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POLITICAL MULTI-TASK PROBLEMS, INCENTIVE PAY AND CITIZEN PARTICIPATION

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Abstract

We analyze the extent and effectiveness of electoral accountability and the problems related to keeping the politicians accountable. We illustrate the importance of developing incentive tools to discipline the incumbents. We propose "incentive pay" as an effective tool and we analyze its potentials and limitations.
To assess the appropriate incentive schemes, we first explore the sources of (re)election incentives for politicians. To analyze the political agency problem, we focus on politician's private interest. We formally characterize the "politcal multi-task problem" in which the office-holder has two tasks: to determine the level of public-good spending and to finance public-good spending by taxing the citizens' private good in a society where citizens' private-good endowments are heterogeneous.
Political multi-task problems typically have outcomes that are difficult to measure. Moreover, citizens have conflicting opinions about optimal policies. The agent has the power to tax the citizens to invest in desired outcomes of some tasks. In such an environment, policy-maker chooses socially inefficient public good levels and expropriates minorities. The model, while simple and abstract is useful to gain a balanced perspective on the conflict of interest between citizens and the policy-maker.
In the main body of this thesis, we study how to efficiently motivate policy-makers to solve political multi-task problems. We propose taxation constraints and "incentive pay" as a tool to discipline incumbents. We study offering performance pay to politicians as a tool to incentivize them. We show that a judicious combination of constitutional limit on taxation and incentive pay based on the level of public-good provision by the office-holder improves welfare.
As an extension to the basic model, we explore the effect of incentive pay on a policy-maker who is not solely motivated by private interest, but also has social welfare concerns. Moreover, we study the results when candidates can compete at the campaign stage by announcing their desired level of incentive pay.
As an alternative disciplining tool, we finally turn to formal citizen participation. We describe the different forms of citizen participation available, and we explore their effectiveness, before addressing "Co-voting", a novel form of citizen participation. To complete our analysis, we discuss the interplay between incentive contracts and citizen participa-

tion. In particular, we show that Co-voting is a supporting tool to implement incentive pay than to a referendum or to parliamentary vote.

Zusammenfassung

In dieser Dissertation werden das Potential und die Risiken von Leistungslohn für gewählte Politiker untersucht, in Kombination mit Besteuerungsauflagen. Auch wird untersucht, ob weitere neue Politik-Instrumente dabei unterstützend einwirken könnten.

Zuerst wird analysiert, warum gewählte Amtsträger im Amt möglicherweise nicht die bestmögliche Leistung erbringen, mit besonderer Berücksichtigung des Zusammenhangs zwischen der Leistung im Amt und den Wiederwahlchancen. Im Fokus der Analyse steht das Privatinteresse des Amtsträgers. In der Dissertation wird das "political multitask problem" des Politikers formal charakterisiert: der Amtsträger (Agent) muss zwei Aufgaben erfüllen, das Ausmass der Ausgaben für ein öffentliches Gut festlegen und dieses öffentliche Gut dadurch finanzieren, dass er Privatgüter der Bürger besteuert. Die Mitglieder der Gesellschaft sind heterogen in Bezug auf ihre Austattung mit Privatgütern.

Typischerweise ist es sehr schwierig, die Ergebnisse von Multitask-Problemen zu messen. Zudem können die Bürger unterschiedlicher Meinungen zur optimalen Politik sein. Im Modell kann der Agent Steuern erheben, um bei bestimmten Aufgaben erwünschte Ergebnisse zu erzielen. Es wird gezeigt, dass der Politiker in solcher Umgebung ein sozial ineffizientes Ausmass an öffentlichen Gütern wählen und Minderheiten enteignen wird. Das Modell ist einfach und abstrakt, doch es erlaubt eine gute Darstellung des Interessenskonfliktes zwischen den Bürgern und dem Amtsträger.

Im Hauptteil der Dissertation wird untersucht, wie man Politiker effizient dazu bringen kann, politische Multitask-Probleme zu lösen. Das Potential und die Risiken von Besteuerungs-Auflagen und "incentive pay" (Leistungslohn) als Disziplinierungsinstrument für Politiker werden analysiert. Die Analyse zeigt, dass die richtige Kombination von konstitutionellen Einschränkungen der Besteuerung und Leistungslohn imstande sind, das allgemeine Wohl zu erhöhen. Dabei wird der Leistungslohn an das Bereitstellen einer bestimmten Menge des öffentlichen Gutes geknüpft.

Als Variante des Grundmodells wird ebenfalls untersucht, wie Leistungslohn sich dann auswirkt, wenn ein Amtsträger neben Privatinteressen auch das Wohl der Allgemeinheit zum Ziel hat. In einer weiteren Analyse wird den Kandidaten für ein Amt erlaubt, bereits während des Wahlkampfes die von ihnen gewünschten Anreiz-Schemen bekanntzugeben, und damit den Wettbewerb mit anderen Kandidaten anzutreten.

Als Kontrapunkt zum Hauptfokus, der auf dem Politiker lag, wird danach die Perspektive gewechselt und es wird untersucht, ob und wie die Amtsträger durch formale Teilnahme der Bürger ("formal citizen participation") an Entscheidungsprozessen zu besseren Leistungen ermutigt werden könnten. Nach einer Beschreibung der mannigfaltigen Varianten der "citizen participation", die denkbar sind und/oder tatsächlich umgesetzt werden, wird besonders auf "Co-voting" eingegangen, einer speziellen – und neuen – Form der Teilnahme, die in repräsentativen Demokratien umgesetzt werden könnte. Co-voting ist ein Verfahren, das bei besonderen Entscheidungen einen Teil der parlamentarischen Entscheidungsbefugnis an die Bürger zurückgibt: eine repräsentative Teilmenge der Bürger entscheidet einmalig zusammen mit dem Parlament, nach einem vorgängig festgelegten Verteilschlüssel.

Im letzten Teil der Dissertation werden die beiden politischen Instrumente Leistungslohn und Co-voting miteinander verglichen und es wird der Frage nachgegangen, ob sie komplementär sein können oder einander ausschliessen. Dabei wird gezeigt, dass Co-voting bei der Implementierung von Leistungslohn unterstützend eingesetzt werden könnte.

Contents

1 Introduction

In economics, the principal-agent theory is used by researchers since the 1970s, following the pioneering work of Ross (1973) and Mitnick (1975). The theory serves as a tool to analyze the issues that arise when one person (agent) makes a decision on behalf of another person (principal). Ross (1973) famously describes the problem of choosing an ice cream flavor for somebody else without knowing this person's taste.

When making such decisions, the so-called "*agency problem*" can arise. The agency problem refers to a situation when the agent's decision is not aligned with the principal's interest. Consider, for instance, a manager who does not reach the goals set by the share holders, an employee who does not perform all the tasks required by his employer or an elected politician who does not keep his campaign promises. Such examples of the agency problem have been thoroughly studied in the literature on contract theory and political economy.[1]

In particular, the principal-agent theory addresses the conflict of interest between the principal and agent that stems from information asymmetry. The theoretical methodology distinguishes between two types of incentive problems: the "*hidden information*" problem and the "*hidden action*" problem. While for the principal, it is important to hire the best agent, in many cases, the agent might have more information about his own abilities and willingness to perform than the principal. In such cases, the agent's hidden information generates the problem of "*adverse selection*". For example, in the secondhand car market, the seller has more information about the car's problems, and may try to sell the car for a higher price without informing the buyer about the problematic issues. Moreover, if the agent's actions are hidden from the principal, the agent can shirk, i.e. he can avoid the difficult or unpleasant tasks or do less work because he finds the rewards too small. In this case, the agency problem is a "*moral hazard*" problem. Often when a manager is protected from the consequences of poor decision-making, moral hazard problems can arise. For instance, if a manager's payment is independent of a project's success, he might make very risky investments. In reality, many incentive problems can be described as a combination of both adverse selection and moral hazard problems.

In economic settings, we use contract theory to explore ways to overcome agency prob-

[1] See, for example, Persson and Tabellini (2002) and Bolton and Dewatripont (2005).

lems. The solution to adverse selection and moral hazard problems is an optimal contract ensuring the selection of the best candidate and disciplining the selected agent to achieve the principal's desired outcomes.

The political agency model applies contract theory and information economics to political settings. In a political setting, voters delegate their power to the policy-maker, whom they have elected to serve one term in office. During this term, the policy-maker makes policy choices on behalf of all the heterogeneous citizens in the society. Since the society is heterogeneous, the policy-maker might not serve the interests of a given group of citizens, but serves other citizens' interests. This might be the case especially if some groups in the society are better organized and more powerful, and can influence politicians by lobbying.

The policy-maker has various motivations to hold office but not all of his motivations are altruistic.[2] Given the policy-maker is not benevolent per se, he will depart from serving the citizens to serve his personal interests during his term . This generates conflicts of interest between the policy-maker and the citizens, even in the absence of adverse selection and moral hazard.

To ensure the alignment of policy choices with the public interest, it is important for the society to hold the policy-maker accountable. The main mechanism for political accountability is election. The role of elections in the electoral accountability is twofold: (1) selecting the most able politician to overcome adverse selection problems and (2) reducing the possibility of moral hazard by disciplining the policy-maker. However, (re)election incentives are insufficient to hold politicians accountable.[3] Holding a policy-maker accountable is even more challenging since the policy-maker is an agent with multiple tasks, and citizens want to hold him to account on a variety of performance outcomes. Some tasks might not have a verifiable outcome, so that the corresponding contract cannot be designed efficiently. If a contract is feasible, i.e. conditioned on an outcome which is verifiable, this contract might not have a strong impact on the policy-maker's overall performance. This follows from the results established by Holmström and Milgrom (1991) in the private sector, stating that applying high-powered incentive schemes to a multi-task agent may not increase the principal's utility. Thus, developing additional mechanisms, incentives, and constitutional rules that restrain the policy-maker is beneficial and necessary. Some of these mechanisms are the subject of the present thesis.

In the framework of political agency problems, we will abstract from information asymmetry problems throughout this thesis and explore the political principal-agent problem

[2] Unlike the view advocated by Pigou (1920), who shaped welfare economics, in public choice and public finance paradigms, a government is assumed to follow its private interests. See for example Stigler (1971) and Buchanan (1975).

[3] See Barro (1973) and Ferejohn (1986).

in a setting with complete information, in which the policy-maker has multiple tasks. We will assume accountability and social welfare are connected in the sense that the more accountable the policy-maker is the higher social welfare will be.

We aim to address the following question: How can we construct corrective measures which are socially optimal from a utilitarian perspective to discipline a multi-task policy-maker in a heterogeneous society? We will address this issue from different perspectives, starting with a survey of politicians' motivations to run for election, then continuing to a formal analysis of political multi-task problems under taxation constraints and pecuniary incentives for public-good provision, and finally complement our research field with a panorama of literature on citizen participation and a comparison between incentive contracts and citizen participation.

In the main part of the thesis (Chapters 3 and 4), we will explore a simple setting in which a policy-maker should (a) determine the level of public-good spending and (b) finance this project by taxing citizens' private good. The citizens have heterogeneous private-good endowments, one group having a higher endowment and the other a lower endowment level. All the citizens have the same preferences over the consumption of private good and public good. The citizens cannot influence the policy-maker's public-good spending or taxation while he is in office. This generates various inefficiencies, which we divide in two categories: (i) the exploitation of the minority and (ii) sub-optimal public-good provision.

We will propose two corrective measures: (1) taxation constraints to overcome minority exploitation and (2) incentive contracts to improve public-good provision. Still, election remains the only mechanism to select or deselect the politician from office.

First, we will examine the effect of tax constraint. We will observe that while it prevents the policy-maker from exploiting the minority, it exacerbates sub-optimal public-good provision. Nevertheless, we will establish that the optimal taxation constraint improves social welfare by changing the feasible policy set.

Second, we will design an incentive contract to improve public-good provision. For this purpose, we will apply the framework of political contract theory to explore corrective measures. This political contract theory was developed in Gersbach (2003) and Gersbach and Liessem (2008) and is surveyed in Gersbach (2012). A political contract is a form of contract that has to be compatible with the principles of liberal democracy and stipulates the performance the candidates must deliver, together with a reward and/or a redistribution depending on the quality of this performance. Such contracts are one-sided and can be offered by the politician himself or set up by the legislature. They must do not interfere with elections, equal voting rights, and separation of powers.

We will propose an incentive contract which rewards the policy-make in his private-good consumption, conditional on the level of public-good provision he provides when in office. We will refer to this incentive contract by "*incentive pay*". We will assume the level of public-good provision is measurable and verifiable. We will establish that the incentive pay the policy-maker receives leads to improved public-good provision. The optimal reward scheme thus improves social welfare.

We will combine the two corrective measures, tax constraints and incentive pay, and we will establish that both tools are successful in lessening minority exploitation and improving public-good provision. Thus, overall, these corrective measures are welfare-improving.

To extend our analysis, we will study a policy-maker who considers society's well-being together with his personal interests when choosing a policy. We will establish that in this setting, incentive pay improves social welfare, especially in poor societies. We will generalize our results for incentive pay to an economy with more than two endowment groups. Moreover, we will investigate a possible way to determine the level of the policy-maker's reward. We will allow candidates to compete for election by announcing their *desired* incentive contract during campaigns. We will establish that in such a setting, there is a campaign strategy under which the candidate from the majority endowment group announces the most rewarding—for himself—contract possible, which is still affordable for the society and wins the election.

Another strand of literature starts from another perspective and addresses the political agency problem by exploring whether *citizen participation* can improve political accountability. Citizen participation in general pursues a redistribution of decision-making power from the policy-makers to the citizens. In other words, it examines alternative mechanisms that do not fully delegate the decision-making power to the policy-maker between election rounds. Citizen participation can be beneficial, as it facilitates information exchange between the policy-maker and the citizens, and it can improve transparency. Thus, it helps holding the policy-maker accountable and can be a powerful tool complementing other monitoring devices. Yet, the choice of a particular type of citizen participation is so wide that a proper assessment of its challenges and limitations before choosing the type is a difficult task. Moreover, if not properly implemented, it can backfire by generating frustration and disinterest among citizens.

In the last chapter of this thesis, we will explore various forms of citizen participation. We will apply the framework of *democracy cube*—developed by Fung (2006)—to determine the consequences of citizen participation in each setting. Finally, we will elaborate on a recent mechanism of citizen participation, developed in Gersbach (2017), to illustrate the potential of citizen participation in overcoming political agency problems. We explore the interplay between Co-voting and incentive pay at the end of this chapter and we show that to implement incentive pay, Co-voting is a better procedure than a referendum or parliamentary vote. We will establish that Co-voting improves transparency and legitimacy and it is less costly than referenda and more inclusive than parliamentary vote. Thus, it yields a more welfare-improving incentive pay.

The dissertation is structured as follows:

- Chapter 2 motivates our research on incentive pay for policy-makers. It consists of two parts. In the first part, we will account for the various sources of politicians' (re)election incentives. In the second part, we will focus on politicians' private interest and we will explore the literature on the use of office-holders' pay as a tool to select and discipline policy-makers. This part serves as a basis for the analysis given in Chapter 3.

- In Chapter 3, we will construct a model of a *political multi-task problem* and we will explore the inefficiencies that arise in this setting. We will propose corrective measures to mitigate these inefficiencies, i.e. a constitutional limit on taxation and incentive pay for policy-makers. We will explore the combined effect of tax limits and incentive pay on social welfare.

- Chapter 4 provides three extensions of the model presented in Chapter 3. In the first part, we relax the assumption that the policy-maker solely serves his personal interest and we consider a policy-maker with altruistic concerns. In the second part, we extend the results of the model developed in Chapter 3 to the case with more than two levels of endowment in the society. Finally, we integrate elections in our model and we allow candidates to compete by announcing their desired incentive pay.

- In Chapter 5, as a counterpart of focusing on politicians, we will switch to the point of view of the citizens. We will examine citizen participation and its various forms of implementation. We will establish the ability of citizen participation to alleviate political agency problems, as well as the risks inherent to citizen participation. We will examine Co-voting, a form of citizen participation which allows a temporary shift of power in a representative democracy from the office-holder to the citizens in a way that is beneficial to both office-holder and citizens. We will discuss various aspects of Co-voting that make it a desirable form of citizen participation. We address the complexity of interactions between citizen participation and incentive contract and as an illustrative example, we establish the positive impact of Co-voting on the design of incentive pay.

- Chapter 6 concludes.

2 What Makes Office-holding Valuable for Politicians?

2.1 Introduction

In a society, the government is the legitimate force that taxes citizens, provides public goods and regulates externalities. How governments should make policies and allocate resources in a democratic setting is the subject of hot debates in academia and society. At a more theoretical level, how different institutional designs can impact democratic policy-making is one of the issues addressed by policy researchers, in particular.

There are two main branches in the economic analysis of governing. From the *welfare economics* point of view, a government has the interest of the public in mind when making policy choices. Its objective is to improve the well-being of its citizens. This perspective was established by Pigou and Mirrlees.[1] Yet, from a *public choice and public finance* point of view, a government follows its "private" interests when making policies. The main advocates of this perspective are Buchanan and Stigler. As Buchanan (1975) describes comprehensively, the rent-seeking behavior of governments is motivated by rational self-interest. This approach has shaped the so-called Chicago political economy framework. According to the Chicago School, although politicians are self interested, the process of political competition can align their interests with that of the public. In his pioneer work, Stigler (1971) assumes that governments are entirely self interested, and he establishes inefficient policy making as a market failure that arises because well-organized interest groups demand specific regulations to enhance their market power, increase their benefits, and generate more rents for themselves. Similarly, Peltzman (1980) assumes that governments are strongly self interested to explain why the size of governments has grown over time relative to income. Moreover, Becker (1983) suggests that lobbying and political competition among interest groups, who are highly affected by certain policies, influence policy outcomes and often yield efficient policies.

Similar to Besley (2006), our approach is a combination of the two approaches described above. This perspective assumes that governments depart from the public interest due

[1] See for example Pigou (1920) and Mirrlees (1995).

to their own interest, but does not dismiss the potential of governments that serve the public's interest. While we believe a benevolent office-holder is better for government, we are in favor of institutional structures that yield the selection of competent politicians and discipline this office-holder in such a way that there is the least possible divergence between the politician's choices and the public's interest.

In today's representative democracies, a government is chosen through elections, by majority rules. Elections, in addition to aggregating the citizens' preferences in a heterogeneous society, are the tool we use to keep politicians accountable. They—theoretically—allow us to choose the best candidate in a political competition and to discipline the incumbent by reelection incentives. In a first step, let us thus abstract from the aggregation function of elections and focus on how elections help (i) to select the most able candidate and (ii) to discipline the elected politician.

A useful framework to study the ability of elections to select high quality candidates is the citizen-candidate framework. Developing this framework, Osborne and Slivinski (1996) and Besley and Coate (1997) show that the election process does not suffice to stop low quality candidates from being elected. Caselli and Morelli (2004) show that due to hidden information, low quality candidates can pretend to be high quality candidates to obtain office, along with the corresponding perks. The perks of office are pecuniary or non-pecuniary benefits that an office-holder accrues, dependent or independent of his policy choices. They should serve as rewards for good performance, but they can attract undesirable candidates. Uncertainty and/or hidden information about the type of a candidate can generate the corresponding adverse selection problem in political competition.

Moreover, once elected, the office-holder's actions are hidden to the public, and the citizens do not know how much effort the office-holder spends on his tasks.

