Candidate Entry, Screening, and the Political Budget Cycle

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Candidate Entry, Screening, and the Political Budget Cycle[*]

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Abstract

We investigate whether relevant private information about citizens' competence in political office can be credibly revealed by their entry and campaign expenditure decisions, as opposed to choice of policy once in office. We find that this depends on whether voters and candidates have *common* or *conflicting* interests; only in the former case can entry be revealing in equilibrium. We apply these results to Rogoff's (1990) model of the political budget cycle, allowing for candidate entry, as well as elections: as interests are common, low-ability candidates are screened out at the entry stage, and so there is no signaling via fiscal policy (i.e. no "political budget cycle"). In a variant of the Rogoff model where citizens differ in honesty, rather than ability, interests are conflicting, and so the political budget cycle can persist in equilibrium.

KEYWORDS: Asymmetric Information, Citizen-Candidate, Representative Democracy, Signaling Games, Political Budget Cycles.

JEL CLASSIFICATION NUMBERS: D72, D78, D82, E82, E62, H60.

1. Introduction

One of the main themes of the political economy literature is that policy-makers may be better informed than voters are about factors that affect their performance in office: ability, effort, honesty, the cost of producing public goods, etc. This asymmetric information gives rise to problems of both adverse selection and moral hazard. For example, low-ability candidates may be elected to office, and once there, may slack, or use the powers of office for personal enrichment (extreme cases might include presidents Marcos of the Philippines and Mobutu of Zaire, and to a lesser degree, Prime Minister Berlusconi in Italy,[1] although on a smaller scale, the problem is endemic, as the recent "cash for questions" scandal in the UK Parliament illustrates[2]).

However, elections provide a mechanism[3] for controlling these adverse selection and moral hazard problems arising from incomplete information. In particular, elections allow: (i) voters to replace "bad" office-holders with good ones (the *selection effect*); (ii) office-holders to signal or conceal information via choice of policy (the *incentive effect*). In the last two decades, a formal literature has grown showing how selection and incentive effects work in particular settings.

First, there are a class of pure adverse selection models where potential office-holders differ only in ability. The seminal contributions here are Rogoff and Sibert (1988), Rogoff (1990), and more recent work includes Harrington (1993), Hess and Orphanides (1995), Bartolini and Drazen (1997), and Drazen (2000b). Rogoff's work showed how selection and incentive effects interact: in his models, ability is signalled through policy in equilibrium (the "political budget cycle"), and thus voters condition their strategies on the performance of politicians while in office.

A second class of models, initiated by Barro (1973), and Ferejohn (1986) are *pure moral hazard models,* where office-holders have a cost of effort, and voters prefer higher effort. Here, only the incentive effect is present in equilibrium, and then only if voters can coordinate their behavior, as *ex post*, voters are indifferent between the incumbent and identical possible replacements. In the *mixed moral hazard, adverse selection* models studied by Austen-Smith and Banks (1989), Banks and Sundaram (1993,1998), and Besley and Case (1995), office-holders choose an unobservable effort, and may be of different ability.[4] Now voters will fire low-performing office-holders even without coordination, as

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[1] An Italian-Swiss accord, currently passing through Italian Parliament, will have the effect of rendering inadmissible evidence in two cases of alleged bribery of judges, in which Mr. Berlusconi is involved (*The Economist*, 29th September, 2001).

[2] "Sir Gordon Downeys' report into the cash-for-questions affair found compelling evidence that Neil Hamilton, a former Tory minister, took cash" from a lobbyist. (*The Economist*, July 3rd 1997).

[3] Nevertheless, elections are suboptimal for two reasons: first, re-election is a crude way of rewarding performance relative to, for instance, performance-related pay, and second, voters cannot credibly commit ex ante, i.e. before incumbents choose policy, and this limits their ability to punish poor performance by incumbents.

[4] A related class of models have office-holders that differ in honesty and can steal tax revenues without

such office-holders reveal themselves to be low-ability.

However, in our view, all this literature suffers from the serious problem that the incumbent office-holder and the agent who challenges the incumbent are assumed to be *randomly drawn* from some population; there is no candidate entry stage. To put it another way, although these models claim to model the interaction between the economy and the political process, they do so incompletely: elections are modelled, but the decisions by citizens to contest these elections (candidate entry) are *not* modelled. This paper attempts to "complete the model" of the political process by modelling candidate entry explicitly, and analyzes the implications of doing so for the "political budget cycle".

Our analysis is in two stages. First, we analyze a one-period model with candidate entry, voting, and policy choice where candidates have private information. Policy choice here plays no informational role as the game is one-shot. Specifically, we suppose that at the beginning of every period, there is a candidate entry stage, where any citizen can stand for election. At the entry stage, candidates can also decide how much to spend contesting the election; so we endogenize the cost of entry, assumed fixed in Besley and Coate (1997). Elections then take place via plurality rule, and the winner becomes policy-maker for that period. Candidates are privately informed about their ability (or other relevant characteristics) prior to entry.[5]

The question we address is whether candidate entry decisions can reveal relevant information about candidates to the electorate in equilibrium. To put some structure on this problem, we assume initially[6] that potential candidates may be of two types, high ability and low ability when in office. All citizens - including the office-holders - get a higher payoff from policy if the office-holder is high ability. However, the office-holders may also get *rents* from holding office, which are ego-rents, plus financial benefits of various kinds (Persson and Tabellini, 2000). These rents may differ by ability type.

It turns out that the answer to our question depends on whether the preferences of voters and candidates are *congruent,*[7] in the sense that high-ability citizens have a greater incentive to seek office than low-ability citizens. Congruent preferences arise, for example, in Rogoff's (1990) model, where candidates for office only differ in ability; both types have the same ego-rent from office. Non-congruence will typically arise where there is an agency problem[8] between office-holder and citizens (Coate and Morris, 1995; Persson

and Tabellini, 2000), in which case dishonest candidates may have a greater incentive to gain office.

Our key insight is the following: free candidate entry acts as a device to screen out candidates who have low-ability in office *if and only if preferences are congruent.* Specifically, with congruent preferences, the only perfect Bayesian equilibrium of our one-period model that is stable (in the sense that it satisfies the Cho-Kreps Intuitive Criterion) is a separating one, where only high-ability candidates enter and spend the minimum amount consistent with separation. On the other hand, with non-congruent preferences, a separating equilibrium does not even exist! So, any equilibrium must be pooling, i.e. candidates are not screened by entry.

The intuition for non-existence of separating equilibrium in the non-congruent case is simple. If there were one, it would be one where only low-ability candidates enter, as by definition, they value office more than high-ability candidates, and where all low-ability candidates spend some amount δ. But then, any candidate can deviate by spending less than δ on campaigning without harming his reputation, as the voters already (correctly) believe the worst about the candidates. So, in equilibrium, campaign spending is driven down to a level where it also pays the high-ability candidates with lower rents from office to enter, i.e. pooling occurs.

We then apply these results to Rogoff's well-known model of the political budget cycle. Specifically, we analyze a two-period version of his model, with elections in both periods, preceded by candidate entry in both periods. We find that the only stable perfect Bayesian equilibrium is separating at the entry stage of the first election; only high ability candidates stand for office. In this case, of course the incumbent in the first period does not have to signal his ability, and so there will be no distortion in policy in the first period, i.e. no "political budget cycle". The outcome is in fact first-best efficient. The reason is that, as remarked above, the Rogoff model has congruent preferences between office-holder and voters.

We then study a different version of the Rogoff model, where candidates have an opportunity to divert tax revenues to their own personal benefit, and differ not in ability, but honesty. In this case, we show that there is always an equilibrium with pooling at the entry stage in the first period, and separation at the stage of policy choice, i.e. in this equilibrium the honest type has to signal his type through policy once in office, not at the entry stage.

Overall, our conclusion is that; (i) with congruent preferences, compared to the benchmark of exogenous candidate selection, free entry of candidates mitigates the political budget cycle; while (ii) with non-congruent preferences, representative democracy leads to the same pattern of policy choice as with exogenous candidate selection.

Finally, these conclusions are, in principle, testable. Our claim is that the political budget cycle is smaller, *ceteris paribus*, when the degree of congruence between office-holders

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and the electorate is high. Moreover, (non)-congruence could be proxied empirically by measures of the rents from holding office. Interestingly, recent empirical studies do support this prediction. For instance, Shi and Svensson (2001) in an empirical investigation (of 123 countries over 21 years) that fits our theoretical modelling, find that political budget cycles are positively related to a proxy for the rents from holding office.[9]

Our results are also related to two other literatures.[10] First, the one-period model we investigate in this paper can be seen as an extension of both the Besley and Coate (1997, 1998) and the Osborne and Slivinski (1996) models of representative democracy to a more general information structure, as both of these models assume that there is *full information* on preferences and ability of citizens.

Second, this paper is a contribution to the broader debate about the efficiency of democracy (Wittman, 1989; Coate and Morris, 1995; and Persson and Tabellini, 2000). For example, Wittman adopts the sanguine view that electoral competition will mitigate both problems of asymmetric information between voters and politicians, and agency problems (shirking, corruption, etc.). By contrast, in a well-known formal model, Coate and Morris (1995) show that in order to maintain a good reputation, dishonest politicians may make inefficient transfers to special interests. This paper shows that free entry will reduce problems of asymmetric information between voters and politicians, but only when agency problems are relatively minor, in that politicians and voters have similar interests.

The layout of the rest of the paper is as follows. Section 2 gives a brief overview of the US electoral system in relation to candidate entry. In Section 3, we construct a simple model to analyze the screening effect of endogenous costly candidate entry. In Section 4, we briefly present a simplified version of Rogoff's model, and in Section 5, we introduce endogenous candidate entry. Section 6 studies a version of Rogoff's model with agency costs. Finally, Section 7 concludes.

2. Candidate Entry in the United States

We now briefly describe some salient features of candidate entry in the US political system. The following quote from Maidment and McGrew (1991) gives an overview:

> "To a considerable extent, candidates have replaced parties as the central influence in political campaigns. Candidates have become the principal actors

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[9]Specifically, they proxy rents from office using the indicators from the International Country Risk Guide. This guide provides a measure of rent-seeking and protection of property rights and includes factors such as the "rule of law", "corruption in government", "quality of the bureaucracy", and "risk of expropriation of private investment".

[10]Our one-period model is also related to a small literature on campaign expenditures as signaling devices (Austen-Smith, 1987; Prat, 1997 and 2000). In particular, our "money burning" role of campaign expenditures is similar to Prat's, although our model is much less sophisticated (no lobbies, candidates are independently wealthy).

in the electoral process. Their abilities and personalities are now critically important factors in any American election. When they enter a Primary election, they must, if they wish to succeed, create their own campaign organization, they must raise the campaign finance through their own efforts and recruit volunteers on the back of their own enthusiasm. [...] Candidates construct personal campaign organizations designed for their own electoral success. [...] Of course, after the victory in the primary election, the candidate becomes the official party nominee, though in a very real sense the nomination is merely a label. The nominees still have to rely on their own resources and organization."
(p. 128).

A first stylized fact is that political parties now have, in many cases, limited control of choice of candidate. Candidates for Gubernatorial, Congressional and Presidential elections are now mostly selected through a primary. In most states, a candidate can run in the primary simply by making a statement of affiliation to the appropriate party, so parties cannot prevent willing candidates from running even if their ideology differs from the party line.[11] In some States (e.g. California) parties are even prohibited by law from endorsing a candidate in the primaries.

A second stylized fact is that contesting elections is costly and becoming even more so.[12] First, candidates must raise funds by themselves to run for the primary. Once a candidate receives party nomination, party funding can then be used to finance part[13] of the campaign (although the campaign finance is still very much the responsibility of the candidate). The implication is that candidates must be skilled in fund-raising or independently wealthy. For example, George W. Bush's contested primary campaign for the Republican Presidential nomination is estimated to have cost around $100m, which he had to raise independently of the Republican party.

A third stylized fact is that information about funds raised for campaign spending are in the public domain, as candidates must file pre-election financial reports, e.g. with the Federal Election Commission in the case of federal elections. The FEC makes this

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[11] For instance, in 1980, a member of the Ku-Klux-Klan won the Democratic Party nomination for a seat in the House of Representatives (Bowles, 1998).

[12] For example, in the 2000 Federal elections, the average winning House campaign cost $636,000, or $4.90 per vote. Winning Senate campaigns averaged $5.6 million, or $6.07 per vote.

[13] For Presidential elections, a large part of the (tightly regulated) financing comes from public funding (following the Federal Election Campaign Finance (FECA) laws of the 1970s and Nixon's Watergate scandal). By contrast, Congressional campaigns are relatively unrestricted: Congressional candidates are permitted to raise as much funds as they can, and to spend as much as they raise. Parties' direct contributions to candidates' campaign for election to the House and Senate are limited by law ($5,000 per candidate in each election cycle for the House, and $17,500 per candidate in each cycle for the Senate). However, besides this direct support, parties can (and do) add "hard" and "soft" money to favor nominated party candidates. The use of soft money (which cannot be used for "express advocacy") is expanding rapidly. See Bowles (1998) for more details.

information immediately available on its web site. Moreover, the media reports widely on funds raised prior to congressional and other elections.[14]

3. Signaling via Candidate Entry

Here, we develop our main arguments in the form of a simple one-period model, which is designed to capture some of the stylized facts of the US system described above. The economy is populated by a set of citizens $i \in N$, $\#N = n \geq 3$. Only one citizen can be office-holder, and the office-holder makes a policy choice. Citizens in a subset $K \subset N$ are of two[15] types: high-ability in office (H) and low-ability in office (L). Citizens not in K are unsuitable for office. We assume that preferences over policy choice are identical: the choice of a type a office-holder results in a payoff W_a for *all* citizens, with $W_H > W_L > 0$. An office-holder of type a also gets an additional payoff of R_a from holding office. This may be interpreted as an ego-rent (as in Rogoff and Sibert, 1988). Alternatively, it may reflect the ability of the office-holder to divert resources to his own pocket (See Section 5 below). Campaign expenditures are subtracted from candidates' payoffs.[16]

We will say that the preferences of citizens and the office-holder are *congruent* if $R_H + W_H > R_L + W_L$, and *non-congruent* if $R_H + W_H < R_L + W_L$. So, congruence simply means that a candidate that is more preferred by voters also has a greater incentive to try and win office. It turns out that this distinction is key to whether candidate entry can screen candidates.

