When elders rule: is gerontocracy harmful for growth?

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When Elders Rule: Is Gerontocracy Harmful for Growth?

A Comparative Study of Seven European Countries

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Abstract

We study the relationship between gerontocracy and aggregate economic perfomance in a simple model where growth is driven by human capital accumulation and productive government spending. We show that gerontocratic élites display the tendency to underinvest in public education and productive government services and thereby may be harmful growth. In absence of intergenerational altruism, the damage caused by gerontocracy is mainly due to the lack in long-term delayed-return investment originated by the shorter life horizon of the ruling class with respect to the rest of the population. An empirical analysis is carried out on a rich data set that allows to test theoretical results across different countries and different sectors. The econometric results confirm our main hypotheses.

***Keywords**: Gerontocracy, Economic Growth and Aggregate Productivity.*

***Jel codes**: J1, O4.*

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1 Introduction

In this paper, we study the connection between the aggregate economic performance and the age of the political élite of a society. In a very simple framework, we show that an older ruling class, whose interest may be less devoted to long-term delayed-return investment, may weaken the human capital accumulation process because of inadequate public education policies and hinder private sector productivity growth because of poor expenditure in productive services. In this sense, we argue that gerontocracy is harmful for growth. To estimate the impact of this phenomenon on the economic performance, we use a wide set of information on the Parliamentarians of a group of European countries along with a rich industry-level data set. Our main goal is to exploit differences in the politicians' age to estimate the effect that the gerontocracy exerts on the allocation of public spending and thus on productivity growth.

Recent years have seen a surge of academic research and policy attention about the causes underlying differences in growth performance across OECD countries. Actually, per capita growth rates have ceased to converge. While productivity has accelerated in some of the most emerging economies and most notably in the United States, it has substantially slowed down especially in continental Europe and Japan (OECD [26]). Focusing on Europe, it is easily observed that since the mid-1990s, the economic performance has experimented a significant contraction compared to earlier periods. The economic literature developed so far has provided various explanations for such a sclerosis. The most commonly cited causes of that sluggish growth concern the atavistic rigidity of the European model, the burden of taxation, the people welfare dependency and the evidence that Europe has used some of the increased productivity, pursued in the past, to increase leisure rather than income. Particularly, a wide consensus has been reached among scholars regarding the "European model", which, despite its successes during the post-war era, is proving to be inadequate now that economic development is increasingly based on innovation and national companies can no longer be protected from foreign competition (Blanchard [8], Gordon [16]). Moreover, several studies point out that the adoption of key general purpose technologies associated with the Information and Communication Technologies (hereafter ICT) revolution has been hindered or impeded in Europe by an excessively regulated labor market and an insufficient level of competition (van Ark et al.[29]). Despite this productivity crisis is a common feature of a number of European economies, remarkable differences emerge from cross country comparisons. For example, OECD [26] reported that, compared with the previous decade, hourly labor productivity picked up in a group of economies, including Norway, Portugal, Germany, Finland and Sweden.

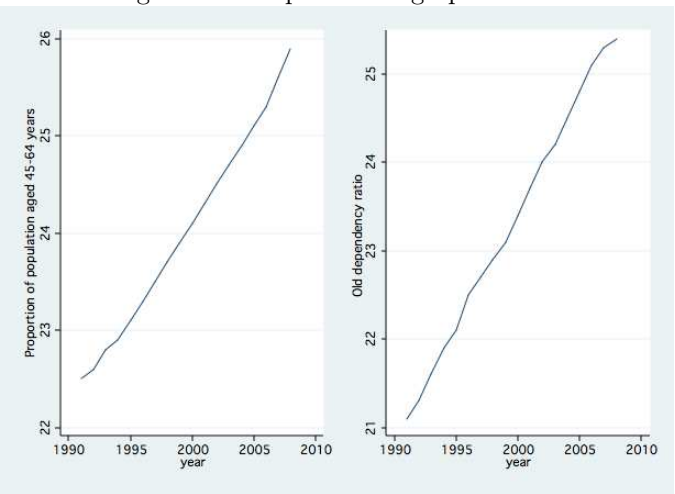
Most recently, new studies are prospecting the idea that a large share of the heterogeneity experienced across Europe could be attributed to the economic and political élites' capacity of managing a country (Caselli and Morelli [12], Mattozzi and Merlo [23]). Along these lines of thinking, the élites' responsibilities, with respect to the institutional, social and technological delays accumulated in the recent past, have become as an issue in the European economic picture.

It is worth noticing that the élites' responsibility does not exclusively derive from their simple tendency to maintain the *status quo*. It is also due to their inability to seize the opportunity given by new technologies and to implement the best choice for the economy as a whole, a direct consequence of the obsolescence of their own human capital.

We think that it is reasonable to assume that this obsolescence is crucially related to the power élites' age. Indeed, as pointed out by Messner and Polborn [24], many political or economic reforms resemble investment projects in their return streams: initially, there is a cost to be borne, but eventually there will be benefits. In this frame, young people will be able to enjoy the benefits longer and hence will be more inclined to favor reforms than older people. Therefore, among individuals of different ages, the oldest ones will not be in favor of the change because they mainly suffer the costs

without being able to reap much of the benefits.

Figure 1: European demographic trend



Source: EUROSTAT

Notice that, here, we define a gerontocratic society as a place where the decision-making process and the political environment are dominated by the oldest individuals, with negative consequences in periods of rapid change and instability, when innovation and flexibility are at a premium.[1]

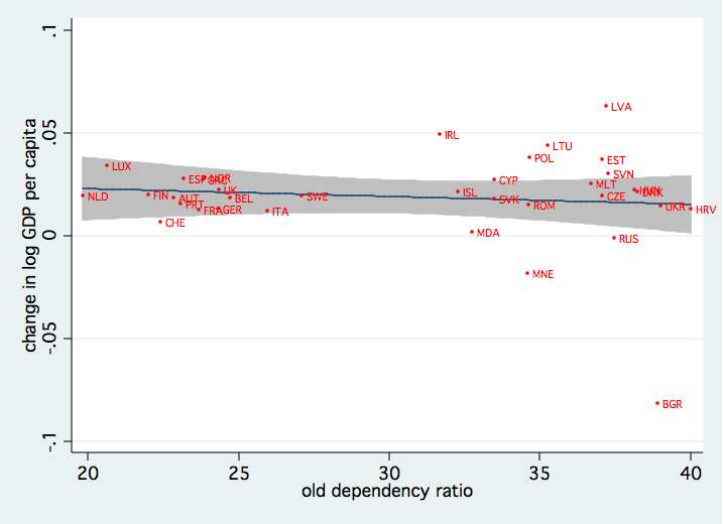
A related question is whether the progressive aging of European population may has led to the increase of gerontocracy during the last three decades. Figure 1 shows the pattern followed by the European demography along the period 1990-2003. This picture reflects the increase of life expectancy. Figure 2 simply plots change in GDP per capita between 1990 and 2007 against the old dependency ratio over the same period. What we prove in the following is that the negative impact of aging is much stronger when we focus only on the élites' and that is mainly due to all those country specific characteristics (i.e. income distribution, electoral rules, social norms) that let power, wealth and prestige flow upwards within an age pyramid in favor of elder power élites.[2]

Existing literature on labor economics provides further support in favor of our idea. Indeed, several studies show that if we consider the average age of workers, without taking into account their role in the firms, a negative link between seniority and productivity exists and this link is much more dramatic in the ICT sector (See Daveri and Maliranta [14]). Indeed, workforce aging is known to entail skill deterioration and lessened ability to adapt and learn new things. One possible explanation relies on the cognitive abilities' tendency to deteriorate with age. Although this decline is not uniform across abilities, after a certain age threshold, further advancements in age are seemingly associated

[1]The Italian picture is emblematic of much that gerontocracy matters. Data recently published on the major Italian newspapers cast no doubt about the fact that gerontocracy is an issue, in politics (Italian Prime minister is 65 year old and the head of the opposition is 70), in the research field (in Italy there exist just 9 under 35 years old college professor and 3 over 10 are over 65 years old), in the banking system (many chairman are much over 65), and in the firms sector where the family based production system lead to a patriarchal behavior. Hence, despite in Italy the retirement age is (nominally) fixed at the age of 65, in politics that it seems the age correnspondent to the acme.

[2]We choose as leading indicator the proportion of population aged 14-64 years and the proportion of population aged 65 and over to population in the interval 15 to 64 provided by Eurostat, but similar pictures can easily be obtained using other statistics.

Figure 2: Old dependency ratio and GDP growth in Europe



Notes: Old dependency ratio is from EUROSTAT; growth rate of real GDP chain *per capita* GDP growth rate is from Penn world Tables. Values are averaged by country from 1990 to 2007. The regression represented by the fitted line yields a coefficient of -0.0003 (standard error=0.0006), N=35, and R^2=0.0124.

with lower productivity at work. Beyond that threshold, further increases of experience add little or nothing to the working ability of a given worker. There are no reasons to believe that power élites are excluded from this process.

Our paper is somehow related to the literature on interest group politics, where existing powerful interest groups may impede the introduction of new technologies in order to protect their economic rents (Fernandez and Rodrik [15], Alesina and Rodrik [2], Acemoglu and Robinson [1]). In these contributions political élites block technological and institutional development because of a political replacement effect. Innovations often erode élites' incumbency advantage, increasing the likelihood that they will be replaced. Fearing replacement, political élites are unwilling to initiate change and may even block economic development.[3]

Our paper is also related to the broad literature that studies the links between different political variables and economic growth (Hashimzade and Davis [18], Hopenhayn and Muniagurria [19], Krusell and Rios-Rull [21], Krusell et al. [22]). In particular, Hashimzade and Davis [18] provide an interesting example on how political uncertainty might impede economic growth. The main conclusion of their thoretical work is that an increase in a political instability produces growth-reducing policies because leads governments to invest less in activities that support human capital accumulation. Along the same line of reasoning, through a simple model very close to the one developed by those authors, we argue that gerontocracy, involving an elder ruling class with a shorter life horizon with respect to the average, determines lower investments in human capital and in productive public services and thereby depresses economic development.[4]

The plan of the paper is as follows. Section 2 lays out the baseline mode and discusses the links

[3]We plan to show in a future article that gerontocracy matters, not only in the political ruling class but even in the entrepreneurial ruling class.

[4]This paper is not an attempt to explain what determines a gerontocratic ruling class (i.e. gerontocracy is not an endogenous variable). The analysis of this phenomenon is on our research agenda. Here we consider gerontocracy (and in the empirical part of the paper all the set of gerontocratic related variables) as exogenous and study the effect of this on growth.

among gerontocracy, public investments and economic growth. Our main conclusion is that gerontocracy is an important source of innovation-retarding policies and therefore depresses economic development. Therefore it can be seen as plausible explanations of the growth pattern differentials across countries. Section 3 presents our empirical analysis. Mostly we focus on how the performances recorded by a group of European countries, whose political structures are often characterized by leaders who are significantly older than most of the adult population, can be explained once this peculiarity is recognized. Econometric results are consistent with theoretical predictions of the model.[5] Section 4 concludes.

2 Theoretical model

2.1 Set up

The model extends the framework proposed by Hashimzade and Davis [18] by taking into account the role of public productive service, along with the public investment in education, as engine of the human capital accumulation.

Demography. In a discrete-time $t \in \{0, 1, \dots \infty\}$ economy, a continuum of measure 1 of consumers/workers produces a single homogenous good. At every moment, the same number of people are born and die, so the population is constant and normalized to one. Each agent has an uncertain lifetime and faces a probability υ of dying at any date. Following Boucekkine, de la Croix and Licandro [9], we model mortality such that the measure of each generation declines deterministically through time. The unconditional probability for an agent of reaching age $a \in [0, \overline{a}]$ is defined as:[6]

$$\upsilon(a) = \frac{e^{-\varrho a} - \kappa}{1 - \kappa} \quad \text{with} \quad \kappa > 0, \varrho < 0, \quad \text{or} \quad \kappa \in (0, 1), \varrho > 0 \tag{1}$$

where the maximum age $\overline{a}$ that an agent can reach is given by:

$$\overline{a} = \frac{-log(\kappa)}{\varrho} \tag{2}$$

No dynastic concerns are taken into account and people care only about their own utility. Similar to Glomm and Ravikumar [17], in each period agents allocate their time between education (e) and production ($1 - e$).

Technology. Production function requires the use of human capital and government purchases and takes the form:

$$Y_t = AG_t^{\eta} \left[(1 - e) H_t\right]^{1-\eta} \tag{3}$$

where $A > 0$ is the constant social marginal return of human capital, $(1 - e)H_t$ is the stock of human capital at time t (i.e. efficiency of labor hour), G_t is the productive government spending (e.g. the provision of productive services, the roll-out and adoption of broadband, antitrust legislation, etc) available at the beginning of period t and $0 < \eta < 1$.[7]

Human capital accumulation is determined according to the following production function:

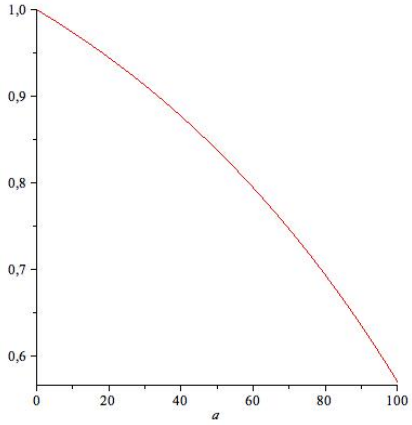
$$H_{t+1} = H_t + \phi(H_t, E_t) \tag{4}$$

[5] In our specific case the countries involved in the quantitative analysis will be Denmark, Finland, France, Italy, Germany and UK.

[6] Typically, individual mortality does not depend only on the individuals age and hinges also on the own consumption of health care and on the level of aggregate activity within a health care system. Boucekkine, de la Croix and Licandro [9] exstensively discuss the survival law defined by equation (1).

[7] The public factor in equation (3) is a common external input. That is G is a pure public good.