To discipline an office-holder in a democracy, citizens have one tool, i.e. reelection incentives. The problems entailed by such disciplining are similar to moral hazard problems in economic contract theory: A politician is an agent having more information about his own performance than the principals. How hard and how well an elected politician works and whether he undertakes the policies he promised during his campaign is often not directly observable by the voters. One typical issue is that a politician who wants to stand for reelection prefers to implement short-term projects instead of more desirable long-term projects, as these are less observable. Bolton and Dewatripont (2005) describe this as one of the main problems arising when a contract is incomplete, i.e. when some aspects of a decision remain unknown. Election is one example of such contracts: Reelection is used to motivate office-holders to make efficient policy choices but the office term is too short and the tasks are too numerous to allow an informed reelection decision based on performance. Barro (1973) and Ferejohn (1986) studied the effect of reelection incentives on the office-holder's policy choices, using the principal-agent framework. The political agency models focus on political situations where voters want to keep the politicians accountable, so that the office-holders implement policies that are aligned with the voters' interests. Ashworth (2012) surveys more recent work that establishes how limited the influence of electoral accountability on policy decisions is.

We observe that hidden information and hidden action lead to adverse selection and moral hazard problems in politics as well. However, even without hidden action and type differences, reelection incentives distort the elected politician's policy choices in favor of the majority. Buchanan and Tullock (1962) showed that a representative government elected based on the majority rule might fail, and that reelection incentives can be counterproductive, even without the problems caused by information asymmetry. This is mainly due to incumbents trying to undertake policies that secure the support of the majority in order to be reelected, instead of doing the "right thing".

Moreover, political agency models are similar to models that analyze the decision making process of agents with career concerns, i.e. experts. In an environment with uncertainty, an expert does not care about the results of the decision he makes, but is concerned with his reputation. Thus, the best incentive for experts is to be reappointed.[2] However, in a political setting, reputation concerns can be counterproductive as they redirect the office-holder's efforts towards those tasks that have observable outcomes.

Thus, we observe that the election process is not sufficient to keep the politicians accountable. Given this shortcoming, Buchanan (1989) argued that it is crucial to improve the rules and the framework of democracy. He establishes that constitutional clauses must be designed to act as a kind of supervisory tool to monitor the government's activities. However, the number of such constraints that can be implemented is limited, both from a legal and practical point of view and thus might only address extreme cases. Persson et al. (1997) argued that if there is a conflict of interest between the executive and legislative branch, separation of powers should allow to discipline the office-holders. However, this result only holds together with appropriate checks and balances, and cannot be applied to all cases. Besley (2006) argues that while additional restraints on a benevolent government would be welfare-reducing, it is important for a self-interested office-holder to be disciplined more than just by reelection or by the supervisory institutions that are currently available.

For an effective government, good institutional structures are necessary—besides legal enforcement systems. Assuming legal enforcement is possible, we want to analyze the incentive tools that yield more effective government accountability.

For this purpose, we address the following issues:

[2] See Ottaviani and Sørensen (2006) for an analysis of experts' reputation building concerns.

- What are the politicians' incentives for being (re)elected?
- How can we improve the selection and discipline of governments through the politicians' sources of (re)election incentives?

2.2 Sources of Reelection Incentives

In general, politicians would like to be (re)elected, and this wish is not generated by pure self-interest. Various sources of reelection incentives have been described in different models, so that an overview of all such concerns and motivations is needed to assess their selection and disciplining potential. We first categorize these motives into five main categories, which have some parallels with those described in Besley (2006). Then, we connect these categories to another set of motivation classification, namely intrinsic, extrinsic and reputational motivations, in line with the analysis of Bénabou and Tirole (2006).

Private Interest: One of the main concerns of politicians running for office is private interest. This includes all forms of private good consumption such as monetary rents or the materialistic perks of holding office. In empirical research, bribery and corruption are taken as indications of politicians' private interest.[3] Theoretical models such as agency models developed by Barro (1973) and Ferejohn (1986) are based on the private interest of politicians.
Besley (2006) refers to politicians' private interest by "narrow self-interest". In a very strict sense, self interest is the private interest of politician in private good consumption. However, Besley (2006) also describes altruistic concerns as a form of self interest, and his account of self interest spans from altruism to pure egoism. We will come back to this point later when we explain the politician's altruistic concerns.

Power: For a politician running for election, there is more to being elected than private interest. Being in office entails power. At a psychological level, it promotes pride and self esteem. In contrast to monetary rents—classified as private interest—power is also a private interest, but it is intangible and difficult both to assess and to monitor. The famous work of Downs (1957) is based on the observation that parties do everything to win elections, power being their greatest motivation. This assumption has generated a large body of literature where those candidates are described as "office-motivated"—with power as their first goal—, who do not care about policies and solely care about winning.[4]

[3] See for example Ades and Di Tella (1999).
[4] See for example Black (1958) and Plott (1967) on office-motivated candidates and the median voter theory.

Besley (2006) refers to this type of motivation as "ego rent", a term first described in Rogoff (1990). It refers to the politician's personal byproducts of producing public goods for the society. This can comprise benefits as diverse as titles, subservient behavior of others, and name recognition. In other words, public good production naturally leads to power, pride and intangible honorific benefits for the office-holder. Maskin and Tirole (2004) even assume that politicians already obtain utility from simply holding office. They model electoral accountability by considering the politician's concerns for prestige and non-pecuniary perks.

Public Good Concerns: A politician, like any other citizen, is affected by public good policies. A politician might run for office to influence public good provision rather than to obtain exclusive monetary and non-monetary perks and rents of being in office. Such a candidate would not make any campaign promise to be elected—in contrast to office-motivated candidates—because he faces a trade off between wining the election and implementing his preferred policy. There is a large body of literature on the analysis of such candidates, referred to as "policy-motivated" candidates, a type which was first introduced in Wittman (1977). He argues that Downs (1957)'s assumption that politicians are solely motivated by the rents of holding the office is unreasonable and incomplete, and yields misleading results. Based on real-life examples, he emphasizes the importance of the politician's policy preferences as the motivation for running for office. As anecdotal evidence, he refers to US-President Johnson, who took an unpopular stance concerning the Vietnam war, and lost reelection.

Persson and Tabellini (2002) define those politicians who are directly motivated by public policy as "partisan" politicians. To describe how their policy preferences are formed, they use a citizen-candidate framework where each citizen decides whether to run for election or not, based on the costs of running for election and the benefits of implementing their desired policy. They show that in a highly polarized society, more policy-oriented candidates run for election.

Besley (2006) also counts public good concerns as a motivation for politicians to run for office. He describes the concern for public goods to be very general, for instance, on environmental issues or tax policy, and to have mainly ideological causes.

Before going on with further election motives for politicians, one should take a closer look at the analysis of politicians' motivations in Persson and Tabellini (2002), compared to the three motives presented so far. Persson and Tabellini (2002) define the motivation to run for election as either "opportunism" or "partisanship". According to them, an opportunistic politician is solely concerned by his personal utility. Such a politician can be "office-seeking" or "rent-seeking". An office-seeking politician is interested in those benefits of holding office that do not depend on the choice of policy. Thus, the only motivation of such a politician is to hold office in itself, and he will implement any policy that guarantees him the support of the majority. In contrast to the office-seeking politician, a rent-seeking politician is interested in those benefits that do depend on his choice of policy. Thus, such a politician has incentives to abuse his power to serve his own interests. Instead of cutting taxes or boosting the economy, he might invest in those projects that allow him to extract the highest rent. Different design of political institutions affect the rent-extraction opportunities for elected politicians accordingly. Thus, political institutions directly impact the (re)election incentives of rent-seeking politicians. An opportunistic politician—be it office-seeking or rent-seeking—encompasses the politician motivated by both private interest and power in our analysis.

As another category, Persson and Tabellini (2002) describe politicians as "partisan". Partisan politicians care about the well-being of particular groups in the society. They are motivated by the possibility of making the policy choice that maximizes a welfare function with distorted weights for the benefit of their favored groups. The notion of partisan politician is similar to what we call "public good concerns" in this paper. While ideology is the driving force for public good concerns in Besley (2006), Persson and Tabellini (2002) consider it to be the reason underlying the difference between opportunism and partisanship.

In a more general classification, human motivation—independent of the political setting—is categorized into *economic* incentives and *social* incentives. In standard contract theory and principal-agent theory, economic incentives are considered to be the incentives for human decisions that depend on the wish for higher income and financial rewards. In contrast to economic incentives, social incentives are non-pecuniary motives which have an interactional nature, such as altruism and public image.

Of the three motivation sources described above, private interest and public good concerns are economic incentives, while power is neither an economic nor a social incentive. Power, although a non-pecuniary incentive, is not a social incentive, as it does not have an interactional nature. Power is a motivation that depends on the nature of the task, so that one could say that performing certain tasks generates power and self confidence. To discuss social incentives, we now have to introduce *altruism* and *public Image*.

Altruism: Altruism is defined as an agent's concern for others' well being. Altruism is a non-pecuniary social motivation, and is not rewarded in privet–good consumption. Altruism is difficult to assess, as it can only be inferred by its consequences, and as these observable consequences might be due to causes other than altruism.

Ledyard (1995) surveys experimental research that study participants' selfish or altruistic

motivations when making decisions about public good provision. The survey concludes that while there is a share of players who choose based on pure self-interest, there is a non-negligible share of players whose choice—while motivated by self-interest—responds to altruism and fairness concerns.
Besley (2006) describes altruism as an individual's or office-holder's "duty of care and loyalty". In Besley (2006), altruism is one of the forms of self-interest, and altruism and self-interest can be served simultaneously, for instance, in the case of a politician who undertakes redistribution policies to the poor because of his *own* sympathy for them.

Public Image: Social norms and social pressure determine which choices are rewarded and which are discouraged and/or punished by a society. Public image motivation is described as an individual's desire to seek social approval. Fehr and Falk (2002) take the first steps towards understanding how this desire interacts with economic incentives, in which settings they reinforce each other, and whether they can crowd out each other's effects.
Although Besley (2006) does not provide a concrete analysis of public image as a motivation, his notion of "duty of care and loyalty" encompasses public image as a motivation for politicians, and serves as a basis for an extended body of literature.
The contrast between economic and social incentives was first established in Frey (1997) and later developed by Fehr and Falk (2002). Frey (1997) describes the complex impact of monetary compensation on social incentives, especially in such important tasks as policy making.
Kreps (1997) categorizes motivation into "intrinsic" and "extrinsic" motivation. He refers to economic incentives as explicit extrinsic incentives and emphasizes the importance of understanding intrinsic motivation and the interaction it has with economic incentives. In his analysis, public image, power and altruism can be intrinsic or extrinsic motivations. According to Kreps (1997), intrinsic motivations are hard to assess especially as they always exist together with extrinsic motivations. Nevertheless, he categorizes intrinsic motivations into two types. The first type of intrinsic motivation is simply a result of being proud of what one does or the utility gains from putting effort in desirable tasks. The second type of intrinsic motivation is a response to vaguely imposed extrinsic motivations such as peer pressure or one's fear of losing job, for instance. Accordingly, Kreps (1997) considers two reasons for adhering to social norms: (1) intrinsic incentives and adhering to social norms as desirable per se, and (2) indirectly, extrinsic incentives and the fact that indifference or misbehavior is costly. Kreps (1997) argues that if agents' intrinsic motivation is of the second type, imposing economic incentives might backfire and distort the intrinsic motivation instead of complementing it. He concludes that for

an economic incentive to be complementary to intrinsic motivations, it is important to implement economic incentives in such a way that they emphasize the voluntary nature of agents' desired tasks.

In line with Kreps (1997), Murdock (2002) assumes that in a principal-agent setting, agents engage in activities that yield financial returns and intrinsic values for them. He focuses on the first type of intrinsic motivations and abstracts from the second type in his analysis. He studies the effect of intrinsic values on the optimal economic incentive contract for the principal and he argues that these two sources of motivation are complementary.

In a setting with hidden information, Bénabou and Tirole (2003) model agents' intrinsic and extrinsic motivations. They perform a game theoretic analysis of how and when intrinsic and extrinsic motivations substitute or complement each other.

In a more recent paper, Bénabou and Tirole (2006) classify an individual's motivations to contribute to public good production into three categories: intrinsic, extrinsic and "reputational" or "self-respect" concerns. They show that extrinsic and/or reputational incentives can change the meaning of public good contributions for individuals and affect the level of these contributions.

Although there are few studies on economic and social incentives in political settings and on politicians running for elections, it is important to examine the effect of incentives when determining the socially optimal incentives for politicians.

Historically, certain incentive schemes in political settings have been documented. For example, Lane (1981) documents that in medieval Venice, the principal was elected by the rich and influential families and the clerics. The elected principal was required to make certain promises at the beginning of his term, for example to fight the heretics. A committee had to establish whether the principal has fulfilled his promises, which remained even after the principal's death, astonishingly, as his family was liable for those promises that had not been kept.

More recently, Lockwood and Porcelli (2013)'s empirical study of local governments in England shows that incentive schemes do improve the performance of governments indeed. They show that a comprehensive performance assessment that rewards good performance with reduced fees and higher flexibility and freedom, was able to decrease moral hazard and resulted in the provision of better services by local governments.

Among all sources of politician's (re)election motives, we now focus on the politicians' private interest. The importance of private interest in incentivizing employees has been long discussed in the literature on employer–employee relationships.[5] Employees are generally protected against being fired or their contract is long term and cannot be easily

[5] For a comprehensive analysis of contract theory, see Bolton and Dewatripont (2005).

terminated. This leaves little room for monitoring the employee's performance. In such settings, one solution would be to make the employee's payment contingent on performance.

In line with this observation, we can see that CEO salaries have risen rapidly in the past few years. Many argue that this high compensation level is due to the fact that powerful managers can set their own salaries, while others interpret this situation as the result of optimal contracting in a competitive environment. Frydman and Jenter (2010) found out that both reasons play an important role. They argue that although there is evidence for a negative effect of such high compensation, it is difficult to measure the causal effect of incentive pay on a firm's value, since the effect of managers' incentive pay is related to many unobservables such as the marginal product of a CEO's effort or his degree of risk aversion.

In political principal-agent models, a politician resembles a CEO in two main aspects: (1) a CEO is elected by shareholders and (2) a CEO is a self-interested, rent-seeking agent who offers his own compensation package to the shareholders to approve.[6] However, unlike CEOs, politicians are rarely evaluated *during* the time they serve in office. Additionally, what keeps politicians accountable is mainly reelection, which is not the case for CEOs.

In the next section, we explore the literature on the use of the interest in private good consumption as a tool to select and discipline politicians.

2.3 Paying Politicians

When discussing politicians' pay, it is important to distinguish two cases: the first is a flat wage level that is offered to politicians, and the second is a performance pay offered to them conditional on their performance on observable outcomes. Additionally, when exploring the effectiveness of politicians' pay, we have to consider its effect on candidate selection separately from its abilities to discipline the office-holder *after* election.

Besley (2004) argues that since higher wages increase the value of holding office, as an incentive scheme, one could offer higher wages to increase office desirability for politicians. Assuming that politicians do not obtain any utility from serving voters, Besley (2004) explores whether a higher wage offered to office-holders affects the *composition of the pool of candidates* or *their performance*. In this theoretical analysis, he shows that voters' welfare improves when office-holders receive higher wages. He explores both the selection effect and the disciplining effect, and shows that the improvement in welfare is

[6] See for example Bebchuk et al. (2002) for an analysis of CEOs rent-seeking behavior.

a result of both a better pool of candidates and a better alignment of the office-holder's policy choices with the voters' preferences. Moreover, he provides anecdotal evidence on U.S. governors to support his theoretical results.

Many empirical studies show that higher wages yield a more efficient selection of competent politicians. Ferraz and Finan (2009) study the effect of higher wages in Brazil's municipal governments. They show that higher wages yield better performance and lead more educated and more experienced politicians running for elections. Additionally, they show that higher wages increase the reelection rates. Kotakorpi and Poutvaara (2011) study the effect of the level of salaries offered to Finland's parliamentary members on the candidates' education level. They show that while a higher salary makes women with higher education run for parliamentary elections, the effect on men is not significant. They explain the different results among men and women due to the gap in wages offered to men and women in the private sector. The increase in wages for the parliamentary positions is more effective among women because their outside options is less attractive than the men's. More recently, Gagliarducci and Nannicini (2013) study the effect of wages on politicians' selection in Italian municipal governments. They show that higher salaries attract more educated candidates and thus improve the efficiency of local municipalities by selecting competent politicians.

In a theoretical study, Caselli and Morelli (2004) consider the effect the value of office has on the pool of candidates. They assess that the value of office for politicians is due to both financial and psychological rewards. They divide potential candidates into high quality and low quality candidates, where a high quality candidate is capable of undertaking the appropriate policy choice at the least possible cost to the society. Their analysis shows that in the absence of any psychological rewards from holding office, low quality candidates are more likely to run for election when high salaries are offered. This results from the fact that the low quality citizens' outside option has less value than the value of holding office. If the value of office has both financial and psychological aspects, the pool of candidates can be dominated by low quality or high quality candidates, depending on how high the overall value of office is.

Similarly, Messner and Polborn (2004) assume that there are bad candidates and good candidates. Aside from their level of competence, bad candidates and good candidates differ in their opportunity costs. The opportunity cost of bad candidates for running for election is lower than that of good candidates. Using a citizen-candidate framework, Messner and Polborn (2004) argue that higher wages incentivize bad candidates to run for election, but that very high wages can yield the opposite results, when good candidates run for election with a higher probability. Mattozzi and Merlo (2008), in line with the analysis of Caselli and Morelli (2004), show that an increase in the level of wages for office-holders yields a decrease in the quality of the candidate pool. Finally, Smart and Sturm (2013) do a theoretical study in a setting where politicians have private information about the state of the world and voters only have prior beliefs about the state. They show that since higher wages increase the value of office, they yield "timid" behavior among office-holders. A timid office-holder would not implement the policy that is first-best according to his private information, but always implements the policy that voters *believe* is the right choice. Timid behavior makes screening incumbents more difficult and the reelection process less effective—as well as the candidate selection process in the long term.

Very little research has been done on performance pay for politicians. How to make the remuneration of office-holders dependent on performance was first examined in Gersbach (2003) and Gersbach and Liessem (2008). More particularly, there are only few examples of performance pay observed in modern political life. One example would be the system that was practiced in Canada. In the province of Manitoba, the salaries of the members of government were made contingent on how well the promises made by government before election had been kept. In Germany a similar scheme was proposed, according to which a cut of 10-30% of salaries would be implemented if the government was not successful in achieving its goals (see Homburger (2005)). Unfortunately, it was not implemented and could not be observed in practice.

Besley (2004) does not analyze the effect of performance pay in political settings, but examines the challenges to be expected from such implementation. He assesses four main challenges of implementing performance pay for politicians. First, one could argue that as office-holders are public servants they should be *self-motivated*. Then, there is no need for performance pay or monetary incentives in general. Second, it is difficult to define a *concrete objective* to be reached. In a heterogeneous society, there can be various objectives worthy of an office-holder's efforts. Additionally, if any group of citizens can incentivize politicians according to its own objective, this can yield contradictory incentive schemes. Third, it is difficult to define *precise and non-manipulatable objectives* in a way that credible outcome measurements can be performed. Finally, an office-holder is a *multi-task agent*. According to Holmström and Milgrom (1991), the problem with incentivizing a multi-task agent is that it might lead to the agent redirecting his efforts towards tasks with easily observable outcomes.

As to these arguments, one should first emphasize that the assumption that office-holders do *not* pursue their own interest has been criticized and questioned for a long time in the literature, just as the reverse position, i.e. that they do indeed pursue their own interest.