We will assume that a citizen of either type always prefers to hold office in place of someone else:

A1. $\min\{R_H + W_H, R_L + W_L\} > \max\{W_H, W_L\}$.

The order of events is as follows.

1. Each citizen i privately observes his own ability a, which is a random draw from $\{H, L\}$ with $\Pr(a = H) \equiv \rho$.

2. All citizens i in K can simultaneously decide whether to enter (stand for election) or not, and if they enter, how much they will spend.

3. Having observed decisions at stage 2, all citizens in N then vote simultaneously for a single candidate, and the winner is selected by plurality rule. Ties are broken fairly.[17]

4. The winner is then office-holder and chooses policy.

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[14]See e.g. "Battling to Keep Majority, the G.O.P. Spreads Cash Around", *New York Times*, October 26, 2000, or "Fund-Raising Feats a Mixed bag for Davis", *Los Angeles Times*, July 31, 2001.

[15]The extension to many types is discussed in Section 6.1 below.

[16]This assumes that all candidates have the same marginal utility of money (which may not be the case, e.g. if some candidates are wealthy). This assumption is relaxed in Section 6.2 below.

[17]That is, if k candidates get equal most numbers of votes, each is selected for office with probability $1/k$.

In the event that nobody stands for election, a *default policy* is selected by the constitution, and we assume that in this event, all citizens have a zero payoff.

This describes a game played between the set N of citizens. It is a game with sequential moves and incomplete information, and our equilibrium concept is perfect Bayesian. Although simple to describe, the game has a complex structure, and it is helpful to formalize stages 2 and 3 somewhat.

At stage 2, all $i \in K$ take an action $s_i \in S_i$, where $S_i = \{0\} \cup \{(1, \delta) \,|\, \underline{\delta} \le \delta < \infty \}$, where 0 denotes no entry, and 1 denotes entry, and δ denotes campaign spending[18] given entry. The minimum level $\underline{\delta}$ of spending will be determined by minimal fixed costs of campaign organization, plus legislative restrictions. In practice, in the US, these minimal costs are very small, and so we set $\underline{\delta} = 0$; the implications of a positive $\underline{\delta}$ are discussed in Section 6.3 below. So, an *entry strategy* at stage 2 for $i \in K$ is a map: $e_i : \{H, L\} \to S_i$.

Now define $C = \{i \in K \,|\, s_i \neq 0\}$ to be the set of candidates who stand for election. At stage 3, a pure action for a voter $i \in N$ is a choice of an element of C. In some equilibria, voters will be indifferent between candidates in (subsets of) C. To break these ties in a neutral manner, we will allow voters to randomize over C; let the set of probability distributions on C be $\Delta(C)$. Then, a *voting strategy* for $i \notin K$ is a map v_i from every possible $\mathsf{s} = (s_1, ..., s_n)$ to $\Delta(C)$. A voting strategy for $i \in K$ is defined in the same way, except that $i \in K$ can also condition his vote on his private information about his type.[19] We now solve the game backwards in the usual way.

3.1. Voting

The first step in the analysis is to formalize beliefs of voters about the ability of candidates, given observed entry decisions. Beliefs can be described by the maps $\pi_i : K \times \mathsf{S} \to [0, 1]$, $i \in N$, where $\pi_i(j, \mathsf{s})$ is the probability assessment on the part of i that candidate $j \in K$, $j \neq i$ is high-ability, given entry decisions $\mathsf{s} = (s_1, ..., s_n)$. Obviously, on the equilibrium path, these beliefs are given by Bayes' rule. Also, by the fact that agents observe their own type, $\pi_i(i, \mathsf{s}) = 1$ if i is type H and zero otherwise.

We impose the following very weak assumption on beliefs at the voting stage;

A2. $\pi_j(i, \mathsf{s}) = \pi_k(i, \mathsf{s})$ all $i \in K$, $j, k \in N$, $\mathsf{s} \in \mathsf{S}$, $k \neq j \neq i$

That is, any two citizens have the same posterior belief about the ability of a third, given the same information. This is certainly true on the equilibrium path, as any two agents have the same prior beliefs about a third, and so it seems natural to impose it also off the equilibrium path. Given A2, we can simplify our notation to $\pi_j(i, \mathsf{s}) = \pi(i, \mathsf{s})$, $j \neq i$.

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[18]Note that here, campaign spending plays no *direct* informational role (e.g. funding advertising, etc): it is purely a signaling device.

[19]Formally, these maps are: $v_i : \mathsf{S} \to \Delta(C)$, $i \notin K$, $v_i : \{H, L\} \times \mathsf{S} \to \Delta(C)$, $i \in K$, where $\mathsf{S} = \times_{i \in K} S_i$.

Also, let $\boldsymbol{\pi}(.) = (\pi(i,.))_{i \in K}$ be a *belief profile*.[20]

Now we can turn to the analysis of the voting subgame. A voter is said to vote *sincerely* if he votes for (one of) his most preferred alternatives. By A1, for any $i \in C$, i's most preferred alternative is that he gains office himself, so the only sincere voting strategy for i is to vote for himself. Now let

$$B(C) = \{j \in C \, | \, \pi(j, \mathsf{s}) \geq \pi(k, \mathsf{s}), \; k \in C \} \tag{3.1}$$

So, $B(C)$ is the subset of candidates who are most preferred by all voters who are not themselves candidates. Therefore, a (pure) sincere voting strategy for $i \notin C$ is a choice of an element of $B(C)$.

The following result[21] tells us that the following sincere voting strategies constitute an undominated Nash equilibrium of the voting continuation game (i.e. a voting equilibrium in the terminology of Besley and Coate (1997)):

Lemma 0. *Assume $k < n-1$. Conditional on any fixed belief profile $\boldsymbol{\pi}(.)$, and first-period actions s, the following sincere voting strategies $v_1^*, ..., v_n^*$ constitute an undominated Nash equilibrium of the voting subgame:*

1. *All $j \notin C$ vote for each candidate in $B(C)$ with probability $1/\#B(C)$*
2. *All $j \in C$ vote for themselves.*

The equilibrium outcome is that every $i \in B(C)$ wins with probability $1/\#B(C)$.

In general, plurality voting games have many equilibria,[22] (Dhillon and Lockwood, 2000), and this game is no exception. However, sincere voting equilibria (if they exist) have a natural appeal, and for this reason, we will assume throughout that this is the equilibrium of the voting subgame. We are also following Osborne and Slivinski (1996) in making this equilibrium selection.

Now suppose that $i \in C/B(C)$. If i withdraws (i.e. decides not to stand for election), it is clear from Lemma 0 that the outcome of the election is unchanged. So, the net gain to i from withdrawing is δ. So, entering in the first place cannot be an equilibrium strategy. This contradiction implies that in equilibrium, $C = B(C)$. The next, very useful, result then follows immediately from this fact, and Lemma 0:

Lemma 1. *Given the voting equilibrium described in Lemma 0, every $i \in C$ wins the election with probability $1/c$.*

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[20] Formally, a belief profile is a mapping $\boldsymbol{\pi} : K \times \mathsf{S} \to [0, 1]$.

[21] This result is proved in the Appendix, as are all others where a proof is required.

[22] For example, the voting strategy profile where everybody votes for the entrant with the lowest value of the index i is an equilibrium.

3.2. Entry

Following Besley and Coate (1997), define a *political equilibrium* to be an equilibrium $e^* = (e_1^*, ..., e_k^*)$ at the entry stage, given sincere equilibria (as described by Lemma 0) in all the voting subgames induced by e^*. Say that entry strategies are *anonymous* if all potential candidates behave alike, conditional on their information $e_i = e$, all $i \in K$. We will only consider political equilibria in anonymous entry strategies (the basic insights generalize to the case where strategies are non-anonymous in equilibrium). Note that there are two types of anonymous entry strategies: *pooling*, where $i \in K$ stands for election (or does not stand) whatever his ability type, second, *separating*, where $i \in K$ only stands if he is high-type (or low-type). Note also that the voting strategies described in Lemma 0 are anonymous,[23] given that citizens in K follow anonymous entry strategies. At this stage, we need to separate out the analysis of congruent and non-congruent preferences.

Congruent Preferences

As a first step, it is convenient to calculate the following probabilities. First, in the pooling equilibrium, by Lemma 1, every $i \in K$ will be elected with probability $1/k$, and the probability that nobody enters is obviously zero. The corresponding probabilities in the separating case can be calculated as follows. Let x be distributed Binomially with parameters $\rho, k-1$: this random variable is the number of entrants other than $i \in K$, if all citizens in K follow the separating strategy of only entering if they are high type. Also, let $\mu = E\left[\frac{1}{x+1}\right]$, and $\lambda = Pr(x=0) = 1 - (1-\rho)^{k-1}$. Here, μ is the expected probability that any $i \in K$ will be elected to office given that he enters and all $j \in K$, $j \neq i$ follow equilibrium separating strategies, and λ is the probability that nobody will enter, given that $i \in K$ does not enter. Armed with these definitions, we then have:

Proposition 1. *Assume $k < n-1$. Then, there exist belief profiles for which an anonymous pooling (political) equilibrium exists, where every $i \in K$ enters with probability 1, and spends some $0 \leq \hat{\delta} \leq \delta_p$, where $\delta_p = \frac{1}{k}\left[R_L - \rho(W_H - W_L)\right]$. Also, there exist belief profiles for which an anonymous separating equilibrium exists where every $i \in K$ enters only if he is a high type, and spends $\underline{\delta}_s \leq \hat{\delta} \leq \overline{\delta}_s$, where $\overline{\delta}_s = \lambda W_H + \mu R_H$, $\underline{\delta}_s = \mu\left[R_L - (W_H - W_L)\right] + \lambda W_H$. There are no other anonymous equilibria.*

The range of possible values of $\hat{\delta}$ in the two equilibria are shown in Figure 1 below.[24] Note two points. First, there cannot be separating equilibria where only low-ability types enter. This is because - from Lemma 1 - all entrants win with probability $1/c$, and also high-ability types get a bigger payoff from winning.

Figure 1 in here

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[23] To see this, note that all entrants are following the same strategy, $\pi(i, s) = \pi(j, s)$, all $i, j \in C$, so then $B(C) = C$. But then, all voters not in C randomize over C, and all voters in C vote for themselves.

[24] Note that for $\rho \simeq 1$, $\delta_p < \underline{\delta}_s$, as $k > E[x+1]$. This is the case shown on the diagram.

Second, there is a range of campaign spending levels in both pooling and separating equilibria: as the proof of Proposition 1 shows, the belief profiles that support these equilibria "punish" non-equilibrium behavior; if some citizen decides to deviate by spending $\delta' \neq \hat{\delta}$, all other citizens assign probability 0 to the event that he is high-ability, and so will not vote for him.

Non-Congruent Preferences

In this case, the probabilities μ, λ are defined as follows. Let x be distributed Binomially with parameters $1 - \rho, k - 1$; again, x is the random number of entrants other than $i \in K$ if all other $j \in K$ follow the separating strategy of only entering if they are low-ability. Then, $\mu = E[\frac{1}{x+1}]$, and $\lambda = 1 - \rho^{k-1}$.

Proposition 2. *Assume $k < n - 1$. Then, there exist belief profiles for which an anonymous pooling (political) equilibrium exists, where every $i \in K$ enters with probability 1, and spends some $0 \leq \hat{\delta} \leq \delta_p$, where $\delta_p = \frac{1}{k}[R_H + (1 - \rho)(W_H - W_L)]$. There are no other anonymous equilibria: in particular, there exist no belief profiles for which a separating equilibrium exists.*

The result is illustrated in Figure 2 below.

Figure 2 in here

Here, the key result is that there is *no separating equilibrium.* The intuition is simple. If there were, it would be one where only low-ability candidates enter, as by definition, they value office more than high-ability candidates. So, suppose that there were such an equilibrium, where all entrants spent $\hat{\delta}$ on campaigning. Then, by Bayes' rule, voters assign probability one to the event that any $i \in C$ who spends $\hat{\delta}$ is low-ability. But then, any $i \in C$ can deviate by spending less on campaigning (i.e. choose some $\delta' < \hat{\delta}$), without lowering the voters' probability belief that i is high-ability, as it is *already* zero! So as long as $\hat{\delta} > 0$, $i \in C$ can deviate by spending less on campaigning without lowering the probability that he gets elected, given that voters vote sincerely. Such a deviation must be profitable and consequently, the equilibrium $\hat{\delta}$ must be zero. But for $\hat{\delta}$ low enough (below some $\underline{\delta}_s$ as defined in the proof of Proposition 2) it becomes also profitable for high-ability candidates to stand for office, in which case the equilibrium cannot be separating.

