Fakultät für Wirtschaftswissenschaften
Facoltà di Economia
Faculty of Economics and Management

BEMPS –
Bozen Economics & Management
Paper Series

NO 47/ 2018

Paying Politicians: Not Too Little, Not Too Much

Alessandro Fedele, Pierpaolo Giannoccolo

Paying Politicians: Not Too Little, Not Too Much*

Alessandro Fedele[a] Pierpaolo Giannoccolo[b]

December 2017

Abstract

How does pay affect the quality of politicians? This paper tackles the question by considering a three-period citizen candidate model where potential candidates vary in skills and in public service motivation. First, potential candidates observe the level of pay in politics and then simultaneously decide whether or not to run for office. Second, an election takes place and only one candidate is elected. Finally, the successful candidate provides a public good, while all the others work in the market sector. In a benchmark model where potential candidates differ only in skills, the quality of the elected politician is shown to increase with pay. If public service motivation is also considered, an inverted U-shaped relationship is found. The latter result is compatible with empirical evidence.

Keywords: Pay; Selection and Quality of Politicians; Skills; Public Service Motivation.

JEL Codes: D72 (Political Processes: Rent-Seeking, Lobbying, Elections, Legislatures, and Voting Behavior), P16 (Political Economy), J24 (Human Capital; Skills; Occupational Choice; Labor Productivity), J3 (Wages, Compensation, and Labor Costs).

*We thank Federico Boffa, Nadia Burani, Marta Di Lascio, Robert Dur, Massimo Morelli, Mirco Tonin, and the seminar audience at the ASSET Conference (Algiers, 2017), XI GRASS Workshop (Bocconi, Milan, 2017), First Bruneck Workshop on the Political Economy of Federalism and Local Development (Bruneck, 2016), and CORE@50 Conference (CORE, Louvain la Neuve, 2016). Alessandro Fedele gratefully acknowledges financial support from Free University of Bozen/Bolzano. The usual *caveat* applies.
[a]Corresponding Author, Faculty of Economics and Management, Free University of Bolzano/Bozen, Italy; e-mail: alessandro.fedele@unibz.it
[b]Department of Economics, University of Bologna, Italy; e-mail: pierpaolo.giannoccolo@unibo.it.

Introduction

Good government is a key ingredient for economies to thrive. In turn, the effectiveness of policy-making is affected by the quality of elected officials, as shown by recent evidence. Jones & Olken (2005), for instance, investigate the impact of political leaders' unexpected death on economic growth and estimate that a one-standard-deviation increase in leader quality enhances annual growth rates by at least 1.47 percentage points. Besley et al. (2010) find that leader identity is a significant determinant of US growth; Besley et al. (2011) extend these results by identifying a positive effect of a leader's education. Gagliarducci & Nannicini (2013) show that the perfomance of Italian municipalities is significantly enhanced by the selection of competent mayors.[1]

It seems plausible to assume that remuneration affects the selection and quality of politicians. It is, however, not obvious in which direction. The present paper investigates this issue.

A relatively recent body of theoretical literature investigates the link between wage and quality of the political class (for seminal contributions, see Caselli & Morelli, 2004, and Messner & Polborn, 2004). Most existing papers measure quality through one dimension, namely skills. Nevertheless, politicians are a special category of workers, whose quality is likely to be affected not only by general skills, but also by specific characteristics that are relevant in politics or, more generally, in the public sector. Among such characteristics, public service motivation (PSM) is one of the oldest topics discussed by public administration scholars and considered to be a crucial determinant of work performance in the public sector (Perry & Wise, 1990; Rainey & Steinbauer, 1999). PSM has been defined as "an individual's predisposition to respond to motives grounded primarily or uniquely in public institutions and organizations" (Perry & Wise, 1990: 368).[2]

This theoretical paper extends the literature by examining how the level of pay in politics, referred to as wage plus any other financial benefits from holding office, affects selection in a framework where the quality of potential candidates (PCs) is proxied by two characteristics; not only skills but also PSM. To take on board the PCs' twofold heterogeneity and, at the same time, tailor the analysis to the distinctive setting of politics, we develop a three-period citizen candidate model, which is in the spirit of Messner & Polborn (2004). PCs are endowed with two different levels of both skills and PSM, either high or low. In the first period, PCs observe the level of politician's uniform pay and then play a candidacy game by simultaneously deciding whether to run for office. In the second period, an election takes place and only one candidate is elected by plurality rule. In the third period, the successful candidate provides a public good, while all the

[1] More generally, Besley (2005: 45) observes: "If the control of politicians through elections is limited, then improving the quality of government requires an increase in the honesty, integrity or competence of those who are elected." In a similar vein, Brändle (2016: 205) argues: "[...] as political control and the credibility of policy commitments are limited, policy choice is also influenced by the identity and quality of the individuals who hold political office."

[2] The notion of PSM is well-established in economics since Francois (2000). For instance, Delfgaauw & Dur (2010: 656) define PSM as "intrinsic preference for working in the public sector relative to working in the private sector". Similarly, Besley (2005: 49) argues that the motivation of politicians "can be thought of as hard-wired into preferences rather than being dependent on external reinforcement".

other PCs dedicate themselves to a private business in the market. The first-period choice to run for office is strategic because, in the case where PCs are not elected or do not run, their payoff is affected by the consumption of the public good provided by the elected candidate, referred to as the free-riding benefit.[3]

In their seminal contribution on PSM, Perry & Wise (1990) argue that PSM is positively related to individual performance in public organizations (for empirical evidence, see, e.g., Naff & Crum, 1999, and Vandenabeele, 2009). Relying on this proposition, most economics papers on this topic assume that PSM has a beneficial impact on public servants' productivity. We continue this line of thought and suppose that, for any given level of skills, a successful candidate with high PSM provides a larger public good level than an individual with low PSM. At the same time, since PSM is primarily or uniquely found in the tasks of public service provision according to Perry & Wise (1990), we assume that PSM has no bearing on the individuals' private business. We also posit that, for any given level of PSM, high-skilled individuals provide a larger public good level when elected and are more productive when running a business than low-skilled individuals.

The utilitarian welfare is proved to be maximized when a highly motivated high-skilled individual is in office in that, thanks to high PSM and skills, she is able to supply the maximum level of the public good consumed by the whole community. By contrast, the highest opportunity cost of becoming a politician is borne by poorly motivated high-skilled PCs, who thus ask for the highest reservation pay, i.e., the pay level for which PCs are indifferent between running for office or running a business. The reservation pays are given by the sum of two values: the difference between PCs' market productivity and the public good level they provide if elected, referred to as the personal opportunity costs, and the aforementioned free-riding benefit. For any given level of skills, the personal costs are larger for poorly motivated PCs because they produce a lower level of public good; for any given level of PSM, they are higher for high-skilled PCs under the standard assumption that skills are better rewarded in the market; as result, poorly motivated high-skilled PCs incur the highest personal costs. Precisely because of that, poorly motivated high-skilled PCs can free-ride on the best politician and therefore enjoy the highest free-riding benefit.

Based on the above premises, we show that when the politician's pay is at its minimum, i.e., just above the lowest reservation pay, the welfare is not maximized since only highly motivated PCs with low skills are attracted: if you pay peanuts, you get (motivated) monkeys. However, when the politician's pay is at its maximum, i.e., above the highest reservation pay, the welfare is not maximized either, because high-skilled PCs with poor PSM are not prevented from running for office, whereas the best candidates are attracted even if the pay is lower. Overall, we find an inverted U-shaped effect of the pay level on the elected politician's quality and, in turn, on welfare. Our finding hinges on the assumption that only skills of PCs can be observed by voters; when the

[3] Given our focus on politician (ex-ante) quality, rather than on behavior once in office, we disregard the role played by reelection or other incentive devices in affecting moral hazard problems (for an analysis of this relevant topic, see, e.g., Smart & Sturm, 2004, Beniers & Dur, 2007, Dogan, 2010, Gersbach & Müller, 2010, Besley et al., 2016).

pay is at its maximum, all PCs run for office, however the election is shown to be won by a high-skilled individual, who is either highly *or* poorly motivated. This is probably the most realistic assumption because information on skills of PCs, such as education and working experience, is generally available. PSM is instead affected by individual predisposition to respond to specific stimuli and innate psychological needs; all these facets are hardly observable, especially for those who stand for election for the first time, as is the case in our static citizen candidate model.

Our inverted U-shaped result is robust to alternative specifications, among which: (i) unobservable skills as opposed to observable ones; (ii) a screening mechanism with different levels of pay for high-skilled and low-skilled PCs, rather than a uniform pay.[4] When PSM is assumed to be observable, along with skills, voters perfectly screen out candidates by choosing only the best (i.e., highly motivated high-skilled) PCs, provided that the latter run for office. As a result, in most cases the equilibrium welfare is first increasing in the pay level and then levels off, once the pay is sufficient to attract the best PCs. However, there are scenarios where the welfare fluctuates in the pay.

To the best of our knowledge, we are the first to obtain a non-monotonic effect, in particular an inverted U-shaped one, of the pay level on politician quality in the economics literature on political selection, as extensively discussed in Section 1. Interestingly, our finding seems compatible with empirical evidence. Although existing contributions measure politicians' quality through different dimensions of skills but not PSM, it is indeed shown that an increase in the relatively low wage paid at the municipal level enhances quality; by contrast, no or negative impacts arise at the national and supranational levels, where wages are higher. Ferraz & Finan (2009) analyze Brazilian local legislators, whose maximum salary varies according to the municipality's population. The authors rely on a regression discontinuity approach to estimate the causal effects of pay raises on political selection and find an improvement in the quality of legislators, as measured by education, type of previous profession, and political experience in office. Using a similar econometric strategy, Gagliarducci & Nannicini (2013) consider data on Italian municipal governments from 1993 to 2001 and conclude that better candidates in terms of education and white collar professional backgrounds are attracted.[5] As mentioned, findings are different at higher levels of government. Kotakorpi & Poutvaara (2011) exploit a reform that increased the monthly salary of Finnish MPs to develop a difference-in-differences analysis; they find a rise of female candidates with higher education, but no effect for male candidates, who represent more than 60% of total candidates. The 2009 pay harmonization in the European Parliament introduced an exceptional raise of 200% per national delegation on average: Fisman et al. (2015) show a negative impact on the quality of MEPs, measured by the selectivity of their undergraduate institutions; Brändle (2015) observe

[4] It should be remarked that the assumption of uniform pay is standard in the political economy literature (e.g., Caselli & Morelli, 2004, Messner & Polborn, 2004, Besley, 2004, Poutvaara & Takalo, 2007, Beniers & Dur, 2007, Mattozzi & Merlo, 2008, and Cerina & Deidda, 2017). An exception is Gersbach (2003), where the politicians' pay is made conditional on the realization of macroeconomic events.

[5] Piqué (2015) investigates Peruvian municipalities and find no evidence that wages affect the fraction of candidates with tertiary studies.

fewer new MEPs with previous political experience at the highest national level.

Our paper is close to Dal Bó et al. (2013). The authors study non-strategic self-selection choices of public servants, whose quality is measured both by ability and PSM. They find evidence of a monotonically positive effect of pay on quality. This result differs from ours and is theoretically explained on the basis of positive correlation between PSM of applicants and their ability.[6] A second contribution of our paper is the following: the result that a relatively low pay is sufficient to attract high-skilled and highly motivated individuals holds for any degree of positive correlation; also perfect correlation, which in our discrete framework is captured by all highly motivated PCs having high skills and all high-skilled PCs having high PSM.

The remainder of the paper is organized as follows. Section 1 reviews the literature. In Section 2, we lay out the theoretical framework. In Section 3, we describe a benchmark model where PCs differ only with respect to skills. In Section 4, we solve the general model and check the robustness of the results. Section 5 concludes. The Appendices contain proofs of the results.

1 Related Literature

This paper is connected with the literature on political selection. The common framework used to study the decision to enter politics is a citizen candidate model with individuals differing in skills. Caselli & Morelli (2004) and Messner & Polborn (2004) study how relative salaries in the political and private sectors affect the average skills of elected politicians and find a monotonically positive impact of pay.[7] Besley (2004) considers the effects of politician remuneration on the behavior in office and demonstrates that an increase in the remuneration raises voter welfare. Smart & Sturm (2004) show, instead, that higher pay enhances the value of being re-elected, hence politicians are induced to implement policies that guarantee re-election rather than policies aimed at increasing the voters' welfare. A pay raise either monotonically increases or decreases politician skills in Poutvaara & Takalo (2007) and Cerina & Deidda (2017).

A few papers develop citizen candidate models with bidimensional heterogeneity among agents. In Beniers & Dur (2007), politicians are heterogeneous in competence and the extent to which they care about the public interest; in Fedele & Naticchioni (2016), politicians have heterogeneous abilities and different fit with the working environment; both papers investigate the behavior of politicians once in office but not the link between pay and selection. Caselli & Morelli (2001) analyze non-strategic political self-selection in a framework where the greatest opportunity cost of entering politics is borne by individuals who are both competent and honest; accordingly, the best qualified individuals are attracted only when the pay is relatively high. Mattozzi & Merlo (2008) rely on

[6] In a similar continuous framework, Barigozzi et al. (2017) show that the positive impact of pay holds true in case of positive but small statistical association between ability and motivation. Interestingly, they find the opposite result that a pay raise may attract less able and less motivated applicants in case of strong positive association.

[7] Messner & Polborn (2004) also derive specific conditions under which a U-shaped relationship between quality and pay may occur. Our opposite result is due to the bidimensional, rather than unidimensional, heterogeneity among PCs.

a dynamic non-strategic citizen candidate model to explain the coexistence of career politicians and individuals with political careers. They consider individuals with different political skills and different market skills and show that a pay raise decreases the average quality of individuals with political careers and can either monotonically increase or decrease that of career politicians. Our analysis adds to the literature on political selection by developing a framework where agents differ in general skills and PSM and by providing a novel non-monotonic result.

This paper is also related to the economics literature on work motivation. Our result that, for any given skill level, highly motivated PCs incur lower personal opportunity costs of entering politics than poorly motivated ones is in line with the so-called labor donation theory (e.g., Rose-Ackerman, 1996, Handy & Katz, 1998). These papers study the determinants of the salary differential between the non-profit and the for-profit sector; in particular, Handy & Katz (1998) show that lower wages in the non-profit sector attract more motivated managers. A similar result is found by Heyes (2005) and Barigozzi & Turati (2012) in the nursing labor market, and by Delfgaauw & Dur (2007) and Barigozzi & Burani (2016) in general models of workers' selection. Delfgaauw & Dur (2010) investigate non-strategic self-selection into the public sector of individuals with different market ability and PSM. The authors show that if the public sector remuneration is lower than the market sector one, more able individuals (for any given level of PSM) choose the market sector, while more motivated individuals (for any given level of ability) work in the public sector; the authors also prove that increasing the public sector remuneration to attract more able individuals is not cost-efficient. The labor donation theory has recently been tested by, e.g., Banuri & Keefer (2016), who run a laboratory experiment and show that less motivated subjects are attracted to public sector jobs when wages are high.[8]

2 Setup

Consider a community of N individuals. $C < N$ are potential candidates (PCs) for a public office, while $N - C$, referred to as ordinary citizens, are not interested in the public office. We introduce the following three-period citizen candidate model.

Before $t = 0$ Nature determines the type of PCs, whose characteristics are described below. The level of parameter w is then publicly announced, $w \geq 0$ denoting wage plus any other financial benefits from holding office.