To overcome the second problem, elections can be used as a tool for aggregating the voters' preferences. Additionally, performance pay could be limited to those tasks for which there exists a consensus of valuation. Alternatively, one could choose objectives that are welfare maximizing as an indicator of performance.

Regarding the third problem, we note that there are two types of tasks with respect to measurement and verifiability: (1) tasks that are *neither observable nor verifiable* and (2) tasks that are *certifiable and have outcomes that can be authenticated* when disclosed. In political settings, health care reforms and national security are of the first type and building bridges or the debt to GDP ratio are of the second type.[7] Yet, a certifiable dimension could often be constructed for tasks of the first type. For health care reforms, for instance, one could measure longevity to assess the success of the reform.

A performance pay that is conditional on the outcome of a task of the second type—such as building a bridge—can be effective if either completion is evident to all, if the government discloses the task's outcome or if there are institutions that enforce disclosure.[8] One could abstract from the verifiability problem by assuming that the output on which the performance pay depends is or can be made fully observable.

Finally, little research has explored the distortionary effects of performance pay on the multi-task agent's effort allocation in politics. Gersbach and Liessem (2008) consider an office-holder's effort problem when undertaking multiple tasks with a fixed budget for the office-holder's wage, when this politician can serve a maximum of two terms. The benefits of the office-holder's efforts on one task are perfectly observable and are distorted by a high level of noise on the other task. The performance pay is designed such that it increases the office-holder's benefit from exerting effort on the "noisy" task. In this paper, Gersbach and Liessem (2008) make performance pay conditional on reelection, and not on a particular aspect of office-holder's performance. They argue that as long as the reelection probability of an incumbent decreases with poor performance, reelection equals a satisfying performance of the office-holder. They establish that zero wage in the first term and a high wage in the second term—together with reelection incentives—yield socially optimal policy choices by the office-holder.

In Chapter 3, we take a novel approach to the multi-task issue and we define "political multi-task problems". This is a setting in which the office-holder (i) chooses the citizens' private-good consumption and (ii) sets the level of public-good spending. Instead of an effort-substitution effect among conflicting tasks, we explore how the society's limited budget generates a competition between different tasks, since the budget size constrains the office-holder's decisions about how to allocate the resources in society. Thus, the non-observability problem within the effort problem is not of prominent importance in political multi-task problems, contrary to standard multi-task problems.

In accordance with the existing literature on this topic, we refer to performance pay for

[7] For more information on verifiability of tasks, see for example Townsend (1979), Gale and Hellwig (1985) and Fishman and Hagerty (1995).

[8] See Shavell (1994) for more information on voluntary and mandatory information acquisition.

politicians by "incentive pay".[9] In Chapter 3, we study the effect of incentive pay on social welfare in a setting with political multi-task problems. In a society which consists of two groups with heterogeneous initial endowments of private-good, we investigate the inefficiencies arising in political multi-task problems: public good under-provision and the minority's exploitation of private-good consumption. We propose two corrective measures, incentive pay and tax limitations. With an incentive pay, that adds to a fixed wage, the office-holder receives a remuneration that is conditional on the level of public-good provision. We show that together with tax limitations, incentive pay improves welfare and that the effectiveness of incentive pay decreases as the size of the government increases. Moreover, in Chapter 4, we explore the effects of incentive pay on the policy choices of an *altruistic* office-holder and find that a low level of incentive pay complements the office-holder's intrinsic motivation to be altruistic and improves social welfare. Additionally, we consider the combined effect of incentive pay together with (re)election incentives in a setting where candidates can compete for election by announcing their desired incentive pay level. We show that there is an equilibrium, where candidates announce strictly positive incentive pay during the campaign stage.

2.4 Summary and Conclusion

We have now surveyed the sources of (re)election incentives for politicians, from the extent and effectiveness of electoral accountability to the manifold problems related to the selection process of competent candidates and of disciplining the incumbents. This illustrates the importance of developing further incentive tools to keep the politicians accountable.

To design the appropriate incentive schemes, it is essential to analyze the politicians' motivations to run for election. These motivations can be outlined into the five most important driving forces, i.e. private interest, power, public good concerns, altruism and public image. These can be summarized in two categories: intrinsic and extrinsic motivations. The impact and interplay of these forces will be at the basis of any analysis of incentive schemes for politicians.

We narrow our analysis to politicians' private interest. Various theoretical and empirical studies investigate the effects of offering higher wages to office-holders, as a tool to improve the selection and the discipline of politicians. Higher wages should be useful at two stages of the election process. It should reduce the candidates pool to the most able ones before election and foster good performance after election, a complex and possibly

[9] Incentive pay is an example of a broader class of the so-called "Political Contracts" surveyed in Gersbach (2012).

contradictory task, as higher rewards generally attract more but not necessarily better candidates.

Moreover, incentive pay should be useful to increase office-holder's accountability. The effective design of incentive pay as an incentive scheme is more complex, however, there are settings in which the challenges and difficulties of incentive pay for politicians can be overcome.

In the next chapters, we are tackling the thorough analysis of incentive pay for politicians.

3 Incentive Pay for Politicians and Political Multi-task Problems*

3.1 Introduction and Motivation

Motivation

As a society we are interested in *good policy-making*. Good policy-making depends on how aligned policy-maker's preferences are with the public's preferences. Therefore, to achieve good policy-making, it is important to understand first how incentives can align politicians' preferences with the public's preferences and second, what attracts politicians to office.

As to the first question, we note that the policy-maker is the agent and citizens the principals in a political principal-agent problem. In a political principal-agent problem, there is (i) a conflict of interest between the agent and the principal, similar to the standard principal-agent problem. In a political setting, however, the society consists of heterogeneous citizens. So in contrast to the standard problem, (ii) the principals themselves, have diverse and often conflicting interests. For example, not all the age groups in the society might agree with a retirement reform plan.

Moreover, (iii) the policy-maker has the power to tax the principals to finance government activities. Hence, the agent's budget is determined by the agent himself. Moreover, the policy-maker can tax particular groups more than others and treat heterogeneous principals asymmetrically.

More importantly, (iv) a policy-maker has many tasks. Besides using his power to tax people to finance social security and social insurance, the policy-maker provides a variety of public goods such as physical safety, health services, education, or public infrastructure. Such multi-task problems in politics (henceforth "political multi-task problems") have in common the difficulty to precisely measure the output of each task in the private sector. For instance, the output change from investments in public health services delivery or social insurance are difficult or impossible to capture by a single figure, while the

* This chapter is based on joint research with Volker Britz and Hans Gersbach.

output of other tasks is easier to measure. Examples are reduction of CO_2 emissions or public debt, or the building of a bridge.

As discussed before, political multi-task problems involve additional aspects compared to those in the private sector. In democracy, the standard solution to political multi-task problems is repeated elections, leading to rejections or reappointments of incumbents. Elections make office-holders accountable to citizens for both—the outputs of all tasks and the level and mode of financing government activities. However, given output measurements issues and the four characteristics of political multi-task problems outlined above, the reelection device fails to ensure *good policy-making* and efficient policy choices.[1]

Understanding the characteristics of the political multi-task problem is a first step towards understanding how we can better incentivize policy-makers by using other tools than elections. This leads us to the second question. The policy-makers are driven by their preferences over power, public image, altruism, public good concerns and private consumption. While power, public image, altruism and public good concerns are particular to a political agent, private consumption is a common interest of both non-political and political agents. In the private sector, the agent's interest in private consumption is the main reason for offering higher salaries to the agent to mitigate moral hazard and adverse selection problems. The question whether this holds for elected policy-makers as well has been recently addressed in the literature. While the theoretical models deliver ambiguous results[2], several empirical analyses show the positive impact of higher pay on the politicians' quality.[3]

In this paper, we first study the inefficiencies that arise when office-holders face political multi-task problems, highlighting the trade-off between providing public goods at the cost of taxing citizens' private good. We then show how these inefficiencies can be alleviated by traditional instruments such as constitutional limits on taxation and protection from governmental extortion. Second, we explore whether and how adding incentive contracts on tasks whose output is verifiable can improve welfare. Such incentive contracts make the policy-maker's pay and thus his consumption dependent on the output of particular tasks. Still, whether policy-makers are or remain in office is solely determined by elections. Thus, the dual mechanism—incentive contracts on particular tasks and elections—is compatible with the rules of liberal democracies. Our aim is to explore whether it is welfare improving to use the dual mechanism in politics.

[1] See for example Barro (1973), Ferejohn (1986) and Maskin and Tirole (2004).

[2] See e.g. Besley (2004), Caselli and Morelli (2004), Messner and Polborn (2004), Poutvaara and Takalo (2007) and Mattozzi and Merlo (2008).

[3] See e.g. Ferraz and Finan (2009) and Kotakorpi and Poutvaara (2011) for empirical papers.

Model and Results

We consider an economy with a private and a public good. All citizens have the same preferences over the two goods, but they have heterogeneous initial endowments of private good. In our model the multi-task policy-maker imposes wealth taxes on citizens based on their initial endowments and uses the tax revenue to finance the public good. In other words, he chooses (i) society's budget size and (ii) budget allocation among citizens. A share of citizens participates in policy-making and the size of this group relative to the population is fixed. Characterizing the inefficiencies in our setting, we see that the policy-maker provides a suboptimal level of public good and taxes all groups of citizens inefficiently. As a corrective measure, we first investigate the effect of constitutional limitations on taxes. This is followed by an analysis of an incentive contract that makes the policy-maker's consumption of the private good dependent on his performance. The contract is conditioned on the level of provision of the public good, which is fully observable. As a third step, we examine the effect of the combination of the incentive contract and the constitutional limitation on taxes.

We show that there exists an incentive contract for the policy-maker that leads welfare improvements. The policy-maker is rewarded in units of the private good, proportionally to the level of provision of the public good. Moreover, we show that under the veil of ignorance about which of the endowment groups will provide the policy-maker, there exists an incentive contract which makes everybody better off and thus it is implementable.

Main Results and Broader Implications

The main analysis in our paper points to broader implications. Election is the sole device citizens have to hold their legislative and executive branches of government accountable. Of course, what constitutional courts do or particular oversight on the executive branch limits governments in various ways, but surely they do not provide incentives to excel in public-good provision. Hence, there appears to be a lack of further incentive devices to motivate office-holders to provide common-interest services and public goods at the level desired by citizens. The dilemma is that with multidimensional state functions and difficult-to-measure outcomes, it is a-priori difficult to introduce high-powered incentive contracts. Still, the paper suggests and shows that incentive contracts on specific tasks with verifiable outcomes enhance welfare. This approach works better, the more constrained the office-holders are in expropriating minority groups. In other words, in societies with a balanced budget sharing to provide public goods and redistributions, introducing incentive contracts may be particularly attractive.

3.2 Relation to Literature

The present paper is related to three strands of literature. First, there is a considerable literature on the characteristics of political multi-task problems. In particular, Ashworth (2005) studies political multi-tasking in legislative organizations. He categorizes tasks as constituency services and policy work, and studies the effect of reelection probability on effort allocation, given the tasks have cost-complementarity.

Hatfield and ì Miquel (2006) study the effort allocation problem for a multi-task politician in the executive branch, who is responsible for the provision of multiple public goods with observable outputs. Given the multiple tasks, promising reelection to the politician yields distortionary effects on effort allocation. This article emphasizes the key role of reelection as a selection tool for citizens to choose the most competent candidate rather than an incentive tool to discipline the office-holder. Ashworth and de Mesquita (2012) examine the political multi-task problem by assuming there is no cost-complementarity for the tasks so that they can eliminate distortions. They show that there is a possible trade-off between using reelection as an incentive tool and using it as a selection tool. They approach the problem of maximizing voters' welfare from an institutional design perspective, based on how voters weigh selection compared to incentivization.

Second, since Holmström and Milgrom (1991), we know that using high-powered incentive schemes in multi-task problems in the private sector may not increase the principal's utility and may even backfire when the output of some tasks is either not verifiable or only measurable with low precision.[4] While in the private sector, it may be possible to measure the aggregate performance of a CEO for instance by a single value such as the firm's value[5], this is not possible for politicians. Hence, the use of incentive contracts—ubiquitous in the private sector—appears to be impossible in the political realm. Nevertheless, we explore the use of incentive contracts in *political* multi-task problems.[6]

There have been first attempts to explore the use of incentive contracts for politicians.[7] They have been introduced by Gersbach (2003) to incentivize politicians to invest in specific long-term projects, output of which cannot help for reelection. Making the remuneration of politicians dependent on specific policies was examined in Gersbach and Liessem (2008), which considers a politician's effort problem undertaking several tasks, when this politician can serve two terms.

[4] For a complete discussion of contract theory, see Bolton and Dewatripont (2005).
[5] On the problems of CEO salaries see e.g. Frydman and Jenter (2010).
[6] In the theory of fair allocations similar problems have been dealt with from an axiomatic point of view. One important insight is that the axioms "responsibility" and "compensation" may be in conflict (see e.g. Fleurbaey (2008)).
[7] Incentive pay is an example of a broader class of the so-called "Political Contracts", surveyed in Gersbach (2012).

In this paper, we examine how to motivate office-holders when we face a multi-task problem having the characteristics outlined above: the difficulty to measure the output of some tasks, a budget determined by the office-holder, the conflicting interests of citizens with each other and with the policy-maker.

3.3 The Model Description

We consider a society with a continuum of citizens of measure one. There are two goods, a private good and a public good. The citizens have the same preferences over consumption pairs (x, g), where x denotes private-good consumption and g denotes public good consumption.
The utility function of a representative citizen, $U : \mathbb{R}^2_+ \longrightarrow \mathbb{R}$, is quasilinear and three times continuously differentiable, and given by

$$U(x, g) = u(x) + g.^8 \tag{3.1}$$

The function $U(x, g)$ is additively separable with $U(0, 0) = 0$. The function $u(x)$ is three-times continuously differentiable, strictly increasing and strictly concave. Furthermore, we assume that the Inada Conditions hold for $u(x)$, $\lim_{x\to\infty} u'(x) = 0$, $\lim_{x\to 0} u'(x) = +\text{"}\infty.\text{"}$ A standard example of $u(x)$ with such properties is $u(x) = x^\alpha$ with $0 < \alpha < 1$.
Citizens have heterogeneous initial endowments of the private good. With probability $0 < \theta_m < \frac{1}{2}$, a citizen is endowed with ω_m units of the private good, and with probability $\frac{1}{2} \leq \theta_M < 1$ with ω_M units, where $\theta_M + \theta_m = 1$.[9] The parameters θ_M, ω_M and ω_m are exogenously-given and common knowledge.
Once the endowments are realized and each citizen knows his own private good endowment, by Borel's Strong Law of Large Numbers, the society is divided into a share θ_m of citizens endowed with ω_m and the complementary share endowed with ω_M. We refer to the members of the groups as the *minority endowment group* and the *majority endowment group*, respectively.
The private good serves as input in public-good production. We denote the aggregate amount of private good spent on the public good by K_g and we refer to it by public-good spending, in short. More specifically, the public-good production function is given by $g = \gamma K_g$, where a unit of K_g results in the provision level g and γ is a strictly positive parameter.

[8] We choose the quasilinear utility function to rule out all substitution effects. The chosen form is more convenient for the analysis of the problem at hand. However, the other form of the quasilinear utility function, $u(g) + x$, would qualitatively lead to similar results.
[9] The general case with n endowment groups is considered in Section 4.3.

In each endowment group, each citizen is an *Elite* citizens with probability μ. Members of the Elite participate in policy-making. Once each citizen knows whether or not he is an Elite citizen, parameter $0 \leq \mu \leq 1$ expresses the share of the citizens engaged in government in each endowment group. It is exogenously-given and common knowledge. An alternative interpretation of a group of Elites is the interest group that supports the policy-maker and with whom the policy-maker shares all benefits. If a citizen does not belong to the Elites, we refer to him as a member of the *Non-elites*.
The policy-maker has the same preferences over the private and the public good as the other citizens.[10] The policy-maker is a member of the Elites and raises taxes and chooses the level of public-good provision. We exclude subsidies and we will introduce a condition on the distribution of endowments to ensure that both groups are taxed in the socially optimal solution.
In particular, the policy-maker selects the level of private-good consumption for the majority endowment group and the minority endowment group denoted by (x_M, x_m) and the public-good spending, K_g that satisfies

$$K_g = \left(\frac{1}{1+\lambda}\right)\left[\Omega - \theta_M x_M - \theta_m x_m\right], \tag{3.2}$$

where the society's total private-good endowment is denoted by $\Omega = \theta_M \omega_M + \theta_m \omega_m$ and the tax burden of each endowment group is given by $\theta_i(\omega_i - x_i)$, $(i = M, m)$. The parameter $(\lambda \geq 0)$ captures possible deadweight losses associated with taxation.
We summarize the policy choices in the following definition.

Definition 3.1
A feasible policy choice consists of a consumption plan for members of the two endowment groups (x_M, x_m) *that satisfies* $0 \leq x_M \leq \omega_M \ , \ 0 \leq x_m \leq \omega_m$.
The public-good provision with the policy choice is given by Equation (3.2).

We evaluate utility and welfare at two stages. The first stage is behind a complete veil of ignorance, without information about the realization of endowments and not knowing whether an individual is a member of the Elites or the Non-elites. In the second stage, citizens observe whether they belong to the Elites or the Non-elites, and each citizen observes to which endowment group he belongs. Throughout the paper, we refer to these two stages as *ex-ante* and *ex-post*, respectively. Figure (3.1) shows the timeline of information revelation.

[10] In Section 3.5, we consider an incentive contract which pays the policy-maker and the Elites from his endowment group a reward in terms of private-good consumption, depending on his choice of policy. Hence, the policy-maker and the Elites' objective function differs from the other citizens.

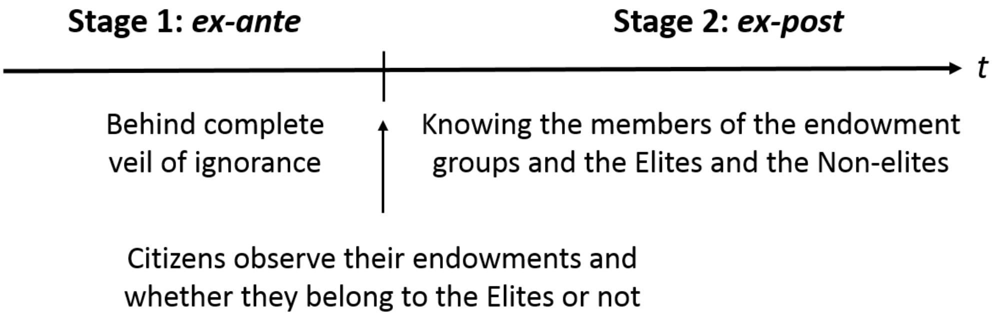


Figure 3.1: Timeline.