3.3. Equilibrium Selection via Stability

Propositions 1 and 2 indicate that in both cases, there are multiple equilibria, and moreover, in the congruent case, there may be both pooling and separating equilibria. We show here that requiring equilibrium to satisfy a version of the Cho-Kreps Intuitive Criterion (IC) in fact rules out all equilibria except one in each case, giving us a unique equilibrium selection.

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First, we adapt the formal definition of the IC to our game, which has many "senders" and "receivers", and where we are assuming a particular play (conditional on beliefs) at the voting stage. Fix an equilibrium (which may be separating or pooling in the congruent case), and let $\hat{u}_a$ be the payoff in this equilibrium for an $i \in K$ of type a. Also, let $u_a(s, \phi, \hat{\pi})$ be the expected payoff to $i \in K$ from an action $s \in S_i$ given that i is of type $a = H, L$, given that voting takes place as described in Lemma 0, and given a belief profile $(\phi, \hat{\pi})$ that assigns probability ϕ to the event that i is a high-type, and $\hat{\pi}$ are beliefs about the type of any $j \in K$, $j \neq i$ generated by equilibrium play[25] by all $j \in K$, $j \neq i$. Then say that (entry) strategy s is *equilibrium dominated*[26] at that equilibrium for i if $\hat{u}_a > u_a(s, 1, \hat{\pi})$. That is, a strategy is dominated for i if he prefers his equilibrium payoff to taking it, even when voters respond to the strategy as if he were high-ability with probability 1.

Now define the set of types for which action s is equilibrium-dominated;

$$D(s) = \{ a \in \{H, L\} \, | \, \hat{u}_a > u_a(s, 1, \hat{\pi}) \} \tag{3.2}$$

Following Cho and Kreps (1987), we now suppose that the receivers (voters) assign probability zero to types in $D(s)$ if they observe a deviation by i from the equilibrium strategy to s, i.e. $\phi(D(s))$ satisfies $\phi(H) = 0$, $\phi(L) = 1$. For convenience, if $D(s) = \emptyset$ or $D(s) = \{H, L\}$, we assume that the receivers do not attempt to make any inference, i.e. $\phi(\emptyset) = \phi(H, L) = \rho$. Then, the reference equilibrium *fails the intuitive criterion (IC)* if for some $s \in S_i$ there exists a type $a = H, L$ such that

$$\hat{u}_a < u_a(s, \phi(D(s)), \hat{\pi})$$

That is, if there exists a "sender" i of type a who would prefer to deviate from his equilibrium action by choosing s, given that by doing so, he could credibly signal to the voters that he was not of type $D(s)$. We can now show:

Proposition 3. *Assume that preferences are congruent. Then, all pooling equilibria fail the IC, as does any separating equilibrium with campaign expenditure $\hat{\delta} > \underline{\delta}_s$.*

The intuition is clear. Starting at the pooling equilibrium, a high type will always be willing to "pay more" via greater campaign spending to signal that he is a high type than the low type is willing to do, and this allows him to signal credibly and break the pooling

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[25] Formally, in the congruent case, $\hat{\pi} = \pi(j, (1, \hat{\delta})) = \rho$ if the equilibrium is pooling, and if the equilibrium is separating, $\hat{\pi} = \pi(j, (1, \hat{\delta})) = 1$, $\hat{\pi} = \pi(j, 0) = 0$. The probability $\hat{\pi}$ is similarly defined in the non-congruent case.

[26] This concept of equilibrium dominance is weaker than in the original Cho-Kreps IC, where the receiver (the voters) are assumed to respond with their undominated action that is best for the sender. However, in the pooling equilibrium, this makes no difference to the "bite" of the criterion, as in either case, all voters would vote for i. In the separating equilibrium, in the Cho-Kreps case, all voters would vote for i, whereas in our case, the constraint imposed by the assumption of sincere voting (as described in Lemma 0) implies that voters would randomize. So, starting at a separating equilibrium, the set of types for which any strategy s is equilibrium dominated is larger, according to our definition.

equilibrium. Starting at a separating equilibrium with $\hat{\delta} > \underline{\delta}_s$, any high type can cut his expenditure by ε to $\hat{\delta} - \varepsilon > \underline{\delta}_s$, and still credibly signal that he is a high type.

We can apply this refinement to the pooling equilibria in the non-congruent case.

Proposition 4. *Assume that preferences are non-congruent. Any pooling equilibrium with $\hat{\delta} > 0$ fails the IC.*

So, as shown in Figures 1 and 2 above, in either case, there is a unique equilibrium that passes the weak intuitive criterion:

- In the congruent case, a separating equilibrium where only $H-$types enter and spend $\underline{\delta}_s$;

- In the non-congruent case, a pooling equilibrium where both types enter and spend 0.

4. An Application: The Rogoff Model

We now turn to apply the results of Section 3 to a simplified version of Rogoff's (1990) Equilibrium Political Budget Cycle model.[27]

4.1. Elements of the Model

The economy is populated by a set N of citizens with $\#N = n > 3$ and evolves over two time periods, $t = 1, 2$. In each time period, there is one office-holder, whose responsibility is to raise taxes and produce public goods. The possible institutions by which the office-holder is selected from the citizens are described in Section 4.2.

There are two types of publicly provided goods,[28] a consumption good and an investment good whose levels of consumption by all citizens in periods $t = 1, 2$ are denoted by g_t and k_t respectively. The investment good is produced in the period before it is consumed, so $k_1 \equiv 0$. All citizens also derive utility from the consumption of a private numéraire good, c_t. Preferences of citizens over $(c_1, g_1, k_2, c_2, g_2)$ are given by

$$u(c_1, g_1) + v(k_2) + u(c_2, g_2) \tag{4.1}$$

where u, v are strictly increasing in their arguments and strictly concave. The office-holder also benefits from an ego-rent of R when in office.

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[27]The two simplifications are: (i) we assume two periods, rather than the T-period setting of Rogoff; (ii) we assume away the "looks" shocks, which, in Rogoff (1990), serve only as a technical device to eliminate pooling equilibrium. These simplifications do not change the structure of the undominated separating equilibrium studied by Rogoff, but allow us to focus on our main argument with the minimum of complexity. The introduction of looks shocks does not affect our results.

[28]Rogoff (1990) implicitly assumes that these goods are technically private, i.e. rivalrous in consumption. This seems a reasonable assumption for most public goods and services (education, health) and so we adopt this assumption here also.

The budget constraint of the representative citizen for period t is:

$$c_t = y - \tau_t \tag{4.2}$$

where, y is the exogenous, per period, endowment of the numéraire good, and τ_t is a tax, also in units of this good, in period t.

The public good production function for period 1 and 2 respectively is given by:

$$g_1 + k_2 = \tau_1 + \theta, \qquad g_2 = \tau_2 + \theta \tag{4.3}$$

where θ measures[29] the ability of the office-holder in transforming the private good (tax revenue) into public goods. As in the one-period model, the *ability types* of the citizens are $a \in \{H, L\}$, with $\theta_H > \theta_L > 0$, and the type of any citizen is determined by a random draw from $\{H, L\}$, with probability $\rho \equiv \Pr(a = H)$ at the beginning of period 1.

4.2. Information Structure and Order of Events

We consider two institutions by which candidates are selected and elections are arranged. The first is that studied by Rogoff.

1. *Partial Democracy (i.e. with Exogenous Candidate Selection)*
At the beginning of period 1, a citizen is selected at random from the population to be office-holder. Conditional[30] on his own ability, he then sets g_1, τ_1 and k_2. Next, at the beginning of period 2, a *challenger* j is randomly selected from the remaining citizens to contest the election against i. All citizens then vote for i or j having observed g_1, τ_1 but not k_2 (or the ability of the incumbent given that θ is private information). The candidate with most votes wins, and then chooses g_2, τ_2.

2. *Representative Democracy (i.e. with Endogenous Candidate Entry)*
At the beginning of period 1, each citizen i privately observes his own θ. Then there is an election, which is characterized by two steps, as in Section 3 above. That is, first, all citizens in $K \subset N$ can simultaneously decide whether to enter (stand for election) or not, and if they enter, how much to spend on campaigning, δ. Let the resulting set of candidates be C_1. All voters then vote[31] simultaneously for a single candidate in C_1, and the winner is selected by plurality rule. Ties are broken fairly.[32] The winner is then office-holder and sets g_1, τ_1 and k_2. A the beginning of period 2, an election identical to

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[29] Note that because of the assumption of two periods, we can simply assume that θ is constant for the two periods of the game, rather than following a moving-average process as in Rogoff (1990).

[30] Note that we are not allowing the choice of policy to depend on the name (index) of the office-holder, i.e. strategies are *anonymous*, as in the above one-period game.

[31] As in the one-period model, we allow voters to randomize.

[32] Here, the *default option* is zero supply of both public goods. We assume w.l.o.g. that $v(0) = u(y, 0) = 0$, so the default option gives all citizens a zero payoff.

that in period 1 occurs. The winner is then office-holder and sets g_2, τ_2. In both elections, voters vote sincerely, i.e. as described in Lemma 0.

4.3. The Efficient Benchmark

Suppose that there were no elections. Then an incumbent of type a would choose policy to maximize (4.1) subject to (4.2) and (4.3). The first-order conditions to this problem can be written

$$
\begin{align}
u_c(y - \tau_1, g_1) &= u_g(y - \tau_1, g_1) && (4.4) \\
u_c(y - \tau_2, \tau_2 + \theta_a) &= u_g(y - \tau_2, \tau_2 + \theta_a) && (4.5) \\
u_g(y - \tau_1, g_1) &= v'(\tau_1 + \theta_a - g_1) && (4.6)
\end{align}
$$

in obvious notation. That is, (4.4) and (4.5) say that the marginal utility from private and public consumption goods must be the same in both periods, and (4.6) says that the marginal utility from the first-period public consumption good and public investment good must be equal. Let the solution to this problem be $(\tau_1^*(\theta_a), g_1^*(\theta_a), \tau_2^*(\theta_a))$. As all citizens have the same preferences, this solution is efficient *conditional* on the ability of the incumbent, θ_a. So, we refer to $(\tau_1^*(\theta_a), g_1^*(\theta_a), \tau_2^*(\theta_a))$ as the *conditionally efficient policy*. This solution is only efficient overall, of course, if $a = H$, i.e. an efficient incumbent is selected. So, we refer to $(\tau_1^*(\theta_H), g_1^*(\theta_H), \tau_2^*(\theta_H))$ as the *first-best efficient policy*.

4.4. Equilibrium with Partial Democracy

We only briefly discuss this case, as it is a special case of the analysis of Rogoff (1990). In period 2, once elected, an office-holder of type $a \in \{H, L\}$ chooses g_2 to maximize $u(c_2, g_2)$ subject to the second-period private budget constraint, $c_2 = y - \tau_2$, and the government budget constraint, $g_2 = \tau_2 + \theta_a$. It is easy to check that the solution to this problem is $\tau_2^*(\theta_a)$, the conditionally efficient policy. So, as $\tau_2^*(\theta_a)$ depends on a, the different types always "separate" in the second period, but this has no significance for voters as the election has already passed. So, say that a PBE is *separating* if first-period policy (g_1, τ_1) depends non-trivially on θ, and *pooling* otherwise.

Rogoff showed that no pooling equilibrium satisfied the Cho-Kreps Intuitive Criterion described above, and that there were a continuum of separating equilibria, depending on the off-the-equilibrium path beliefs of voters. In all these equilibria, the first-period policy of the low-ability type is conditionally efficient, as this type has nothing to signal $((\widehat{\tau}_1(\theta_L), \widehat{g}_1(\theta_L) = \tau_1^*(\theta_L), g_1^*(\theta_L))$, but the first-period policy of the high-ability type will generally[33] be distorted by the need to signal (i.e. $(\widehat{\tau}_1(\theta_H), \widehat{g}_1(\theta_H) \neq \tau_1^*(\theta_H), g_1^*(\theta_H))$; Rogoff called this distortion the "political budget cycle".

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[33]The exception is when the types are sufficiently different that a low-type would not want to choose $\tau_1^*(\theta_H), g_1^*(\theta_H)$, even when by doing so it could be sure of re-election.

4.5. Equilibrium with Representative Democracy

In this Section, we analyze the Rogoff model[34] under the alternative, and more realistic, institution of a representative democracy (i.e. where candidate entry is endogenized). The resulting model essentially is a twice-repeated version of the model of Section 3, with the additional complication that the winner of the first-period election (the incumbent) can signal his ability via first-period policy choice. Nevertheless, we will find that the analysis of Section 3 will give us a powerful guide for our analysis. In particular, note that in the Rogoff model, using the notation of Section 3, $R_H = R_L = R$, so preferences are always congruent. We will also assume throughout that voters have a lexicographic second preference for the incumbent, i.e. if a voter believes that both challenger and incumbent are high-ability with the same probability, then the voter strictly prefers the incumbent. We solve the model backwards to characterize the perfect Bayesian equilibria (PBE).