Figure 3: Survival law



where no depreciation is assumed, E_t is the public investment in education and ϕ is the learning technology described by the following homothetic function:

$$\phi(H_t, E_t) = e\zeta H_t^{\alpha} E_t^{1-\alpha} \tag{5}$$

with $\zeta > 0$ and $0 < \alpha < 1$. Output is taxed at fixed rate τ. This implies that the following condition, representing the government budget constraint, must hold:

$$\tau Y_t = G_t + E_t + R^g = \sigma_{gt}\tau Y_t + \sigma_{et}\tau Y_t + (1 - \sigma_{gt} - \sigma_{et})\tau Y_t \qquad \text{with} \quad (\sigma_{gt} + \sigma_{et}) \leq 1 \quad \forall t \tag{6}$$

Net output is consumed by the consumers/workers, $C_t^p = (1 - \tau)Y_t$.

Political environment. At each time t the government in charge chooses σ_{gt} and σ_{et} to finance productive government spending and public education respectively while the rest is consumed by the government without any benefit for the community. Roughly speaking, this private benefit enjoyed by the élites can be viewed as direct appropriation of tax revenues. For that reason we call it *government rent* and we indicate it with R_t^g. We assume that all the politicians in the office belong to the same generation. This simplification allows to consider each Government as a single individual of age $a \in [0, \overline{a}]$. We consider an environment where two governments randomly alternate in office. To keep matter simple, we follow Hashimzade and Davis [18] in assuming that the two governments are identical and face the same exogenous probability π of being voted out and replaced. At time zero, political élites know their status $\epsilon_0 \in \{l, w\}$. $\epsilon = l$ means that the incumbent government has lost the election. We assign at this event a positive probability π. At the opposite, with probability $(1 - \pi)$, $\epsilon = w$ and the incumbent government remains in charge. In the former case ($\epsilon = l$) goverment receives a retirement rent R^r, in the latter ($\epsilon = w$) it allocates tax revenues between productive government spending, public education and its own (unproductive) rent.

Political élites' maximize the following instantaneous return function:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} (\beta \upsilon(a))^t \left[\theta U(R_t^g) + (1 - \theta) U(C_t^p)\right] \tag{7}$$

where U is the strictly concave twice differentiable istantaneous return function, $R_t^g = (1 - \sigma_{gt} - \sigma_{et})\tau Y_t$ is the government rent, C_t^p is the private consumption and β is the time discount factor. In equation (7) θ and $(1 - \theta)$ are respectively the weight of government rent and the weight of the

private consumption (i.e. θ provides a measure of politicians' "selfishness"). while $\mathbb{E}_0$ denotes the expectation conditional on information available at date $t = 0$.[8]

In a such environment the controls σ_g and σ_e at date t depend only on the current state H, so that $\sigma_{gt} = \sigma_g(H_t)$ and $\sigma_{et} = \sigma_e(H_t)$.

The *policy vector* is denoted by $\Psi = \{\sigma_{g1}, \sigma_{e1}, \sigma_{g2}, \sigma_{e2}, \dots\}$ and in the present economy we let it consist of the amount of tax revenues the government invest to finance productive public services and public education plans, σ_g and σ_e respectively.

In light of that it is important to point out that any given policy generates a stochastic law of motion for the state:

$$H_{t+1} = \Xi\left(H_t, \sigma_{gt}, \sigma_{et}, \epsilon\right)$$

which will be stationary if σ_g and σ_e are stationary.

Following the standard notation used in literature, let now denote the variable at time t and $t+1$ as those without and with primes. The functional equation associated to the maximization problem faced by a government in charge at the beginning of period t is

$$V(H,\epsilon) = \max_{\{\sigma_e,\sigma_g\}_{t=0}^{\infty}} \left\{ \left[\theta U(R^g) + (1-\theta)U(C^p)\right] + \beta\upsilon > (a)E\left[V(H^{'},\epsilon^{'})\right]\right\} \tag{8}$$

$s.t$

$$\begin{aligned} Y &= Y = AG^{\eta}\left[(1-e)\,H\right]^{1-\eta} \\ H_0 &> 0 \\ H^{'} &= \Xi\left(H, \sigma_g, \sigma_e, \epsilon\right) \\ C &= (1-\tau)Y \\ R^g &= \begin{cases} (1-\sigma_g-\sigma_e)\tau Y & \text{if } \epsilon = w \\ R^r & \text{if } \epsilon = l \end{cases} \end{aligned} \tag{9}$$

where at time zero, H_0 is pre-determined, and R_0^g and H_1 are chosen and the uncertainty is due to the risk of an electoral loss in the subsequent period. Notice that equation (8) holds for any $t \in (0,\infty)$. The value function (8) is the present discount value of the incumbent ruling class evalueted along the optimal program.

As previously mentioned, R^r indicates the retirement rent gained in case of electoral loss. Since we are focusing on the burden that gerontocracy places on the economic performance, it seems reasonable to assume that the role played by the retirement rent - whose benefits can actually be enjoyed over a short period of time - in the political élites' decision process is negligible. Therefore we assume that R^r is a constant and lower than $(1-\sigma_g-\sigma_e)\tau Y$.

The following assumptions are maintained for the remainder of this section.

Assumption 1. *Life expectancy declines through time according to (1).*

Assumption 2. $H \in \mathcal{H} \subset \mathcal{R}$, $(\sigma_g + \sigma_e) \in (0,1)$ *and* $E, G \in \mathcal{A} \subset \mathcal{R}$.

Assumption 3. $U : X \to \mathcal{R}$ *is a strictly increasing, twice continously differentiable and concave utility function, with* $U'(0) = \infty$ *and* $U'(\infty) = 0$.

Assumption 4. *Retirement rent* R^r *is assumed be constant,* $R^r = \overline{R} < (1-\sigma_e-\sigma_g)\tau Y$.

In this model we choose to focus on the optimizing behavior of the political élites. Therefore we postpone to a further extension the modeling of a voting stage and the analysis of the role that population's age may exert on the political outcomes and then on the aggregate economic performance. In other words, in order to be able to analyze our main question in a meaningful way, we

[8] Notice that the expectation $\mathbb{E}$ is with respect to ϵ and is understood to be conditional on σ_{et} and σ_{gt}.

need to find a link between the age structure of the political élites and the policies implemented. For that reason we focus on a such simple environment. Moreover we added an aggregate technology that ensures a perpetual growth driven by productive government services and investment in education. The provision of both government services and public education is financed by a tax on income, whose revenues are also used to finance the élites' unproductive rent R^g. As it will be more clear in the following paragraph, this assumption is crucial to highlight the trade-off faced by the policy maker and the role of gerontocracy. Each rational government will choose the amount of tax revenues to invest in innovation and education that will yield a rent R^g as large as possible, under the uncertainty of being re-elected in the subsequent election. In this conceptualization, the term $\upsilon(a)\pi$ can be interpreted as complement to 1 of the turnover rate, among politicians belonging to different generations. According to the empirical evidence, this turnover rate raises as the political élite gets older. As it appers clearly from equation (8), the lower is $\upsilon(a)\pi$ the higher is the relative weight of the current benefit with respect to the future, making it optimal for politicians to raise their private unproductive rent and lower the productive public investments.

2.2 Equilibrium and Results

Here we interested into analyzing the long-run effects of gerontocracy, therefore we focus on the stationary equilibrium which involves time-invariant decision rules in the infinite horizon. This concept uses a recursive representation of the political élites' problem.

Definition 1. *Given the initial H_0 and $H_t \in \Gamma(H_{t-1}) \subset \mathcal{H}$, with Γ continuous and compact-valued, a* Balaced Growth Path *(hereafter* BGP*) for the economy is a collection of sequences $\{H, Y, C^p, R^g, \sigma_g, \sigma_e, G, E, e\}_{t=0}^{\infty}$ such that:*

i) H evolves according to (4);

ii) government budget is balanced, $\tau Y_t = G_t + E_t + R_t^g$;

iii) politicians solve problem (8-9).

Let now V_l denote the value of an electoral loss, which occurs with probability π, and V_w the value of being electeded, which occurs with probability $(1-\pi)$. Then we have the following proposition.

The optimal value function V for the political élites' optimization problem (8-9) is a solution to the Bellman equation:

$$V(H) = \max_{\{\sigma_e, \sigma_g\}_{t=0}^{\infty}} \left\{ \theta U(R^g(H)) + (1-\theta)U(C^p(H)) \right] + \beta \upsilon(a) \left[\pi V_l(H') + (1-\pi) V_w(H') \right] \right\} \quad (10)$$

subject to (9).

With interior equilibrium, the first order conditions and the envelope condition for the political élites' problem are respectively:

$$[FOC] \qquad \frac{\partial V}{\partial \sigma_g} = 0 \Rightarrow \frac{\partial U}{\partial \sigma_g} + \beta \upsilon(a) \left[\pi \frac{\partial V_l}{\partial H'} \frac{\partial H'}{\partial \sigma_g} + (1-\pi) \frac{\partial V_w}{\partial H'} \frac{\partial H'}{\partial \sigma_g} \right] = 0 \quad (11)$$

$$[FOC] \qquad \frac{\partial V}{\partial \sigma_e} = 0 \Rightarrow \frac{\partial U}{\partial \sigma_g} + \beta \upsilon(a) \left[\pi \frac{\partial V_l}{\partial H'} \frac{\partial H'}{\partial \sigma_e} + (1-\pi) \frac{\partial V_w}{\partial H'} \frac{\partial H'}{\partial \sigma_e} \right] = 0 \quad (12)$$

$$[ENV] \qquad \frac{\partial V_l}{\partial H} = \frac{\partial U(\overline{R})}{\partial H}; \quad \frac{\partial V_w}{\partial H} \frac{\partial}{\partial H} \left[\theta U(R^g) + (1-\theta) U(C^p) \right] \quad (13)$$

Conditions (11-12-13), togheter with the trasversality condition:

$$\lim_{t \to \infty} (\beta \upsilon(a))^t \frac{\partial U(\cdot)}{\partial H} H_t = 0 \quad (14)$$

and the initial condition of the economy fully characterize the solution of the political élites' problem.

Finally, the assumption of identical governments implies that they choose the same optimal level of σ_e and σ_g, which is constant along the BGP where all the *per capita* variables grow at the same rate given by

$$\gamma = \zeta e \left[A^{1/(1-\eta)} \sigma_e \sigma_g^{\eta/(1-\eta)} \tau (1-e) \right]^{1-\alpha} \tag{15}$$

Simple algebra provides the following proposition.

Proposition 1. *Along the* BGP*, the growth rate of* per capita *variables is increasing in the amount of tax revenues used to finance education and productive services:*

$$\left.\frac{\partial \gamma}{\partial \sigma_e}\right|_{BGP} > 0 \quad \textit{and} \quad \left.\frac{\partial \gamma}{\partial \sigma_g}\right|_{BGP} > 0$$

Proof 1. *See appendix A.1.*

Recalling that along BGP, $H^{'} = H(1+\gamma)$, proposition 1 also implies:

$$\frac{\partial H^{'}}{\partial \sigma_e} = H \left(\frac{1-\alpha}{\sigma_e} \right) \gamma \tag{16}$$

$$\frac{\partial H^{'}}{\partial \sigma_g} = H \left(\frac{1-\alpha}{1-\eta} \frac{\eta}{\sigma_g} \right) \gamma \tag{17}$$

2.2.1 Comparative statics: the role of gerontocracy

In order to obtain explicit solutions for σ_e and σ_g and do some comparative statics, we assume now that the politicians' preferences are defined as follows.

Assumption 5. *Power élites' utility function is logarithmic,* $U(\cdot) = \ln(\cdot)\ \forall t \in (0, \infty)$.

Provided that v depends on the politicians' age according to (1), solving (11-13) with respect σ_g and σ_e yields:

$$\sigma_g^* = \eta \frac{\beta v (1-\pi)(1-\alpha)}{\theta + \beta v (1-\pi)(1-\alpha)}, \tag{18}$$

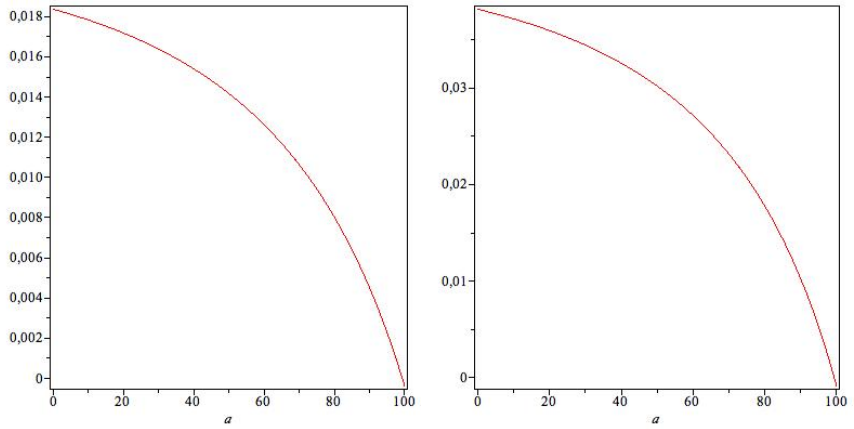
$$\sigma_e^* = (1-\eta) \frac{\beta v (1-\pi)(1-\alpha)}{\theta + \beta v (1-\pi)(1-\alpha)}. \tag{19}$$

Proposition 2. *Along the BGP, both the optimal government spending in productive services* σ_g^* *and education* σ_e^* *decline when the political élite gets older. Thus, the older is the political élite (i.e. the higher is a) the lower is the equilibrium growth rate* γ.

Proof 2. *See appendix A.2.*

In a simple framework, we showed that politicians' age is negatively related to their intentions in favor of adopting potential growth enhancing policies (see Bellettini et al. [7], Tabaka and Barr [27]). Our main finding is that public investments do respond to changes in the ruling class age structure, which affect the re-election probabilitiy, and therefore size of the unproductive rent enjoyed by the élite. We conclude that the older is the political élite, the lower are the public resources devoted to productive services and education. Needless to say that if the ruling class does not introduce innovations and does not invest in education, human capital accumulation declines and the economic growth slows considerably.