3.3.1 Socially Optimal Solution

As a benchmark, we consider the solution a utilitarian social planner would choose. The utilitarian social planner measures welfare by taking the sum of all citizens' utilities and maximizes the welfare function by choosing a feasible policy.
The social planner's optimization problem is given by

$$\max_{(x_M, x_m)} \quad W(x_M, x_m) = \sum_{i=M,m} \theta_i u(x_i) + \left(\frac{\gamma}{1+\lambda}\right)\left[\Omega - \sum_{i=M,m} \theta_i x_i\right], \tag{3.3}$$
$$\text{subject to} \quad 0 \le x_i \le \omega_i, \; i = M, m.$$

First, we note that if all resources in the society were spent on public-good provision, i.e. zero private-good consumption for both groups, then the marginal utility from private-good consumption would be infinite due to the Inada Conditions. Consequently, allocating zero private-good consumption is not socially optimal,

$$\lim_{x_i \to 0} \frac{\partial W}{\partial x_i} = \theta_i \underbrace{\lim_{x_i \to 0} u'(x_i)}_{=+\infty} - \frac{\gamma \theta_i}{1+\lambda} = +\infty \quad i \in \{M, m\}.$$

Moreover, to ensure the interior solution, we make the following assumption:

Assumption 3.1
The initial endowment of both groups satisfies

$$u'(\omega_i) < \frac{\gamma}{1+\lambda} \quad i \in \{M, m\}.$$

With Assumption 3.1, if public-good spending was zero, the marginal utility from private-good consumption of both groups would be less than the constant marginal utility from public good. Thus, even a small decrease in the level of private-good consumption of both

groups which yields a small increase in the level of public-good spending, is an improvement. We observe that Assumption 3.1 guarantees that $K_g^s = 0$ is not optimal and that at the social optimum, K_g^s is strictly positive.
Additionally, Assumption 3.1 states that the endowment of both groups has to be sufficiently high, such that it is socially optimal for them to participate in financing the public good. This ensures that both groups are taxed in the socially optimal solution.
We observe that at the social optimum, the private-good consumption of both groups and public-good spending are strictly positive. Thus, the socially optimal solution is interior and we find it by examining the first–order condition,

$$u'(x_i^s) = \frac{\gamma}{1+\lambda}. \tag{3.4}$$

Due to the strict concavity of $u(\,\cdot\,)$, there exists a unique value of x^s that satisfies Equation (3.4). The social optimum $(x_M, x_m) = (x^s, x^s)$ is the allocation at which the marginal welfare of the private good equals the marginal welfare of the public good.
Given x^s, the implied socially optimal level of public-good spending is

$$K_g^s = \frac{1}{1+\lambda}\left[\Omega - x^s\right]. \tag{3.5}$$

At the socially optimal solution, social welfare cannot be improved by reshuffling resources from private consumption to the public good or by reallocating the private good between the two groups.

3.3.2 The Policy-maker's Optimal Solution

We next turn to the solution that is optimal from the policy-maker's point of view. The policy-maker is assumed to be a member of the majority endowment group, to reflect the majoritarian principle of democracy.
The policy-maker maximizes his utility function by choosing a policy from the feasible set. The policy-maker's optimization problem is therefore

$$\max_{(x_M, x_m)} \quad U(x_M, x_m) = u(x_M) + \left(\frac{\gamma}{1+\lambda}\right)\left[\Omega - \sum_{i=M,m} \theta_i x_i\right],$$
$$\text{subject to} \quad 0 \le x_i \le \omega_i, \; i = M, m.$$

We denote the solution to the above problem by x_M^p and x_m^p, respectively. In other words, x_M^p refers to the private-good consumption of the policy-maker's (majority) endowment group and x_m^p refers to the private-good consumption of the minority endowment group, as chosen by the policy-maker.

First, we note that the policy-maker does not derive any utility from the private-good consumption of the minority endowment group. Therefore, the policy-maker taxes this group as much as possible and sets $x_m^p = 0$.
What remains of the policy-maker's optimization problem is the trade-off between the majority endowment group's private-good consumption and public-good spending. We note that due to the Inada Conditions, at $x_M^p = 0$ the marginal utility from private-good consumption is infinite. Thus, the choice of $x_M^p = 0$ is not optimal for the policy-maker. To ensure the interior solution and to ascertain that both groups contribute to the financing of the public good, we make the following assumption:

Assumption 3.2
The initial endowment of the majority endowment group satisfies

$$u'(\omega_M) < \frac{\gamma\theta_M}{1+\lambda}. \tag{3.6}$$

Assumption 3.2 states that the majority endowment group's initial endowment is so high that makes it desirable for the policy-maker to tax his own endowment group. Thus, Assumption 3.2 eliminates the case in which the policy-maker subsidizes his own endowment group. Since both endowment groups are taxed by the policy-maker, public-good spending is strictly positive.
We observe that the policy-maker's choice of x_M^p is interior. To find it, we consider the first–order condition with respect to x_M^p,

$$u'\left(x_M^p\right) = \frac{\gamma\theta_M}{1+\lambda}. \tag{3.7}$$

And the public-good spending is given by

$$K_g^p = \frac{1}{1+\lambda}\left[\Omega - \sum_{i=M,m} \theta_i x_i^p\right]. \tag{3.8}$$

3.3.3 Sources of Non-optimality

The results in Sections 3.3.1 and 3.3.2 enable us to compare the policy choices of the utilitarian social planner and the policy-maker. The fact that the minority endowment group is excluded from power leads to two distortions in the policy-maker's choice relative to the utilitarian social planner's choice. We discuss each of these distortions in the following.
First, the minority endowment group has zero private-good consumption. The policy-maker does not care about the minority endowment group's private-good consumption. Thus, compared to the social planner, the minority's private-good consumption decreases

from x^s to zero. This is strongly welfare reducing due to the Inada Conditions.
Second, the private-good consumption of majority-endowment-group citizens is higher at the policy-maker's optimum than at the social planner's optimum. From Equation (3.4) and Equation (3.7), we directly obtain

$$u'\left(x_M^p\right) = \theta_M u'(x^s). \tag{3.9}$$

Since $\frac{1}{2} \leq \theta_M < 1$ and $u'(\,\cdot\,)$ is strictly decreasing, we have $x_M^p > x^s$.
Intuitively, we see that the policy-maker does not internalize the benefit from private-good consumption of other members of his own endowment group. Thus, compared to the social planner, he needs a higher level of private-good consumption to be indifferent between a marginal increase in his private-good consumption and a marginal increase in public-good spending.
Therefore, the policy-maker's level of public-good provision differs from the social optimum level. We note that the first distortion increases public-good spending, while the second decreases it. To determine which of the two dominates, we proceed with the following analysis.
First, to characterize public good under-provision and over-provision, we compare Equations (3.5) and (3.8),

$$K_g^p < K_g^s \Leftrightarrow \quad \theta_M x_M^p > x^s, \qquad \text{(under-provision)} \tag{3.10}$$

$$K_g^p \geq K_g^s \Leftrightarrow \quad \theta_M x_M^p \leq x^s. \qquad \text{(over-provision)} \tag{3.11}$$

If the private-good consumption of the majority endowment group is higher than the aggregate private-good consumption in the socially optimal solution, there is public good under-provision. Otherwise, there is public good over-provision.
Suppose public-good spending is at the level chosen by the social planner but only the majority endowment group consumes any private good and the minority is fully exploited. In this case, the policy-maker's private-good consumption is $\frac{x^s}{\theta_M}$.
If the policy-maker's marginal utility from private-good consumption is higher than his marginal utility from the public good then he under-provides the public-good. In other words, if

$$u'\left(\frac{x^s}{\theta_M}\right) > \theta_M \frac{\gamma}{1+\lambda},$$

the policy-maker wants to increase his own private-good consumption. Thus, he deducts from public-good spending and adds to his private-good consumption. By using Equation

(3.4), the above inequality can be rewritten as

$$\frac{1}{\theta_M} u'\left(\frac{1}{\theta_M} x^s\right) > u'\left(x^s\right). \tag{3.12}$$

In the following proposition, we show that Inequality (3.12) holds when the third derivative of $u(\,\cdot\,)$ is positive.

Proposition 3.1
If $u'''(\,\cdot\,)$ is non-negative, the public good is under-provided by the policy-maker.

The proof of Proposition 3.1 is given in Appendix A. In the remainder of this paper, we focus on under-provision and make the assumption that $u'''(\,\cdot\,) \geq 0$. The following example illustrates a case of public good under-provision.

Example 3.1
Let $u(x) = \sqrt{x}$. Then, $u'''(x)$ is non-negative. By Proposition 3.1, the public good is under-provided.
We note that with $u(x) = \sqrt{x}$, Inequality (3.12) reduces to

$$\sqrt{\theta_M} < 1.$$

Since $\frac{1}{2} \leq \theta_M < 1$, this always holds.

To summarize our results in this section, we observe that the policy-maker fails on efficient private-good allocation and public-good provision. We refer to the deviations from the socially optimal solution as inefficiencies in political multi-task problems and assuming $u'''(\,\cdot\,) \geq 0$, we categorize them into two main categories:

- **exploitation of the minority endowment group,**
- **public good under-provision.**

Next, we explore various corrective measures to overcome these inefficiencies.

3.3.4 Corrective Measures

We explore corrective measures for the observed inefficiencies in political multi-task problems outlined in the last section. First, we apply constitutional tax limits to protect the minority endowment group from exploitation. Specifically, we consider an upper limit on tax rates which prevents the policy-maker from fully taxing citizens. Second, to overcome under-provision of the public good, we introduce a political contract that involves an incentive pay for the policy-maker, and depends on the level of public good provided. Finally, we combine tax protection with this incentive contract and study the effect on social welfare.

While the first measure—constitutional tax rules—is standard and widely applied in practice,[11] the second measure is non-standard. Indeed, it is one of the purposes of this paper to explore whether such political contracts—alone or together with tax rules—are welfare-improving.

3.4 Constitutional Limitation on Taxes

In this section, we explore the consequences of constitutional limits on taxes. We assume there is an article in the constitution that forbids taxation of citizens with a tax rate above $b \in [0,1]$ and we investigate the optimal choice of b. The private-good consumptions chosen for both groups by the policy-maker has to be non-negative and should satisfy the constitutional tax limit. Accordingly, we define the set C as the feasible set,

$$C = \{(x_M, x_m) \mid (1-b)\omega_i \leq x_i \leq \omega_i, i = M, m\}. \tag{3.13}$$

The policy-maker solves for

$$\begin{aligned} \max_{(x_M, x_m)} \quad & U(x_M, x_m) = u(x_M) + \left(\frac{\gamma}{1+\lambda}\right)\left[\Omega - \sum_{i=M,m} \theta_i x_i\right], \\ \text{subject to} \quad & (x_M, x_m) \in C. \end{aligned}$$

Since the policy-maker does not derive any utility from the minority's private-good consumption, he taxes them as much as possible and sets

$$x_m^p = \omega_m(1-b), \tag{3.14}$$

Given Assumption 3.2, it is not optimal for the policy-maker to choose $x_M^p = \omega_M$. In fact, depending on b, the choice of x_M^p under tax limit can be interior or it can be corner solution,

$$x_M^p = \max\{x_c^p, (1-b)\omega_M\}, \tag{3.15}$$

[11] Gersbach et al. (2012) provides examples of constitutional rules that restrict taxation in the U.S. and in other countries. A famous example is from the Texas constitution (Article 8, Sec. 1(a)), which states *"Taxation shall be equal and uniform."*

where x_c^p is the level of private-good consumption that satisfies the first-order condition with respect to x_M,

$$u'\left(x_c^p\right) = \frac{\gamma\theta_M}{1+\lambda}. \tag{3.16}$$

Public-good spending is given by

$$K_g^p = \frac{1}{1+\lambda}\left[\Omega - \sum_{i=M,m} \theta_i x_i^p\right]. \tag{3.17}$$

For $b \in [0,1]$, let $x_m^p(b)$, $x_M^p(b)$ and $K_g^p(b)$ be the solution to the system of Equations (3.14), (3.15) and (3.17).

We denote the ex-ante utilitarian welfare under the tax limit b by $W(b)$. At the ex-ante stage, the citizens do not know yet if they belong to the Elites or to the Non-elites, nor to which endowment group they belong. However, the policy-maker's ex-post choice of policy can be anticipated. Consequently, the function $W(b)$ can be written as follows:

$$W(b) = \theta_M u(x_M^p(b)) + \theta_m u(x_m^p(b)) + \gamma K_g^p(b). \tag{3.18}$$

The optimal constitutional tax limit is set ex-ante in the constitution. To find the constitutional tax limit, we maximize the ex-ante social welfare.

We first note that without tax protection ($b = 1$), the minority has zero private-good consumption. By the Inada Conditions, they have infinite marginal utility from private-good consumption. Thus, imposing a b slightly smaller than one generates a great improvement for the minority.

Additionally, we observe that if the policy-maker cannot impose any taxes ($b = 0$), there is zero public-good spending. Given Assumption 3.1, this cannot be optimal. In fact, allowing the policy-maker to tax at all, however little, is better than no taxation. Thus, a very small b is an improvement compared to $b = 0$.

We next establish the existence of an interior optimal tax limit and we derive the optimal value for b. The optimal b is such that no infinitesimal lump sum tax on the whole population can improve welfare.

Proposition 3.2

(i) There exists a unique constitutional limit on tax rates, $b^* \in (0,1)$ *which maximizes* $W(b)$.

(ii) This optimal tax limit is equal to

$$b^* = \begin{cases} 1 - \frac{x^s}{\omega_m} & \text{if} \quad \frac{u'\left(x_c^p \frac{\omega_m}{\omega_M}\right)}{u'(x^s)} \leq 1, \\ 1 - \frac{x_c^p}{\omega_M} & \text{if} \quad 1 < \frac{u'\left(x_c^p \frac{\omega_m}{\omega_M}\right)}{u'(x^s)} < 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right), \\ \tilde{b} & \text{if} \quad \frac{u'\left(x_c^p \frac{\omega_m}{\omega_M}\right)}{u'(x^s)} \geq 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right), \end{cases}$$

where $\tilde{b}$ *is implicitly given by*

$$\frac{\gamma}{1+\lambda} = \frac{\theta_M \omega_M}{\Omega} u'\left((1-\tilde{b})\omega_M\right) + \frac{\theta_m \omega_m}{\Omega} u'\left((1-\tilde{b})\omega_m\right). \tag{3.19}$$

The proof of Proposition 3.2 is given in Appendix A.
The value of b^* depends on exogenous values γ, λ, θ_m, ω_M, ω_m and on the function $u(\cdot)$. We recall that ω_m is the initial endowment of the minority endowment group. The larger ω_m, the higher the tax limit that attains the maximum social welfare. If the minority's initial endowment is large enough, such that $\omega_m \geq (\frac{x^s}{x_c^p})\omega_M$,[12] then $b^* = 1 - \frac{x^s}{\omega_m}$. However, if the minority's endowment is less than the majority's initial endowment such that $\omega_m < (\frac{x^s}{x_c^p})\omega_M$, then a smaller tax limit $b^* = 1 - \frac{x_c^p}{\omega_M}$, is the welfare maximizer. If the inequality in initial endowment of the two groups is more severe, such that $\frac{u'\left(x_c^p \frac{\omega_m}{\omega_M}\right)}{u'(x^s)} \geq 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right)$, then an even smaller tax limit $b^* = \tilde{b}$, maximizes welfare.
The effect of tax protection on the two inefficiencies in political multi-task problems is twofold. On the one hand, tax protection is beneficial, since it alleviates the exploitation of the minority endowment group. On the other hand, however, it exacerbates public good under-provision. Additionally, a smaller b^* yields an even lower public-good provision. We note that although the protection of the minority endowment group from full taxation yields more severe public-good under-provision[13], it improves welfare.
The following example illustrates how citizens' preferences affect the optimal tax limit and the level of public-good provision.

[12] We recall from Equation (3.4) that $u'(x^s) = \frac{\gamma}{1+\lambda}$ and from Equation (3.16) that $u'(x_c^p) = \frac{\gamma\theta_M}{1+\lambda}$. Given $u'(x^s) < u'(x_c^p)$ and since $u'(\cdot)$ is strictly decreasing, we have $x^s < x_c^p$.

[13] We recall from Equation (3.17) that the higher after-tax private-good consumption of citizens is the lower the public-good spending.

Example 3.2

Let $\omega_m > \omega_M$. Since $x^s < x_c^p$, $\frac{x^s}{x_c^p} < 1$. Given $\frac{\omega_m}{\omega_M} > 1$, we have $\frac{x^s}{x_c^p} < \frac{\omega_m}{\omega_M}$. Thus, we have $x^s < (\frac{\omega_m}{\omega_M})x_c^p$ and given $u'(\cdot)$ is strictly decreasing,

$$u'\left((\frac{\omega_m}{\omega_M})x_c^p\right) < u'(x^s).$$

By Proposition 3.2, the optimal constitutional upper bound on the tax rates, $b^* = 1 - \frac{x^s}{\omega_m}$, maximizes social welfare. Consider a utility function of the form $u(x) = x^\alpha$, where $0 < \alpha < 1$. Substituting for x^s by using Equation (3.4) in b^*, we obtain

$$b^* = 1 - \frac{1}{\omega_m}\left[\frac{\alpha(1+\lambda)}{\gamma}\right]^{\frac{1}{1-\alpha}}.$$

We let $x^s(\alpha)$ be the solution to Equation (3.4). Taking the derivative of x^s with respect to α, we note that if $\frac{1+\lambda}{\gamma} < \frac{e^{\left(\frac{1}{\alpha}\right)}}{\alpha}$, x^s is an increasing function of α. Consequently, if $\frac{1+\lambda}{\gamma} < \frac{e^{\left(\frac{1}{\alpha}\right)}}{\alpha}$ holds, the smaller α, the smaller x^s, and the larger the optimal constitutional tax limit and the level of public-good provision.

3.5 Incentive Contract: General Considerations

We next introduce an incentive contract for politicians. The contract stipulates that the policy-maker receives some additional amount of the private good, depending on the level of public-good provision. This is a "Political Contract" in the sense of Gersbach (2012).[14] For such a contract to be enforceable, it has to be conditioned on a variable connected with a verifiable performance level. We assume that the public good can be translated into a variable for which the quantifiable and verifiable dimension either exist or can be constructed. As to global warming, for instance, the quantifiable dimension might be a certain reduction of CO_2 emissions. For infrastructure projects, the number of road kilometers or of bridges built is quantifiable. The simplest example of a verifiable variable is the level of public debt.

