Preying on the young

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Abstract

This paper discusses corruption and growth in democracies. It states, that an increase in the political power of the old, aggravates corruption and diminishes growth. This is because, the old use their political power to induce more government transfers from the young. In turn, these transfers fuel corruption, crowd out investment and therefore reduce growth. This effect is more intense in economies with weak institutions. This is so, because in such economies increased government transfers also increase private resources allocated to rent seeking. Furthermore, since the political power of the old depends on their population share, shifts in this share can account for variations in corruption and growth. The paper, explores these ideas with the help of an endogenous growth, overlapping generations’ model. In this context, repeated elections decide the size of government transfers. I model these elections using probabilistic voting.

1 Introduction

This paper develops a model that links corruption and growth in democracies. In relation to this matter, most economists agree that democracy reduces corruption and promotes growth. Moreover, for the most part, empirical observation verifies this view. However, there are exceptions to this rule, since certain countries are both corrupt and democratic. Greece and Italy are two notable examples of such countries.

The existence of these countries poses certain questions. The first question has to do with the persistence of corruption. In particular, if corruption diminishes welfare why do democracies fail to curtail it? This question relates very much to the apparent inability of Greek authorities to enforce the reforms prescribed in the recent bailout programs.
The second question has to do with the effect of corruption in economic performance. In this respect, most economists believe that corruption harms growth. However, if corruption is persistent shouldn’t its negative effect on growth be also persistent? Indeed, this is the case for corrupt countries in Asia and Africa that seem to be trapped in poverty. However, in countries like Greece and Italy, growth demonstrates substantial variability. For example, Greece was the second fastest growing country in the OECD, in the period right after World War II. This performance is inconsistent with the historic level of corruption in the country.

In order to address these questions, I start with an observation. In particular, I observe that corruption is essentially a government transfer from the young to the old, much like a pay as you go pension system. On the one hand, this is so, because, earnings from corrupt activities, mostly originate from the government budget. Therefore, corruption burdens all taxpayers, young and old. On the other hand, only older individuals can benefit from corruption. In turn, this is so for two reasons. First, corrupt activities typically require the assistance of a suitable network of people. Such networks take time to form and thus are not available for the young. Second, corruption is often possible only for individuals with a position of authority or influence. Again, such positions are rarely occupied by very young individuals.

This analysis has a key implication. Namely, an increase in the political power of older citizens increases corruption and causes growth to fall. This is so, because the old use their increased political power to induce more government spending and therefore taxes. They do this, in order to increase their income through legal government transfers, but also in order to increase the potential for rent seeking. In turn, the additional taxes, along with private resources allocated to rent seeking, crowd out investment and lead to smaller growth.

I explore the ideas above with the help of an overlapping generations’ model. There are three types of agents in the model. Firms, individuals and government. Firms are price takers and use a standard AK technology. Individuals live for two periods. In the first period they are young and in the second they are old. The young work and use their wages to consume and invest. They have two investment options open to them. They can either accumulate human and physical capital, or acquire means of political and social influence (i.e. by connecting to the “right people”). Capital accumulation provides returns from the private sector, while means of influence facilitate the appropriation of government funds. Nevertheless, from a social point of view, the two types of investment are not equivalent. Human and physical capital increase productivity and enhance growth. In contrast, the “right connections” aim solely at redistributing government resources.
and are therefore a deadweight loss. When individuals get old they neither work nor invest. Instead, they live off their investments. Finally, the government runs a balanced budget. This budget consists of public goods and transfers. The latter depict the share of the state funds that can be appropriated through corruption. In each period, an election determines the size and the structure of the budget. I describe this election using a version of the probabilistic voting model. This version explicitly incorporates influence by pressure groups. Thus, it captures the effect of informal political institutions like clientelism and lobbying. In general, creating lobbies and clientelistic networks takes time. Therefore, such groups are mainly a prerogative of the old. As a result, the political power of the old typically exceeds their share in the electorate.

The main results of the model highlight the effects of political power on economic performance. Specifically, an increase in the current political power of the old increases government transfers and corruption. In turn, this action reduces investment and therefore growth. Furthermore, if the young anticipate an increase in the political power of the old in the future, they substitute capital investment with investment in influence. They do this in order to enhance their rent seeking potential. This behaviour is optimal since they expect an increase in transfers. Thus, not only the current but also the future political power of the old affects corruption and growth.

This setting explains both the persistence of corruption in democracies and the puzzling economic performance of countries like Greece and Italy. Specifically, following my model, a decrease in government transfers boosts growth and benefits the current young and all future generations. However, the current old will vote against such a policy. This is so because the old have already committed their resources to the corrupt system. They have financed transfers when they were young and they have already spent resources to acquire influence. So they stand to gain nothing from such a reform. The same is true for institutional changes that can curtail corruption. Consider for example changes in the election law that can combat clientelism. By voting for such changes, the old diminish their political power and thus, decrease their welfare. As long as the political power of the old is sufficiently large, a democratic country cannot adopt such reforms.

Moreover, democracy implies that the political power of the old and therefore growth rates, depend also on the demographic structure of the population. Thus, my model points to changes in this structure, in order to explain variation in economic performance. For example in the 1950, the average Greek was much younger than the average citizen in the developed countries that made up the OECD at the time. As a result, the political power of the old was very small at the time, while investment and growth climaxed.
Since 1950 though, the population in Greece aged much faster than in the other developed countries. This occurrence can explain the poor economic performance of Greece after 1980.

Let me now briefly discuss the relevant literature. My paper relates to three distinct strands of literature. First, methodologically it is closest to [14] and [8]. These papers also develop an overlapping generations’ model with probabilistic voting. They use the distribution of political power among generations to analyze political outcomes. In particular, the first considers public debt and the second the structure of the budget. However, none of these papers discusses the relation between government budget, corruption and growth. The second strand of literature considers explicitly the relation between these three variables. The papers in this literature like [1] and [13] explore the dynamic mechanisms that underpin their evolution. To my knowledge though, there is no other paper that associates the distribution of political power among generations to corruption and growth. Finally, to the extent that my model applies to Greece, my paper also relates to a strand of literature that considers the cause of the bad economic performance of Greece after 1980. Examples of such papers are [2] and [5]. These papers also view corruption as the main cause of this bad performance. However, they treat corruption as an isolated incident that started in the late 1970s. On the contrary, I treat the period that followed 1980 as a special case of a broader pattern.

The rest of the paper is organized as follows. Section 2 describes the model. Section 3 provides the key results. Section 4 discusses certain key implications of the model while section 5 considers Greece as a case study. Finally, section 6 concludes.

2 Model

2.1 Description

I consider an overlapping generations’ model with an infinite horizon. There are three types of agents in the model: individuals, firms and government. Individuals, live for two periods. In the first period, they are young, while in the second they get old. Young individuals provide labour, while the old do not work and live off their investments. In particular, the young allocate their disposable income among consumption, productive investment (i.e. human and physical capital) and investment in rent seeking (i.e. connecting to the right people). The latter investment leads to the formation of social networks (lobbies, cliques e.tc.). The purpose of these networks, is to assist their
members in appropriating a share of the government budget. Since forming networks takes time, only the old can participate and benefit from them. Thus, there are two sources of income available for the old, returns to capital and proceeds from rent seeking.

Firms use an AK technology and operate in a perfectly competitive market. Thus, all resources are fully employed, the wage equals the marginal product of labour and the interest rate equals the marginal product of capital.

The government decides on the size of the budget and its allocation between public goods and transfers. The latter, depict the part of the budget that can be appropriated by the old, through rent seeking. Transfers constitute a substitute for individual income and can either be legitimate (pensions, social benefits e.t.c) or not (unnecessary government jobs, excessive payments to government suppliers e.t.c). The government decides on the budget, through elections held each period. The networks of old individuals, except from appropriating government resources, also influence the outcome of the elections, by providing support to candidates who cater for their interests.

Let me now turn to the details of the model. In what follows I suppress indices for individuals and time, in order to simplify notation. Instead I use the subscripts \( y \) and \( o \) for the representative young and old respectively and the standard recursive notation to identify next period variables (\( \zeta \)’ is next period’s \( \zeta \)). I follow the same notation throughout the paper.

### 2.2 Individuals

**Population.**

In each period the economy is populated by a continuum of young, with length \( N_y \) and a continuum of old, with length \( N_o \). Total population in each period is \( N = N_y + N_o \). The shares of the two generations in the population are \( s_y = \frac{N_y}{N} \) and \( s_o = \frac{N_o}{N} \). The two age groups are not independent, since young grow up to become next period’s old (\( N_y = N_o' \)). However, the number of the young in each period changes exogenously. This last feature captures demographic transition.
Preferences.
Both age groups consume a private good \((c)\) and a public good \((G)\). For tractability I represent preferences over the two goods, using an additively separable logarithmic utility function. Thus, the lifetime utility of a young individual takes the form:

\[
u_y = \ln c_y + \theta \ln G + \beta [\ln c_o + \theta \ln G']\tag{1}\]

where \(\beta \in (0,1)\) is the time discount factor and \(\theta > 0\) captures the preference weight on public good and is common for both age groups.