$t = 0$ C PCs decide simultaneously whether to run for office. Their cost of candidacy is normalized to zero.

$t = 1$ An election takes place if there is at least one candidate. In this case, all N individuals vote and only one candidate is elected. Throughout the paper, we refer to her as the politician

[8] For recent experimental analyses on the selection of motivated workers in public service jobs, see also Ashraf et al. (2016) and Deserranno (2017).

and to the other $C-1$ PCs who are not elected or decide not to run as non-ordinary citizens.

$t=2$ The politician exerts an effort $e \geq 0$ to provide a public good for all members of the community; the public good level is denoted by $G(e)$, $G' > 0 > G''$; the politician receives the pay w, which is financed through a lump-sum tax levied on all N members of the community; if no PCs run, the public good is not supplied and no tax is levied. Each non-ordinary citizen runs a business in the market sector and earns income $M(a)$, $M' > 0 > M''$, $a \geq 0$ representing the effort level.

All $N-C$ ordinary citizens are homogeneous and characterized by the payoff function,

$$Z \equiv M + G(e) - \frac{w}{N}, \tag{1}$$

where: M denotes ordinary citizens' income; $G(e)$ is the linear utility from the consumption of the public good; $\frac{w}{N}$ is the lump-sum tax.

On the contrary, PCs are heterogeneous with respect to two dichotomous characteristics: the level of PSM, denoted by parameter $\gamma_i \in \{\gamma_M, \gamma_P\}$, $0 < \gamma_M < \gamma_P$, and the level of skills, measured by parameter $\theta_j \in \{\theta_L, \theta_H\}$, $0 < \theta_L < \theta_H$.[9] Four different types of PCs, denoted by $ij = \{M, P\} \times \{L, H\}$, are thus present in the community. The proportion of type-ij PCs is $\lambda_{ij} \geq 0$, with $\lambda_i \equiv \lambda_{iL} + \lambda_{iH} > 0$, $\lambda_j \equiv \lambda_{Mj} + \lambda_{Pj} > 0$, and $\sum_{ij} \lambda_{ij} = 1$. Each PC privately observes her own level of PSM; by contrast, the level of skills and the proportion λ_{ij} are common knowledge. The following table summarizes the distribution of PCs:

Table 1. Distribution of PCs

PSM level \ Skill level	Low skills	High skills	Total
Low PSM	$\lambda_{ML}C$	$\lambda_{MH}C$	$\lambda_M C$
High PSM	$\lambda_{PL}C$	$\lambda_{PH}C$	$\lambda_P C$
Total	$\lambda_L C$	$\lambda_H C$	C

We remark that the distribution of PCs encompasses any possible degree of interdependence between PSM and skills: from no association, or independence, which arises when $\lambda_{ij} = \lambda_i \cdot \lambda_j$, to perfect association, which occurs when either $\lambda_{ML} = \lambda_{PH} = 0$, or $\lambda_{PL} = \lambda_{MH} = 0$.

We denote with $c(e, \gamma_i, \theta_j)$ and $s(a, \theta_j)$ the type-ij PCs' effort disutility function when they are in office and when they work in the market, respectively, the latter value being affected only by skills. The two functions are assumed to be increasing and convex in e and a: $c_e > 0$, $c_{ee} > 0$, $s_a > 0$, and $s_{aa} > 0$, subscripts e, a and ee, aa denoting first and second derivatives. We suppose that, ceteris paribus, PCs with higher skills incur nonhigher disutility and less marginal disutility both in politics and in the market. In symbols, $c(e, \gamma_i, \theta_H) \leq c(e, \gamma_i, \theta_L)$, $s(a, \theta_H) \leq s(a, \theta_L)$, $c_e(e, \gamma_i, \theta_H) < c_e(e, \gamma_i, \theta_L)$, and $s_a(a, \theta_H) < s_a(a, \theta_L)$. Similarly, PCs with higher PSM incur nonhigher disutility and less marginal disutility (only) when they are in office:

$$c(e, \gamma_P, \theta_j) \leq c(e, \gamma_M, \theta_j) \text{ and } c_e(e, \gamma_P, \theta_j) < c_e(e, \gamma_M, \theta_j). \tag{2}$$

[9] Subscript M evokes the notion of market (or low public service motivation), whereas P echoes the concept of politics (or high public service motivation).

In conclusion, we let the number of individuals be relatively large:

Assumption 1 $N > \underline{N}$.[10]

The role of Assumption 1 will become clear in the rest of the analysis.

3 Benchmark Analysis

To understand the role played by PSM in our framework, we first study a benchmark case where the PCs' effort disutility functions are affected only by skills. Accordingly, just two types of PCs, low-skilled and high-skilled, denoted by $j = L, H$, are present in the community. The number of type-j PCs is $\lambda_j C > 0$, with $\lambda_L C + \lambda_H C = C$. In addition, the effort disutility function of the politician must be rewritten as $c(e, \theta_j)$. The model is solved backwards, beginning with the third-period politician's choice of effort.

The politician. When a type-j candidate is elected, her payoff function is

$$U_j \equiv G(e) - c(e, \theta_j) + w - \frac{w}{N}, \tag{3}$$

where: $G(e)$ is the public good consumption linear utility; $c(e, \theta_j)$ is the effort disutility; w is the pay level; $\frac{w}{N}$ is the lump-sum tax.

At $t = 2$, a type-j politician selects the effort level e_j^* to maximize payoff U_j; we find that a politician with higher skills exerts more effort at the optimum,[11]

$$e_H^* > e_L^*, \tag{4}$$

and provides a higher level of the public good, $G(e_H^*) > G(e_L^*)$.

Non-ordinary citizens. We now turn to the $C - 1$ non-ordinary citizens' third-period choice of effort in the market sector. When any type-j PC is not elected or does not run, her payoff function is

$$Z_j \equiv M(a) - s(a, \theta_j) + G(e_k^*) - \frac{w}{N}, \tag{5}$$

where: $M(a) - s(a, \theta_j)$ is the market income net of the effort disutility; $G(e_k^*)$ indicates the utility from the optimal level of the public good provided by type-$k = L, H$ politician. At $t = 2$, any type-j citizen chooses the effort level a_j^* to maximize payoff Z_j. In line with inequality (4), we prove that high-skilled PCs exert higher effort in the market sector, $a_H^* > a_L^*$.

Welfare. Before proceeding, we are interested in studying how the politician's skill level affects the societal welfare. Adopting a utilitarian approach, we define welfare as the sum of all individuals' payoffs. The utilitarian welfare S_j when a type-j PC is in office amounts thus to

$$S_j \equiv U_j + (\lambda_j C - 1) Z_j + \lambda_{-j} C Z_{-j} + (N - C) Z : \tag{6}$$

[10] The value of threshold $\underline{N}$ is computed in Appendix C.

[11] FOC $G'(e) - c_e(e, \theta_j) = 0$ is necessary and sufficient to find the unique solution e_j^* that we assume to be positive and finite. Applying the implicit function theorem to FOC yields $\partial e / \partial \theta = c_{e\theta} / (G'' - c_{ee})$, which is strictly positive by assumption.

subscript $-j = L, H$ expresses the non-ordinary citizens' type different from that of the politician, hence $(\lambda_j C - 1)$ indicates the number of type-j non-ordinary citizens and $\lambda_{-j} C$ the number of non-ordinary citizens of the other type; the last term, $(N - C) Z$, is the sum of ordinary citizens' payoffs.

Plugging e_j^*, a_j^* and a_{-j}^* into (6) and rearranging yields the optimal welfare,

$$S_j^* = P_j + (\lambda_j C - 1) M_j + \lambda_{-j} C M_{-j} + (N - C) M + (N - 1) G_j, \tag{7}$$

where $P_j \equiv G\left(e_j^*\right) - c\left(e_j^*, \theta_j\right)$, $M_j \equiv M\left(a_j^*\right) - s\left(a_j^*, \theta_j\right)$, and $G_j \equiv G\left(e_j^*\right)$. The first term of the RHS of (7) is the politician's optimal public good consumption utility net of her effort disutility; the second and third terms denote the non-ordinary citizens' optimal market incomes net of their effort cost; the fourth term is the sum of ordinary citizens' incomes; finally, the last term represents the sum of public good consumption utilities enjoyed by all individuals but the politician. Note that w does not appear in (7) because w is transferred from the citizens and the politician to the politician herself.

We prove that the optimal welfare is enhanced when a high-skilled instead of a low-skilled PC is in office; in symbols,

$$S_H^* > S_L^*. \tag{8}$$

Inequality (8) is equivalent to

$$P_H - P_L + (N - 1)(G_H - G_L) > M_H - M_L. \tag{9}$$

The LHS of (9) is positive and denotes the benefit from the presence of a high-skilled politician instead of a low-skilled one in the public sector.[12] Similarly, the RHS of (9) is positive and indicates the benefit from the presence of a high-skilled non-ordinary citizen instead of a low-skilled one in the market. Overall, inequality (9) is fulfilled under Assumption 1. The intuition is as follows: from a societal point of view, skills are more relevant in politics, where a type-H politician has a beneficial impact on all individuals, than in the market, where the beneficial impact works through the income of just an individual.

Election. At $t = 1$, the election is held provided there is at least one candidate. The electoral system is based on the plurality rule; in particular, it has the following three features: each voter is allowed to vote for at most one candidate; the candidate receiving the most votes is elected; if at least two candidates receive the same number of votes, the tie is broken with a random draw. We assume that all N individuals vote as if their votes were pivotal and recall that the skill level of any PC is observable.

The voting behavior is as follows:[13] each candidate votes for herself; by contrast, all the others, i.e., ordinary citizens and PCs who did not run at $t = 0$, vote with the aim of maximizing their

[12] To see this, note that $G_H - G_L > 0$ by virtue of (4) and that inequality $P_H - P_L > 0$, equivalent to $G\left(e_H^*\right) - c\left(e_H^*, \theta_H\right) > G\left(e_L^*\right) - c\left(e_L^*, \theta_L\right)$, holds true since $G\left(e_H^*\right) - c\left(e_H^*, \theta_H\right) > G\left(e_L^*\right) - c\left(e_L^*, \theta_H\right)$ by definition of (unique) optimal effort and $G\left(e_L^*\right) - c\left(e_L^*, \theta_H\right) \geq G\left(e_L^*\right) - c\left(e_L^*, \theta_L\right)$ by assumption.

[13] The proof is in Appendix A.1.

payoff. Ordinary citizens' and PCs' payoffs, (1) and (5), are both increasing in G. Given that $G_H > G_L$, all voters except candidates prefer a high-skilled candidate to a low-skilled one because they benefit from a higher public good level. On these grounds, the election outcome is as follows. A type-H candidate has probability $\frac{1}{h}$ of winning the election, with $h \in [1, \lambda_H C]$ denoting the number of type-H actual candidates. By contrast, a type-L candidate has zero probability of winning if at least one type-H runs; the probability rises to $\frac{1}{l}$ if no type-H runs, with $l \in [1, \lambda_L C]$ denoting the number of type-L candidates.

3.1 Candidacy Game

At $t = 0$, all PCs simultaneously choose whether to run for office by comparing the expected payoff from running to that from not running. The former is given by $p(w + P_j) + (1 - p)[M_j + G_k] - \frac{w}{N}$, $p \in [0, 1]$ denoting the generic probability that a type-j PC wins the election: with probability p, she is elected and obtains the politician's pay w plus P_j, the optimal level of the public good she is able to provide net of her effort disutility; with probability $1 - p$, she is not elected and ends up with the optimal market income net of her effort disutility, M_j, plus the utility from the public good provided by a type-k politician, G_k. On the contrary, when a type-j PC does not run, she gets either $M_j + G_k - \frac{w}{N}$, in case there are other candidates, or simply M_j in case the public good is not provided and no tax is levied because there are no candidates.

The key role in the candidacy game is played by the PCs' reservation pay, defined as the minimum pay level a PC is willing to accept to run. There are five reservation pays, denoted by $w_j(G_k) \equiv \Delta_j + G_k$ with $\Delta_j \equiv M_j - P_j$, and whose values are computed in Appendix A.2.1: $w_H(G_H) = \Delta_H + G_H$, the reservation pay asked for by a type-H PC when, in case she does not run or she is not elected, the politician is another type-H; $w_j(G_L) = \Delta_j + G_L$, the reservation pay of a type-j PC when, in case she does not run or she is not elected, the politician is type-L; $w_j(0) = \frac{N}{N-1}\Delta_j$, the reservation pay of a type-j PC when, in case she does not run, the public good is not supplied and no tax is levied due to lack of other candidates.

The five reservation pays consist of two values. The difference $\Delta_j \equiv M_j - P_j$ is the personal opportunity cost of being a politician; indeed, when winning the election a type-j PC gives up M_j, the market income net of the effort disutility, but produces and enjoys P_j, the public good level net of the effort disutility; the higher Δ_j, the less beneficial being a politician, the higher the reservation pays $w_j(G_k)$. The amount G_k is referred to as the free-riding benefit from not being a politician; indeed, when a type-j PC does not win the election or does not run, she enjoys the public good produced by a type-k politician without exerting any effort; the higher G_k, the higher the reservation pays $w_j(G_k)$ because a larger free-riding benefit makes the public office less attractive. The free-riding benefit is absent, $G_k = 0$, in case there are no other candidates. Finally, one should note there is no reservation pay for type-L PCs when at least a type-H one runs. In this case, type-L PCs' probability of winning the election is $p = 0$; as a consequence, they are indifferent between running for office or not for any level of w.

To provide the complete ranking of the five reservation pays, we suppose that skills are better rewarded in the market sector than in the public sector. This is a standard assumption in the political economy literature. In symbols,

$$M_H - M_L > P_H - P_L \Leftrightarrow \Delta_H > \Delta_L. \tag{10}$$

Accordingly, for any given level of the free-riding benefit G_k, type-L PCs agree to accept a lower minimum pay than type-H ones to run because they incur lower personal opportunity costs. By virtue of (10) and recalling that the reservation pays are increasing in the free-riding benefit, the ranking of the reservation pays is as follows:[14]

$$\begin{gathered} w_L(0) < \min\{w_L(G_L), w_H(0)\} < \\ \max\{w_L(G_L), w_H(0)\} < w_H(G_L) < w_H(G_H). \end{gathered} \tag{11}$$

On the above grounds, we investigate how the pure-strategy Nash equilibria (NEs) of the candidacy game played at $t = 0$ by C PCs are affected by the level of the politician's pay, w; we disregard weakly dominated strategies; to have a comprehensive analysis, we suppose that all the reservation pays are positive, i.e., $w_L(0) > 0$.[15]

If $w < w_L(0)$, the unique NE is such that no PCs decide to run for office. If $w_L(0) \leq w < \min\{w_L(G_L), w_H(0)\}$, type-$H$ PCs do not run; only one type-L PC runs, while the other $\lambda_L C - 1$ type-L PCs do not run. If $\min\{w_L(G_L), w_H(0)\} \leq w < w_H(G_L)$, type-$H$ PCs do not run; either all type-L PCs run, or only one type-L PC runs while the other $\lambda_L C - 1$ type-L PCs do not run. If $w_H(G_L) \leq w < w_H(G_H)$, only one type-$H$ PC runs, while the other $\lambda_H C - 1$ type-H PCs do not run; type-L PCs run. Finally, if $w \geq w_H(G_H)$, the unique NE is such that all PCs decide to run.