Second Period: $t = 2$

First, we need a formalization of off-the-equilibrium-path beliefs as in Section 3. Let $\pi(j, h)$, $j \neq i$ be the probability assessment on the part of all $i \neq j$ that candidate $j \in K$ is high-ability, given a *public history*[35] of play h. Generally, h is a list of all past candidate entry and campaign expenditure decisions by $i \in K$, and voting decisions by $i \in N$, plus a choice of first-period policy g_1, τ_1 by the first-period incumbent, denoted l. This formulation embodies Assumption 2 of Section 3, i.e. that given the same information, citizens form the same beliefs. For example, at the beginning of period 2, $h = (\mathsf{s}_1, \mathsf{v}_1, l, g_1, \tau_1)$, where $\mathsf{s}_1 \in \mathsf{S}$ are first-period entry decisions, $v_{i,1} \in \Delta(C_1)$ is a voting decision by $i \in N$, and $\mathsf{v}_1 = (v_{i,1})_{i \in N}$, and finally g_1, τ_1 is a policy choice by the incumbent l.

Optimal policy choice by the office-holder of ability a at period 2 is the same as in the case of partial democracy, so if a type a is in office, continuation payoffs from policy for all citizens are

$$V_a = u(y - \tau_2^*(\theta_a), \ \tau_2^*(\theta_a) + \theta_a)$$

and the office-holder additionally gets an ego-rent of R. Note that $V_H > V_L$. Now consider the voting equilibrium, given a candidate set C_2. The equilibrium strategies are exactly as in Lemma 0. However, note now[36] that the lexicographic preference for the incumbent

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[34]In this section, we will assume that utility is quasi-linear in the private good, i.e. $u(c, g) = c + u(g)$. Otherwise, as Rogoff observed, "*A fee tends to distort a (selfish) leader's choice of tax policy, because it gives him a different trade-off between private and public goods expenditure than the representative voter.*" (p.33). Of course, if this effect is small, then our results carry over approximately to the more general case.

[35]Voters can condition their actions on the public history, plus observation of their own θ.

[36]The other complicating factor is that possibly $\pi(l, h) = 0$. In this case, if l chooses an s that only $H-$types would choose in equilibrium, we have an impossible event, and Bayesian updating does not apply. We assume that in this case, $\pi(l, h) = 0$ remains unchanged.

means that the set $B(C_2)$ needs to be slightly redefined. If $l \notin C_2$, it is as above in (3.1). If $l \in C_2$, and $\pi(l, h) \geq \pi(h, j)$, all $j \in C_2$, then $B(C_2) = \{l\}$. Then, the following result is straightforward:

Lemma 2. *Assume that $\pi(l, h) = 1$ at history $h = (\mathsf{s}_1, \mathsf{v}_1, l, g_1, \tau_1)$, and that voting at $t = 2$ is as described by Lemma 0. Then, the only possible PBE of the continuation game starting in period $t = 2$ is where only l enters and chooses minimum campaign spending ($s_{l,2} = (1, 0)$, $s_{m,2} = 0$, $m \in K$, $m \neq l$) and where l is elected.*

First period: $t = 1$

Define W_H, W_L to be the continuation payoffs of type H, L office-holders, conditional on being elected at period 1. Then, we can define the *first period candidate entry game conditional on W_H, W_L* to be the game where at period 1, all $i \in K$ make their entry and campaign expenditure decisions, and all $i \in N$ then vote. From Proposition 3, it is immediate that:

Lemma 3. *Given any fixed continuation payoffs $W_H > W_L$, the only anonymous PBE of the first period candidate entry game which satisfies the IC is where every $i \in K$ enters iff $\theta^i = \theta_H$.*

Say that the PBE of the Rogoff model with endogenous entry is *intuitive* if the anonymous PBE of the first period candidate entry game satisfies IC, conditional on any fixed continuation payoffs W_H, W_L. We now have one of our key results of the paper.

Proposition 5. *There is a unique intuitive PBE of the Rogoff model with representative democracy. This equilibrium has the following structure. At $t = 1$, every $i \in K$ enters iff he is high-ability, and all entrants are elected with probability $1/c$. The office-holder l chooses the efficient fiscal policy in period 1, i.e. $(g_1, \tau_1) = (g_1^*(\theta_H), \tau_1^*(\theta_H))$. Then, at $t = 2$, only l enters, and is elected again. Once in office, he chooses the efficient fiscal policy in period 2, i.e. $\tau_1 = \tau_2^*(\theta_H)$.*

In this equilibrium, candidates fully signal their ability at the candidate entry stage, so the ability of the office-holder is fully known, and so there is no need to signal to the electorate via policy. That is, the entry decision is a *substitute*, and probably[37] a more efficient one at that, for signaling via policy. So, in equilibrium, there is no distortionary (fiscal policy) signaling activity by the incumbent, in contrast to the case with exogenous candidate selection. In fact, ignoring campaign expenditures, the equilibrium of Proposition 5 is *first-best efficient*; a competent type is selected for office in each period, and he does not signal via policy distortion.

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[37]Subject, of course, to the qualification that in the first-period election, all candidates waste resources $\underline{\delta}_s$ in signaling. However, this loss is likely in practice to be small relative to distortions in policy due to the political budget cycle.

5. Another Application: The Rogoff Model with an Agency Problem

We now consider a different version of the Rogoff model, where politicians differ not in ability, but in the extent to which they wish to appropriate tax revenues for their own personal or party benefit.[38] We start with our two-period version of the Rogoff model outlined in the previous Section, and normalize the ability parameter of all office-holders to zero, i.e. $\theta = 0$. So, the public good production functions for periods 1 and 2 respectively are given by:

$$g_1 + k_2 = \tau_1 - r_1, \qquad g_2 = \tau_2 - r_2 \tag{5.1}$$

where r_1, r_2 are the amounts of tax revenues taken in the form of rents by politicians. This modelling of the agency problem follows Persson and Tabellini (2000), Chapter 4.

So, citizen's preferences over policy outcomes (including r_1, r_2) in the two time periods are

$$u^c(\tau_1, g_1, r_1, \tau_2, r_2) = u(y - \tau_1, g_1) + v(\tau_1 - g_1 - r_1) + u(y - \tau_2, \tau_2 - r_2)$$

Citizens eligible for office have preferences over policy outcomes identical to citizens, except that they value both office and the rents that can be extracted from office:

$$u^c(\tau_1, g_1, r_1, \tau_2, r_2) + R + \nu[\phi(r_1) + \phi(r_2)], \ \nu \in \{\nu_H, \nu_L\}, \ \nu_L > \nu_H$$

where ϕ is a strictly increasing, strictly concave function with $\lim_{r \to 0} \phi'(r) = \infty$. So, here ν measures the honesty of the politician, rather than ability. Also, here, H, L stand for high and low honesty respectively.[39] We suppose that the honesty type of a citizen is determined by random draw at the beginning of period 1, and $\rho \equiv \Pr(\nu = \nu_H)$. Without loss of generality, we assume $\nu_H = 0$. The order of events with either partial or representative democracy is exactly as in Section 4.2 except that once policy has been chosen in any period $t = 1, 2$, the politician may choose r_t. Also, voters do not observe r_1, r_2 directly, as they do not observe θ in the base Rogoff model.[40]

5.1. Partial Democracy

Once elected at $t = 2$, the office-holder of type $a = H, L$ solves the problem of choosing τ_2, r_2 to maximize $u(y - \tau_2, \tau_2 - r_2) + \nu_a \phi(r_2)$. Let the solution to this problem be $\tau_2^*(\nu_a), r_2^*(\nu_a)$. It is easily checked that at the end of the second period, a "dishonest"

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[38]For related models, see Besley and Smart (2001), and Persson and Tabellini (2000).
[39]Here, R is an exogenous ego-rent from office, and is introduced solely to ensure that Assumption 1 is satisfied.
[40]Of course, a voter can infer r_1 in period 2 from the levels of τ_1, g_1, k_2 but by then it is too late.

office-holder will take a positive amount of rent $(r_2^*(\nu_L) > 0)$, whereas an "honest" office-holder will take zero rent $(r_2^*(\nu_H) = 0)$. So, following the notation of the previous Section, the second-period continuation payoffs of non-office holders are

$$V_a = (y - \tau_2^*(\nu_a), \ \tau_2^*(\nu_a) - r_2^*(\nu_a))$$

in the event that a type $a = H, L$ citizen is office-holder, with $V_H > V_L$. Also, note that the continuation payoffs of the office-holder of type a may be written as $R_a + V_a$, where $R_a = R + \nu_a \phi(r_2^*(\nu_a))$, so that the direct payoff from office now includes the payoff from diverted tax revenues. By the envelope theorem, it is easy to see[41] that $R_L + V_L > R_H + V_H$, so the continuation payoffs of office-holders are *non-congruent* with those of citizens.

Now we turn to the choice of first-period policy. First, consider the first-order conditions to the problem of maximizing the first-period policy of the office-holder, ignoring the effect this choice may have on the probability that he wins the election. The first-order conditions are, in the case where there is an interior solution:

$$u_c(y - \tau_1, g_1) = u_g(y - \tau_1, g_1) \tag{5.2}$$
$$u_g(y - \tau_1, g_1) = v'(\tau_1 - g_1 - r_1) \tag{5.3}$$
$$v'(\tau_1 - g_1 - r_1) = \nu_a \phi'(r_1) \tag{5.4}$$

In the case that the politician is honest, there is a corner solution for r_1 with $r_1 = 0$. Denote the solution to (5.2)-(5.4) - as modified when $a = H$ - by $(\tau_1^*(\nu_a), g_1^*(\nu_a), r_1^*(\nu_a))$ and, following the terminology of Section 4.3, call the solution *conditionally efficient*.[42] Of course, as the $H-$type is completely honest, $(\tau_1^*(\nu_H), g_1^*(\nu_H), r_1^*(\nu_H))$ is *first-best efficient* in the same sense as in Section 4.3.

Now consider equilibrium first-period policy. We will focus on separating equilibrium, which must satisfy two conditions. First, the dishonest type must choose his conditionally efficient policy (as he has nothing to signal). Second, given this fact, the policy of the honest type $(\widehat{\tau}_1(\nu_H), \widehat{g}_1(\nu_H), \widehat{r}_1(\nu_H))$ must credibly separate the two, i.e. the honest type must prefer his policy, given that choosing this policy implies re-election with probability 1:

$$u\left(y - \widehat{\tau}_1(\nu_H), \widehat{g}_1(\nu_H)\right) + v\left(\widehat{\tau}_1(\nu_H) - \widehat{g}_1(\nu_H) - \widehat{r}_1(\nu_H)\right) + V_H + R_H \tag{5.5}$$
$$\geq \ u\left(y - \tau_1^*(\nu_L), g_1^*(\nu_L)\right) + v\left(\tau_1^*(\nu_L) - g_1^*(\nu_L) - r_1^*(\nu_L)\right) + \rho V_H + (1-\rho)V_L$$

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[41] To see this, note that $R + V \equiv \max_{\tau_2, r_2} u(y - \tau_2, \tau_2 - r_2) + \nu\phi(r_2)$, and so by the envelope theorem, $R + V$ is increasing in ν.

[42] In the case of the dishonest incumbent, this is somewhat misleading, but it is nevertheless consistent with earlier terminology.

and the dishonest type must prefer his own conditionally efficient policy, even though he forfeits re-election due to his theft of tax revenue:

$$u\left(y - \tau_1^*(\nu_L), g_1^*(\nu_L)\right) + v\left(\tau_1^*(\nu_L) - g_1^*(\nu_L) - r_1^*(\nu_L)\right) + v_L\phi(r_1^*(\nu_L)) + \rho V_H + (1-\rho)V_L \geq$$
$$u\left(y - \widehat{\tau}_1(\nu_H),\ \widehat{g}_1(\nu_H)\right) + v\left(\widehat{\tau}_1(\nu_H) - \widehat{g}_1(\nu_H) - \widehat{r}_1(\nu_H)\right) + v_L\phi(\hat{r}_1(\nu_H)) + V_L + R_L \quad (5.6)$$

So, a *separating equilibrium policy* is a pair $(\tau_1^*(\nu_L), g_1^*(\nu_L), r_1^*(\nu_L)), (\widehat{\tau}_1(\nu_H), \widehat{g}_1(\nu_H), \widehat{r}_1(\nu_H))$ that satisfies (5.5), (5.6). It is straightforward to show that such a separating equilibrium policy exists. Under some conditions, credible separation is not possible when $(\widehat{\tau}_1(\nu_H), \widehat{g}_1(\nu_H), \widehat{r}_1(\nu_H)) = (\tau_1^*(\nu_H), g_1^*(\nu_H), 0)$ so any separating equilibrium will involve policy distortion by the honest type (i.e. a political budget cycle in Rogoff's terminology).

5.2. Representative Democracy

In this Section, we analyze the Rogoff model with an agency problem under the alternative, and more realistic, institution of a representative democracy. As in the base Rogoff case, the resulting model essentially is a twice-repeated version of the model of Section 3, with the additional complication that the winner of the first-period election (the incumbent) can signal his ability via first-period policy choice. We solve the model backwards.

Second Period: $t = 2$

First, as above in the case of partial democracy, optimal policy choice by the office-holder of ability a at period 2 gives payoff V_a to all citizens, with $V_H > V_L$, and the office-holder gets an ego-rent of R_a. Next, we will formalize off-the-equilibrium-path beliefs as in Section 4, i.e. $\pi(j, h)$, $j \neq i$ is the probability assessment on the part of all $i \neq j$ that candidate $j \in K$ is high-ability, given a public history of play h. Note that Lemma 2 above obviously applies to this case also, i.e. if voters believe the incumbent is high-ability with probability 1 at the beginning of period 2, then in equilibrium, the incumbent fights the election uncontested, and wins.