Budget constraints.
In each period, each young individual supplies inelastically one unit of labour. The budget constraint of the young is

\[
w - t_y = c_y + k' + x'\tag{2}\]

where \(w\) is the wage and \(t_y\) is the tax he pays. The young allocate their disposable income between private good consumption and savings. The savings take the form of investment, either in capital \((k')\) or in actions that facilitate rent seeking in the future \((x')\). The latter investment is transformed in actual rent seeking activity \((\mu)\) through the function

\[
\mu = x^\gamma\tag{3}\]

where \(\gamma \in (0,1]\) is a parameter capturing efficiency in rent seeking activities\(^1\).

Taking a broad view on the variables above, I think of \(k\) as a composite form of capital incorporating both physical and human capital. Also, I interpret \(x\) as resources (money, effort, time), used to obtain certain skills and connections. These skills and connections are used to form social networks, with the purpose and ability to succeed in rent seeking. In this sense, \(\gamma\) parametrizes social and institutional aspects of an economy that influence the success of such networks (moral values, trust, quality of institutions e.t.c.). To avoid confusion, from now on when I refer to corruption, I will refer to \(\mu\) or to \(x\). For the parameter \(\gamma\), I will use the term social institutions. I will refer to weak social institutions to describe a high value for \(\gamma\).

Let me turn now to the old. Old individuals earn their income from capital and rent seeking. Following [1], I model rent seeking as a zero sum game. Thus, the budget constraint of the old is:

\[
Rk + \frac{\mu Z}{\mu N_o} - t_o = c_o\tag{4}\]

\(^1\)For a similar specification see [1], who use a linear version of equation 3.
where $R$ is the return to capital, $\bar{\mu}$ is the average rent seeking activity in the economy and $Z$ is the part of the budget that can be appropriated through corruption (transfer). Old individuals do not make any decisions. Their choices in the first period, along with political and market outcomes determine their income. In the second period, they consume this income in full, since there are no bequests in the model.

Because only the old benefit from rent seeking, the transfer $Z$, can be viewed as a standard intergenerational transfer, like a pay as you go pension scheme. However, my intention is to capture a broader idea. Namely, that corruption in general, is a transfer from young to old, since young can not benefit from it. This is so for two reasons. First, because it takes time for the young to acquire the necessary connections and skills to succeed in corruption. Second, because it also takes time before the young get to a position that allows them to be corrupt. For example, seniority is usually an important qualification for top government jobs, while companies bidding for government contracts often need to satisfy certain conditions in terms of experience and size.

In this sense, the right connections, much like capital, are an investment in the future. Yet, not all types of investment are equivalent from a social point of view. Investment in capital and knowledge increases production and productivity. On the contrary, resources allocated to corruption constitute a deadweight loss.

Substituting the two budget constraints (equations 2 and 4) in the utility function (equation 1) yields the following expressions for young and old:

$$u_y = \ln \left( w - t_y - k' - x' \right) + \theta \ln G + \beta \ln \left( Rk + \frac{\bar{\mu}Z}{\bar{\mu}N_o} - t_o \right) + \theta \ln G'$$

and

$$u_o = \ln \left( Rk + \frac{\bar{\mu}Z}{\bar{\mu}N_o} - t_o \right) + \theta \ln G$$

**Utility maximization.**

In each period, an election determines government policy (taxes and budget allocation) first. Then, young individuals decide on the allocation of their resources. Therefore, the young are aware of the current policy, when deciding, but do not know next period’s policy. However, future policy affects their utility as well. In order to address that, the young form predictions about future policy and condition their decisions on these predictions. In equilibrium all predictions are correct. For notational simplicity, I use the same notation both for predictions and actual variables.

In particular, the young choose $k'$ and $x'$ in order to maximize their utility.
(equation 5). First order conditions imply:

\[
\frac{c_o'}{c_y} = \beta R \\
\frac{c_o'}{c_y} = \beta \gamma \frac{x^{\gamma-1}}{\bar{\mu}} \frac{Z'}{N_o'}
\]

Then imposing symmetry and using standard algebra yields:

\[
x' = \gamma \frac{Z'}{R N_o} \\
k' = \frac{\beta}{1+\beta}(w - t_y) - \frac{1 + \beta \gamma}{R(1+\beta)} \frac{Z'}{N_o'} + \frac{t_o'}{R(1+\beta)}
\] (7) (8)

Substituting equations 7 and 8 in the budget constraint of the young (equation 2) yields:

\[
c_y = \frac{w - t_y}{1+\beta} + \frac{1 - \gamma}{R(1+\beta)} \frac{Z'}{N_o'} - \frac{t_o'}{R(1+\beta)}
\] (9)

If \( \gamma \in (0, 1) \) second order conditions are satisfied and consequently, the first order conditions above solve the maximization problem of the young. I will discuss the case \( \gamma = 1 \), later in the paper.

2.3 Firms

In each period a large number of firms produce the private good. These firms are price takers and use an AK technology as in [12]. Their production function is \( y = \kappa^{1-\alpha} \kappa^\alpha l^{1-\alpha} \) where \( y \) is the output of the representative firm, \( \kappa, l \) are the capital and labour used by each firm and \( \bar{\kappa} \) is the average capital across firms.

Capital is perfectly mobile and depreciates fully after each period. Furthermore I assume that the population of firms equals the population of young individuals (\( N_y \)). Thus, each firm employs, in equilibrium, one unit of labour. Then, using the profit maximizing conditions and imposing symmetry yields \( w = (1 - a)A\kappa \), \( R = aA \) and \( Y = AK \) where \( Y \) and \( K \) stand for the aggregate output and capital in the economy. Finally, notice that all capital is held by old individuals. Therefore, the capital employed by each firm satisfies \( \kappa = \frac{N_o}{N_y} k \), where \( k \) is the capital held by each old individual. Consequently, \( w = (1 - a)A\frac{N_o}{N_y} k \) and \( Y = AN_o k \).
2.4 Government

Budget.
Taxes are lump sum and the government runs a balanced budget. Therefore, total spending for public goods and government transfers, equals total tax revenue or

\[ G + Z = N_o t_o + N_y t_y \]

Furthermore, since \( Z \) is a transfer from the young to the old, without loss of generality, I interpret it as a net transfer. Then, the lump sum taxes for old and young equal to:

\[ t_o = \frac{G}{N} \]  \hspace{1cm} (10)
\[ t_y = \frac{G}{N} + \frac{Z}{N_y} \]  \hspace{1cm} (11)

Political decision process.
I model the political decision process, using a variation of the probabilistic voting model discussed by [10]. In particular, in the beginning of each period, two candidates take part in an election. Prior to the election, the two candidates commit to a policy, in order to attract voters. In this case, they choose public good provision and government transfers. After the election, the candidate who wins implements his policy. The goal of the two candidates is to win the race for office. Yet, the election outcome does not only depend on the choice of policy by the candidates. Specifically, a candidate can increase the probability of winning if he can secure the support of organized networks. Since forming networks takes time, only older people participate in them. Thus, the model implies that the political power of the old exceeds their election turnout. This feature of the model depicts political corruption and especially clientelism.

In particular, networks and their support to candidates capture two distinct types of questionable political activity. The first is the activity of lobbies offering campaign contributions. The second is the activity of cliques, providing favours for the voters of certain candidates. Indeed, in clientelistic politics, candidates in order to get re-elected, often have to assist their voters with things like jumping a hospital queue, avoiding fines or criminal prosecution, obtaining undeserved social benefits e.t.c. Politicians are not able to provide such services, without the help of organized networks that operate in the private or the public sector.

\textsuperscript{2}See pages 58-62 in [10]. The model in [10] is an adaptation of the probabilistic voting model introduced by [9].
Under the above setting, both candidates choose the same policy, which maximizes the following political objective function:

\[ V = \varphi u_y + (1 - \varphi)u_o \]  

(12)

where \( \varphi \) and \( 1 - \varphi \) represent the political power of young and old voters respectively. These parameters incorporate the political characteristics of the two age groups. In particular,

\[ \varphi = \frac{\omega_y \lambda_y}{\omega_y \lambda_y + \omega_o \lambda_o} (1 + h)^{-1} \]  

(13)

where \( \omega_y \) and \( \omega_o \) are the share of young and old in the electorate, \( \lambda_y \) and \( \lambda_o \) capture the number of swing voters in each age group and \( h \) represents the effects of clientelism and political corruption on the election outcome. From now on, I will refer to \( h \) as political institutions. I will refer to weak political institutions to describe a high value for \( h \).