Some of the above results deserve a detailed explanation. Focus on interval $w \in [w_H(0), w_H(G_L))$, where at least one type-L PC stands for election: any single type-H PC would run if nobody else did because w is sufficient to compensate her just for the personal opportunity costs, Δ_H; yet, type-H PCs do not run because they can free-ride on the public good G_L provided by type-L candidate(s). Consider now $w \in [w_H(G_L), w_H(G_H))$: one high-skilled PC decides to run along with all low-skilled PCs, hence all the other high-skilled PCs free-ride on her. The intuition is as follows. If a type-H PC expects all the other type-H PCs not to run, her free-riding benefit would be G_L because the election would be won by a type-L candidate; she therefore decides to run because w is sufficient to compensate her for both the personal opportunity costs, Δ_H, and the low free-riding benefit, G_L. At the same time, if all the other type-H PCs expect one type-H PC to run they prefer not to do so because the election will be won by this type-H candidate; as a result, w is not sufficient to compensate them for the high free-riding benefit, G_H. Finally, it is worth observing that all high-skilled PCs stand for election only when the pay is set at least as high as the top reservation pay, $w \geq w_H(G_H)$; we refer to this interval as the maximum pay level.

[14] For further details, see Appendix A.2.2.

[15] The proof is in Appendix A.2.3.

3.2 Pay Level and Welfare

The last step of our benchmark analysis studies how the level of pay w, publicly announced before $t = 0$, affects the societal welfare. Even if w does not appear in (7), the pay level impacts on the size of welfare through the following selection mechanism.

If $w < w_L(0)$, no PCs decide to run. In that case, the public good level is zero, no tax is levied, and the equilibrium welfare will be given by the sum of payoffs of PCs, who are all active in the market, and ordinary citizens: $S_0^* = \sum_j \lambda_j C M_j + (N - C) M$. If $w_L(0) \leq w < w_H(G_L)$, only type-L PCs, either one or all, run. As a result, a type-L candidate will be elected. The resulting equilibrium welfare will be S_L^*, which is higher than S_0^* under Assumption 1. If $w \geq w_H(G_L)$, at least one type-H PC runs along with type-L PCs. Accordingly, a type-H candidate will be elected and the equilibrium welfare will be $S_H^* > S_L^*$.

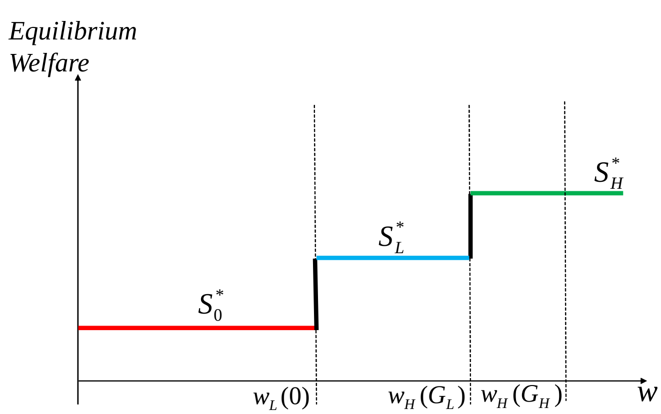
We sum up our findings in the following

Proposition 1 *When only skills affect the potential candidates' effort disutility, the equilibrium welfare is increasing in the politician's pay.*

On one hand, inequality (8) ensures that the societal welfare is enhanced when a high-skilled politician rather than a low-skilled one is in office; on the other hand, the analysis of the candidacy game reveals that high-skilled PCs decide to run at larger pay levels; as a consequence, setting a relatively high pay for politicians is the only way to attract high-skilled PCs and enhance the equilibrium welfare. This finding is in line with seminal results concerning the effect of pay on the quality of politicians (Caselli & Morelli, 2004; Messner & Polborn, 2004; Besley, 2004).

In conclusion, we illustrate the results of Proposition 1 by means of Figure 1, where the politician's pay w is depicted on the horizontal axis and the equilibrium welfare on the vertical axis. It is apparent that the equilibrium welfare increases with w. In Appendix A.3, we show that the benchmark analysis results are robust to the two following modifications: (i) a screening mechanism with two different levels of pays for high-skilled PCs and low-skilled PCs, rather than a uniform pay, and (ii) unobservable skill level.

FIGURE 1: ILLUSTRATION OF PROPOSITION 1



4 General Analysis

In this section, we solve backwards the three-period model laid out in Section 2, where PCs' effort disutility functions are affected not only by the skill level, but also by the PSM level.

The politician. When a type-ij candidate is elected, her payoff function at $t = 2$ is

$$U_{ij} \equiv G(e) - c(e, \gamma_i, \theta_j) + w - \frac{w}{N}. \tag{12}$$

FOC $G'(e) - c_e(e, \gamma_i, \theta_j) = 0$ yields the unique effort level e^*_{ij} that maximizes (12). We let e^*_{ij} be positive and finite. Applying the implicit function theorem to FOC yields $\partial e/\partial\theta > 0$ and, by virtue of (2), $\partial e/\partial\gamma > 0$. It follows that, for any given level of PSM, a politician with higher skills exerts a higher optimal effort,

$$e^*_{iH} > e^*_{iL}, \tag{13}$$

and, for any given level of skills, a politician with higher PSM exerts a nonlower optimal effort,

$$e^*_{Pj} > e^*_{Mj}. \tag{14}$$

Overall, a type-PH (-ML) politician exerts the highest (lowest) optimal effort level and provides the highest (lowest) level of the public good; in symbols,

$$\begin{gathered} e^*_{PH} > \max\{e^*_{MH}, e^*_{PL}\} > \min\{e^*_{MH}, e^*_{PL}\} > e^*_{ML} \Leftrightarrow \\ G(e^*_{PH}) > \max\{G(e^*_{MH}), G(e^*_{PL})\} > \min\{G(e^*_{MH}), G(e^*_{PL})\} > G(e^*_{ML}). \end{gathered} \tag{15}$$

Non-ordinary citizens. When a type-ij PC is not elected or does not run, her payoff function at $t = 2$ is

$$Z_{ij} \equiv M(a) - s(a, \theta_j) + G(e^*_{lk}) - \frac{w}{N}, \tag{16}$$

where $G(e^*_{lk})$ denotes the optimal level of the public good provided by type-$lk = \{M, P\} \times \{L, H\}$ politician. This payoff function is not affected by PSM, (i.e., $Z_{Pj} = Z_{Mj}$) and is almost equivalent to (5). It follows that the optimal effort exerted by a non-ordinary citizen with higher skills is larger, $a^*_H > a^*_L$.

Welfare. We study how the politician's PSM and skills affects the utilitarian welfare of the community. The utilitarian welfare when type-ij PC is in office is denoted by S_{ij} and amounts to

$$S_{ij} \equiv U_{ij} + (\lambda_{ij}C - 1) Z_{ij} + \textstyle\sum_{fh} \lambda_{fh} C Z_{fh} + (N - C) Z. \tag{17}$$

Subscript $fh \neq ij$, $f = M, P$ and $h = L, H$, expresses the three non-ordinary citizens' types that differ from the politician's type; for instance, if $ij = PH$ then $fh = PL$, ML, MH. Accordingly, $\lambda_{ij}C - 1$ indicates the number of type-ij non-ordinary citizens but the politician and $\sum_{fh} \lambda_{fh} C$ the number of all the other non-ordinary citizens. Plugging e^*_{ij}, a^*_j and a^*_h into (17) and rearranging yields the optimal welfare when a type-ij politician is in office,

$$S^*_{ij} = P_{ij} + (\lambda_{ij}C - 1) M_j + \textstyle\sum_{fh} \lambda_{fh} C M_h + (N - C) M + (N - 1) G_{ij}, \tag{18}$$

where $P_{ij} \equiv G\left(e_{ij}^*\right) - c\left(e_{ij}^*, \gamma_i, \theta_j\right)$, $M_j \equiv M\left(a_j^*\right) - s\left(a_j^*, \theta_j\right)$, $M_h \equiv M\left(a_h^*\right) - s\left(a_h^*, \theta_h\right)$, and $G_{ij} \equiv G\left(e_{ij}^*\right)$.

We first show that the welfare is enhanced when, for any given level of skills, a high-motivated PC instead of a low-motivated PC is in office,

$$S_{Pj}^* > S_{Mj}^*. \tag{19}$$

Indeed, inequality (19) can be rearranged as

$$P_{Pj} - P_{Mj} + (N-1)\left(G_{Pj} - G_{Mj}\right) > 0. \tag{20}$$

The LHS of (20) is positive and denotes the benefit from the presence of a high-motivated politician instead of a low-motivated one in the public sector: for any given level of skills, a high-motivated politician obtains a higher payoff than a low-motivated one, $P_{Pj} > P_{Mj}$, and increases the level of the public good, $G_{Pj} > G_{Mj}$.[16] The RHS is instead zero because the level of PSM does not affect the market payoff.

We then show that

$$S_{iH}^* > S_{iL}^* \tag{21}$$

is fulfilled under Assumption 1; this is in line with condition (8). Overall, the welfare is maximized (minimized) when a type-PH (-ML) PC is in office; in symbols,

$$S_{PH}^* > \max\left\{S_{MH}^*, S_{PL}^*\right\} > \min\left\{S_{MH}^*, S_{PL}^*\right\} > S_{ML}^*. \tag{22}$$

Election. At $t = 1$, the election is held provided at least one PC stands for election. Voters observe the skill level of candidates, but not their PSM level. We focus on the voting behavior of ordinary citizens and PCs who did not run at $t = 0$; it is they who drive the election outcome, as shown in the benchmark analysis. To this aim, two alternative cases must be analyzed separately according to (15): $G_{MH} > G_{PL}$ or $G_{PL} > G_{MH}$.

When $G_{MH} > G_{PL}$ the ranking of optimal public good levels is $G_{PH} > G_{MH} > G_{PL} > G_{ML}$, i.e., the level provided by a high-skilled politician is higher than that offered by a low-skilled one, no matter the level of PSM. In this case, voting for high-skilled candidates rather than low-skilled ones is the payoff-maximizing choice of all voters except candidates, even though the candidates' PSM level cannot be observed.

When instead $G_{PL} > G_{MH}$, the ranking of optimal public good levels is $G_{PH} > G_{PL} > G_{MH} > G_{ML}$, i.e., the level provided by a high-motivated politician is higher than that offered by a low-motivated one, no matter the level of skills. In this case, voting for high-skilled candidates might not be payoff-maximizing. In Appendix B.1, we derive sufficient conditions under which

[16] Inequality $P_{Pj} > P_{Mj}$ is equivalent to $G\left(e_{Pj}^*\right) - c\left(e_{Pj}^*, \gamma_P, \theta_j\right) > G\left(e_{Mj}^*\right) - c\left(e_{Mj}^*, \gamma_M, \theta_j\right)$, which holds true since $G\left(e_{Pj}^*\right) - c\left(e_{Pj}^*, \gamma_P, \theta_j\right) > G\left(e_{Mj}^*\right) - c\left(e_{Mj}^*, \gamma_P, \theta_j\right)$ by definition of unique optimal effort and $G\left(e_{Mj}^*\right) - c\left(e_{Mj}^*, \gamma_P, \theta_j\right) \geq G\left(e_{Mj}^*\right) - c\left(e_{Mj}^*, \gamma_M, \theta_j\right)$ by virtue of (2).

high-skilled candidates are still preferred and suppose these conditions are fulfilled. For the sake of completeness, in Appendix B.3.2, we discuss the opposite case where low-skilled candidates are preferred.

Summing up, the election outcome is as follows. A type-iH candidate has probability $\frac{1}{ph+mh}$ of winning the election, with ph (mh) denoting the number of type-PH (-MH) candidates. By contrast, a type-iL candidate has zero probability of winning if at least one type-iH runs; the probability rises to $\frac{1}{pl+ml}$ if no type-iH runs, with pl (ml) indicating the number of type-PL (-ML) candidates.

4.1 Candidacy game

At $t = 0$, all PCs choose simultaneously whether to run. Since candidates privately observe their PSM level, the candidacy game takes place under incomplete information. In Appendix B.2.1, we calculate the ten reservation pays that drive the candidacy choices of PCs. As in the benchmark analysis, any high-skilled PC has three different reservation pays, while two reservation pays are asked for by any low-skilled PC.

We first describe the reservation pays required by any type-iH PC by focusing on the three relevant alternative scenarios. If at least one high-skilled PC besides the one under scrutiny decides to run, the latter's reservation pay is

$$w_{iH}\left(E_H^i\right) = \Delta_{iH} + E_H^i, \tag{23}$$

with $\Delta_{iH} \equiv M_H - P_{iH}$ and $E_H^i \equiv \frac{\lambda_{iH}C-1}{\lambda_{-iH}C+\lambda_{iH}C-1}G_{iH} + \frac{\lambda_{-iH}C}{\lambda_{-iH}C+\lambda_{iH}C-1}G_{-iH}$, $i = M, P$ and $-i = P, M$. If no other high-skilled PCs besides the one under scrutiny and at least one type-iL PC run, the reservation pay is

$$w_{iH}\left(E_L\right) = \Delta_{iH} + E_L, \tag{24}$$

with $E_L \equiv \frac{\lambda_{PL}}{\lambda_{PL}+\lambda_{ML}}G_{PL} + \frac{\lambda_{ML}}{\lambda_{PL}+\lambda_{ML}}G_{ML}$. Finally, if the high-skilled PC under scrutiny is the only candidate, her reservation pay is

$$w_{iH}\left(0\right) = \frac{N}{N-1}\Delta_{iH}. \tag{25}$$

Again the reservation pays are positively affected by two values, the personal opportunity cost of becoming a politician, Δ_{iH}, and three different free-riding benefits, E_H^i, E_L, or zero. The free-riding benefits are in expected terms because any type-iH PC cannot observe the other candidates' PSM level and is therefore uncertain about the public good level provided by the successful candidate.[17]

[17] The free-riding benefits are computed as follows. We first consider E_H^P, the free-riding benefit enjoyed by any type-PH PC in case either she does not win the election or does not run and at least another high-skilled PC does run (E_H^M is computed similarly). Any type-PH PC anticipates that the winner will be a high-skilled candidate, but ignores her PSM level; she can simply calculate the probability that the successful candidate has high or low PSM, on the basis of the high-motivated and low-motivated PCs' number, $\lambda_{PH}C$ and $\lambda_{MH}C$, within the population of high-skilled PCs, $(\lambda_{PH} + \lambda_{MH})\,C$; moreover, any type-$PH$ PC excludes herself from the population of high-motivated high-skilled PCs because she anticipates she does not win the election or does not run. We now investigate E_L, the free-riding benefit enjoyed by any type-PH PC in case she does not win the election or does not run, no other