First period: $t = 1$

Define W_H, W_L as the payoffs of type H, L office-holders (excluding ego-rents and rents from diverted tax revenue), conditional on being elected at period 1. Then, we can define the *first period candidate entry game conditional on R_H, R_L, W_H, W_L* to be the game where at period 1, all $i \in K$ make their entry and campaign expenditure decisions, and all $i \in N$ then vote. From Proposition 2, it is immediate that:

Lemma 4. *Given any fixed continuation payoffs $R_H + W_H < R_L + W_L$, in any anonymous perfect Bayesian equilibrium of the first period candidate entry game, every $i \in K$ enters, whatever their type.*

Given this result, we now have:

Proposition 6. *There is always a PBE of the Rogoff model (with an agency problem) with endogenous entry with the following structure. At $t = 1$, every $i \in K$ enters, and all entrants are elected with probability $1/k$. The office-holder l chooses a separating fiscal policy in period 1, i.e. $(\hat{g}_1(\theta_H), \hat{\tau}_1(\theta_H), \hat{r}_1(\theta_H))$, if his type is H, and $(g_1^*(\theta_L), \tau_1^*(\theta_L), r_1^*(\theta_L))$ if his type is L, where these policy choices satisfy (5.5),(5.6) above. Then, at $t = 2$, if l is type H, only l enters, and is elected again. Once in office, he chooses the efficient tax $\tau_2 = \tau_2^*(\theta_H)$. Otherwise, only $i \in K/\{l\}$ enter. Each is elected with probability $1/(k-1)$, and once in office, chooses $\tau_2 = \tau_2^*(\theta_a)$ if of type a.*

In this equilibrium, candidates cannot signal their ability at the candidate entry stage, so there is still a need to signal to the electorate via policy. That is, the entry decision does *not* substitute for signaling via policy. This is obviously in contrast to the base Rogoff model, and is being driven by the fact that here, citizen and office-holder preferences are non-congruent. We would expect to find similar conclusions if candidate entry were introduced into other models where office-holders differ in honesty, e.g. Coate and Morris (1995).

6. Some Extensions

6.1. Many Ability Types

Suppose that there are now m potential ability types, i.e. $a \in \{1, ..., m\}$, where $\rho_i \equiv \Pr(a = i)$, and $i = 1, ..., m$. As before, we denote by W_a the payoff to all citizens (other than the office-holder) if a candidate of type a is elected. Without loss of generality, we will assume that $W_m > W_{m-1} > ...W_1$.

Now say that preferences are *congruent* if $W_m + R_m > W_{m-1} + R_{m-1} > ...W_1 + R_1$, and *non-congruent* if $W_m + R_m < W_{m-1} + R_{m-1}... < W_1 + R_1$. The main difference from the two-type case is now that the congruent and non-congruent cases do not logically exhaust all the possibilities, i.e. there may be "mixed" cases, e.g. if $n = 3$, we may have $W_3 + R_3 > W_1 + R_1 > W_2 + R_2$. However, it is clear that fully specified models, such as the "Rogoff" models of Sections 4 and 5, where potential candidates only differ in one dimension (ability or honesty) will exhibit congruence or non-congruence.[43]

Given these definitions, it is then straightforward to prove that Propositions $1 - 4$ extend to the case of m types. We begin with the congruent case. Here, it is easy to see that any anonymous equilibrium will take the following form: for some $1 \leq q \leq m$, $i \in K$ only enter if they are type $r \geq q$. If $q = 1$, the equilibrium is pooling, if $q = m$, separating, and if $1 < q < m$, semi-separating. A result giving precise existence conditions for each of these equilibria is available on request.

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[43]It is easy to check that in the base Rogoff model of Section 4, even with m ability types, preferences are congruent, and in the "honesty" version of the model, preferences are non-congruent.

However, we are mostly interested in which of these equilibria pass the IC. Let x_m be the number of candidates, excluding any $i \in K$, if $K/\{i\}$ only enter if they are of highest ability: x_m is distributed Binomially with parameters $k-1$, ρ_m. Also, let $\mu_m = E[\frac{1}{x_m+1}]$, $\lambda_m = Pr(x_m = 0)$. Then, we have:[44]

Proposition 7. *Assume that preferences are congruent. All pooling and all semi-separating equilibria fail the IC. Also, any separating equilibrium with campaign expenditure $\hat{\delta} > \underline{\delta}_m$ fails the IC, where $\underline{\delta}_m = \mu_m(W_{m-1} + R_{m-1}) + (\lambda_m - \mu_m)W_m$.*

This is a direct extension of Proposition 3 to the case of many types.

Turning to the non congruent case, again, it is easy to see that any anonymous equilibrium will take the following form: for some $1 \leq q \leq m$, $i \in K$ only enter if they are type $r \leq q$. If $q = m$, the equilibrium is pooling, if $q = 1$, separating, and if $1 > q > m$, semi-separating. Moreover, an argument as in Proposition 2 establishes that separating equilibria cannot exist: a result giving precise existence conditions for the remaining equilibria is available on request.

Again, we are mostly interested in which of these equilibria pass the IC. Let x_q be the number of candidates, excluding any $i \in K$, if $K/\{i\}$ only enter if they are of ability lower than $1 \leq q \leq m$: x_q is distributed Binomially with parameters $k-1$, $\theta_q = \sum_{r=1}^{q} \rho_r$. Also, let $\mu_q = E[\frac{1}{x_q+1}]$, $\lambda_q = \Pr(x_q = 0)$. Then, as in the two-type case, it is possible to show that no (fully) separating equilibrium exists. However, now, following the arguments of the proof of Proposition 1, it is possible to show that if $\underline{\delta}_q \leq \hat{\delta} \leq \overline{\delta}_q$, there exists a semi-separating equilibrium where any $i \in K$ enters only if he is of type $r \leq q$, where $1 > q > m$, and spends $\underline{\delta}_q \leq \hat{\delta} \leq \overline{\delta}_q$, where

$$\overline{\delta}_q = \mu_q(W_q + R_q) + (\lambda_q - \mu_q)\sum_{r=1}^{q} \rho_r W_r / \theta_q$$

$$\underline{\delta}_q = \mu_q(W_{q+1} + R_{q+1}) + (\lambda_q - \mu_q)\sum_{r=1}^{q} \rho_r W_r / \theta_q$$

Call such a semi-separating equilibrium a $q-semi\text{-}separating$ equilibrium.

Proposition 8. *Assume that preferences are non congruent. There exists no separating equilibrium. All $q-semi$ separating equilibria with $\hat{\delta} > \underline{\delta}_q$ fail the IC, as does any pooling equilibrium with $\hat{\delta} > 0$.*

This is a partial generalization of Proposition 4. As in the case of two types, the only pooling equilibrium that passes the IC has the lowest possible expenditure of zero. But now, we may also have semi-separating equilibria with minimal expenditures. However, with a semi-separating equilibrium at the entry stage, there remains some uncertainly

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[44]The proofs of all the Propositions in this Section and the following Section are available on request by emailing the corresponding author. [See Not-For-Publication Appendix]

about the type of the incumbent, and so some scope for signaling through policy choice. So, the main insights are robust to the case where more than two ability types are introduced.

6.2. Heterogenous Wealth and Fund-Raising Abilities

So far, we have assumed that spending an amount δ during the campaign is equally costly for all candidates. However, the "ability to spend" during a campaign will depend both on the candidates' personal wealth and their fund-raising ability. In some cases, personal wealth clearly leads to greater spending and electoral success.[45] An extreme example is Jon Corzine, a former managing director of Goldman Sachs, with no experience of office, who spent $55 million of his own money contesting a seat in Senate representing New Jersey, and won. Fund-raising ability, on the other hand, may be related to a candidate's own personal characteristics, as well as his political track record, and in particular, whether he is the incumbent.[46] Therefore, it seems desirable to test the robustness of our results to heterogeneity in the ability of candidates to spend.

We model this as follows. Every candidate in K is now described by two characteristics: his ability, as before, and also his cost of "burning" money, $b = H, L$. So, a candidate who enters and spends δ incurs a cost $\varphi_b \delta$, where $b \in \{H, L\}$ is his cost type, with $\varphi_H > \varphi_L > 0$. Citizens can now be of four possible types: two ability types a, and two burning cost types b, i.e. $(a, b) \in \{(H, H), (H, L), (L, H), (L, L)\}$. We will show that as long as the cost difference $\varphi_H - \varphi_L$ is not "too large", then the results of Section 3 go through effectively unchanged. Also, the upper bound on $\varphi_H - \varphi_L$ goes to infinity with the number of potential candidates, $\#K$, so when there is a large number of potential candidates, our arguments of Section 3 are robust to even considerable cost differences among candidates.

In this new setting, we say that congruence occurs when types $(H, H), (H, L)$ place a higher value on office than $(L, H), (L, L)$. A necessary condition for congruence is clearly $W_H + R_H > W_L + R_L$. But even if this inequality holds, congruence in our extended model will not occur when δ is very large, as then a low-ability, low-cost type (L, L) may prefer to enter, whereas a high-ability, high-cost type (H, H) may not.[47] However, there is of

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[45] Although wealth is often described in the media (and in the political science literature) as giving an unfair advantage in the US, a recent study (Milyo and Groseclose, 1999), exploiting a unique dataset on the wealth of House incumbents running in the 1992 race, reveals that on average, personal wealth does not matter: i.e. rich candidates did not spend more on average on their campaigns than poor ones, and were no more likely to win greater shares of the vote.

[46] The major determinant of campaign raising and spending is incumbency (e.g. Salmore and Salmore, 1985, chapter 4). For instance, for the 2000 House elections, the average challenger raised $361,314, while the average incumbent raised $891,956.

[47] Note that type (H, L) places a higher value on office than does (H, H), and type (L, L) places a higher value on office than does (L, H).

course an upper bound on δ in any anonymous equilibrium: this is[48] the value of δ which makes any $i \in K$ of type (H, L) indifferent between entering and not, given that all $j \in K$ only enter if they are of type (H, L). This value can be easily calculated to be

$$\bar{\delta}_{HL} = \frac{1}{\varphi_L}[\lambda_{HL}W_H + \mu_{HL}R_H] \tag{6.1}$$

where x_{HL} is the number[49] of candidates (other than some $i \in K$) in this equilibrium, $\lambda_{HL} = Pr(x_{HL} = 0)$, and $\mu_{HL} = E[1/(x_{HL} + 1)]$.

So, we can define candidate and voter preferences to be *congruent* if, given that $\delta \leq \bar{\delta}_{HL}$, (H, H) places a higher value on office than (L, L), i.e.

$$W_H + R_H - \varphi_H \bar{\delta}_{HL} > W_L + R_L - \varphi_L \bar{\delta}_{HL}$$

which using (6.1), reduces to the condition that the difference in burning costs is not too large, i.e.

$$\varphi_H - \varphi_L < \frac{W_H + R_H - (W_L + R_L)}{\lambda_{HL}W_H + \mu_{HL}R_H} \tag{6.2}$$

Note that if the candidate set K is large, i.e. $k \to \infty$, $\lambda_{HL}, \mu_{HL} \to 0$, the upper bound on the difference in costs becomes very large, and so congruence requires little more than it does in the base case. The intuition for this is simple: when there are many candidates, the probability of any one candidate winning is small, and so any potential candidate is only willing to spend a small amount in the campaign. But then it does not matter greatly if costs of "burning" money are heterogenous.

If preferences are congruent in the sense of (6.2), it is clear that there can be four types of anonymous equilibrium: (i) a pooling equilibrium where all types enter; (ii) separating (with respect to ability) equilibria where either only (H, L) types or (H, L) and (H, H) types enter; (iii) a *mixed* equilibrium where (H, L), (H, H) and (L, L) enter. Call the separating equilibrium where only (H, L) types enter *strong*, and the one where (H, L) and (H, H) types enter, *weak*. A result giving precise existence conditions for each of these equilibria is available on request. Generally, these take the form that equilibrium campaign expenditures $\hat{\delta}$ must lie in an interval $[\underline{\delta}_i, \bar{\delta}_i]$, where $i = p$, ss, ws, m in the pooling, strong and weak separating, and mixed cases respectively. Note that $\underline{\delta}_p = 0$.

However, we are mostly interested in which of these equilibria pass the IC. We can show:

Proposition 9. *Assume congruent preferences. Then the only anonymous equilibria to pass the IC are the strongly separating equilibrium with minimal campaign expenditure*

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[48]Type (H, L) is the one who has the most to gain from entering, and so will be willing to pay the most to signal.

[49]x_{HL} is distributed Binomially with parameters $k - 1$, ρ_{HL}, where $\rho_{HL} = Pr((a, b) = (H, L))$.

$\hat{\delta} = \underline{\delta}_{ss}$ and the weakly separating equilibrium with minimal campaign expenditure $\hat{\delta} = \underline{\delta}_{ws}$, where $\underline{\delta}_{ss}$, $\underline{\delta}_{ws} > 0$.

So, we see that when preferences are congruent, the result is essentially the same as in the base case: candidate entry screens out low-ability candidates.