Figure 4: Gerontocracy and governement spending



Optimal investment in productive services (left graph), Optimal investment in education (right graph)

3 Empirical investigation

In this section we describe the empirical strategy in the search for explanations of the nexus between gerontocracy and growth. To verify whether gerontocracy implies a lack of investment in education and limitations in productive expenditure in our data set, we employ several specifications using industry-level data for the EU industries. Our model predicts that growth depends on country-specific factors such as ruling class' age, which in turn determines the amount productive government spending and the human capital accumulation pattern. Departing from our simple theoretical results, we also attempt to exploit the richness of our data in order to assess the impact that the productive services provided by the goverment exert on the performance of each single sector, during the observation period.[9]

3.1 Data and descriptive analysis

Two are main sources employed in our empirical analysis. The first source is the DataCube provided by EURELITE network that collects information concerning the characteristics of national parliamentarians in European countries. The data set DataCube encompasses roughly fifty variables related to the social and political background of national legislators. Beyond some basic socio-demographic variables like education there is also information on politicians' linkage to politics, economy and other spheres of society. Particular attention is given to the pre-parliamentary political experience including positions in local politics, leading party functions, and membership in the cabinet. In our econometric exercise, we basically focus on two main policians' attributes:

- the legislators age when they get in office, which actually constitues our measure of gerontocracy and
- the percentage of newcomers in each electoral round, which provides a measure of the political turnover.

Moreover a wide set of variable are taken into account and used as control, such as those that indicate the positions in the framework of hierarchically and functionally differentiated societies (e.g. social status, occupation, education, and gender), those that are more specically and directly related to the

[9]To the extent that those determinants are independent across countries, each national sector can be correctly treated as an independent data point of an economic experiment.

range of positions offered by the political system (such as involvement in party ofces, elective positions at local and regional levels, and government ofces), and those that refer to their parliamentary career, such as their age at entry into parliament and the number of elections for which they had stood successfully. The summary statistics of the main variable involved in the subsequent analysis are reported in table 9. Particularly, it must pointed out that both variables *log*(*gerontocracy*) and *log*(*newcomers*), which are calculated on the mean age of the politicians in the office and the mean age of the newcomers, have been previously corrected for national life expectancy in order to obtain a more accurate measure of the relative elderly of the poltical class (see figure 5 for a detailed picture of the cross country differences in life expectancy and politicians' age in the sample).

Table 1: Summay statistics, gerontocracy related variables

Variable	Definition	Obs	Mean	Std.Dev.	Min	Max
log(gerontocracy)	log of the politicians' mean age	5670	3.87	0.04	3.79	3.97
log(new comers)	log of the newcomers' mean age	5670	3.78	0.06	3.58	3.91
log(seniority)	log of the # of years in the office	5670	3.48	0.49	2.15	4.6
log(education)	log of the % of politicians with a university degree	5670	4.1142	0.27	3.43	4.49
background	local/national political backbround	5040	3.82	0.73	1.80	4.51
inter	interaction b/w *log(seniority)* and *log(newcomers)*	5670	21.96	2.35	18.25	24.88

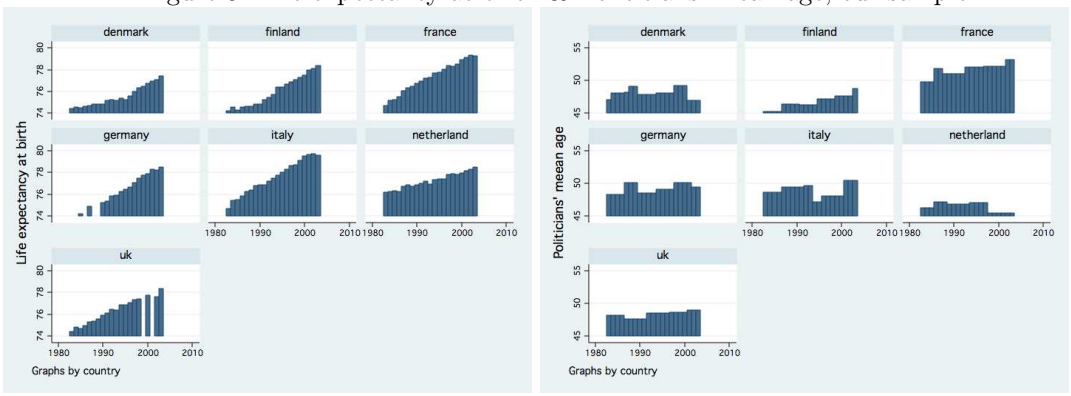
Notes: See Appendix A.3 for data definitions and sources.

Table 2: Summay statistics, EUKLEMS variables

Variable	Definition	Obs	Mean	Std.Dev.	Min	Max
log(tfp)	log of the tfp growth index	5664	4.581	0.191	3.381	7.567
log(ict)	log of the ict index	5866	4.490	0.904	0.139	7.405
log(nict)	log of the non-ict index	5852	4.557	0.250	2.172	5.751
log(gict)	log of the public ict index	5839	4.527	0.793	2.575	6.659
log(gos)	log of the gross operating surplus index	5430	0.190	0.144	-0.205	0.981

Notes: See Appendix A.3 for data definitions and sources.

Figure 5: Life expectancy at birth & Politicians' mean age, our sample

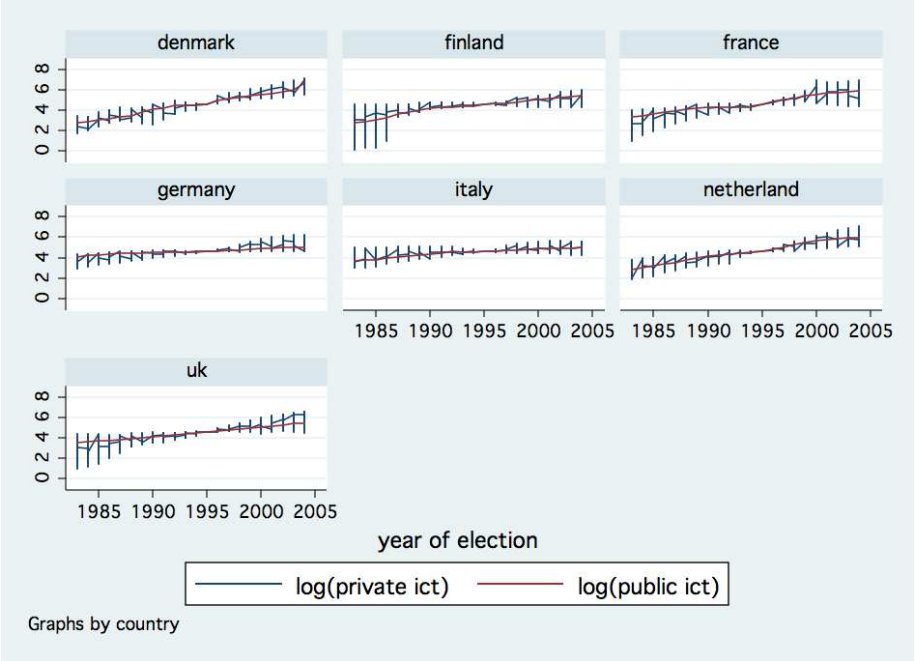


Source: our calculations

The second source is the databes provided by EU KLEMS. This data set includes measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for all European Union member states from 1970 onwards. The richness of the

information collected by EU KLEMS allows to check the effects of gerontocracy at sectorial level and suggests to use as endogenous variable the TFP growth, which can also be computed sector by sector, in order to capture as much hetherogeneity as possible rather than on a mere aggregate indicator, such teh *per capita* GDP. Moreover EU KLEMS provides our main measure for the public productive services, which is identified by the public ICT expenditure (the variable *gict*). In order to construct this variable we focus on the ICT capital services of the non-market economy. Those indicators are directly provided by EU KLEMS and includes the real estate sector, public administration and education, health and social services. According to our theretical frame, a strong linkage between public ICT and TFP growth should emerge from the data. Our hypothesis, is that the former could positively affect the latter by increasing the private ICT. The data support this intuition (see figure 6 where we plot the (log of) public and private ICT patterns).

Figure 6: Private and public ICT



Source: our calculations

In merging information from these two different sources, we obtain a sample that includes 7 countries (Denmark, Finland, France, Italy, Germany and UK) and 71 industries aggregated into 6 "macro"sectors (electrical machinery post and communication, manufacturing, finance and business services, distribution services, personal and social services, non-market services plus other goods producing industries), from 1983 to 2004.

Finally, since we are interested in examining the effects of gerontocracy on growth focusing also on how much it affects the public expenditures on education, a further variable has been taken into account: the total expenditure on education (the variable *pee*), computed both as a percentage of the GDP and as as a percentage of the total public expenditure and provided by EUROSTAT.

Before performing our econometric exercise, we now turn to examine the degree of correlation between gerontocracy and TFP growth. Several interesting results emerge from table 3, where the (n,m) cell shows the average correlation between the TFP growth rate of industry n and the level of gerontocracy attributed to country m through the variable $log(gerontocracy)$. The general negative impact exerted by gerontocracy is quite transparent when looking at the last row of the table, which reports the column average and then indicates the domestic correlation of the TFP growth with our measure of gerontocracy. Particulary, this detrimental effect seems to be stronger the higher is the technological complexity of the industry, being larger in sector as "electrical machinery post and communication". Notice that the older are the politicians the stronger are these negative correlations. Indeed, with the sole exception of France whose politicians are (on average) the most educated of the panel, higher negative correlations have been experienced where the gerontocracy is stronger (i.e. Italy, Germany and UK).

A different picture appears if we compute the degree of correlation between variable $log(newcomers)$ and the sectorial TFP growth. Remember that this variable is the (log of the) age of the newcomers in each national Parliament. Results reported in table 4 suggest that the problem is not the politicians' age *sic et simpliciter*. In comparison with the previous table, correlations are much more tenuous and frequently positive. A possible explanation could be that older newcomers, during their working life (presumably in the private sector), have acquired skills and competences that (partially or completly) compensate the human capital obsolescence due to 'aging (see figure 9 in appendix for further details).

Table 3: Correlation of sectorial TFP growth and $log(gerontocracy)$

country industry	**DNK**	**FIN**	**FRA**	**GER**	**ITA**	**NLD**	**UK**	**avg**
1	-0.521	0.129	-0.179	-0.645	-0.444	-0.741	-0.635	-0.434
2	0.034	0.146	-0.101	-0.537	-0.606	-0.565	-0.503	-0.305
3	-0.109	0.007	0.197	0.108	0.146	0.473	0.427	0.178
4	-0.083	0.239	-0.040	-0.609	-0.617	-0.643	-0.637	-0.341
5	0.648	-0.035	0.065	0.515	0.348	0.295	0.479	0.331
6	-0.281	0.128	0.038	-0.491	-0.013	-0.022	-0.454	-0.157
avg	-0.052	0.102	-0.003	-0.277	-0.198	-0.201	-0.220	

Notes: 1 - electrical machinery post and communication, 2- manufacturing, 3- finance and business services, 4- distribution services, 5-personal and social services, 6-non-market services + other goods producing industries.

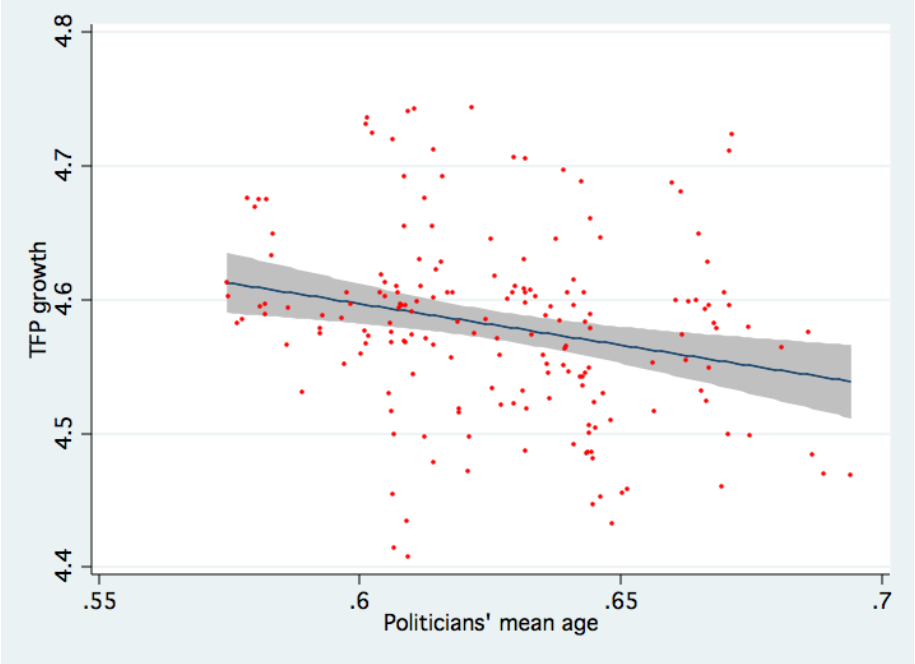
Table 4: Correlation of sectorial TFP growth and $log(newcomers)$

country industry	**DNK**	**FIN**	**FRA**	**GER**	**ITA**	**NLD**	**UK**	**avg**
1	-0.230	-0.195	0.450	-0.825	-0.404	0.292	0.442	-0.067
2	0.061	-0.067	0.235	-0.586	-0.578	0.467	0.454	-0.002
3	-0.022	0.019	-0.305	0.597	0.169	-0.572	-0.470	-0.084
4	-0.051	-0.012	0.259	-0.552	-0.574	0.309	0.472	-0.021
5	0.369	-0.100	-0.261	0.681	0.543	-0.558	-0.284	0.056
6	-0.092	-0.027	-0.111	-0.622	0.055	0.170	0.342	-0.041
avg	0.006	-0.064	0.045	-0.218	-0.131	0.018	0.159	

Notes: 1 - electrical machinery post and communication, 2- manufacturing, 3- finance and business services, 4- distribution services, 5-personal and social services, 6-non-market services + other goods producing industries.