We turn our attention to any type-iL PC, who is characterized by just two reservation pays; indeed, when at least a type-iH PC runs, there is no reservation pay for any type-iL PC because she has zero probability of winning the election, hence she is indifferent between running or not; we hence focus on the case where no type-iH PCs decide to run. If at least one low-skilled PC besides the one under scrutiny decides to run, the latter's reservation pay is

$$w_{iL}\left(E_L^i\right) = \Delta_{iL} + E_L^i, \tag{26}$$

with $\Delta_{iL} \equiv M_L - P_{iL}$ The expected free-riding benefit $E_L^i \equiv \frac{\lambda_{iL}C-1}{\lambda_{iL}C+\lambda_{-iL}C-1}G_{iL} + \frac{\lambda_{-iL}C}{\lambda_{iL}C+\lambda_{-iL}C-1}G_{-iL}$ is computed as follows. Any type-iL PC who does not run or is not elected anticipates that the winner will have her same PSM level, i.e., type-i, with probability $\frac{\lambda_{iL}C-1}{\lambda_{iL}C+\lambda_{-iL}C-1}$ and the other PSM level, i.e., type-$-i$, with probability $\frac{\lambda_{-iL}C}{\lambda_{iL}C+\lambda_{-iL}C-1}$. If instead the low-skilled PC under scrutiny is the only candidate, her reservation pay depends only on her personal opportunity costs:

$$w_{iL}(0) = \frac{N}{N-1}\Delta_{iL}. \tag{27}$$

To provide the complete ranking of the ten reservation pays, we suppose that, for any given PSM level, skills are better rewarded in the market sector; this is in line with condition (10) and equivalent to assume that high-skilled PCs incur higher personal opportunity costs of becoming a politician than low-skilled PCs, for any given PSM level; in symbols,

$$M_H - M_L > P_{iH} - P_{iL} \Leftrightarrow \Delta_{iH} > \Delta_{iL}. \tag{28}$$

Moreover, one can show that, for any given level of skills, the personal opportunity costs are lower for high-motivated PCs than for low-motivated ones, $\Delta_{Mj} > \Delta_{Pj}$. The reason is that the former PCs are more productive when in office thanks to higher PSM, but equally productive in the market; in symbols,

$$P_{Pj} - P_{Mj} > 0 \Rightarrow M_j - P_{Mj} > M_j - P_{Pj} \Rightarrow \Delta_{Mj} > \Delta_{Pj}. \tag{29}$$

Overall, by virtue of inequalities (28) and (29), type-MH (-PL) PCs incur the highest (lowest) personal opportunity costs of becoming a politician,

$$\Delta_{MH} > \max\{\Delta_{PH}; \Delta_{ML}\} > \min\{\Delta_{PH}; \Delta_{ML}\} > \Delta_{PL}. \tag{30}$$

Finally, in Appendix B.2.2, we prove that the ordering of free-riding benefits is as follows:

$$E_H^M > E_H^P > E_L^M > E_L > E_L^P > 0. \tag{31}$$

The top expected free-riding benefit, E_H^M, is enjoyed by a type-MH PC when at least another high-skilled PC runs; E_H^M is indeed associated to the highest probability, $\frac{\lambda_{PH}C}{\lambda_{PH}C+\lambda_{MH}C-1}$, that the

high-skilled PCs run and at least one type-iL PC does. In this case, $\frac{\lambda_{PL}}{\lambda_{PL}+\lambda_{ML}}$ and $\frac{\lambda_{ML}}{\lambda_{PL}+\lambda_{ML}}$ denote the prior probabilities calculated by any type-PH PC that the low-skilled successful candidate has high or low PSM. Finally, there is no free-riding benefit when only the type-PH PC under scrutiny runs, i.e., $ih = 0$ and $il = 0$: her reservation pay, $w_{iH}(0)$, depends only on her personal opportunity costs Δ_{iH}.

successful candidate is the best (i.e., type-PH) politician. The other free-riding benefits are lower because either such probability is lower ($\frac{\lambda_{PH}C-1}{\lambda_{MH}C+\lambda_{PH}C-1}$ in E_H^P), or just low-skilled PCs run (in E_L^M, E_L, and E_L^P).

Putting together (30) and (31), one can show that the highest reservation pay is $w_{MH}\left(E_H^M\right) = \Delta_{MH} + E_H^M$, required by any type-$MH$ PCs when at least another high-skilled PC runs; indeed, type-MH PCs incur the highest personal opportunity costs of entering politics and enjoy the highest expected free-riding benefit when they do not run or they are not elected. On the contrary, the lowest reservation pay is $w_{PL}(0)$, asked for by any type-PL PC when she is the only one running because she incurs the lowest personal opportunity costs and enjoys no free-riding benefit.

On the above grounds, in Appendix B.2.3, we study how the pure-strategy Bayesian Nash equilibria (BNEs) of the candidacy game played $t = 0$ by C PCs are affected by the level of the politician's pay, w. We disregard weakly dominated strategies and, to have a comprehensive analysis, suppose that all the reservation pays are positive, i.e., $w_{PL}(0) > 0$. The two main insights from the equilibrium analysis are the following: the most expensive PCs are *not* the best PCs; the best PCs are *neither* the most expensive *nor* the cheapest. More precisely, at the equilibrium of the candidacy game, type-MH PCs decide to run only when the pay level is at its maximum, i.e., at least as high as the top reservation level, $w \geq w_{MH}\left(E_H^M\right)$; by contrast, the best potential politicians, i.e., type-PH, also run at intermediate levels of w.

4.2 Pay Level and Welfare

We conclude our analysis by studying how the level of the politician's pay, publicly announced before $t = 0$, affects the equilibrium welfare through the selection of PCs.[18]

There are four relevant intervals of w. When w is below the lowest reservation pay $w_{PL}(0)$, the choice of not running is a dominant strategy for any PC; the public good is not supplied, no tax is levied and the equilibrium welfare is given by the sum of PCs' market incomes net of effort disutility plus the sum of ordinary citizens' incomes,

$$\underline{S}^* \equiv \textstyle\sum_{ij} \lambda_{ij} C M_{ij} + (N - C)\, M. \tag{32}$$

This is the lowest welfare level, i.e., $\underline{S}^* < S^*_{ML}$ under Assumption 1.

When $w_{PL}(0) \leq w < w_{PH}(E_L)$, either only one type-$PL$ PC or all type-PL PCs decide to run; the other PCs do not run because w is not even sufficient to cover their personal opportunity costs or because they prefer to free-ride. A type-PL candidate will be elected and the equilibrium welfare will be S^*_{PL}.[19]

When $w_{PH}(E_L) \leq w < w_{MH}\left(E_H^M\right)$, worse (type-$MH$) PCs can free-ride on better (type-PH) candidates; this type of free-riding is not present in the benchmark analysis. The reasoning is as

[18] See Appendix B.2.3 for details.

[19] An additional relevant interval of w arises in case $w_{ML}\left(E_L^M\right) < w_{PH}(E_L)$: type-$PL$ and -ML PCs run, whereas type-PH and -MH PCs do not when $w \in \left[w_{ML}\left(E_L^M\right), w_{PH}(E_L)\right)$ (for the effect on welfare, see Appendix B.2.3 and Figure A1).

follows. At least one type-PH PC decide to run because w is sufficient to cover both Δ_{PH}, her personal opportunity cost, and E_L, the expected free-riding benefit in case no other type-iH PCs run, hence the public good is provided by a low-skilled politician whose PSM level is unobservable. By contrast, type-MH PCs do not run because w can be sufficient to cover their larger personal opportunity costs, Δ_{MH}, but not their top expected free-riding benefit on the public good provided a high-skilled politician, E_H^M. Since only high-motivated PCs within the set of high-skilled ones decide to run, a type-PH candidate will be elected and the equilibrium welfare will be S^*_{PH}.

Finally, when w is at its maximum, i.e., nonlower than the highest reservation pay $w_{MH}\left(E_H^M\right)$, all PCs decide to run at equilibrium. In this case, each type-iH candidate has probability $\frac{1}{\lambda_{PH}C+\lambda_{MH}C}$ of winning the election, whereas a type-iL candidate has zero probability of winning. The equilibrium welfare takes thus the following expected value,

$$E\left(S_H^*\right) \equiv \frac{\lambda_{PH}}{\lambda_{PH}+\lambda_{MH}} S^*_{PH} + \frac{\lambda_{MH}}{\lambda_{PH}+\lambda_{MH}} S^*_{MH}, \tag{33}$$

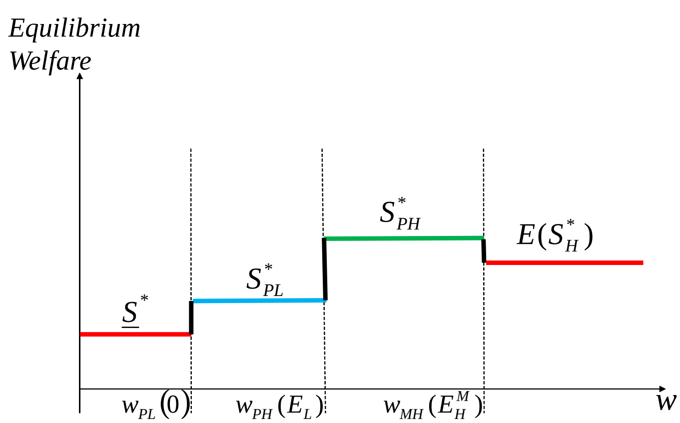
where $\frac{\lambda_{PH}}{\lambda_{PH}+\lambda_{MH}}\left(\frac{\lambda_{MH}}{\lambda_{PH}+\lambda_{MH}}\right)$ is the probability that a type-PH (-MH) candidate is elected. Note that $E\left(S_H^*\right)$ is lower than S^*_{PH}; the reason is that also low-motivated PCs within the set of high-skilled ones decide to run, hence the probability the successful candidate has low PSM is positive rather than zero.

We sum up the above findings in the following

Proposition 2 *When both PSM and skills affect the potential candidates' effort disutility, there is an inverted U-shaped relationship between the equilibrium welfare and the politician's pay.*

Proposition 1 asserts that as long as skills are the sole determinant of PCs' effort disutility, the equilibrium welfare is maximized when the politician's pay is top because all the best PCs run. This does not occur in the general framework according to Proposition 2, since the poor motivation of the most expensive PCs, type-MH, makes them relatively little productive. This result is illustrated in Figure 2, where it is apparent the inverted U-shaped relationship between the equilibrium welfare and the level of w.

Figure 2: Illustration of Proposition 2



4.3 Robustness of the Results

In this subsection, we discuss the robustness of our findings.

First, since the assumptions of uniform pay and observable skills are proved not to affect our benchmark results, they are kept in the general framework; here, we discuss the role played by the PSM level unobservability.[20] Suppose PSM is observable along with skills: one can prove that the equilibrium welfare is initially increasing in and then unaffected by w in most cases. However, there are equilibria where the welfare fluctuates in w. In particular, as w rises the welfare initially increases from S^*_{PL} to S^*_{PH}, it then diminishes to S^*_{MH}, and it finally increases again to S^*_{PH}.[21] The reasoning is as follows. At a relatively low, but not minimum, pay level, one type-PH PC stands for election. At a higher, but not maximum, pay level, only one poorly motivated PC within the pool of high-skilled PCs is attracted because type-PH PCs free-ride on her; in this case, the equilibrium welfare is S^*_{MH}, provided that $G_{MH} > G_{PL}$. When w is at its maximum, all PCs run for office and the equilibrium welfare is S^*_{PH}.

Second, we discuss the extension to negative levels of PSM (i.e., $\gamma_M < 0 < \gamma_P$) to capture the case of PCs who prefer to work in the market sector (for an analogous definition of negative PSM, see Delfgaauw & Dur, 2010). More precisely, for any given level of skills, individuals with negative PSM are assumed to have higher net market incomes than those with positive PSM, $M_{Mj} > M_{Pj}$. This new specification impacts only on inequalities (20) and (29), which become $P_{Pj} - P_{Mj} + (N-1)(G_{Pj} - G_{Mj}) > 0 > M_{Pj} - M_{Mj}$ and $P_{Pj} - P_{Mj} > 0 > M_{Pj} - M_{Mj}$. Since both inequalities are still fulfilled, the welfare ranking, (22), and that of personal opportunity costs of becoming a politician, (30), do not change; on this basis, one can show that our results are not affected.

Third, in Appendix B.3.2, we investigate the alternative election outcome where low-skilled candidates are preferred over high-skilled ones by focusing on the following scenario: the distribution of PCs is such that all low-motivated PCs have high skills ($\lambda_{ML} = 0$) and all high-skilled PCs have low PSM, ($\lambda_{PH} = 0$) and the public good level provided by a type-MH politician is lower than that provided by a type-PL one (i.e., $G_{MH} < G_{PL}$). In this case, the hidden PSM level of PCs can be perfectly inferred from the observation of the skill level; ordinary citizens and PCs who did not run know that low-skilled candidates, who have high PSM, are better than high-skilled candidates, who have instead low PSM. We find that setting w at least as high as the lowest reservation pay but below the second lowest reservation pay is sufficient to maximize the equilibrium welfare because one among the best (type-PL) PCs is attracted, while the worst (type-MH) PCs are excluded.

Finally, in Appendix B.3.3, we investigate the opposite case where all high-motivated PCs are

[20] The case where both PSM and skills are unobservable is analyzed in Fedele & Giannoccolo (2013): disregarding strategic interaction among PCs, it is found that the inverted U-shaped relationship between the equilibrium welfare and the politician's pay holds true under some parametric restrictions. Yet, the full unobservability case is not our preferred specification because the election becomes completely random and its screening role is overlooked.

[21] The proof is in Appendix B.3.1.

endowed with high skills ($\lambda_{PL}C = 0$) and all high-skilled PCs have high PSM ($\lambda_{MH} = 0$). This is the scenario considered by Dal Bó et al. (2013). Again, we find that setting w at least as high as the lowest reservation pay but below the second lowest reservation pay is sufficient to maximize the equilibrium welfare, unless very specific parametric conditions are fulfilled.

Overall, the result that a relatively low level of w is sufficient to maximize welfare because the best PCs stand for election, while worse PCs do not, proves to be robust to several alternative specifications.

5 Conclusion

In this paper, we have investigated the impact of the pay level on the selection of PCs with both heterogeneous skills and heterogeneous PSM. First, we have considered a benchmark model with skills as the only determinant of PCs' quality and have shown that the utilitarian welfare increases with the politician's pay since the best, i.e., high-skilled, PCs are attracted to politics only if the pay covers their high opportunity costs of entering politics. This is in line with seminal theoretical results on political selection. When PSM has also been taken into account, we have demonstrated the existence of a non-monotonic relationship between the level of pay and the (expected) quality of the elected politician. This finding is compatible with the empirical evidence on the impact of pay on politicians' selection and quality.

To shed further light on the link between politicians' pay and their quality, future empirical and experimental research might consider to measure not only skills but also PSM of candidates and politicians, as suggested by our analysis.

A Appendix: Benchmark Analysis

A.1 Election

First suppose $h \in [1, \lambda_H C]$ type-H and $l \in [1, \lambda_L C]$ type-L PCs decided to run at $t = 0$. Each candidate votes for herself; the reason is that PCs decide to run when their payoff from being in office is larger than that from the business; voting for herself increases the probability of getting the former payoff. Instead, $N - C$ ordinary citizens plus $C - (h + l)$ PCs who decided no to run vote randomly for one candidate H because $G_H > G_L$. This means that each type-H candidate gets $[N - (h + l)] \times (1/h)$ additional expected votes. Overall: each type-L candidate gets 1 vote; each type-H candidate gets $1 + [N - (h + l)]/h > 1$ expected votes. There is a tie among all type-H candidates, which is broken with a random draw. Therefore, each type-H candidate wins with probability $1/h$ and each type-L candidate wins with probability 0.

Suppose now $h = 0$ and $l \in [1, \lambda_L C]$, i.e., only l type-L PCs decided to run at $t = 0$. Each candidate votes for herself. Instead, $N - C$ ordinary citizens plus $C - l$ PCs who decided no to run vote either randomly for one candidate L if $G_L - \frac{w}{N} > 0$ or for no candidates if $G_L - \frac{w}{N} < 0$. This means that each type-L candidate gets either $1 + (N - l) \times (1/l)$ expected votes or just her vote and wins with probability $1/l$.

