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Age, Inequality and the Public Provision of Healthcare

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Abstract

How does economic inequality affect public spending on healthcare in democracies? Does this depend upon the demographic composition of the electorate? We build a multi-dimensional model of political decision-making with endogenous political parties to analyse such questions. Voters in our model differ in terms of income and age. The tax rate, the allocation of the revenue between income redistribution and two forms of public spending – healthcare and capital investment – are determined through political competition. All agents value healthcare equally but the young like capital investment more than the old do. We find that when the young are a majority, public healthcare spending tends to be lower on average than when the young are a minority. Moreover, when the old are a majority the equilibrium public healthcare provision depends critically upon the extent of income inequality. We also discuss implications regarding the on-going demographic transition (population ageing) and the Covid-19 pandemic.

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I INTRODUCTION

The topic of income redistribution has been one of the central themes in the political economy literature. Closely related to this is the issue of public provision of private goods, such as education and healthcare, since these are viewed as a form of redistribution in the positive literature. Education may be considered as redistribution from either the rich to the poor (see e.g., Glomm and Ravikumar (1998)) or from the poor to the rich in the case of higher education, where the poor are financially constrained from attending universities (a la Fernández and Rogerson (1995)). The issue could be perceived from another angle — namely, age cohorts, as done in Gradstein and Kaganovich (2004) who posit public education as redistribution from the old to the young.[2] As regards the public provision of healthcare, one could argue that it is a type of redistribution from the rich to the poor (e.g., Epple and Romano (1996)). In terms of the age dimension, it is less clear – unlike the case of education – that one age cohort *ceteris paribus* would necessarily prefer more public provision of healthcare than the other. After all, both the young and the old have need for healthcare services even if the specific forms of the requirements may vary by age.

While the above papers analyse models in which the *only* possible form of redistribution available to society is redistribution in kind (i.e., public provision of education or healthcare), Levy (2005) makes a significant advancement by allowing for society to use income redistribution as an additional policy tool. This allows one to document the patterns of in kind provision of education along with pure transfers in society, and, in particular, observe the trade-offs involved across these two forms of redistribution. However, the scenario where aside from income redistribution and redistribution in kind of a good valued differently by age cohorts (e.g., education), there is *also* the possibility of public provision of a good which is valued *similarly* by all agents in society (e.g., healthcare) remains unexplored. We aim to close this gap by studying the *simultaneous* public provision of such different goods in a setup where income redistribution remains feasible. Therefore, we are able to engage with a broader set of questions than hitherto possible. In this paper, we ask the following questions: what is the pattern of public provision of these two different types of goods when income transfers are feasible? Are they going to to "crowd out" one another? How will the demographic parameters (size of the old versus young cohorts) affect this pattern? Will the level of economic inequality affect this and if yes, then how so? The answers to such questions can shed light on the public provision of healthcare and

[2] The argument is that the young's income in the future is dependent on their current education while it is not so for the old.

thereby speak to two of the most crucial challenges currently confronting society — (i) population ageing and (ii) the coronavirus pandemic. We discuss the implications of our theory in each of these cases in detail below taking care to distinguish between developing and developed economies.

In this paper, we build a multi-dimensional model of political decision-making with endogenous political parties to analyse such questions. Like in Levy (2005), the voters in our model differ in terms of income and age. The first marker (i.e., income) drives the conflict in preferences over the tax rate where the poor (who are assumed to be more numerous) ideally desire maximum taxation while the rich want it as minimal as possible.

The age dimension symbolizes another form of conflict in tastes. We posit that there is a good – call it capital spending – from which the young gain more than the old do.[3] This capital spending could encompass a wide-range of activities (say, physical infrastructure spending) which augments the market activity and hence the earnings of the young. It can be also viewed as some legal capacity investments like in Besley and Persson (2010) which supports markets and in general production-related activities. The old agent's consumption possibilities do not depend as much upon such current market-augmenting measures by the government. As mentioned earlier, we also allow for another form of in-kind public provision. This is a good which is valued equally by all agents and in particular is devoid of the young-versus-old conflict. We think of this good as healthcare since all agents irrespective of their income or age would want to consume it. As in Epple and Romano (1996), the agents may supplement their public healthcare consumption by purchases from the private market.

There is a political process which determines the tax rate and the allocation of the revenues between income redistribution and public spending. Our modeling of the political process follows the one in Levy (2005) closely. The setup builds on the "citizen candidate" model *a la* Besley and Coate (1997) and Osborne and Slivinski (1996). Notably, it allows both for endogenous entry of politicians and for endogenous political parties. Here parties choose which platforms to offer, where each platform specifies the tax rate and the division of the tax revenues under the following heads — income transfers, public healthcare and capital spending. There is a restriction on the platforms any party may advance — it can only offer credible platforms, that is, policies in the Pareto set of their members. Given the platforms that are offered, the citizens cast their vote for the platform they like most and the political outcome is determined by plurality.[4]

[3]Capital spending could in principle include education-related spending. More on this later.

[4]The platform which gains the largest number of votes is the winner.

In this setup, we require our equilibrium outcome to be "stable" in the following sense: given the political outcome, the members of any political party do not wish to split from their party and thereby induce a different political outcome. The equilibrium analysis specifies the composition of political parties along with the level of public healthcare, private healthcare, income transfers, capital spending and the total size of government.

Our analysis reveals the following. Both sets of factors – namely, demographic considerations and income inequality – are very critical in determining the nature of the equilibrium coalitions and the winning platforms. When the young are a majority, public healthcare spending tends to be lower on average than when the young are a minority. Moreover, when the old are a majority the equilibrium public healthcare provision depends quite fundamentally upon the extent of income inequality. To be specific, if income inequality is above a certain threshold then the equilibrium public healthcare provision may exceed the level for when income inequality is lower than that threshold. This arises from the difference in the composition of the winning party in equilibrium for the two scenarios (above/below the inequality threshold).

Our finding that the provision of public healthcare may be higher when the old – rather than the young – are a majority is significant as we do not assume that the preferences for healthcare vary by age. It is undeniable that the extent of public healthcare spending determines the capacity of a state to deal with economy-wide health shocks. To be sure, the responses may well depend upon other factors but the stock of healthcare becomes a constraint.[5] The effect of public healthcare spending on the elderly is significant and can become a major determinant of the extent of fatalities among them (see e.g., Vogt and Kluge (2015)).[6] Similarly, increased public healthcare expenditure can reduce infant mortality and reduce low-birth weights (e.g., Fujiwara (2015)).[7] Consider the issue of the major demographic shift during the 21st century — namely, population ageing across both rich and poor countries.[8] Our model is able to provide predictions about how such

[5]See Jalan and Sen (2020) for an insight into the success behind the southern Indian state of Kerala's pandemic containment strategy.

[6]Vogt and Kluge (2015) investigate the impact of public spending on mortality disparities using the reunification of East and West Germany in 1990 as a natural experiment. Before reunification, the gap between life expectancy in the East and West was large and growing. After reunification, life expectancy at 65 in the East increased rapidly and converged with that in the West, in contrast to Czechoslovakia, Hungary and Poland where mortality conditions are still similar to those in East Germany in 1990. They show that expenditures on both pensions and healthcare reduce mortality, but healthcare is most critical.

[7]Fujiwara (2015) finds that the introduction of electronic voting (EV) technology in Brazil resulted in the enfranchisement of the poor and this subsequently raised the number of prenatal visits by health professionals and lowered the prevalence of low-weight births by less educated women, but not for the more educated.

[8]See Kotlikoff (2019) and Mahal and Mohanty (2019) among others.

a demographic shift will affect public expenditures in democracies. As the share of the elderly increase, our model demonstrates how the political process in democracies may, by itself, lead to increases in the provision of public healthcare.[9]

Our analysis suggests that in economies where the young are more numerous than the elderly, the political process may not guarantee adequate – from a utilitarian perspective – public spending on healthcare. Hence, these are the economies which are *ceteris paribus* the least prepared to handle a pandemic like Covid-19. In addition, a pandemic which is more fatal for the elderly may itself affect the demography parameters in an adverse manner by shifting the majority in favour of the young and thus depressing healthcare spending even further. The pandemic may also affect economic inequality which in turn might trigger movements in the equilibrium platforms in the post-pandemic world.[10]

For the basic intuition behind our main results, we first direct attention to the implications of changes in income inequality. Intuitively, when income inequality is sufficiently low then the preferences of the young rich and the young poor agents are closely aligned; both would prefer positive levels of capital spending which would boost their consumption possibilities and enable them to procure healthcare privately. Hence for sufficiently low levels of income inequality, the young poor agent will prefer the ideal policy of the young rich agent over that of the old poor agent; observe, the old poor agent's ideal point will have maximum taxation and some healthcare spending but no capital spending. This precedence of age-wise alignment over income-wise alignment for the young poor is a key factor in determining the equilibrium outcomes.

Now consider the situation where the young are a majority. Here it is the young poor voters who represent majoritarian interests, advocating maximum taxation as well as high levels of capital spending and some healthcare spending. The rich agents attempt to counter this by forming a coalition with the old poor. They offer a platform with a lower tax rate and lower capital spending which yields a payoff to the old poor in excess of what the young poor's platform offers. As we show below, the rich are able to safeguard against complete redistribution by joining forces with the old poor. Notice that the extent of income inequality does *not* affect the core logic of this alliance formation, although it has the potential to change the composition of the equilibrium platform.

Next, consider the case when the old are a majority. Here, income inequality assumes special importance. If income inequality is low enough so that the the young poor agent

[9] This is not to suggest that population ageing and the resultant demands on the healthcare system is not a particularly worrisome issue for democracies. The idea is that political institutions and electoral processes may serve to mitigate some of the pressure.

[10] This is discussed in more detail under Section IV.

prefers the ideal policy of the young rich over that of the old poor, then in the absence of any coalitions the old poor agent cannot win. This is so as the old poor would not have the support of the young poor against the platform of the young rich agent since the age-wise alignment dominates the income-wise alignment for the young poor. However, the young poor agent can run and win here (i.e., in the "no coalitions" scenario) as they would have the support of the old poor agents. Thus, the equilibrium coalition formation process would echo the case of the young majority with one significant difference — as the old are a majority, there will be equilibria where the winning coalition is solely composed of the old agents.

Things look very different when income inequality is high enough to align all the poor agents together under the old majority scenario. Here it is the old poor voters who represent majoritarian interests, advocating maximum taxation as well as *zero* capital spending and positive levels of healthcare spending. The analogy with the young majority case is quite apparent here. The rich agents attempt to form a coalition with the young poor which involves a lower tax rate and some capital and healthcare spending. By a suitable choice of tax rates and public spending, the rich can guarantee themselves higher utility by joining forces with the young poor. The latter are happy to join as long as the party's proposal gives them greater utility than the old poor agent's ideal policy. We show that such compromises always exist within our framework.

The above discussion illustrates how the equilibrium winning party composition and the nature of the winning policies change with demography and income inequality. We find that the capital spending patterns exhibits a (weakly) positive cohort size effect when the ambient level of income inequality is sufficiently low. This follows from the similarity in the equilibrium features between the young majority case and that of the old majority with low income inequality case. The latter scenario has some equilibria where the old agents alone form the winning party and so there is no capital spending in those equilibria; otherwise, the set of equilibria coincide in these two cases. Conversely, when income inequality is high, then it is possible to have a negative cohort size effect for capital spending like in Levy (2005).

There is a lack of consensus in the matter of stylised empirical facts regarding the effect of the share of the elderly on redistributive policies. Ladd and Murry (2001) and Harris, Evans and Schwab (2001) find that the elderly have no significant effect on public education in the United States. On the one hand, Case, Hines and Rosen (1993) find that a larger proportion of elderly residents reduces per capita expenditures on education and health. On the other hand, Alesina, Baqir and Easterly (1999) find a positive effect of the elderly share on education spending per pupil in U.S. municipalities. To the extent that capital spending in our setup captures some form of human capital spending, our analysis suggests that some these seemingly contradictory empirical results could potentially be explained by the effect income inequality has in terms of the (negative/positive) cohort size effect.

