

# Paying Politicians: A (Semi-)Structural Approach

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## Abstract

I use a semi-structural approach to address the relationship between wages paid to politicians, citizens' decision to participate in politics, and their behaviour and performance in office. I build on recent advances in the political economics literature (Aruoba, Drazen and Vlaicu, 2015) seeking to better quantify and disentangle the different mechanisms at play, and provide a stronger link to the theoretical literature and clearer policy implications.

I estimate the model by Aruoba et al (2015) using the data on Italian municipalities collected by Gagliarducci and Nannicini (2013). I rely on the structure proposed by Aruoba et al (2015) to identify unobservable characteristics of the political environment (quality of politicians, proportion of office-motivated and intrinsic-motivated candidates, among others) in two comparable samples of Italian municipalities with different wages, exploiting a discontinuity in mayors' wages determined by the Italian law. This institutional setting provides arguably exogenous variation in wages (Gagliarducci and Nannicini, 2013) that allows to attribute the differences in parameters' estimates to the change in wages.

Results show that higher wages lead to a pool of more able but also more office-motivated politicians. Overall, better remunerations lead to better average performance. The effect is mainly driven by the change in candidates' skills, but it is also favoured by an enhanced effect of elections, which allow to better discipline and screen out bad incumbents.

## I. Introduction

How can a society improve its politicians' performance? From a political economics perspective, culture and institutions (that is, the shared preferences and beliefs, and the rules shaping people's behaviour) are key determinants of a society's capability to both select and discipline its politicians. In this paper I focus on politicians wages, with the aim of contributing to the understanding on how they affect citizens' decision to participate in politics, and incumbents' behaviour and performance.

The main innovation of the project is to use a semi-structural approach to address the relationship between politicians' remuneration and their performance, building on recent advances in the political economics literature (Aruoba, Drazen and Vlaicu, 2015). Relative to the existing empirical literature on the topic, this approach serves to better quantify and disentangle

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the different mechanisms at play, providing a stronger link to the theoretical literature and clearer policy implications. The project also intends to contribute by expanding the current databases on Italian municipalities and their politicians.

This paper shows the estimation of the model by Aruoba, Drazen and Vlaicu (2015) using the data on Italian municipalities collected by Gagliarducci and Nannicini (2013). Aruoba, Drazen and Vlaicu (2015) build a stochastic political agency model with imperfect information, which allows to identify and estimate some basic characteristics of the electoral and political environment using information on electoral results and politicians' performance. The structure of their model allows to identify the parameters behind the quality of politicians, the proportion of office-motivated vs. intrinsic-motivated candidates, and the competitiveness of the electoral races. The estimated parameters can be then used to simulate counterfactual scenarios, and quantify the selection effect and discipline effect of elections on politicians' performance. I rely on their proposed structure to estimate the model parameters on two comparable samples of Italian municipalities with different wages, exploiting a discontinuity in mayors' wages determined by the Italian law.<sup>1</sup> This institutional setting provides arguably exogenous variation in wages (Gagliarducci and Nannicini, 2013) that allows to attribute the differences in parameters' estimates to the change in wages. Wages are assumed to affect the behaviour and performance of politicians only through their effect on the quality and motivations of the candidates' pool and the competitiveness of the election (i.e. parameters of the model). The paper thus follows a semi-structural approach in the sense that parameters in each separate sample are estimated using the structural identification provided by the model by Aruoba, Drazen and Vlaicu (2015), and the natural experiment generated by the Italian law (Gagliarducci and Nannicini, 2013) allows to give a causal interpretation to the observed differences. The estimated parameters are then used to quantify how wages affect the discipline and selection effects of elections.

Results show that higher wages lead to a pool of more able but also more office-motivated politicians. Overall, better remunerations lead to better average performance. The effect is mainly driven by the change in candidates' skills, but it is also favored by an enhanced effect of elections, which allow to better discipline and screen out bad incumbents. These results show how the structural estimation of a political economics model can help to better disentangle the different mechanisms through which wages affect political performance. Results are insightful, but rely on some assumptions regarding politicians' and voters' behaviour that find only weak support on the data. These limitations highlight one of the main challenges to be addressed in future research: the need to collect more information and to obtain more and better measures of politicians' performance.

The structure of the paper is as follows: Section II presents a brief review of the main theoretical and empirical contributions in this literature. In the following section, I describe the theoretical model proposed by Aruoba, Drazen and Vlaicu (2015). Section IV discusses the institutional setting in Italian municipalities and the data set used. In Section V, I present

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<sup>1</sup>The Italian Law determines that mayors' wages depend on the number of inhabitants in the municipality, following a non-decreasing step function. The law determines 9 population thresholds for which the mayor wage increases. As Gagliarducci and Nannicini (2013), I focus on the 5000 inhabitants threshold and estimate the model for those municipalities just above and below.

the results of the estimation. Finally, I conclude, and briefly comment on limitations of the current project and lines for future research.

## II. Related Literature

How do wages paid to politicians affect their performance? The economic approach to this question has usually distinguished two different aspects of it: (i) how the pool of candidates is affected by the politicians' remuneration (the so-called *selection* or, more precisely, *ex-ante selection* channel); and (ii) how wages affect the behaviour of politicians once they are in office (*discipline* channel) and the possibility of voters to screen out bad incumbents (*ex-post selection* channel).

From a theoretical perspective, two families of models address each of these two different aspects: On the one hand, *citizen-candidate* models present alternative mechanisms that explain what drives different types of individuals into politics (Persson and Tabellini, 2000; Caselli and Morelli, 2004; among others). These models analyze the choice of individuals who decide whether to participate as a candidate in elections for public office or to stay working in the private sector by comparing the relative value of both options. They do not consider the incentive problems that arise once the politician is in office (by assuming, for example, no possibility of reelection) and focus just on how the equilibrium pool of candidates responds to changes in the different exogenous variables in the model. On the other hand, *political agency* models analyze the joint behaviour of incumbent politicians and voters, and how it is affected by different informational structures and institutional settings (Persson and Tabellini, 2000). This type of models assume an exogenous pool of politicians and focus on how the optimal effort of the incumbent and the capability of voters to screen politicians depend on the exogenous variables and on the alternative assumptions.

Besley (2004) and Broilo, Nannicini, Perotti and Tabellini (2013) present models combining both an agency and a citizen-candidate setting. Besley (2004) addresses specifically the question on politicians wages, and provides an overview of the main mechanisms relating the remuneration paid to politicians and their behaviour. In the model, a representative voter opts between reelecting the incumbent politician or replacing her with a (random) member of an endogenous pool of candidates. Citizens in the economy differ in both their (unobservable) honesty and their private sector wage, and decide whether to run as candidates or keep their private jobs. Incumbents, who are subject to a two term-limit, can either respond to voters demands or behave dishonestly. The voter seeks to reelect honest politicians and get rid of corrupt ones.

How does politicians remuneration affect the equilibrium choices of the different agents? *Ceteris paribus*, a higher wage increases the value of holding office and might induce a dishonest incumbent to behave responsively in order to be reelected. This discipline effect on politicians performance can be partially offset by voters' reduced chances to distinguish between different types of politicians: if both good and bad politicians behave well when reelection is possible, voters are unable to separate the wheat from the chaff (*ex-post selection*). Reelected bad

politicians will then misbehave when term limits are binding and reelection is not possible. The equilibrium choices of each type of incumbent affect their reelection probabilities, and they jointly impact on the value of pursuing public office, altering the endogenous pool of candidates (ex-ante selection).