I provide microfoundations and motivation for equations 12 and 13 in appendix B1.

3 Equilibrium

3.1 Policy choice

In the previous section, I have already characterized the optimality conditions for firms and individuals. In order to fully characterize the equilibrium allocation, I also need to determine the choice of government policy and the growth of the economy.

Let me first turn to the choice of policy. In particular, following the elections, the current government chooses the policy that maximizes its objective (equation 12). However, this objective also depends on the actions of the next government. Specifically, next period’s policy. This is so, because the current young, who vote today, will also be alive next period. Thus, the choice of policy is essentially a game, between successive governments.

Typically, such a game has many equilibria. Here, I follow [7] and solve for a differentiable Markov perfect equilibrium\(^3\). The characteristic of this equilibrium is that it depends only on the current values of payoff relevant variables. In my model, these variables are the state variable \( K \) and the exogenous variables \( \varphi \), \( N_y \) and \( N_o \).

\(^3\)Other papers following this approach include [4], [6] and recently [14] and [8].
I treat $\varphi$, $N_y$, and $N_o$ as exogenous variables in order to trace the effects of demographic transition on corruption and growth. Specifically, a demographic shift, enters my model as a change in the number of the young. In turn, this change has two effects. First, it affects the shares of the two generations in the population ($s_y, s_o$). Changes in these shares influence the political outcome, because they affect the per capita costs and benefits from the government transfer $Z$. Second, the demographic shift, affects the share of the two generations in the electorate ($\omega_y, \omega_o$) and thus their political power ($\varphi, 1 - \varphi$).

In the formal definition below, I define equilibrium as a function of $Y$ instead of $K$. I do this for simplicity of exposition. Due to the linear relation between capital and output ($Y = AK$), this variation has no effect on the outcome. Finally notice that although the model has infinite horizon, the equilibrium can be characterized by considering only two successive periods.

Let $T \equiv (Z, G)$ be the policy profile, $n \equiv (N_y, N_o)$ be the population profile and $\pi \equiv (\varphi, n)$ be the profile of exogenous variables. Using the first order conditions and the budget constraints, I can rewrite the saving rule of the young (equation 8) and the objective of the government (equation 12) as:

$$Y' = Y(T, T'; Y, \pi, \xi)$$

$$V = V(T, T'; Y, \pi, \xi)$$

where $\xi \equiv (\beta, \gamma, \vartheta, a, A)$ is the profile of parameters. In what follows I suppress $\xi$.

**Definition. Political equilibrium.**

Let $Y \in \mathbb{R}_+$ and $\pi, \pi' \in [0, 1] \times \mathbb{R}_2^+$. A function $T : \mathbb{R}_+ \times [0, 1] \times \mathbb{R}_2^+ \rightarrow \mathbb{R}_2^+$, such that $T = T(Y; \pi) = (Z(Y; \pi), G(Y; \pi))$ is a political equilibrium, if it maximizes the function $V = V(T, T'; Y, \pi)$, with respect to $T$, subject to $T' = T(Y'; \pi')$ and $Y' = Y(T, T'; Y, \pi)$.

The definition above describes a notion of stationarity, in the sense that successive governments, respond in the same way to the same conditions.

### 3.2 Derivation of equilibrium

The first order conditions of the maximization problem in the definition are:

$$\frac{\partial V(T, T'; Y, \pi)}{\partial T} + \frac{\partial V(T, T'; Y, \pi) \partial T(Y'; \pi')}{\partial T'} = 0$$

For this derivation and details of all other calculations in this section see appendix B2.
where $\frac{\partial T(Y; \pi)}{\partial T} = \frac{\partial T(Y; \pi)}{\partial Y} \frac{\partial Y(T,T';Y,\pi)}{\partial T}$. This derivative captures the strategic linkage between successive governments. It describes the path through which the current government can manipulate future policy. In particular, when the government sets policy it also sets the taxes for the young. This action affects the disposable income of the young and therefore their savings. In turn, these savings determine future output, and hence affect future policy.

The first order conditions above are known in the literature as Generalized Euler Equations (GEE). Their characteristic is that they include derivatives of the solution. In this case $\frac{\partial T(Y; \pi)}{\partial Y}$.

Expanding the GEE yields:

$$\varphi [-R + (1 - \gamma) \frac{\partial Z}{\partial Z} - s_y \frac{\partial G}{\partial Z}] + \beta \varphi \theta \frac{\partial G'}{G'} \frac{\partial Z}{\partial Z} + \frac{(1 - \varphi)}{e_o N_o} = 0 \tag{16}$$

$$\varphi [-Rs_y + (1 - \gamma) \frac{\partial Z}{\partial Z} - s_y \frac{\partial G}{\partial Z}] + \beta \varphi \theta \frac{\partial G'}{G'} \frac{\partial G}{\partial G} + \frac{\theta}{e_o N_o} + (1 - \varphi) = 0 \tag{17}$$

Following the literature I guess and verify policy rules that are linear in output. In particular, my guess is:

$$Z = \Delta(\varphi, n) Y, \quad G = E(\varphi, n) Y$$

Furthermore, for notational simplicity, I define $\Delta(\varphi, n) \equiv \Delta, \Delta(\varphi', n') \equiv \Delta'$ and likewise for $E$.

The saving rule (equation 8) implies

$$Y' = \frac{1}{a(1 + \beta)} [(1 - a) Y - s_y G - Z] - (1 + \beta \gamma) Z' + s_o G] \tag{18}$$

Substituting the guess functions in the equation above and solving for $Y'$, I get $Y' = \Lambda[(1 - a) Y - Z - s_y G]$, where $\Lambda \equiv \beta R[a(1 + \beta) + (1 + \beta \gamma) \Delta' - s_o E^{-1}]^{-1}.$

Then, I can calculate the derivatives that appear in the GEE.

$$\frac{\partial Z}{\partial Z} = -\Delta \Lambda, \quad \frac{\partial G}{\partial Z} = -E' \Lambda, \quad \frac{\partial Z}{\partial G} = -\Delta \Lambda s_y, \quad \frac{\partial G}{\partial G} = -E' \Lambda s_y.$$ 

Substituting the derivatives above in the GEE and solving for $G$, I get

$$G = \frac{\theta (a Y + Z)}{1 - \varphi + \theta s_o} \tag{19}$$

Then, using equations 19 and 16, I derive the policy rules.

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5 see for example [14]
The policy rules imply that
\[ \Delta = \frac{1 - \varphi + \theta s_o}{(1 + \varphi \beta)(1 + \theta)} - a \]  
\[ G = \theta \frac{1}{(1 + \varphi \beta)(1 + \theta)} Y \]  
(20)  
(21)

The proof of property 1 is in Appendix A1 and follows closely [8].

The second property is robustness. It is always comforting to know that a possibly non unique equilibrium is consistent with the unique equilibrium of a simpler model.

**Property 2. Robustness**

Consider a simple version of the model in this paper, in which there is no public good and the parameter \( \gamma \) (social institutions) is equal to one. Then, this simple model has a unique differentiable Markov perfect equilibrium, which is consistent with the equilibrium in equations 20, 21 and 22.

Indeed, setting \( \gamma = 1 \) and \( \theta = 0 \) in the original model yields a unique equilibrium that satisfies\(^6\) \[ g_Y = \beta R \frac{1 + \beta \varphi}{1 + \beta \varphi} \frac{1}{1 - \varphi}. \]  
This is also what follows from equation 22.

The equilibrium of this simple model is unique, because there is no interaction between successive governments. This is so, because future transfers don’t affect the utility of the young. To see this, notice that when \( \gamma = 1 \),

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\(^6\)See appendix A1 for derivation
equation 7 implies that investment in rent seeking is 

\[ \frac{1}{R} \mathbb{E} Z \]  

Apparently, this is the present value of future transfers. Therefore, the cost for the young, in terms of investment in rent seeking, exactly counsels out, the benefit from future transfers. Thus, transfers vanish from their utility and therefore from the current government objective. I get back to this simple model later in the paper.

**Comparative Statics**

Let me now turn to comparative statics\(^7\). First, consider the policy rules. Notice that \( \mathbb{E} = \frac{\mathcal{F}}{\mathcal{G}} \) and \( E = \frac{\mathcal{G}}{\mathcal{F}} \) represent ratios of Government spending to output. It turns out that both these ratios decrease as the political power of the young increases (\( \frac{\partial \mathbb{E}}{\partial \phi}, \frac{\partial \mathcal{E}}{\partial \phi} < 0 \)). This result is driven by the tax burden, associated with government spending. In particular, the young dislike taxes and consequently vote against them. This is so, because taxes diminish disposable income and therefore, also diminish investment and future welfare.