Fernández and Levy (2008), like us, highlight the implications of the trade-off between general redistribution and targeted transfers. They, however, focus on goods that are explicitly targeted to many small interest groups, such as local public goods, and study the effect of diversity on redistribution. In particular, they do not focus on the interplay of income inequality and cohort sizes like we do here.

The remainder of the paper is organised as follows. Section II describes the basic model while Section III reports the main results of the analysis. Section IV contains a discussion on the implications of our findings regarding population ageing and the Covid-19 pandemic. Section V concludes. All proofs and detailed derivations are collected in the Appendix.

II THE MODEL

We start with a description of the economic environment outlining the various agents and their preferences.

II.I *The Economic Environment*

There is a unit mass of agents in the economy. These agents are different in two dimensions — namely, income and age. We first focus on the former marker.

We will assume that there are two levels of income in the economy. The poor have income w_p and the rich have income w_r where $w_r > w_p > 0$. Also, we will assume – as is standard in the literature – that the poor are more numerous. Hence, letting π denote the mass of the poor we have $\pi > 1/2$. So, the average income in the economy is given by w where

$$w = \pi w_p + (1 - \pi) w_r.$$

There are two types of goods in this economy. One is a numeraire good – denoted by x – which is liked by all agents. The other is healthcare – denoted by h – which too is liked by all agents. For a typical agent, the utility function is given by $u(x, h)$ which is assumed to be strictly increasing in both arguments, strictly concave and twice differentiable. We assume that it represents homothetic preferences. Specifically, we assume the following:

Assumption 1. u_x, $u_h > 0$, u_{xx}, $u_{hh} < 0$ with $u_{xh} \geq 0$ and $u(x, 0) = 0 \; \forall x \geq 0$.

Society chooses a tax level $t \in [0, 1]$ via the political process described in Section II.II which is levied on all agents. Tax revenues thus raised may finance three things: (i) income transfer in a lump sum way which we denote by $T \geq 0$, (ii) the provision of healthcare i.e., $h \geq 0$ and (iii) infrastructure/capital investment which we denote by $k \geq 0$. The prices of healthcare and capital investment in terms of the numeraire x are assumed to be unity.[11] Thus, the budget constraint is given by

$$tw = T + h + k.$$

What is the purpose of k? The answer to this question relates *directly* to our second source of heterogeneity among the agents (i.e., age). We posit that k has the ability to influence the (post-redistribution) consumption of the numeraire good differently across age groups. We assume that there are two age groups — the "young" and the "old". The former value k more than the latter. Specifically, upon the implementation of a policy (t, h, k), the numeraire consumption of a young agent is given by

$$x_y = f(k)[w_i(1 - t) + tw - h - k]$$

where $i \in \{p, r\}$ and $f(.)$ satisfies the following:

Assumption 2. $f(0) = 1$, $f' > 0$, $f'' < 0$ with $f'(0) = +\infty$.

For the old agents, k has no such effect. So the numeraire consumption of an old agent is given by

$$x_o = w_i(1 - t) + tw - h - k$$

where $i \in \{p, r\}$. The assumption that $f(k)$ for an old agent is unity for all values of k is made for simplicity. Our core results are substantively unchanged if we instead assume that $x_o = f(\delta k)[w_i(1-t)+tw-h-k]$ for $\delta \in (0, 1)$. The key point is that k benefits the young more than the old.

As mentioned earlier, k denotes capital investment (say, physical infrastructure spending) which augments the market activity and hence the earnings of the young. Our k may also be viewed more broadly as some legal capacity investments like in Besley and

[11] This is without loss of generality in terms of the qualitative results.

Persson (2010) which supports markets and in general production-related activities. The old agent's consumption possibilities do not depend as much upon such current market-augmenting measures by the government.

Healthcare may be supplemented by purchases in the private market as in Epple and Romano (1996) and Levy (2005); we denote this private healthcare by s. This may be exercised by both young and old agents as healthcare is equally valued by both groups. There is, however, no option of supplementing k — hence, whatever k is provided publicly is all there is for the agents to do with. Again, this does not mean that there is no private investment in this economy. It is just that k is the essential public investment required for a market economy to function.

We impose a particular requirement on the availability of the private healthcare services (s). These services are accessible to agents *above* a certain income threshold. In particular, the poor agents *without* any lump sum transfer cannot avail of these services and must necessarily depend on public healthcare. This motivates the following assumption.

Assumption 3. There exists $\underline{w} \in (w_p, w_r)$ such that $s = 0$ for any agent with post-redistribution income lower than $\underline{w}$.

Notice, this does not rule out the possibility of some poor agents accessing s in equilibrium although it makes it contingent upon them receiving a certain level of transfers. Also, we do *not* require $\underline{w}$ to be above w.

The four groups in the population are then the old rich (r_o), the young rich (r_y), the old poor (p_o), and the young poor (p_y). Like in Levy (2005), we assume that none of the four groups composes a majority in the population. We denote the mass of the young agents by $\theta \in (0, 1)$.

As mentioned earlier, we assume that the poor form a majority (i.e., $\pi > \frac{1}{2}$). We also assume that this is true within each age group. For simplicity, we analyse the case where the proportion of the poor within the young and the old are the same. We later discuss the implications of relaxing this assumption.[12]

II.I.I *Ideal policies*

By construction, the set of feasible policies is given by

$$Q \equiv \{(t, k, h) : tw \geq h + k, t \in [0, 1], h, k \geq 0\}.$$

[12]In particular, we show that allowing the old be to richer on average than the young does not affect our results as long as the p_o agents are more numerous than the r_o agents.

We now characterise – for each of the four segments of the population – the ideal policies within this set Q. Let $q^*(i)$ denote the ideal policy of group i where $i \in \{r_o, p_o, r_y, p_y\}$.

Start with the old poor agents — i.e., p_o. Clearly, p_o would like $t = 1$ and $k = 0$ as it entails maximum redistribution and hence the best possibility of consuming both goods (x and h). As k reduces the consumption of the numeraire without delivering any additional gains, p_o would ideally want $k = 0$. Hence, the problem simplifies to the maximisation of $u(w - h, h)$ by choosing $h \in [0, w]$. By Assumption 1, the optimal h – call it $h^*(p_o)$ – lies in the interior.

Now consider the p_y segment of the population. Such an agent would also ideally have $t = 1$. Then the problem simplifies to the maximisation of $u(f(k)[w - k - h], h)$ by choosing $k, h \geq$ with $w \geq k + h$. As $f'(0) = +\infty$, it follows that $k^*(p_y) > 0$. Hence $q^*(p_y) \equiv (t = 1, k^*(p_y), h^*(p_y))$ denotes this ideal policy.

Next, consider the old rich agents — i.e., r_o. Like p_o, these agents will also ideally like $k = 0$. Also, they would ideally set lump sum redistribution $T(= tw - h)$ equal to 0. As for the choice of the tax rate, the r_o agent would like $t = 0$ and hence $h = 0$. To see why, observe that public healthcare provision implies $t > 0$ and this means that for obtaining h equal to the amount of tw, the rich pay tw_r; hence it effectively costs the rich more than unity (the price of private healthcare) per unit of h. Hence, they will rather choose $t = 0$ and purchase a positive level of private healthcare — therefore, $s > 0$. This defines their ideal policy, namely, $q^*(r_o)$.

Finally, we come to the r_y segment of the population. By $f'(0) = +\infty$ in Assumption 2, it must be that r_y sets t, $k > 0$. Like r_o, they would ideally set lump sum redistribution $T(= tw - k - h)$ equal to 0. By the same logic as for r_o, this agent will also set $h = 0$ and $s > 0$. This describes their ideal policy $q^*(r_y)$.

The key features of the above discussion along with some additional observations are collected in the following lemma.

Lemma **1.** *The ideal policies of the four segments display the following properties:*

(i) $k^*(p_y)$ *and* $k^*(r_y)$ *are strictly positive;*
(ii) $k^*(p_o) = k^*(r_o) = 0$*;*
(iii) p_o *prefers* $q^*(p_y)$ *over* $q^*(r_o)$*;*
(iv) $h^*(p_o) < h^*(p_y)$.

By part (i) of Lemma 1, we have that both $f(k^*(p_y))$ and $f(k^*(p_y))$ are strictly greater than unity. This implies, for each income category, the numeraire consumption of the young can be higher than the old's when each agent is allowed to choose their ideal policy. Recognising that all agents – irrespective of age or income – may access the public healthcare provided, this immediately leads us to the conclusion that the utility of the young agents exceeds that of the old agents in each income category. To be sure, in picking the ideal policy the rich agents (both young and old) choose their consumption of private healthcare optimally but that simply re-reinforces the preceding statement. This does not mean that the old agents must necessarily be worse-off in comparison to the younger ones in the aggregate — specifically, the possibility that the old agents may be richer than the young ones on average (in terms of what proportion of the cohort earns w_r as opposed to w_p) is consistent with our framework although the baseline model assumes identical income distributions for each age cohort.[13]

By $h^*(r_o) = h^*(r_y) = 0$ and part (iv) of Lemma 1, it is fair to say that the "demand" for public healthcare expenditure from the old agents is actually lower than that from their younger counterparts.[14] In spite of this, we show later that it is possible for the equilibrium provision of public healthcare to be *higher* when the old are a majority. Notably, this logic is not overturned if we allow for the possibility than the old agents may be richer than the young ones on average.

In the analysis of the political model described below, the focus will be on pure strategy equilibria. To guarantee the existence of pure strategy equilibrium in this general economic environment, we impose the following restrictions on the parameters of the utility function. For $i \in \{p_y, p_o, r_y, r_o\}$, let $v_i(q)$ denote the indirect utility function of i, for any q in the set of feasible policies Q. We will assume that r_o prefers $q^*(r_y)$ over $q^*(p_o)$. In other words, we make the following assumption.

Assumption 4. $v_{r_o}(q^*(r_y)) > v_{r_o}(q^*(p_o))$.

In what follows, we will take Assumptions 1 through 4 as operative unless otherwise stated. We next describe the political process which determines the equilibrium policy for the society.

II.II *The Political Process*

The political process is essentially the same as the one in Levy (2005) which in turn is based on Levy (2004). The two main features of this process are the *endogenous* formation

[13] Section IV discusses this issue in greater detail.

[14] This is because healthcare is a normal good in our setup just like in Epple and Romano (1996) for all agents irrespective of their age.

of parties and the *stability* of the political outcomes. We discuss both features – which are closely inter-related – in some detail below.

As regards a political party's platform, the key idea is that each party can only offer *credible* policies — namely, policies in the Pareto set of its members. By a Pareto set for a party, we mean a set of feasible policies whose elements have the following feature — there is no other feasible policy which leaves all the members of the party weakly better off and some strictly so. When a politician runs as an individual candidate he can only offer his ideal policy, as in the "citizen candidate" model.[15] This means that if a p_o agent runs as a candidate without forming an alliance with any of the other three segments of the population, then the only platform this agent can credibly offer is $q^*(p_o)$. The same consideration naturally applies to each of the other three segments of society — i.e., r_o, r_y and p_y .

If, however, heterogeneous politicians join together to form a party, then matters are quite different. The Pareto set of such a party is larger than the set of the ideal policies of the individual members. For example, the party of the old rich and the old poor can offer all policies with $k = 0$ and different tax rates, $t \in [0, 1]$ and correspondingly $h \in [0, h^*(p_o)]$. In a similar vein, the party of the old rich and the young rich can offer $t \in [0, t^*(r_y)]$ with $h = 0$ and some level of capital investment ranging from 0 to $k^*(r_y)$, and so on. The details regarding the construction of the Pareto set for each possible coalition is contained in the Appendix. This particular structure on policy platforms of the parties reflects the idea that parties allow different groups to come to (efficient) internal compromises.[16]

The party formation process is the first step towards determining the equilibrium policy outcome(s). Given the two markers in our economy, assume that there are four politicians participating in the political process, each representing a different group of voters. Specifically, politician i has the preferences of group $i \in \{r_o, p_o, r_y, p_y\}$.