A.2 Candidacy Game

A.2.1 Reservation Pays

We first compute $w_H(G_H)$ by investigating the candidacy choice of a type-H PC when there are $h-1 \geq 1$ type-H candidates besides her and $l \geq 0$ type-L candidates. In this case, her expected payoff is

$$\frac{1}{h}(w+P_H)+\left(1-\frac{1}{h}\right)(M_H+G_H)-\frac{w}{N}, \tag{34}$$

when she runs, and

$$M_H+G_H-\frac{w}{N}, \tag{35}$$

when she does not run. The type-H PC's reservation pay solves equality (34) = (35) and is given by $w_H(G_H)=\Delta_H+G_H$.

We now compute $w_H(G_L)$ and $w_H(0)$ by investigating the choice of a type-H PC when $h-1=0$ type-H PCs besides her and $l \geq 0$ type-L PCs run. In this case, she wins the election with probability one, hence payoff (34) becomes $w+P_H-\frac{w}{N}$. By contrast, payoff (35) becomes $M_H+G_L-\frac{w}{N}$ if $l \in [1, \lambda_L C]$ and M_H if $l=0$. Two reservation pays arise, $w_H(G_L)=\Delta_H+G_L$ if $l \in [1, \lambda_L C]$ and $w_H(0)=[N/(N-1)]\Delta_H$ if $l=0$.

We turn to the study of a type-L PC's candidacy choice. If at least one type-H runs, she is indifferent as to whether to run or not because her probability of winning the election is zero. In symbols, equality $0(w+P_L)+(1-0)[M_L+G_H]-\frac{w}{N}=M_L+G_H-\frac{w}{N}$ is fulfilled for any w. We then compute $w_L(G_L)$ by supposing there are $h=0$ type-H candidates and $l-1 \geq 1$ type-L candidates besides her. Substituting h and H with l and L into (34) and (35) yields the payoff of the type-L PC when running for office and when not running. The reservation pay is $w_L(G_L)=\Delta_L+G_L$. We finally compute $w_L(0)$ by supposing there are $h=0$ type-H candidates and $l-1=0$ type-L candidate besides her; in this case, the reservation pay is $w_L(0)=[N/(N-1)]\Delta_L$.

A.2.2 Ranking of Reservation Pays

First note that $w_H(G_H) > w_H(G_L) \Leftrightarrow G_H > G_L$; a type-$H$ PC asks for a higher minimum pay to run if there is at least another type-H candidate because her free-riding benefit is larger. Inequalities $w_H(G_L) > w_L(G_L)$ and $w_H(0) > w_L(0)$ can be rearranged as $\Delta_H > \Delta_L$, which is true by virtue of (10). Finally, inequality $w_j(G_L) > w_j(0)$ is fulfilled under Assumption 1. Overall, the ranking of reservation pays is given by (11).

A.2.3 Candidacy Game Equilibria

The choice of running (not running) for office is denoted by $\mathcal{C}$ ($\mathcal{N}$). We first remark that $\mathcal{N}$ is weakly dominated by $\mathcal{C}$ for any type-L PC when $w \geq w_L(G_L)$. Indeed, if at least one type-H PC runs, any type-L is indifferent between $\mathcal{C}$ and $\mathcal{N}$; if no type-H PC runs, any type-L prefers $\mathcal{C}$ over $\mathcal{N}$. Accordingly, we disregard the play of strategy $\mathcal{N}$ by type-L PCs in the interval $w \geq w_L(G_L)$.

- We start with the two extreme intervals of w. If $w < w_L(0)$, $\mathcal{N}$ is a dominant strategy for any PC. If instead $w \geq w_H(G_H)$, $\mathcal{C}$ is a dominant strategy for any type-H PC and a weakly dominant strategy for any type-L.

- If $w_L(0) \leq w < \min\{w_L(G_L), w_H(0)\}$, $\mathcal{N}$ is a dominant strategy for any type-H PC because $w < w_H(0)$. When all but one (i.e., $\lambda_L C - 1$) type-L PCs play $\mathcal{N}$, the best response of one type-L PC is $\mathcal{C}$ because $w \geq w_L(0)$. When only one type-L PC plays $\mathcal{C}$, the best response of any other type-L is $\mathcal{N}$ because $w < w_L(G_L)$.

  Suppose $\min\{w_L(G_L), w_H(0)\} = w_L(G_L)$. If $w_L(G_L) \leq w < w_H(0)$, $\mathcal{N}$ is a dominant strategy for any type-H PC; the best response of any type-L PC is $\mathcal{C}$. If $w_H(0) \leq w < w_H(G_L)$, $\mathcal{N}$ is the best response of any type-H PC when at least one type-L plays $\mathcal{C}$; $\mathcal{C}$ is the best response of any type-L PC when at least one type-H plays $\mathcal{N}$.

  Suppose now $\min\{w_L(G_L), w_H(0)\} = w_H(0)$. If $w_H(0) \leq w < w_L(G_L)$, $\mathcal{N}$ is the best response of any type-H PC when at least one type-L plays $\mathcal{C}$. When all but one type-L PCs play $\mathcal{N}$, the best response of one type-L PC is $\mathcal{C}$. When only one type-L PC plays $\mathcal{C}$, the best response of any other type-L is $\mathcal{N}$. If $w_L(G_L) \leq w < w_H(G_L)$, $\mathcal{N}$ is the best response of any type-H PC to type-L candidates playing the weakly dominant strategy $\mathcal{C}$.

- Finally, if $w_H(G_L) \leq w < w_H(G_H)$, type-$L$ PCs play the weakly dominant strategy $\mathcal{C}$. When all but one type-H PCs play $\mathcal{N}$, the best response of one type-H PC is $\mathcal{C}$. When only one type-H PC plays $\mathcal{C}$, the best response of any other type-H is $\mathcal{N}$.

A.3 Robustness of the Results

Screening mechanism. Since the skill level is observable, the usual assumption of uniform pays may seem awkward; we therefore relax it and introduce a screening mechanism with two different level of pays, w_H for high-skilled PCs and $w_L < w_H$ for low-skilled PCs such that only high-skilled PCs run; for instance, $w_L < w_L(0)$ and $w_H \geq w_H(G_H)$. Interestingly, this mechanism commands a relatively high pay to attract all type-H PCs and to maximize the equilibrium welfare. This is exactly in the spirit of Proposition 1, which is therefore not affected by the assumption of uniform pays. The intuition is that the screening activity is carried out by the election; even in presence of uniform pays, voters exclude low-skilled candidates by not voting for them because they can observe their skill levels.

Unobservable skill level. When the skill level is not observable, the election outcome is affected because voters are not able to distinguish between high-skilled and low-skilled candidates; as a result, all candidates have the same probability of winning the election. Such probability is given by $\frac{1}{h+l}$, with h (l) denoting the number of type-H (type-L) candidates. In turn, the random outcome of the election affects the reservation pays asked for by PCs. In particular, there exist two levels of reservation pays for each type-$j = L, H$ PC: (i) $w_j\left(E^j\right) \equiv \Delta_j + E^j$ is the reservation pay when at least another PC runs, with $E^j \equiv (\lambda_j C - 1)\, G_j / (C-1) + \lambda_{-j} C G_{-j} / (C-1)$ denoting the expected free-riding benefit enjoyed by any type-j PC in case she does not win the election or does not run and at least another PC does; $w_j(0) = N\Delta_j / (N-1)$ is the reservation pay when no other PCs run. Inequalities $w_j\left(E^j\right) > w_j(0)$ are implied by $w_j(G_L) > w_j(0)$ because $w_j\left(E^j\right) > w_j(G_L)$ and $w_j(G_L) > w_j(0)$ by virtue of Assumption 1; $w_H\left(E^H\right) > w_L\left(E^L\right)$ is equivalent to $C > 1 + (G_H - G_L) / (\Delta_H - \Delta_L)$, which we assume to hold; this inequality is in the spirit of Assumption 1. The ranking of the four reservation pays is thus

$$w_L(0) < \min\left\{w_H(0), w_L\left(E^L\right)\right\} < \max\left\{w_H(0), w_L\left(E^L\right)\right\} < w_H\left(E^H\right). \tag{36}$$

The pure-strategy Nash equilibria (NEs) of the candidacy game played at $t = 0$ by C PCs are as follows. If $w < w_L(0)$, no PCs decide to run. The equilibrium welfare is S_0^*. If $w_L(0) \leq w < w_H\left(E^H\right)$, all type-$H$ PCs do not run; either all type-L PCs run or only one type-L PC runs, while the other $\lambda_L C - 1$ do not run. The equilibrium welfare is S_L^*. If $w \geq w_H\left(E^H\right)$, all PCs decide to run. In this case, each candidate has probability $1/C$ of winning the election. The equilibrium welfare takes thus the following expected value, $\lambda_H S_H^* + \lambda_L S_L^*$, where λ_H (λ_L) becomes the probability that the winner is a type-H (-L) candidate. Since $S_0^* < S_L^* < \lambda_H S_H^* + \lambda_L S_L^*$, the above findings confirm the results of Proposition 1.

B Appendix: General Analysis

B.1 Election

We divide our proof into two parts, (a) and (b), depending on whether high-skilled PCs decided to run at $t = 0$ or not to run.

(a) Suppose at least one high-skilled PC and at least one low-skilled PC decided to run at $t = 0$; in symbols, $ih = ph + mh \in [1, \lambda_H C]$ and $il = pl + ml \in [1, \lambda_L C]$. We consider two different cases, (i) and (ii).

(i) $G_{PL} > G_{MH}$. Each candidate votes for herself. Instead, $N - C$ ordinary citizens prefer to vote randomly for a high-skilled candidate rather than a low-skilled one when

$$\frac{\lambda_{PH}}{\lambda_{PH} + \lambda_{MH}} G_{PH} + \frac{\lambda_{MH}}{\lambda_{PH} + \lambda_{MH}} G_{MH} > \frac{\lambda_{PL}}{\lambda_{PL} + \lambda_{ML}} G_{PL} + \frac{\lambda_{ML}}{\lambda_{PL} + \lambda_{ML}} G_{ML} : \tag{37}$$

the LHS (RHS) of the above inequality is the public good level ordinary citizens expect when voting a high-skilled (low-skilled) candidate. The LHS can be explained as follows: when ordinary citizens vote for a high-skilled candidate, they do not observe her PSM level; rather, they can simply compute the probability that the candidate has high or low PSM, by relying on the proportion of high-motivated and low-motivated PCs, λ_{PH} and λ_{MH}, within the population of high-skilled PCs, $(\lambda_{PH} + \lambda_{MH})\, C$. A similar reasoning applies to the RHS.

Type-PH PCs who did not run at $t = 0$ prefer to vote randomly for one high-skilled candidate when

$$\frac{\lambda_{PH}C - 1}{\lambda_{PH}C + \lambda_{MH}C - 1} G_{PH} + \frac{\lambda_{MH}C}{\lambda_{PH}C + \lambda_{MH}C - 1} G_{MH} > \frac{\lambda_{PL}}{\lambda_{PL} + \lambda_{ML}} G_{PL} + \frac{\lambda_{ML}}{\lambda_{PL} + \lambda_{ML}} G_{ML}. \tag{38}$$

The LHS of (38) is different from that of (37) because, unlike ordinary citizens, PCs who did not run update their prior probabilities concerning the type of candidates; in particular, any type-PH PC excludes herself from the population of high-motivated high-skilled PCs when computing the probability that a high-skilled candidate has high or low PSM. Similarly, type-MH PCs who did not run prefer to vote randomly for one high-skilled candidate when

$$\frac{\lambda_{PH}C}{\lambda_{PH}C + \lambda_{MH}C - 1} G_{PH} + \frac{\lambda_{MH}C - 1}{\lambda_{PH}C + \lambda_{MH}C - 1} G_{MH} > \frac{\lambda_{PL}}{\lambda_{PL} + \lambda_{ML}} G_{PL} + \frac{\lambda_{ML}}{\lambda_{PL} + \lambda_{ML}} G_{ML}. \tag{39}$$

The corresponding condition for type-PL PCs is

$$\frac{\lambda_{PH}}{\lambda_{PH} + \lambda_{MH}} G_{PH} + \frac{\lambda_{MH}}{\lambda_{PH} + \lambda_{MH}} G_{MH} > \frac{\lambda_{PL}C - 1}{\lambda_{PL}C + \lambda_{ML}C - 1} G_{PL} + \frac{\lambda_{ML}C}{\lambda_{PL}C + \lambda_{ML}C - 1} G_{ML} \tag{40}$$

and for type-ML PCs is

$$\frac{\lambda_{PH}}{\lambda_{PH} + \lambda_{MH}} G_{PH} + \frac{\lambda_{MH}}{\lambda_{PH} + \lambda_{MH}} G_{MH} > \frac{\lambda_{PL}C}{\lambda_{PL}C + \lambda_{ML}C - 1} G_{PL} + \frac{\lambda_{ML}C - 1}{\lambda_{PL}C + \lambda_{ML}C - 1} G_{ML}. \tag{41}$$

We derive sufficient conditions under which the election outcome is such that each type-iH candidate wins with probability $1/(ph + mh)$ and each type-L candidate wins with probability 0. Consider the following inequality

$$\begin{aligned} &\tfrac{\lambda_{PH}C-1}{\lambda_{PH}C+\lambda_{MH}C-1} G_{PH} + \tfrac{\lambda_{MH}C}{\lambda_{PH}C+\lambda_{MH}C-1} G_{MH} > \\ &\tfrac{\lambda_{ML}C-1}{\lambda_{ML}C+\lambda_{PL}C-1} G_{ML} + \tfrac{\lambda_{PL}C}{\lambda_{ML}C+\lambda_{PL}C-1} G_{PL}. \end{aligned} \tag{42}$$

If (42) is fulfilled, then (37)-(41) are all fulfilled as well. We thus suppose that (42) holds true for any $\lambda_{ij} > 0$. As a result, all voters except candidates prefer high-skilled candidates over low-skilled ones. Each type-iL candidate gets 1 vote; each type-iH candidate gets $1 + [N - (ph + mh + pl + ml)] \times [1/(ph + mh)] > 1$ expected votes. There is a tie among all type-iH candidates, which is broken with a random draw.

(ii) $G_{MH} > G_{PL}$. Each candidate votes for herself. Instead, $N - C$ ordinary citizens plus $C - (ph + mh + pl + ml)$ PCs who decided no to run vote randomly for one high-skilled candidate. To prove it, note that $e^*_{MH} > e^*_{PL}$ implies $G_{PH} > G_{MH} > G_{PL} > G_{ML}$, that in turn implies both (38) and (41). Overall, each type-iL candidate gets 1 vote; each type-iH candidate gets $1 + [N - (ph + mh + pl + ml)] \times (1/ph + mh) > 1$ expected votes. There is a tie among all type-iH candidates, which is broken with a random draw. Therefore, each type-iH candidate wins with probability $1/(ph + mh)$, whereas each type-L candidate wins with probability 0.

(b) Suppose high-skilled PCs decided not to run at $t = 0$. In symbols, $ih = ph+mh = 0$ and $il = pl+ml \in [1, \lambda_L C]$. In this case, each type-iL candidate votes for herself. All the other $N-(pl + ml)$ voters vote either randomly for one type-iL candidate if $E_L - \frac{w}{N} > 0$ or for no candidates if $E_L - \frac{w}{N} < 0$. As a result, each type-iL candidate gets either $1 + [N - (pl + ml)] \times [1/(pl + ml)]$ expected votes or just her vote and wins with probability $1/(pl + ml)$.