We assume the simplest form of incentive contract, in which the policy-maker is rewarded linearly by an amount of additional private good per unit of the public-good provision, and that the level of provision, g, is observable and quantifiable. In our setting, public good has a linear production function and is proportional to public-good spending ($g = \gamma K_g$). Since the technology and the production function are common knowledge, for the sake

[14] By construction, the Political Contract does not interfere with the rules of liberal democracy. The rules governing the design, implementation and assessment process must be added as a new article to the constitution.

of simplicity, we make the reward conditional on the level of public-good spending. The parameter $(\beta \geq 0)$ denotes the reward per unit of public-good spending and it is finite.
We recall our definition of the Elites: citizens who take part in policy-making or are members of the policy-maker's supporting interest group. We assume that the policy-maker shares the reward only with the Elites of his endowment group. Consequently, for any given consumption plan and incentive contract with parameter β, the budget constraint is given by

$$K_g + \underbrace{\mu\theta_M\beta K_g}_{\text{aggregate incentive pay}} = \frac{1}{1+\lambda}\left[\Omega - \sum_{i=M,m}\theta_i x_i\right]. \tag{3.20}$$

The cost of the incentive pay to the society, $C = \beta\mu\theta_M K_g$, depends on the reward per unit of public-good spending, on the size of the majority-endowment-group Elites, and on the amount of public-good spending.
With the introduction of our incentive contract, the Elites and the Non-elites of the majority endowment group have differing preferences over policies. Thus, it is useful to distinguish between the consumption level within the policy-maker's endowment group. With the introduction of incentive pay, the majority-endowment-group Elites receive a reward—in private-good consumption—which the majority-endowment-group Non-elites do not receive. For the majority-endowment-group Non-elites, we denote the level of private-good consumption by x_{MN}. For the majority-endowment-group Elites, we denote private-good consumption by x_{ME},

$$x_{ME} = x_{MN} + \beta(1+\lambda)K_g. \tag{3.21}$$

The first summand is the after-tax level of private-good consumption for the majority endowment group and the second summand is the reward the majority-endowment-group Elites receive due to the incentive contract. We observe from Equation (3.20) that the incentive pay is financed by the collected tax revenue which is reduced due to possible deadweight losses. This is the reason why $(1+\lambda)$ enters Equation (3.21).
Given this distinction between x_{ME} and x_{MN}, we modify our definition of feasible policy by replacing x_M with x_{MN}. We define the feasible policy set, C', as

$$C' = \{(x_{MN}, x_m) \mid 0 \leq x_{MN} \leq \omega_M, 0 \leq x_m \leq \omega_m\}. \tag{3.22}$$

Additionally, for any given level of private-good consumption (x_{MN}, x_m), the level of public-good spending—implied from the budget constraint—can be written as

$$K_g = \frac{[\Omega - \theta_M x_{MN} - \theta_m x_m]}{(1+\lambda)(1+\mu\theta_M\beta)}. \tag{3.23}$$

By substituting for $x_{MN} = x_{ME} - \beta(1+\lambda)K_g$ in Equation (3.23), public-good spending can be equivalently written as

$$K_g = \frac{[\Omega - \theta_M x_{ME} - \theta_m x_m]}{(1+\lambda)[1-\beta\theta_M(1-\mu)]}. \tag{3.24}$$

With incentive pay, the policy-maker's optimization problem is therefore

$$\max_{(x_{MN}, x_m)} \quad U(x_{MN}, x_m) = u\left(x_{MN} + \beta\frac{[\Omega - \theta_M x_{MN} - \theta_m x_m]}{1+\mu\theta_M\beta}\right) + \gamma\frac{[\Omega - \theta_M x_{MN} - \theta_m x_m]}{(1+\lambda)(1+\mu\theta_M\beta)},$$
$$\text{subject to} \quad (x_{MN}, x_m) \in C'.$$

We denote the policy-maker's optimal choice of private-good consumption for the minority endowment group, the majority-endowment-group Non-elites and the majority-endowment-group Elites, by x^p_m, x^p_{MN} and x^p_{ME}, respectively.
We immediately observe that $U(\,\cdot\,,\,\cdot\,)$ is strictly decreasing in the private-good consumption of the minority endowment group, and as a result, the policy-maker sets

$$x^p_m = 0. \tag{3.25}$$

The policy-maker faces a more complex trade-off between private-good consumption and public-good spending in this case, compared to the case in Section 3.3.2, since he receives an incentive pay in private-good consumption based on the level of public good he provides.
We observe that it is not optimal for the policy-maker to set $x^p_{MN} = \omega_M$. From Equation (3.24), we can see that with the incentive contract, the policy-maker's marginal utility of public-good spending is higher than his marginal utility of public-good spending without the incentive pay,

$$\frac{\gamma\theta_M}{1+\lambda} \leq \frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}.$$

Additionally, with the incentive pay from Equation (3.21), we have $x^p_{ME} \geq x^p_{MN}$. At $x^p_{MN} = \omega_M$, given $u'(\,\cdot\,)$ is strictly decreasing, Assumption 3.2 yields

$$u'\left(x^p_{ME}\right) \leq \underbrace{u'\left(x^p_{MN}\right)}_{=u'(\omega_M)} < \frac{\gamma\theta_M}{1+\lambda} \leq \frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}.$$

From the above inequality, we obtain $u'\left(x^p_{ME}\right) < \frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}$. Thus, it is not optimal for the policy-maker to set $x^p_{MN} = \omega_M$ and imposing a very small tax on his own endowment group improves his utility compared to zero taxation of the majority endowment group.

However, the choice of $x^p_{MN} = 0$ might be optimal. Although at $x^p_{MN} = 0$, the majority-endowment-group Non-elites' marginal utility of private-good consumption will be infinite due to the Inada Conditions, the policy-maker's marginal utility will not be infinite because of the incentive pay. With $x^p_{MN} = 0$, we obtain

$$K^p_g = \frac{\Omega}{(1+\lambda)(1+\mu\theta_M\beta)}, \quad \text{and} \tag{3.26}$$

$$x^p_{ME} = \frac{\beta\Omega}{1+\mu\theta_M\beta}, \tag{3.27}$$

by using Equation (3.23) and Equation (3.21), respectively.

Suppose the policy-maker fully taxes both endowment groups. If the policy-maker's marginal utility of private-good consumption is higher than his marginal utility of public good, then he prefers o tax his own endowment group less and set $x^p_{MN} > 0$. In other words, if

$$u'\left(\frac{\beta\Omega}{1+\beta\mu\theta_M}\right) \geq \frac{\gamma\theta_M}{(1+\lambda)\left(1-\beta\theta_M(1-\mu)\right)}, \tag{3.28}$$

the policy-maker wants to increase his own private-good consumption. Thus, it is optimal for the policy-maker to set $x^p_{MN} = 0$, if Inequality (3.28) does not hold.

However, if Inequality (3.28) holds, the interior solution is the optimal policy for the policy-maker. We find the interior solution by examining the first-order condition with respect to x_{MN},

$$u'\left(\underbrace{x^p_{MN} + \beta\left(1+\lambda\right)K^p_g}_{=x^p_{ME}}\right) = \frac{\gamma\theta_M}{(1+\lambda)\left[1-\beta\theta_M\left(1-\mu\right)\right]}. \tag{3.29}$$

Substituting for $x^p_m = 0$ into Equation (3.24) and by using Equation (3.29) for x^p_{ME}, the implied level of public-good spending for the interior solution is given by

$$K^p_g = \frac{\left[\Omega - \theta_M x^p_{ME}\right]}{(1+\lambda)\left[1-\beta\theta_M\left(1-\mu\right)\right]}. \tag{3.30}$$

Let $x^p_{MN}(\beta)$, $x^p_{ME}(\beta)$, and $K^p_g(\beta)$ be the solution to the system of Equations (3.21), (3.29) and (3.30). For the intermediate result, stated in the next lemma, we require $\beta < \frac{1}{\theta_M(1-\mu)}$. This ensures $u'(\,\cdot\,) > 0$ in Equation (3.29) and ensures continuity of $K^p_g(\beta)$, given by

Equation (3.30). Later, we establish that Inequality (3.28) requires an upper bound on the reward parameter which is strictly smaller than $\frac{1}{\theta_M(1-\mu)}$.
The following lemma states the comparative statics with respect to β for the interior solution to the policy-maker's problem:

Lemma 3.1
Let $\beta < \frac{1}{\theta_M(1-\mu)}$ *and* $\mu \in [0,1)$. *The following properties hold:*

(i) $\frac{\partial x^p_{ME}}{\partial \beta} < 0$,

(ii) $\frac{\partial K^p_g}{\partial \beta} > 0$,

(iii) $\frac{\partial x^p_{MN}}{\partial \beta} < 0$.

The proof of Lemma 3.1 is given in Appendix A.
The results in Lemma 3.1 assess the incentive contract's impact on the interior policy choices. The minority endowment group's private-good consumption does not depend on the incentive pay, since the minority endowment group is fully exploited. Public-good spending is increasing with β at the interior solution. The cost of the additional public-good spending due to the incentive contract is shared by the majority-endowment-group Elites and Non-elites. Thus, the majority-endowment-group Elites' private-good consumption, $x^p_{ME}(\beta)$ is a decreasing function of β. The cost of the incentive pay has to be paid by the majority-endowment-group Non-elites. The Non-elite citizens of the policy-maker's endowment group are those citizens who are not entitled to the reward from the contract, but have to pay for its costs. The majority-endowment-group Non-elites' private-good consumption, $x^p_{MN}(\beta)$, is a decreasing function of β, due to the costs of the reward and the additional public-good spending.
The next proposition follows from Lemma 3.1 and establishes the admissible range for β that ensures the interior solution.

Proposition 3.3
Let $\mu \in [0,1)$.

(i) There exists a unique $\bar{\beta} < \frac{1}{\theta_M(1-\mu)}$ *that satisfies*

$$u'\left(\frac{\bar{\beta}\Omega}{1+\mu\theta_M\bar{\beta}}\right) = \frac{\gamma\theta_M}{(1+\lambda)\left[1-\bar{\beta}\theta_M(1-\mu)\right]}. \tag{3.31}$$

(ii) The policy-maker's optimization problem has a unique optimal interior solution if

and only if

$$0 \leq \beta \leq \bar{\beta}.$$

The proof of Proposition 3.3 is given in Appendix A.
To provide intuition about the results in Proposition 3.3, we compare Equation (3.31) with Inequality (3.28). At $\bar{\beta}$, the reward parameter is so high that the policy-maker's marginal utility of private-good consumption is equal to his marginal utility of public good. Thus, it is optimal for the policy-maker to set $x^p_{MN} = 0$. For all $\beta < \bar{\beta}$, the reward parameter is such that the policy-maker's marginal utility of private-good consumption is higher than his marginal utility of public good, if he sets $x^p_{MN} = 0$. Thus, the optimal solution to the policy-maker's problem is interior.
In the remainder of this section, we assume $\beta \in [0, \bar{\beta}]$ to ensure interior solution to the policy-maker's problem.
Before presenting the results for the optimal incentive contract, we show the results for the case with $\mu = 1$ in the next proposition.

Proposition 3.4
The incentive contract has no impact if and only if $\mu = 1$.

The proof of Proposition 3.4 is given in Appendix A. The result follows from Equations (3.29) and (3.30), where the policy choice remains unchanged with the introduction of the incentive contract when $\mu = 1$.[15] To provide intuition about the above proposition, we note that at $\mu = 1$, every citizen in the majority endowment group belongs to the Elites. Since everyone in the majority endowment group is entitled to the reward and the majority-endowment-group Non-elites has no members, no one pays for the costs of the contract. In this case, the incentive pay is not effective. More precisely, the citizens' private-good consumptions do not change with the incentive pay. As a result, public-good provision is not affected by the incentive contract either. In the remainder of this dissertation, we focus on $\mu \in [0, 1)$.
The ex-ante welfare function as a function of the incentive parameter is given by

$$W(\beta) = \theta_M(1-\mu)u(x^p_{MN}(\beta)) + \theta_M \mu u(x^p_{ME}(\beta)) + \theta_m u(x^p_m) + \gamma K^p_g(\beta). \tag{3.32}$$

Due to additive separability, welfare is a weighted sum of the the citizens' utilities. The ex-ante welfare function thus depends on the policy choices, the size of the majority endowment group, and the size of the Elites. The first and second terms denote the

[15] At $\mu = 1$ Equation (3.29) is equal to Equation (3.7), and Equation (3.30) is equal to Equation (3.8).

utility of private-good consumption for the majority-endowment-group Non-elites and the majority-endowment-group Elites, respectively. The third term denotes the minority group's utility of private-good consumption and the last term denotes the society's public-good level.

The incentive parameter is set ex-ante. In Proposition 3.3, we have established the admissible range for β. The upper bound of β, as defined in Equation (3.31), solely depends on exogenous parameters and the function $u(x)$, which are common knowledge. In order to find the optimal reward, $\beta^* \in [0, \bar{\beta}]$, the ex-ante social welfare function $W(\beta)$ should be maximized.

We first note that without incentive pay ($\beta = 0$), we are back to the case in Section 3.3.2, where in addition to the minority's exploitation, the public good is under-provided and the majority's private-good consumption is higher than the optimal level. By Lemma 3.1, introducing a very small incentive pay increases the public-good spending and decreases the majority-endowment-group Elites' private-good consumption as well as the majority-endowment-group Non-elites' private-good consumption. These three effects improve social welfare. Thus, having a very small incentive pay is better than having none.

Additionally, we observe that an incentive pay with $\bar{\beta}$ cannot be optimal. Suppose the policy-maker is rewarded according to the incentive contract $\bar{\beta}$. Then, like the minority, the majority-endowment-group Non-elites have zero private-good consumption. Thus, by the Inada Conditions, they have infinite marginal utility. A small decrease of the reward parameter highly improves social welfare.

Theorem 3.1 assesses the existence of an optimal incentive contract.

Theorem 3.1
Let $\mu \in [0, 1)$. There exists $\beta^* \in (0, \bar{\beta})$ which maximizes $W(\beta)$.

Proof of Theorem 3.1 is given in Appendix A.

From the proof of Theorem 3.1, we obtain a formula for determining the politician's optimal reward. The reward is implicitly given by

$$\theta_M(1-\mu)u'\left(x^p_{MN}(\beta^*)\right)\left.\frac{\partial x^p_{MN}}{\partial \beta}\right|_{\beta^*} + \theta_M \mu u'\left(x^p_{ME}(\beta^*)\right)\left.\frac{\partial x^p_{ME}}{\partial \beta}\right|_{\beta^*} = \frac{\gamma}{1+\lambda}\left[\frac{\theta_M \left.\frac{\partial x^p_{ME}}{\partial \beta}\right|_{\beta^*}}{1-\beta^*\theta_M(1-\mu)} - \frac{\theta_M^2(1-\mu)x^p_{ME}(\beta^*)}{\left(1-\beta^*\theta_M(1-\mu)\right)^2}\right].$$

To provide further insight, we next study the case $\mu = 0$ as an illustrative example and we establish numerical results for β^*.

3.6 Incentive Contract: A Special Case

If the Elites consist of finitely many citizens ($\mu = 0$), the contract is costless. The budget constraint of the society

$$K_g = \left(\frac{1}{1+\lambda}\right)[\Omega - \theta_M x_{MN} - \theta_m x_m],$$

is the same as the initial budget, without an incentive contract in Equation (3.2).
Consequently, the rewarded policy-maker's problem has the following form:

$$\max_{(x_{MN},x_m)} \quad U(x_{MN}, x_m) = u\left(x_M + \beta\left[\Omega - \theta_M x_{MN} - \theta_m x_m\right]\right) + \gamma\frac{[\Omega - \theta_M x_{MN} - \theta_m x_m]}{(1+\lambda)},$$
$$\text{subject to} \quad (x_{MN}, x_m) \in C'.$$

The policy-maker immediately sets $x_m^p = 0$.
By Proposition 3.3, the policy-maker's problem has a unique interior solution if and only if $\beta \in [0, \bar{\beta}]$. We assume $\beta \in [0, \bar{\beta}]$ where $\bar{\beta}$ is implicitly given by

$$u'\left(\bar{\beta}\Omega\right) = \frac{\gamma\theta_M}{(1+\lambda)(1-\bar{\beta}\theta_M)},$$

where we have substituted for $\mu = 0$ in Equation (3.31).
From the first-order condition with respect to x_{MN}, we obtain the interior solution

$$u'\left(x_{MN}^p + \beta(1+\lambda)K_g^p\right) = \left(\frac{\gamma\theta_M}{(1+\lambda)\left[1-\beta\theta_M\right]}\right).$$

The private-good consumption of the majority-endowment-group Elites differs from the majority-endowment-group Non-elites by $\beta(1+\lambda)K_g$, due to the incentive pay,

$$x_{ME}^p = x_{MN}^p + \beta(1+\lambda)K_g^p.$$

And the public-good spending is given by

$$K_g^p = \frac{[\Omega - \theta_M x_{ME}^p]}{(1+\lambda)\left[1-\beta\theta_M\right]}.$$

We note that these results are identical to those in Equations (3.29) and (3.30), with μ set equal to zero.
Intuitively, we expect the effect of incentive pay on the level of public good to be enhanced when the size of the Elites' group decreases. At $\mu = 0$, rewards can be given without social cost. This is due to the fact that only a finite number of citizens belongs

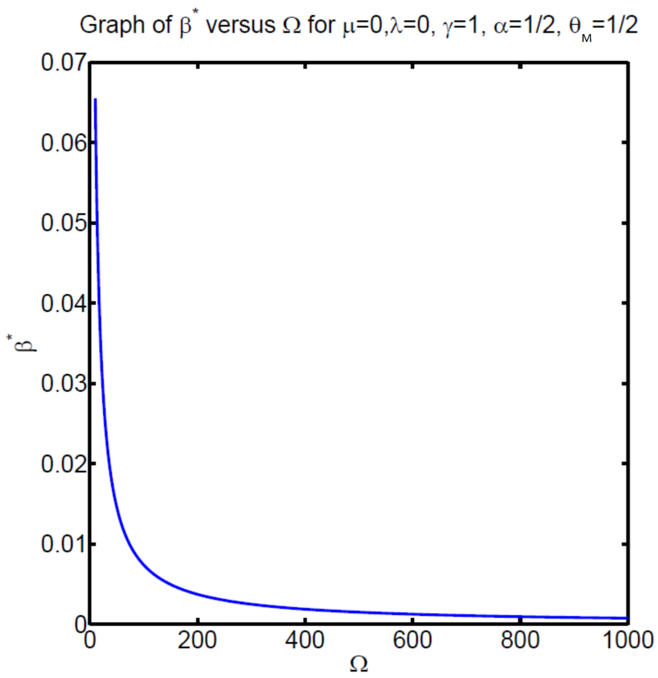


Figure 3.2: Numerical example.

to the majority-endowment-group Elites and is entitled to the reward. The rest of the majority-endowment-group citizens belongs to the Non-elites who finance the incentive pay and contribute to the additional public-good spending induced by the contract. A group of Non-elite citizens as large as the endowment group can collectively afford higher incentive pay and contribute more to the provision of the public good.[16]

By Theorem 3.1, there exists an incentive contract that is socially optimal at $\mu = 0$. Finding β^* for the costless contract is not feasible analytically.

As an example, we solve for β^* numerically, using the following set of parameters: $\mu = 0$, $\lambda = 0$, $\gamma = 1$, $\theta_M = \theta_m = \frac{1}{2}$ and $u(x) = x^{\frac{1}{2}}$. The optimal reward parameter as a function of the total private good endowment is depicted in Figure (3.2). We can see that the optimal β^* value decreases, with the society's total private good endowment Ω increasing.

3.7 Incentive Contract: Implementability

In this section, we explore the conditions for the implementability of the incentive contract. For the contract to be implementable, a majority of citizens must be in favor of it.[17]

[16] This is also clear from Equation (3.30). We can see that for any given β, the public-good spending of a rewarded policy-maker is a strictly decreasing function of the size of the Elites, μ.

[17] In practice, an actual political process that can determine the implementability of the incentive contract could be a referendum or a parliamentary vote. In Chapter 5, we discuss "Co-voting" as an alternative

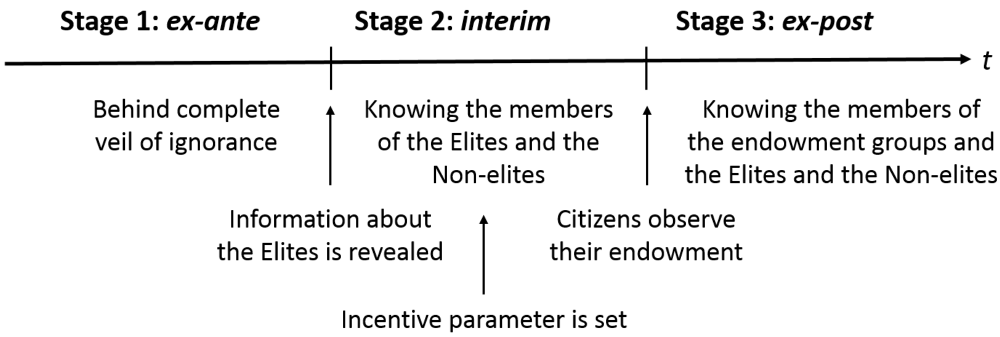


Figure 3.3: Timeline.