For similar reasons, as the return of capital or the weight of future welfare increase, current government spending decreases in order to facilitate investment. Thus, \( \frac{\partial \mathbb{E}}{\partial a} \), \( \frac{\partial \mathbb{E}}{\partial \beta} \), and \( \frac{\partial \mathcal{E}}{\partial \beta} \) are negative. Finally, the preference for public good \( \theta \), has the expected effect (\( \frac{\partial \mathbb{E}}{\partial \theta} > 0 \) and \( \frac{\partial \mathcal{E}}{\partial \theta} < 0 \)).

Consider now the growth rate of the economy \( g_Y \). The key result of this paper is that growth increases with the political power of the young. Specifically, both \( \frac{\partial g_Y}{\partial \phi} \) and \( \frac{\partial g_Y}{\partial \phi} \) are positive. Equivalently, growth decreases with the political power of the old, current and future.

Consider first the current old. An increase in their political power increases both types of public spending and especially \( Z \), which is a transfer from the young to the old. Thus, the available resources for the young decrease, along with capital investment and growth. Now turn to the future old. An increase in their political power influences growth in two ways. First, it increases next period’s transfers. This means that the current young need not invest much in capital, since they will have an alternative source of income when they grow old. Second, the anticipated increase in transfers next period, makes rent seeking activities more attractive. Thus, the current young substitute investment in capital with investment in rent seeking. Furthermore, weak political institutions (a large \( h \)) amplify these two effects.

To see this notice that the definition of political power (equation 13) implies that \( \frac{\partial (1-\phi)}{\partial h} > 0 \).

For completeness, notice that the return to capital has a positive effect on growth (\( \frac{\partial g_Y}{\partial a} > 0 \) and \( \frac{\partial g_Y}{\partial A} > 0 \)), while weak social institutions have a negative effect (\( \frac{\partial g_Y}{\partial \gamma} < 0 \)). Finally, the effects of the time preference parameter \( \beta \) and \( h \) are positive.

\(^7\)see appendix A2 for details and calculations
the preference for public good $\theta$ on growth, are ambiguous. Let me now turn to some key implications of the model.

4 Implications

4.1 Resistance to reforms

Very often, governments in corrupt countries seem unwilling or unable to change policies and institutions that foster corruption. Yet, given that corruption decreases welfare, this behaviour by governments is puzzling. This puzzle is even greater in democratic countries with corruption, like Greece or Italy. Governments in such countries answer to the voters for their actions. Thus, it is very difficult to explain why policies that facilitate corruption can emerge in such countries.

My model offers a possible explanation for this puzzle. In particular, the model implies that citizens typically vote against policies and institutional reforms that can control corruption. The rejection of anti-corruption policies, follows from equation 20. This equation implies that transfers are always positive, as long as the political power of the old is sufficiently large. Therefore, if the young expect to have a lot of political power when they grow old, they also expect to collect a lot of transfers. These expectations cause the young to invest in rent seeking activities. This last action generates corruption. Furthermore, things are worse when social norms ($\gamma$) and political institutions ($h$) favour corruption. Specifically, a high $\gamma$ makes rent seeking activities “cheaper”, while a high $h$, increases the political power of the old. Hence, democracies generate corruption, because old individuals can use their political power to extract resources from the young.

This result holds in the model, despite the fact that corruption reduces welfare and growth. To highlight the welfare effects of corruption, in appendix A3 I consider a stationary version of the model where $\phi' = \phi$, $\gamma = 1$ and $\theta = 0$. I solve the model with and without transfers. It turns out that growth and lifetime utility are greater in the case without transfers. Hence, the possibility for transfers decreases welfare. This result is not surprising, since transfers decrease capital investment and cause a deadweight loss.

I turn now to institutional changes. I consider two such changes. The first, is a clause in the constitution that forbids transfers. The second, is a decrease in $h$. From the discussion above, it is clear, that these two changes can curtail corruption and boost growth and welfare. However, in a democracy, voters must ratify such reforms.

---

8 For details on the conditions under which $\Delta > 0$ see appendix A2.
I consider first the zero transfer clause. It turns out that a democracy can not adopt such a clause in the constitution. To see this let me introduce commitment in the model. Specifically, assume that in period \( t \) elections determine a constant level of transfers for all future periods. Clearly then, if the political power of the old is sufficiently large, transfers are positive, in this case as well. The easiest way to see this, is to consider the model in Appendix A2 (proof of robustness). In this simple model, the choice of transfer \( Z \) is not only positive, but also the same to the case without commitment. This result is derived from the fact that \( Z' \) does not appear in the objective of the government.

Let me now discuss a decrease in \( h \). This decrease can be interpreted as reinforcing checks and balances in the polity. Examples of such changes include, increasing the independence of the courts, creating independent administrative bodies e.t.c.

In order to model political decisions for such changes, I consider a version of the model with an additional, one off, election. In particular, prior to voting for policy in period \( t \), individuals vote for \( h \), or equivalently vote to determine the political power of the two generations. This allocation of political power, in turn, determines policy in the next election. I assume both elections follow the probabilistic voting model. Thus, the outcome in both elections maximizes the government objective function (equation 12). As above, I consider a simple stationary version of the model. Let \( \varphi \) be the original political power of the young and \( \varphi^* \) be the political power of the young after the institutional changes. Then, as in section 2.2. the chosen policy (second election) maximizes \( V = \varphi^*u_y + (1 - \varphi^*)u_o \). Substituting the solution of this problem in the utility functions of the individuals, yields \( u_y(\varphi^*) \) and \( u_o(\varphi^*) \). Then, the first election maximizes \( V^* = \varphi u_y(\varphi^*) + (1 - \varphi)u_o(\varphi^*) \) with respect to \( \varphi^* \). The outcome of this maximization, as I show in appendix A3, is \( \varphi^* = \varphi \). This is not a striking result. It simply states that if you ask a group individuals to vote on their future voting power, the outcome will inevitably reflect their current voting power, since it is the one they use to vote. Thus, any proposed reform is voted down.

The failure of anti-corruption policy, I present in this subsection has a simple cause. It is due to the fact that individuals, in different phases of their lives, have conflicting interests. Politics, with or without commitment, are simply the means to advance these interests. Thus, young are happy to vote for the eradication of corruption with both their hands. However, they never vote alone. The old always have a different view. In this respect, resistance to reforms is greater in societies with weak political institutions, since the old enjoy more political power there.

In the next section I provide some examples from Greek politics that are
consistent with this view. Let me now turn to the relation between corruption and the size of budget.

### 4.2 Corruption and the size of government

There are two well-known results in the literature, regarding the relation between government spending and corruption. The first is that countries with bigger governments tend to be more corrupt. The second is that corruption is more associated with redistributive payments than with other forms of government spending\(^9\). In accordance with the literature, my model also delivers similar results. In particular, I find that the ratio of total government spending to output and the ratio of transfers to public good spending are increasing in \(h\) (i.e. \(\frac{\partial(\Delta+E)}{\partial h}, \frac{\partial(\Delta/E)}{\partial h} > 0\))\(^10\). Since corruption \((\mu)\) increases with \(h\), ceteris paribus, my model predicts a positive correlation between corruption and these variables.

Although these two results are in general consistent with the data, there are some notable exceptions, like Denmark and Finland. These countries on the one hand, do very well with respect to corruption indices and on the other hand, have relatively big governments and a significant budget for social benefits. However, my model offers a possible explanation for these exceptions as well. In particular, even if there is no corruption (i.e. \(\gamma = 0\) and \(h = 0\) ) the model can still deliver sizeable budget and transfers. This outcome can occur due to strong preferences for public good \((\theta)\) and/or an extensive political power of the old. The latter can emerge due to entirely legitimate reasons, like the presence of a substantial number of older individuals in the electorate. The data are consistent with this interpretation, since both Denmark and Finland have a particularly aged population (see Appendix B3 for a table with relevant data).

### 4.3 Demographic shocks: Persistence and business cycles

Let me now consider the effects of a temporary demographic shock. In particular, I consider a change in the fertility rate that lasts only for one period. Then, I trace the effects of this shift on growth, as the new generation advances, from one age group to another. It turns out, that the effect of the shock on growth is persistent, as it lasts for three periods. Furthermore, this

\(^9\)For the first result see [1] and for the second see [11].

\(^10\)Calculating the sign of these derivatives from equations 20 and 21 is straightforward given that \(\frac{\partial \varphi}{\partial h} < 0\)
shock generates an oscillating cyclical pattern and a non-monotonic relationship between growth and population age. The latter result is consistent with relevant empirical work.

Let me demonstrate the above effects with the help of a numerical example. Consider a version of the model in which there is an additional generation made up of children. Children do not vote and are not taxed. Therefore, their presence does not affect anything in the model other than total population.