Let $\mathbf{\Omega}$ be the set of all possible partitions on the set of politicians $\{r_o, p_o, r_y, p_y\}$. Take any partition $\omega \in \mathbf{\Omega}$. For example, $\omega = p_o|p_y|r_o|r_y$ is the partition in which each politician can only run as an individual candidate. Analogously, the partition $p_op_y|r_o|r_y$ denotes that the poor representatives form a party and each of the rich politicians can run as an individual — hence, there are three potential candidates in this situation. Taking the partition of politicians into parties as given, we proceed to the next step which is the

[15] See e.g., Besley and Coate (1997) and Osborne and Slivinski (1996).

[16] The assumption about heterogeneous parties rests on the idea that it is relatively easy for a small group of politicians to monitor one another. The population at large can then trust promises which represent internal compromises in the party. Ray and Vohra (1997) analyse a general model in which agreements within coalitions are binding, as in our setup.

process of election.

In an election all candidates in a given partition simultaneously choose whether to offer a platform and if so, *which* platform in their Pareto set to offer. The entire set of citizens then vote for the platform they like most. The election's outcome is the platform which receives the highest number of votes. If there are ties, then each is chosen with equal probability. If no platform is offered by any candidate, a default status quo is implemented. As is standard, we assume that the status quo is a situation which is worse for all players than any other outcome.[17]

II.II.I *Equilibrium*

Now we are ready to define the equilibrium set platforms for a given partition. A set of platforms given a partition $\omega \in \mathbf{\Omega}$ constitute an equilibrium when given the other platforms, no party can change its action (offering a different platform from within its Pareto set, by withdrawing altogether, or joining the race) and improve the utility of all its members. In effect, the set of platforms constitute mutual best-responses for every party. Given that the platform with the greatest support is the winner, let $\mathbf{q}^*(\omega)$ denote the set of equilibrium winning platforms for the partition ω.

Unlike Levy (2005), we do *not* however assume the following tie-breaking rule: in equilibrium a party does not offer some platform if, given the other platforms that are offered, all party members are indifferent between offering this platform and not running at all.[18]

We characterise *stable* political outcomes — namely, those equilibrium winning platforms and their associated partition which are robust to politicians changing their party membership. Start with a partition $\omega_0 \in \mathbf{\Omega}$ and identify $\mathbf{q}^*(\omega_0)$, i.e., the set of equilibrium winning platforms associated with it. Take any element of $\mathbf{q}^*(\omega_0)$. Next, consider a situation where a politician or group of politicians choose to split from their party, while the rest of the representatives maintain their party membership. In this new induced partition $\omega_1 \in \mathbf{\Omega}$, a new set of equilibrium winning platforms will arise, namely, $\mathbf{q}^*(\omega_1)$. If the deviant splinter group is able to get a (weakly) higher payoff from *any* element in $\mathbf{q}^*(\omega_1)$, then the original equilibrium winning platform associated with the partition ω_0 does *not* constitute a stable political outcome.

[17]Another possible option for the status quo is simply the policy of no redistribution, i.e., a 'government shut-down'. This would not change the analysis in any way.

[18]This is not because we believe that the tie-breaking rule is implausible. We simply do so for a technical reason — not assuming this tie-breaking rule guarantees that we have pure-strategy equilibrium platforms for every possible partition.

In other words, a stable political outcome is an equilibrium winning platform such that *no* politician (or a group of politicians) can break their party and receive a (weakly) higher utility from some equilibrium winning platform in the newly induced partition. Thus, it is robust to such individual or collective deviations.[19]

Political parties are endogenous in the model in the sense that we identify the structure of coalitions and political outcomes such that no group of politicians wish to quit their party. In such a setup, endogenous parties – namely, stable coalitions of different representatives – always arise in equilibrium. The core prediction of our model is therefore the set of stable political outcomes with endogenous parties. One can easily identify the winning platform in any given stable political outcome. In what follows, we will analyse the dependence of the winning platform on the economic and demographic factors.

III MAIN RESULTS

We aim to demonstrate how income inequality and demographic factors affect the provision of public healthcare in this model. By demographic factors, we refer to the relative sizes of the young and old agents in the economy. This is captured succinctly by the size of the young $\theta \in (0, 1)$.

What do we mean by income equality? Given our rather parsimonious set of parameters, we focus on the ratio of the incomes of the rich to that of the poor — hence, $\frac{w_r}{w_p}$ while keeping the mean income w constant. In other words, we focus on mean-preserving spreads as our indicator of increased income inequality. One interesting implication of income inequality is the following. When $\frac{w_r}{w_p}$ is sufficiently low, a p_y agent prefers $q^*(r_y)$ over $q^*(p_o)$; otherwise, the ranking of these policies for p_y is reversed. Intuitively, the age-wise alignment of preference over policies dominates the income-wise alignment of the same for the p_y agents for lower levels of inequality. The following lemma states this more explicitly.

LEMMA **2.** *There exists $\rho^* > 1$ such that as long as $\frac{w_r}{w_p} < \rho^*$, a p_y agent prefers $q^*(r_y)$ over $q^*(p_o)$. For $\frac{w_r}{w_p} > \rho^*$, p_y prefers $q^*(p_o)$ over $q^*(r_y)$.*

To be sure, in the case of "low" inequality (i.e., $\frac{w_r}{w_p} < \rho^*$) the post-redistribution income of p_y is above $\underline{w}$ (defined in Assumption 4) and so the p_y agent is able to purchase private healthcare s; otherwise, a p_y agent would always prefer $q^*(p_o)$ over $q^*(r_y)$ as $h^*(r_y) = 0$ implies $v_{p_y}(q^*(r_y)) = 0$.

[19] The stability requirement used here is the same as the one in Levy (2005).

In what follows, we will use this threshold ρ^* to demarcate the "low" and "high" economic inequality ranges. We begin our analysis with the case where the young agents are a majority in the economy — i.e. $\theta > \frac{1}{2}$.

III.I *Young majority ($\theta > \frac{1}{2}$).*

When the young outnumber the old, it is the p_y group which is the largest of the four segments in society. To gain an intuition for the set of stable political outcomes in this scenario, first consider the case when *no* coalitions are possible — i.e., each of the four groups must run alone if they decide to. Clearly, in such a situation the set of policies that may be offered are the ideal policies of the groups; hence, $q^*(p_y)$, $q^*(r_y)$, $q^*(p_o)$ and $q^*(r_o)$.

In this partition – i.e., $p_o|p_y|r_o|r_y$ – there is only one possible equilibrium outcome. An agent from the p_y group runs offering its ideal policy $q^*(p_y)$ and wins since the p_o group supports it (in case any of the rich agents run). To see why this is the unique equilibrium outcome for this partition, consider the following arguments.

If p_o also ran with its ideal policy on offer, it would not win as r_y would support p_y over p_o (and thus p_y would win as $\theta > \frac{1}{2}$). This derives from the following:
(a) $q^*(p_y)$ offers the same level of utility to all young agents since it involves $t = 1$ and $k > 0$;
(b) $q^*(p_o)$ offers the same level of utility to *all* agents since it involves $t = 1$ and $k = 0$; and
(c) the latter payoff is lower than the former for every young agent — i.e., $v_{j_y}(q^*(p_o)) < v_{j_y}(q^*(p_y))$ for $j \in \{p, r\}$.
If any/both of the rich groups ran, it would not affect the outcome as p_o would support p_y over each rich group since the rich offer $h = 0$ and *no* lump sum income transfer which would enable p_o access to private healthcare ($s > 0$).

Now we ask if allowing coalitions to form can change the above equilibrium outcome. As we demonstrate below, the answer is indeed in the affirmative. However, note that any winning coalition *must* have the support of p_o and r_y. If not, either of these two groups may support p_y and thus form the requisite majority needed for the latter's victory. Moreover, as shown in the Appendix, p_y cannot be part of any coalition because this agent has incentives to break the coalition, run alone and thereby win the election. The p_y agent hence cannot credibly commit to cooperate with other groups. As a result, *any* coalition which wins against p_y must have the support of both p_o and r_y.

This begs the question as to whether there exists some feasible policy which both p_o and r_y prefer over the outcome of $p_o|p_y|r_o|r_y$; otherwise, a coalition including both groups would not be possible. The following lemma addresses this specific question.

LEMMA **3.** *There exists a feasible policy $q \in Q$ such that all agents in p_o, r_y and r_o prefer q over $q^*(p_y)$.*

In the proof of Lemma 3, we demonstrate how by one can construct a feasible policy starting from $q^*(p_y)$ by simultaneously lowering t and k while keeping h at $h^*(p_y)$. The reduction in k should be large enough so that the drop in t does not reduce the overall consumption of the numeraire for p_o. The reduction in t is designed to boost the net consumption of the numeraire for r_y in spite of the reduction in k. Finally, r_o is in favour of such a policy as the level of public healthcare is pegged at the same level (i.e., $h^*(p_y)$) while the lower tax rate enables a greater consumption of the numeraire.

Building on the above lemma, we now state our first main result.

PROPOSITION **1.** *When the young are a majority, then the following obtain:*

(i) An equilibrium always exists.
(ii) Any winning party is composed of the old poor and some rich representatives.
(iii) The equilibrium tax rate is positive but not unity.
(iv) The provision of public healthcare is positive but no higher than $h^*(p_o)$.

The proof of Proposition 1 involves three steps. First, we characterise the Pareto set of policies for each possible coalition (i.e., party). Next, we characterise the equilibrium platform(s) for each possible partition. Finally, we are able to identify the stable political outcomes based on the various equilibrium payoffs deduced in the preceding step. The details are documented in the Appendix.

To develop the intuition behind the results in Proposition 1, we revert to the discussion about how any winning coalition necessarily needs to secure the support of the p_o and r_y groups. Now, these two sets of agents must get a payoff above what $q^*(p_y)$ offers them. By Lemma 3, we know that at least one such feasible policy does exist. Hence, one possibility is that they form a party – i.e., $p_o r_y$ – and offer some policy from their Pareto set which meets this requirement.[20] As long as this policy from their Pareto set is preferred by the r_o agents to $q^*(p_y)$, this meets the requirement for being an equilibrium policy. Clearly, neither p_o nor r_y stand to gain from splitting the party as then we are back in the $p_o|p_y|r_o|r_y$ world where $q^*(p_y)$ is the only possible outcome.

[20]The policy constructed in the proof of Lemma 3 actually does not belong to the Pareto set of the party $p_o r_y$. The details are available in the Appendix.

By a similar logic, it may be possible for all the old agents to form a party – i.e., $p_o r_o$ – and offer something from their Pareto set which every old agent and r_y prefer over $q^*(p_y)$. Clearly, such a policy involves a positive tax rate (which is less than unity) and $k = 0$.[21] Again, neither p_o nor r_o would want to break this coalition as that would catapult them into the $p_o|p_y|r_o|r_y$ scenario with $q^*(p_y)$ as the (only possible) outcome.

In both these equilibrium partitions – namely, $p_o r_y|r_o|p_y$ and $p_o r_o|r_y|p_y$ – the provision of public healthcare is positive. This is so as the p_o agents value healthcare (recall $u(x, 0) = 0$ for every $x \geq 0$ by Assumption 1) and the rich prefer spending tax revenue on public healthcare rather than face higher tax rates under the $p_o|p_y|r_o|r_y$ scenario. By the preceding discussion, it is apparent that the multiplicity of equilibria arises not only from the different partitions but also from the variety of policies in the relevant Pareto sets which meet the equilibrium criteria.

III.I.I *The effect of income inequality*

By Lemma 2, which side of ρ^* the term $\frac{w_r}{w_p}$ lies on, determines p_y preferences as regards $q^*(p_o)$ and $q^*(r_y)$. The ranking of these two ideal policies by p_y is however not crucial in the case of $\theta > \frac{1}{2}$. This is essentially because the party formation process relies on the exclusion – rather than inclusion – of p_y by enlisting the support of p_o and r_y. Hence, regardless of the value of $\frac{w_r}{w_p}$ vis-a-vis ρ^* the results of Proposition 1 apply.

There is one aspect, however, which *does* depend on income inequality — this concerns the equilibrium level of k. One can sharpen the predictions of Proposition 1 in this regard.