In the baseline model presented by Besley (2004), an increase in politicians remuneration leads to improved performance, driven by both better discipline (that exceeds the reduced ex-post selection) and a more honest pool of politicians. However, these results hinge on some specific assumptions. As discussed by Besley (2004) himself, both the effect on discipline and ex-ante selection could be negative in slightly different and also plausible settings. In particular, the direction of the ex-ante selection effect is highly dependent on the parametric assumptions in the model. An increase in the remuneration of politicians raises the value of office and attracts more people into politics, both honest and dishonest. Hence, the joint distribution of private sector wages and honesty is a key determinant of the direction and the size of the effect of a wage increase in the quality of the pool of politicians, and there are not *a priori* unequivocal assumptions on this distribution. The dimensions of politicians' quality (i.e. which characteristics define a good politician), and how these characteristics correlate with marketable skills are crucial for ex-ante selection.

Caselli and Morelli (2001, 2004) and Messner and Polborn (2004) present two citizen-candidate models and discuss alternative reasons why higher wages might not necessarily lead to better quality candidates. In Caselli and Morelli's (2001) model, citizens' types have two dimensions: honesty and competence. The main tension in the model is that, while voters prefer competent and honest politicians, its low quality citizens (i.e. those dishonest and/or incompetent) who have a comparative advantage in pursuing elective office.<sup>2</sup> While very low (high) remunerations induce only low (high) quality citizens to be elected, in the intermediate cases, voters have to choose between honest but incompetent or competent but dishonest candidates. In these situations, local increases in wages can induce a better balance between these two groups, implying that as one desirable quality increases the other falls.<sup>3</sup>

Messner and Polborn (2004) include an additional mechanism: *free-riding*. In their model, when deciding whether to run or not, citizens not only compare the relative rewards in each occupation, but also weigh the potential improvement in the quality of the public service provided if they are elected instead of another candidate. In their setting, citizens differ only in their competence, which is common knowledge and positively correlated to their (random) outside option. Again, at very high (low) wages only the highest (lowest) competence citizens are elected; but now, in the intermediate cases, an increase in the politician remuneration might induce a fall in the quality of the pool of candidates. This negative effect is the result of two opposing forces: on the one hand, a higher remuneration increases the reward from office

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<sup>2</sup>Competence is assumed to be perfectly correlated to market skills, while honesty is orthogonal to them. The comparative advantage of low quality citizens is due to: (a) incompetent citizens having a lower opportunity cost of becoming a politician; and (b) dishonest ones extracting rents from corruption, and thus obtaining a higher reward from being in office.

<sup>3</sup>Caselli and Morelli (2001, 2004) focus in the case when the rewards from office are endogenous, and depend on the quality of the pool of politicians (current and past). They show that both *multiple equilibria* and *path dependence* in politicians' quality might arise (i.e. countries with the exact same exogenous characteristics might be stuck in a "bad politicians" or a "good politicians" equilibrium).

and the probability that citizens will run as candidates; on the other hand, this increased probability might induce high quality citizens to free ride on other less competent candidates.

The existence of different theories with opposite predictions underscores the importance of empirical efforts to address this question, a task that faces several challenges. First and foremost, the key identification issue comes from the potential endogeneity of wages. Di Tella and Fisman (2004), for example, show evidence for the United States consistent with governors being rewarded with higher salaries for fiscal conservatism. Second, the empirical analysis requires a reliable measure of performance of the elected politicians. Finally, the existence of different mechanisms complicates the interpretation of the results and the policy implications that can be obtained from them.

In recent years, a number of empirical studies have circumvented some of these issues and exploited quasi-experimental settings to address the question on the relationship between remuneration and the selection and discipline of politicians. Ferraz and Finan (2011) exploit discontinuous jumps introduced by the Brazilian law in the (maximum) wages of local legislators across municipalities, and find that higher wages increase their productivity (as measured by the number of bills submitted and approved), and the provision of some public services. They also find a small effect on the education of the candidates and in the competition for office: higher wages lead to more and better educated candidates. Their data set and research design do not allow them to fully disentangle the ex-ante selection and the discipline effect on performance; however, they show that, even after controlling for the observable characteristics of the politicians, the effect of wages on performance remains significant, an indication of enhanced discipline.

Fisman, Harmon, Kamenica and Munk (2014) analyze the effect of salaries on the performance of the members of the European Parliament. They use a panel data approach, exploiting the introduction of a law that equalized the wages of the representatives of the different countries, which were originally highly different. Their analysis shows no significant effect of wages on the effort exerted by elected politicians, as measured by their participation in parliamentary activities and their shirking behaviour.<sup>4</sup> Higher wages augment incumbents' willingness to stay in office, leading to longer average tenures, and increase the number of parties that field candidates for the European Parliament. On the selection front, Fisman *et al* (2014) find that higher wages reduce the average educational quality of incumbents.

Finally, Gagliarducci and Nannicini (2013) use a similar approach as the one used by Ferraz and Finan (2011) to analyze the effect of wages on politicians personal characteristics and on a set of performance measures using information on Italian municipalities. They use a regression discontinuity approach, exploiting a feature of Italian legislation: mayors' wages follow a scale that depends on the number of inhabitants in the municipality. They focus on small cities (around 5000 inhabitants) and find that, on average, higher wages attract better educated politicians. They also show that better paid politicians run smaller government and increase municipal administrative efficiency. In order to disentangle both mechanisms, they

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<sup>4</sup>Fisman *et al* (2014) construct a measure of shirking given by the number of days a member of the parliament signed the attendance register but did not participate in any of the votes held that day.

focus on the sub-sample of reelected mayors and compute the difference in the performance between their first and second term in office. They find that the performance of reelected incumbents is lower when the term-limit is binding, and consider this fall as the (negative of the) discipline effect. They finally show that this discipline effect is not different between the two sides of the population threshold, and conclude that higher wages do not lead to greater discipline.

The empirical evidence shows no clear pattern on the effect of wages on performance, and, in particular, on the relative importance of the different mechanisms. This lack of unanimity might be in part a consequence of the empirical challenges listed above, which complicate the execution of empirical studies and the interpretation of their results. In this state of things, the vast theoretical literature on the topic is extremely useful. The structural estimation of a model that combines both the endogenous entry of politicians and the agency problem should provide a clearer link between theory and evidence, and allow to simulate counterfactual scenarios, helping to disentangle the different effects at play and to obtain precise policy implications. This paper aims at giving a first contribution in this direction, and to point out limitations and lines of future research that need to be pursued to obtain further answers to these questions.

## **Estimation of a Political Agency Model.**

The first preliminary step of the project is the estimation of the agency model introduced by Aruoba, Drazen and Vlaicu (2015). The estimation and simulation of this model allows, under its assumptions, to disentangle the discipline and the ex-post selection effects of elections. I estimate the model separately on two comparable samples of Italian municipalities, exploiting the discontinuity in mayors' wages determined by the Italian law (as done by Gagliarducci and Nannicini (2013)). Under the assumption that samples do not differ in any other relevant dimension, the difference between estimates in each of the samples responds to the difference in wages.

It is important to note that, in this exercise, the mechanisms relating wages with the quality of the pool of politicians, their behaviour and their accountability are not explicitly modeled. Thus, the exercise only allows to observe if wages have impacted on the pool of politicians and on their accountability, but does not allow to simulate counterfactual scenarios that combine alternative wage schedules and institutional arrangements.

### III. A Political Accountability Model (Aruoba, Drazen and Vlaicu, 2015)<sup>5</sup>

Aruoba, Drazen and Vlaicu (2015) build and estimate a political agency model with the aim of quantifying the discipline and the (ex-post) selection effects of elections.<sup>6</sup> In this section, I present this model. I first describe its main elements, the equilibrium concept, and the solution and estimation procedures. Finally, I briefly explain the counterfactual scenario built to measure and disentangle the different effects.