While so far, we have only focused on the ex-ante and the ex-post cases, it is now useful to consider an interim case. Suppose we are in a society where Elites are the educated citizens in the society. Citizens know whether they belong to the Elites or not at an interim stage. However, they will only observe their endowments at a later stage, when an exogenous shock to the initial endowment is realized and some citizens will have a higher endowment, while the others will have a lower one. Figure (3.3) shows the timeline of information revelation.

At the interim stage, we consider the Elites' and the Non-elites' interest in the incentive contract separately. In other words, we evaluate the citizens' expected utilities when they do not know their endowment group yet, but know with certainty whether they belong to the Elites or to the Non-elites. The probability of belonging to the majority endowment group is the same for the Elites and the Non-elites, and equal to θ_M, and the probability of belonging to the minority endowment group for the Elites and Non-elites is equal to θ_m. The interim expected utility of an Elite and a Non-elite citizen is given by

$$\mathcal{U}_E(\beta) = \theta_M \left[u\left(x^p_{ME}(\beta)\right) + \gamma K^p_g(\beta) \right] + \theta_m \left[u\left(x^p_m\right) + \gamma K^p_g(\beta) \right] \text{ and} \tag{3.33}$$

$$\mathcal{U}_{NE}(\beta) = \theta_M \left[u\left(x^p_{MN}(\beta)\right) + \gamma K^p_g(\beta) \right] + \theta_m \left[u\left(x^p_m\right) + \gamma K^p_g(\beta) \right], \tag{3.34}$$

respectively.

Proposition 3.5

(i) The Elites expect to be interim better off with the incentive contract for all $\beta \in [0, \bar{\beta}]$.

(ii) Let $\gamma \geq (1+\lambda)^2$,the Non-elites expect to be interim better off with the incentive contract if $\mu \leq 1 - \frac{(1+\lambda)^2}{\gamma}$ and β is small enough.

implementation process in details.

The proof of Proposition 3.5 is given in Appendix A. We note that if $\mu \in [\frac{1}{2}, 1)$, the incentive contract is implementable. This results from the fact that the Elites have the majority and they are interim better off with the incentive contract for all β values. However, if $\mu \in \left[0, \frac{1}{2}\right)$ the implementability of the contract also depends on how the interim expected utility of the Non-elites changes with the incentive contract.

It is useful to provide intuition about Statement (ii) in Proposition 3.5. With probability θ_m, a Non-elite citizen belongs to the minority endowment group. The minority endowment group Non-elites are strictly better off with the incentive contract, because the public-good level increases with the incentive pay and their private-good consumption does not depend on β. However, for any citizen, the probability of belonging to the majority endowment group is higher than the probability of belonging to the minority endowment group, $\theta_M > \theta_m$. Unlike the minority endowment group Non-elites, the majority-endowment-group Non-elites are worse off with the incentive contract. Although the public-good level is higher with the incentive pay, the majority-endowment-group Non-elites' private-good consumption is decreasing in β.

For a Non-elite citizen to be interim better off with the incentive contract, it has to be that the expected positive effect of the incentive contract on the minority endowment group Non-elites' utility dominates the incentive contract's expected negative effect on the majority-endowment-group Non-elites' utility. The incentive contract's negative effect on the majority-endowment-group Non-elites' utility is a result of the costs of the incentive pay being financed by the majority-endowment-group Non-elites. With small enough β and μ, the cost of the incentive pay decreases sufficiently for the Non-elites to be interim better off with the contract. If the cost of the incentive pay is small enough, both the Elites and the Non-elites are interim better off, and the incentive contract is implementable.

The next corollary follows immediately from Proposition 3.5.

Corollary 3.1

(i) The ex-ante optimal incentive contract β^* is implementable if and only if $\mu \in \left[\frac{1}{2}, 1\right)$.

(ii) Any contract that makes the Non-elites interim better off is implementable and welfare improving.

The proof of Corollary 3.1 is given in Appendix A.

Corollary 3.1 establishes that the Non-elites are interim worse off with the incentive contract at the optimal β^*. Thus, for the optimal contract to be implementable the Elites should have the majority in the society. Moreover, it shows that if the contract is such that it makes the Non-elites interim better off, it has the support of everyone in the society. Additionally, it is welfare improving relative to the policy-maker's choice without the incentive contract.

3.8 Tax Protection and the Incentive Contract

We have argued until now that the incentive contract is an effective tool for alleviating the public-good under-provision. Yet it cannot protect the minority endowment group from exploitation. A constitutional limit on tax rates can guarantee the protection of the minority endowment group from exploitation, but reduces the—already under-provided—public-good level. In this section, we combine tax protection and the incentive contract, and study their overall effect on society's welfare.

3.8.1 The policy-maker's Problem

As in Section 3.4, we assume there is an article in the constitution that imposes an upper bound on tax rates. We note that at $b = 0$, the private good endowment of all citizens is protected by the constitution. With b set to zero, the policy-maker cannot raise taxes and consequently, public-good spending and the incentive pay are equal to zero. Given Assumption 3.1, zero public-good spending cannot be optimal. In fact, allowing the policy-maker to tax, however little, is better than no taxation. Thus, a very small b is an improvement compared to $b = 0$.

Moreover, we note that at $b = 1$, the problem is the same as the one without constitutional tax protection, and the results in Section 3.5 hold. We note that without tax protection ($b = 1$) and with the incentive pay, at least the minority receives zero private-good consumption.[18] By the Inada Conditions, the minority citizens have infinite marginal utility from private-good consumption. Thus, imposing a b slightly smaller than one leads to a big improvement.

Thus, the basic argument given in Section 3.4 for the existence of interior solution for the optimal tax limit is equally valid in the presence of incentive pay as it is without incentive pay.

The private-good consumptions chosen by the policy-maker should satisfy the constitutional tax limit. We define the set C'' as the feasible policy set,

$$C'' = \{(x_{MN}, x_m) \mid (1-b)\omega_M \leq x_{MN} \leq \omega_M, (1-b)\omega_m \leq x_m \leq \omega_m\}.$$

[18] We recall from Section 3.5 that if β is set too high, the majority-endowment-group Non-elites' might have zero private-good consumption, additionally to the minority endowment group.

We consider the policy-maker's optimization problem, taking both the reward and tax protection into account,

$$\max_{(x_{MN},x_m)} \quad U(x_{MN},x_m) = u\left(x_{MN} + \beta\frac{[\Omega-\theta_M x_{MN}-\theta_m x_m]}{1+\mu\theta_M\beta}\right) + \gamma\frac{[\Omega-\theta_M x_{MN}-\theta_m x_m]}{(1+\lambda)(1+\mu\theta_M\beta)},$$
$$\text{subject to} \quad (x_{MN},x_m)\in C''.$$

We denote the policy-maker's choice of private-good consumption for the minority endowment group by x_m^p. We can immediately conclude that the policy-maker chooses

$$x_m^p = (1-b)\omega_m. \tag{3.35}$$

To find the optimal choice of x_{MN}, we define the Lagrangian

$$L \equiv u\left(x_{MN} + \beta\frac{[\Omega-\theta_M x_{MN}-\theta_m\omega_m(1-b)]}{1+\mu\theta_M\beta}\right) + \gamma\frac{[\Omega-\theta_M x_{MN}-\theta_m\omega_m(1-b)]}{(1+\lambda)(1+\mu\theta_M\beta)}$$
$$+ l_1\left(x_{MN}-(1-b)\omega_M\right) + l_2\left(\omega_M - x_{MN}\right).$$

We have substituted for x_m^p from Equation (3.35) in the above. The first constraint—with l_1 as Lagrange multiplier—ensures that the policy-maker's taxation respects the constitutional limit on taxation, as given in Inequality (3.13). The second constraint—with l_2 as Lagrange multiplier—ensures that the policy-maker does not subsidize his own endowment group.

The policy-maker's choice of private-good consumption for majority-endowment-group Non-elites is denoted by x_{MN}^p, and the majority-endowment-group Elites' private-good consumption—denoted by x_{ME}^p—is accordingly given by

$$x_{ME}^p = x_{MN}^p + \underbrace{\beta\frac{[\Omega-\theta_M x_{MN}^p-\theta_m\omega_m(1-b)]}{1+\mu\theta_M\beta}}_{\text{incentive pay}}. \tag{3.36}$$

From the first-oder condition with respect to x_{MN}, we obtain

$$u'\left(x_{MN}^p + \beta\frac{[\Omega-\theta_M x_{MN}^p-\theta_m\omega_m(1-b)]}{1+\mu\theta_M\beta}\right) = \left(\frac{\gamma\theta_M}{(1+\lambda)\left[1-\beta\theta_M(1-\mu)\right]}\right)$$
$$+(l_2-l_1)\left(\frac{1+\mu\theta_M\beta}{1-\beta\theta_m(1-\mu)}\right). \tag{3.37}$$

3.8.2 Conditions on Corner and Interior Solution

Depending on whether the two constraints are binding or not, we have the following three cases:

Case 1 If Equation (3.37) is satisfied for $l_1 = 0$ and $l_2 = 0$, then, neither of the two constraints is binding and we have interior solution given by

$$u'\left(x^p_{MN} + \beta\frac{[\Omega - \theta_M x^p_{MN} - \theta_m \omega_m (1-b)]}{1+\mu\theta_M\beta}\right) = \left(\frac{\gamma\theta_M}{(1+\lambda)\left[1-\beta\theta_M(1-\mu)\right]}\right). \tag{3.38}$$

Case 2 If Equation (3.37) is satisfied for $l_1 > 0$ and $l_2 = 0$, then, by complementary slackness conditions, we have

$$x^p_{MN} = (1-b)\omega_M, \text{ and} \tag{3.39}$$

$$x^p_{ME} = (1-b)\omega_M + \frac{\beta b \Omega}{1+\mu\theta_M\beta}. \tag{3.40}$$

Case 3 If Equation (3.37) is satisfied for $l_1 = 0$ and $l_2 > 0$, then, by complementary slackness conditions, we have

$$x^p_{MN} = \omega_M, \text{ and} \tag{3.41}$$

$$x^p_{ME} = \omega_M + \frac{\beta b \theta_m \omega_m}{1+\mu\theta_M\beta}. \tag{3.42}$$

Before discussing each case in details, we note that the public-good spending in all cases is implied by society's budget constraint and is given by

$$K^p_g = \frac{[\Omega - \theta_M x^p_{MN} - \theta_m x^p_m]}{(1+\lambda)(1+\mu\theta_M\beta)}, \tag{3.43}$$

or equivalently by

$$K^p_g = \frac{[\Omega - \theta_M x^p_{ME} - \theta_m x^p_m]}{(1+\lambda)\left[1-\beta\theta_M(1-\mu)\right]}, \tag{3.44}$$

where we have substituted for x^p_{MN} from Equation (3.36) in Equation (3.43).
We first examine the policy-maker's solution in Case 3. By comparing Equation (3.44) and Equation (3.8), we can see that with the incentive contract, the policy-maker's marginal utility of public-good spending is higher than his marginal utility of public-good spending without the incentive pay,

$$\frac{\gamma\theta_M}{1+\lambda} \leq \frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}.$$

Additionally, with the incentive pay from Equation (3.36), we have $x^p_{ME} \geq x^p_{MN}$. At $x^p_{MN} = \omega_M$, given $u'(\cdot)$ is strictly decreasing, Assumption 3.2 yields

$$u'\left(x^p_{ME}\right) \leq \underbrace{u'\left(x^p_{MN}\right)}_{=u'(\omega_M)} < \frac{\gamma\theta_M}{1+\lambda} \leq \frac{\gamma\theta_M}{(1+\lambda)\left(1-\beta\theta_M(1-\mu)\right)}.$$

Thus, Case 3 is not optimal for the policy-maker.

However, depending on how high the reward parameter is, Case 1 or Case 2 can be the optimal solution for the policy-maker. To be more precise, if

$$u'\left((1-b)\omega_M + \frac{\beta b\Omega}{1+\mu\theta_M\beta}\right) \geq \frac{\gamma\theta_M}{(1+\lambda)\left(1-\beta\theta_M(1-\mu)\right)} \tag{3.45}$$

holds, the interior solution in Case 1 is the optimal policy for the policy-maker.

We focus on the interior solution and we present the results for Case 1 as this is arguably the most important case.

For a given $b \in (0,1)$, we consider $x^p_{MN}(\beta)$, $x^p_{ME}(\beta)$, and $K^p_g(\beta)$ to be the solution to the system of Equations (3.36), (3.38) and (3.44).

The results in Lemma 3.1 hold true in this section as well, since b is a positive exogenously given parameter and does not change the monotonicity of $x^p_{MN}(\beta)$, and $x^p_{ME}(\beta)$. The next proposition is a generalization of our results in Proposition 3.3.

Proposition 3.6

Let $b_c = 1 - \frac{x^p_c}{\omega_M}$.

(i) For all $b \in [0, b_c]$ and $\beta \geq 0$, Case 2 describes the optimal solution to the policy-maker's problem.

(ii) For all $b \in [b_c, 1]$ and $0 \leq \beta \leq \bar{\beta}_b$, Case 1 describes the optimal solution to the policy-maker's problem, where $\bar{\beta}_b$ uniquely satisfies

$$u'\left((1-b)\,\omega_M + \frac{\bar{\beta}_b b\Omega}{1+\mu\theta_M\bar{\beta}_b}\right) = \frac{\gamma\theta_M}{(1+\lambda)\left[1-\bar{\beta}_b\theta_M\,(1-\mu)\right]}. \tag{3.46}$$

(iii) For all $b \in [b_c, 1]$ and $\beta \geq \bar{\beta}_b$, Case 2 describes the optimal solution to the policy-maker's problem.

The proof is given in Appendix A.

We observe that with the tax limit set too low, the optimal solution to the policy-maker's problem cannot be interior solution even for very small β values. Similar to the intuition provided for the results in Proposition 3.3, in Statements (ii) of this proposition we show for what range of reward parameter and tax limit the optimal solution to the policy-maker's problem is the interior solution. Inequality (3.45) stipulates an upper bound on β, determined by $x^p_{MN}\left(\bar{\beta}_b\right) = (1-b)\omega_M$. At this upper bound $\bar{\beta}_b$, the reward parameter is high enough for the policy-maker to be indifferent between the interior solution and the corner solution $x^p_{MN} = (1-b)\omega_M$. According to Proposition 3.6, the majority-endowment-group Elites' marginal utility of private-good consumption at $\bar{\beta}_b$ is given by Equation (3.46). Clearly, the value of the reward parameter's upper-bound in this case depends on b, hence the subscript b in the notation of $\bar{\beta}_b$.

3.8.3 Socially Optimal Solution

To find the optimal β, we maximize the ex-ante welfare. The ex-ante welfare function as a function of the incentive parameter is given by

$$W(\beta) = \theta_M(1-\mu)u(x^p_{MN}(\beta)) + \theta_M\mu u(x^p_{ME}(\beta)) + \theta_m u(x^p_m) + \gamma K^p_g(\beta). \tag{3.47}$$

The following theorem is a generalization of our results in Theorem 3.1. We show that in Case 1, for any level of tax protection, there exists an optimal contract.

Theorem 3.2
For a given $b \in (b_c, 1)$, where $b_c = 1 - \frac{x^p_c}{\omega_M}$, there exists $\beta^*_b \in \left(0, \bar{\beta}_b\right]$ which maximizes $W(\beta)$.

The proof is given in Appendix A. Overall, Theorem 3.2 indicates that incentive pay and tax protection can work together to improve welfare.
A discussion of Case 2, which splits into two sub-cases

(i) $b \in [0, b_c]$ and $\beta \geq 0$, and

(ii) $b \in [b_c, 1]$ and $\beta \geq \bar{\beta}_b$,

is given in Appendix C. There, we also introduce concept of *weak optimality* and how such solutions can be implemented.

3.9 Summary and Conclusion

We studied an economy with citizens who have heterogeneous initial endowments and homogeneous preferences over a private good and a public good. We developed the political multi-task problem where the policy-maker taxes citizens' private-good endowments and determines the level of public-good provision. We identified the inefficiencies in this setting as the exploitation of the minority endowment group and under-provision of the public good. To overcome these inefficiencies, we explored two corrective measures: tax protection and incentive pay. We demonstrated that there exists a unique tax limit that maximizes welfare and protects the minority from exploitation. Moreover, we established that there exists an incentive pay for the policy-maker that improves social welfare by raising the level of public-good provision. Additionally, we showed that by choosing the right incentive parameter, we can ensure that at least a majority is in favor of the incentive pay at the interim stage where Elite and Non-elite citizens are known but the endowments are not realized yet. Finally, we examined the combined effect of incentive pay and tax protection and we showed that the policy-maker's choice of policy is divided into three cases. In the case where the tax limit is high enough and the incentive parameter is small enough for the solution of the policy-maker's optimization problem to be interior, we show that there exists a combination of incentive pay and tax limit that improves social welfare.

4 Altruism, Fragmented Societies, and Election

4.1 Introduction

In this chapter, we explore the robustness of our results with respect to the key assumptions of our model. First, we relax the assumption that the policy-maker only maximizes his personal utility, and we assume he values social welfare in addition to his utility. So far we have focused on the private interest as the main source among the politician's sources of reelection incentives—as introduced in Chapter 2. By extending the model to an altruistic policy-maker, we take into account both the private interest and the altruism as a politician's sources of reelection incentives, and we investigate the effect of incentive pay on the policy-maker's decision making. We compare the effect of incentive pay on the policy decisions of the altruistic policy-maker in wealthy and less wealthy societies.
Second, to generalize the model, we allow more than two endowment groups $n > 2$. This generalization enriches the setting and allows a better understanding of the conflict of interest between citizens in a heterogeneous society. In a society where a majority endowment group exists, we examine whether our results hold for a society with more than two endowment groups.
Third, we discuss what happens when candidates compete for election by announcing their desired incentive contract. We explore whether there is an equilibrium where a majority is better off with the incentive pay announced by a candidate.

4.2 Altruistic Politician

In this section, we consider a policy-maker who cares about the overall welfare of the society in addition to his direct utility, i.e. a policy-maker who has altruistic preferences. We do the analysis based on the notion of non-paternalistic altruism. Non-paternalistic altruism was first formally analyzed by Edgeworth (1881).[1] The well-being of an altruistic

[1] For a more recent discussion of non-paternatlistic altruism see e.g. Lindbeck and Weibull (1988) and Kolm and Ythier (2006).

agent depends on the others' well-being, i.e. the agent's utility depends on the utilities of the others and not on their consumption level. This can be formulated by separable utility functions.

The altruistic concern is not limited to the policy-maker but can include all majority-endowment-group Elites, which we will assume. We calculate welfare from the perspective of a utilitarian social planner. Another interpretation of the welfare function is the utility function of the representative agent in the society. We denote the overall utility of the altruistic policy-maker by $U^{p_{alt}}$ and the policy-maker's utility from his personal consumption of private and public good by U^p. We denote the policy-maker's degree of altruism toward the representative agent by $\eta > 0$, which is exogenously-given. The altruistic policy-maker's utility is given by

$$U^{p_{alt}}(x_M, x_m) = U^p(x_M, x_m) + \eta W(x_M, x_m). \tag{4.1}$$

The function $U^p(.,.)$ is the same utility function as in previous sections, and $W(.,.)$ is the welfare function introduced in Section 3.3.1. To avoid an infinite sequence of mutual concerns, we assume the representative agent only cares about his own utility and not about the policy-maker's altruistic concerns.