PROPOSITION **2.** *When the young are a majority, the level of k offered in equilibrium depends upon $\frac{w_r}{w_p}$. In particular, when this ratio is sufficiently low (while above unity), $k > 0$ in all equilibrium platforms.*

The idea behind the above result is quite straightforward. Consider a policy of positive taxation and provision of public healthcare and $k = 0$ which delivers the old poor agents a payoff higher than what $q^*(p_y)$ offers them. Such a policy might leave the rich young agents with sufficient disposable income to obtain amounts of the numeraire good and private healthcare so that they prefer the policy over $q^*(p_y)$. In other words, the post-redistribution income for r_y from this policy after netting out the private healthcare expenditure exceeds $f(k^*(p_y))[w - h^*(p_y) - k^*(p_y)]$. Notice, for this to be possible, w_r needs to be "sufficiently" high relative to the average income w in order to counteract

[21] The fact that k must be zero follows from the definition of the Pareto set of the old agents.

the effect of $f(k^*(p_y))$.[22] With continued reduction in income inequality, this is no longer feasible after a point. Hence, in such a scenario, to keep the rich young's payoff above $v_{r_y}(q^*(p_y))$ some positive level of capital spending *has* to be provided.

The implications of income inequality are far more substantial in the case when the old agents form a majority in society. This is what we examine in the next section.

III.II *Old majority ($\theta < \frac{1}{2}$).*

In this scenario, the magnitude of $\frac{w_r}{w_p}$ relative to ρ^* is a crucial determinant of the equilibrium outcome. Taking cognisance of this issue, we analyse each case separately.

III.II.I *Low Inequality ($\frac{w_r}{w_p} < \rho^*$).*

Like in the case of $\theta > \frac{1}{2}$, we will begin with the examination of the case where no coalitions are possible — i.e., $p_o|p_y|r_o|r_y$. To keep the analysis tractable, we make one further assumption.

Assumption 5. The mass of the rich agents taken together (i.e., r_y and r_o) exceeds that of the poor old agents (p_o).

With the above assumption in place, we are able to characterise for $p_o|p_y|r_o|r_y$ a unique pure strategy equilibrium. In this equilibrium, both p_y and r_y run and the policy which wins is $q^*(p_y)$.[23] Note that p_o does *not* run. If p_o did, then $q^*(p_o)$ would not win since $q^*(r_y)$ would defeat $q^*(p_o)$ given Assumption 5 (as r_o prefers $q^*(r_y)$ over $q^*(p_o)$ by Assumption 4). Knowing this, the p_o agent will not run as s(he) prefers $q^*(p_y)$ over $q^*(r_y)$; hence, it is better for p_o to not offer a platform. Given that both p_y and r_y are running, r_o cannot gain by running. By running, r_o would not affect the outcome – i.e., $q^*(p_y)$ – as p_o would vote for $q^*(p_y)$, as would all the p_y agents.

There is no other equilibrium set of platforms for this partition.[24] Any one agent running while the other three do not is not an equilibrium. Take p_y. If p_y decides to run and nobody else does, then p_o can profitably deviate. This is how – by running, p_o wins the election since r_o prefers $q^*(p_o)$ over $q^*(p_y)$ and the old are a majority. Note, p_o running and nobody else doing so is not an equilibrium as r_y can run and win (with r_o and p_y's support). Similarly, r_y running and nobody else doing so is not an equilibrium either —

[22] Recall, $f(k^*(p_y))$ exceeds unity as $k^*(p_y) > 0$.

[23] This is where *not* imposing the tie-breaking rule in Levy (2005) makes a difference. By that rule, r_y would not run and thus nullify this equilibrium.

[24] To be precise, there is no other equilibrium set of platforms in pure strategies.

p_y can run and win (with p_o's support). Finally, observe that r_o as the solitary candidate is not an equilibrium as p_y can run and defeat r_o's platform.

In light of the above, much like in the case of $\theta > \frac{1}{2}$, the equilibrium outcome for $p_o|p_y|r_o|r_y$ is p_y's ideal policy. What is noteworthy is that here p_y manages to win despite being *smaller* than p_o. Given the 'no-party' outcome (i.e., $q^*(p_y)$ winning), the equilibria for the $\theta > \frac{1}{2}$ case immediately become candidate equilibria for this scenario. Before examining that more carefully, we briefly discuss what happens when Assumption 5 is violated.

When the mass of the rich is indeed smaller than that of the old poor, then for $p_o|p_y|r_o|r_y$ having p_y and r_y run is no longer an equilibrium. Observe that here if p_o runs too then the winner will be $q^*(p_o)$ as p_o is larger than either p_y or the rich agents. But then this is not an equilibrium either, as p_y can gain by not running. If p_y does not run then r_y would win with r_o and p_y's support — recall, the p_y agent prefers $q^*(r_y)$ over $q^*(p_o)$ in this scenario. In fact, there is no equilibrium in pure strategies for this situation. There is one in mixed strategies since this 'no-party' game is finite; however, the details of such an equilibrium is quite dependent on parametric assumptions. Therefore, we prefer to impose Assumption 5 for analytical tractability. We would like to emphasise that the *key* demarcation between the rich and the poor in this model is that the mean income lies below the former's income and above the latter's. Hence, Assumption 5 is quite plausible in most settings particularly when one considers that the old agents are in fact richer on average in reality than their younger counterparts.

We now present the main result as regards the stable political outcomes for this scenario.

PROPOSITION **3.** *When the old are a majority and the level of income inequality is such that $\frac{w_r}{w_p} < \rho^*$, then the following obtain:*

(i) An equilibrium always exists.

(ii) Any winning party is composed of the old poor and some rich representatives.

(iii) The equilibrium tax rate is positive but not unity.

(iv) The provision of public healthcare is positive but no higher than $h^*(p_o)$.

(v) The provision of capital investment is nil, i.e., $k = 0$, in some equilibrium platforms.

Like in the case of Proposition 1, we proceed to identify the stable political outcomes for this scenario by first working out all the equilibria for all possible partitions and then eliminating the ones which have profitable deviations by some agents.

There are several similarities between the set of equilibria in this scenario and the one for the young majority case. The main distinction lies in the equilibrium level of capital investment. As noted in Proposition 2, the level of k is positive for sufficiently low levels of income inequality when the young are a majority, while by part (v) of Proposition 3 we have $k = 0$ in some equilibrium platforms when the old constitute a majority. This difference arises from the fact that now the old agents by themselves can win with $k = 0$ as they constitute a majority — hence, there is no need to ensure (by offering $k > 0$) that p_y agents prefer their party's policy over $q^*(p_y)$.

The situation is altogether different in the case of $\frac{w_r}{w_p} > \rho^*$ with the old being the majority.

III.II.II *High Inequality ($\frac{w_r}{w_p} > \rho^*$).*

When $\frac{w_r}{w_p} > \rho^*$, we know – by Lemma 2 – that the p_y agents prefer $q^*(p_o)$ over $q^*(r_y)$. This, in conjunction with the fact that the old are a majority, implies that in the $p_o|p_y|r_o|r_y$ partition it is p_o who will win (with p_y's support if any of the rich agents run). The arguments are basically identical to the corresponding case of $\theta > \frac{1}{2}$ and we omit them for the sake of brevity.

We next examine if allowing coalitions to form can change the equilibrium outcome. It is clear that any winning coalition *must* have the support of p_y and r_o. If not, either of these two groups may support p_o and thus form the requisite majority needed for the latter's victory. Moreover, as discussed in the Appendix, p_o cannot be part of any coalition because this agent has incentives to break the coalition, run alone and thereby win the election. The p_o agent hence cannot credibly commit to cooperate with other groups. As a result, *any* coalition which needs to win against p_o must do so with the support of p_y and r_o. But for that to transpire, one needs to ensure that such a winning policy is indeed feasible. The following lemma argues that is indeed the case.

Lemma **4.** *There exists a feasible policy $\tilde{q} \in Q$ such that all agents in p_y, r_o and r_y prefer $\tilde{q}$ over $q^*(p_o)$.*

In the proof of Lemma 4, we construct a feasible policy starting from $q^*(p_o)$ by suitably choosing t and k while pegging h at $h^*(p_o)$. The key idea is to ensure that p_y and r_o (individually) are guaranteed a level of numeraire consumption *higher* than what $q^*(p_o)$ delivers to them. Our assumptions on the returns from k to the young – particularly, $f'(0) = +\infty$ and $f'' < 0$ – are sufficient to ensure that this is possible. Moreover, such a policy is also more appealing to r_y over $q^*(p_o)$ as the numeraire consumption delivered to this agent exceeds that to r_o (as $k > 0$ and hence $f(k) > 1$) which, in turn, exceeds the one from $q^*(p_o)$.

Using the lemma above, we proceed to identify the stable political outcomes for this scenario by first working out all the equilibria for all possible partitions and then eliminating the ones which have profitable deviations by some agents. The properties of such equilibrium outcomes are stated in more detail below.

Proposition **4.** *When the old are a majority and the level of income inequality is such that* $\frac{w_r}{w_p} > \rho^*$, *then the following obtain:*

(i) An equilibrium always exists.

(ii) Any winning party is composed of the young poor and some rich representatives.

(iii) The equilibrium tax rate is positive but not unity.

(iv) The provision of public healthcare is positive but no higher than $h^*(p_y)$.

(v) The provision of capital investment is positive, i.e., $k > 0$ *in all equilibria.*

As discussed earlier, for a coalition to be stable it has to have the support of the young poor and the old rich agents. One possibility is that these two groups form a party and offer some policy from their Pareto set which each party member *and* the young rich prefer over the ideal policy of p_o. As the young value k more than the old and $f'(0) = +\infty$, setting $k > 0$ is an efficient way to garner the former's support. To ensure that both sets of rich agents enjoy a level of consumption of the numeraire good above what $q^*(p_o)$ offers, the equilibrium tax rate is less than unity. Clearly, neither the young poor nor the old rich agents have any incentive to break this coalition as doing so results in them receiving lower payoffs respectively from $q^*(p_o)$.

Next, we establish the existence of an equilibrium platform where the level of public healthcare is actually in excess of what the poor old agents would ideally want. The following proposition contains the relevant details.

Proposition **5.** *When the old are a majority and the level of income inequality is such that* $\frac{w_r}{w_p} > \rho^*$, *then there always exists an equilibrium outcome where* $h \in (h^*(p_o), h^*(p_y)]$.

III.III *Comparisons in terms of public goods provision*

Our analysis allows for some comparisons in terms of public goods provision across different levels of inequality and demographic composition. In all three cases – i.e., $\theta > \frac{1}{2}$, $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$, and $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$ – the stable political outcome in equilibrium is generically not unique. The multiplicity arises not only in terms of the possible partitions but also in terms of the platforms offered in equilibrium. This makes a straightforward comparison of public goods provision across the different scenarios quite challenging.

Nonetheless, some clear distinctions do emerge. We highlight them below.

First, contrast the case of $\theta > \frac{1}{2}$ with that of $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$. These are more "alike" as the party formations in equilibrium are geared towards the avoidance of the emergence of $q^*(p_y)$ as the equilibrium outcome in these two cases. In fact, *all* equilibria in the case of $\theta > \frac{1}{2}$ except those involving $k > 0$ (in the $p_o r_y r_o | p_y$ partition) are also equilibria in the case of $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$. The ones with $k > 0$ in the $p_o r_y r_o | p_y$ partition are *not* equilibria when $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$ since the $p_o r_o$ group can deviate gainfully to induce the $p_o r_o | r_y | p_y$ partition by keeping the same tax rate h but setting $k = 0$ and adjusting h upwards accordingly. Notice, the old agents would win by breaking away and offering this platform as the old are a majority.[25] Hence, the set of equilibrium outcomes for $\theta > \frac{1}{2}$ and those for $\theta < \frac{1}{2}$ with $\frac{w_r}{w_p} < \rho^*$ differ by only those cases.

The following result sheds light in terms of the differences in public goods provision across these two different scenarios.

PROPOSITION **6.** *Consider the equilibrium winning platforms for two alternative situations: (a) when the young are a majority and (b) when the old are a majority and* $\frac{w_r}{w_p} < \rho^*$ *("low" income inequality). For the stable political outcomes that do not overlap for (a) and (b), the following obtain:*

(i) the level of k *is positive in such equilibrium winning platforms in scenario (a) and nil in scenario (b); and*

(ii) for any equilibrium winning platform in (a) there is a corresponding equilibrium winning platform in (b) with the same tax rate and where the level of h *is (weakly) higher.*

The above result clearly indicates that the level of capital spending tends to be higher when the young are a majority as compared to when the old are a majority with "low" income inequality in *all* the cases where the equilibrium winning platforms differ between the two scenarios. As the young prefer k more than the old, it suggests a positive cohort size effect when income inequality is "low" (recall Proposition 2).