The model describes the joint behaviour of an infinitely-lived representative voter and a sequence of incumbent mayors, who are subject to a two-term limit. In each period when the term limit is not binding, the voter decides whether to reelect the incumbent or not. If the incumbent is not reelected or the term limit is binding, a new incumbent is chosen randomly from an exogenous pool of candidates. There are two types of politicians: good and bad, who differ in their disutility of effort. Good politicians do not dislike doing high effort. Bad politicians do. The voter does not observe neither the mayor's type nor her effort, but just her performance. Performance is random, but depends positively on effort. Elections help the voter to discipline and screen the mayors.

The timing of the model is as follows: (i) the incumbent mayor decides her level of effort; (ii) a performance realization is drawn from the probability distribution that corresponds to the chosen effort level; (iii) the voter observes the performance and updates the probability of the incumbent being of good or bad type; (iv) the voter observes a popularity shock that affects the relative attractiveness of the incumbent and her opponents; (v) taking into account the updated probability of the incumbent's type and the popularity shock, the voter decides whether to reelect or not the incumbent; (vi) if the incumbent is not reelected, a new one is chosen randomly from the pool of candidates; if she is reelected, she chooses her optimal level of effort, and, in the following period, a random candidate takes office. Whenever a new incumbent takes office, the cycle starts again.

The voter and the incumbent both know the parameters of the model, and the decision processes of the different agents, which I describe in the following subsections.

#### **Mayor's problem.**

Every period, the incumbent mayor decides whether to exert high effort ( $e = H$ ) or low effort ( $e = L$ ). Her effort choice influences her performance ( $y$ ), which can be understood as the efficiency in managing the municipality, or, more broadly, how effectively she responds to

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<sup>5</sup>This section follows sections 3.1-3.5, 4.1-4.2 and 5.2 of the article by Aruoba, Drazen and Vlaicu (2015).

<sup>6</sup>Aruoba, Drazen and Vlaicu (2015) estimate the model using information on U.S governors for 1982-2012. They find that elections significantly increase incumbents' performance, mainly through the discipline channel. Throughout this section, I present the model referring the incumbent as a "mayor" and not as a "governor" (as it was in the original article).

citizens' demands. In particular, performance follows the rule:

$$y_i|e_i = H \sim N(Y_H, \sigma_y^2) \quad (1)$$

$$y_i|e_i = L \sim N(Y_L, \sigma_y^2) \quad (2)$$

for term  $i = 1, 2$ , where  $Y_H > Y_L$ .

Exerting high effort leads, on average, to a better performance, which is independent of the incumbent's type or the term she is in. The mayor knows that the voter takes her performance into consideration when deciding to reelect her, and, thus, anticipates that her reelection probability depends on the effort choice:  $\rho_H$  ( $\rho_L$ ) is the probability of being reelected when effort is high (low).

Politicians can be either good ( $\theta = G$ ) or bad ( $\theta = B$ ). The politicians' type is not observed by the voter, who nevertheless knows that there is an exogenous fraction  $\pi$  of good politicians in the pool of candidates. Good and bad politicians obtain an exogenous rent  $r$  from being in office.

Exerting low effort has no utility cost for each of both types ( $c(L, B) = c(L, G) = 0$ ); but good and bad politicians differ in the cost of exerting high effort. While good politicians bear no utility loss from high effort ( $c(H, G) = 0$ ), bad politicians suffer a random cost  $c$ , which is expressed as a fraction of the exogenous rents of office ( $r$ ) and is assumed to be drawn from a uniform distribution on the interval  $[0, 1]$ . The cost  $c$  is observed by the incumbent (before choosing her effort level) but not by the voters.

The incumbent's problem is then:

$$\max_{e_1, e_2} [1 - c(e_1; \theta)]r + [\mathbf{1}_H \rho_H + (1 - \mathbf{1}_H) \rho_L][1 - c(e_2; \theta)]r \quad (3)$$

where  $e_i$  is effort in term  $i$  and  $\mathbf{1}_H$  is an indicator function that equals 1 if effort is high, and equals zero otherwise. In solving this decision problem, the incumbent takes the reelection probabilities ( $\rho_H, \rho_L$ ) as given. The decision problem (implicitly) assumes that incumbents always run for reelection.

A strategy for the incumbent is an effort choice for each term, and each possible level of  $c$ . The optimal strategy is the one that solves the maximization problem above (3).

Good politicians always find optimal to exert high effort. In the first term, high effort increases the probability of reelection and bears no additional utility cost.<sup>7</sup> In the second term, they are indifferent between high or low effort, but they lean to the voters' side and exert high effort. The optimal strategy for bad type politicians is less trivial. In the second term, when there is no possibility of reelection, they exert low effort. In the first term, they exert high effort if the cost ( $c$ ) is smaller than the expected benefit of doing so, given by the increase in the reelection chances. The optimal strategy is then to choose high effort if and only if  $c < \rho_H - \rho_L$ .

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<sup>7</sup>In equilibrium,  $\rho_H > \rho_L$ .



It is important to note that  $r$  (the exogenous rents of office) does not affect the optimal strategy of the mayor, *conditional on the model parameters*. Nevertheless, as it follows from the previous review of the theoretical and empirical literature, the expected value of office (that is affected by the value of  $r$ ) might impact on the quality of the pool of candidates, the proportion of office-motivated vs. intrinsic-motivated ones, and the competitiveness of the electoral races (captured by the model parameters). The impact of wages on behaviour and performance therefore is not direct, but moderated by the characteristics of the political environment captured by the parameter values. In this paper, no structure is imposed on the relationship between wages and the model parameters.<sup>8</sup>

In short, in equilibrium, good politicians always exert high effort, and bad politicians only do so in the first term if the cost ( $c$ ) is sufficiently low. Hence, under the distributional assumption for  $c$ , the equilibrium probability of a low type incumbent exerting high effort in the first term is:

$$\delta \equiv P(e_1 = H | \theta = L) = \rho_H - \rho_L \quad (4)$$

### Voter's problem.

In every period that the term limit is not binding, the representative voter chooses whether to reelect the incumbent or not. If the incumbent is reelected, she takes office for a second and last term, and then is replaced by a random pick from the pool of candidates. If she is not reelected, a random candidate takes office directly in the following period. Whenever a new incumbent takes office, the game starts again.

Voters have all the same preferences and information, and, thus, allow for a representative voter. The representative voter is infinitely lived and seeks to maximize her discounted expected utility. The voter instantaneous utility is linear in the mayor's performance.

The model includes a popularity shock  $\varepsilon \sim N(\mu, \sigma_\varepsilon)$ , which is observed by the voter before the reelection decision but not by the incumbent, and that is added to the voters' utility if the incumbent is reelected. In this way, a positive mean of the popularity shock ( $\mu > 0$ ) implies an incumbency advantage. The popularity shock adds stochasticity to the reelection rule and intends to capture every other factor that influences voters' decision apart from the incumbent's performance.

The representative voter's lifetime utility, after observing the incumbent's first term performance and the popularity shock, is:

$$W(y_1, \varepsilon) = y_1 + \beta \max_{R \in \{0,1\}} \mathbb{E} \{ R [y_2 + \varepsilon + \beta W(y'_1, \varepsilon')] + (1 - R) W(y'_1, \varepsilon') | y_1, \varepsilon \} \quad (5)$$

where  $\beta$  is the voter's discount rate between electoral terms, and  $R$  is the decision to reelect

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<sup>8</sup>Building and estimating a fully-fledged model that explicitly models the different channels through which wages impact on politicians' performance is part of the future research agenda.

( $R = 1$ ) or not reelect ( $R = 0$ ).

The voter's problem can be rewritten as follows:

$$W(y_1, \varepsilon) = y_1 + \beta \max_{R \in \{0,1\}} R [\mathbb{E}[y_2|y_1] + \varepsilon + \beta \mathbb{V}] + (1 - R) \mathbb{V} \quad (6)$$

where  $\mathbb{V}$  denotes  $\mathbb{E}[W(y'_1, \varepsilon')]$ , which is constant because all the stochastic variables are not persistent. The voter takes the probability  $\delta$  as given when solving the decision problem.