3.2 Identification and estimation

Figure 7: Gerontocracy and TFP growth



Notes: See Appendix A.3 for data definitions and sources. Values are averaged by country and by year from 1983 to 2004. The regression represented by the fitted line yields a coefficient of -0.61 (standard error=0.19), N=182, and R^2=0.0568.

Our simple theoretical model indicates that gerontocracy is growth reducing because it produces insufficient investments in education (i.e. low *pee*) and innovation (i.e. low *gict*). Therefore the econometric analysis must quantify both the impact of gerontocracy on the extent of such investments and their contribution to the TFP growth. Our baseline approach relies on SUR technique (Zellner [30], Zellner and Huang [31] and Zellner [32]). Formally, we specify a system of two equations: sectorial TFP and (log of) ICT defined as follows:

$$
\begin{aligned}
g_{ijt} &= \alpha_1 + \beta_1 pee_{ijt} + \beta_2 log(ict)_{ijt} + \beta_3 \mathbf{S}_{ijt} + \beta_4 \mathbf{X}_{ijt} + \eta_{ijt} && (20)\\
log(ict)_{ijt} &= \alpha_2 + \beta_5 pee_{ijt} + \beta_6 log(gict)_{ijt} + \beta_7 log(ict)_{ijt} + \beta_8 log(gerontocracy)_{ijt-1} \\
&\quad + \beta_9 log(newcomers)_{ijt-1} + \beta_{10} log(seniority)_{ijt-1} && (21)\\
&\quad + \beta_{11} inter_{ijt-1} + \beta_{12} log(education)_{ijt-1} + \beta_{13} \mathbf{S}_{ijt} + \beta_{14} \mathbf{X}_{ijt} + \varepsilon_{ijt} \\
log(gict)_{ijt} &= \alpha_3 + \beta_{15} pee_{ijt} + \beta_{16} log(ict)_{ijt} + \beta_{17} log(gerontocracy)_{ijt-1} \\
&\quad + \beta_{18} log(newcomers)_{ijt-1} + \beta_{19} log(seniority)_{ijt-1} \\
&\quad + \beta_{20} inter_{ijt-1} + \beta_{21} log(education)_{ijt-1} + \beta_{22} \mathbf{S}_{ijt} + \beta_{23} \mathbf{X}_{ijt} + \xi_{ijt} && (22)
\end{aligned}
$$

where i represents each (macro)sector, j represents each country t represents each time period (with $t = 1, 2, \ldots T$).

In equations (20-22) g_{ijt} is the TFP growth rate while $log(gict)_{ijt}$ is the logarithm of the contribution of public ICT capital service to growth (at time t in sector i in country j). $\mathbf{S}_{ijt}$ is a vector of sector-specific variables and $\mathbf{X}_{ijt}$ is a vectors of other controls such as market openness, aggregate public expenditure, country dummies. In the above specification gerontocracy affects TFP growth because it explains both the private and public ICT (equations 21 and 22). That is the total effect on TFP growth is given by

$$\beta_2 \left(\beta_8 + \beta_6 \beta_{17}\right)$$

where the first term is the direct effect and the second one is the indirect effect trough the public ICT investment.

Estimation results of the system equation (20) by are presented in Tables 5-6 with respect to the all sample (estimates industry by industry are reportend in appendix A.4). Four different specifications are presented to consider different TFP estimates provided by EU KLEMS (in models I and II the TFP is value added based while in models III and IV it is gross output based) and different measure of public expenditure on education, which have been considered either as in terms of GDP (pee_{gdp} in models I and III) or as a share of the total public expenditure (pee_{pe} in models II and VI).

Table 5: Gerontocracy & TFP, all sectors #1

	Model I			Model II		
	g	$log(ict)$	$log(gict)$	g_{go}	$log(ict)$	$log(gict)$
$log(hhs)_t$	0.0146**	-0.0151		-0.00160	-0.0150	
	(0.00608)	(0.0103)		(0.00446)	(0.0103)	
$log(hms)_t$	0.110***	0.00449		0.0343***	0.00705	
	(0.0181)	(0.0311)		(0.0133)	(0.0311)	
$log(hls)_t$	-0.0153*	0.0114		-0.0130**	0.0108	
	(0.00854)	(0.0147)		(0.00627)	(0.0147)	
$log(gerontocracy)_{t-1}$		-5.065***	-5.634***		-5.070***	-5.655***
		(0.585)	(0.190)		(0.584)	(0.189)
$log(newcomers)_{t-1}$		0.342	12.55***		0.913	12.31***
		(1.559)	(0.529)		(1.556)	(0.527)
$log(seniority)_{t-1}$		-0.649	6.276***		-0.342	6.166***
		(1.158)	(0.411)		(1.156)	(0.409)
$log(gict)_t$		0.353***			0.353***	
		(0.0480)			(0.0479)	
pee_{gdpt}		0.0810***	0.179***		0.0788***	0.180***
		(0.0179)	(0.00574)		(0.0178)	(0.00572)
$log(nict)_t$		0.220***			0.211***	
		(0.0293)			(0.0293)	
$log(ict)_t$	0.0260***			0.00934***		
	(0.00479)			(0.00352)		
Constant	4.281***	-173.1***	-264.0***	4.514***	-176.5***	-262.5***
	(0.100)	(14.12)	(2.207)	(0.0737)	(14.09)	(2.200)
Observations	3,221	3,221	3,221	3,221	3,221	3,221
R-squared	0.101	0.866	0.976	0.030	0.866	0.976

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.Models I and II present TFP (value added based) growth as dependent variable while models III and IV present TFP (gross output based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

As predicted by the theory the empirical analysis based on SUR estimation indicates that the TFP growth pattern is highly affected by gerontocracy. The main results are summarized in table 7 corroborate our theoretical prediction. Our regressions indicate that the TFP growth is mainly due to ICT capital services and that gerontocracy negatively affect ICT capital services both directly and indirectly, through the discouraging effect that it has on public ICT. Moreover public expenditure on education positively affect TFP growth through the public ICT channel ($log(gict)$). Our estimations indicates that a decrease of $log(gerontocracy)$ increases unambigously the TFP growth index, with elasticities equal to -0.18 and -0.07, depending on the measure of TFP growth and education employed.

We notice also that the adoption of ICT ($log(ict)$) is accompanied by complementary investments ($log(nict)$), presumably related to changes in the organizational structure and the skill composition of the labor force. Finally our result show that the TFP growth increases with the share of skilled workers ($log(hhs)$).

It is worth noticing that possible edogeneity problem can arise because of the nature of ICT capital, which might be correlated with the error term. If this endogeneity occurs previous estimation methods is likely to produce biased and inconsistent results. Therefore we adopt a different approach based on instrumental-variables (IV) regressions to estimate the impact of gerontogracy on TFP growth. The alternative identification strategy might be to use the (log of) public ICT $log(gict)$ which is strictly related to the set of gerontocracy varibles, since

Table 6: Gerontocracy & TFP, all sectors #2

	Model III			Model IV		
Variables	g	$log(ict)$	$log(gict)$	g_{go}	$log(ict)$	$log(gict)$
$log(hhs)_t$	0.0150**	-0.0157		-0.00189	-0.0158	
	(0.00613)	(0.0104)		(0.00451)	(0.0104)	
$log(hms)_t$	0.109***	0.00491		0.0324**	0.00752	
	(0.0182)	(0.0311)		(0.0134)	(0.0311)	
$log(hls)_t$	-0.0146*	0.00990		-0.0133**	0.00914	
	(0.00859)	(0.0147)		(0.00632)	(0.0147)	
$log(gerontocracy)_{t-1}$		-5.031***	-4.741***		-5.040***	-4.757***
		(0.553)	(0.207)		(0.552)	(0.207)
$log(newcomers)_{t-1}$		2.554	11.93***		3.121*	11.74***
		(1.604)	(0.615)		(1.600)	(0.614)
$log(seniority)_{t-1}$		2.343*	7.109***		2.615**	7.027***
		(1.266)	(0.498)		(1.263)	(0.497)
$log(gict)_t$		0.397***			0.397***	
		(0.0437)			(0.0436)	
pee_{pet}		0.0349***	0.0255***		0.0346***	0.0254***
		(0.00505)	(0.00199)		(0.00504)	(0.00199)
$log(nict)_t$		0.224***			0.213***	
		(0.0293)			(0.0293)	
$log(ict)_t$	0.0265***			0.00992***		
	(0.00481)			(0.00354)		
$Constant$	4.276***	-194.0***	-290.5***	4.518***	-197.0***	-289.3***
	(0.101)	(14.64)	(2.898)	(0.0742)	(14.61)	(2.894)
Observations	3,192	3,192	3,192	3,192	3,192	3,192
R-squared	0.101	0.867	0.972	0.030	0.867	0.972

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.Models I and II present TFP (value added based) growth as dependent variable while models III and IV present TFP (gross output based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 7: The effect of Gerontocracy on TFP growth

	All sectors		
	via private ICT	*via public ICT*	*Total*
Model I	-0.132***	-0.052***	-0.184***
Model II	-0.047***	-0.019***	-0.066***
Model III	-0.134***	-0.050***	-0.184***
Model IV	-0.050***	-0.019***	-0.069***

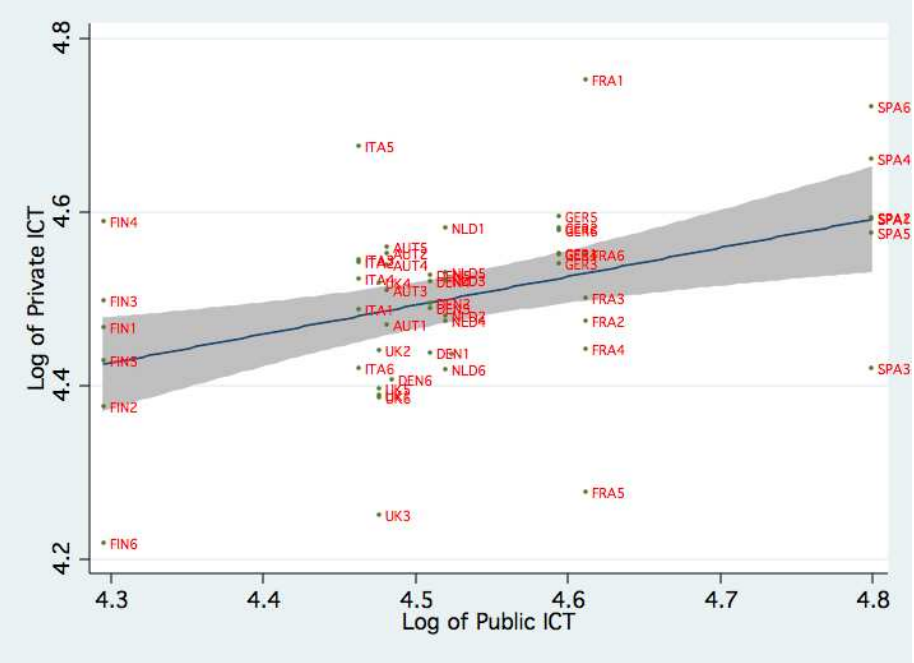
Notes: *** p<0.01, ** p<0.05, * p<0.1.Models I and II present TFP (value added based) growth as dependent variable while models III and IV present TFP (gross output based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

it directly derives from élite's choice, as an instrument for the (log of) private ICT $log(ict)$.

$$g_{ijt} = \alpha_1 + \beta_1 log(ict)_{ijt} + \beta_3 \mathbf{S}_{ijt} + \beta_4 \mathbf{X}_{ijt} + \eta_{ijt} \quad (23)$$

$$\begin{aligned} log(ict)_{ijt} = {} & \alpha_2 + \beta_5 pee_{ijt} + \beta_6 log(gict)_{ijt} + \beta_7 log(ict)_{ijt} + \beta_8 log(gerontocracy)_{ijt-1} \\ & + \beta_9 log(newcomers)_{ijt-1} + \beta_{10} log(seniority)_{ijt-1} \\ & + \beta_{11} inter_{ijt-1} + \beta_{12} log(education)_{ijt-1} + \beta_{13} \mathbf{S}_{ijt} + \beta_{14} \mathbf{X}_{ijt} + \varepsilon_{ijt} \end{aligned} \quad (24)$$

Figure 8: 1^{st} stage relationship between private and public ICT



Notes: See Appendix A.3 for data definitions and sources. Values are averaged by national sectors from 1983 to 2004. The regression represented by the fitted line yields a coefficient of .331 (standard error=0.098), N=54, and R^2=0.16. 1 - electrical machinery post and communication, 2- manufacturing, 3- finance and business services, 4- distribution services, 5-personal and social services, 6-non-market services + other goods producing industries.

where i represents each (macro)sector, j represents each country t represents each time period (with $t = 1, 2, \ldots T$). This identification strategy will be valid as long as $(log(gict))$ is uncorrelated with η_{ijt}, that is if the (log of the) public expenditure on ICT has no effect on TFP growth other than through its influence on the private sectors' ICT pattern. Figure 8 illustrate the relationship between the $log(gict)$ and $log(ict)$. The slope of the regression line shows that an higher public expenditure on ICT has substantially improved the private one. IV estimates are presented in table 8 for all sectors while results sector by sector are provided in appendix A.5. These estimates display the strong negative first-stage relationship between (log of) gerontocracy and the (log of) private ICT capital services, which in turn benefits from the level of the (log of) public ICT capital services. The corresponding 2SLS estimate of the income of private ICT on TFP growth is about 0.43 This result is also high significant, with a p-value of 0.