Also, part (ii) of Proposition 6 suggests that the set of equilibrium platforms with the $p_o r_o | r_y | p_y$ partition for the for $\theta < \frac{1}{2}$ with $\frac{w_r}{w_p} < \rho^*$ scenario may involve greater public healthcare as compared to the ones with $k > 0$ in the $p_o r_y r_o | p_y$ partition. In this particular sense, one may claim that the case of the old majority with "low" inequality is associated with a higher level of public healthcare provision relative to the young majority case. Taken together, Proposition 6 suggests a type of substitution across the two publicly provided goods when one compares the young majority case with the case where the old are a majority with "low" income inequality.

[25] Also, both p_o and r_o gain by this deviation.

Next, we focus on the old majority case and compare between the "low" and "high" inequality scenarios. The comparison here is more complicated than in the previous situation, as the composition of the winning party is quite different in the two cases. As recorded in Proposition 3, in the "low" inequality case it is the *old* poor and some rich representatives while in the case of "high" inequality, it is the *young* poor and some rich representatives (see Proposition 4). In the latter case, the party formations in equilibrium are geared towards the avoidance of the emergence of $q^*(p_o)$ as the equilibrium outcome. Hence, there is no clear way to compare the set of equilibrium winning platforms in one case with those in the other.

Proposition 5 does, however, provide an important insight in this regard. This proposition establishes that there is a set of equilibrium winning platforms in the "high" inequality scenario where public healthcare provision is greater than in *any* equilibrium under the "low" inequality scenario. In other words, *no* equilibrium winning platform in the "low" inequality scenario can match these levels of public healthcare provision (described in Proposition 5) by part (iv) of Proposition 3. To be sure, given the multiplicity of equilibria in both scenarios there could be some equilibrium outcome in the "high" inequality scenario where public healthcare provision exceeds that under *some* equilibrium outcome in the "low" inequality scenario. However, on the basis of the upper bound of public healthcare provision in equilibrium, it is fair to claim – for the old majority case – that the "high" inequality scenario has a greater potential to deliver a greater level of public healthcare provision than the "low" inequality one.

In terms of the level of capital spending, Proposition 4 tells us that the "high" inequality scenario always delivers a positive level of spending in equilibrium although the same does not apply to the "low" inequality scenario (recall, in particular, the cases where the old form a party and win while offering $k = 0$).

In sum, one may thus stake the following claim: the equilibrium level of public healthcare provision associated with the young majority scenario is – on average – lower than that under the old majority one. Additionally, within the old majority scenario, the "high" inequality case has a greater potential to deliver a greater level of public healthcare provision than the "low" inequality one. Thus, income inequality may actually *not* be detrimental for public healthcare provision. This appears to be counter-intuitive on the surface, but follows from the logic of political party formation conjoined with the idea that healthcare is a normal good for all agents irrespective of age. As regards to the level of capital spending, there appears to be a a positive cohort size effect when income inequality is "low" but not necessarily so when income inequality is "high".

III.IV *Income distribution by age cohorts.*

In the baseline model, we assumed that the distribution of incomes among the young agents coincides with that among the old ones. This was done for simplicity and is not strictly necessary for our results. We can allow for the old agents to have a higher proportion of rich individuals relative to the young agents. As long as the poor old agents outnumber the rich old agents, nothing in our analysis is altered. In fact, by allowing this we may ensure that Assumption 5 is more easily satisfied.

When the old are richer than the young on average, it implies that for some values of θ lower than $\frac{1}{2}$ but "close" p_y may still be the largest (sub)group just like in the $\theta > \frac{1}{2}$ case. This possibility, however, does not change the equilibrium outcome for the either the "high" inequality or the "low" inequality scenario. The "low" inequality scenario is perhaps obvious as the $p_y|p_o|r_y|r_o$ partition in that case still leads to $q^*(p_y)$ as the equilibrium outcome. In the case of "high" inequality, the following transpires in the $p_y|p_o|r_y|r_o$ case: the p_o agent runs and wins with the ideal policy $q^*(p_o)$. Although p_y is larger than p_o, the former cannot run and win against the latter as r_o would support $q^*(p_o)$ over $q^*(p_y)$; this guarantees p_o's victory given that the old are a majority. Thus, nothing of substance is altered.

IV DISCUSSION

We discuss two specific issues here. The first confronts the issue of population ageing and the second relates our results to the current coronavirus pandemic.

IV.I *Implications regarding population ageing.*

It may be fair to claim that the most significant global demographic trend of the 21st century is population ageing. This is driven by three primary forces: declining fertility, increasing longevity, and the progression of large contingents to older ages. Nearly every country – be it rich or poor – is seeing a substantial rise in the share of its population over 60. Does every country have the necessary institutions and policies in place to promote economic and social security among older people in a financially sustainable way? The answer is possibly in the negative. While such a multi-faceted question cannot be comprehensively tackled in the current paper, we can however focus on a pertinent aspect of this issue.

Observe, our model can only be applied to democracies — it offers no insights on popu-

lation ageing in non-democratic setups. In terms of the structure of the model, there are three distinct cases which arise from population ageing:
(a) there is a movement from $\theta > \frac{1}{2}$ (young majority case) to $\theta < \frac{1}{2}$ (old majority case);
(b) there is a drop in θ while not crossing $\frac{1}{2}$ for $\theta > \frac{1}{2}$ (young majority case); and
(c) $\theta < \frac{1}{2}$ (old majority case) initially and continues to be so due to population ageing.

Consider case (a) first. Based on the discussion in section III.III, this movement from $\theta > \frac{1}{2}$ (young majority) to $\theta < \frac{1}{2}$ (old majority) implies that an upward movement in public healthcare provision is possible. Moreover, in societies where income inequality is relatively high, increased provision of *both* public healthcare and capital spending is possible (recall Propositions 2, 4 and 5). Hence, an ageing population may be able to adjust for its needs – at least, to an extent – by virtue of the democratic process in this particular scenario.

Now consider case (b). As stated in Proposition 1 and in the discussion thereafter, there is a multiplicity of equilibria for the young majority case. As we have not applied any equilibrium selection criteria in our analysis, we cannot make any definite prediction about the direction of changes in either public healthcare or capital spending arising from a fall in θ while the young remain a majority.[26]

Several developing countries would fall under cases (a) and (b). In fact, the demographic dividend in such countries could be (partially) offset by the process of population ageing. Our analysis suggests that high inequality may not actually be hindrance in the allocation of public spending in such a context.

For case (c), the considerations for case (b) apply *mutatis mutandis.*

IV.II *Implications regarding Covid-19.*

A pandemic like Covid-19 could affect the economy in various ways. We elaborate on a few possibilities within the context of our setup.

(i) It may lead to a preference shift in favour of healthcare relative to the numeraire across the entire population. The obvious implication of this shift would be an increase in $h^*(p_o)$ and $h^*(p_y)$ which would result in "a level effect" for all equilibrium platforms in all scenarios (young majority, old majority with either "high" inequality or "low" inequality).

(ii) It may cause a demographic shift owing to differential vulnerability to the pandemic.

[26]It is possible to envisage some bargaining between the members of the winning coalition which may well depend upon θ, but we refrain from imposing this additional structure on the theoretical setup.

Specifically, the old may suffer more fatalities and thus there could be an increase in the population share of the young agents. Thus, for economies where θ was slightly below $\frac{1}{2}$, the pandemic fatalities could move θ to just over $\frac{1}{2}$. Based on the discussion in section III.III, this effect on θ implies that a downward movement in public healthcare provision is possible.

(iii) It may cause incomes to fall but in a way that economic inequality would increase. Ghosh (2020) argues that the lockdowns induced by the pandemic not only depress the national income but also hurt the poor more than the rest and thereby leave the economy more unequal than before the pandemic. In terms of our model parameters, this means a decrease in w and an increase in $\frac{w_r}{w_p}$. The effect of a fall in w is straightforward. It causes $h^*(p_o)$ and $h^*(p_y)$ to decline since healthcare is a normal good.

The effects of an increase in $\frac{w_r}{w_p}$ are more complex. When the young are a majority, the set of equilibrium platforms are not necessarily affected in any particular direction. By Proposition 2, it may be the case that the possibility of having $k > 0$ is reduced but this does not suggest anything definite regarding public healthcare provision. Such a scenario is more likely to be representative of several developing countries where investments in public healthcare is typically low and the middle income and rich sections of the population rely on private healthcare facilities.

When it comes to the old majority scenario, a rise in $\frac{w_r}{w_p}$ can potentially have a significant effect. To be specific, if the increase in inequality results in $\frac{w_r}{w_p}$ exceeding ρ^* starting from $\frac{w_r}{w_p} < \rho^*$, then there is a possibility that public healthcare provision in equilibrium might actually rise based on the discussion in section III.III. Otherwise, an increase in $\frac{w_r}{w_p}$ has no definite effect on the set of equilibria.

After taking stock of points (i) — (iii), what can one say about the net effect of such a pandemic on public healthcare provision? For the young majority case (i.e., $\theta > \frac{1}{2}$ prior to the pandemic), the effect in (i) would tend to increase public healthcare provision while the fall in w would tend to depress it. Hence, the net effect in such a scenario is ambiguous. Although from a relative perspective, it is fair to claim that the demand for healthcare increases since h/w goes up. For the situation where the pandemic shifts θ to above $\frac{1}{2}$, there is an additional downward force on public healthcare provision owing to the effect in (ii). For $\theta < \frac{1}{2}$ even after the pandemic, the effect in (i) would tend to increase public healthcare provision as would the effect of increased inequality; however, there would still be a downward force owing to the fall in w. Again, relative to income levels one may claim that healthcare spending has increased.

In sum, the net effect on public healthcare provision for the old majority case (post-pandemic) would be more substantive (and positive) than for the young majority case ($\theta > \frac{1}{2}$ prior to *and* after the pandemic). This is due to the rise in income inequality which then leads to a greater demand for healthcare spending.

It is important to bear in mind that the magnitude of the demographic shift is itself a function of – *inter alia* – the level of public healthcare provision as the poor may be more susceptible to the pandemic than the rich (greater exposure, social distancing less feasible and the like). It is the case that the ambient levels of government spending on healthcare – even in percentage of national income terms – is significantly lower in developing countries than in the developed ones (see e.g., Tandon, Fleisher, Li and Yap (2014)). This implies that the magnitude of the demographic shift could be more substantial for poorer nations.

V CONCLUSION

In this paper, we have explored how economic inequality may affect the level of public spending on healthcare in democracies. Insofar as public healthcare spending is seen as a form of redistribution (in kind) from the rich to the poor, it is natural to expect a relationship between its provision and the income distribution in society. We also highlight how this relationship is affected by the demographic composition of the electorate. To do so, we utilise a multi-dimensional model of political decision-making with endogenous political parties. Our setup builds on Epple and Romano (1996) and Levy (2005), and by expanding on the policy space we are able to make some novel predictions.

Like in Levy (2005), the voters in our model differ in terms of income and age and that there is a political process which determines the tax rate and the allocation of the revenues between income redistribution and public spending. However, unlike Levy (2005) we allow for *two* forms of public spending — healthcare and capital investment. The former is equally valued by all agents but the latter is preferred more by young agents than the old ones (much like education in the extant literature). We demonstrate that when the young are a majority the level of public healthcare spending tends to be lower on average than when the young are a minority. Moreover, when the old are a majority the equilibrium level of public healthcare *crucially* depends upon the extent of income inequality in a more fundamental way than in the young majority case. We show how increases in income inequality may actually lead to higher levels of public healthcare spending, contrary to popular perception.

In terms of the results of the effects of income inequality, we observe a parallel with the findings of Levy (2005). Levy (2005) shows that when the old are a majority, higher income inequality may increase both tax rates and public education. Our analysis demonstrates that when the old are a majority then increasing income inequality may lead to equilibria where capital spending *and* public healthcare provision is higher; see Proposition 5 in particular. Furthermore, Levy (2005) has that in the young majority scenario, higher income inequality may decrease tax rates. This is possible in our setup too.