B.2 Candidacy Game

B.2.1 Reservation Pays

The reservation pays of any type-iH PCs are computed as follows.

(i) $ih-1\geq 1$ type-iH PCs besides the one under scrutiny and $il\geq 0$ type-iL PCs run. In this case, any type-iH PC gets

$$\begin{gathered}\tfrac{1}{ih}\left(w+P_{iH}\right)+\left(1-\tfrac{1}{ih}\right)+\Big[M_{iH}+\\ \tfrac{\lambda_{iH}C-1}{\lambda_{iH}C+\lambda_{-iH}C-1}G_{iH}+\tfrac{\lambda_{-iH}C}{\lambda_{iH}C+\lambda_{-iH}C-1}G_{-iH}\Big]-\tfrac{w}{N},\end{gathered} \tag{43}$$

when running: with probability $1/ih$, she is elected and obtains the politician's pay w plus P_{iH}, the optimal level of the public good she is able to provide net of her effort disutility; with probability $1-1/(ih)$, she is not elected and ends up with the optimal market income net of her effort disutility, M_{iH}, plus the utility from the public good provided by the high-skilled successful candidate; since the PSM level of the politician is not observable, the public good level is in expected terms and computed as in the LHS of (38) or (39), mutatis mutandis. By contrast, the type-iH PC gets

$$M_{iH}+\frac{\lambda_{iH}C-1}{\lambda_{iH}C+\lambda_{-iH}C-1}G_{iH}+\frac{\lambda_{-iH}C}{\lambda_{iH}C+\lambda_{-iH}C-1}G_{-iH}-\frac{w}{N}, \tag{44}$$

when not running. Solving (43) = (44) by w yields (23).

(ii) $ih-1=0$ type-iH PC besides her and $il\geq 1$ type-iL PCs run. In this case, the type-iH PC wins the election and she gets

$$w+P_{iH}-\frac{w}{N}, \tag{45}$$

when running and

$$M_{iH}+\frac{\lambda_{PL}}{\lambda_{PL}+\lambda_{ML}}G_{PL}+\frac{\lambda_{ML}}{\lambda_{PL}+\lambda_{ML}}G_{ML}-\frac{w}{N}, \tag{46}$$

when not running. The value (24) follows.

(iii) $ih-1=0$ type-iH PC besides her and $il=0$ type-iL PCs run. In this case, she gets $w+P_{iH}-\frac{w}{N}$, when running, and M_{iH}, when not running. Her reservation pay is thus given by (25).

We now compute the reservation pays of any type-iL PC. We let $ih=0$, i.e., no high-skilled PCs run, and consider two different scenarios.

(i) $il-1\geq 1$ low-skilled PCs besides her run. In this case, she gets

$$\begin{gathered}\tfrac{1}{il}\left(w+P_{iL}\right)+\left(1-\tfrac{1}{il}\right)+\Big[M_{iL}+\\ \tfrac{\lambda_{iL}C-1}{\lambda_{iL}C+\lambda_{-iL}C-1}G_{iL}+\tfrac{\lambda_{-iL}C}{\lambda_{iL}C+\lambda_{-iL}C-1}G_{-iL}\Big]-\tfrac{w}{N},\end{gathered} \tag{47}$$

when running and

$$M_{iL}+\frac{\lambda_{iL}C-1}{\lambda_{iL}C+\lambda_{-iL}C-1}G_{iL}+\frac{\lambda_{-iL}C}{\lambda_{iL}C+\lambda_{-iL}C-1}G_{-iL}-\frac{w}{N}, \tag{48}$$

when not running. Solving (47) = (48) by w yields (26).

(ii) $il-1=0$ low-skilled PCs besides her run. In this case, she gets $w+P_{iL}-\frac{w}{N}$, when running, and M_{iL}, when not running. Her reservation pay is thus given by (27).

B.2.2 Ranking of Free-riding Benefits

$E_H^M>E_H^P$ is equivalent to

$$\frac{G_{PH}}{\lambda_{MH}C+\lambda_{PH}C-1}>\frac{G_{MH}}{\lambda_{PH}C+\lambda_{MH}C-1}\Leftrightarrow G_{PH}>G_{MH}, \tag{49}$$

which holds true. $E_H^P>E_L^M$ is equivalent to (42), which is assumed to be fulfilled for any λ_{ij}. $E_L^M>E_L$ is equivalent to

$$\begin{gathered}\tfrac{\lambda_{PL}C}{(\lambda_{ML}C+\lambda_{PL}C-1)(\lambda_{PL}C+\lambda_{ML}C)}G_{PL}>\tfrac{\lambda_{PL}C}{(\lambda_{ML}C+\lambda_{PL}C-1)(\lambda_{PL}C+\lambda_{ML}C)}G_{ML}\\ \Leftrightarrow G_{PL}>G_{ML},\end{gathered} \tag{50}$$

which holds true. Finally, $E_L > E_L^P$ is equivalent to

$$\begin{array}{c} \frac{\lambda_{ML}C}{(\lambda_{PL}C+\lambda_{ML}C)(\lambda_{PL}C+\lambda_{ML}C-1)}G_{PL} > \frac{\lambda_{ML}C}{(\lambda_{PL}C+\lambda_{ML}C)(\lambda_{PL}C+\lambda_{ML}C-1)}G_{ML} \\ \Leftrightarrow G_{PL} > G_{ML}, \end{array} \tag{51}$$

which holds true.

In the special scenario where $G_{PL} > G_{MH}$ and $\lambda_{PH}C = \lambda_{ML}C = 1$, the ranking of free-riding benefits becomes $E_L^M > E_L > E_L^P > E_H^M > E_H^P$ if C is relatively high. The resulting impact on the candidacy game equilibria and the equilibrium welfare is analyzed in the last paragraph of Appendix B.2.3.

B.2.3 Candidacy Game Equilibria and Equilibrium Welfare

We first focus on the two extreme intervals of w, i.e., w below (not below) the lowest (highest) reservation pay. If $w < w_{PL}(0)$, $\mathcal{N}$, the choice of not running, is a dominant strategy for any PC, hence the equilibrium welfare is given by (32). If $w \geq w_{MH}\left(E_H^M\right)$, $\mathcal{C}$, the choice of running, is a dominant strategy for any type-iH PC and a weakly dominant strategy for any type-iL PC. The BNE is such that all PCs run, hence the (expected level of) the equilibrium welfare is given by (33). Before proceeding, we remark that $\mathcal{N}$ is a dominant strategy for any type-ij PC when w is lower than her lowest reservation pay; similarly, $\mathcal{C}$ is a dominant (weakly dominant) strategy for any type-iH (-iL) PC when w is higher than her highest reservation pay.

Besides the two extreme levels of the reservation pays, several alternative rankings of the other eight reservation pays are compatible with the two chains of inequalities in (30) and that in (31). Yet, since the reservation pays are affected by two factors, the personal opportunity costs and the free-riding benefits, the presentation of the results can be streamlined by focusing on the polar scenarios where the ranking is driven either by the first or by the second factor. This simplification is without loss of generality. Indeed, since $w_{PL}(0)$ ($w_{MH}\left(E_H^M\right)$) is the lowest (highest) reservation pay, one can prove that under all possible alternative rankings, at least one type-PL PC (but no other types) runs when w is just above $w_{PL}(0)$, whereas type-MH PCs run only when w is at its maximum; this confirms Proposition 2.

(i) Suppose first the personal opportunity costs drive the ranking of reservation pays. Two subcases must be considered according to (30). If $\Delta_{PH} > \Delta_{ML}$, the ranking is

$$\begin{array}{c} w_{MH}\left(E_H^M\right) > w_{MH}\left(E_L\right) > w_{MH}(0) > w_{PH}\left(E_H^P\right) > w_{PH}\left(E_L\right) \\ > w_{PH}(0) > w_{ML}\left(E_L^M\right) > w_{ML}(0) > w_{PL}\left(E_L^P\right) > w_{PL}(0): \end{array} \tag{52}$$

note that inequalities $w_{iH}(E_L) > w_{iH}(0)$ and $w_{iL}\left(E_L^i\right) > w_{iL}(0)$ are true under Assumption 1. If instead $\Delta_{PH} < \Delta_{ML}$, the ranking is

$$\begin{array}{c} w_{MH}\left(E_H^M\right) > w_{MH}\left(E_L\right) > w_{MH}(0) > w_{ML}\left(E_L^M\right) > w_{ML}(0) \\ > w_{PH}\left(E_H^P\right) > w_{PH}\left(E_L\right) > w_{PH}(0) > w_{PL}\left(E_L^P\right) > w_{PL}(0). \end{array} \tag{53}$$

When (52) holds true, the BNEs are as follows.

- If $w \in \left[w_{PL}(0), w_{PL}\left(E_L^P\right)\right)$, $\mathcal{N}$ is a dominant strategy for any type-iH and -ML PC because $w < w_{ML}(0) (< w_{iH}(0))$. When all PCs but one type-PL PC play $\mathcal{N}$, the best response of one type-PL PC is $\mathcal{C}$ because $w \geq w_{PL}(0)$. When only one type-PL PC plays $\mathcal{C}$, the best response of any other PC is $\mathcal{N}$ because $w < w_{PL}\left(E_L^P\right)$. At the BNE, only one type-PL PC runs, hence the equilibrium welfare is S_{PL}^*.
- If $w \in \left[w_{PL}\left(E_L^P\right), w_{ML}\left(E_L^M\right)\right)$, $\mathcal{N}$ is a dominant strategy for any type-iH PC because $w < w_{PH}(0)$; $\mathcal{C}$ is a weakly dominant strategy for any type-PL PC because $w \geq w_{PL}\left(E_L^P\right)$; any type-$ML$ PC's best response is $\mathcal{N}$ because $w < w_{ML}\left(E_L^M\right)$. At the BNE, only type-$PL$ PCs run, hence the equilibrium welfare is S_{PL}^*.
- If $w \in \left[w_{ML}\left(E_L^M\right), w_{PH}\left(E_L\right)\right)$, $\mathcal{C}$ is a weakly dominant strategy for any type-iL PC because $w \geq w_{ML}\left(E_L^M\right)$; the best response of any type-ih PC is $\mathcal{N}$ because $w < w_{PH}\left(E_L\right)$. The

BNE is such that all low-skilled PCs run, whereas all high-skilled PCs do not; the equilibrium welfare is $E\left(S_L^*\right)=\frac{\lambda_{PL}}{\lambda_{PL}+\lambda_{ML}}S_{PL}^*+\frac{\lambda_{ML}}{\lambda_{PL}+\lambda_{ML}}S_{ML}^*$, where $\frac{\lambda_{PL}}{\lambda_{PL}+\lambda_{ML}}\left(\frac{\lambda_{ML}}{\lambda_{PL}+\lambda_{ML}}\right)$ is the probability that the winner is a type-PL (-ML) candidate.

- If $w\in\left[w_{PH}\left(E_L\right),w_{PH}\left(E_H^P\right)\right)$, $\mathcal{C}$ is a weakly dominant strategy for any type-iL PC because $w>w_{ML}\left(E_L^M\right)$. When all high-skilled PCs but one type-PH PC play $\mathcal{N}$, the best response of this type-PH PC is $\mathcal{C}$ because $w\geq w_{PH}\left(E_L\right)$. When only one high-skilled PC plays $\mathcal{C}$, the best response of any other high-skilled is $\mathcal{N}$ because $w<w_{PH}\left(E_H^P\right)$. The BNE is such that all low-skilled PCs and only one type-PH PC run, whereas all the other high-skilled PCs do not; the equilibrium welfare is S_{PH}^*.
- Finally, if $w\in\left[w_{PH}\left(E_H^P\right),w_{MH}\left(E_H^M\right)\right)$, $\mathcal{C}$ is a weakly dominant strategy for any low-skilled PC and a dominant one for any type-PH PC because $w\geq w_{PH}\left(E_H^P\right)$. The best response of any type-MH PC is $\mathcal{N}$ because $w<w_{MH}\left(E_H^M\right)$. The BNE is such that type-PH, -PL, and -ML PCs run, while type-MH PCs do not; the equilibrium welfare is S_{PH}^*.

When (53) holds true, the BNEs are as follows.

- If $w\in\left[w_{PL}\left(0\right),w_{PL}\left(E_L^P\right)\right)$, the BNE is such that only one type-PL PC runs, hence the equilibrium welfare is S_{PL}^*.
- If $w\in\left[w_{PL}\left(E_L^P\right),w_{PH}\left(E_L\right)\right)$, the BNE is such that only type-PL PCs run, hence the equilibrium welfare is S_{PL}^*.
- If $w\in\left[w_{PH}\left(E_L\right),w_{PH}\left(E_H^P\right)\right)$, the BNE is such that type-PL PCs and only one type-PH PC run, whereas all the other high-skilled PCs and type-ML PCs do not; the equilibrium welfare is S_{PH}^*.
- If $w\in\left[w_{PH}\left(E_H^P\right),w_{ML}\left(E_L^M\right)\right)$, the BNE is such that all high-motivated PCs run, whereas all low-motivated PCs do not; the equilibrium welfare is S_{PH}^*.
- If $w\in\left[w_{ML}\left(E_L^M\right),w_{MH}\left(E_H^M\right)\right)$, the BNE is such that type-PH, -PL, and -ML PCs run; type-MH PCs do not; the equilibrium welfare is S_{PH}^*.

(ii) Suppose now the free-riding benefits drive the ranking of reservation pays. When $\Delta_{PH}>\Delta_{ML}$, the ranking is

$$\begin{aligned}&w_{MH}\left(E_H^M\right)>w_{PH}\left(E_H^P\right)>w_{ML}\left(E_L^M\right)>w_{MH}\left(E_L\right)>w_{PH}\left(E_L\right)\\&>w_{PL}\left(E_L^P\right)>w_{MH}\left(0\right)>w_{PH}\left(0\right)>w_{ML}\left(0\right)>w_{PL}\left(0\right).\end{aligned}\tag{54}$$

When $\Delta_{PH}<\Delta_{ML}$, the ranking is

$$\begin{aligned}&w_{MH}\left(E_H^M\right)>w_{PH}\left(E_H^P\right)>w_{ML}\left(E_L^M\right)>w_{MH}\left(E_L\right)>w_{PH}\left(E_L\right)\\&>w_{PL}\left(E_L^P\right)>w_{MH}\left(0\right)>w_{ML}\left(0\right)>w_{PH}\left(0\right)>w_{PL}\left(0\right).\end{aligned}\tag{55}$$

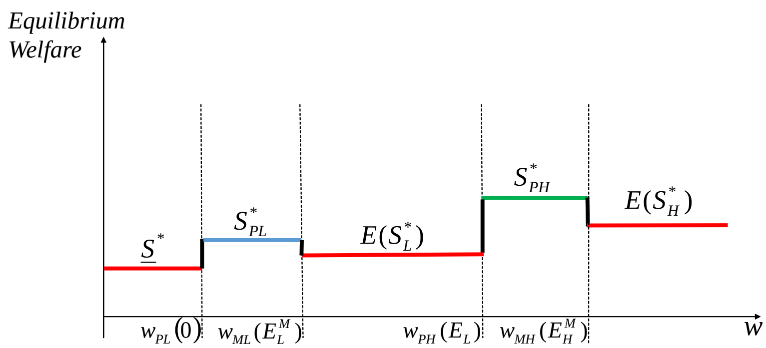
The BNEs under both scenarios (54) and (55) are as follows.