The constant  $\mathbb{V}$  can be expressed as:

$$\begin{aligned} \mathbb{V} = & [\pi + (1 - \pi)\delta] \iint W(y'_1, \varepsilon') \phi\left(\frac{y'_1 - Y_H}{\sigma_y}\right) \phi\left(\frac{\varepsilon' - \mu}{\sigma_\varepsilon}\right) dy'_1 d\varepsilon', \\ & + (1 - \pi)(1 - \delta) \iint W(y'_1, \varepsilon') \phi\left(\frac{y'_1 - Y_L}{\sigma_y}\right) \phi\left(\frac{\varepsilon' - \mu}{\sigma_\varepsilon}\right) dy'_1 d\varepsilon', \end{aligned} \quad (7)$$

In order to solve her decision problem, the representative voter observes the first term performance and updates the probability of the incumbent being of good type. The Bayesian posterior probability ( $\hat{\pi}(y_1)$ ) is:

$$\hat{\pi}(y_1) \equiv \frac{\pi \phi\left(\frac{y'_1 - Y_H}{\sigma_y}\right)}{[\pi + (1 - \pi)\delta] \phi\left(\frac{y'_1 - Y_H}{\sigma_y}\right) + (1 - \pi)(1 - \delta) \phi\left(\frac{y'_1 - Y_L}{\sigma_y}\right)} \quad (8)$$

The conditional expectation of the incumbent's second term performance is then:

$$\mathbb{E}[y_2|y_1] = \hat{\pi}(y_1)Y_H + [1 - \hat{\pi}(y_1)]Y_L \quad (9)$$

A strategy for the representative voter is a choice to reelect or not to reelect for each possible combination of first term performance and popularity shock ( $y_1, \varepsilon$ ). In the optimal strategy, the incumbent is reelected if and only if:

$$\hat{\pi}(y_1)Y_H + [1 - \hat{\pi}(y_1)]Y_L + \varepsilon + \beta \mathbb{V} > \mathbb{V} \quad (10)$$

The voter reelects the incumbent if either  $y_1$  or  $\varepsilon$  are sufficiently high. In particular, for a given value of the first term performance, the popularity shock that makes the voter indifferent between reelection and picking a new candidate is:

$$\hat{\varepsilon}(y_1) \equiv (1 - \beta)\mathbb{V} - \hat{\pi}(y_1)Y_H - [1 - \hat{\pi}(y_1)]Y_L \quad (11)$$

Hence, the optimal reelection rule for a given  $y_1$ , is:

$$R(y_1, \varepsilon) = \begin{cases} 0 & \text{if } \varepsilon \leq \hat{\varepsilon}(y_1) \\ 1 & \text{if } \varepsilon > \hat{\varepsilon}(y_1) \end{cases} \quad (12)$$

The reelection probability, conditional on the first term performance, implied by the optimal reelection rule is:

$$\psi(y_1) \equiv P(R = 1|y_1) = P[\varepsilon > \hat{\varepsilon}(y_1)] = 1 - \Phi\left(\frac{\hat{\varepsilon}(y_1) - \mu}{\sigma_\varepsilon}\right) \quad (13)$$

Hence, in equilibrium, the incumbent's reelection probability conditional on her effort is:

$$\rho_H = \int \psi(y_1) \phi\left(\frac{y_1 - Y_H}{\sigma_y}\right) dy_1 \quad (14)$$

$$\rho_L = \int \psi(y_1) \phi\left(\frac{y_1 - Y_L}{\sigma_y}\right) dy_1 \quad (15)$$

### Equilibrium.

As explained above, in equilibrium, good politicians always exert high effort, and bad politicians exert low effort when the term limit is binding. Knowing this, the equilibrium of the model consists of (a) a strategy for bad incumbents for their first term in office; (b) a strategy (reelection rule) for the representative voter; and (c) a system of beliefs, such that: (i) they solve the maximization problem of the incumbent and the voter, respectively; (ii) they are consistent with each other; and (iii) and they are consistent with the voter's Bayesian update of beliefs.

Formally, Aruoba, Drazen and Vlaicu (2015) state the following definition:

**Definition.** The outcome of a Perfect Bayesian Equilibrium of the game between a mayor and the voter is a collection of scalars  $(\rho_L, \rho_H, \delta, \mathbb{V})$  where:

1. Given  $\delta$ , the voters choices lead to  $\rho_L, \rho_H$  and  $\mathbb{V}$ .
2. Given  $\rho_L, \rho_H$  and  $\mathbb{V}$ , a bad mayors' choice of  $e_1$  leads to  $\delta$ .

### Solution.

As it follows from the formal definition of the equilibrium, for given parameter values, to solve the model it is sufficient to find the values for  $\rho_L, \rho_H, \delta, \mathbb{V}$ . In fact, for given values of  $\delta$  and  $\mathbb{V}$ , it is possible to evaluate the equilibrium mappings:  $\hat{\pi}(y_1)$  (equation 8),  $\hat{\varepsilon}(y_1)$  (equation 11),  $W(y_1, \varepsilon)$  (equation 6),  $R(y_1, \varepsilon)$  (equation 12) and  $\psi(y_1)$  (equation 13). Then, once these functions are evaluated, the values for  $\rho_L$  and  $\rho_H$  can be obtained from equations (14) and (15), respectively. The only two additional conditions that need to be satisfied are equations (7) and (4). Hence, finding the equilibrium of the model amounts to solving the following non-linear two-by-two system of equations, where the two unknowns are  $\mathbb{V}$  and  $\delta$ :

$$\begin{aligned} \mathbb{V} &= [\pi + (1 - \pi)\delta] \iint W(y'_1, \varepsilon') \phi\left(\frac{y'_1 - Y_H}{\sigma_y}\right) \phi\left(\frac{\varepsilon' - \mu}{\sigma_\varepsilon}\right) dy'_1 d\varepsilon', \\ &\quad + (1 - \pi)(1 - \delta) \iint W(y'_1, \varepsilon') \phi\left(\frac{y'_1 - Y_L}{\sigma_y}\right) \phi\left(\frac{\varepsilon' - \mu}{\sigma_\varepsilon}\right) dy'_1 d\varepsilon', \\ \delta &= \rho_H - \rho_L \end{aligned}$$

where  $W(y'_1, \varepsilon')$  is given by equation (6), and  $\rho_H$  and  $\rho_L$  are given by (14) and (15), respectively.