Moreover, to keep things simple, I assume that \( \gamma = 1, \theta = 0, \beta = 1, R = 1, h = 0, \omega_y \lambda_y = s_y \) and \( \omega_o \lambda_o = s_o \). I also assume that the age of the children is 1, the age of the young is 2 and the age of the old is 3. Thus if there is one member in each generation the average age of the population is 2. Under these assumptions, the growth rate in the economy, is given by

\[
g_Y = \frac{\beta R \Phi^{1+\Phi}}{1+\Phi} + \Phi
\]

where, \( \Phi = \frac{2(1+\beta)}{1-\phi} = 2N_y/N_o \). Finally, the per capita growth is

\[
g_Y = \frac{g_Y N}{N}.
\]

Furthermore, I assume that the economy is initially in a stationary state, in which all generations have one member. Then, I consider two distinct shifts in the number of children that last only for one period. One shift is positive (+10%) and the other is negative (-10%). These changes depict spikes in the fertility rate, also known as baby boom and baby bust respectively.

Table 1, in Appendix A4 summarizes all calculations, while figures 1 and 2 below portray the main results.

Figure 1 plots the calculated growth against time.

**Figure 1**: Figures 1a and 1c depict total growth in the case of a baby boom and a baby bust respectively, while figures 1b and 1d the per capita growth in the two cases.
As it follows from the figure above, the effect of a demographic shock lasts for three periods. To see this, let me consider the case of a baby boom. The baby boomers affect policy and therefore growth through their vote, in the two periods when they are young and old. However, in addition to these two periods, they also affect investment when they are children. This is so, because an increase in the number of children today, implies a greater political power for the young next period and therefore a decrease in government transfers. In anticipation of this decrease in transfers, capital investment rises in the current period.

This last effect generates a non monotonic relation between average age and growth. In the case of a baby boom, when the children advance from childhood to being young, average age increases. On the same time though, the increased capital investment of the previous period, pays off. Thus, output and growth expand along with the population age. However, as the baby boomers continue to age, the political power of the old increases. In turn, this increase causes investment and growth to drop. Things are reverse in the case of the baby bust. Thus, the relation between population age and growth depends on the type of demographic change. In the case of a baby boom, an inverse U shaped curve emerges, while in the case of a baby bust the curve is U shaped. This non monotonic relation between age and growth is consistent with the empirical work by [3].

Figure 2, portrays the calculated relation between the age of the population and growth.

Figure 2: Figure 2a portrays Per Capita Growth against the age of the population in the case of a baby boom. Figure 2b portrays results for baby bust.

In the next section I discuss a case study.
5 Case Study: Greece

In this section I consider Greece as a case study. In particular, I show that Greece is a country with weak institutions, in which the old enjoy a lot of political power especially in the last decades. As a result Greece after 1980 suffers from slow growth and exhibits resistance to useful reforms\textsuperscript{11}.

Let me first consider weak institutions.

5.1 Weak institutions

The two examples that follow manifest the extent and complexity of corrupt networks in Greece.

Weak social institutions

Example 1: In February 2013 the mayor of Thessaloniki, which is the second largest city in Greece, was convicted to life in prison for embezzlement. In addition to the mayor, four town hall employees were convicted for the same crime\textsuperscript{20}.

Example 2: In March 2017 three doctors were convicted to imprisonment for accepting bribes from a hospital supplier. All three doctors are University professors and work for government hospitals in Thessaloniki\textsuperscript{22}. Another 24 people are awaiting trial for the same crime in Athens. They are also accused of receiving bribes from the same hospital supplier as the doctors from Thessaloniki\textsuperscript{19}.

These examples are an indication that social norms, customs and values in Greece favour the creation of corrupt networks. In terms of the model, the examples are an indication that $\gamma$ is very high in Greece.

Let me now give two examples of clientelistic politics.

Weak political institutions

Example 3: In September 2008 an MP from Crete and former minister was convicted to one year in prison for abetting a criminal. The MP tried to persuade a police officer to lie in court, in order to acquit a drug dealer. As it turned out, the drug dealer was a member of a powerful local network that could secure at least 50 votes for the MP in exchange for his help. Furthermore, it was revealed that the police officer involved, was appointed in the police force with the help of the MP\textsuperscript{21}.

Example 4: In December 2016 another MP from Crete was tried for abetting a criminal. The MP had phoned the director of a state dairy school and asked him not to expel a student, who was accused of bullying one of his students.

\textsuperscript{11}The examples discussed in this section are very well known in Greece. I provide the relevant references, mainly from Greek on-line press, in a separate section at the end of the paper.
fellow students. The incident became broadly known after the bullied student committed suicide. The MP never denied making the call. Nevertheless, he was acquitted because the members of the court decided that his actions didn’t constitute a crime[18].

The last two examples portray the extent of clientelistic politics in Greece. They also demonstrate the variety of favours that politicians offer to their voters and the role of organized networks, in delivering these favours. In terms of the model, these examples are an indication of a high $h$.

All four examples above are fairly recent. However such examples can be found throughout Modern Greek history. This fact implies that weak institutions are persistent. Nevertheless, extensive fluctuations in economic activity and corruption, are also a dominant feature of Greek history.

In 5.2 below I consider the distribution of political power and its role in explaining such fluctuations.

5.2 Demographic structure and growth

In order to highlight the role of political power, I consider post war growth in Greece. Specifically, between 1950 and 1980 Greece grew at an average of 5.3 % per year. This growth rate was the second highest among OECD countries and exceeded by far the OECD average which was 3.5 %. On the contrary between 1980 and 2010 per capita growth in Greece was 1.3 %, well below the OECD average which was 1.7 %. This contradiction seems even more staggering given the favourable conditions for Greece after 1980\(^1\).

The table below offers a possible explanation for this contradiction. It reports the ratio of individuals between 15 and 55 years old, to the number of individuals over 55 years old. The table compares Greece with the 24 countries that were OECD members prior to 1980\(^2\). As it turns out, in 1950 Greece had a much younger population than the OECD countries. Since then though, the population in Greece aged much faster than the OECD average. Because Greece is a democracy, this demographic shift corresponds to a similar shift in political power. Thus, the initially large number of young can explain the remarkable growth between 1950 and 1980. In a similar manner, the rapid drop in the number of young that followed, can explain

\(^{12}\)In the period 1980-2010 Greece knew unprecedented political stability, while education and health care improved substantially. Furthermore, Greece became a member of EU and thus had full access to the single market. Finally, after 2000 interest rates decreased significantly due to the introduction of Euro.

\(^{13}\)These 24 countries, possibly with the exception of Turkey, are what we often call, the western developed democracies. As such, these countries are considered in other similar studies like [14]
the vast decline of the growth rate after 1980.

### Ratio of 15-55/55+\(^\text{14}\)

<table>
<thead>
<tr>
<th>Country</th>
<th>1950</th>
<th>1980</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>4.52</td>
<td>2.71</td>
<td>1.79</td>
</tr>
<tr>
<td>OECD av.</td>
<td>3.65</td>
<td>2.95</td>
<td>2.04</td>
</tr>
</tbody>
</table>

I turn now to the issue of resistance to reforms.

#### 5.3 Resistance to reforms

Following the 2008 financial crisis, Greece lost the ability to service its public debt. As a result the IMF, the EU and the ECB (henceforth the troika) offered Greece a bailout program. In exchange for the bailout, the Greek authorities agreed to certain economic and administrative reforms. Honouring the agreement, the Greek parliament adopted most of these reforms. However, the government failed to enforce the decisions of the parliament in an effective manner. I consider now an example of such a failure.

In 2011, the Greek government introduced a uniform salary grid in the public sector. Prior to this arrangement, each section of the government paid its own salaries. This inconsistent policy caused sizeable discrepancies in pay between employees with similar qualifications. This variance in salaries reflected differences in political power across government sectors. Notably, the admittedly corrupt personnel of the Revenue Service enjoyed by far the highest salaries in the public sector\(^\text{15}\). Inevitably, the privileged groups within the government resisted fiercely the new grid, since it meant dramatic salary cuts for them.

This resistance led the government to introduce a 30% cap in salary cuts\(^\text{16}\). The 30% cap created a bizarre situation in the former highly paid sectors of the government. On the one hand, the employees hired before 2011 benefited from the cap and earned 70% of their old salary. On the other hand, the employees hired after 2011 received the new salary. In most cases this situation caused a staggering difference in pay in favour of the “old” employees. For example, in the Revenue Service this difference was around 50% of the new salary[16]. Then, in 2015, following the problems caused by this situation,

\(^{14}\text{Source: United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2015 Revision.}\)

\(^{15}\text{In December 2011 a former senior official of the ministry of finance revealed in a conference that total bribes in the Revenue Service, are roughly equal to the 40% of all fines[22].}\)

\(^{16}\text{In 2014 more than 10% of the civil servants benefited from the cap[15].}\)
the government decided to reinstate higher salaries for all Revenue Service personnel. This action put an end to the whole idea of a uniform salary grid.