- If $w\in\left[w_{PL}\left(0\right),w_{PL}\left(E_L^P\right)\right)$, the BNE is such that only one type-PL PC runs, hence the equilibrium welfare is S_{PL}^*.
- If $w\in\left[w_{PL}\left(E_L^P\right),w_{PH}\left(E_L\right)\right)$, the BNE is such that only type-PL PCs run, hence the equilibrium welfare is S_{PL}^*.
- If $w\in\left[w_{PH}\left(E_L\right),w_{ML}\left(E_L^M\right)\right)$, the BNE is such that type-PL PCs and only one type-PH PC run; the equilibrium welfare is S_{PH}^*.
- If $w\in\left[w_{ML}\left(E_L^M\right),w_{PH}\left(E_H^P\right)\right)$, the BNE is such that all low-skilled PCs and only one type-PH PC run, whereas all the other high-skilled PCs do not; the equilibrium welfare is S_{PH}^*.

- If $w \in \left[w_{PH}\left(E_H^P\right), w_{MH}\left(E_H^M\right)\right)$, the BNE is such that type-PH, -PL, and -ML PCs run; type-MH PCs do not; the equilibrium welfare is S_{PH}^*.

Figure 2 in the text describes the relationship between the equilibrium welfare and w when rankings (53)-(54)-(55) hold true; Figure A1 focuses on ranking (52) and confirms the result of Proposition 2 by showing a (double) inverted U-shaped relationship between the equilibrium welfare and w.

Figure A1: Illustration of Proposition 2, Ranking (52)



Before concluding, we briefly discuss the candidacy game equilibria and the equilibrium welfare in the peculiar scenario where the ranking of free-riding benefits is $E_L^M > E_L > E_L^P > E_H^M > E_H^P$ (see Appendix B.2.2). One can show that the highest reservation pay becomes either $w_{MH}(E_L)$, if the personal opportunity costs drive the ranking, or $w_{ML}\left(E_L^M\right)$, if the free-riding benefits drive the ranking. Interestingly, Proposition 2 still holds true; the intuition is that type-MH PCs still decide to run at higher pay levels than type-PH PCs, who in turn, demand higher reservation pays than type-PL PCs.

B.3 Robustness of the Results

B.3.1 Observable PSM and Skills

When both PSM and skills are observable, the election outcome is driven by the ranking of public good levels, as in the benchmark case. One can prove the existence of fourteen reservation pays and eight relevant rankings of reservation pays. Here, we focus on the scenarios where the welfare can fluctuate in w (the complete proof is available upon request). Suppose $G_{PH} > G_{MH} > G_{PL} > G_{ML}$ and that the free-riding benefits drive the ranking of reservation pays. When personal opportunity costs are such that $\Delta_{MH} > \Delta_{PH} > \Delta_{ML} > \Delta_{PL}$, the ranking is

$$\begin{gathered} w_{PH}(G_{PH}) > w_{MH}(G_{MH}) > w_{PH}(G_{MH}) \\ > w_{MH}(G_{PL}) > w_{PH}(G_{PL}) > w_{PL}(G_{PL}) \\ > w_{MH}(G_{ML}) > w_{PH}(G_{ML}) > w_{ML}(G_{ML}) > w_{PL}(G_{ML}) \\ > w_{MH}(0) > w_{PH}(0) > w_{ML}(0) > w_{PL}(0). \end{gathered} \tag{56}$$

When personal opportunity costs are such that $\Delta_{MH} > \Delta_{ML} > \Delta_{PH} > \Delta_{PL}$, the ranking is

$$\begin{gathered} w_{PH}(G_{PH}) > w_{MH}(G_{MH}) > w_{PH}(G_{MH}) \\ > w_{MH}(G_{PL}) > w_{PH}(G_{PL}) > w_{PL}(G_{PL}) \\ > w_{MH}(G_{ML}) > w_{ML}(G_{ML}) > w_{PH}(G_{ML}) > w_{PL}(G_{ML}) \\ > w_{MH}(0) > w_{ML}(0) > w_{PH}(0) > w_{PL}(0). \end{gathered} \tag{57}$$

Disregarding weakly dominated strategies, the NEs under both (56) and (57) are as follows. If $w < w_{PL}(0)$, no PCs run. If $w \in [w_{PL}(0), w_{ML}(0))$, only one type-$PL$ PC runs; the equilibrium welfare is S_{PL}^*. If $w \in [w_{ML}(0), w_{ML}(G_{ML}))$, either only one type-$PL$ PC runs or one type-PL PC and all type-ML run; the equilibrium welfare is S_{PL}^*. If $w \in [w_{ML}(G_{ML}), w_{PL}(G_{PL}))$, one type-$PL$ PC and all type-ML run; the equilibrium welfare is S_{PL}^*. If $w \in [w_{PL}(G_{PL}), w_{PH}(G_{PL}))$, all type-$iL$ PC run; the equilibrium welfare is S^*_{PL}. If $w \in [w_{PH}(G_{PL}), w_{MH}(G_{PL}))$, all type-$iL$ PCs and only one type-PH PC run; the equilibrium welfare is S^*_{PH}. If $w \in [w_{MH}(G_{PL}), w_{PH}(G_{MH}))$, either all type-$iL$ PCs and only one type-MH PC run or all type-iL PCs and only one type-PH PC run; the equilibrium welfare is either S^*_{MH} or S^*_{PH}. If $w \in [w_{PH}(G_{MH}), w_{MH}(G_{MH}))$, either all type-$iL$ and -MH PCs and only one type-PH PC run or all type-iL and only one type-PH PC run; the equilibrium welfare is S^*_{PH}. If $w \in [w_{MH}(G_{MH}), w_{PH}(G_{PH}))$, all type-$iL$ and -MH PCs and only one type-PH PC run; the equilibrium welfare is S^*_{PH}. If $w \geq w_{PH}(G_{PH})$, all PCs run.

B.3.2 Perfect Association between PSM and Skills: Case I

In Appendix B.1, we derive sufficient conditions under which a type-iH candidate wins the election with probability one. Here, we study the opposite case where low-skilled candidates are preferred by assuming that the following two conditions hold: (i) $G_{PL} > G_{MH}$ and (ii) the distribution of PCs takes the following form:

Table A1. Perfect Association between PSM and Skills: Case I

PSM level \ Skill level	Low skills	High skills	Total
Low PSM	0	$\lambda_{MH}C$	$\lambda_M C$
High PSM	$\lambda_{PL}C$	0	$\lambda_P C$
Total	$\lambda_L C$	$\lambda_H C$	C

We investigate the effect of w on the equilibrium welfare in this specific scenario. Note that the candidacy game takes place under complete information as the PSM level can be inferred from the observation of the skill level. We first remark that $S^*_{PL} > S^*_{MH}$ is equivalent to $N > 1 + (\Delta_{MH} - \Delta_{PL}) / (G_{PL} - G_{MH})$; this inequality is fulfilled under Assumption 1 when $G_{PL} > G_{MH}$; accordingly, a type-PL (-MH) politician can be referred to as the best (worst) politician. The election outcome is straightforward. All voters observe the skill level and infer the PSM level; since $G_{PL} > G_{MH}$, all voters except candidates prefer (high-motivated) low-skilled candidates over (low-motivated) high-skilled ones; each type-PL candidate wins with probability $(1/pl)$, where pl is the number of type-PL candidates, and each type-MH candidate wins with probability 0 when at least one type-PL PC runs.

There are five reservation pays that drive the candidacy choices of PCs: type-PL PCs ask for three different levels, $w_{PL}(G_{PL}) = \Delta_{PL} + G_{PL}$, $w_{PL}(G_{MH}) = \Delta_{PL} + G_{MH}$, and $w_{PL}(0) = [N/(N-1)]\Delta_{PL}$; type-$MH$ PCs ask for two different levels, $w_{MH}(G_{MH}) = \Delta_{MH} + G_{MH}$, and $w_{MH}(0) = [N/(N-1)]\Delta_{MH}$. We recall that (i) $G_{PL} > G_{MH} > 0$ and $\Delta_{MH} > \Delta_{PL}$ by virtue of (30); (ii) $w_{PL}(G_{MH}) > w_{PL}(0)$ is implied by $w_{MH}(G_{MH}) > w_{MH}(0)$, which is in turn fulfilled under Assumption 1, On this basis, four alternative rankings of the reservation pays arise:

$$w_{PL}(G_{PL}) > w_{MH}(G_{MH}) > w_{PL}(G_{MH}) > w_{MH}(0) > w_{PL}(0), \tag{58}$$

$$w_{MH}(G_{MH}) > w_{PL}(G_{PL}) > w_{PL}(G_{MH}) > w_{MH}(0) > w_{PL}(0), \tag{59}$$

$$w_{MH}(G_{MH}) > w_{PL}(G_{PL}) > w_{MH}(0) > w_{PL}(G_{MH}) > w_{PL}(0), \tag{60}$$

$$w_{MH}(G_{MH}) > w_{MH}(0) > w_{PL}(G_{PL}) > w_{PL}(G_{MH}) > w_{PL}(0). \tag{61}$$

The candidacy game NEs as a function of w and the resulting values of the equilibrium welfare are computed as follows.

Ranking (58): (i) if $w < w_{PL}(0)$, nobody runs and the equilibrium welfare is given by (32) after substituting $\lambda_{PH} = \lambda_{ML} = 0$; (ii) if $w_{PL}(0) \leq w < w_{MH}(0)$, just one type-$PL$ PC runs and the equilibrium welfare is maximized and equal to S^*_{PL}; (iii) if $w_{MH}(0) \leq w < w_{PL}(G_{MH})$, there are two NEs, either just one type-PL PC or just one type-MH PC runs, with the effect that the equilibrium welfare is either S^*_{PL} or S^*_{MH}; (iv) if $w_{PL}(G_{MH}) \leq w < w_{MH}(G_{MH})$, just one type-$PL$ PC runs, while type-MH PCs are indifferent as to whether to run or not, the equilibrium welfare is S^*_{PL}; (v) if $w_{MH}(G_{MH}) \leq w < w_{PL}(G_{PL})$, just one type-$PL$ PC and all type-MH PCs run, the equilibrium welfare is S^*_{PL}; (vi) if $w \geq w_{PL}(G_{PL})$, all PCs run and the equilibrium welfare is S^*_{PL}.

Ranking (59): (i) if $w < w_{PL}(0)$, nobody runs and the equilibrium welfare is given by (32); (ii) if $w_{PL}(0) \leq w < w_{MH}(0)$, just one type-$PL$ PC runs and the equilibrium welfare is S^*_{PL}; (iii) if $w_{MH}(0) \leq w < w_{PL}(G_{MH})$, there are two NEs, either just one type-PL PC or just one type-MH PC runs, with the effect that the equilibrium welfare is either S^*_{PL} or S^*_{MH}; (iv) if $w_{PL}(G_{MH}) \leq w < w_{PL}(G_{PL})$, just one type-$PL$ PC runs, while type-MH PCs are indifferent, the equilibrium welfare is S^*_{PL}; (v) if $w_{PL}(G_{PL}) \leq w < w_{MH}(G_{MH})$, all type-$PL$ PCs run, while type-MH PCs are indifferent, the equilibrium welfare is S^*_{PL}; (vi) if $w \geq w_{MH}(G_{MH})$, all PCs run and the equilibrium welfare is S^*_{PL}.

Ranking (60): (i) if $w < w_{PL}(0)$, nobody runs and the equilibrium welfare is given by (32); (ii) if $w_{PL}(0) \leq w < w_{MH}(0)$, just one type-$PL$ PC runs and the equilibrium welfare is S^*_{PL}; (iii) if $w_{MH}(0) \leq w < w_{PL}(G_{PL})$, just one type-$PL$ PC runs, while type-MH PCs are indifferent, the equilibrium welfare is S^*_{PL}; (iv) if $w_{PL}(G_{PL}) \leq w < w_{MH}(G_{MH})$, all type-$PL$ PCs run, while type-MH PCs are indifferent, the equilibrium welfare is S^*_{PL}; (v) if $w \geq w_{MH}(G_{MH})$, all PCs run and the equilibrium welfare is S^*_{PL}.

Ranking (61): (i) if $w < w_{PL}(0)$, nobody runs and the equilibrium welfare is given by (32); (ii) if $w_{PL}(0) \leq w < w_{PL}(G_{PL})$, just one type-$PL$ PC runs and the equilibrium welfare is S^*_{PL}; (iii) if $w_{PL}(G_{PL}) \leq w < w_{MH}(0)$, all type-$PL$ PCs run and the equilibrium welfare is S^*_{PL}; (iv) if $w_{MH}(0) \leq w < w_{MH}(G_{MH})$, all type-$PL$ PCs run, while type-MH PCs are indifferent, the equilibrium welfare is S^*_{PL}; (v) if $w \geq w_{MH}(G_{MH})$, all PCs run and the equilibrium welfare is S^*_{PL}.

B.3.3 Perfect Association between PSM and Skills: Case II

Dal Bó et al. (2013), henceforth DBFR, develop a continuous framework, where applicants for public sector positions have heterogeneous market ability, $\upsilon \in [0, \infty)$, and heterogeneous public service motivation (PSM), $\pi \in [0, \infty)$. The authors prove that a pay rise always increases both the average market ability and the average PSM of applicants attracted. This result, which contradicts Proposition 2, hinges upon the following hypotheses. The market ability is an increasing function of the PSM, $\upsilon = m(\pi)$, and the derivative of m is larger than one, $m'(\pi) > 1$: this is a specific form of perfect positive correlation between PSM and market ability. In addition, the reservation wage asked for by potential applicants is positively affected by $\upsilon = m(\pi)$ and negatively by π. Given that $m'(\pi) > 1$, the positive effect of $\upsilon = m(\pi)$ prevails over the negative one of π; as a consequence, the reservation wage of a more motivated (hence more able) applicant is larger than that of a less motivated (hence less able) applicant; the DBFR result follows.

In our discrete framework, perfect positive correlation between PSM and market ability is equivalent to the following case of perfect association between PSM and skills:

Table A2. Perfect Association between PSM and Skills: Case II

PSM level \ Skill level	Low skills	High skills	Total
Low PSM	$\lambda_{ML}C$	0	$\lambda_M C$
High PSM	0	$\lambda_{PH}C$	$\lambda_P C$
Total	$\lambda_L C$	$\lambda_H C$	C

We investigate the effect of w on the equilibrium welfare within this specific distribution of PCs. Note that the candidacy game takes place under complete information. For the sake of brevity, we just comment on the results, without reporting the complete proof, which is in the spirit of that in Appendix B.3.2. We first observe that $S^*_{PH} > S^*_{ML}$ by virtue of (22), so that a type-PH (-ML) politician can be defined as the best (worst) politician. The election outcome is straightforward. All voters except candidates observe the skill level and infer the PSM level; since $G_{PH} > G_{ML}$ by virtue of (15), each type-PH candidate is elected with probability $(1/ph)$, where ph is the number of type-PH candidates, whereas type-ML candidates are not elected when at least one type-PH PC runs. The PCs' candidacy choices are driven by the following five reservation pays: type-PH PCs ask for three different levels, $w_{PH}(G_{PH}) = \Delta_{PH} + G_{PH}$, $w_{PH}(G_{ML}) = \Delta_{PH} + G_{ML}$, and $w_{PH}(0) = [N/(N-1)]\,\Delta_{PH}$; type-$ML$ PCs ask for two different levels, $w_{ML}(G_{ML}) = \Delta_{ML} + G_{ML}$, and $w_{ML}(0) = [N/(N-1)]\,\Delta_{ML}$. Recalling that $G_{PH} > G_{ML} > 0$, seven alternative rankings of the reservation pays arise.