We now turn to the non-congruent case. Generally, non-congruence occurs when types $(H, H), (H, L)$ place a *lower* value on office than $(L, H), (L, L)$. A necessary condition for non-congruence is $W_H + R_H < W_L + R_L$. Similar arguments to above show that the necessary and sufficient condition for non-congruence is

$$\varphi_H - \varphi_L < \frac{W_L + R_L - (W_H + R_H)}{\lambda_{LL} W_L + \mu_{LL} R_L} \qquad (6.3)$$

where x_{LL} is the number[50] of candidates (other than some $i \in K$) in the anonymous equilibrium where only (L, L) types enter, and $\lambda_{LL} = Pr(x_{LL} = 0)$, and $\mu_{LL} = E[1/(x_{LL} + 1)]$. As before, note that if the candidate set K is large, i.e. $k \to \infty$, $\lambda_{LL}, \mu_{LL} \to 0$, the upper bound on the difference in costs becomes very large, and so non-congruence requires little more than it does in the base case.[51]

In this case, there are only two possible types of equilibrium; a pooling equilibrium, and a *mixed* equilibrium where all types except (H, H) enter. Precise conditions under which these equilibria exist can be established, and take the same general form as in the congruent case. Then, we have:

Proposition 10. *Assume that preferences are non-congruent. The only anonymous equilibria that pass the IC are the pooling equilibrium with minimal campaign expenditure* $\hat{\delta} = 0$, *and the mixed equilibrium with minimal campaign expenditure* $\hat{\delta} = \underline{\delta}_m$.

So, we see that in this case, *some* screening is possible with non-congruence; high-ability, high-cost types are screened out. However, if these types are small in number, i.e. $Pr(H, H) \simeq 0$, then there is effectively no screening via entry.

6.3. Other Extensions

Throughout, we have assumed that minimum campaign expenditure $\underline{\delta}$ is zero. If $\underline{\delta} > 0$, all relevant Lemmas and Propositions are modified in the obvious way, except for Proposition 2. Specifically, in both Propositions 1 and 2, the lower bound on pooling equilibrium expenditure is now $\underline{\delta}$, not zero, and in Proposition 1, the lower bound on separating equilibrium expenditure is now $\max\{\underline{\delta}_s, \underline{\delta}\}$. The main change is to Proposition 2, where a separating equilibrium now exists if $\underline{\delta}$ is above the level $\underline{\delta}_s = \mu(W_H + R_H) + (\lambda - \mu)W_L$ at which a high-ability type would want to enter, given that only low-ability types enter.

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[50]x_{LL} is distributed Binomially with parameters $k - 1$, ρ_{LL}, where $\rho_{LL} = Pr((a, b) = (L, L))$.

[51]So, when $\#K$ is large, almost all parameter configurations will exhibit either congruence or non-congruence.

For then, there is a (unique) separating equilibrium where only low-ability types enter, and all spend $\hat{\delta} = \underline{\delta}$: entrants would like to cut spending, as they pay no signaling penalty for doing so, but it is now not technically feasible.

We have also imposed the assumption of anonymity on equilibrium strategies, and have ruled out randomization over entry and campaign expenditure decisions. Relaxing either of these assumptions does not change the main insights of the paper greatly.

7. Conclusions

This paper shows that candidate entry may reveal valuable information in a representative democracy, in an environment where information is *asymmetric* between citizens and office-holders. In particular, in a simple setting, we find that information is revealed at the candidate entry stage if and only if preferences are congruent between voters and candidates. This result extends (partially) to more general settings where the cost of entry depends on other candidate characteristics (e.g. wealth) that are unrelated to performance in office.

We should also note that the general message, result of our paper is much more general than the current context which we have used to illustrate it. It applies to a general class of asymmetric information games in which an agent has an informational advantage (e.g. cost, ability, etc.). For instance, our result also applies to many asymmetric information games in monetary policy (e.g. Vickers, 1986; Barro, 1986; Rogoff, 1987; Cukierman and Meltzer, 1986; Cukierman and Liviathan, 1991) and to recent models that have extended these work (e.g. Bartoloni and Drazen, 1997; Cukierman and Tommasi, 1998).[52] In all these models, the first-period incumbent is *exogenously* chosen. The agent has an informational advantage which leads to a signaling distortion in the first-period. Endogenizing this selection process, as we have shown, leads to a first-best if society designs the cost of entry into policy making optimally. Again, the message is that (representative) democracy is more efficient than what the literature currently shows.

As a final point, we note that we have assumed that voter preferences over policies are homogenous. This assumption has the attractive implication that in the benchmark case of complete information about candidate ability, an able candidate will be elected. When voter preferences over policies are heterogenous, this is not necessarily the case, as Besley and Coate (1997) showed. Besley and Coate have an example where the majority of voters prefers a candidate who has a lower preference for public good provision, even though he is less able at producing the public good than other potential candidates. In equilibrium, the less able candidate will be elected. The extension of our approach to

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[52]See Drazen (2000a) for a graduate textbook exposition of many of these asymmetric information games in macroeconomics, and Drazen (2000b) for a recent review of the latest research on Political Business Cycles.

heterogenous preferences is a topic for future work.

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A. Appendix

Proof of Lemma 0. Say that voter $i \in N$ *is pivotal for* $P_i \subset C$ if given the realizations of the voting strategies of $j \neq i$, P_i is the set of candidates that get x or $x - 1$ votes, where x is the maximum number of votes received by any $k \in C$. Then i can affect the probability of winning of only candidates in P_i. Now, given the random voting strategies of the other players, there are m possible sets $P_i^1, ..., P_i^m$ for which i is pivotal, with probabilities $\xi^1, ..., \xi^m$.

(a) Consider first $i \in N/C$. We show first that $P_i^h \subset B$, all $h = 1, ..., m$. First, given the strategies of $j \neq i$ described in the Lemma, some $j \in B$ will get at least two votes. (To see this, note that every $j \in B$ gets j's vote, and also $n - b - 1$ additional votes are distributed randomly among members of B, where $b = \#B$. As $n - b - 1 \geq n - c - 1 \geq n - k - 1 \geq 1$, where $c = \#C$, at least one $j \in B$ must get an additional vote). Also, all $j \notin B$ get zero votes. So, no $j \notin B$ can ever be in P_i^h. So, j is indifferent between all candidates between whom he can ever be pivotal ($\cup_{h=1}^m P_i^h \subset B$). So, it obviously is a best response for i to randomize over B.

(b) Now consider $i \in B$. By Assumption 1, i most prefers to vote for himself. Then, he is indifferent between all other members of B, and finally ranks all C/B last. By a similar argument to (a) above, $P_i^h \subset B$, all $h = 1, ..., m$. So, with some positive probability ξ, i will be pivotal between himself and other member(s) of B, and with probability $1 - \xi$, he will only be pivotal between other members of B. Given this, it is clear that i's unique best response is to vote for himself.

(c) Now consider $i \in C/B$. Again, by Assumption 1, i most prefers to vote for himself. Then, he is indifferent between all other members of B, and finally ranks all C/B last. By a similar argument to (a) above, $P_i^h \subset B$, all $h = 1, ..., m$. So, i is never pivotal between himself and member(s) of B; he is only pivotal between members of B. So, it obviously is a best response for i to randomize over B. $\square$

Proof of Proposition 1. (a) *Pooling Equilibrium.* We assume the following off-the-equilibrium path beliefs: $\pi_i(j, \mathsf{s}) = 0$, $j \in C$, if $s_i = (1, \delta')$, all $\delta' \neq \hat{\delta}$. Given these beliefs, no $j \in K$ will wish to stand for election and spend less (or more) than $\hat{\delta}$, as he anticipates that he will win with probability 0 if he does so. We now derive the condition under which it is a best response for every $i \in K$ to stand for election and spend $\hat{\delta}$, whatever his type, given that all $j \in K$, $j \neq i$ are following this strategy. The critical case is where i is type L. If $i \in K$ is type-L, the required condition is

$$\frac{1}{k}(R_L + W_L) + \frac{k-1}{k}(\rho W_H + (1 - \rho)W_L) - \hat{\delta} \geq \rho W_H + (1 - \rho)W_L \qquad \text{(A.1)}$$

The LHS of (A.1) is the expected payoff to entering and spending $\hat{\delta}$, given that i will be elected with probability $1/k$ (by Lemma 1). The RHS of (A.1) is the expected payoff to

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not entering. Rearranging, this gives

$$\hat{\delta} \leq \frac{R_L - \rho(W_H - W_L)}{k} = \delta^p$$

This must clearly hold in equilibrium.

(b) *Separating Equilibrium.* We assume the same off-the-equilibrium path beliefs as in the pooling case. Again, given these beliefs, no $j \in K$ will wish to stand for election and spend less (or more) than $\hat{\delta}$. We now derive conditions under which the strategy of only entering if $a = H$ (i.e. $e(H) = (1, \hat{\delta})$, $e(L) = 0$) is a best response for i to this same strategy by all $j \in K$, $j \neq i$. Suppose that all $j \in K$, $j \neq i$ are following the strategy $e(H) = (1, \hat{\delta})$, $e(L) = 0$. Then, from i's point of view, the number of entrants other than i is x, where x, μ, λ are defined in Section 3.2. But then if i does not enter, his payoff will be $(1 - \lambda)W_H$, no matter what his type. By Lemma 1, if he does enter, his (expected) payoff will be $\mu(W_a + R_a) + (1 - \mu)W_H - \hat{\delta}$ if his type is a. So, the required condition is

$$\mu(W_H + R_H) + (1 - \mu)W_H - \hat{\delta} \geq (1 - \lambda)W_H > \mu(W_L + R_L) + (1 - \mu)W_H - \hat{\delta}$$

or, rearranging

$$\lambda W_H + \mu R_H \geq \hat{\delta} > \mu(W_L + R_L) + (\lambda - \mu)W_H$$

(c) *No other equilibria.* There cannot be an equilibrium where nobody enters, i.e. $e(a) = 0, a = H, L$. For suppose there were: then some $i \in K$ could deviate by entering and spending 0. Moreover, such a deviant will be elected, as all voters prefer even a low-ability office-holder to none at all. Such a deviation is profitable because $R_H + W_H > 0$. Also, there cannot be an equilibrium where $i \in K$ enters only if he is a low type, i.e. $e(L) = (1, \delta)$, $e(H) = 0$, as if $i \in K$ is type H, he benefits by strictly more from entry than if he is type L. $\square$

Proof of Proposition 2.(a) *Pooling Equilibrium.* The argument here is the same as in the proof of Proposition 1, except that now the critical condition is for type H. For this $i \in K$ to wish to stand and spend $\hat{\delta}$ when he is of type H, given that all others are doing so, it must be that

$$\frac{1}{k}(R_H + W_H) + \frac{k-1}{k}(\rho W_H + (1 - \rho)W_L) - \hat{\delta} \geq (\rho W_H + (1 - \rho)W_L)$$

Rearranging, this gives

$$\hat{\delta} \leq \delta^p = \frac{R_H + (1 - \rho)(W_H - W_L)}{k}$$

(b) *Separating Equilibrium.* First, note that there can be no separating equilibrium where only high types enter, as by assumption, if a high type weakly favors entry, a low

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type strictly favors entry. So, suppose that there is a separating equilibrium where all $i \in K$ enter only if $a = L$, and all entrants spend $\hat{\delta}$. Then, and argument similar to that in the proof of Proposition 1 establishes that $\hat{\delta}$ must be sufficiently high to deter entry by high types, i.e. $\underline{\delta}_s \leq \hat{\delta}$, where $\underline{\delta}_s = \mu(W_H + R_H) + (\lambda - \mu)W_L$. Now suppose that some $i \in K$ deviates to $(1, \delta')$, $\delta' < \underline{\delta}_s$. By making this deviation, he cannot lower the belief (on the part of voters) that he is a H type, as it is already zero. So, his probability of election cannot fall, and as he is spending less, so he must profit from this deviation. So, we cannot have $\underline{\delta}_s \leq \hat{\delta}$, and consequently, no separating equilibrium can exist.

(c) *No other equilibria.* As in the proof of Proposition 1. $\square$

Proof of Proposition 3. (a) Assume that the equilibrium is pooling . Then equilibrium payoffs are

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}(\rho W_H + (1 - \rho)W_L) - \hat{\delta}, \ a = H, L \tag{A.2}$$

Moreover as voters all strictly prefer a candidate i who they believe to be high-ability with probability 1 to any candidate following the pooling strategy, i will be elected with probability 1, and so

$$u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \delta. \tag{A.3}$$

Using (A.2), (A.3), and simple computation gives $D(1, \delta) = \{L\}$ if $x < \delta \leq y$ where $x = \left(\frac{k-1}{k}\right)(W_L + R_L) + A$, $y = \left(\frac{k-1}{k}\right)(W_H + R_H) + A$, $A = \hat{\delta} - \left(\frac{k-1}{k}\right)(\rho W_H + (1-\rho)W_L)$. So, then $\phi(D(1, \delta)) = 1$ if $\delta \in (x, y]$. But then

$$u_H((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = R_H + W_H - \delta, \quad \delta \in (x, y]$$

So for ε small,

$$
\begin{aligned}
\hat{u}_H &= \frac{1}{k}(R_H + W_H) - A \\
&< \frac{1}{k}(R_H + W_H) - A + \left(\frac{k-1}{k}\right)(R_H + W_H - W_L - R_L) - \varepsilon \\
&= R_H + W_H - \left(\frac{k-1}{k}\right)(W_L + R_L) - A - \varepsilon \\
&= R_H + W_H - (x + \varepsilon) = u_H((1, x + \varepsilon), \phi(D_i(1, x + \varepsilon)), \hat{\pi})
\end{aligned}
$$

so the equilibrium fails the IC, as claimed.