The Greek government initiated this reform in salaries at the recommendation of the troika. However, the troika is not responsible for the failure. In order to support this view, let me discuss a much older reform that also failed.

In 1994 the Greek government created the Supreme Council for Civil Personnel Selection\textsuperscript{17} (henceforth SCPS). SCPS is an independent administrative authority that hires the civil servants in Greece. It aimed to terminate the long tradition of clientelism in the employment of civil servants.

However, this did not happen. Soon after the foundation of SCPS, a series of legal loopholes marginalized it. The most effective of these loopholes, was hiring employees with a fixed term contract. This was especially convenient, since SCPS does not have the authority to hire this type of personnel. In particular, in the decade 1994-2004 the annual number of fixed term employees hired, was roughly 5 times the number of employees hired by SCPS\textsuperscript{17}. Furthermore, local and national authorities repeatedly renewed most contracts. As a result, the number of fixed term employees reached 70,000 by 2004. They amounted to the 10\% of the population of civil servants at the time. Following this development, the government passed a law in 2004 that allowed 35,000 fixed term employees to remain in the public sector indefinitely. This law effectively terminated the exclusive jurisdiction of SCPS to hire civil servants.

The failed reforms above are not unique. On the contrary, many similar incidents occurred in the last decades. However, prior to 1980 Greek governments realized a lot of successful reforms. For example in the 1950s, the government founded a number of new agencies and organizations. For the most part, these new agencies proved very efficient and contributed significantly to the rapid economic development of that period. An example of such an agency is the state electricity company. This company started operation in 1950 and by 1955 doubled total electricity production. In the following two decades, it created almost all the energy infrastructure that exists today in Greece. My model can explain this discrepancy in the success of reforms across time, since the failure of reforms coincides with the ageing of the population. I discuss this issue further in the conclusions below.

\textsuperscript{17}Known in Greece as ASEP
6 Conclusions

The key feature of this paper, is that the distribution of political power across generations affects corruption and growth. This is so, because the old are those who mainly benefit from government spending. Therefore, an increase in their political power also increases public expenditure. In turn, increased government spending, generates corruption and diminishes capital investment and growth. This effect is stronger in countries with weak institutions.

In general, political and social institutions depend on the history of each country and do not change much over time. However, their effects appear to vary significantly from period to period. For example, cronyism and clientelism seem to underpin the poor economic performance in the last 4 decades in Greece. However, these two characteristics trace back to the beginning of the Greek state in the 19th century. Yet, they haven’t been able to prevent the Greek economic “miracle” that occurred between 1950 and 1980.

My model can account for this discrepancy. In particular, in democracies the political power of each generation crucially depends on the demographic structure. Thus, a rapid increase in the number of young can diminish the negative effect of weak institutions. On the contrary, an increase in the number of the old causes high corruption and low growth and therefore makes the negative effects of weak institutions more visible.

In this sense, demographic shifts due to wars, baby booms, immigration waves, e.t.c. can cause virtuous cycles of low corruption and fast growth and vicious cycles of high corruption and low growth, depending on their characteristics. These cycles are more visible in countries with social and political institutions that foster corruption.

Appendix

A1. Properties

Property 1. Convergence

Consider the terminal period $T$. In this period the expectation for next period’s policy is $Z' = 0$ and $G' = 0$. Then the objective of the government in period $T$ is

$$V = \varphi \ln (w - \frac{G}{N} - \frac{Z}{N_y}) + (1 - \varphi) \ln (RK + \frac{Z}{N_o} - \frac{G}{N}) + \theta \ln G.$$

Since $w$ is a linear function of $Y$ it is easy to show that maximizing $V$ with respect to $Z, G$ yields a unique solution that is linear in $Y$ (i.e. $Z = \Delta_T Y$ and $G = E_T Y$. Then the problem of the government in period $T - 1$ looks exactly like the infinite period problem I solve in the text, with the exception
that $\Delta_T$ and $E_T$ substitute for $\Delta'$ and $E'$. However, as I show in appendix B1, the solution to the infinite period problem is stationary ($\Delta'$ and $E'$ vanish from the solution). Thus, the policy for all periods prior to $T$, is always equal to that of the infinite period model ($Z = \Delta Y$ and $G = EY$). Clearly as time goes to infinity period $T$ vanishes. This concludes the proof.

**Property 2. Robustness**

The first order conditions for firms and individuals are identical to the general case, with the exception that $\gamma = 1$ and $G, G' = 0$. Thus, $Y' = \frac{1}{a}[\frac{\beta R}{1 + w}(aY - Z) - Z']$, $c_y = [(N_y(1 + \beta))^{-1}((1 - a)Y - Z]$ and $c_o = N_o^{-1}(aY + Z)$. Then, the first order condition, for the maximization of the government’s objective, with respect to $Z$ is $\varphi(1 + \beta)c_oN_o = (1 - \varphi)N_yc_y$. Solving for $Z$ yields: $Z = \frac{1 - a - a\varphi}{1 + \varphi}Y$, where $\Phi = \frac{(1 + \beta)^2}{1 - \varphi}$. Therefore, $\Delta = \frac{1 - a - a\varphi}{1 + \varphi}$. Substituting $Z = \Delta Y$ in the expression for $Y'$, I get $Y' = \frac{\beta R}{1 + \beta} \frac{1 - a - \Delta}{a + \Delta}$ or $\frac{Y'}{Y} = \frac{\beta R}{1 + \beta} \frac{1 + \varphi}{1 + \varphi} = \beta R \frac{1 + \varphi}{1 + \varphi} \frac{1 - \varphi}{1 - \varphi}$.

**A2. Comparative statics**

$0 \leq \Delta \leq 1$ and $0 \leq E \leq 1$

Since $\Delta$ and $E$ are shares of government spending in output, they must satisfy the inequalities above. This is obvious for $E$. As for $\Delta$ it can be written as:

$$\Delta = \frac{(1 - \varphi)(1 - a) - \varphi[1 + \beta(1 + \theta)]a + \theta[(1 - a)s_o - a s_y]}{1 - \varphi + \varphi[1 + \beta(1 + \theta)] + \theta}$$

It is evident from the expression above that if $\Delta > 0$ then $\Delta < 1$. Again from this expression, it is clear that $\Delta > 0$ if $\frac{s_o}{s_y} < \frac{1 - a}{a}$ and $\varphi < \frac{1 - a}{a}$. That is, if the share of the young in the population and their political power is sufficiently small. Yet, even if the first inequality doesn’t hold, there exists a number $\eta$, such that $\Delta > 0$, for every $\varphi < \eta$. In other words if for given population shares the political power of the young is sufficiently small $\Delta > 0$.

$$\frac{\partial g_y}{\partial \omega} > 0$$

The political power of the young $\varphi(\omega)$ appears only in the expressions for $\Delta'$ and $E'$. Thus, $\text{sign}\frac{\partial g_y}{\partial \omega} = \text{sign}[-(1 + \beta \gamma)\frac{\partial \Delta}{\partial \omega} + s_o \frac{\partial E}{\partial \omega}]$. For simplicity define $\omega \equiv (1 + \theta)(1 + \varphi \beta)$. Then $-(1 + \beta \gamma)\frac{\partial \Delta}{\partial \omega} + s_o \frac{\partial E}{\partial \omega} = \frac{(1 + \beta \gamma)\omega + \frac{s_o}{\omega}(1 + \beta \gamma)(1 - \varphi)}{\omega^2} > 0$.

$$\frac{\partial g_y}{\partial \gamma} < 0$$

25
Since $\gamma$ appears only in the denominator of the growth rate expression, I rearrange this denominator as follows:

$$
\gamma \beta \left[(1 - \varphi' + \theta s_o') - a(1 + \theta)(1 + \beta \varphi')\right] + a \beta (1 + \theta)(1 + \beta \varphi') + (1 - \varphi' + \theta s_o')
$$

Then $\text{sign}\left[\frac{\partial g_y}{\partial \gamma}\right] = -\text{sign}\left[(1 - \varphi' + \theta s_o') - a(1 + \theta)(1 + \beta \varphi')\right] < 0$ because the term $(1 - \varphi' + \theta s_o') - a(1 + \theta)(1 + \beta \varphi')$ is the numerator in $\Delta$ which is positive as long as $\Delta$ is positive.