The equilibrium is found by solving numerically the system above. I evaluate the system at a grid of values for  $(\mathbb{V}, \delta)$  and pick the combination that minimizes the sum of squared differences between the two sides of the equations as the initial condition for a standard solver algorithm.<sup>9</sup>

### Estimation.

There are seven parameters to estimate:  $\pi$ ,  $Y_H$ ,  $Y_L$ ,  $\sigma_y$ ,  $\mu$ ,  $\sigma_e$  and  $\beta$ . The discount factor  $\beta$  is fixed at 0.85, which represents roughly a 3 percent annual discounting over a five-year term. The rest of the parameters are estimated by maximum likelihood. The data set consists of a measure of performance for each mayor for each term in office (either one or two), and a reelection variable ( $R$ ) that takes value 1 if the mayor was reelected and value 0 if not. The density of a mayor who won reelection with performance  $y_1$  and  $y_2$  is:

$$\begin{aligned} p_W(y_1, y_2) &\equiv \pi \phi\left(\frac{y_1 - Y_H}{\sigma_y}\right) \psi(y_1) \phi\left(\frac{y_2 - Y_H}{\sigma_y}\right) \\ &\quad + (1 - \pi) \delta \phi\left(\frac{y_1 - Y_H}{\sigma_y}\right) \psi(y_1) \phi\left(\frac{y_2 - Y_L}{\sigma_y}\right) \\ &\quad + (1 - \pi)(1 - \delta) \phi\left(\frac{y_1 - Y_L}{\sigma_y}\right) \psi(y_1) \phi\left(\frac{y_2 - Y_L}{\sigma_y}\right) \end{aligned}$$

The density of a mayor who lost reelection with a performance  $y_1$  is:

$$\begin{aligned} p_L(y_1) &\equiv \pi \phi\left(\frac{y_1 - Y_H}{\sigma_y}\right) [1 - \psi(y_1)] \\ &\quad + (1 - \pi) \delta \phi\left(\frac{y_1 - Y_H}{\sigma_y}\right) [1 - \psi(y_1)] \\ &\quad + (1 - \pi)(1 - \delta) \phi\left(\frac{y_1 - Y_L}{\sigma_y}\right) [1 - \psi(y_1)] \end{aligned}$$

The contribution to the likelihood of each observation (mayor) is:

$$L_k \equiv R_k \log [p_W(y_{1k}, y_{2k})] + (1 - R_k) \log [p_L(y_{1k})]$$

The log-likelihood is the sum of the above expression over all the observations of the sample. The maximum likelihood estimates are found numerically using a standard optimization

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<sup>9</sup>I implement this algorithm in Matlab. Codes are available upon request.

algorithm. I run the algorithm from different initial conditions to assess its convergence properties and to reduce the chances of finding a local, and not global, maximum.<sup>10</sup>

### Computing the Discipline and Selection Effects of Elections.

In order to quantify the discipline and the selection effects of elections, Aruoba, Drazen and Vlaicu (2015) use the estimated values of the parameters to evaluate a counterfactual scenario in which mayors can only serve one term. The discipline effect and the selection effect are then computed by comparing the results in the benchmark model and in the one-term limit counterfactual.

The solution to the one-term limit model is straightforward. The voter has no choice in this setting: every period a new incumbent is chosen randomly from the exogenous pool of candidates. Given that there are no reelection chances, bad politicians always exert low effort. Good politicians are indifferent between low and high effort, but again choose to exert high effort. Hence, in equilibrium, the average fraction of incumbents exerting high effort is given by the parameter  $\pi$ , and the average performance in each period is equal to  $\pi Y_H + (1 - \pi)Y_L$ .

In the two-term limit setting, elections help the voter to discipline and screen the mayors. The discipline effect of elections comes from those bad politicians who exert high effort in the first term in order to increase their reelection chances. In particular, the discipline effect is calculated in two different ways. First, as the difference between the two models in the proportion of candidates that exert high effort in their first term in office:

$$\underbrace{\pi + (1 - \pi)\delta}_{\substack{\% \text{ of high effort in first term} \\ \text{(two-term limit model)}}} - \underbrace{\pi}_{\substack{\% \text{ of high effort} \\ \text{(one-term limit model)}}} = \underbrace{(1 - \pi)\delta}_{\text{discipline effect \#1}}$$

Second, as the difference between the two models in the incumbents' average first term performance:

$$\underbrace{[\pi + (1 - \pi)\delta] Y_H + (1 - \pi)(1 - \delta)Y_L}_{\substack{\text{average performance in first term} \\ \text{(two-term limit model)}}} - \underbrace{\pi Y_H + (1 - \pi)Y_L}_{\substack{\text{average performance} \\ \text{(one-term limit model)}}} = \underbrace{(1 - \pi)\delta [Y_H - Y_L]}_{\text{discipline effect \#2}}$$

The selection effect comes from the fact that more good mayors are reelected than bad mayors. Aruoba *et al* (2015) propose also two measures for the selection effect. First, the difference between the proportion of good politicians among those who are reelected and the exogenous fraction of good candidates:

<sup>10</sup>I implement this algorithm in Matlab. Codes are available upon request. The optimization routine is time-consuming, since every evaluation of the likelihood function requires to numerically solve the model to find the equilibrium for the given set of parameter values. The standard deviations are obtained by computing (numerically) the negative of the inverse of the Hessian of the log-likelihood function at the optimum, and taking the square root of the elements in its main diagonal.

$$\underbrace{\frac{\pi \rho_H}{[\pi + (1 - \pi)\delta] \rho_H + (1 - \pi)(1 - \delta)\rho_L}}_{\substack{\% \text{ of high effort in second term} \\ \text{(two-term limit model)}}} - \underbrace{\pi}_{\substack{\% \text{ of high effort} \\ \text{(one-term limit model)}}} = \text{selection effect \#1}$$

Second, as the difference between the average second term performance of reelected mayors in the benchmark model and the average performance in the one-term limit scenario:

$$\underbrace{\frac{\pi \rho_H Y_H + [(1 - \pi)\delta \rho_H + (1 - \pi)(1 - \delta)\rho_L] Y_L}{[\pi + (1 - \pi)\delta] \rho_H + (1 - \pi)(1 - \delta)\rho_L}}_{\substack{\text{average performance in second term} \\ \text{(two-term limit model)}}} - \underbrace{\pi Y_H + (1 - \pi) Y_L}_{\substack{\text{average performance} \\ \text{(one-term limit model)}}} = \text{selection effect \#2}$$

In the results section below, I present the different effects as a percentage change with respect to the one-term limit model, and not as an absolute difference as here.

It is important to clarify that the validity of the counterfactual evaluations and of the estimated effects relies on a crucial assumption: the parameters in the model must be structural in the sense of being unaltered by the counterfactual policy change. This assumption is common to every counterfactual simulation, but it is not at all trivial in the exercise conducted here. In particular, it is not obvious that a change in the term limit would leave the pool of candidates unaffected. The theoretical models discussed above argue that the pool of candidates depends, among other variables, on the value of public office, which could be affected by a change in the term limit. In the sections below, I follow Aruoba, Drazen and Vlaicu (2015) and proceed under the assumption that the model parameters are structural.

## IV. Institutional Framework and Data

I estimate the above model using data on Italian municipalities for the period 1993-2000, first used by Gagliarducci and Nannicini (2013). In this section, I explain the Italian municipalities' institutional setting and describe the data set.

### Institutional Framework.

In Italy there are around 8,000 municipalities. The municipal government is composed by a mayor (Sindaco), an executive committee (Giunta) chosen by the mayor, and an elected council (Consiglio Comunale). Until 1993, municipal governments had a proportional parliamentary system: citizens elected the council members, who then appointed a mayor. Since 1993, mayors are elected directly by the citizens and are subject to a two term limit.<sup>11</sup> The institutional framework matches in these dimensions that of the theoretical model.

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<sup>11</sup>Before 1993, mayors were not subject to term limits. Those mayors who were in office when the new law was introduced were allowed to run for two additional terms.

The remuneration of the mayor is determined by the number of inhabitants in the city (as measured by the last population census available), following a non-decreasing step function with nine jumps. Wages are adjusted every year to account for price inflation. In addition to wages, there are other policies and regulations that change with the population size of the municipality: the number and the remuneration of the members of the executive committee and of the council; the electoral rule; and the possibility of running a health care district or host a municipal hospital, among others. Table 1, obtained from Gagliarducci and Nannicini (2013), shows the different policies and their respective population thresholds.

