t^r + \gamma\left(M_t^l - M_t^r\right)\right]\xi\theta_t^i + b\left(\overline{G} - L_t^l\right) - b\left(\overline{G} - L_t^r\right)$ for a young citizen of type $\theta_t^i$ and $d\left(\overline{G} - L_t^l\right) - d\left(\overline{G} - L_t^r\right)$ for each old citizen (type $\theta_t^i = -1$). The latter formula has weakly negative value because $L_t^r \leq L_t^l$, so (a) all citizens of type $\theta_t^i = -1$ face a weakly negative short-term fiscal effects. The former has weakly positive value at $\theta_t^i = 0$, and is continuous and weakly increasing in $\theta_t^i$. Thus, either (i) the fiscal effects are weakly negative for all $\theta_t^i \in \Theta$, implying that in such case $\tilde{\theta}_t$ is trivially the highest type in $\Theta$; or (ii) by the intermediate value theorem, there exists $\tilde{\theta}_t$ (not necessarily an element of $\Theta$) such that (b) $\left[L_t^l - L_t^r + \gamma\left(M_t^l - M_t^r\right)\right]\xi\tilde{\theta}_t + b\left(\overline{G} - L_t^l\right) - b\left(\overline{G} - L_t^r\right) \leq 0$ for all $\theta_t^i \in \Theta$ such that $0 \leq \theta_t \leq \tilde{\theta}_t$. Results (a) and (b) together imply that the short-term fiscal effects are weakly negative for all $\theta_t^i \in \Theta$ such that $\theta_t \leq \tilde{\theta}_t$ where $\tilde{\theta}_t \geq 0$. □

**Proposition 4.** *For any Social Welfare Function $SWF\left((M_t, L_t); \varphi \mid h_t, s_t\right)$ that assigns a strictly positive weight to each native individual with $\theta_t^i > 0$, there exist thresholds $\breve{\omega}_t > 0$ and $\check{z}_t \in [0,1)$ such that if $\omega^{Low} \leq \breve{\omega}_t$ and $z_t \in [\check{z}_t, 1)$, then a marginal loosening in the immigration policy is welfare-enhancing.*

**Proof.** We proof this result for any $\Delta \in [0, \check{\Delta})$. The *SWF* for a time horizon $T \geq 2$ in period $t$ has the following form:

$$SWF\left((M_t, L_t); \varphi \mid h_t, s_t\right) = E_t\left[\int_{-1}^{+\infty} u_t\left(\left\{(M_t, L_t), x_{t+1}^*\right\}; \theta_t, \varphi, z_t(h_t)\right) d\Psi_t(\theta_t) + \right. \\ \left. + \sum_{r=1}^{T-t} \int_0^{+\infty} u_{t+r}\left(\left\{(M_{t+r}^*, L_{t+r}^*), x_{t+r+1}^*\right\}; \theta_{t+r}, \varphi, z_t\left(h_{t+r}\right)\right) d\Psi_{t+r}(\theta_{t+r}) \right| h_t, s_t\right] \tag{32}$$

Suppose a marginal increase in $M_t$ evaluated at $M_t^*$ is not welfare-enhancing for some $SWF$ with $\Psi_{t+r}(\theta_{t+r}) > \max\left\{\Psi_{t+r}(\theta'_{t+r}), 0\right\}$ for all $\theta'_{t+r} \in \Theta_t$ such that $\theta'_{t+r} < \theta_{t+r}$. I define the marginal social welfare function as follows:

$$MSW\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right) \\ := \lim_{M_t' \to M_t^*} \frac{SWF\left((M_t', L_t^*); \varphi \mid h_t, s_t\right) - SWF\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right)}{M_t' - M_t^*} \tag{33}$$

First, we set $\Delta = 0$ and we calculate the effect of an increase in $M_t$ on each individual objective function that enters the formula for $MSW$. In this case $v_t$ is differentiable for all citizen's types, such that for each individual $i$ we get:

$$\lim_{M_t' \to M_t^*} \frac{v_t\left((M_t', L_t^*); \theta_t^i, \varphi \mid h_t, s_t\right) - v_t\left((M_t^*, L_t^*); \theta_t^i, \varphi \mid h_t, s_t\right)}{M_t' - M_t^*} \\ = \gamma\xi\theta_t^i \times \mathbf{1}\left[\theta_t^i \geq 0\right] + c'(M_t^*) \tag{34}$$