We now solve the altruistic policy-maker's optimization problem. It is given by

$$\begin{aligned}
\max_{(x_M, x_m)} \quad & U^{p_{alt}}(x_M, x_m) = U^p(x_M, x_m) + \eta W(x_M, x_m) \\
& = (1 + \eta\theta_M)\, u(x_M) + \eta\theta_m u(x_m) + (1 + \eta)\, \frac{\gamma\left[\Omega - \sum_{i=M,m} \theta_i x_i\right]}{1 + \lambda}, \\
\text{subject to} \quad & 0 \leq x_i \leq \omega_i,\ i = M, m,
\end{aligned}$$

where $\eta > 0$ is a strictly positive, exogenously-given parameter that accounts for the level of the policy-maker's altruism. The solution to the altruistic policy-maker's problem is denoted by $x_M^{p_{alt}}$ and $x_m^{p_{alt}}$. The superscript p_{alt} denotes the altruistic policy-maker's optimal choice.

Due to the Inada Conditions, it is not optimal for the altruistic policy-maker to set $x_M^{p_{alt}} = x_m^{p_{alt}} = 0$. Moreover, due to Assumption 3.2, $x_M^{p_{alt}} = \omega_M$ cannot be optimal for the policy-maker. Additionally, the marginal utility of the minority's private-good consumption for the altruistic policy-maker is larger than the marginal utility of the socially optimal public-good level,

$$\frac{\gamma}{1 + \lambda} < \left(\frac{\gamma}{1 + \lambda}\right) \frac{1 + \eta}{\eta}.$$

Thus, given Assumption 3.1, which requires $u'(\omega_m) < \frac{\gamma}{1+\lambda}$, we obtain

$$u'(\omega_m) < \left(\frac{\gamma}{1+\lambda}\right)\frac{1+\eta}{\eta}.$$

As a result, the choice of $x_m^{p_{alt}} = \omega_m$ cannot be optimal for the altruistic policy-maker. We observe that the solution to the altruistic policy-maker's problem is interior. We examine the first–order conditions with respect to $x_M^{p_{alt}}$ and $x_m^{p_{alt}}$. We obtain

$$u'\left(x_m^{p_{alt}}\right) = \left(\frac{\gamma}{1+\lambda}\right)\frac{1+\eta}{\eta}, \text{ and} \tag{4.2}$$

$$u'\left(x_M^{p_{alt}}\right) = \left(\frac{\gamma\theta_M}{1+\lambda}\right)\frac{1+\eta}{1+\eta\theta_M}, \tag{4.3}$$

respectively. Accordingly, public-good spending is given by

$$K_g^{p_{alt}} = \frac{1}{1+\lambda}\left[\Omega - \sum_{i=M,m}\theta_i x_i^{p_{alt}}\right]. \tag{4.4}$$

The following lemma is useful for comparing private-good consumption under the altruistic policy-maker with the optimal consumption level and consumption under the non-altruistic policy-maker.

Lemma 4.1

The private-good consumption under the altruistic policy-maker, the social planner and the non-altruistic policy-maker has the following order:

$$0 = x_m^p < x_m^{p_{alt}} < x^s < x_M^{p_{alt}} < x_M^p. \tag{4.5}$$

Proof of Lemma 4.1 is given in Appendix B.

We recall that the non-altruistic policy-maker would set $x_m^p = 0$. Given the altruistic policy-maker derives utility from the minority endowment group's private-good consumption, this minority endowment group is exploited less than before, $x_m^{p_{alt}} > 0$. However, its private-good consumption is still smaller than the socially optimal level, $x^s > x_m^{p_{alt}}$.

Moreover, compared to a non-altruistic politician, the altruistic policy-maker allocates lower private-good consumption to the citizens from his own endowment group, $x_M^{p_{alt}} < x_M^p$. However, their private-good consumption is still larger than the socially optimal level, $x^s < x_M^{p_{alt}}$.

Public-good under-provision is characterized by Inequality (3.10). Accordingly, under an altruistic policy-maker, the public good is thus under-provided if

$$\sum_{i=M,m} \theta_i x_i^{p_{alt}} > x^s. \tag{4.6}$$

The following proposition is a generalization of Proposition 3.1 to the case of the altruistic policy-maker.

Proposition 4.1
If $u'''(.) \geq 0$, the public good is under-provided by the altruistic policy-maker, for a finite $\eta > 0$.

Proof of Proposition 4.1 is given in Appendix B.
We emphasize that unless the policy-maker derives infinite utility from the overall social welfare, the public good will be under-provided even if the policy-maker is altruistic.
We note that the more altruistic the policy-maker, the more utility he derives from social welfare. At the limit, with very large η, $\eta \to \infty$, the public good is at the socially optimal level and so is the private-good consumption of both endowment groups. Moreover, if η approaches zero, the altruistic policy-maker's choice of private-good consumption for the majority and the minority endowment groups will approach the choice of the non-altruistic policy-maker.
As an example, we solve the altruistic policy-maker's optimization problem numerically, using the following set of parameters: $\lambda = 0$, $\gamma = 1$, $\theta_M = \frac{2}{3}$ and $u(x) = x^{\frac{1}{2}}$. The public-good spending as a function of the altruism parameter is depicted in Figure 4.1. We can see that public-good spending increases with the level of altruism and marginally approaches the socially optimal level, but stays below K_g^s. Given the non-optimal public-good provision, we apply the incentive contract (as introduced in Section 3.5) to improve the level of public good and the overall welfare.
The contract is costly and it modifies the budget constraint in the following way:

$$K_g + \mu\theta_M\beta K_g = \frac{1}{1+\lambda}\left[\Omega - \sum_{i=M,m} \theta_i x_i\right].$$

With the incentive pay, the majority-endowment-group Elites receive a reward —in private-good consumption—which the majority-endowment-group Non-elites do not receive. It is useful to distinguish between the consumption levels within the policy-maker's endowment group: it is x_{MN} for the Non-elites and

$$x_{ME} = x_{MN} + \beta(1+\lambda)K_g, \tag{4.7}$$

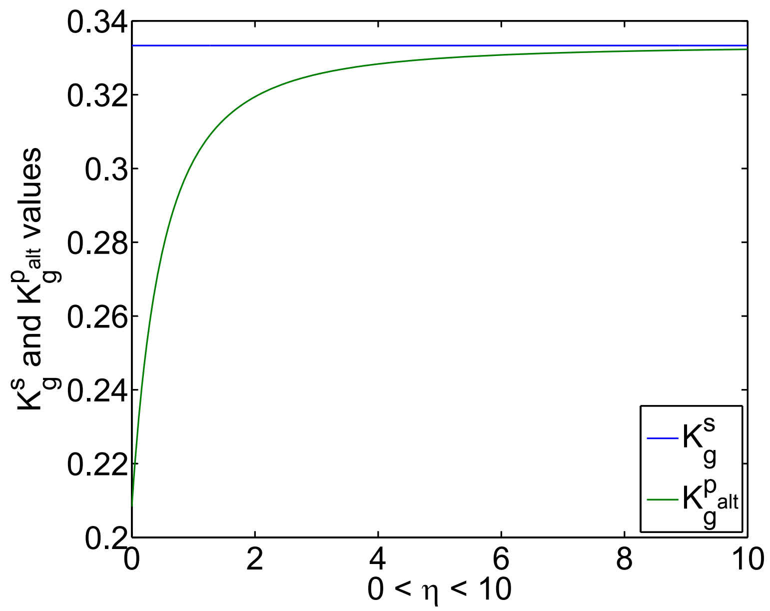


Figure 4.1: Numerical example.

for the Elites. With the incentive pay, the altruistic policy-maker's optimization problem becomes

$$\max_{(x_{MN},x_m)} \quad U(x_{MN},x_m) = u\left(x_{MN} + \beta\frac{[\Omega - \theta_M x_{MN} - \theta_m x_m]}{1+\mu\theta_M\beta}\right) + \gamma\frac{[\Omega - \theta_M x_{MN} - \theta_m x_m]}{(1+\lambda)(1+\mu\theta_M\beta)}$$
$$+\eta\left[\theta_M\mu u\left(x_{MN} + \beta\frac{[\Omega - \theta_M x_{MN} - \theta_m x_m]}{(1+\mu\theta_M\beta)}\right) + \theta_M(1-\mu)u(x_{MN}) + \theta_m u(x_m) + \frac{\gamma[\Omega - \theta_M x_{MN} - \theta_m x_m]}{(1+\lambda)(1+\mu\theta_M\beta)}\right],$$
$$\text{subject to} \quad (x_{MN},x_m) \in C'.$$

Due to the Inada Conditions, it is not optimal for the altruistic policy-maker to set $x_M^{p_{alt}} = x_m^{p_{alt}} = 0$.

To find the interior solution, we examine the first-order conditions. We obtain

$$\begin{aligned} u'\left(x_{ME}^{p_{alt}}\right) &= u'\left(x_{MN}^{p_{alt}} + \beta(1+\lambda)K_g^{p_{alt}}\right) \\ &= \frac{1}{(1-\beta\theta_M(1-\mu))(1+\eta\mu\theta_M)}\left[\frac{\gamma\theta_M(1+\eta)}{1+\lambda} - \eta\theta_M(1-\mu)(1+\beta\mu\theta_M)u'\left(x_{MN}^{p_{alt}}\right)\right], \end{aligned} \tag{4.8}$$

$$u'\left(x_m^{p_{alt}}\right) = \frac{1}{1+\beta\mu\theta_M}\left[\frac{\gamma(1+\eta)}{(1+\lambda)\eta} + \frac{\beta[1+\eta\mu\theta_M]}{\eta}u'\left(x_{ME}^{p_{alt}}\right)\right]. \tag{4.9}$$

Moreover, for the public good we obtain

$$K_g^{p_{alt}} = \frac{\left[\Omega - \theta_M x_{ME}^{p_{alt}} - \theta_m x_m^{p_{alt}}\right]}{(1+\lambda)\left[1 - \beta\theta_M(1-\mu)\right]}. \tag{4.10}$$

For the next analysis, we substitute for $u'\left(x_{ME}^{p_{alt}}\right)$ from Equation (4.8) into Equation (4.9) and we obtain

$$u'\left(x_m^{p_{alt}}\right) = \frac{1}{1-\beta\theta_M(1-\mu)}\left[\underbrace{\left(\frac{\gamma}{1+\lambda}\right)\frac{1+\eta}{\eta}}_{u'\left(x_m^{p_{alt}}(\beta=0)\right)} - \beta\theta_M(1-\mu)u'\left(x_{MN}^{p_{alt}}\right)\right]. \tag{4.11}$$

Furthermore, we substitute for $u'\left(x_{MN}^{p_{alt}}\right)$ from Equation (4.11) intro Equation (4.8) and we obtain

$$\begin{aligned} u'\left(x_{ME}^{p_{alt}}\right) &= u'\left(x_{MN}^{p_{alt}} + \beta(1+\lambda)K_g^{p_{alt}}\right) \\ &= \frac{\eta}{\beta(1+\eta\theta_M\mu)}\left[(1+\mu\theta_M\beta)\,u'\left(x_m^{p_{alt}}\right) - \underbrace{\left(\frac{\gamma}{1+\lambda}\right)\frac{1+\eta}{\eta}}_{u'\left(x_m^{p_{alt}}(\beta=0)\right)}\right]. \end{aligned} \tag{4.12}$$

We let $x_m^{p_{alt}}(\beta)$, $x_{MN}^{p_{alt}}(\beta)$, $x_{ME}^{p_{alt}}(\beta)$, and $K_g^{p_{alt}}(\beta)$ be the solution to the system of Equations (4.10), (4.11) and (4.12). The analytical solution of the policy-maker's maximization problem is more complex in such a setting. Due to altruism, the marginal utility of private-good consumption for each group of citizens depends on the marginal utility of private-good consumption of the other groups.

From Equations (4.11) and (4.12), it is not clear whether the private-good consumption of the Elites is increasing or decreasing with β. However, we can see from Equation (4.12) that given $u'(\cdot) > 0$ and requiring the term in bracket to be strictly positive, we have

$$\frac{u'\left(x_m^{p_{alt}}(0)\right)}{1+\mu\theta_M\beta} < u'\left(x_m^{p_{alt}}(\beta)\right). \tag{4.13}$$

Thus, for $\mu = 0$ and given $u''(\cdot) < 0$, we expect the private-good consumption of the minority endowment group to be a decreasing function of β, $x_m^{p_{alt}}(0) > x_m^{p_{alt}}(\beta)$. Moreover, substituting for $u'\left(x_m^{p_{alt}}(\beta)\right)$ from Equation (4.11) into Equation (4.12), we obtain

$$u'\left(x_{ME}^{p_{alt}}(\beta)\right) = \frac{\eta\theta_M}{(1+\eta\theta_M\mu)(1-\beta\theta_M(1-\mu))}\left[u'\left(x_m^{p_{alt}}(0)\right) - (1-\mu)(1+\mu\theta_M\beta)u'\left(x_{MN}^{p_{alt}}(\beta)\right)\right].$$

with β increasing	
$x_m^{p_{alt}}(\beta)$	decreases
$x_{MN}^{p_{alt}}(\beta)$	decreases
$x_{ME}^{p_{alt}}(\beta)$	decreases first and then increases
$K_g^{p_{alt}}(\beta)$	increases first and then decreases
$W(\beta)$	increases first and then decreases

Table 4.1: Summary of Numerical Results for Incentivized Altruistic Policy-maker.

Given $u'(\cdot) > 0$, we require the term in the brackets to be strictly positive and we obtain

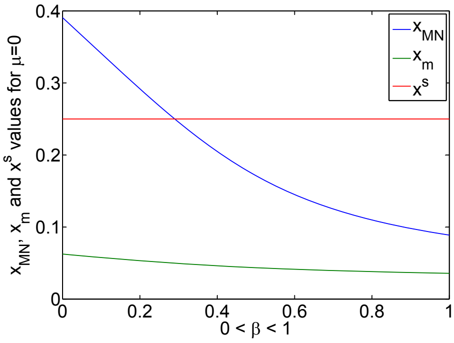
$$u'\left(x_{MN}^{p_{alt}}(\beta)\right) < \frac{u'\left(x_m^{p_{alt}}(0)\right)}{(1+\mu\theta_M\beta)(1-\mu)}. \tag{4.14}$$

We note that if $(1-\mu)(1+\mu\theta_M\beta) \geq 1$ then $x_{MN}^{p_{alt}}(\beta) \geq x_m^{p_{alt}}(0)$ for all β values. Combining Inequality (4.14) with Inequality (4.13), we obtain

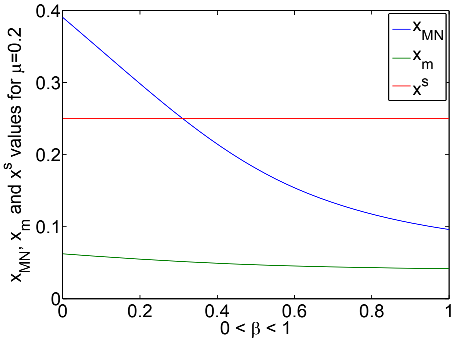
$$(1-\mu)\, u'\left(x_{MN}^{p_{alt}}(\beta)\right) < u'\left(x_m^{p_{alt}}(\beta)\right). \tag{4.15}$$

Thus, for $\mu = 0$, we expect the minority endowment group to consume less private good than the majority-endowment-group Non-elites, i.e. $x_m^{p_{alt}}(\beta) < x_{MN}^{p_{alt}}(\beta)$.
Although we cannot derive analytic expressions for the policy choices, we solve them numerically to provide evidence how the policy choice changes with the incentive pay.
We compute $x_m^{p_{alt}}(\beta)$, $x_{MN}^{p_{alt}}(\beta)$, $x_{ME}^{p_{alt}}(\beta)$, and $K_g^{p_{alt}}(\beta)$ and analyze the resulting level of social welfare. To ascertain that the policy-maker's optimal policy is always interior, we fix the upper bound of β to $\beta = 1$.
First, to keep it simple, we focus on the case with $\eta = 1$. Later, we compare our results for higher and lower η values. Furthermore, throughout this section, we assume there is no friction in the taxation process, $\lambda = 0$. Additionally, for the sake of simplicity we assume that $\gamma = 1$, and that the majority endowment group has a share of $\theta_M = \frac{2}{3}$ in the society, and that the utility function has the form $u(x) = x^{\frac{1}{2}}$.
For a qualitative summary of our main results, see Table (4.1). Next, we analyze the results in details.

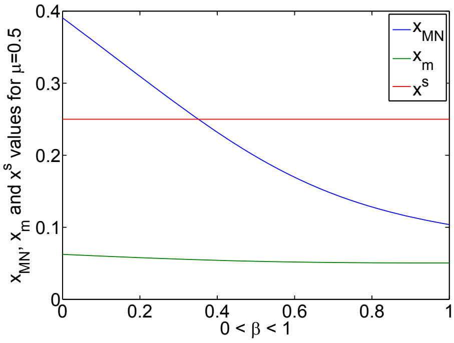
Figure (4.2) shows the private-good consumption of the majority-endowment-group Non-elites and the minority endowment group citizens as a function of β. Figures (4.2a)–(4.2d) depict the result for the Elites sizes of $\mu = 0$, $\mu = 0.2$, $\mu = 0.5$ and $\mu = 0.7$,



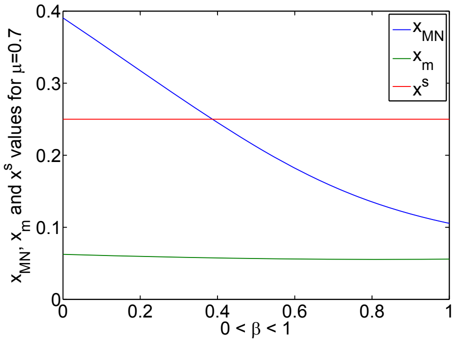
(a) Private good consumption of minority endowment group and Non-elites and the social optimal level at $\mu = 0$.



(b) Private good consumption of minority endowment group and Non-elites and the social optimal level at $\mu = 0.2$.



(c) Private good consumption of minority endowment group and Non-elites and the social optimal level at $\mu = 0.5$.



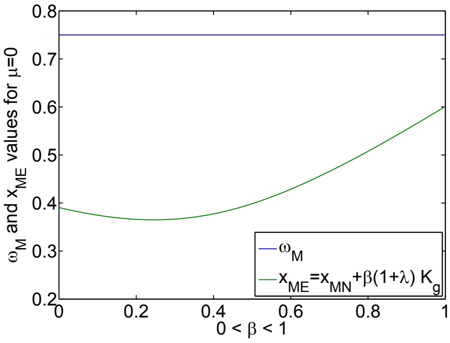
(d) Private good consumption of minority endowment group and Non-elites and the social optimal level at $\mu = 0.7$.

Figure 4.2: This is a graph of private-good consumption of the minority endowment group and the Non-elites and the socially optimal private-good consumption for parameter values $\lambda = 0$, $\gamma = 1$, $\eta = 1$, $\theta_M = 2/3$, $\omega_M = 0.75$, and $\omega_m = 0.25$.