Table 8: Gerontocracy & TFP, all sectors

	2SLS estimator		**2-Step GMM estimation**	
	Coef.	*P-value*	*Coef.*	*P-value*
First stage regression for $log(ict)_t$				
$log(hhs)_t$	-0.0221	0.016		
$log(hms)_t$	-0.0151	0.484		
$log(hls)_t$	0.0073	0.599		
$log(marketopenness)_t$	0.4089	0.000		
Gos_{t-1}	-0.0250	0.494		
$log(nict)_t$	0.2831	0.000		
$log(gerontocracy)_{t-1}$	-4.1623	0.000		
$log(newcomers)_{t-1}$	0.7737	0.579		
$log(seniority)_{t-1}$	0.7910	0.394		
$log(gict)_t$	0.3969	0.000		
pee_{gdp}	0.5045	0.001		
Trend	0.0868	0.000		
Second stage				
$log(ict)_t$	0.4292	0.000	0.0418	0.000
$log(hhs)_t$	0.0129	0.010	0.0118	0.000
$log(hms)_t$	0.0046	0.626	-0.0003	0.959
$log(hls)_t$	-0.0067	0.350	-0.0032	0.521
$log(marketopenness)_t$	0.0649	0.011	0.0957	0.000
Gos_{t-1}	0.0584	0.007	0.0932	0.000
Number of obs	3743		3743	

4 Concluding remarks

In this paper we argue that when young people cease to be the engine of an economy, long-run economic growth is endangered. Over the last three decades, a lot of European economies have fallen into an old-age trap, a self-reinforcing mechanism whereby élites, generally the most aged individuals, have used control of the political system to exclude new generations, who are reasonably the most dynamic and innovative part of the population, from the access to power.

We do not analize this machanism formally (i.e. we do not explain what are the determinants of gerontocracy). Moreover we do not focus on some possible "good"consequencies that gerontocracy may have on a society as a whole, for example in reducing the inequalities. The aim of this paper is to explore the possible linkages between the age of the ruling class and the long-run growth rates both theoretically and empirically.

Our study relies on a simple endogenous growth model where long-run growth rate is directly affected by public productive services and public investment on education. The empirical analysis corroborates these findings. Estimations indicates that a decrease of gerontocracy increases unambigously the TFP growth index, with elasticities equal to -1.17 percent in the 2SLS model and -0.18 and -0.07 in the SUR models.

There are several modifications to our approach that are worth pursuing. In the theoretical model for instance, we introduce several assumptions aimed at obtaining an analytical friendly framework. The next step will be to test how robust these results are when these simplifications are relaxed. Particularly, we plan to address in a subsequent work the formal attempt to endogenize the gerontocracy. Moreover, from an empirical standpoint we delegate

to a further paper the extension of our data set in order to include information about the managers employed in the private sector.

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A Appendix

A.1 Proof of proposition 1

Along the BGP:

$$\left.\frac{Y_{t+1}-Y_t}{Y_t}\right|_{BGP} \equiv \gamma = \left[A\left(\tau\sigma_g A\right)^{\frac{\eta}{1-\eta}}\left(1-e\right)^{\frac{\eta}{1-\eta}}\right]\left(H_{t+1}-H_t\right)-1 \tag{25}$$

Recalling that $E_t = \sigma^e \tau Y_t$ and $G_t = \sigma_g \tau Y_t$, we obtain:

$$\gamma = e\zeta\left[\tau\sigma_e A^{\frac{1}{1-\eta}}\left(\tau\sigma_g(1-e)^{\eta}\right)^{\frac{\eta}{1-\eta}}\right]^{1-\alpha}$$

Differrentiating γ w.r.t. σ_e and σ_g yields:

$$\frac{\partial\gamma}{\partial\sigma^e} = e\zeta\left(\sigma_e\tau\, A^{\frac{1}{1-\eta}}\left(\tau\,\sigma_g\left(1-e\right)^{\eta}\right)^{\frac{\eta}{1-\eta}}\right)^{1-\alpha}\frac{\left(1-\alpha\right)}{\sigma_e} > 0 \tag{26}$$

$$\frac{\partial\gamma}{\partial\sigma_g} = e\zeta\left(\sigma_e\tau\, A^{\frac{1}{1-\eta}}\left(\tau\,\sigma_g\left(1-e\right)^{\eta}\right)^{\frac{\eta}{1-\eta}}\right)^{1-\alpha}\frac{\left(1-\alpha\right)\eta}{\left(1-\eta\right)\sigma_g} > 0 \tag{27}$$

A.2 Proof of proposition 2

$$\frac{\sigma_g^*}{da} = \frac{d\sigma_g^*}{dv}\frac{dv}{da} = \eta\frac{\beta\left(1-\pi\right)\left(1-\alpha\right)}{\left[\theta+\beta v\left(1-\pi\right)\left(1-\alpha\right)\right]^2}\frac{dv}{da} < 0$$

$$\frac{\sigma_e^*}{da} = \frac{d\sigma_e^*}{dv}\frac{dv}{da} = \left(1-\eta\right)\frac{\beta\left(1-\pi\right)\left(1-\alpha\right)}{\left[\theta+\beta v\left(1-\pi\right)\left(1-\alpha\right)\right]^2}\frac{dv}{da} < 0$$

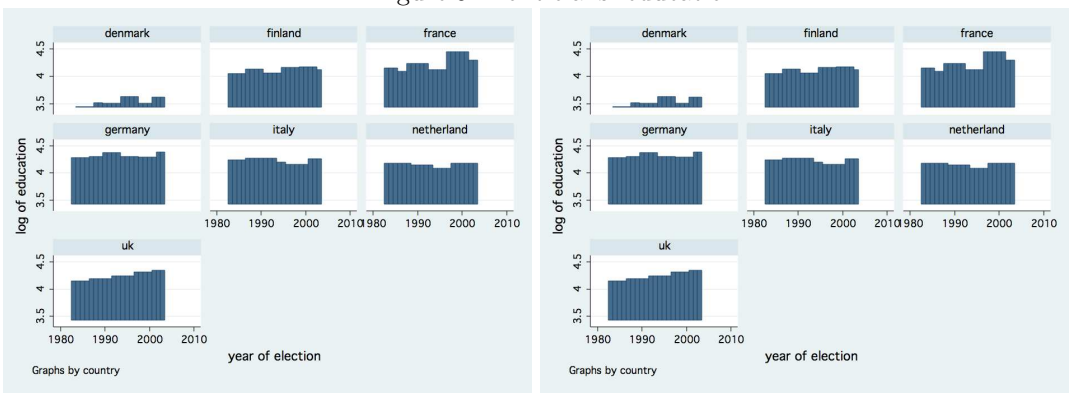
because of assumption (A.2) which implies that $v'\left(a\right) < 0$.

A.3 Data definitions and sources

Table 9: Data definitions and sources

Variables	Source
Gerontocracy related variables	
$log(gerontocracy)$ = log of the politicians' mean age	EURELITE
$log(newcomers)$ = log of the newcomers' mean age	EURELITE
$log(seniority)$ = log of the # of years in the office	EURELITE
$log(education)$ = log of the % of politicians with a university degree	EURELITE
$background$ = local/national political backbround	EURELITE
$inter$ = interaction b/w log(seniority) and log(newcomers)	EURELITE
$roots$ = log of place of birth=place election	EURELITE
gos = Gross operating surplus (in millions of local currency)	EU KLEMS
Growth accounting variables	
g = TFP (value added based) growth (1995=100)	EU KLEMS
g_{GO} = TFP (gross output based) growth (1995=100)	EU KLEMS
$log(ict)$ = log of ICT capital services (1995=100)	EU KLEMS
$log(nict)$ = log of non-ICT capital services (1995=100)	EU KLEMS
$log(gict)$ = log of non-market + other goods industries ICT capital services (1995=100)	our calculation on EU KLEMS
$log(hhs)$ = log of hours worked by high-skilled persons engaged (share in total hours)	EU KLEMS
$log(hms)$ = log of hours worked by medium-skilled persons engaged (share in total hours)	EU KLEMS
$log(hls)$ = log of hours worked by low-skilled persons engaged (share in total hours)	EU KLEMS
$log(marketopenness)$= log of exports plus Imports divided by GDP is the total trade as a percentage of GDP	PWT 6.1
Education variables	
pee_{pe}= public expenditure on education as a percentage of total public expenditure	EUROSTAT
pee_{gdp}= public expenditure on education as a percentage of GDP	EUROSTAT

Figure 9: Politicians' education



Notes: See Appendix A.3 for data definitions and sources. Values in the lower panel are averaged by country from 1983 to 2004. The regression represented by the fitted line yields a coefficient of 1.7 (standard error=3.07), N=7, and R^2=0.05.

A.4 SUR estimates: sector by sector

Table 10: Gerontocracy & TFP, Electrical machinery, post and communication#1

	(1)	(2)	(3)	(4)	(5)	(6)
	I			II		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00938	0.00950		-0.00558	0.00961	
	(0.00759)	(0.0119)		(0.00550)	(0.0119)	
l_hms	0.145***	0.0455		0.0527**	0.0503	
	(0.0298)	(0.0479)		(0.0216)	(0.0479)	
l_hls	-0.0157	0.0269		-0.0121	0.0271	
	(0.0110)	(0.0177)		(0.00799)	(0.0177)	
l_marketopeness	0.245***	-0.532***	0.0556*	0.0831***	-0.548***	0.0650**
	(0.0356)	(0.0764)	(0.0286)	(0.0259)	(0.0763)	(0.0286)
dum2	-0.0635***	-0.639	-0.762***	-0.0239	-0.653	-0.720***
	(0.0214)	(0.563)	(0.211)	(0.0156)	(0.562)	(0.210)
dum3	0.0173	-0.944**	-0.689***	0.0235	-0.927**	-0.675***
	(0.0225)	(0.460)	(0.172)	(0.0163)	(0.459)	(0.171)
dum4	0.103***	-0.00556	1.174***	0.0445***	0.0183	1.166***
	(0.0137)	(0.129)	(0.0426)	(0.00998)	(0.129)	(0.0425)
dum5	0.0631**	-0.301***	0.578***	0.0286	-0.260***	0.562***
	(0.0251)	(0.0801)	(0.0277)	(0.0183)	(0.0800)	(0.0277)
dum6	-0.0706*	-0.240***	-0.600***	-0.0448	-0.257***	-0.592***
	(0.0424)	(0.0910)	(0.0229)	(0.0308)	(0.0909)	(0.0228)
dum7	-0.189***	-0.244	-1.254***	-0.0904***	-0.277	-1.213***
	(0.0320)	(0.557)	(0.207)	(0.0233)	(0.556)	(0.207)
L.l_gerontocracy		-3.604***	-5.619***		-3.604***	-5.641***
		(0.627)	(0.209)		(0.626)	(0.208)
L.l_newcomers		-1.490	12.51***		-0.917	12.26***
		(1.673)	(0.581)		(1.670)	(0.579)
L.l_seniority		-1.729	6.246***		-1.421	6.131***
		(1.242)	(0.452)		(1.239)	(0.450)
L.inter		0.361	-1.807***		0.272	-1.768***
		(0.277)	(0.0983)		(0.277)	(0.0980)
L.l_education		-0.440***	-0.707***		-0.466***	-0.699***
		(0.148)	(0.0541)		(0.148)	(0.0540)
L.l_background		-0.181	-0.745***		-0.180	-0.735***
		(0.138)	(0.0498)		(0.138)	(0.0496)
L.local		0.523***	-0.279***		0.474***	-0.260***
		(0.0727)	(0.0268)		(0.0725)	(0.0267)
L.roots		0.123	1.133***		0.151	1.127***
		(0.126)	(0.0417)		(0.126)	(0.0415)
gos	0.117***	0.0527		0.109***	0.0533	
	(0.0323)	(0.0500)		(0.0234)	(0.0500)	
l_gict		0.352***			0.352***	
		(0.0514)			(0.0513)	
pee_gdp		0.0717***	0.179***		0.0696***	0.180***
		(0.0192)	(0.00631)		(0.0192)	(0.00629)
l_nict		0.342***			0.328***	
		(0.0353)			(0.0352)	
hp_s	0.00658	0.0423***	0.00368	-0.00499	0.0424***	0.00367
	(0.00673)	(0.0114)	(0.00428)	(0.00490)	(0.0114)	(0.00428)
trend		0.0881***	0.125***		0.0891***	0.124***
		(0.00689)	(0.000871)		(0.00687)	(0.000869)
l_ict	0.0377***			0.0151***		
	(0.00588)			(0.00427)		
Constant	4.123***	-155.3***	-263.7***	4.435***	-158.8***	-262.2***
	(0.155)	(15.15)	(2.430)	(0.113)	(15.11)	(2.422)
Observations	2,670	2,670	2,670	2,670	2,670	2,670
R-squared	0.133	0.866	0.976	0.043	0.866	0.976

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 11: Gerontocracy & TFP, Electrical machinery, post and communication#2