What is key is the nature of the political compromises made by the different sections of society. Essentially, the two markers in this society (age and income) present a real trade-off. This is particularly so for the young poor agents. If income inequality is sufficiently low then the young poor agents may prefer to align with the young rich rather than the old poor agents. This makes a critical difference in the equilibrium political alliances when the old are a majority. And *that* is the main driving force behind our results.

Our findings shed light on some of the key determinants of the existing variation in public healthcare spending across various democracies. Our results demonstrate how in the case of the old being a majority and inequality being sufficiently high, there is an equilibrium level of public healthcare provision which *always* exceeds the maximum level of public healthcare possible in equilibrium when either the inequality is lower or when the young are a majority. Hence, both cohort size and income inequality are critical factors in determining public spending on items valued equally by all age cohorts. In terms of empirical work, our results suggest the need for further analysis – both at the national and sub-national levels – which looks simultaneously at the composition of parties or coalitions, the level of economic inequality, the level of public provision of healthcare as well as the consumption of private healthcare services.

Our analysis can shed some light on policy formulation pertaining to one of the most significant global demographic trends of the 21st century — namely, population ageing. Our results suggests that an ageing population may be able to adjust for its needs – at least, to an extent – by virtue of the democratic process of the determination of taxation and public spending. Finally, our results speak to the on-going coronavirus pandemic by outlining some implications of the same for public healthcare spending in the near future. We also highlight the differing implications for developed and developing nations. Hence, this should be of interest to academics and policy-makers alike.

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APPENDIX

Proof. [Lemma 1.]

Parts (i) and (ii) have been established in the main body.

For part (iii), note that $q^*(r_o)$ implies $t = h = k = 0$. Hence, from $q^*(r_o)$ a p_o agent gets utility $u(w_p, 0) = 0$ by Assumption 1.
Note, $q^*(p_y)$ implies $t = 1$ and $h,\ k > 0$. Hence, from this policy a p_o agent gets utility $u(w-h-k, h)$. Observe that p_y gets $u(f(k)[w-h-k], h)$ from $q^*(p_y)$; hence, $u(f(k)[w-h-k], h) > u(w-h, h)$ by revealed preference. This establishes $w-h-k > 0$. This implies $u(w-h-k, h)$ must be strictly positive and hence establishes part (iii).

For part (iv), first note that the standard two-good utility maximising condition will apply for both $q^*(p_y)$ and $q^*(p_o)$. Specifically, $u_x(x^*(p_y), h^*(p_y)) = u_h(x^*(p_y), h^*(p_y))$ for p_y and $u_x(x^*(p_o), h^*(p_o)) = u_h(x^*(p_o), h^*(p_o))$ for p_o since the price of h equals that of x and the solutions are interior.

Now, as p_y prefers $q^*(p_y)$ over $q^*(p_o)$ (by definition), it follows

$$u(f(k^*(p_y))[w-k^*(p_y)-h^*(p_y)], h^*(p_y)) > u(w-h^*(p_o), h^*(p_o)).$$

Suppose $h^*(p_y) \leq h^*(p_o)$. Then $f(k^*(p_y))[w-k^*(p_y)-h^*(p_y)] > w-h^*(p_o)$. As $u_{xx} < 0$ and $u_{xh} \geq 0$, then given $h^*(p_y) \leq h^*(p_o)$ it must be that

$$u_x(f(k^*(p_y))[w-k^*(p_y)-h^*(p_y)], h^*(p_y)) < u_x(w-h^*(p_o), h^*(p_o)).$$

By the first-order conditions then it follows that

$$u_h(f(k^*(p_y))[w-k^*(p_y)-h^*(p_y)], h^*(p_y)) < u_h(w-h^*(p_o), h^*(p_o)).$$

As $f(k^*(p_y))[w-k^*(p_y)-h^*(p_y)] > w-h^*(p_o)$ and $u_{hh} < 0$, the above relation implies $h^*(p_y) > h^*(p_o)$. This contradicts the initial supposition and completes the proof. ∎

Proof. [Lemma 2.]

Consider $q^*(r_y)$ and $q^*(p_o)$. As r_y strictly prefers the former over the latter, we have

$$u(f(k^*(r_y))[w_r(1-t^*(r_y))-s^*(r_y)], s^*(r_y)) > u(w-h^*(p_o), h^*(p_o)).$$

Let $w' = \frac{w_r}{\rho}$ where $\rho > 1$. Now consider $u(f(k^*(r_y))[w'(1-t^*(r_y))-s^*(r_y)], s^*(r_y))$ and

$u(w - h^*(p_o), h^*(p_o))$. Clearly, for $\rho \to 1$,

$$u(f(k^*(r_y))[w'(1 - t^*(r_y)) - s^*(r_y)], s^*(r_y)) > u(w - h^*(p_o), h^*(p_o)).$$

Now, let s' denote the optimal choice for the maximisation of $u(f(k^*(r_y))[w'(1-t^*(r_y)) - s], s)$. Thus, for ρ sufficiently close to 1,

$$u(f(k^*(r_y))[w'(1 - t^*(r_y)) - s'], s') > u(w - h^*(p_o), h^*(p_o)).$$

As $u(f(k^*(r_y))[w'(1-t^*(r_y)) - s'], s')$ is monotonically decreasing in ρ, there exists $\rho^* > 1$ such that

$$u(f(k^*(r_y))[w_r(1 - t^*(r_y))/\rho^* - s'(\rho^*)], s'(\rho^*)) = u(w - h^*(p_o), h^*(p_o)).$$

Hence, $\frac{w_r}{w_p} > (<)\rho^*$ implies $v_{p_y}(q^*(r_y)) < (>)v_{p_y}(q^*(p_o))$. ■

Proof. [Lemma 3.]

Start with policy $q^*(p_y)$. Consider a policy $q \in Q$ with $t' \in (0,1)$, $k' \in (0, k^*(p_y))$ and $h = h^*(p_y))$ so the numeraire consumption of p_o is higher than $w - k^*(p_y) - h^*(p_y)$. Hence, we need to ensure that

$$(1 - t')w_p + t'w - k' - h^*(p_y) > w - k^*(p_y) - h^*(p_y).$$

Let $t'w - k' = w - k^*(p_y)$. Observe that, by construction, p_o prefers this policy over $q^*(p_y)$.

If we can show that for this q, the numeraire consumption of r_y is greater than $f(k^*(p_y))[w - k^*(p_y) - h^*(p_y)]$, then the proof is complete. The numeraire consumption of r_y from q is

$$f(k')[(1 - t')w_r + t'w - k' - h^*(p_y)] = f(k')[(1 - t')w_r + w - k^*(p_y) - h^*(p_y)].$$

By using $k' = k^*(p_y) - w(1 - t')$, we can rewrite the above as

$$f(k^*(p_y) - w(1 - t'))[(1 - t')w_r + w - k^*(p_y) - h^*(p_y)].$$

Let $Z(t) \equiv f(k^*(p_y) - w(1 - t))[(1 - t)w_r + w - k^*(p_y) - h^*(p_y)]$.
Observe that $Z(1) = f(k^*(p_y))[w - k^*(p_y) - h^*(p_y)]$.

Consider the problem of choosing t to maximise $Z(t)$. Straightforward differentiation yields:

$$Z'(t) = wf'(k^*(p_y) - w(1-t))[(1-t)w_r + w - k^*(p_y) - h^*(p_y)] - w_r f(k^*(p_y) - w(1-t)).$$

$$Z''(t) = w^2 f''(k^*(p_y) - w(1-t))[(1-t)w_r + w - k^*(p_y) - h^*(p_y)] - 2w_r w f'(k^*(p_y) - w(1-t)).$$

Clearly, $Z'' < 0$ as $f' > 0$ and $f'' < 0$ implying that Z is concave in t. Note that

$$Z'(1) = wf'(k^*(p_y))[w - k^*(p_y) - h^*(p_y)] - w_r f(k^*(p_y)) < 0$$

as $f'(k^*(p_y))[w - k^*(p_y) - h^*(p_y)] = f(k^*(p_y))$ by the definition of $q^*(p_y)$. Hence, by continuity, $\exists \epsilon > 0$ such that $\forall t \in (1-\epsilon, 1)$,

$$Z(t) > Z(1) = f(k^*(p_y))[w - k^*(p_y) - h^*(p_y)].$$

Choosing t' from this $\epsilon-$ interval ensures that r_y prefers q over $q^*(p_y)$.

Finally, note that r_o prefers q over $q^*(p_y)$ as both policies offer the same h while

$$(1-t')w_r + t'w - k' - h^*(p_y) > (1-t')w_p + t'w - k' - h^*(p_y) > w - k^*(p_y) - h^*(p_y)$$

guarantees a higher level of the numeraire good. ■

For the proofs of the main Propositions we go through a set of steps – similar to Levy (2005) – in order to identify the stable political outcomes.

Step 1: Pareto sets of all possible parties.

We will denote the Pareto set of party i by $PS(i)$.

Given the Pareto set of any two groups, the rest (i.e., the Pareto set of three groups) follows from the union of all bilateral Pareto sets.

Consider the party $p_o r_y$.

$$PS(p_o r_y) = \{(t, k, h) \in Q : k \leq k^*(r_y), h \leq h^*(p_o)\}.$$

As p_o prefers $k = 0$ over $k > 0$ and $q^*(r_y)$ has $k = k^*(r_y)$, $PS(p_o r_y)$ cannot have k any higher. Similarly, $h \leq h^*(p_o)$ as both groups are better off switching to $h^*(p_o)$ from $h > h^*(p_o)$. To see why focus on the numeraire consumption of each group. Let

$h' > h^*(p_o)$. The numeraire consumption is given by

$$x_{r_y}(t,k,h') = [(1-t)w_r + tw - k - h' - s]f(k)$$

and

$$x_{p_o}(t,k,h') = (1-t)w_p + tw - k - h'.$$

Now consider reducing h to $h^*(p_o)$ while keeping t and k unchanged.

Clearly, $x_{p_o}(t,k,h^*(p_o)) > x_{p_o}(t,k,h')$ and the increment is matched by a one-for-one reduction in h. Note, this change leaves p_o better off by Assumption 1 since for p_o

$$\left.\frac{u_x}{u_h}\right|_{(t,k,h')} < \left.\frac{u_x}{u_h}\right|_{(t,k,h^*(p_o))} < \left.\frac{u_x}{u_h}\right|_{q^*(p_o)} = 1.$$

Observe that r_y is indifferent between the two policies as s can be adjusted upwards for the drop in h. This rules out $h > h^*(p_o)$ for $PS(p_o r_y)$.

Consider the party $p_y r_o$.

$$PS(p_y r_o) = \{(t,k,h) \in Q : k \leq k^*(p_y), h \leq h^*(p_y)\}.$$

As r_o prefers $k = 0$ over $k > 0$ and $q^*(p_y)$ has $k = k^*(p_y)$, $PS(p_y r_o)$ cannot have k any higher. Similarly, $h \leq h^*(p_y)$ as both groups are better off switching to $h^*(p_y)$ from $h > h^*(p_y)$. To see why focus on the numeraire consumption of each group. Let $h'' > h^*(p_y)$. The numeraire consumption is given by

$$x_{r_o}(t,k,h'') = (1-t)w_r + tw - k - h'' - s$$

and

$$x_{p_y}(t,k,h'') = [(1-t)w_p + tw - k - h'']f(k).$$

Now consider reducing h to $h^*(p_y)$ while keeping t and k unchanged.

Clearly, $x_{p_y}(t,k,h^*(p_o)) > x_{p_y}(t,k,h'')$ and the increment is no less than reduction in h as $f(k) \geq 1$. Note, this change leaves p_y better off by Assumption 1 since for p_y

$$\left.\frac{u_x}{u_h}\right|_{(t,k,h'')} < \left.\frac{u_x}{u_h}\right|_{(t,k,h^*(p_y))} < \left.\frac{u_x}{u_h}\right|_{q^*(p_y)} = 1.$$

Observe that r_o is indifferent between the two policies as s can be adjusted upwards for the drop in h. This rules out $h > h^*(p_y)$ for $PS(p_y r_o)$.