Table 1: Legislative Thresholds for Italian Municipalities. (Gagliarducci and Nannicini, 2013)

Population	Wage Mayor	Wage Ex. Com.	Fee Council	Ex. Com. Size	Council Size	Electoral Rule	Neighbor. Councils	Hospital/Health
Below 1,000	1,291	15%	18	4	12	single	no	no/no
1,000 – 3,000	1,446	20%	18	4	12	single	no	no/no
3,000 – 5,000	2,169	20%	18	4	16	single	no	no/no
5,000 – 10,000	2,789	50%	18	4	16	single	no	no/no
10,000 – 15,000	3,099	55%	22	6	20	single	no	no/no
15,000 – 20,000	3,099	55%	22	6	20	runoff	no	no/no
20,000 – 30,000	3,099	55%	22	6	20	runoff	no	yes/no
30,000 – 50,000	3,460	55%	36	6	30	runoff	allowed	yes/no
50,000 – 60,000	4,132	75%	36	6	30	runoff	allowed	yes/no
60,000 – 100,000	4,132	75%	36	6	30	runoff	allowed	yes/yes
100,000 – 250,000	5,010	75%	36	10	40	runoff	yes	yes/yes
250,000 – 500,000	5,784	75%	36	12	46	runoff	yes	yes/yes
Above 500,000	7,798	75%	36	14-16	50-60	runoff	yes	yes/yes

**Notes:** *Population* is the number of resident inhabitants as measured by the last available Census. *Wage Mayor* and *Wage Ex. Com.* refer to the monthly gross wage of the mayor and the members of the executive committee, respectively; the latter is expressed as a percentage of the former, which refers to 2000 and is measured in Euros. *Fee Council* is the reimbursement per session paid to council members and is measured in Euros. The wage thresholds at 1,000 and 10,000 were introduced in 2000; all of the others date back to 1960. *Ex.Com.Size* is the maximum allowed number of executives appointed by the mayor. *Council Size* is the number of seats in the City Council. All of the size thresholds were set in 1960. Since 1993, Electoral Rule can be either single round (with 60% premium) or runoff (with 66% premium) plurality voting. *Neighborhood Councils* are bodies that represent different neighborhoods within the city and are provided with independent budgets. *Hospital/Health* captures whether the municipality is allowed to have a hospital or a health-care district, respectively.

Only two thresholds determine a jump exclusively on the politicians' remuneration: 5,000 and 50,000. Following Gagliarducci and Nannicini (2013) choice, I focus on the 5,000 inhabitants threshold, for which the sample size is relatively large (which is not the case for the 50,000 inhabitants threshold). In addition to these data availability issues, the choice of relatively small municipalities seems particularly fit to address the effect of wages on the selection and behaviour of politicians, given that the other material and immaterial rewards associated to public office appear *a priori* to be less important than in larger municipalities, and regional or national positions. In the 5,000 inhabitants thresholds, the mayor's monthly

gross wage jumps a significant 28.5%, from 2169€ to 2789€.

There are two additional clarifications about the institutional framework that are important. First, as described in Table 1, the wages of both the mayors and the executive committee change at the 5,000, and thus it is not possible to clearly disentangle the effect of both policy changes. Nevertheless, the change in the remuneration of the committee members is small in absolute value and, as Gagliarducci and Nannicini (2013) indicate, it is safe to assume that most of the effect comes from the change in the mayor’s wage. Second, the Italian law indicates that under specific conditions the municipal council can allow a 15-percent wage increase for the mayor. Gagliarducci and Nannicini (2013) conducted a telephone interview survey to 36 mayors in municipalities between 4,900 and 5,100 in office on May 1st, 2009, and found that only 2 out of 36 respondents had been granted this increase. In the estimation of the model, I assume that the municipalities on each side of the threshold are equal among them. The existence of different wage levels within each of the two samples would then generate problems. I assume, based on the results of the survey by Gagliarducci and Nannicini (2013), that these wage increases are rare enough not to generate major biases.<sup>12</sup>

## Data.

The model is estimated in two different samples, one to each side of the 5,000 inhabitants threshold. The unit of observation is a mayor, who might have been in office for one or two terms. The only variable needed to estimate the model is the measure of performance ( $y$ ). In the original article, Aruoba *et al* (2015) use the “job approval ratings” as proxy for performance, collected from surveys of voters. They measure performance as the fraction of respondents who consider the mayor as either good or excellent, and average across the different waves of the survey in each term. This variable is not available for Italian mayors.

The measure of performance I use is the speed of payment, defined as “the ratio between the outlays actually paid and the outlays committed in the municipal budget within the year” (Gagliarducci and Nannicini, 2013). The timing of payments is under control of the municipal government, and, thus, the variable is intended to proxy the efficiency of the mayor’s administration. In the model, performance enters directly in the utility function of the voter. An important assumption for the validity of the replication exercise is that the speed of payment is in fact a good proxy for administrative efficiency, which affects citizens’ welfare. The speed of payment is computed annually by the Ministry of Interior (Ministero dell’Interno). The measure used is the average over the years of the mayor’s term, without considering the transition years (in which elections take place).

I use a bandwidth of 300 inhabitants, and estimate the model for those mayors elected dur-

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<sup>12</sup>There is a third important additional aspect of the institutional setting. The Italian law allows elected mayors to keep their jobs. Independent workers can accumulate earnings from both activities without restrictions, while dependent workers have to either ask for an absence leave or accept a 50-percent cut in their mayor’s wage. In the same telephone survey mentioned above, Gagliarducci and Nannicini (2013) asked mayors about their current job status. The fraction of mayors with other jobs was 53 percent and 54 percent in each side of the threshold, respectively. The self-reported number of hours worked per week was 38 for full-time mayors, and 28 for part-time mayors. As noted by Gagliarducci and Nannicini (2013), the evidence indicates that being a mayor carries an important opportunity cost.



ing the period 1993-2000 in municipalities with 4700 to 5000, and 5000 to 5300 inhabitants.<sup>13</sup> I exclude women mayors due to the following reason: In the theoretical model, mayors are assumed to always run for reelection, but, in the data, we observe that many of them decide not to seek a second term in office. This is an important issue since mayors who decide to drop out voluntarily will be considered as losers in the estimation of the model, and might bias the results. Only if all mayors who have dropped out would have lost the elections if they had decided to run, there would be no problem. Assuming this is far-fetched. In the current data set, we cannot identify which mayors had dropped out and who had run for elections, but we know that the rate of dropping out is significantly higher among women. Hence, I exclude women mayors from the sample to ameliorate this misspecification bias.<sup>14</sup>

The “low-wage sample” (< 5000) consists of 103 observations, of which 56 are reelected mayors (54% reelection rate). The “high-wage sample” (> 5000) includes 122 mayors, 62 of them who have been reelected (51% reelection rate). The municipalities in the different samples are similar in terms of their geographical characteristics (with the obvious exception of population size).

Table 2: Geographical Characteristics of Municipalities

	Low-wage Sample	High-wage Sample	Difference	SD Diff.
Population (1991)	4845.2	5156.5	-311.3***	(12.040)
North (1:Yes, 0:No)	0.466	0.492	-0.026	(0.067)
Extension ( $Km^2$ )	42.97	42.05	0.917	(5.480)
Altitude ( <i>mts.</i> )	254.5	236.26	18.24	(29.744)
<i>N</i>	103	122	225	

The choice of the bandwidth seeks to balance two needs: working with a relatively large sample on both sides of the threshold, and keeping municipalities relatively homogeneous in terms of size across both samples. Nannicini and Gagliarducci (2013) show that the speed of payment is in general related to population size. This is not an issue for their identification strategy, since they use a regression discontinuity design and explicitly control for population size. I use a relatively small bandwidth (the difference in population size between the smallest and the biggest city in the samples is less than 13 percent) and assume that, within the chosen range, population does not significantly affect administrative efficiency. The linear regressions of first and second term performances on population size show no clear effect of population on the speed of payment within each of the samples (the coefficient is only significantly different from zero for the second term performance in the high-wage sample, with a p-value around 5% ).

<sup>13</sup>I repeated the estimation using a bandwidth of 250 inhabitants, and results are qualitatively unchanged.