### A3. Resistance to reforms

**Solution with and without transfers**

The lifetime utility of the young, is linear in first period consumption. Thus in order to compare lifetime utility with and without transfers it suffices to compare $c_y$ in the two cases. Solving the model without government (transfers and public goods) yields $g_Y = \frac{\beta R (1 - a)}{(1 + \beta)(1 + \beta \varphi')}$ and $c_y = \frac{1 - a}{N_y (1 + \beta)(1 + \beta \varphi')}$. The consumption of the young $c_y$, for the case with transfers, in the simple model I discuss in A2, is $c_y = \frac{\Phi^* N_y}{N_y (1 + \beta)(1 + \Phi^*)}$, while the growth rate is $\frac{Y'}{Y} = \frac{\beta R}{1 + \beta \Phi^* (1 + \Phi^*)}$. It turns out that as long as $\Phi < \frac{1 - a}{a}$, growth and welfare are greater without transfers. In this respect notice that $\Phi < \frac{1 - a}{a}$, is the condition under which transfers are positive.

**Institutional change**

I consider here a simple version of the model ($\gamma = 1$, $\theta = 0$). Following the results I present in Appendix A2 for this model, I can write: $Z = \frac{1 - a - a \Phi^*}{1 + \Phi^*}$, $c_y = \frac{\Phi^*}{N_y (1 + \beta)(1 + \Phi^*)}$, $c_o = \frac{1}{N_o (1 + \Phi^*)}$. Then, since $c_o = \beta R c_y$, I get $u_y = (1 + \beta) \ln c_y + C$, where $C$ is a constant. Then, maximizing the objective $V$ of the government is equivalent to maximizing $\varphi(1 + \beta)\ln(\Phi^* - \ln(1 + \Phi^*)) - (1 - \varphi) \ln(1 + \Phi^*)$ or $\Phi \ln \Phi^* - (1 + \Phi) \ln(1 + \Phi^*)$. Taking first order conditions with respect to $\Phi^*$ in the last expression, yields $\frac{\Phi}{\Phi^*} = \frac{1 + \Phi}{1 + \Phi^*}$ or $\Phi^* = \Phi$.

### A4. Demographic shocks

Table 1, displays the calculations that lead to the results in figures 1 and 2. The baby boom and baby bust are generated by an increase and a decrease respectively, in children by 10%. I present the calculations only for the case of baby boom. The calculations for the baby bust are very similar.
Table 1

<table>
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<th>$N_y$</th>
<th>$N_o$</th>
<th>$N'_y$</th>
<th>$N'_o$</th>
<th>$N$</th>
<th>$N'$</th>
<th>$\Phi$</th>
<th>$\Phi'$</th>
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<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

In table 1 above, the growth rate ($g_Y$) in period $t$ depicts the ratio $\frac{Y_{t+1}}{Y_t}$, since $g_Y = \frac{Y_Y}{Y}$. On the other hand, in figure 2, I associate growth between periods $t$ and $t-1$, with the average age in period $t$. Thus, to derive the data of figure 2, the column of $g'_Y$ must be forwarded one period.

B1. Probabilistic voting model

In the beginning of each period an election takes place. The outcome of this election determines government policy. In this appendix I provide a model of this political process. This model belongs in the general class of probabilistic voting models.

In particular, two candidates, $A$ and $B$, participate in the election and two age groups, old and young, make up the electorate. Voters cast their vote according to two criteria. First, the policy endorsed by each candidate and second, general preferences over the two candidates. The latter can be due to ideological proximity to the voter, support from the media, favours offered by the candidate e.t.c. Furthermore, the old are organized in a network that supports the two candidates.

I let $S_A$ and $S_B$ be the network support to candidates $A$ and $B$ respectively and normalize total support to 1 ($S_A + S_B = 1$). Furthermore to simplify notation I define $S_A \equiv S$ and $S_B \equiv 1 - S$.

One can think of the network above, as a lobby that offers financial support to the candidates. However I interpret it in a broader manner that also incorporates aspects of clientelistic policy. Think for example of doctors in a government hospital that allow the voters of a particular candidate to jump the que for a rare bed$^{18}$.

$^{18}$In a discussion in the Greek parliament in the 12th of April 2017 a government MP and doctor said that you need to know the prime minister to get a bed in an intensive care unit.
The objective of the network is:

\[ V_{Nt} = P_Au_o(T_A) + P_Bu_o(T_B) - \frac{1}{2} \left[ \left( S - \frac{1}{2} \right)^2 + \left( 1 - S - \frac{1}{2} \right)^2 \right] \] (23)

where \( P_A \) and \( P_B \) are the probabilities of winning for the two candidates. These probabilities, as I will show later on, depend on the support of the network. Variables \( T_A, T_B \) represent the choice of policy by the two candidates.\(^{19}\)

Equation 23 above is the expected utility of the old, plus a quadratic cost that depends on the extent of one sided-support. To motivate the last part, think how difficult it would be for the doctors of a hospital to justify admitting only the voters of a particular candidate.

On the other hand, the purpose of each candidate is to maximize the probability of winning the election (\( P_A, P_B \)). In order to work out this probability I start with the behavior of the voter.

Voter \( i \) from age group \( j (j = o, y) \) votes for candidate \( A \) if:

\[ u_j(T_A) \geq u_j(T_B) + \delta + \sigma_{ij} \] (24)

where \( \delta \) is the overall popularity for candidate \( A \) in the electorate and satisfies \( \delta = \tilde{\delta} + h(S_A - S_B) = \tilde{\delta} + h(1 - 2S) \). In turn \( \tilde{\delta} \sim U\left[-\frac{1}{2\psi}, \frac{1}{2\psi}\right] \) is the overall ideological bias for candidate \( A \) and \( \sigma_{ij} \sim U\left[-\frac{1}{2\lambda_j}, \frac{1}{2\lambda_j}\right] \) is the individual ideological bias for the same candidate. Finally \( h > 0 \) quantifies the effect of network support on the election.

The parameters \( \psi \) and \( \lambda_j \) capture the degree of ideological polarisation, both among the voters in general and in each age group in particular. If these parameters increase, the respective populations of \( \tilde{\delta} \) and \( \sigma_{ij} \) concentrate around the mean of their distributions, which is zero. Thus ideological preferences for a candidate become weaker. Therefore it is easier for the candidates to turn the voters in their favour by choosing policies appropriately. In this sense, these parameters depict shares of swing or undecided voters.

Consider now the critical voter in age group \( j \), also named \( j \). This is the voter who is indifferent between the two candidates. Thus his ideological bias satisfies, \( \sigma_j = u_j(T_A) - u_j(T_B) - \tilde{\delta} - h(1 - 2S) \). Then all individuals in age group \( j \) with \( \sigma_{ij} \leq \sigma_j \) vote for \( A \). Using the properties of the uniform distribution, the share of votes for candidate \( A \) in age group \( j \) is \( \Pi'_j = \left( \sigma_j + \frac{1}{2\lambda_j} \right) \lambda_j \) and the total share of votes in the electorate is \( \Pi_A = \sum_j \omega_j \left( \sigma_j + \frac{1}{2\lambda_j} \right) \lambda_j \).

\(^{19}\)For notational simplicity I use \( T \) to describe the budget allocation between public goods and transfers. \( T = (N, Z) \)
Then the probability of winning for candidate $A$ is $P_A = Pr(\Pi_A \geq \frac{1}{2})$

where $\Pi_A \geq \frac{1}{2} \Rightarrow \sum_j \omega_j \sigma_j \lambda_j \geq 0 \Rightarrow \sum_j \omega_j \lambda_j (u_j(T_A) - u_j(T_B)) - \sum_j \omega_j \lambda_j h(1 - 2S) - \delta \sum_j \omega_j \lambda_j \geq 0 \Rightarrow \bar{\delta} \leq \frac{\sum_j \omega_j \lambda_j (u_j(T_A) - u_j(T_B))}{\sum_j \omega_j \lambda_j} - h(1 - 2S)$.

Using the distribution of $\bar{\delta}$, the equation above implies:

$$P_A = \frac{1}{2} + \sum_j \pi_j (u_j(T_A) - u_j(T_B)) - h(1 - 2S)$$

where $\pi_j = \frac{\psi \omega_j \lambda_j}{\sum_j \omega_j \lambda_j}$. Then, the objective of candidate $B$ can be derived from the fact that $P_B = 1 - P_A$.

Using the objectives of the network and the candidates (equations 23 and 25) I can now turn to the calculation of the political equilibrium. The sequence of events is as follows: First, the candidates announce their policies ($T_A, T_B$). Then, the network provides support to the two candidates. Finally, elections take place and the winning candidate implements his policy.

I start by considering the network since it moves after the candidates. In particular the network maximizes equation 23 with respect to $S$ taking into account the definition of $P_A$ (equation 25) and the fact that $P_B = 1 - P_A$.

First order conditions for this problem yield:

$$(1 - 2S) + 2\psi h(u_j(T_A) - u_j(T_B)) = 0$$

or equivalently

$$S = \frac{1}{2} + \psi h(u_j(T_A) - u_j(T_B))$$

In words, the network offers excess support for a candidate, only if he furthers the interests of its members.