(b) Assume that the equilibrium is separating. Also, assume w.l.o.g. that $\underline{\delta} < \underline{\delta}_s$. Then $\hat{\pi}(D, (1, \hat{\delta})) = 1$, $D \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = \mu(R_a + W_a) + (1 - \mu)W_H - \delta$. So, $u_H((1, \delta), 1, \hat{\pi}) = \hat{u}_H + \hat{\delta} - \delta$. So, $(1, \delta)$ is dominated for H iff $\delta > \hat{\delta}$. Moreover, $(1, \delta)$ is dominated for L as long as $\delta > \underline{\delta}_s$. So, for $\underline{\delta}_s < \delta \leq \hat{\delta}$, $H \notin D(1, \delta) = \{L\}$, so $\phi(D(1, \delta)) = 1$, $\underline{\delta}_s < \delta \leq \hat{\delta}$. But then by construction,

$$\hat{u}_H < \hat{u}_H + \hat{\delta} - \delta = u_H((1, \delta), \phi(D(1, \delta)), \hat{\pi}), \ \underline{\delta}_s < \delta < \hat{\delta}$$

So, as long as $\underline{\delta}_s < \hat{\delta}$, the separating equilibrium fails the IC. Obviously, if $\underline{\delta}_s = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the IC. $\square$

Proof of Proposition 4. By Proposition 2, the equilibrium is pooling. Then $\hat{\pi}(D, (1, \hat{\delta})) = \rho$, $D \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \delta$. Moreover, equilibrium payoffs are:

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}(\rho W_H + (1 - \rho)W_L) - \hat{\delta}, \; a = H, L$$

So, if $R_L + W_L - \delta \geq \hat{u}_L$, $R_H + W_H - \delta \geq \hat{u}_H$, action $(1, \delta)$ is dominated for neither type. Simple computation tells us that this occurs when $\delta \leq x = \hat{\delta} + \left(\frac{k-1}{k}\right)[R_H + (1 - \rho)(W_H - W_L)]$. So, then $D(1, \delta) = \{\emptyset\}$, $\delta \leq x$. But as $\phi(D(1, \delta)) = \rho$, we have:

$$u_a((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}(\rho W_H + (1 - \rho)W_L) - \delta, \; \delta \leq x$$

Now, $\hat{\delta} < x$ by construction. So, it follows that for any $\hat{\delta} > \delta > 0$,

$$u_a((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = \hat{u}_a + \hat{\delta} - \delta > \hat{u}_a$$

so that the equilibrium fails the IC. Obviously, when $\hat{\delta} = 0$, this cannot happen, so the pooling equilibrium where $\hat{\delta} = 0$ passes the IC. $\square$

Proof of Lemma 2. Suppose to the contrary that some $m \in K$, $m \neq l$ enters in equilibrium. Clearly, if $\pi(l, h) = 1$, then all $i \notin N/K$ will vote for l. So, m cannot win and so entry cannot be optimal, a contradiction. $\square$

Proof of Proposition 5. (a) *Existence.* This follows directly from Lemmas 1 and 2, as long as $W_H > W_L$, given the equilibrium policy choices of high and low types. But, in *any* PBE, a high type who wins office in period 1 must have a higher continuation payoff than a low type. First, the payoff from period 1 policy choice is strictly higher, as the high type is more able. Second, second-period continuation payoffs must be at least as high, as the high-type can always follow the pooling strategy of imitating the low type.

(b) *Uniqueness.* Suppose that there were another intuitive equilibrium. In this other equilibrium, $W_H > W_L$ by the argument in (a). But then, by Proposition 3, this other equilibrium must have the same first-period equilibrium entry strategies as the one described in Proposition 5. But then, $\pi(h, l) = 1$ at the beginning of the second period, so the equilibrium in the second period must also be the same as in the case of partial democracy. So, there cannot be another equilibrium, a contradiction. $\square$

Proof of Proposition 6. Consider the continuation game from the end of $t = 1$ when some $l \in K$ is the incumbent. If he has revealed himself to be high-ability, he will be re-elected with probability 1. If he has revealed himself to be low-ability, with probability 1, some other candidate will enter, who is high-ability with probability ρ. So, in either case, the continuation payoffs of the incumbent are the same as in the partial democracy case. So, conditional on $l \in K$ being elected at period 1, if voters are uncertain about l's

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type, there is always a separating equilibrium where the policy choices satisfy (5.5),(5.6) above. But by Lemma 4, there must be a pooling equilibrium at the candidate entry stage at $t = 1$, as long as $R_H + W_H < R_L + W_L$, confirming that voters will be uncertain about l's type. But, in *any* PBE, a $L-$type who wins office in period 1 must have a higher continuation payoff than a $H-$type, as he gets a payoff from rent that the other type cannot, and the L-type always steals some rent in either the first or the second period. So, there must be a pooling equilibrium at the candidate entry stage, confirming the assumption that voters are uncertain about l's type. $\square$

B. Not For Publication Appendix

B.1. Proofs of Some Propositions in the Paper

Proof of Proposition 7. (a) Assume that the equilibrium is *pooling*. Then $\hat{\pi}(j,(1,\hat{\delta})) = \rho_1$, $j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = R_a + W_a - \delta$, Moreover, equilibrium pay-offs are $\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}\sum_{i=1}^m \rho_i W_i - \hat{\delta}$. So, simple computation gives $D(1,\delta) = \{L\}^{53}$ if $x^{\#} < \delta \le y^{\#}$ where $x^{\#} = \left(\frac{k-1}{k}\right)(W_{m-1} + R_{m-1}) + A^{\#}$, $y^{\#} = \left(\frac{k-1}{k}\right)(W_m + R_m) + A^{\#}$, $A^{\#} = \hat{\delta} - \left(\frac{k-1}{k}\right)\sum_{i=1}^m \rho_i W_i$. So, then $\phi(D(1,\delta)) = 1$ if $\delta \in (x^{\#}, y^{\#}]$. But then

$$u_m((1,\delta),\phi(D(1,\delta)),\hat{\pi}) = R_m + W_m - \delta, \qquad \delta \in (x^{\#}, y^{\#}]$$

So for ε small,

$$
\begin{aligned}
\hat{u}_m &= \frac{1}{k}(R_m + W_m) - A^{\#} < \frac{1}{k}(R_m + W_m) - A^{\#} + \left(\frac{k-1}{k}\right)(R_m + W_m - W_{m-1} - R_{m-1}) - \varepsilon \\
&= R_m + W_m - \left(\frac{k-1}{k}\right)(W_{m-1} + R_{m-1}) - A^{\#} - \varepsilon \\
&= R_m + W_m - (x^{\#} + \varepsilon) = u_m((1, x^{\#} + \varepsilon), \phi(D(1, x^{\#} + \varepsilon)), \hat{\pi})
\end{aligned}
$$

Hence the equilibrium fails the IC, as claimed.

(b) Assume that the equilibrium is *semi separating*. Then $\hat{\pi}(j,(1,\hat{\delta})) = \rho_q$, $j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = R_a + W_a - \delta$, and $\hat{u}_a = \mu_q(W_a + R_a) + (1 - \mu_q)\sum_{r=1}^q \rho_r W_r/\theta_q - \hat{\delta}$. So, simple computation gives $D(1,\delta) = \{L\}$ if $x_q < \delta \le y_q$, where $x_q = (1 - \mu_q)(W_{m-1} + R_{m-1} - \sum_{r=1}^q \rho_r W_r/\theta_q) + \hat{\delta}$, and $y_q = (1 - \mu_q)(W_m + R_m - \sum_{r=1}^q \rho_r W_r/\theta_q) + \hat{\delta}$. So, then $\phi(D(1,\delta)) = 1$ if $\delta \in (x_q, y_q]$. But then $u_m((1,\delta),\phi(D(1,\delta)),\hat{\pi}) = R_m + W_m - \delta$, $\delta \in (x_q, y_q]$. So, for ε small,

$$
\begin{aligned}
\hat{u}_m &= \mu_q(W_m + R_m) + (1 - \mu_q)\sum_{r=1}^q \rho_r W_r/\theta_q - \hat{\delta} \\
&< R_m + W_m - \left(1 - \mu_q\right)(R_{m-1} + W_{m-1}) + \left(1 - \mu_q\right)\sum_{r=1}^q \rho_r W_r/\theta_q - \hat{\delta} - \varepsilon, \quad \mu_q < 1 \\
&= R_m + W_m - (1 - \mu_q)\left(R_{m-1} + W_{m-1} - \sum_{r=1}^q \rho_r W_r/\theta_q\right) - \hat{\delta} - \varepsilon \\
&= R_m + W_m - (x_q + \varepsilon) = u_m((1, x_q + \varepsilon), \phi(D(1, x_q + \varepsilon)), \hat{\pi})
\end{aligned}
$$

So the semi-separating equilibrium fails the IC, as claimed.

(c) Assume that the equilibrium is *separating*. Then $\hat{\pi}(j,(1,\hat{\delta})) = 1$, $j \in K$, so $u_a((1,\delta),1,\hat{\pi}) = \mu_m(R_a + W_a) + (1 - \mu_m)W_m - \delta$. So, $u_m((1,\delta),1,\hat{\pi}) = \hat{u}_m + \hat{\delta} - \delta$. So,

---

[53]Where L now regroup all types $a = \{1, ..., m-1\}$ except the highest ability type agent, i.e. a type-m agent.

$(1, \delta)$ is dominated for m iff $\delta > \hat{\delta}$. Moreover, $(1, \delta)$ is dominated for L as long as $\delta > \underline{\delta}_m$. So, for $\underline{\delta}_m < \delta \leq \hat{\delta}$, $m \notin D(1, \delta) = \{L\}$, so $\phi(D(1, \delta)) = 1$, $\underline{\delta}_m < \delta \leq \hat{\delta}$. But then by construction,

$$\hat{u}_m < \hat{u}_m + \hat{\delta} - \delta = u_m((1, \delta), \phi(D(1, \delta)), \hat{\pi}), \quad \underline{\delta}_m < \delta < \hat{\delta}$$

So, as long as $\underline{\delta}_m < \hat{\delta}$, the separating equilibrium fails the IC. Obviously, if $\underline{\delta}_m = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the IC. $\square$

Proposition 8. Assume that the equilibrium is pooling. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho_1$, $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \delta$. Moreover, equilibrium payoffs are $\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k} \sum_{i=1}^m \rho_i W_i - \hat{\delta}$, $a \in \{1, .., m\}$. So, if $R_a + W_a - \delta \geq \hat{u}_a$, $a \in \{1, .., m\}$, action $(1, \delta)$ is dominated for no ability type. This occurs when $\delta \leq x = \hat{\delta} + \left(\frac{k-1}{k}\right)[R_m + W_m - \sum_{i=1}^m \rho_i W_i]$. So, then $D(1, \delta) = \{\emptyset\}$, $\delta \leq x$. But as $\phi(D(1, \delta)) = \rho_1$, we have:

$$u_a((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k} \sum_{i=1}^m \rho_i W_i - \delta, \qquad \delta \leq x$$

Now, $\hat{\delta} < x$ by construction. So, it follows that for any $\hat{\delta} > \delta > \underline{\delta}$, $u_a((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = \hat{u}_a + \hat{\delta} - \delta > \hat{u}_a$ so that the equilibrium fails the IC. Obviously, when $\hat{\delta} = \underline{\delta}$, this cannot happen, so the pooling equilibrium where $\hat{\delta} = \underline{\delta}$ passes the IC.

(b) Assume that the equilibrium is q−separating. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho_q$, $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \delta$. Moreover, equilibrium payoffs are $\hat{u}_a = \mu_q(R_a + W_a) + (1 - \mu_q) \sum_{r=1}^q \rho_r W_r / \theta_q - \hat{\delta}$. So, simple computation gives $D(1, \delta) = \{\overline{Z}\}$ if $x_q < \delta \leq y_q$, where $x_q = (1 - \mu_q)(W_{q+1} + R_{q+1} - \sum_{r=1}^q \rho_r W_r / \theta_q) + \hat{\delta}$, and $y_q = (1 - \mu_q)(W_q + R_q - \sum_{r=1}^q \rho_r W_r / \theta_q) + \hat{\delta}$. So, then $\phi(D(1, \delta)) = 1$ if $\delta \in (x_q, y_q]$. But as $\phi(D(1, \delta)) = \rho_q$, we have:

$$u_a((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = \mu_q(R_a + W_a) + (1 - \mu_q) \sum_{r=1}^q \rho_r W_r / \theta_q - \delta, \qquad \delta \in (x_q, y_q]$$

Now, $\hat{\delta} < x_q$ by construction. So, it follows that for any $\hat{\delta} > \delta > 0$, $u_a((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = \hat{u}_a + \hat{\delta} - \delta > \hat{u}_a$ so that the equilibrium fails the IC. Obviously, when $\hat{\delta} = 0$, this cannot happen, so the semi separating equilibrium where $\hat{\delta} = 0$ passes the IC, as claimed. $\square$

Proof of Proposition 9. (a) Assume that the equilibrium is pooling. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho$, $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \varphi_b \delta$, Moreover, equilibrium pay-offs are

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}(\rho W_H + (1 - \rho)W_L) - \varphi_b \hat{\delta}, \qquad (a, b) = (H, L)$$

Let $x' = [\left(\frac{k-1}{k}\right)(W_L + R_L) + A_L] / \varphi_L$, $y' = [\left(\frac{k-1}{k}\right)(W_H + R_H) + A_H] / \varphi_H$, $A_b = \varphi_b \hat{\delta} - \left(\frac{k-1}{k}\right)[\rho W_H + (1 - \rho)W_L]$. We can see that now two cases are possible depending on whether $\varphi_H - \varphi_L$ is "too large" or not (where we have defined in (6.2) the maximum spread between φ_H and φ_L).