	(1)	(2)	(3)	(4)	(5)	(6)
	III			IV		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00973	0.00854		-0.00604	0.00856	
	(0.00765)	(0.0119)		(0.00556)	(0.0119)	
l_hms	0.145***	0.0461		0.0484**	0.0508	
	(0.0300)	(0.0477)		(0.0218)	(0.0477)	
l_hls	-0.0147	0.0236		-0.0128	0.0236	
	(0.0111)	(0.0176)		(0.00806)	(0.0176)	
l_marketopeness	0.244***	-0.662***	-0.166***	0.0816***	-0.676***	-0.159***
	(0.0359)	(0.0752)	(0.0311)	(0.0262)	(0.0751)	(0.0311)
dum2	-0.0632***	1.626***	1.554***	-0.0243	1.570***	1.594***
	(0.0215)	(0.594)	(0.243)	(0.0157)	(0.593)	(0.243)
dum3	0.0167	1.108**	1.113***	0.0226	1.093**	1.128***
	(0.0226)	(0.509)	(0.209)	(0.0165)	(0.508)	(0.209)
dum4	0.103***	0.280**	1.584***	0.0439***	0.299**	1.580***
	(0.0138)	(0.135)	(0.0464)	(0.0100)	(0.135)	(0.0463)
dum5	0.0679**	-0.160*	0.819***	0.0330	-0.119	0.807***
	(0.0302)	(0.0860)	(0.0317)	(0.0220)	(0.0859)	(0.0317)
dum6	-0.0672	-0.150	-0.683***	-0.0465	-0.168*	-0.678***
	(0.0427)	(0.0922)	(0.0265)	(0.0310)	(0.0921)	(0.0264)
dum7	-0.188***	2.034***	0.406	-0.0892***	1.966***	0.440*
	(0.0322)	(0.619)	(0.256)	(0.0235)	(0.617)	(0.255)
L.l_gerontocracy		-3.745***	-4.738***		-3.751***	-4.753***
		(0.593)	(0.228)		(0.592)	(0.227)
L.l_newcomers		1.202	11.92***		1.778	11.71***
		(1.718)	(0.677)		(1.713)	(0.676)
L.l_seniority		1.554	7.098***		1.836	7.005***
		(1.355)	(0.547)		(1.352)	(0.546)
L.inter		-0.117	-1.765***		-0.205	-1.733***
		(0.288)	(0.115)		(0.287)	(0.115)
L.l_education		-0.289*	-0.682***		-0.322**	-0.675***
		(0.149)	(0.0607)		(0.149)	(0.0606)
L.l_background		-0.130	-0.629***		-0.129	-0.619***
		(0.135)	(0.0547)		(0.135)	(0.0546)
L.local		0.308***	-0.645***		0.259***	-0.631***
		(0.0766)	(0.0292)		(0.0764)	(0.0292)
L.roots		0.150	1.573***		0.176	1.573***
		(0.127)	(0.0425)		(0.126)	(0.0425)
gos	0.118***	0.0442		0.110***	0.0448	
	(0.0325)	(0.0501)		(0.0237)	(0.0501)	
l_gict		0.379***			0.379***	
		(0.0468)			(0.0467)	
pee_pe		0.0373***	0.0255***		0.0371***	0.0252***
		(0.00542)	(0.00219)		(0.00540)	(0.00219)
l_nict		0.351***			0.337***	
		(0.0353)			(0.0352)	
hp_s	0.00588	0.0298***	-0.00417	-0.00480	0.0299***	-0.00410
	(0.00656)	(0.0109)	(0.00451)	(0.00478)	(0.0109)	(0.00451)
trend		0.0918***	0.134***		0.0927***	0.134***
		(0.00678)	(0.00101)		(0.00677)	(0.00101)
l_ict	0.0385***			0.0159***		
	(0.00590)			(0.00429)		
Constant	4.114***	-181.7***	-290.3***	4.450***	-184.9***	-289.1***
	(0.156)	(15.65)	(3.187)	(0.113)	(15.62)	(3.183)
Observations	2,646	2,646	2,646	2,646	2,646	2,646
R-squared	0.133	0.868	0.972	0.043	0.868	0.972

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 12: Gerontocracy & TFP, Manufacturing (excluding electrical)#1

	(1)	(2)	(3)	(4)	(5)	(6)
	I			II		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00938	0.00950		-0.00558	0.00961	
	(0.00759)	(0.0119)		(0.00550)	(0.0119)	
l_hms	0.145***	0.0455		0.0527**	0.0503	
	(0.0298)	(0.0479)		(0.0216)	(0.0479)	
l_hls	-0.0157	0.0269		-0.0121	0.0271	
	(0.0110)	(0.0177)		(0.00799)	(0.0177)	
l_marketopeness	0.245***	-0.532***	0.0556*	0.0831***	-0.548***	0.0650**
	(0.0356)	(0.0764)	(0.0286)	(0.0259)	(0.0763)	(0.0286)
dum2	-0.0635***	-0.639	-0.762***	-0.0239	-0.653	-0.720***
	(0.0214)	(0.563)	(0.211)	(0.0156)	(0.562)	(0.210)
dum3	0.0173	-0.944**	-0.689***	0.0235	-0.927**	-0.675***
	(0.0225)	(0.460)	(0.172)	(0.0163)	(0.459)	(0.171)
dum4	0.103***	-0.00556	1.174***	0.0445***	0.0183	1.166***
	(0.0137)	(0.129)	(0.0426)	(0.00998)	(0.129)	(0.0425)
dum5	0.0631**	-0.301***	0.578***	0.0286	-0.260***	0.562***
	(0.0251)	(0.0801)	(0.0277)	(0.0183)	(0.0800)	(0.0277)
dum6	-0.0706*	-0.240***	-0.600***	-0.0448	-0.257***	-0.592***
	(0.0424)	(0.0910)	(0.0229)	(0.0308)	(0.0909)	(0.0228)
dum7	-0.189***	-0.244	-1.254***	-0.0904***	-0.277	-1.213***
	(0.0320)	(0.557)	(0.207)	(0.0233)	(0.556)	(0.207)
L.l_gerontocracy		-3.604***	-5.619***		-3.604***	-5.641***
		(0.627)	(0.209)		(0.626)	(0.208)
L.l_newcomers		-1.490	12.51***		-0.917	12.26***
		(1.673)	(0.581)		(1.670)	(0.579)
L.l_seniority		-1.729	6.246***		-1.421	6.131***
		(1.242)	(0.452)		(1.239)	(0.450)
L.inter		0.361	-1.807***		0.272	-1.768***
		(0.277)	(0.0983)		(0.277)	(0.0980)
L.l_education		-0.440***	-0.707***		-0.466***	-0.699***
		(0.148)	(0.0541)		(0.148)	(0.0540)
L.l_background		-0.181	-0.745***		-0.180	-0.735***
		(0.138)	(0.0498)		(0.138)	(0.0496)
L.local		0.523***	-0.279***		0.474***	-0.260***
		(0.0727)	(0.0268)		(0.0725)	(0.0267)
L.roots		0.123	1.133***		0.151	1.127***
		(0.126)	(0.0417)		(0.126)	(0.0415)
gos	0.117***	0.0527		0.109***	0.0533	
	(0.0323)	(0.0500)		(0.0234)	(0.0500)	
l_gict		0.352***			0.352***	
		(0.0514)			(0.0513)	
pee_gdp		0.0717***	0.179***		0.0696***	0.180***
		(0.0192)	(0.00631)		(0.0192)	(0.00629)
l_nict		0.342***			0.328***	
		(0.0353)			(0.0352)	
hp_s	0.00658	0.0423***	0.00368	-0.00499	0.0424***	0.00367
	(0.00673)	(0.0114)	(0.00428)	(0.00490)	(0.0114)	(0.00428)
trend		0.0881***	0.125***		0.0891***	0.124***
		(0.00689)	(0.000871)		(0.00687)	(0.000869)
l_ict	0.0377***			0.0151***		
	(0.00588)			(0.00427)		
Constant	4.123***	-155.3***	-263.7***	4.435***	-158.8***	-262.2***
	(0.155)	(15.15)	(2.430)	(0.113)	(15.11)	(2.422)
Observations	2,670	2,670	2,670	2,670	2,670	2,670
R-squared	0.133	0.866	0.976	0.043	0.866	0.976

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 13: Gerontocracy & TFP, Manufacturing (excluding electrical)#2

	(1)	(2)	(3)	(4)	(5)	(6)
	III			IV		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00973	0.00854		-0.00604	0.00856	
	(0.00765)	(0.0119)		(0.00556)	(0.0119)	
l_hms	0.145***	0.0461		0.0484**	0.0508	
	(0.0300)	(0.0477)		(0.0218)	(0.0477)	
l_hls	-0.0147	0.0236		-0.0128	0.0236	
	(0.0111)	(0.0176)		(0.00806)	(0.0176)	
l_marketopeness	0.244***	-0.662***	-0.166***	0.0816***	-0.676***	-0.159***
	(0.0359)	(0.0752)	(0.0311)	(0.0262)	(0.0751)	(0.0311)
dum2	-0.0632***	1.626***	1.554***	-0.0243	1.570***	1.594***
	(0.0215)	(0.594)	(0.243)	(0.0157)	(0.593)	(0.243)
dum3	0.0167	1.108**	1.113***	0.0226	1.093**	1.128***
	(0.0226)	(0.509)	(0.209)	(0.0165)	(0.508)	(0.209)
dum4	0.103***	0.280**	1.584***	0.0439***	0.299**	1.580***
	(0.0138)	(0.135)	(0.0464)	(0.0100)	(0.135)	(0.0463)
dum5	0.0679**	-0.160*	0.819***	0.0330	-0.119	0.807***
	(0.0302)	(0.0860)	(0.0317)	(0.0220)	(0.0859)	(0.0317)
dum6	-0.0672	-0.150	-0.683***	-0.0465	-0.168*	-0.678***
	(0.0427)	(0.0922)	(0.0265)	(0.0310)	(0.0921)	(0.0264)
dum7	-0.188***	2.034***	0.406	-0.0892***	1.966***	0.440*
	(0.0322)	(0.619)	(0.256)	(0.0235)	(0.617)	(0.255)
L.l_gerontocracy		-3.745***	-4.738***		-3.751***	-4.753***
		(0.593)	(0.228)		(0.592)	(0.227)
L.l_newcomers		1.202	11.92***		1.778	11.71***
		(1.718)	(0.677)		(1.713)	(0.676)
L.l_seniority		1.554	7.098***		1.836	7.005***
		(1.355)	(0.547)		(1.352)	(0.546)
L.inter		-0.117	-1.765***		-0.205	-1.733***
		(0.288)	(0.115)		(0.287)	(0.115)
L.l_education		-0.289*	-0.682***		-0.322**	-0.675***
		(0.149)	(0.0607)		(0.149)	(0.0606)
L.l_background		-0.130	-0.629***		-0.129	-0.619***
		(0.135)	(0.0547)		(0.135)	(0.0546)
L.local		0.308***	-0.645***		0.259***	-0.631***
		(0.0766)	(0.0292)		(0.0764)	(0.0292)
L.roots		0.150	1.573***		0.176	1.573***
		(0.127)	(0.0425)		(0.126)	(0.0425)
gos	0.118***	0.0442		0.110***	0.0448	
	(0.0325)	(0.0501)		(0.0237)	(0.0501)	
l_gict		0.379***			0.379***	
		(0.0468)			(0.0467)	
pee_pe		0.0373***	0.0255***		0.0371***	0.0252***
		(0.00542)	(0.00219)		(0.00540)	(0.00219)
l_nict		0.351***			0.337***	
		(0.0353)			(0.0352)	
hp_s	0.00588	0.0298***	-0.00417	-0.00480	0.0299***	-0.00410
	(0.00656)	(0.0109)	(0.00451)	(0.00478)	(0.0109)	(0.00451)
trend		0.0918***	0.134***		0.0927***	0.134***
		(0.00678)	(0.00101)		(0.00677)	(0.00101)
l_ict	0.0385***			0.0159***		
	(0.00590)			(0.00429)		
Constant	4.114***	-181.7***	-290.3***	4.450***	-184.9***	-289.1***
	(0.156)	(15.65)	(3.187)	(0.113)	(15.62)	(3.183)
Observations	2,646	2,646	2,646	2,646	2,646	2,646
R-squared	0.133	0.868	0.972	0.043	0.868	0.972

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 14: Gerontocracy & TFP, Finance and business services#1

	(1)	(2)	(3)	(4)	(5)	(6)
	I			II		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00938	0.00950		-0.00558	0.00961	
	(0.00759)	(0.0119)		(0.00550)	(0.0119)	
l_hms	0.145***	0.0455		0.0527**	0.0503	
	(0.0298)	(0.0479)		(0.0216)	(0.0479)	
l_hls	-0.0157	0.0269		-0.0121	0.0271	
	(0.0110)	(0.0177)		(0.00799)	(0.0177)	
l_marketopeness	0.245***	-0.532***	0.0556*	0.0831***	-0.548***	0.0650**
	(0.0356)	(0.0764)	(0.0286)	(0.0259)	(0.0763)	(0.0286)
dum2	-0.0635***	-0.639	-0.762***	-0.0239	-0.653	-0.720***
	(0.0214)	(0.563)	(0.211)	(0.0156)	(0.562)	(0.210)
dum3	0.0173	-0.944**	-0.689***	0.0235	-0.927**	-0.675***
	(0.0225)	(0.460)	(0.172)	(0.0163)	(0.459)	(0.171)
dum4	0.103***	-0.00556	1.174***	0.0445***	0.0183	1.166***
	(0.0137)	(0.129)	(0.0426)	(0.00998)	(0.129)	(0.0425)
dum5	0.0631**	-0.301***	0.578***	0.0286	-0.260***	0.562***
	(0.0251)	(0.0801)	(0.0277)	(0.0183)	(0.0800)	(0.0277)
dum6	-0.0706*	-0.240***	-0.600***	-0.0448	-0.257***	-0.592***
	(0.0424)	(0.0910)	(0.0229)	(0.0308)	(0.0909)	(0.0228)
dum7	-0.189***	-0.244	-1.254***	-0.0904***	-0.277	-1.213***
	(0.0320)	(0.557)	(0.207)	(0.0233)	(0.556)	(0.207)
L.l_gerontocracy		-3.604***	-5.619***		-3.604***	-5.641***
		(0.627)	(0.209)		(0.626)	(0.208)
L.l_newcomers		-1.490	12.51***		-0.917	12.26***
		(1.673)	(0.581)		(1.670)	(0.579)
L.l_seniority		-1.729	6.246***		-1.421	6.131***
		(1.242)	(0.452)		(1.239)	(0.450)
L.inter		0.361	-1.807***		0.272	-1.768***
		(0.277)	(0.0983)		(0.277)	(0.0980)
L.l_education		-0.440***	-0.707***		-0.466***	-0.699***
		(0.148)	(0.0541)		(0.148)	(0.0540)
L.l_background		-0.181	-0.745***		-0.180	-0.735***
		(0.138)	(0.0498)		(0.138)	(0.0496)
L.local		0.523***	-0.279***		0.474***	-0.260***
		(0.0727)	(0.0268)		(0.0725)	(0.0267)
L.roots		0.123	1.133***		0.151	1.127***
		(0.126)	(0.0417)		(0.126)	(0.0415)
gos	0.117***	0.0527		0.109***	0.0533	
	(0.0323)	(0.0500)		(0.0234)	(0.0500)	
l_gict		0.352***			0.352***	
		(0.0514)			(0.0513)	
pee_gdp		0.0717***	0.179***		0.0696***	0.180***
		(0.0192)	(0.00631)		(0.0192)	(0.00629)
l_nict		0.342***			0.328***	
		(0.0353)			(0.0352)	
hp_s	0.00658	0.0423***	0.00368	-0.00499	0.0424***	0.00367
	(0.00673)	(0.0114)	(0.00428)	(0.00490)	(0.0114)	(0.00428)
trend		0.0881***	0.125***		0.0891***	0.124***
		(0.00689)	(0.000871)		(0.00687)	(0.000869)
l_ict	0.0377***			0.0151***		
	(0.00588)			(0.00427)		
Constant	4.123***	-155.3***	-263.7***	4.435***	-158.8***	-262.2***
	(0.155)	(15.15)	(2.430)	(0.113)	(15.11)	(2.422)
Observations	2,670	2,670	2,670	2,670	2,670	2,670
R-squared	0.133	0.866	0.976	0.043	0.866	0.976