<sup>14</sup>The correction is small since women are very few in the sample: 14 overall (8 in the low-wage sample, and 6 in the high-wage sample). I performed the estimation for the complete sample (including women) and all the results are qualitatively unchanged.

In the model, municipalities are identical in all relevant dimensions and mayors differ only in their type. These are obviously strong assumptions. In this sense, the main issue is the difference between municipalities in North and the South, which present many long-dated and highly documented differences. In particular, a regression of speed of payment on a North dummy (taking a 1 for municipalities in the Northern regions of Italy and a 0 otherwise) shows that the difference between the two groups is significant, even though it does not explain much of the observed variation (R-squared smaller than 0.1). Another important doubt is whether there are observable characteristics of the mayors that are related to their performance in office, and could inform voters decision. Table 3 shows the linear regressions of first and second term performance (speed of payment) on some mayor's personal characteristics. The joint explanatory potential of the variables is low. Nevertheless, there are some statistically significant patterns: mayors who are unemployed when running for their first term in office perform worse than those employed, particularly in independent or white collars jobs. The number of years of schooling also appears to be negatively correlated to first-term performance. None of the included personal characteristics seem to explain cross-mayor variation in the second-term performance.

	Low-wage Sample		High-wage Sample	
	First-term Performance ( $Y_1$ )	Second-term Performance ( $Y_2$ )	First-term Performance ( $Y_1$ )	Second-term Performance ( $Y_2$ )
Age	0.112 (0.0699)	0.174 (0.108)	0.00590 (0.0748)	0.0698 (0.120)
Years of School	-0.544 (0.258)**	-0.328 (0.305)	-0.174 (0.288)	0.656 (0.529)
White Collar	0.954 (1.504)	-0.0754 (1.831)	-0.464 (1.502)	-2.366 (2.533)
Blue Collar	-0.542 (2.013)	3.684 (2.759)	-0.637 (1.977)	2.651 (3.219)
Unemployed	-4.720 (2.292)**	1.682 (3.445)	-4.266 (2.208)*	2.924 (3.879)
$N$	121	61	102	55
$R^2$	0.084	0.177	0.040	0.041

Constant term omitted. Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## V. Results

In this section, I present the results of the estimation of the agency model proposed by Aruoba, Drazen and Vlaicu (2015) on two different samples of Italian municipalities. Table 2 shows the estimated values of the six structural parameters in the model (as noted before, the parameter  $\beta$  is fixed at 0.85).

**Table 2: Parameter Estimates**

Structural Parameters	$\pi$	$Y_L$	$Y_H$	$\sigma_y$	$\mu$	$\sigma_\epsilon$
Low-wage Sample	0.944 (0.032)	57.5 (5.11)	79.4 (0.54)	5.22 (0.40)	2.3 (1.56)	7.89 (1.58)
High-wage Sample	0.788 (0.088)	68.7 (2.78)	81.4 (0.72)	4.54 (0.55)	1.26 (1.63)	9.56 (3.30)

Note: standard deviations in parentheses.

In the low-wage sample, the proportion of good candidates ( $\pi$ ) is very high.<sup>15</sup> Good politicians bear no utility loss from exerting high effort and, thus, are not affected by reelection motives: they behave responsively in both their first and second term. This behaviour might respond to politicians being motivated by other material or immaterial rewards. If, for example, public service motivation is a first order consideration for politicians, reelection incentives should not affect their behaviour. There are other potential explanations for this result: on the one hand, politicians could be motivated by some after-public-office rewards accrued by good performers, such as social recognition, a political career, or professional opportunities in the private sector.<sup>16</sup> In the high-wage sample, the fraction of good candidates is smaller than for low-wage municipalities. This result hints that higher wages crowd out other motivations, and leads to a pool of politicians that is, on average, more affected by reelection considerations.

The increase in wages not only leads to less public-service-motivated candidates, but to more able ones. In the high-wage sample, the mean of the performance distributions for high effort ( $Y_H$ ) and low effort ( $Y_L$ ) are higher than those in the low-wage sample. In other words, for a given level of effort, politicians in the high-wage sample are, on average, better at managing the municipality, and deliver a higher speed of payment.

It is important to note that the difference between the two samples is statistically weak. For each of the six structural parameters estimated, the two-standard-deviations confidence intervals overlap, indicating that the differences between the samples pointed out in the previous paragraphs might be due to sample variation, and not to differences in the underlying structural parameters. This consideration applies also for the following discussion on the effects of wages on the ex-post selection and the discipline effects.

In both samples, the parameters of the distribution of the popularity shock ( $\mu, \sigma_\epsilon$ ) show

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<sup>15</sup>The fact that this proportion is so high (and close to 1) might be problematic since it could reflect a poor fit of the model, and difficult identification of the model parameters. In the extreme case where all mayors are of the same type, they all exert the same effort in both terms and therefore it would be impossible to identify whether they are all of the good or of the bad type (that is, whether the observed performance comes from low effort or high effort). In our case, it is somewhat reassuring of our interpretation (i.e. most candidates are of the good type and exert high effort) that in the high-sample (where there is more variability of types) the estimated means of the performance with high and low effort are close to the estimates in the low sample.

<sup>16</sup>The political career motivation, although potentially important, does not seem to be extremely relevant in this context. Using an extended version of the database provided by Gagliarducci and Nannicini (2013) on Italian politicians, I find that the great majority of the mayors in small municipalities in the last decades have not pursued a political career at the regional or national level; and, more importantly, that only a small fraction of the regional and national politicians start their political career as mayors or council members in small municipalities.

that there is a small incumbency advantage ( $\mu > 0$ ) and a relatively large variance, which leads to the popularity shock being very important in the reelection decision. The results indicate that the measure of performance is not capturing important factors driving the voters' decision. The interpretation of this result hinges on how much we rely on the chosen measure as an appropriate proxy of performance. If the speed of payment is a good measure of the mayor's performance, the results show that Italian voters in small municipalities are not too responsive to local administrative efficiency, but are focused on other factors, possibly national or regional politics, or ideological considerations. One of the main challenges to be addressed in future research is to dig deeper into this question by constructing different measures of performance and assessing the voters' responsiveness to such measures.

**Table 3: Equilibrium Values**

Equilibrium Values	$\delta$	$\rho_L$	$\rho_H$	$\mathbb{V}$
Low-wage Sample	0.52	0.04	0.56	531.7
High-wage Sample	0.30	0.24	0.54	534.1

Table 3 shows the equilibrium values of the endogenous variables for the two sets of parameter values. The equilibrium probability of being reelected is higher when high effort ( $\rho_H$ ) is exerted than when low effort ( $\rho_L$ ) is done, but the difference between the two is higher in the low-wage sample. In the low-wage sample, the difference between  $Y_H - Y_L$  is large compared to the variance of the distributions ( $\sigma_y$ ), and the performance realization is highly informative about the incumbent's effort level.

The first block of Table 4 (below) shows some relevant statistics of the benchmark model for both sets of parameter values: (a) the percentage of incumbents exerting high effort in the first and the second term; (b) the mayor's average performance in their first and second term; and (c) the voter's life-time welfare (i.e. the present value of the incumbent's performance, without considering the utility derived from the popularity shock). The results show that higher wages lead to a lower fraction of incumbent's exerting high effort in each of both terms, but to a higher average performance, consequence of the enhanced ability of the politicians. The second block ("One-term limit counterfactual") presents the results for the model with no reelection: the percentage of incumbents exerting high effort in each period, their average performance, and the voter's life-time welfare.