(a) When $\Delta_{PH} < \Delta_{ML}$, $w_{PH}(G_{ML}) > w_{PH}(0)$ is implied by $w_{ML}(G_{ML}) > w_{ML}(0)$, which is in turn equivalent to $N > 1 + \Delta_{ML}/G_{ML}$ and fulfilled under Assumption 1; we have

$$w_{PH}(G_{PH}) > w_{ML}(G_{ML}) > w_{PH}(G_{ML}) > w_{ML}(0) > w_{PH}(0), \tag{62}$$

$$w_{PH}(G_{PH}) > w_{ML}(G_{ML}) > w_{ML}(0) > w_{PH}(G_{ML}) > w_{PH}(0), \tag{63}$$

$$w_{ML}(G_{ML}) > w_{PH}(G_{PH}) > w_{PH}(G_{ML}) > w_{ML}(0) > w_{PH}(0), \tag{64}$$

$$w_{ML}(G_{ML}) > w_{PH}(G_{PH}) > w_{ML}(0) > w_{PH}(G_{ML}) > w_{PH}(0), \tag{65}$$

$$w_{ML}(G_{ML}) > w_{ML}(0) > w_{PH}(G_{PH}) > w_{PH}(G_{ML}) > w_{PH}(0). \tag{66}$$

Under the above five rankings, setting w at least as high as the lowest reservation pay, $w_{PH}(0)$, but below the second lowest one is sufficient to maximize the equilibrium welfare because one among the best (type-PH) PCs is attracted, while the worst (type-ML) PCs are excluded.

(b) When $\Delta_{PH} > \Delta_{ML}$, $w_{ML}(G_{ML}) > w_{ML}(0)$ is implied by $w_{PH}(G_{ML}) > w_{PH}(0)$, which is turn fulfilled under Assumption 1; we have

$$w_{PH}(G_{PH}) > w_{PH}(G_{ML}) > w_{PH}(0) > w_{ML}(G_{ML}) > w_{ML}(0), \tag{67}$$

$$w_{PH}(G_{PH}) > w_{PH}(G_{ML}) > w_{ML}(G_{ML}) > w_{PH}(0) > w_{ML}(0). \tag{68}$$

Inequality $\Delta_{PH} > \Delta_{ML}$ corresponds with $m'(\pi) > 1$ in DBFR because it ensures that more motivated more able PCs incur higher personal opportunity costs of entering politics than less motivated less able PCs. Under (67), the equilibrium welfare turns out to be increasing in w; this is in line with the DBFR result. Under (68), two NEs of the candidacy game arise when $w \in [w_{PH}(0), w_{ML}(G_{ML}))$: either just one type-$ML$ PC or just one type-PH PC runs; in the latter case, the resulting equilibrium welfare is equal to S^*_{PH}, whereas it falls to S^*_{ML} if the pay is raised to $w \in [w_{ML}(G_{ML}), w_{PH}(G_{ML}))$ as only type-ML PCs stand for election. This proves that the equilibrium welfare is maximized at a relatively low w and contradicts the DBFR result. The intuition is as follows. Ranking (67) is driven by the personal opportunity costs, while ranking (68) by the free-riding benefits; when the latter matter, type-PH PCs may prefer to enter at relatively low pays to avoid the risk that the public good is not provided.

Overall, our result that a relatively low level of w is sufficient to maximize welfare proves to be robust to any degree of association between PSM and skills: the two cases of perfect association described by Tables A1 and A2, and the general case described by Table 1 in the text. The only exception is given by ranking (67) and may be given by (68). Yet, (67) arises within an extremely specific subset of our framework, which requires two extra conditions besides the perfect association case described by Table A2: $\Delta_{PH} > \Delta_{ML}$ and $w_{PH}(0) > w_{ML}(G_{ML})$.

Interestingly, condition $\Delta_{PH} > \Delta_{ML} \Leftrightarrow M_H - M_L > P_{PH} - P_{ML}$ is less likely to hold in our framework compared to the DBFR framework. The reason is as follows. We assume that skills affect PCs' productivity both in the public and in the market sector. As a result, the RHS $P_{PH} - P_{ML}$ is enhanced not only by high PSM vis-à-vis low PSM but also by high skills vis-à-vis low skills. On the contrary, the RHS is "lower" in DBFR, where the positive effect of skills is overlooked because the individuals' utility in the public sector is influenced only by the motivation level.

Moreover, condition $w_{PH}(0) > w_{ML}(G_{ML}) \Leftrightarrow G_{ML} < (N/N-1)\Delta_{PH} - \Delta_{ML}$ is always fulfilled in the non-strategic DBFR framework once Δ_{PH} is assumed to be larger than Δ_{ML}, because the reservation pays depend only on the personal opportunity costs, i.e., the free-riding benefit G_{ML} is zero. By contrast, such condition may not be fulfilled in our framework because the reservation pays are also affected by the free-riding benefit; if this is the case, (68) rather than (67) is the relevant ranking and the DBFR result may not hold.

C Assumption 1

Threshold $\underline{N}$ is given by

$$\begin{aligned}\underline{N} = \max\Big\{&1 + \tfrac{\Delta_H - \Delta_L}{G_H - G_L}; 1 + \tfrac{\Delta_{iH} - \Delta_{iL}}{G_{iH} - G_{iL}}; 1 + \tfrac{\Delta_{MH} - \Delta_{PL}}{G_{PL} - G_{MH}}; 1 + \tfrac{\Delta_{ML}}{G_{ML}};\\ &1 + \tfrac{\Delta_{MH}}{G_{MH}}; 1 + \tfrac{\Delta_{PH}}{G_{ML}}; 1 + \tfrac{\Delta_{PH}}{E_L}; 1 + \tfrac{\Delta_{PL}}{E_L^P}\Big\}\end{aligned} \tag{69}$$

and derived by considering separately the benchmark and the general analysis.
Benchmark analysis. In the benchmark analysis, inequalities $S_H^* > S_L^*$, $S_L^* > S_0^*$ and $w_j(G_L) > w_j(0)$ are claimed to hold under Assumption 1. These inequalities can be rearranged as $N > 1 + (\Delta_H - \Delta_L) / (G_H - G_L)$, $N > 1 + \Delta_L / G_L$, and $N > 1 + \Delta_j / G_L$, respectively; recalling that $\Delta_H > \Delta_L$ and $G_H > G_L$, they are fulfilled when

$$N > 1 + \frac{\Delta_H - \Delta_L}{G_H - G_L}. \tag{70}$$

General analysis. In the general analysis, inequalities $S_{iH}^* > S_{iL}^*$, $S_{ML}^* > \underline{S}^*$, $w_{iH}(E_L) > w_{iH}(0)$, and $w_{iL}\left(E_L^i\right) > w_{iL}(0)$ are claimed to hold under Assumption 1. These inequalities can be rearranged as $N > 1 + (\Delta_{iH} - \Delta_{iL}) / (G_{iH} - G_{iL})$, $N > 1 + \Delta_{ML}/G_{ML}$, $N > 1 + \Delta_{iH}/E_L$, and $N > 1 + \Delta_{iL}/E_L^i$. In addition, in Appendices B.3.2 and B.3.3, we let $S_{PL}^* > S_{MH}^*$ (when $e_{PL}^* > e_{MH}^*$), $w_{MH}(G_{MH}) > w_{MH}(0)$, and $w_{PH}(G_{ML}) > w_{PH}(0)$, that can be rearranged as $N > 1 + (\Delta_{MH} - \Delta_{PL}) / (G_{PL} - G_{MH})$, $N > 1 + \Delta_{MH}/G_{MH}$, and $N > 1 + \Delta_{PH}/G_{ML}$. Recalling that $\Delta_{iH} > \Delta_{iL}$, $\Delta_{Pj} > \Delta_{Mj}$, $E_L^M > E_L > E_L^P$, and $E_L^M > G_{ML}$, the above inequalities are fulfilled when

$$\begin{aligned} N > \max \Big\{ & 1 + \tfrac{\Delta_{iH} - \Delta_{iL}}{G_{iH} - G_{iL}}; 1 + \tfrac{\Delta_{MH} - \Delta_{PL}}{G_{PL} - G_{MH}}; 1 + \tfrac{\Delta_{ML}}{G_{ML}}; 1 + \tfrac{\Delta_{PH}}{E_L}; \\ & 1 + \tfrac{\Delta_{MH}}{G_{MH}}; 1 + \tfrac{\Delta_{PH}}{G_{ML}}; 1 + \tfrac{\Delta_{PL}}{E_L^P} \Big\}. \end{aligned} \tag{71}$$

Overall, if Assumption 1 holds, i.e., if N is larger than $\underline{N}$ in (69), both (70) and (71) are fulfilled.

References

[1] Ashraf, N., O. Bandiera and S.S. Lee 2016 Do-gooders and go-getters: Career incentives, selection, and performance in public service delivery *IGC Working Paper* S-89236-ZMB-X

[2] Banuri, S. and P. Keefer 2016 Pro-social motivation, effort and the call to public service *European Economic Review* 83, 139-164

[3] Barigozzi, F. and G. Turati 2012 Human health care and selection effects. Understanding labor supply in the market for nursing *Health Economics* 21(4), 477-483

[4] Barigozzi, F. and N. Burani 2016 Screening workers for ability and motivation *Oxford Economic Papers* 68(2), 627-650

[5] Barigozzi, F., N. Burani and D. Raggi 2017 Productivity Crowding-out in Labor Markets with Motivated Workers *Mimeo, University of Bologna*

[6] Beniers, K.J. and R. Dur 2007 Politicians' motivation, political culture, and electoral competition *International Tax and Public Finance* 14, 29-54

[7] Besley, T. 2004 Paying Politicians: Theory and Evidence *Journal of the European Economic Association* 1, 193-215

[8] Besley, T. 2005 Political Selection *Journal of Economic Perspectives* 19(3), 43-60

[9] Besley, T., T. Persson and D. M. Sturm. 2010. Political competition, policy and growth: theory and evidence from the US *Review of Economic Studies* 77(4), 1329-1352

[10] Besley, T., J. G. Montalvo and M. Reynal-Querol 2011 Do Educated Leaders Matter? *The Economic Journal* 121(554), F205-227

[11] Besley, T., T. Persson and M. Reynal-Querol 2016 Resilient Leaders and Institutional Reform: Theory and Evidence *Economica* 83(332), 584-623

[12] Brändle, T. 2015 Does Remuneration Affect the Discipline and the Selection of Politicians? Evidence from pay harmonization in the European Parliament *Public Choice* 162, 1-24

[13] Brändle, T. 2016, Do Institutions Affect Citizens' Selection into Politics? *Journal of Economic Surveys* 30(2), 205-227

[14] Caselli, F. and M. Morelli 2001 Bad Politicians *NBER Working Paper* 8532

[15] Caselli, F. and M. Morelli 2004 Bad Politicians *Journal of Public Economics* 88, 759-782

[16] Cerina, F. and L. G. Deidda 2017 Rewards from public office and the selection of politicians by parties *European Journal of Political Economy* 47, 1-18

[17] Dal Bó, E., F. Finan, and M. A. Rossi 2013 Strenghtening State Capabilities: the Role of Financial Incentives in the Call to Public Service *Quarterly Journal of Economics* 128(3), 1169-1218

[18] Delfgaauw, J. and R. Dur 2007 Signaling and screening of workers' motivation *Journal of Economic Behavior & Organization* 62(4), 605-624

[19] Delfgaauw, J. and R. Dur 2010 Managerial Talent, Motivation, and Self-selection into Public Management *Journal of Public Economics* 94, 654-660

[20] Deserranno, E. 2017 Financial Incentives as Signals: Experimental Evidence from the Recruitment of Village Promoters in Uganda *Mimeo*, *Northwestern University*

[21] Dogan, M. K. 2010 Transparency and political moral hazard *Public Choice* 142, 215-235

[22] Fedele, A. and P. Giannoccolo 2013 Moneycracy *Working Paper 893/2013, Department of Economics, University of Bologna* and *BEMPS Working Paper* 07/2013

[23] Fedele, A. and P. Naticchioni 2016 Moonlighting Politicians: Motivation Matters! *German Economic Review* 17(2), 127-156

[24] Ferraz, C. and F. Finan 2009 Motivating Politicians: the Impacts of Monetary Incentives on Quality and Performance *NBER Working Paper* 14906

[25] Fisman, R., N. A. Harmon, E. Kamenica, and I. Munk 2015 Labor Supply of Politicians *Journal of the European Economic Association* 13, 871-905

[26] Francois P. 2000 "Public service motivation" as an argument for government provision *Journal of Public Economics* 78, 275-299

[27] Gagliarducci, S. and T. Nannicini 2013 Do Better Paid Politicians Perform Better? Disentangling Incentives from Selection *Journal of the European Economic Association* 11(2), 369-398

[28] Gersbach, H. 2003 Incentives and Elections for Politicians and the Down-up Problem, in: Murat R. Sertel and Semih Koray (eds.), *Advances in Economic Design, Studies in Economic Design*, Springer

[29] Gersbach, H. and M. Müller 2010 Flexible pensions for politicians *Public Choice* 145, 103-124

[30] Handy, F. and E. Katz 1998 The Wage Differential between Non-profit Institutions and Corporations: Getting More by Paying Less? *Journal of Comparative Economics* 26(2), 246-261

[31] Heyes, A. G. 2005 The economics of vocation or 'why is a badly paid nurse a good nurse'? *Journal of Health Economics* 24, 561-569

[32] Jones, B. and B. Olken 2005 Do Leaders Matter? National Leadership and Growth since World War II *Quarterly Journal of Economics* 120(3), 835-864

[33] Kotakorpi, K. and P. Poutvaara 2011 Pay for politicians and candidate selection: An empirical analysis *Journal of Public Economics* 95, 877-885

[34] Mattozzi, A. and A. Merlo 2008 Political careers or career politicians? *Journal of Public Economics* 92(3-4), 597-608

[35] Messner, M. and M. Polborn 2004 Paying Politicians *Journal of Public Economics* 88, 2423–2445

[36] Naff , K. C. and J. Crum 1999 Working for America: Does Public Service Motivation Make a Difference? *Review of Public Personnel Administration* 19(3), 5-16

[37] Perry, J. L. and L. R. Wise 1990 The Motivational Bases of Public Service Public Administration Review 50(3), 367-373

[38] Piqué, R. 2015 Higher Pay, Worse Outcomes? The Impact of Mayoral Wages on Local Government Quality in Peru *Mimeo*, *Northwestern University*

[39] Poutvaara, P. and T. Takalo 2007 Candidate Quality *International Tax and Public Finance* 14, 7-27

[40] Rainey, H. G. and P. Steinbauer 1999 Galloping elephants: Developing elements of a theory of effective government organizations *Journal of Public Administration Research and Theory* 9(1), 1-32

[41] Rose-Ackerman S. 1996 Altruism, Nonprofits and Economic Theory *Journal of Economic Literature* 34, 701-728

[42] Smart, M. and D. Sturm 2004 Paying politicians: Is more always better? *Mimeo, University of Munich*

[43] Vandenabeele, W. 2009 The Mediating Effect of Job Satisfaction and Organizational Commitment on Self-Reported Performance: More Robust Evidence of the PSM–Performance Relationship *International Review of Administrative Sciences* 75(1), 53-78