Consider the party $p_y p_o$.

$$PS(p_y p_o) = \{(t, k, h) \in Q : t = 1, k \leq k^*(p_y), h \in [h^*(p_o), h^*(p_y)]\}.$$

As any poor agent prefers t as high as possible, $PS(p_y p_o)$ must have $t = 1$. Given that p_o wants k as low as possible and p_y wants it no higher than $k^*(p_y)$, the level of k in $PS(p_y p_o)$ must be as stated above. By the definition of $q^*(p_o)$ it is clear that h cannot be lower than $h^*(p_o)$. The arguments made for the case of $PS(p_y r_o)$ may be used here to justify the upper bound on h.

Consider the party $r_y r_o$.

$$PS(r_y r_o) = \{(t, k, h) \in Q : t \in [0, t^*(r_y)], k \leq k^*(r_y) \equiv t^*(r_y)w, h = 0\}.$$

Every rich agent prefers t as low as possible and similarly for h. The r_y agent ideally prefers $k^*(r_y) = t^*(r_y)w > 0$ from the definition of $q^*(r_y)$. These considerations define the features of $PS(r_y r_o)$.

Consider the party $p_y r_y$.

$$PS(p_y r_y) = \{(t, k, h) \in Q : t > 0, k \leq max\{k^*(p_y), k^*(r_y)\}, h \leq h^*(p_y)\}.$$

As every young agent ideally prefers $k > 0$, it follows that t and k should be as above. Additionally, as r_y would prefer to keep h as low as possible (so as to keep t down), it follows that $h \leq h^*(p_y)$.

Consider the party $p_o r_o$.

$$PS(p_o r_o) = \{(t, k, h) \in Q : k = 0, h \leq h^*(p_o)\}.$$

As the old agents do not benefit from k, it follows that $k = 0$ in $PS(p_o r_o)$. Additionally, as r_y would prefer to keep h as low as possible (so as to keep t down), it follows that $h \leq h^*(p_o)$.

Step 2: The equilibria for each partition.

We have discussed the case of $p_y|p_o|r_y|r_o$ for different values of θ in the main body. Here we turn to all other possible partitions.

Only one party with two members:

Consider $p_y p_o|r_y|r_o$. The "poor" party wins with those policies in $PS(p_y p_o)$ which each of their members prefer to the ideal policy of either rich group. Such policies always exist. For $\theta > \frac{1}{2}$ and for $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$, the policy $q^*(p_y)$ satisfies the requirement. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the policy $q^*(p_o)$ satisfies the requirement.

Consider $r_y r_o|p_y|p_o$. When either $\theta > \frac{1}{2}$ or $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$, p_y wins against the "rich" party with its ideal policy $q^*(p_y)$. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the policy $q^*(p_o)$ wins.

Consider $p_y r_y|p_o|r_o$. For $\theta > \frac{1}{2}$, the party $p_y r_y$ wins with all policies in $PS(p_y r_y)$ which r_y agents prefer over $q^*(r_o)$ and p_y agents prefer over $q^*(p_o)$. For $\frac{w_r}{w_p} < \rho^*$, $q^*(r_y)$ is such a policy. If such a policy does not exist when $\frac{w_r}{w_p} > \rho^*$, then p_o runs alone and wins with p_y's support. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$, the equilibrium platforms for the $\theta > \frac{1}{2}$ case constitute the equilibria. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the party $p_y r_y$ wins with all policies in $PS(p_y r_y)$ which r_o agents prefer over $q^*(p_o)$. The existence of such a policy is documented in Lemma 4.

Consider $p_o r_o|p_y|r_y$. For $\theta > \frac{1}{2}$, the party $p_o r_o$ offers a policy in $PS(p_o r_o)$ which the r_y and the p_o agents prefer over $q^*(p_y)$. If such a policy does not exist, then p_y runs alone and wins. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$, the party $p_o r_o$ offers a policy in $PS(p_o r_o)$ which the p_o agents prefer over $q^*(p_y)$. Such a policy exists as shown in part (v) of Proposition 3. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the party $p_o r_o$ wins with $q^*(p_o)$.

Consider $p_o r_y|p_y|r_o$. For $\theta > \frac{1}{2}$, the party $p_o r_y$ offers a policy in $PS(p_o r_y)$ which the party members and the r_o agents prefer over $q^*(p_y)$. The existence of such a policy is shown in part (iv) of Proposition 1. The same policies are also equilibria for $\theta > \frac{1}{2}$ and for $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the party $p_o r_y$ wins with $q^*(p_o)$.

Consider $p_y r_o|p_o|r_y$. For $\theta > \frac{1}{2}$, the party $p_y r_o$ offers $q^*(p_y)$ and wins. Other policies in $PS(p_y r_o)$ which p_y and r_y agents prefer over $q^*(p_o)$ are equilibrium platforms too. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$, the party $p_y r_o$ offers $q^*(p_y)$ and wins. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the party $p_y r_o$ wins with all policies in $PS(p_y r_o)$ which r_y agents prefer over $q^*(p_o)$. The existence of such a policy is documented in Lemma 4.

Two parties with two members each:

Consider $p_y p_o|r_y r_o$. The "poor" party always wins with all their policies in $PS(p_y p_o)$.

Consider $p_o r_o|p_y r_y$. For $\theta > \frac{1}{2}$, the party $p_y r_y$ must win. In particular, $q^*(p_y)$ is an equilibrium winning platform. For $\theta < \frac{1}{2}$, the party $p_o r_o$ must win. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$, the party $p_o r_o$ offers a policy in $PS(p_o r_o)$ which the p_o agents prefer over $q^*(p_y)$. Such a policy exists as shown in part (v) of Proposition 3. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the party $p_o r_o$ wins by offering the policy $q^*(p_o)$.

Consider $p_y r_o | p_o r_y$. Take any q which lies in $PS(p_y r_o) \cap PS(p_o r_y)$ with $t, k, h > 0$. Any party (or both parties) offering such a q is an equilibrium. To see why, note it is not possible for either party to deviate to a different q' in their Pareto set which will improve the utility of *both* types of members.

Only one party with three members:

Consider $p_o r_o r_y | p_y$. For $\theta > \frac{1}{2}$, the party $p_o r_o r_y$ offers a policy in $PS(p_o r_o r_y)$ which all the party members prefer over $q^*(p_y)$. The existence of such a policy is shown in part (iv) of Proposition 1. The same policies are also equilibria for $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$. For $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$, the party $p_o r_o r_y$ offering $q^*(p_o)$ (and thereby winning) is an equilibrium aside from the ones outlined above.

Consider $p_y r_o r_y | p_o$. For $\theta > \frac{1}{2}$, the party $p_y r_o r_y$ offers a policy in $PS(p_y r_o r_y)$ which all the party members prefer over $q^*(p_o)$. The existence of such a policy is shown in Lemma 4. Additionally, the party $p_y r_o r_y$ offering $q^*(p_y)$ is also an equilibrium. The same policies – except $q^*(p_y)$ – are also equilibria for $\theta < \frac{1}{2}$.

Consider $p_o p_y r_o | r_y$. The party $p_o p_y r_o$ wins with all policies which the poor prefer over $q^*(r_y)$ (e.g., $q^*(p_y)$) or r_y wins with $q^*(r_y)$.

Consider $p_o p_y r_y | r_o$. The party $p_o p_y r_y$ wins with all policies which the poor prefer over $q^*(r_o)$ (e.g., $q^*(p_y)$) or r_o wins with $q^*(r_o)$.

As can be seen, several partitions have multiple equilibrium outcomes. We now examine how many are robust to deviations by one or more members of a party.

Step 3: Stable political outcomes.

Case (1): $\theta > \frac{1}{2}$

Whenever p_y is a member of a party then it is not stable as p_y will break to run alone and win. When the rich agents form the party, then again p_y wins, so this party is not stable either. The partition in which $r_o p_o$ is the only party may be stable provided they can offer a policy from their Pareto set which r_y prefer over $q^*(p_y)$. The partition in which $r_y p_o$ is the only party is stable as they can offer a policy in their Pareto set which they and r_o prefer over $q^*(p_y)$.

Consider the partition $p_y r_o | p_o r_y$. Take any equilibrium policy from that partition — call it q. Now, if $v_{r_o}(q) \leq v_{r_o}(q^*(p_y))$ then r_o breaks away as there is an equilibrium platform for $p_y | r_o | p_o r_y$ which provides to r_o more utility than $v_{r_o}(q^*(p_y))$. In fact, as long as such a policy exists in $PS(p_o r_y)$ which guarantees the $p_o r_y$ members a payoff more than what $q^*(p_y)$ offers, and r_o more than $v_{r_o}(q)$, r_o will choose to break away. Suppose there is actually no such policy in $PS(p_o r_y)$. This implies that any policy which r_o prefers over q delivers lesser utility than $q^*(p_y)$ to either or both of p_o and r_y. W.l.o.g, let p_o be the one getting strictly lower utility. Then p_o can break away and induce the partition $p_y r_o|p_o|r_y$ with $q^*(p_y)$ being offered by $p_y r_o$. Thus, $p_y r_o|p_o r_y$ is not stable.

Finally, $p_o r_o r_y|p_y$ is stable with the same policies as in the case of $r_y p_o|r_o|p_y$.

Case (2): $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$

Here, considerations similar to the case of $\theta > \frac{1}{2}$ apply since in the $r_y|p_o|r_o|p_y$ case, it is p_y who wins. So, $r_y p_o|p_y|r_o$ is stable as the party $r_y p_o$ can offer a policy in their Pareto set which they and r_o prefer over $q^*(p_y)$. The partition in which $r_o p_o$ is the only party is stable as they can offer a policy from their Pareto set which they prefer over $q^*(p_y)$.

Note, $p_y r_o|p_o r_y$ is not stable for exactly the same reasons as in Case (1) above.

Finally, $p_o r_o r_y|p_y$ is stable with the same policies as in the case of $r_y p_o|r_o|p_y$ only if $k = 0$ in those policies. Otherwise, $p_o r_o$ will break away and set $k = 0$ for those same policies and win as the old are a majority.

Case (3): $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} > \rho^*$

Whenever p_o is a member of a party then it is not stable as p_o will break to run alone and win. When the rich agents form the party, then again p_o wins, so this party is not stable either. The partition in which $r_y p_y$ is the only party may be stable provided they can offer a policy from their Pareto set which r_o prefer over $q^*(p_o)$. The partition in which $p_y r_o$ is the only party is stable as they can offer a policy in their Pareto set which they and r_y prefer over $q^*(p_o)$.

Consider the partition $p_y r_o|p_o r_y$. Take any equilibrium policy from that partition — call it q. Now, if $v_{r_y}(q) \leq v_{r_y}(q^*(p_o))$ then r_y breaks away as there is an equilibrium platform for $p_o|r_y|p_y r_o$ which provides r_y more utility than $v_{r_y}(q^*(p_o))$. In fact, as long as such a policy exists in $PS(p_y r_o)$ which guarantees the $p_y r_o$ members a payoff more than what $q^*(p_o)$ offers, and r_y more than $v_{r_y}(q)$, r_y will choose to break away. Suppose there is actually no such policy in $PS(p_y r_o)$. This implies that any policy which r_y prefers over q delivers lesser utility than $q^*(p_o)$ to either or both of p_y and r_o. W.l.o.g, let p_y be the one getting strictly lower utility. Then p_y can break away and induce the partition $p_o r_y|p_y|r_o$ with $q^*(p_o)$ being offered by $p_o r_y$. Thus, $p_y r_o|p_o r_y$ is not stable.

Finally, $p_y r_o r_y|p_o$ is stable with the same policies as in the case of $p_y r_o|r_y|p_o$.

Proof. [PROPOSITION 1.]

Parts (i) — (iii) follow from the arguments in Case (1) under Step 3 above.

(iv) Consider all possible alliances of the old poor and some of the rich, i.e., $p_o r_y$, $p_o r_o$ and $p_o r_y r_o$. The maximum level of h across the Pareto sets of these parties is $h^*(p_o)$. Now we show that there exists a feasible policy q' with $h \leq h^*(p_o)$ such that $v_i(q') > v_i(q^*(p_y))$ for $i \in \{p_o, r_o, r_y\}$.