Let me now turn to the choice of policy by candidate $A$. Substituting equation 26 in equation 25 yields $P_A = \frac{1}{2} + \sum_j \pi_j (u_j(T_A) - u_j(T_B)) + 2h^2 \psi^2 (u_o(T_A) - u_o(T_B)) = \frac{1}{2} + \pi_y (u_y(T_A) - u_y(T_B)) + (\pi_o + 2h^2 \psi^2) (u_o(T_A) - u_o(T_B))$. Since $P_B = 1 - P_A$, the above equation implies that both candidates maximize $\pi_y u_y(T) + (\pi_o + 2h^2 \psi^2) u_o(T)$, with respect to $T$, which in turn is equivalent to maximizing:

$$\varphi u_y(T) + (1 - \varphi) u_o(T)$$

where $\varphi = \frac{\pi_y}{\pi_o + \pi_y + 2h^2 \psi^2}$. Substituting $\pi_o$ and $\pi_y$ in the definition of $\varphi$ gives

$$\varphi = \frac{\omega_y \lambda_y}{(\omega_y \lambda_y + \omega_o \lambda_o)(1 + 2\psi h^2)}.$$
Without loss of generality I set $\psi = \frac{1}{2h}$ and thus

$$\varphi = \frac{\omega_y \lambda_y}{(\omega_y \lambda_y + \omega_o \lambda_o)(1 + h)}$$  \hspace{1cm} (28)

Equations 27 and 28 correspond to equations 12 and 13 in the main text.

**B2. Solving for equilibrium**

I start with equation 8 in the text which is

$$k^* = \frac{\beta}{1 + \beta}(w - t_y) - \frac{1 + \beta \gamma}{R(1 + \beta)} Z^* + \frac{t_o^*}{R(1 + \beta)}$$

I multiply this equation by $RN_y$ to derive equation 18 below

$$Y^* = \frac{1}{a(1 + \beta)}[\beta R[(1 - a)Y - s_y G - Z] - (1 + \beta \gamma)Z^* + s_o G^*]$$

Then I eliminate taxes from the consumption functions of young and old. Furthermore I multiply and divide the first of these functions by $RN_y$ and the second by $N_o$, to get:

$$c_y = \frac{1}{RN_y} \left[ \frac{R[(1 - a)Y - s_y G - Z]}{1 + \beta} + \frac{1 - \gamma}{(1 + \beta) N_o} - \frac{G^*}{(1 + \beta) N_o} \right]$$ \hspace{1cm} (29)

$$c_o = \frac{aY + Z - s_o G}{N_o}$$ \hspace{1cm} (30)

I can write the objective of the government equation 12 as

$$V = \varphi(1 + \beta) \ln c_y + \theta \ln G + \beta \varphi \theta \ln G^* + (1 - \varphi) \ln c_o$$

Then the first order conditions for the maximization problem are

$$\frac{\partial V}{\partial Z} = 0$$ \hspace{1cm} (31)

$$\frac{\partial V}{\partial G} = 0$$ \hspace{1cm} (32)

These first order conditions yield the GEE (equations 16 and 17) in the text:

$$\varphi \left[ -R + (1 - \gamma) \frac{\partial G^*}{\partial Z} - s_o \frac{\partial G^*}{\partial Z} \right] + \frac{\beta \varphi \theta}{c_y N_y R} \frac{\partial G^*}{\partial Z} + \frac{(1 - \varphi)}{c_o N_o} = 0$$ \hspace{1cm} (33)

$$\varphi \left[ -Rs_y + (1 - \gamma) \frac{\partial G^*}{\partial G} - s_o \frac{\partial G^*}{\partial G} \right] + \frac{\beta \varphi \theta}{c_y N_y R} \frac{\partial G^*}{\partial G} + \frac{\theta}{G} + \frac{(1 - \varphi)}{c_o N_o} = 0$$ \hspace{1cm} (34)

Rearranging terms in the GEE and substituting in them the value of the derivatives
\[
\frac{\partial Z}{\partial Z} = -\Delta \Lambda, \quad \frac{\partial G}{\partial Z} = -E' \Lambda, \quad \frac{\partial Z}{\partial G} = -\Delta \Lambda s_y, \quad \frac{\partial G}{\partial G} = -E' \Lambda s_y.
\]

yields:

\[
\frac{\varphi[-R - (1 - \gamma)\Delta \Lambda + s_y E']}{c_y N_y R} = \frac{\beta \varphi E \Lambda - (1 - \varphi)}{c_o N_o} \tag{35}
\]

\[
\frac{\varphi[-Rs_y - (1 - \gamma)s_y \Delta \Lambda + s_y s_y E']}{c_y N_y R} = \frac{\beta \varphi s_y E \Lambda - (1 - \varphi) - \theta}{c_o N_o} \tag{36}
\]

Combining the two equations above to eliminate the LHS I get

\[
\frac{\theta}{s_y G} = \frac{1 - \varphi}{s_y c_o N_o} \Rightarrow \theta(aY + Z - s_y G) = (1 - \varphi)G
\]

or

\[
G = \frac{\theta(aY + Z)}{1 - \varphi + \theta s_o} \tag{37}
\]

In order to proceed define \( \Sigma \equiv (1 - a)Y - Z - s_y G \). Then \( Y' = \Lambda \Sigma \) and \( G' = E' \Lambda \Sigma \), \( Z' = \Delta \Lambda \Sigma \). Thus, \( c_y R N_y (1 + \beta)^{-1} = R \Sigma + (1 - \gamma)\Delta \Lambda \Sigma - s_y E' \Lambda \Sigma \). Therefore the first of the GEE above (equation 35) becomes

\[
\frac{-\varphi(1 + \beta)}{\Sigma} = \frac{\varphi \beta \theta}{\Sigma} - \frac{1 - \varphi}{c_o N_o}
\]

or equivalently \( \varphi(1 + \beta(1 + \theta))(aY + Z - s_y G) = (1 - \varphi)[(1 - a)Y - Z - s_y G] \).

Substituting equation 37 in this equation and solving for \( Z \) yields the policy rule for \( Z \):

\[
Z = \left[ \frac{1 - \varphi + \theta s_o}{(1 + \varphi \beta)(1 + \theta)} - a \right] Y \tag{38}
\]

Then substituting equation 38 back in equation 37 and solving for \( G \) yields the policy rule for \( G \):

\[
G = \frac{\theta}{(1 + \varphi \beta)(1 + \theta)} Y \tag{39}
\]

The policy rules (equations 38 and 39) imply \( \Delta = \frac{1 - \varphi + \theta s_o}{(1 + \varphi \beta)(1 + \theta)} - a, \ E = \frac{\theta}{(1 + \varphi \beta)(1 + \theta)} \) and \( \Delta' = \frac{1 - \varphi + \theta s_o}{(1 + \varphi \beta)(1 + \theta)} - a, \ E' = \frac{\theta}{(1 + \varphi \beta)(1 + \theta)} \).

Now in order to calculate the growth rate of the economy let me first rearrange terms in equation 18

\[
[(1 + \beta)a + (1 + \beta \gamma)\Delta' - s_y E']Y' = \beta R[(1 - a) - \Delta - s_y E]Y \tag{40}
\]

Then substituting \( \Delta, \ \Delta', \ E \) and \( E' \) in equation 40 above and solving for \( Y'/Y \) yields the growth rate of the economy:

\[
g_Y = \frac{\varphi(1 + \beta \varphi)[1 + \beta(1 + \theta)]}{(1 + \beta \varphi)[a \beta(1 - \gamma)(1 + \beta \varphi)(1 + \theta) + (1 + \beta \gamma)(1 - \varphi) + \beta \gamma \theta s_o]}
\]
B3. Denmark and Finland

The table that follows compares Finland and Denmark to the set of the 24 countries that where OECD members prior to 1980. These 24 countries, possibly with the exception of Turkey, are what we often call, the western developed democracies. As such, these countries are considered in similar studies like [14]. The table displays government spending over GDP, the Corruption Perception Index of the Transparency International and the ratio of individuals over 55 to the active population (individuals over 15), all three for the year 2010. The point of this comparison is that the increased number of the old in Denmark and Finland is a source political power. This "legitimate" political power of the old, can possibly explain the increased government spending in these countries, despite the apparent lack of corruption.

<table>
<thead>
<tr>
<th>Countries</th>
<th>Gov. spend. / GDP %</th>
<th>CPI</th>
<th>55+ / 15+ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>43</td>
<td>9.3</td>
<td>36</td>
</tr>
<tr>
<td>Finland</td>
<td>40</td>
<td>9.2</td>
<td>38</td>
</tr>
<tr>
<td>Average (24 count.)</td>
<td>37</td>
<td>7.6</td>
<td>34</td>
</tr>
</tbody>
</table>

The sources for the data in the table are:

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