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(i) Case 1: $\varphi_H - \varphi_L$ is small enough. In this case, simple computation give $D(1,\delta) = \{L\}$ if $x' < \delta \le y'$. So, then $\phi(D(1,\delta)) = 1$ if $\delta \in (x', y']$. But then $u_H((1,\delta), \phi(D(1,\delta)), \hat{\pi}) = R_H + W_H - \varphi_b\delta$, $\delta \in (x', y']$. So for ε small,

$$
\begin{aligned}
\hat{u}_H &= \frac{1}{k}(R_H + W_H) - A_H < \frac{1}{k}(R_H + W_H) - A_L - \varepsilon, \quad \text{since } A_H > A_L \\
&< \frac{1}{k}(R_H + W_H) - \frac{A_L}{\varphi_L} - \varepsilon, \quad \text{since } \varphi_L > 1 \\
&< \frac{R_H + W_H}{k} - \frac{A_L}{\varphi_L} + \left(\frac{k-1}{k}\right)(R_H + W_H) - \frac{1}{\varphi_L}\left(\frac{k-1}{k}\right)(W_L + R_L) - \varepsilon \\
&= R_H + W_H - \frac{1}{\varphi_L}\left[\left(\frac{k-1}{k}\right)(W_L + R_L) + A_L\right] - \varepsilon \\
&= R_H + W_H - (x' + \varepsilon) = u_H((1, x' + \varepsilon), \phi(D(1, x' + \varepsilon)), \hat{\pi})
\end{aligned}
$$

where we have used the fact that $R_H + W_H - W_L - R_L > 0$ since we are in the congruence case. And therefore $\left(\frac{k-1}{k}\right)(R_H + W_H) - \frac{1}{\varphi_L}\left(\frac{k-1}{k}\right)(W_L + R_L) > 0$ since $\varphi_L > 1$. So the pooling equilibrium fails the IC, as claimed.

(ii) Case 2: $\varphi_H - \varphi_L$ is large enough. In this case, simple computation gives $D(1,\delta) = \{H\}$ if $y' < \delta \le x'$. So, then $\phi(D(1,\delta)) = 0$ if $\delta \in (y', x']$. Therefore, any citizens that deviates from the equilibrium strategy is believed to be a low-type with probability one, and will therefore never be elected but will lose the entry cost δ, i.e.

$$
u_L((1,\delta), \phi(D(1,\delta)), \hat{\pi}) = \rho W_H + (1 - \rho)W_L - \varphi_L\delta, \quad \delta \in (y', x']
$$

This obviously is a dominated strategy since the equilibrium payoff is

$$
\begin{aligned}
\hat{u}_L &= \frac{1}{k}(R_L + W_L) - A_L = \frac{1}{k}(R_L + W_L) + \left(\frac{k-1}{k}\right)(\rho W_H + (1-\rho)W_L) - \varphi_L\hat{\delta} \\
&> \frac{1}{k}(R_L + W_L) + \left(\frac{k-1}{k}\right)(\rho W_H + (1-\rho)W_L) - \varphi_L\delta \\
&> \rho W_H + (1-\rho)W_L - \varphi_L\delta = u_L((1,\delta), \phi(D(1,\delta)), \hat{\pi})
\end{aligned}
$$

were we have used A1: i.e. $R_L + W_L > W_H$, and the fact that $\delta \in (y', x'] > \hat{\delta}$ by construction. So the pooling equilibrium does not fails the IC when $\varphi_H - \varphi_L$ is large enough.

(b) (i) Assume that the equilibrium is *strongly separating* and that $\varphi_H - \varphi_L$ is not "too large" so that $\underline{\delta}_{st} < \overline{\delta}_{st}$. Then $\hat{\pi}(j, (1,\hat{\delta})) = 1$, $j \in K$, and $u_a((1,\delta), 1, \hat{\pi}) = \mu_0(R_a + W_a) + (1 - \mu_0)W_H - \varphi_b\delta$. Thus, $u_H((1,\delta), 1, \hat{\pi}) = \hat{u}_H + \varphi_L\hat{\delta} - \varphi_L\delta$. So, $(1,\delta)$ is dominated for $(a,b) = (H,L)$ iff $\delta > \hat{\delta}$. Moreover, $(1,\delta)$ is dominated for a types $(a,b) = \{(H,H),(L,L),(L,H)\}$ as long as $\delta > \underline{\delta}_{st}$. So, for $\underline{\delta}_{st} < \delta \le \hat{\delta}$, $(H,L) \notin D(1,\delta) = \{(H,H),(L,L),(L,H)\}$, so $\phi(D(1,\delta)) = 1$, for $\underline{\delta}_{st} < \delta \le \hat{\delta}$. But then by construction,

$$
\hat{u}_H < \hat{u}_H + \varphi_L\hat{\delta} - \varphi_L\delta = u_H((1,\delta), \phi(D(1,\delta)), \hat{\pi}), \quad \underline{\delta}_{st} < \delta < \hat{\delta}
$$

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So, as long as $\underline{\delta}_{st} < \hat{\delta}$, the separating equilibrium fails the IC. Obviously, if $\underline{\delta}_{st} = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the IC.

(ii) Assume that the equilibrium is *weakly separating* and that $\varphi_H - \varphi_L$ is not "too large" so that $\underline{\delta}_{ws} < \overline{\delta}_{ws}$. Then $\hat{\pi}(j, (1, \hat{\delta})) = 1$, $j \in K$, and $u_{ab}((1, \delta), 1, \hat{\pi}) = \mu_1(R_a + W_a) + (1 - \mu_1)W_H - \varphi_b\delta$. Thus, $u_{Hb}((1, \delta), 1, \hat{\pi}) = \hat{u}_H + \varphi_b(\hat{\delta} - \delta)$. So, $(1, \delta)$ is dominated for $a = H$ only if $\delta > \hat{\delta}$. Moreover, $(1, \delta)$ is dominated for a low-ability type (regardless of its burning cost) as long as $\delta > \underline{\delta}_{ws}$. So, for $\underline{\delta}_{ws} < \delta \leq \hat{\delta}$, $a = H \notin D(1, \delta) = \{a = L\}$, so $\phi(D(1, \delta)) = 1$, for $\underline{\delta}_{ws} < \delta \leq \hat{\delta}$. But then by construction,

$$\hat{u}_H < \hat{u}_H + \varphi_b(\hat{\delta} - \delta) = u_{HL}((1, \delta), \phi(D(1, \delta)), \hat{\pi}), \qquad \underline{\delta}_{ws} < \delta < \hat{\delta}$$

So, as long as $\underline{\delta}_{ws} < \hat{\delta}$, the separating equilibrium fails the IC. Obviously, if $\underline{\delta}_{ws} = \hat{\delta}$, this argument does not apply, and so this separating equilibrium passes the IC.

(iii) Assume that the equilibrium is *semi separating* and that $\varphi_H - \varphi_L$ is not "too large" so that $\underline{\delta}_{se} < \overline{\delta}_{se}$, and $x_2 < \delta \leq y_2$. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho_2 > 0$,[54] $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \varphi_b\delta$, and

$$\hat{u}_a = \mu_2(W_a + R_a) + (1 - \mu_2)\Psi - \varphi_b\hat{\delta}$$

where $\Psi = [(\rho\omega + \rho(1 - \omega))W_H + (1 - \rho)(1 - \omega)W_L] / [1 - (1 - \rho)\omega]$. So, simple computation gives $D(1, \delta) = \{L\}$ if $x_2 < \delta \leq y_2$, where $x_2 = \frac{1 - \mu_2}{\varphi_L}(R_L + W_L - \Psi) + \hat{\delta}$, and $y_2 = \frac{1 - \mu_2}{\varphi_H}(R_H + W_H - \Psi) + \hat{\delta}$. So, then $\phi(D(1, \delta)) = 1$ if $\delta \in (x_2, y_2]$. But then

$$u_H((1, \delta), \phi(D(1, \delta)), \hat{\pi}) = R_H + W_H - \varphi_b\delta, \qquad \delta \in (x_2, y_2]$$

So, for ε small,

$$
\begin{aligned}
\hat{u}_H &= \mu_2(W_H + R_H) + (1 - \mu_2)\Psi - \varphi_L\hat{\delta} \\
&< R_H + W_H - (1 - \mu_2)(R_L + W_L) + (1 - \mu_2)\Psi - \varphi_L\hat{\delta} - \varphi_L\varepsilon, \quad \mu_2 < 1 \\
&= R_H + W_H - \varphi_L\left[\frac{1 - \mu_2}{\varphi_L}(R_L + W_L - \Psi) + \hat{\delta}\right] - \varphi_L\varepsilon \\
&= R_H + W_H - \varphi_L(x_2 + \varepsilon) = u_H((1, x_2 + \varepsilon), \phi(D(1, x_2 + \varepsilon)), \hat{\pi})
\end{aligned}
$$

So the semi-separating equilibrium fails the IC, as claimed. $\square$

Proof of Proposition 10. (i) Assume that the equilibrium is *pooling*. Then $\hat{\pi}(j, (1, \hat{\delta})) = \rho$, $j \in K$, so $u_a((1, \delta), 1, \hat{\pi}) = R_a + W_a - \varphi_b\delta$. Moreover, equilibrium pay-offs are:

$$\hat{u}_a = \frac{1}{k}(R_a + W_a) + \frac{k - 1}{k}[\rho W_H + (1 - \rho)W_L] - \varphi_b\hat{\delta}, \qquad (a, b) = (H, L)$$

So, if $R_L + W_L - \varphi_H\delta \geq \hat{u}_L$, $R_H + W_H - \varphi_H\delta \geq \hat{u}_H$, action $(1, \delta)$ is dominated for neither ability type. Simple computation tells us that this occurs when $\delta \leq x' = \hat{\delta} +$

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[54]where $\rho_2 = 1 - \omega - \rho(1 - 2\omega) + \rho^2(1 + \omega)(\omega - 1)^2 - \omega\rho^3(\omega - 1)^2$.

$\frac{1}{\varphi_H}\left(\frac{k-1}{k}\right)[R_H + (1-\rho)(W_H - W_L)]$. So, then $D(1,\delta) = \{\emptyset\}$, $\delta \le x'$. But as $\phi(D(1,\delta)) = \rho$, we have:

$$u_a((1,\delta), \phi(D(1,\delta)), \hat\pi) = \frac{1}{k}(R_a + W_a) + \frac{k-1}{k}[\rho W_H + (1-\rho)W_L] - \varphi_b\delta, \qquad \delta \le x'$$

Now, $\hat\delta < x'$ by construction. So, it follows that for any $\hat\delta > \delta > \underline\delta$,

$$u_a((1,\delta), \phi(D(1,\delta)), \hat\pi) = \hat u_a + \varphi_b\hat\delta - \varphi_b\delta > \hat u_a$$

so that the equilibrium fails the IC. Obviously, when $\hat\delta = \underline\delta$, this cannot happen, so the pooling equilibrium where $\hat\delta = \underline\delta$ passes the IC.

(ii) Assume that the equilibrium is *semi separating* and that $\varphi_H - \varphi_L$ is not "too large". Then $\hat\pi(j, (1,\hat\delta)) = \rho_2$, $j \in K$, so $u_a((1,\delta), 1, \hat\pi) = R_a + W_a - \varphi_b\delta$, and

$$\hat u_a = \mu_2(W_a + R_a) + (1 - \mu_2)\Psi - \varphi_b\hat\delta$$

where $\Psi = [(\rho\omega + \rho(1-\omega))W_L + (1-\rho)(1-\omega)W_H]/[1 - (1-\rho)\omega]$. So, if $R_L + W_L - \varphi_H\delta \ge \hat u_L$, $R_H + W_H - \varphi_L\delta \ge \hat u_H$, action $(1,\delta)$ is dominated for neither ability type. Simple computation give $D(1,\delta) = \{\emptyset\}$ if $\delta \le x_\emptyset$, where $x_\emptyset = (1 - \mu_2)[W_H + R_H - \Psi]/\varphi_L + \hat\delta$. So, then $\phi(D(1,\delta)) = \emptyset$ if $\delta \le x_\emptyset$. But as $\phi(D(1,\delta)) = \rho_2$, then

$$u_a((1,\delta), \phi(D(1,\delta)), \hat\pi) = \mu_2(W_a + R_a) + (1 - \mu_2)\Psi - \varphi_b\delta, \qquad \delta \le x_\emptyset$$

But we know that $\hat\delta < x_\emptyset$ by construction. So, it follows that for any $\hat\delta > \delta > \underline\delta$,

$$u_a((1,\delta), \phi(D(1,\delta)), \hat\pi) = \hat u_a + \varphi_b\hat\delta - \varphi_b\delta > \hat u_a$$

so that the equilibrium fails the IC. Obviously, when $\hat\delta = \underline\delta_{se}$, this cannot happen, so the pooling equilibrium where $\hat\delta = \underline\delta_{se}$ passes the IC. $\square$