**Table 4: Properties of Estimated Model**

	Low-wage Sample	High-wage Sample
<b>BENCHMARK MODEL</b>		
High Effort (Term 1)	97.3%	85.2%
High Effort (Term 2)	96.8%	85.9%
Average Performance (Term 1)	78.81	79.49
Average Performance (Term 2)	78.70	79.57
PV $\{Y_t\}$	525.2	530.1
<b>ONE-TERM LIMIT COUNTERFACTUAL</b>		
High Effort	94.4%	78.8%
Average Performance	78.19	78.67
PV $\{Y_t\}$	521.3	524.5
<b>MEASURES OF INTEREST</b>		
$\Delta$ PV $\{Y_t\}$	0.76	1.07
Discipline #1 (% Change)	3.07	8.10
Discipline #2 (% Change)	0.81	1.03
Selection #1 (% Change)	2.53	8.94
Selection #2 (% Change)	0.67	1.14

The last block of the table (“Measures of interest”) shows the discipline and the selection effect (measured in the two ways previously described) and the overall change in the life-time welfare induced by the possibility of reelection. Elections increase welfare by allowing voters to discipline and screen their mayors. The increase in welfare due to elections is larger in the high-wage sample, driven by both greater discipline and selection effects.

On the discipline side, in the low-wage sample, the proportion of first-termers who exert high effort increases 3.07% relative to the one-term limit scenario. The average performance in the first term increases 0.81%. The effect is greater in the high-wage sample: the fraction of mayor’s exerting high effort raises 8.10% and the average performance increases by 1.03%.

Voter’s welfare is also benefited by the voters’ possibility to screen out bad politicians. In the low-wage sample, the proportion of incumbents exerting high effort in their second term in office is 2.53% greater than in the one-term limit counterfactual, and leads to a 0.67% increase in the average performance. The selection effect is also greater in the high-wage sample, where the proportion of good politicians among those who are reelected is 8.94% higher than the fraction of good citizens in the pool of candidates (the average performance of second-termers is 1.14% higher than when no reelection is possible).

Why is the welfare gain from elections greater in the high-wage sample? Higher wages lead to a pool of politicians that is more balanced in terms of types. In the trivial cases of

candidates being all of the same type ( $\pi = 0$  or  $\pi = 1$ ), elections provide no welfare gain to the voters. It is only when both bad and good candidates coexist that elections are relevant. In the low-wage sample, almost every candidate is of the good type, and, thus, voters have little room to discipline and select incumbents. In the high-wage sample, the proportion of those reelection-motivated (bad) politicians is relatively large and, thus, it becomes more important to have an institutional setting that provides incumbents with incentives to exert high effort, and gives the voters the possibility to screen out those politicians who will likely misbehave if reelected.

The greater effect of elections in the high-wage sample due to a more balanced pool of politicians is in part mitigated by the smaller difference between the performance of those incumbents who exert high effort and those who do not. In this sense, it is immediate to note that if effort did not affect performance ( $Y_H = Y_L$ ), elections would not provide any welfare gain. Higher wages lead to a pool of more able politicians, as measured by the means of the performance distributions, given by  $Y_H$  and  $Y_L$ . The relative increase in  $Y_L$  is greater than that in  $Y_H$ , and (given a similar  $\sigma_y$  in the two samples) this reduces both the voters' possibility to screen out those incumbents who exert low effort and their gain from doing so. This can be seen from the equilibrium reelection probabilities: while in the low-wage sample only 4 percent of those who exert low effort are reelected, this fraction increases to 24 percent in the high-wage sample (as shown in Table 3).

The last piece of results relates to the article by Gagliarducci and Nannicini (2013). In their article, briefly presented in Section II, they find that higher wages lead to better performance (in particular, higher speed of payments), mainly through the composition channel (*ex-ante selection + ex-post selection*). As explained above, they focus on the sub-sample of reelected mayors and, by comparing their relative performance in the first and second term in office, argue that wages do not lead to greater discipline. The exercise proposed in this field paper tries to improve upon the one performed by Gagliarducci and Nannicini (2013) by providing a closer link to the theoretical literature. The structural estimation is more transparent about the assumptions needed to disentangle the different effects and about the precise definition of each of them. The overall result is the same: higher wages lead to better performance, but here we observe that both the ex-ante selection channel and elections (partly through the discipline channel) explain the increase. The structural estimation of the model makes the interaction between the different channels explicit: it is mostly the change in the pool of candidates that enhances the role of elections on performance.

The above exercise does not allow to fully disentangle and quantify the different effects, since it is not possible to evaluate counterfactual scenarios with different wage levels and term limits that would serve to that purpose. Nevertheless, we can obtain some indicative information: in the one-term limit scenario, where elections play no role, higher wages lead to a voter's welfare increase of 0.6% (3.2), which can only be explained by the change in the pool of candidates. The increase in the benchmark setting is higher (0.9%) due to an enhanced effect of elections. Both the discipline and the ex-post selection channels, which lead, respectively, to greater increases in the average first and second term performance, explain this improvement.

## VI. Conclusions

This paper uses a semi-structural approach to estimate the effect of wages on politicians' performance in Italian municipalities, and to disentangle and quantify the discipline and selection channels behind such effect. It relies on the model proposed by Aruoba, Drazen and Vlaicu (2015), and exploits the exogenous variation in wages generated by the Italian institutional framework (as in Gagliarducci and Nannicini, 2013).

The estimation results show that, in the Italian municipalities under analysis, higher wages crowd out other motivations, and lead to a pool of politicians that is, on average, more affected by reelection considerations. The increase in wages not only leads to less intrinsically-motivated candidates, but to more able ones: for a given level of effort, politicians in the high-wage sample are, on average, better at managing the municipality, and deliver a higher speed of payment. Overall, higher wages lead to better administrative efficiency by attracting more able but less disinterested candidates. Elections are important for this improvement by allowing voters to discipline and screen out some of the reelection-motivated politicians.

The analysis done in this paper, although insightful, has limitations that should be taken into consideration when interpreting the above results, and that could be used as guide for future research addressing these questions. First and most importantly, it is crucial to obtain better measures of politicians' performance. This would not only be a contribution in itself, but it would be also important to better accommodate the model's assumptions. The current measure (*speed of payments*) has interesting features (mainly, it is under the direct control of the mayor and there is arguably not much voters' disagreement on it), but its relationship with voters' welfare is somewhat weak. In addressing this limitation, there are two alternative routes that might be worth exploring: (a) Income and expenditure statements of every municipality in Italy are available on an annual basis, and can be used to construct indexes on the state of local finances (some of them readily available in the information set provided by the Ministero dell'Interno).<sup>17</sup> (b) Judicial sentences involving public officials are passed by different courts (Procure Generale and Regionali, Consiglio di Stato, Tribunali Amministrativi Regionali), which keep public records, in some cases available online. The systematic analysis of the documents on the judicial decisions might allow to build a new data set on the number and characteristics of the corruption and mismanagement cases involving Italian mayors and council members, a potentially relevant measure of performance.

Second, in the above analysis, the mechanisms relating wages to politicians' quality, behaviour and performance are not explicitly modeled. The analysis therefore does not allow to simulate counterfactual scenarios that combine alternative wage schedules and institutional arrangements. Building a model that explicitly considers incumbents' remunerations and allows to identify structural parameters behind the relationship between remuneration and performance would be the appropriate way to address this limitation. This paper raises some key issues when pursuing this task. In particular, it is important to further analyze (a) if the observable characteristics of candidates provide information to the voters on their quality as

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<sup>17</sup>Periodic reports produced by Corte dei Conti, the government agency in charge of analyzing regional and municipal financial statements, provide an orientation on how to evaluate the administrative efficiency of the municipalities and build alternative measures.

policy makers (i.e. whether types in the model are observable or not), and (b) if these features are measurable and available to the econometrician. Furthermore, the model should contemplate some heterogeneity across municipalities: for example, municipalities' educational or employment level (which could account for differences in the pool of candidates).

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