Lastly, consider an individual born in period $t+r$ for $r > 0$. Given $\Delta = 0$, we know that future equilibrium policies are invariant in current policy choices. Thus, I get:

$$E_t\left[v_{t+r}\left((M_{t+r}, L_{t+r}); \theta_{t+r}^i, \varphi \mid h_{t+r}, s_{t+r}\right) \mid h_t, s_t, (M_t', L_t^*)\right] + \\ -E_t\left[v_{t+r}\left((M_{t+r}, L_{t+r}); \theta_{t+r}^i, \varphi \mid h_{t+r}, s_{t+r}\right) \mid h_t, s_t, (M_t^*, L_t^*)\right] = 0 \tag{35}$$

i.e. if $\Delta = 0$ current policy choices do not affect future outcomes. Thus, for $\Delta = 0$, the limit in (34) exists and it simply a derivative. Using the results in (34) and (35) we get:

$$MSW\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right) = \psi\xi \int_{\Theta_t \setminus \{-1\}} \theta_t d\Psi_t(\theta_t) + c'(M_t^*) \int_{\Theta_t} d\Psi_t(\theta_t) \tag{36}$$

Note that given the definition of $\Theta_t$, $\omega^{Low} \in \Theta_t$ implies $Q_\rho\left(\omega^{Low}\right) > 0$, and in turn there exists $\check{z}_t < 1$ such that $F_{\rho,t}\left(\omega^{Low} \mid h_t\right) = 0.5$, which implies $\theta_t^p(z_t) = \omega^{Low}$ for all $z_t \in [\check{z}_t, 1)$. Thus, using this result into formula (34) we get: $\gamma\xi\omega^{Low}\left(z_t\right) + c'(M_t^*)$ for all $z_t \in \left[\check{z}_t, 1\right)$. Now consider the extreme case $\omega^{Low} = 0$. This implies that the ideal policy of the pivotal voter is $\arg\max_{(M_t, L_t) \in X} v_t\left((M_t, L_t); 0, \varphi \mid h_t, s_t\right) = (\underline{M}, L_t^*)$, where $\underline{M}$ solves $c'(\underline{M}) = 0$. Set $M_t^* = \underline{M}$ into (33) and $z_t \in \left[0, \check{z}_t\right]$ to get

$$MSW\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right) = \gamma\xi \int_{\Theta_t \setminus \{-1\}} \theta_t d\Psi_t(\theta_t) > 0 \tag{37}$$

which is strictly positive for any weight function that satisfies $\Psi_{t+r}(\theta_{t+r}) > \max\left\{\Psi_{t+r}(\theta'_{t+r}), 0\right\}$ for all $\theta'_{t+r} \in \Theta_t$ such that $\theta'_{t+r} < \theta_{t+r}$. Note that $MSW\left((M_t, L_t); \varphi \mid h_t, s_t\right)$ is jointly continuous in $(M_t, L_t), \Delta$ because each function $v_{t+r}$ for $r = 0, 1, \ldots, T-t$ that enters the formula for $MSW$ is jointly continuous in $(M_t, L_t), \Delta, \theta_t^p$ by Lemma 2 and the sum and integration over such functions preserve continuity. Moreover, because by Lemma 2 $v_t\left((M_t, L_t); \theta_t^p(z_t), \varphi \mid h_t, s_t\right)$ is jointly continuous in $(M_t, L_t), \theta_t^p, \Delta$ and strictly concave in $(M_t, L_t)$, and $X$ is a convex set, by the maximum theorem the optimal policy $(M_t^*, L_t^*)$ is jointly continuous in $\Delta, \theta_t^p$, implying that the function $MSW$ evaluated at the optimal policy; i.e., $MSW\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right)$, is itself jointly continuous in $\Delta, \theta_t^p$. Then either $MSW\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right) > 0$ for all $\Delta \in [0, \tilde{\Delta})$ and all possible values of $\omega^{Low}$ that satisfy $\omega^{Low} > 0$, or the intermediate value theorem implies that there exists thresholds $\check{\Delta} > 0$ and $\breve{\omega}_t > 0$ such that if $\Delta \in [0, \check{\Delta})$ and $\omega^{Low} \in \left[0, \breve{\omega}_t\right]$, then $MSW\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right) > 0$. In particular, we set $\overline{\Delta} = \min\left\{\hat{\Delta}, \check{\Delta}\right\}$ (see proof to Proposition 3 for $\hat{\Delta}$) to ensures that $\Delta \in [0, \check{\Delta})$. In turn, $MSW\left((M_t^*, L_t^*); \varphi \mid h_t, s_t\right) > 0$ implies that if $z_t \in [\check{z}_t, 1)$ and $\omega^{Low} \in \left[0, \breve{\omega}_t\right]$, a marginal increase in $M_t$ evaluated at $M_t^*$ is strictly welfare-enhancing for any $SWF$ that satisfies $\Psi_{t+r}(\theta_{t+r}) > \max\left\{\Psi_{t+r}(\theta'_{t+r}), 0\right\}$ for all $\theta'_{t+r} \in \Theta_t$ such that $\theta'_{t+r} < \theta_{t+r}$. This leads to a contradiction. □

## Appendix C. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jpubeco.2024.105199.

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