Start with $q \in Q$ from Lemma 3. Hence, $t \in (0,1)$, $k \in (0, k^*(p_y))$ and $h = h^*(p_y)$. Now consider $q_1 \in Q$ with the same tax rate and k as q but with $h = h^*(p_0)$. Given t is unchanged, q_1 offers p_o more of the numeraire but less of h (by the same amount) than q. Hence, p_o prefers q_1 over q as

$$\left.\frac{u_x}{u_h}\right|_q > \left.\frac{u_x}{u_h}\right|_{q_1} > \left.\frac{u_x}{u_h}\right|_{q^*(p_o)} = 1.$$

Therefore, $\exists t' < t$ such that

$$v_{p_o}(q_1) > v_{p_o}(t', k, h^*(p_0)) = v_{p_o}(q) > v_{p_o}(q^*(p_y)).$$

Denote this policy $(t', k, h^*(p_0))$ by q'.

Now consider r_y. As u is homothetic it follows that $s > 0$ for r_y under q since by Lemma 3

$$f(k)[(1-t)w_r + tw - k - h^*(p_y)] > f(k^*(p_y))[w - k^*(p_y) - h^*(p_y)].$$

As $t' < t$, it means that

$$f(k)[(1-t')w_r + t'w - k - h^*(p_o)] > f(k)[(1-t)w_r + tw - k - h^*(p_y)].$$

Hence, r_y will increase the consumption of s under q' as compared to q. Hence, r_y gets a higher level of healthcare consumption by a combination of lower h and more s where the former is relatively more expensive for the rich than the latter. Hence, r_y prefers q' over q.

Identical arguments apply to r_o and hence we can claim that r_o too prefers q' over q. ■

Proof. [PROPOSITION 2.]

Denote a candidate policy which every old agent and r_y prefer over $q^*(p_y)$ by $(t' \in (0,1), h', k' = 0)$. By Proposition 1, $h' \leq h^*(p_o) < h^*(p_y)$. Let s denote the private healthcare consumption of r_y. As r_y prefers this over $q^*(p_y)$, it must be that

$$(1-t')w_r + t'w - h' - s > f(k^*(p_y))[w - h^*(p_y) - k^*(p_y)],$$

by the logic in Lemma 1 part (iv). Similarly, $h' + s \geq h^*(p_y)$ implying $s > 0$.

Clearly, as $\frac{w_r}{w_p} \to 1$, it follows that $w_r + t'(w - w_r) \to w$. Moreover,

$$w - h^*(p_y) < f(k^*(p_y))[w - h^*(p_y) - k^*(p_y)]$$

since $h^*(p_o) < h^*(p_y)$ and

$$w - h^*(p_o) < f(k^*(p_y))[w - h^*(p_y) - k^*(p_y)]$$

by the definition of $q^*(p_y)$. This implies

$$w - h' - s < f(k^*(p_y))[w - h^*(p_y) - k^*(p_y)].$$

Hence, for $\frac{w_r}{w_p} > 1$ but sufficiently close to 1

$$w_r + t'(w - w_r) - h' - s < f(k^*(p_y))[w - h^*(p_y) - k^*(p_y)].$$

Thus, $(t' \in (0,1), h', k' = 0)$ cannot simultaneously guarantee every old agent and r_y a payoff over what $q^*(p_y)$ offers for such $\frac{w_r}{w_p}$. Hence, $k > 0$ for such levels of income inequality. ■

Proof. [PROPOSITION 3.]

Parts (i) — (iii) follow from the arguments in Case (2) under Step 3 above. Part (iv) comes from Step 1.

Part (v): We will show that $p_o r_o | p_y | r_y$ is a stable equilibrium partition where $p_o r_o$ wins.

Consider $q' \in Q$ from the proof of part (iv) of Proposition 1. Recall $q' = (t', k > 0, h^*(p_0))$ such that $v_i(q') > v_i(q^*(p_y))$ for $i \in \{p_o, r_o, r_y\}$. Consider a policy $q'' \equiv (t', k = 0, h^*(p_0))$. Note, by construction, $q'' \in PS(p_o r_o)$. Moreover, for $i \in \{p_o, r_o\}$, we have

$$v_i(q'') > v_i(q') > v_i(q^*(p_y)).$$

As $\theta < \frac{1}{2}$, it follows that q'' is the winning platform in this partition. This establishes that $k = 0$ in some equilibria. ■

Proof. [LEMMA 4.]

Recall $q^*(p_o)$ delivers the same level of the numeraire (i.e., $w - h^*(p_o)$) and the same level of h (i.e., $h^*(p_o)$) to all agents. We now show that $\exists k > 0$ such that

$$f(k)[w - k - h^*(p_o)] > w - h^*(p_o).$$

Let $\lambda(k) \equiv f(k)[w-k-h^*(p_o)]$. Note, $\lambda(0) = w-h^*(p_o)$ by construction. Straightforward differentiation yields:

$$\lambda'(k) = f'(k)[w - k - h^*(p_o)] - f(k)$$

$$\lambda''(k) = f''(k)[w - k - h^*(p_o)] - 2f'(k) < 0$$

since $f' > 0$ and $f'' < 0$. Moreover, $\lambda'(0) = +\infty$. Hence, $\exists \epsilon > 0$ such that $\forall k \in (0, \epsilon)$ we have $f(k)[w - k - h^*(p_o)] > w - h^*(p_o)$. Pick some k in this interval — call it $\tilde{k}$. By continuity, $\exists \delta > 0$ such that

$$f(\tilde{k})[(1-t)w_p + tw - \tilde{k} - h^*(p_o)] > w - h^*(p_o)$$

whenever $t \in (1-\delta, 1)$. Again, $\exists \sigma > 0$ such that

$$(1-t)w_r + tw - \tilde{k} - h^*(p_o) > w - h^*(p_o)$$

whenever $t \in (0, 1-\sigma)$.

Note that for r_o's case we need $t < 1 - \frac{\tilde{k}}{w_r - w}$. Let $\sigma \equiv \frac{\tilde{k}}{w_r - w}$. Similarly, defining δ as

$$\frac{1}{(w - w_p)}\left[w - h^*(p_o) - \tilde{k} - \frac{w - h^*(p_o)}{f(\tilde{k})}\right]$$

will satisfy p_y's case. Clearly, $\delta = \sigma = 0$ when $\tilde{k} = 0$. Differentiating δ and σ w.r.t. $\tilde{k}$ and using $f'(0) = +\infty$ establishes that for $\tilde{k}$ sufficiently close to 0, it must be that $\delta > \sigma$.

Hence, $\forall t \in (1-\delta, 1-\sigma)$, the following hold:

$$f(\tilde{k})[(1-t)w_p + tw - \tilde{k} - h^*(p_o)] > w - h^*(p_o),$$

and

$$(1-t)w_r + tw - \tilde{k} - h^*(p_o) > w - h^*(p_o).$$

Denote by $\tilde{q}$ a policy with $\tilde{h} = h^*(p_o)$, $t \in (1-\delta, 1-\sigma)$ and $k = \tilde{k}$. By the above two inequalities, p_y and r_o respectively prefer $\tilde{q}$ over $q^*(p_o)$ as the former leaves them with more of the numeraire good while providing the same level of h as the latter.

Finally, r_y also prefers $\tilde{q}$ over $q^*(p_o)$ since the numeraire provision by $\tilde{q}$ is even larger than that for r_o as $\tilde{k} > 0$. ■

Proof. [PROPOSITION 4.]

Parts (i) — (iii) follow from the arguments in Case (3) under Step 3 above. Part (iv) comes from Step 1.

Part (v): Suppose not. Let $q = (t, k = 0, h)$ denote an equilibrium platform. Hence, it follows that $v_i(q) > v_i(q^*(p_o))$ for $i \in \{p_y, r_y, r_o\}$.

Take the case of p_y. Note, $v_{p_y}(q)$ implies a utility of $u((1-t)w_p + tw - h, h)$ for p_y. Given that $w_p < w$ and $t \in (0,1)$, we have

$$u((1-t)w_p + tw - h, h) < u(w - h, h).$$

By definition,

$$u(w - h, h) \leq u(w - h^*(p_o), h^*(p_o)).$$

Hence,

$$u((1-t)w_p) + tw - h, h) < u(w - h^*(p_o), h^*(p_o))$$

thus implying $v_{p_y}(q) < v_{p_y}(q^*(p_o))$ which leads to a contradiction. ■

Proof. [PROPOSITION 5.]

Start with $\tilde{q} \in Q$ from Lemma 4 and the partition $p_y r_o | r_y | p_o$. Hence, $\tilde{h} = h^*(p_o)$. Also,

$$f(\tilde{k})[(1-\tilde{t})w_p + \tilde{t}w - \tilde{k} - h^*(p_o)] > w - h^*(p_o),$$

and

$$(1-\tilde{t})w_r + \tilde{t}w - \tilde{k} - h^*(p_o) > w - h^*(p_o).$$

By continuity, $\exists\, \bar{t} \in (\tilde{t}, 1)$ and $\overline{h} > h^*(p_o)$ with $\bar{t}w - \overline{h} = \tilde{t}w - h^*(p_o)$ such that

$$f(\tilde{k})[(1-\bar{t})w_p + \bar{t}w - \tilde{k} - \overline{h}] \geq w - h^*(p_o),$$

and

$$(1-\bar{t})w_r + \bar{t}w - \tilde{k} - \overline{h} \geq w - h^*(p_o).$$

Let $\overline{q} \equiv (\bar{t}, \tilde{k}, \overline{h})$. We will now show that $\overline{q}$ is an equilibrium platform for $p_y r_o | r_y | p_o$.

The above (weak) inequalities along with $\overline{h} > h^*(p_o)$ ensures that both p_y and r_o prefer $\overline{q}$ over $q^*(p_o)$. Additionally, as

$$f(\tilde{k})[(1-\bar{t})w_r + \bar{t}w - \tilde{k} - \overline{h}] > (1-\bar{t})w_r + \bar{t}w - \tilde{k} - \overline{h} \geq w - h^*(p_o),$$

it follows that r_y also prefers $\overline{q}$ over $q^*(p_o)$. ■

Proof. [Proposition 6.]

As noted in the main text, *all* equilibria in the case of $\theta > \frac{1}{2}$ except those involving $k > 0$ (in the $p_o r_y r_o | p_y$ partition) are also equilibria in the case of $\theta < \frac{1}{2}$ and $\frac{w_r}{w_p} < \rho^*$. Now consider any equilibrium winning platform with $k > 0$ in the $p_o r_y r_o | p_y$ partition — call it $q \equiv (t, h, k)$. Consider $q' \equiv (t, h', 0)$ and $h' \geq h$.

Observe, that $v_i(q') > v_i(q) > v_i(q^*(p_y))$ for $i = p_o, r_o$.

Also, $q' \in PS(p_o r_o)$ for a suitable choice of $h' \in [h, h^*(p_o)]$. Suppose not. Hence, $h' < h$ for q' to be in $PS(p_o r_o)$. This implies both p_o and r_o prefer to substitute public healthcare spending with more T for the tax rate t. Recall, $q \in PS(p_o r_y r_o)$. Here, h was chosen rather than h' even though p_o and r_o prefer otherwise (since T is even lower under q than under q'). This implies r_y must strictly prefer (t, h, k) over (t, h', k). Given that r_y can purchase $s = h - h'$ with the additional T under q', it must be that r_y is indifferent between (t, h, k) and (t, h', k). This contradiction establishes $h' \geq h$.

When $\theta < 1/2$ and $\frac{w_r}{w_p} < \rho^*$, $p_o r_o$ can break away, induce $p_o r_o | r_y | p_y$ and propose q'. By construction, q' is an equilibrium winning platform for $p_o r_o | r_y | p_y$. Such platforms with the $p_o r_o | r_y | p_y$ partition are equilibria for this scenario and not for $\theta > 1/2$. As $k = 0$ in such platforms, part (i) immediately follows.

For (ii), notice that q' involves $h' \geq h$ and since the choice of q was arbitrary, the statement follows. ■

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