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 15: Gerontocracy & TFP, Finance and business services#2

	(1)	(2)	(3)	(4)	(5)	(6)
	III			IV		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00973	0.00854		-0.00604	0.00856	
	(0.00765)	(0.0119)		(0.00556)	(0.0119)	
l_hms	0.145***	0.0461		0.0484**	0.0508	
	(0.0300)	(0.0477)		(0.0218)	(0.0477)	
l_hls	-0.0147	0.0236		-0.0128	0.0236	
	(0.0111)	(0.0176)		(0.00806)	(0.0176)	
l_marketopeness	0.244***	-0.662***	-0.166***	0.0816***	-0.676***	-0.159***
	(0.0359)	(0.0752)	(0.0311)	(0.0262)	(0.0751)	(0.0311)
dum2	-0.0632***	1.626***	1.554***	-0.0243	1.570***	1.594***
	(0.0215)	(0.594)	(0.243)	(0.0157)	(0.593)	(0.243)
dum3	0.0167	1.108**	1.113***	0.0226	1.093**	1.128***
	(0.0226)	(0.509)	(0.209)	(0.0165)	(0.508)	(0.209)
dum4	0.103***	0.280**	1.584***	0.0439***	0.299**	1.580***
	(0.0138)	(0.135)	(0.0464)	(0.0100)	(0.135)	(0.0463)
dum5	0.0679**	-0.160*	0.819***	0.0330	-0.119	0.807***
	(0.0302)	(0.0860)	(0.0317)	(0.0220)	(0.0859)	(0.0317)
dum6	-0.0672	-0.150	-0.683***	-0.0465	-0.168*	-0.678***
	(0.0427)	(0.0922)	(0.0265)	(0.0310)	(0.0921)	(0.0264)
dum7	-0.188***	2.034***	0.406	-0.0892***	1.966***	0.440*
	(0.0322)	(0.619)	(0.256)	(0.0235)	(0.617)	(0.255)
L.l_gerontocracy		-3.745***	-4.738***		-3.751***	-4.753***
		(0.593)	(0.228)		(0.592)	(0.227)
L.l_newcomers		1.202	11.92***		1.778	11.71***
		(1.718)	(0.677)		(1.713)	(0.676)
L.l_seniority		1.554	7.098***		1.836	7.005***
		(1.355)	(0.547)		(1.352)	(0.546)
L.inter		-0.117	-1.765***		-0.205	-1.733***
		(0.288)	(0.115)		(0.287)	(0.115)
L.l_education		-0.289*	-0.682***		-0.322**	-0.675***
		(0.149)	(0.0607)		(0.149)	(0.0606)
L.l_background		-0.130	-0.629***		-0.129	-0.619***
		(0.135)	(0.0547)		(0.135)	(0.0546)
L.local		0.308***	-0.645***		0.259***	-0.631***
		(0.0766)	(0.0292)		(0.0764)	(0.0292)
L.roots		0.150	1.573***		0.176	1.573***
		(0.127)	(0.0425)		(0.126)	(0.0425)
gos	0.118***	0.0442		0.110***	0.0448	
	(0.0325)	(0.0501)		(0.0237)	(0.0501)	
l_gict		0.379***			0.379***	
		(0.0468)			(0.0467)	
pee_pe		0.0373***	0.0255***		0.0371***	0.0252***
		(0.00542)	(0.00219)		(0.00540)	(0.00219)
l_nict		0.351***			0.337***	
		(0.0353)			(0.0352)	
hp_s	0.00588	0.0298***	-0.00417	-0.00480	0.0299***	-0.00410
	(0.00656)	(0.0109)	(0.00451)	(0.00478)	(0.0109)	(0.00451)
trend		0.0918***	0.134***		0.0927***	0.134***
		(0.00678)	(0.00101)		(0.00677)	(0.00101)
l_ict	0.0385***			0.0159***		
	(0.00590)			(0.00429)		
Constant	4.114***	-181.7***	-290.3***	4.450***	-184.9***	-289.1***
	(0.156)	(15.65)	(3.187)	(0.113)	(15.62)	(3.183)
Observations	2,646	2,646	2,646	2,646	2,646	2,646
R-squared	0.133	0.868	0.972	0.043	0.868	0.972

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 16: Gerontocracy & TFP, Personal and social services#1

	(1)	(2)	(3)	(4)	(5)	(6)
	I			II		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00938	0.00950		-0.00558	0.00961	
	(0.00759)	(0.0119)		(0.00550)	(0.0119)	
l_hms	0.145***	0.0455		0.0527**	0.0503	
	(0.0298)	(0.0479)		(0.0216)	(0.0479)	
l_hls	-0.0157	0.0269		-0.0121	0.0271	
	(0.0110)	(0.0177)		(0.00799)	(0.0177)	
l_marketopeness	0.245***	-0.532***	0.0556*	0.0831***	-0.548***	0.0650**
	(0.0356)	(0.0764)	(0.0286)	(0.0259)	(0.0763)	(0.0286)
dum2	-0.0635***	-0.639	-0.762***	-0.0239	-0.653	-0.720***
	(0.0214)	(0.563)	(0.211)	(0.0156)	(0.562)	(0.210)
dum3	0.0173	-0.944**	-0.689***	0.0235	-0.927**	-0.675***
	(0.0225)	(0.460)	(0.172)	(0.0163)	(0.459)	(0.171)
dum4	0.103***	-0.00556	1.174***	0.0445***	0.0183	1.166***
	(0.0137)	(0.129)	(0.0426)	(0.00998)	(0.129)	(0.0425)
dum5	0.0631**	-0.301***	0.578***	0.0286	-0.260***	0.562***
	(0.0251)	(0.0801)	(0.0277)	(0.0183)	(0.0800)	(0.0277)
dum6	-0.0706*	-0.240***	-0.600***	-0.0448	-0.257***	-0.592***
	(0.0424)	(0.0910)	(0.0229)	(0.0308)	(0.0909)	(0.0228)
dum7	-0.189***	-0.244	-1.254***	-0.0904***	-0.277	-1.213***
	(0.0320)	(0.557)	(0.207)	(0.0233)	(0.556)	(0.207)
L.l_gerontocracy		-3.604***	-5.619***		-3.604***	-5.641***
		(0.627)	(0.209)		(0.626)	(0.208)
L.l_newcomers		-1.490	12.51***		-0.917	12.26***
		(1.673)	(0.581)		(1.670)	(0.579)
L.l_seniority		-1.729	6.246***		-1.421	6.131***
		(1.242)	(0.452)		(1.239)	(0.450)
L.inter		0.361	-1.807***		0.272	-1.768***
		(0.277)	(0.0983)		(0.277)	(0.0980)
L.l_education		-0.440***	-0.707***		-0.466***	-0.699***
		(0.148)	(0.0541)		(0.148)	(0.0540)
L.l_background		-0.181	-0.745***		-0.180	-0.735***
		(0.138)	(0.0498)		(0.138)	(0.0496)
L.local		0.523***	-0.279***		0.474***	-0.260***
		(0.0727)	(0.0268)		(0.0725)	(0.0267)
L.roots		0.123	1.133***		0.151	1.127***
		(0.126)	(0.0417)		(0.126)	(0.0415)
gos	0.117***	0.0527		0.109***	0.0533	
	(0.0323)	(0.0500)		(0.0234)	(0.0500)	
l_gict		0.352***			0.352***	
		(0.0514)			(0.0513)	
pee_gdp		0.0717***	0.179***		0.0696***	0.180***
		(0.0192)	(0.00631)		(0.0192)	(0.00629)
l_nict		0.342***			0.328***	
		(0.0353)			(0.0352)	
hp_s	0.00658	0.0423***	0.00368	-0.00499	0.0424***	0.00367
	(0.00673)	(0.0114)	(0.00428)	(0.00490)	(0.0114)	(0.00428)
trend		0.0881***	0.125***		0.0891***	0.124***
		(0.00689)	(0.000871)		(0.00687)	(0.000869)
l_ict	0.0377***			0.0151***		
	(0.00588)			(0.00427)		
Constant	4.123***	-155.3***	-263.7***	4.435***	-158.8***	-262.2***
	(0.155)	(15.15)	(2.430)	(0.113)	(15.11)	(2.422)
Observations	2,670	2,670	2,670	2,670	2,670	2,670
R-squared	0.133	0.866	0.976	0.043	0.866	0.976

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 17: Gerontocracy & TFP, Personal and social services#2

	(1)	(2)	(3)	(4)	(5)	(6)
	III			IV		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00973	0.00854		-0.00604	0.00856	
	(0.00765)	(0.0119)		(0.00556)	(0.0119)	
l_hms	0.145***	0.0461		0.0484**	0.0508	
	(0.0300)	(0.0477)		(0.0218)	(0.0477)	
l_hls	-0.0147	0.0236		-0.0128	0.0236	
	(0.0111)	(0.0176)		(0.00806)	(0.0176)	
l_marketopeness	0.244***	-0.662***	-0.166***	0.0816***	-0.676***	-0.159***
	(0.0359)	(0.0752)	(0.0311)	(0.0262)	(0.0751)	(0.0311)
dum2	-0.0632***	1.626***	1.554***	-0.0243	1.570***	1.594***
	(0.0215)	(0.594)	(0.243)	(0.0157)	(0.593)	(0.243)
dum3	0.0167	1.108**	1.113***	0.0226	1.093**	1.128***
	(0.0226)	(0.509)	(0.209)	(0.0165)	(0.508)	(0.209)
dum4	0.103***	0.280**	1.584***	0.0439***	0.299**	1.580***
	(0.0138)	(0.135)	(0.0464)	(0.0100)	(0.135)	(0.0463)
dum5	0.0679**	-0.160*	0.819***	0.0330	-0.119	0.807***
	(0.0302)	(0.0860)	(0.0317)	(0.0220)	(0.0859)	(0.0317)
dum6	-0.0672	-0.150	-0.683***	-0.0465	-0.168*	-0.678***
	(0.0427)	(0.0922)	(0.0265)	(0.0310)	(0.0921)	(0.0264)
dum7	-0.188***	2.034***	0.406	-0.0892***	1.966***	0.440*
	(0.0322)	(0.619)	(0.256)	(0.0235)	(0.617)	(0.255)
L.l_gerontocracy		-3.745***	-4.738***		-3.751***	-4.753***
		(0.593)	(0.228)		(0.592)	(0.227)
L.l_newcomers		1.202	11.92***		1.778	11.71***
		(1.718)	(0.677)		(1.713)	(0.676)
L.l_seniority		1.554	7.098***		1.836	7.005***
		(1.355)	(0.547)		(1.352)	(0.546)
L.inter		-0.117	-1.765***		-0.205	-1.733***
		(0.288)	(0.115)		(0.287)	(0.115)
L.l_education		-0.289*	-0.682***		-0.322**	-0.675***
		(0.149)	(0.0607)		(0.149)	(0.0606)
L.l_background		-0.130	-0.629***		-0.129	-0.619***
		(0.135)	(0.0547)		(0.135)	(0.0546)
L.local		0.308***	-0.645***		0.259***	-0.631***
		(0.0766)	(0.0292)		(0.0764)	(0.0292)
L.roots		0.150	1.573***		0.176	1.573***
		(0.127)	(0.0425)		(0.126)	(0.0425)
gos	0.118***	0.0442		0.110***	0.0448	
	(0.0325)	(0.0501)		(0.0237)	(0.0501)	
l_gict		0.379***			0.379***	
		(0.0468)			(0.0467)	
pee_pe		0.0373***	0.0255***		0.0371***	0.0252***
		(0.00542)	(0.00219)		(0.00540)	(0.00219)
l_nict		0.351***			0.337***	
		(0.0353)			(0.0352)	
hp_s	0.00588	0.0298***	-0.00417	-0.00480	0.0299***	-0.00410
	(0.00656)	(0.0109)	(0.00451)	(0.00478)	(0.0109)	(0.00451)
trend		0.0918***	0.134***		0.0927***	0.134***
		(0.00678)	(0.00101)		(0.00677)	(0.00101)
l_ict	0.0385***			0.0159***		
	(0.00590)			(0.00429)		
Constant	4.114***	-181.7***	-290.3***	4.450***	-184.9***	-289.1***
	(0.156)	(15.65)	(3.187)	(0.113)	(15.62)	(3.183)
Observations	2,646	2,646	2,646	2,646	2,646	2,646
R-squared	0.133	0.868	0.972	0.043	0.868	0.972

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 18: Gerontocracy & TFP, Distribution services#1

	(1)	(2)	(3)	(4)	(5)	(6)
	I			II		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00938	0.00950		-0.00558	0.00961	
	(0.00759)	(0.0119)		(0.00550)	(0.0119)	
l_hms	0.145***	0.0455		0.0527**	0.0503	
	(0.0298)	(0.0479)		(0.0216)	(0.0479)	
l_hls	-0.0157	0.0269		-0.0121	0.0271	
	(0.0110)	(0.0177)		(0.00799)	(0.0177)	
l_marketopeness	0.245***	-0.532***	0.0556*	0.0831***	-0.548***	0.0650**
	(0.0356)	(0.0764)	(0.0286)	(0.0259)	(0.0763)	(0.0286)
dum2	-0.0635***	-0.639	-0.762***	-0.0239	-0.653	-0.720***
	(0.0214)	(0.563)	(0.211)	(0.0156)	(0.562)	(0.210)
dum3	0.0173	-0.944**	-0.689***	0.0235	-0.927**	-0.675***
	(0.0225)	(0.460)	(0.172)	(0.0163)	(0.459)	(0.171)
dum4	0.103***	-0.00556	1.174***	0.0445***	0.0183	1.166***
	(0.0137)	(0.129)	(0.0426)	(0.00998)	(0.129)	(0.0425)
dum5	0.0631**	-0.301***	0.578***	0.0286	-0.260***	0.562***
	(0.0251)	(0.0801)	(0.0277)	(0.0183)	(0.0800)	(0.0277)
dum6	-0.0706*	-0.240***	-0.600***	-0.0448	-0.257***	-0.592***
	(0.0424)	(0.0910)	(0.0229)	(0.0308)	(0.0909)	(0.0228)
dum7	-0.189***	-0.244	-1.254***	-0.0904***	-0.277	-1.213***
	(0.0320)	(0.557)	(0.207)	(0.0233)	(0.556)	(0.207)
L.l_gerontocracy		-3.604***	-5.619***		-3.604***	-5.641***
		(0.627)	(0.209)		(0.626)	(0.208)
L.l_newcomers		-1.490	12.51***		-0.917	12.26***
		(1.673)	(0.581)		(1.670)	(0.579)
L.l_seniority		-1.729	6.246***		-1.421	6.131***
		(1.242)	(0.452)		(1.239)	(0.450)
L.inter		0.361	-1.807***		0.272	-1.768***
		(0.277)	(0.0983)		(0.277)	(0.0980)
L.l_education		-0.440***	-0.707***		-0.466***	-0.699***
		(0.148)	(0.0541)		(0.148)	(0.0540)
L.l_background		-0.181	-0.745***		-0.180	-0.735***
		(0.138)	(0.0498)		(0.138)	(0.0496)
L.local		0.523***	-0.279***		0.474***	-0.260***
		(0.0727)	(0.0268)		(0.0725)	(0.0267)
L.roots		0.123	1.133***		0.151	1.127***
		(0.126)	(0.0417)		(0.126)	(0.0415)
gos	0.117***	0.0527		0.109***	0.0533	
	(0.0323)	(0.0500)		(0.0234)	(0.0500)	
l_gict		0.352***			0.352***	
		(0.0514)			(0.0513)	
pee_gdp		0.0717***	0.179***		0.0696***	0.180***
		(0.0192)	(0.00631)		(0.0192)	(0.00629)
l_nict		0.342***			0.328***	
		(0.0353)			(0.0352)	
hp_s	0.00658	0.0423***	0.00368	-0.00499	0.0424***	0.00367
	(0.00673)	(0.0114)	(0.00428)	(0.00490)	(0.0114)	(0.00428)
trend		0.0881***	0.125***		0.0891***	0.124***
		(0.00689)	(0.000871)		(0.00687)	(0.000869)
l_ict	0.0377***			0.0151***		
	(0.00588)			(0.00427)		
Constant	4.123***	-155.3***	-263.7***	4.435***	-158.8***	-262.2***
	(0.155)	(15.15)	(2.430)	(0.113)	(15.11)	(2.422)
Observations	2,670	2,670	2,670	2,670	2,670	2,670
R-squared	0.133	0.866	0.976	0.043	0.866	0.976

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

Table 19: Gerontocracy & TFP, Distribution services#2

	(1)	(2)	(3)	(4)	(5)	(6)
	III			IV		
VARIABLES	l_tfp	l_ict	l_gict	l_tfp_go	l_ict	l_gict
l_hhs	0.00973	0.00854		-0.00604	0.00856	
	(0.00765)	(0.0119)		(0.00556)	(0.0119)	
l_hms	0.145***	0.0461		0.0484**	0.0508	
	(0.0300)	(0.0477)		(0.0218)	(0.0477)	
l_hls	-0.0147	0.0236		-0.0128	0.0236	
	(0.0111)	(0.0176)		(0.00806)	(0.0176)	
l_marketopeness	0.244***	-0.662***	-0.166***	0.0816***	-0.676***	-0.159***
	(0.0359)	(0.0752)	(0.0311)	(0.0262)	(0.0751)	(0.0311)
dum2	-0.0632***	1.626***	1.554***	-0.0243	1.570***	1.594***
	(0.0215)	(0.594)	(0.243)	(0.0157)	(0.593)	(0.243)
dum3	0.0167	1.108**	1.113***	0.0226	1.093**	1.128***
	(0.0226)	(0.509)	(0.209)	(0.0165)	(0.508)	(0.209)
dum4	0.103***	0.280**	1.584***	0.0439***	0.299**	1.580***
	(0.0138)	(0.135)	(0.0464)	(0.0100)	(0.135)	(0.0463)
dum5	0.0679**	-0.160*	0.819***	0.0330	-0.119	0.807***
	(0.0302)	(0.0860)	(0.0317)	(0.0220)	(0.0859)	(0.0317)
dum6	-0.0672	-0.150	-0.683***	-0.0465	-0.168*	-0.678***
	(0.0427)	(0.0922)	(0.0265)	(0.0310)	(0.0921)	(0.0264)
dum7	-0.188***	2.034***	0.406	-0.0892***	1.966***	0.440*
	(0.0322)	(0.619)	(0.256)	(0.0235)	(0.617)	(0.255)
L.l_gerontocracy		-3.745***	-4.738***		-3.751***	-4.753***
		(0.593)	(0.228)		(0.592)	(0.227)
L.l_newcomers		1.202	11.92***		1.778	11.71***
		(1.718)	(0.677)		(1.713)	(0.676)
L.l_seniority		1.554	7.098***		1.836	7.005***
		(1.355)	(0.547)		(1.352)	(0.546)
L.inter		-0.117	-1.765***		-0.205	-1.733***
		(0.288)	(0.115)		(0.287)	(0.115)
L.l_education		-0.289*	-0.682***		-0.322**	-0.675***
		(0.149)	(0.0607)		(0.149)	(0.0606)
L.l_background		-0.130	-0.629***		-0.129	-0.619***
		(0.135)	(0.0547)		(0.135)	(0.0546)
L.local		0.308***	-0.645***		0.259***	-0.631***
		(0.0766)	(0.0292)		(0.0764)	(0.0292)
L.roots		0.150	1.573***		0.176	1.573***
		(0.127)	(0.0425)		(0.126)	(0.0425)
gos	0.118***	0.0442		0.110***	0.0448	
	(0.0325)	(0.0501)		(0.0237)	(0.0501)	
l_gict		0.379***			0.379***	
		(0.0468)			(0.0467)	
pee_pe		0.0373***	0.0255***		0.0371***	0.0252***
		(0.00542)	(0.00219)		(0.00540)	(0.00219)
l_nict		0.351***			0.337***	
		(0.0353)			(0.0352)	
hp_s	0.00588	0.0298***	-0.00417	-0.00480	0.0299***	-0.00410
	(0.00656)	(0.0109)	(0.00451)	(0.00478)	(0.0109)	(0.00451)
trend		0.0918***	0.134***		0.0927***	0.134***
		(0.00678)	(0.00101)		(0.00677)	(0.00101)
l_ict	0.0385***			0.0159***		
	(0.00590)			(0.00429)		
Constant	4.114***	-181.7***	-290.3***	4.450***	-184.9***	-289.1***
	(0.156)	(15.65)	(3.187)	(0.113)	(15.62)	(3.183)
Observations	2,646	2,646	2,646	2,646	2,646	2,646
R-squared	0.133	0.868	0.972	0.043	0.868	0.972

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

Notes. Models I and II present TFP (value added based) as dependent variable while models III and IV present tfp (gross aoutput based) growth as dependent variable. Models I and III have public expenditure on education expressed in terms of GDP while models II and IV have public expenditure on education expressed as share of the total public expenditure.

A.5 IV estimates: sector by sector

Table 20: 2SLS estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Elecom	Mexelec	Finbus	Pers	Distr
VARIABLES	l_tfp	l_tfp	l_tfp	l_tfp	l_tfp	l_tfp
l_ict	0.0429***	0.188***	0.0778***	-0.0418***	0.0509***	-0.0856***
	(0.00465)	(0.0221)	(0.00697)	(0.0140)	(0.0104)	(0.00914)
l_hhs	0.0129**	-0.116***	-0.0676***	0.0612	-0.0379**	-0.0276***
	(0.00502)	(0.0413)	(0.00963)	(0.0375)	(0.0154)	(0.00845)
l_hms	0.00457	-0.605***	-0.135***	0.119	-0.133***	-0.0619**
	(0.00938)	(0.108)	(0.0208)	(0.0764)	(0.0343)	(0.0241)
l_hls	-0.00667	-0.381***	-0.0988***	0.0307	-0.134***	-0.104***
	(0.00715)	(0.0671)	(0.0187)	(0.0326)	(0.0276)	(0.0262)
l_marketopeness	0.0648**	0.556***	0.225***	-0.0610	0.0202	-0.0361
	(0.0256)	(0.0898)	(0.0340)	(0.0657)	(0.0477)	(0.0414)
dum2	-0.0341**	-0.202***	-0.143***	-0.0533	-0.0288	-0.0160
	(0.0157)	(0.0645)	(0.0227)	(0.0580)	(0.0313)	(0.0250)
dum3	-0.0264**	-0.0993*	-0.00836	-0.0232	0.0544*	-0.00660
	(0.0130)	(0.0516)	(0.0181)	(0.0401)	(0.0280)	(0.0257)
dum4	0.0443***	0.108***	0.0754***	-0.0220	0.0294	0.0649***
	(0.0101)	(0.0367)	(0.0136)	(0.0277)	(0.0183)	(0.0166)
dum5	0.0333	0.0805	0.0751***	-0.106*	0.0521	0.00243
	(0.0206)	(0.0704)	(0.0267)	(0.0625)	(0.0357)	(0.0331)
dum6	-0.00619	-1.178***	-0.330***	0.137	-0.537***	-0.358***
	(0.0305)	(0.243)	(0.0682)	(0.152)	(0.104)	(0.0854)
dum7	-0.0478**	-0.573***	-0.147***	0.00332	0.0128	0.0268
	(0.0239)	(0.0880)	(0.0324)	(0.0661)	(0.0470)	(0.0445)
gos	0.0585***	0.551***	0.789***	0.351***	0.272***	0.258***
	(0.0217)	(0.100)	(0.105)	(0.123)	(0.0885)	(0.0987)
hp_s	0.00541	0.00602	0.00423	0.00565	0.0114	0.0146*
	(0.00550)	(0.0188)	(0.00703)	(0.0144)	(0.00933)	(0.00874)
Constant	4.440***	8.306***	5.419***	3.957***	5.362***	5.553***
	(0.0811)	(0.710)	(0.174)	(0.487)	(0.275)	(0.223)
Observations	3,743	260	1,300	251	511	260
R-squared	0.062	0.667	0.261	0.186	0.231	0.547

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

Table 21: GMM estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Elecom	Mexelec	Finbus	Pers	Distr
VARIABLES	l_tfp	l_tfp	l_tfp	l_tfp	l_tfp	l_tfp
l_ict	0.0418***	0.166***	0.0755***	-0.0348***	0.0540***	-0.0888***
	(0.00502)	(0.0219)	(0.00837)	(0.0102)	(0.0109)	(0.00924)
l_hhs	0.0118***	-0.0712**	-0.0640***	0.0157	-0.0287	-0.0322***
	(0.00425)	(0.0324)	(0.00982)	(0.0368)	(0.0198)	(0.00787)
l_hms	-0.000394	-0.565***	-0.128***	0.0995	-0.0959**	-0.0460*
	(0.00759)	(0.0881)	(0.0176)	(0.0612)	(0.0480)	(0.0252)
l_hls	-0.00325	-0.372***	-0.0825***	0.0195	-0.123***	-0.115***
	(0.00506)	(0.0635)	(0.0155)	(0.0235)	(0.0322)	(0.0249)
l_marketopeness	0.0957***	0.567***	0.238***	-0.143**	0.0455	0.0202
	(0.0250)	(0.0850)	(0.0303)	(0.0677)	(0.0516)	(0.0404)
dum2	-0.0488***	-0.170***	-0.158***	-0.0435	-0.0297	-0.0332
	(0.0134)	(0.0567)	(0.0224)	(0.0465)	(0.0346)	(0.0210)
dum3	-0.0365***	-0.141***	-0.0211	0.0733*	0.0419	0.000749
	(0.0111)	(0.0490)	(0.0151)	(0.0376)	(0.0281)	(0.0219)
dum4	0.0638***	0.133***	0.111***	-0.0233	0.0302*	0.0644***
	(0.0112)	(0.0309)	(0.0166)	(0.0200)	(0.0170)	(0.0108)
dum5	0.0342***	0.0608	0.0814***	-0.117**	0.0470***	0.00460
	(0.00813)	(0.0509)	(0.0109)	(0.0500)	(0.0152)	(0.0122)
dum6	0.0115	-1.261***	-0.266***	0.0820	-0.497***	-0.389***
	(0.0206)	(0.224)	(0.0549)	(0.106)	(0.110)	(0.0758)
dum7	-0.0683***	-0.619***	-0.155***	0.0736	-0.0213	-0.0345
	(0.0221)	(0.0866)	(0.0289)	(0.0589)	(0.0475)	(0.0434)
gos	0.0932***	0.551***	0.889***	0.400***	0.347***	0.193**
	(0.0196)	(0.0923)	(0.124)	(0.108)	(0.105)	(0.0828)
hp_s	0.00530	0.0133	0.00181	0.00554	0.00990	0.0130**
	(0.00566)	(0.0148)	(0.00711)	(0.00996)	(0.00742)	(0.00597)
Constant	4.492***	8.151***	5.345***	4.044***	5.168***	5.639***
	(0.0755)	(0.633)	(0.153)	(0.424)	(0.370)	(0.237)
Observations	3,743	260	1,300	251	511	260
R-squared	0.060	0.656	0.252	0.146	0.219	0.520

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