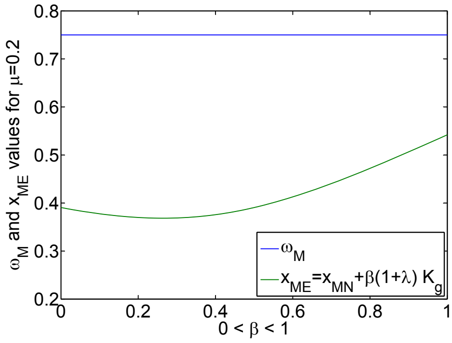
respectively. The red line in these figures depicts the optimal level of private-good consumption according to the social planner.

We can see that for all μ values, $x_m^{p_{alt}}(\beta) < x_{MN}^{p_{alt}}(\beta)$, which confirms our findings in Inequality (4.15) for $\mu = 0$. Moreover, the private-good consumption of majority-endowment-group Non-elites and the one of the minority endowment group are both decreasing in β for all μ values. This is in line with Inequality (4.13) at $\mu = 0$, which requires the private-good consumption of the minority endowment group to be a decreasing function of β. The numerical results in Figure (4.2) show that the introduction of incentive pay allows higher tax revenues.

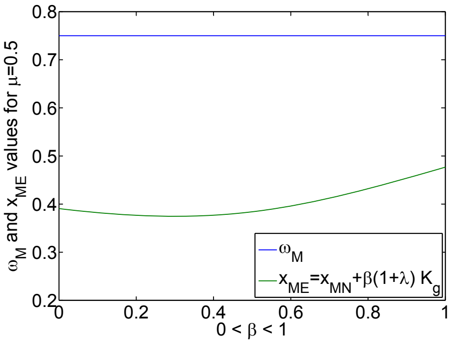
Next we study the majority-endowment-group Elites' private-good consumption. Figures (4.3a)–(4.3d) show $x_{ME}^{p_{alt}}$ for Elites sizes of $\mu = 0$, $\mu = 0.2$, $\mu = 0.5$ and $\mu = 0.7$, respectively. We see that $x_{ME}^{p_{alt}}$ is decreasing with β at first, until it reaches a minimum, and then increases with larger β values. Given the majority-endowment-group Elites do not



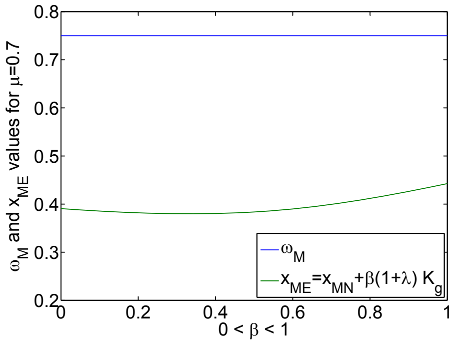
(a) Private good consumption of the Elites and the initial private good endowment of majority endowment group at $\mu = 0$.



(b) Private good consumption of the Elites and the initial private good endowment of majority endowment group at $\mu = 0.2$.



(c) Private good consumption of the Elites and the initial private good endowment of majority endowment group at $\mu = 0.5$.



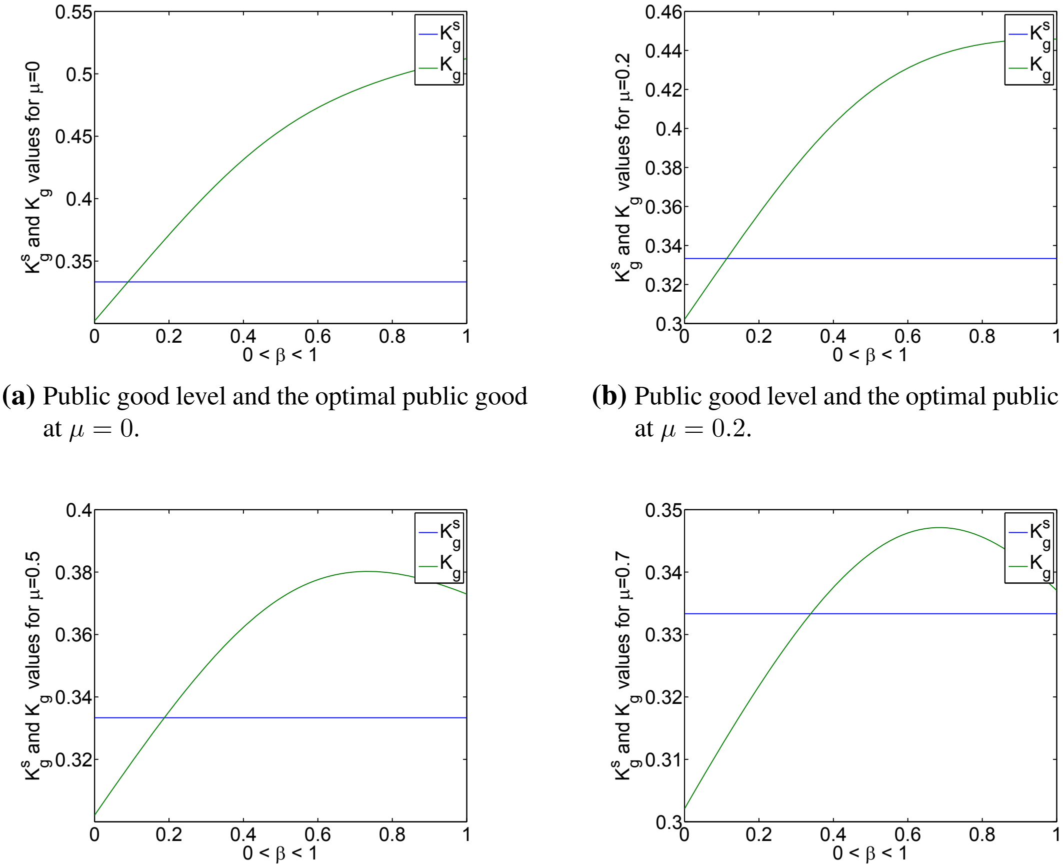
(d) Private good consumption of the Elites and the initial private good endowment of majority endowment group at $\mu = 0.7$.

Figure 4.3: This is a graph of private-good consumption of the Elites and the initial private good endowment of majority endowment group for parameter values $\lambda = 0$, $\gamma = 1$, $\eta = 1$, $\theta_M = 2/3$, $\omega_M = 0.75$, and $\omega_m = 0.25$.

contribute to the costs of the incentive pay, the fact that their private-good consumption is decreasing with the reward for small β values shows that the majority-endowment-group Elites contribute to financing the additional public-good provision. However, for larger β values, the reward the majority-endowment-group Elites receive is much larger in so far that overall, their private-good consumption is increasing with β.

The blue line in Figure (4.3) depicts the initial level of majority-endowment-group citizens' private good endowment. We note that we have set the range of β in such a way that we ensure there is no subsidization and that $x_{ME}^{p_{alt}} < \omega_M$ holds.

We now consider the effect of incentive pay on the public-good spending. Figures (4.4a)–(4.4d) show $K_g^{p_{alt}}$ for Elites sizes of $\mu = 0$, $\mu = 0.2$, $\mu = 0.5$, and $\mu = 0.7$, respectively. At $\mu = 0$, the public-good spending is increasing in β. For larger μ values, we see that the public-good spending is increasing at first and reaches the socially optimal level of public-good spending K_g^s. Yet, it continues to increase with β until it reaches a maximum



(a) Public good level and the optimal public good at $\mu = 0$.

(b) Public good level and the optimal public good at $\mu = 0.2$.

(c) Public good level and the optimal public good at $\mu = 0.5$.

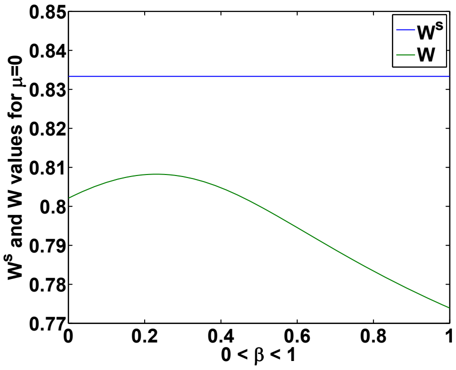
(d) Public good level and the optimal public good at $\mu = 0.7$.

Figure 4.4: This is a graph of the public-good level in the society and the optimal public good for $\lambda = 0$, $\gamma = 1$, $\eta = 1$, $\theta_M = 2/3$, $\omega_M = 0.75$, and $\omega_m = 0.25$.

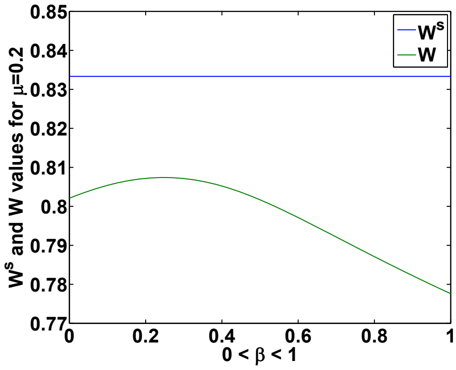
value. Then it decreases with β. We note that, under the altruistic policy-maker, if the reward parameter is not small enough, the public good can be over-provided. Moreover, for large β and μ values, the cost of the incentive pay is so high that the additional tax revenue is mainly used to finance the reward and does not increase public-good spending.

So far, we can see that the effect of incentive pay on the altruistic policy-maker's policy choice in this example differs from its effect on the non-altruistic policy-maker's choice. In contrast to the results from Lemma 3.1, under the altruistic policy-maker, (i) the minority endowment group's private-good consumption is decreasing with β, (ii) the majority-endowment-group Elites' private-good consumption is a decreasing function of β only for small β values and finally, (iii) public-good spending is increasing in β only for small μ or β values.

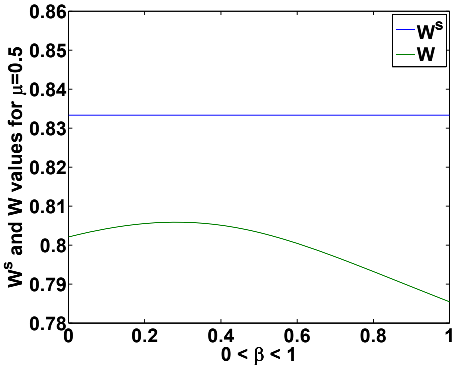
Finally, we analyze the robustness of our results in Theorem 3.1 for the altruistic policy-



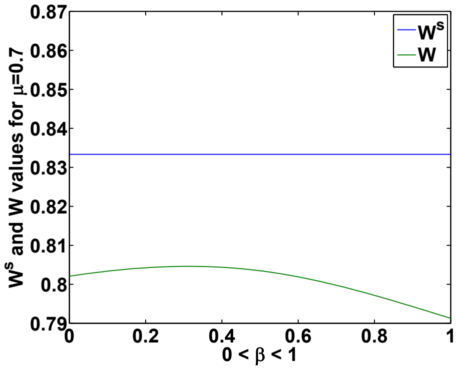
(a) Welfare in the society and the optimal welfare at $\mu = 0$.



(b) Welfare in the society and the optimal welfare at $\mu = 0.2$.



(c) Welfare in the society and the optimal welfare at $\mu = 0.5$.

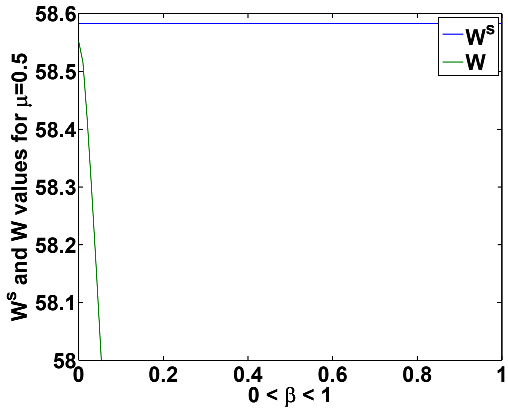


(d) Welfare in the society and the optimal welfare at $\mu = 0.7$.

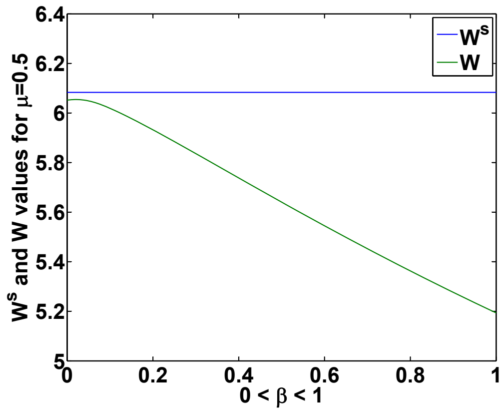
Figure 4.5: This is a graph of welfare in the society and the optimal welfare for $\lambda = 0$, $\gamma = 1$, $\eta = 1$, $\alpha = 1/2$, $\theta_M = 2/3$, $\omega_M = 0.75$, and $\omega_m = 0.25$.

maker in Figure (4.5). Figures (4.5a)-(4.5d) depict the welfare under the altruistic policy-maker for Elites sizes of $\mu = 0$, $\mu = 0.2$, $\mu = 0.5$, and $\mu = 0.7$, respectively. First, for small μ and β values, the incentive pay is welfare improving (Figures (4.5a)–(4.5b)). This is in line with Theorem 3.1. Moreover, with μ increasing, the results in Figures (4.5c)–(4.5d) suggest that it might not be worthwhile in terms of welfare to implement incentive pay. This is in line with our results in Proposition 3.4, where we have shown that for the extreme case with an Elite size of $\mu = 1$, the incentive contract has no impact. The blue line in Figure (4.5) depicts social welfare under the utilitarian social planner.

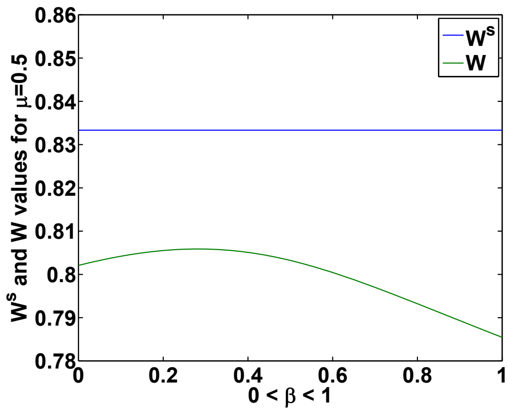
We emphasize that the robustness of the results in Theorem 3.1 in our numerical analysis greatly depends on the total initial private good endowment. To show the impact of initial endowments on the effect of incentive pay in improving welfare, we show the welfare for three different levels of initial endowment. We set μ to $\mu = 0.5$. Figure (4.6) is numerical evidence how the incentive pay is more welfare improving in societies with lower initial



(a) Welfare for $\omega_M = 75$, and $\omega_m = 25$.



(b) Welfare for $\omega_M = 7.5$, and $\omega_m = 2.5$.



(c) Welfare for $\omega_M = 0.75$, and $\omega_m = 0.25$.

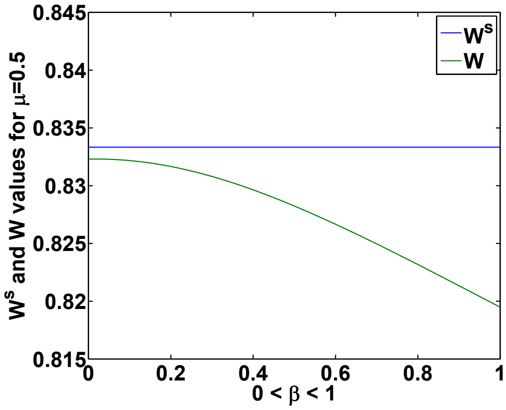
Figure 4.6: This is a graph of welfare for $\lambda = 0$,$\gamma = 1$, $\eta = 1$, $\theta_M = 2/3$, and $\mu = 0.5$.

endowments.
To better understand the numerical results in Figure (4.6), we note that the optimal private-good consumption (Equation (3.4)) does not depend on the initial endowment levels. In the absence of incentive pay, the altruistic policy-maker's choice of private-good consumption (Equations (4.2) and (4.3)) does not depend on the initial endowment levels either. As a result, a society with high initial endowments can afford higher public-good spending (as depicted in Figures (4.6a)–(4.6c) at $\beta = 0$). In such a society, introducing incentive pay can reduce welfare, despite the fact that it increases the—already high—public-good spending. At a high level of public-good spending the contract is very costly and yields a high private-good consumption for the majority-endowment-group Elites at the expense of the other citizens' private-good consumption. The positive impact of higher public-good spending can be dominated by the negative impact the high cost of the contract has on welfare. In Figure (4.6), we see how the positive effect of incentive pay on welfare diminishes in societies with very high initial endowments.
Finally, we show that the more altruistic the policy-maker, the less substantial the role of incentive pay in improving welfare. We provide numerical examples for $\eta = 0.1$, $\eta = 1$ and $\eta = 10$ in Figures (4.7a), (4.7b) and (4.7c), respectively. In all these examples $\mu = 0.5$, $\omega_M = 0.75$ and $\omega_m = 0.25$.

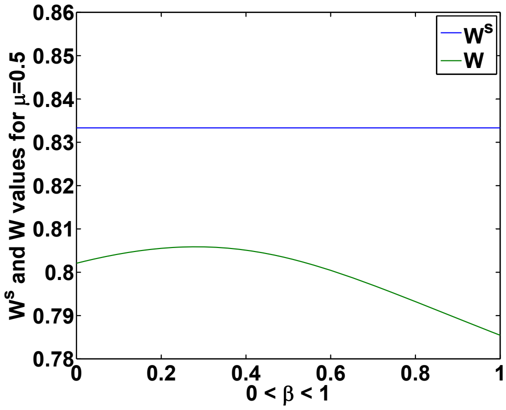
4.3 More Endowment Groups

In this section, we consider the same society, but we generalize the model to n endowment groups—instead of two endowment groups, as in the baseline model. The citizens of all endowment groups have the same preferences over consumption but they have heterogeneous initial endowments of the private good. We define the set of endowment groups' indices by $I = \{1, \cdots, n\}$ and each endowment group is indexed by $i \in I$.
With probability $0 < \theta_i < 1$, a citizen is endowed with ω_i units, for $i \in I$, where $\sum_{i \in I} \theta_i = 1$. The parameters θ_i and ω_i for $i \in I$ are exogenously-given and common knowledge.
As before, a share μ of the citizens of each endowment group consists of *Elite* citizens. Members of the Elite are those citizens who participate in policy-making. In each endowment group, a citizen can be one of the Elite citizens with probability $0 \leq \mu \leq 1$. The probability is the same across all endowment groups.
To ensure that citizens favor taxation for the provision of the public good to taxation for redistribution, we assume the initial endowments satisfy

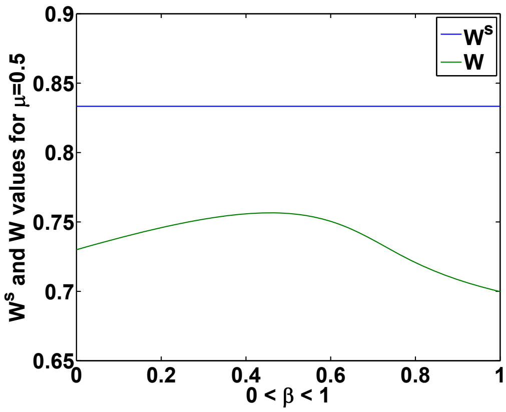
$$u'(\omega_i) \leq \frac{\gamma}{1 + \lambda}, \quad \forall i \in I. \tag{4.16}$$



(a) Welfare for $\eta = 10$.



(b) Welfare for $\eta = 1$.



(c) Welfare for $\eta = 0.1$.

Figure 4.7: This is a graph of welfare for $\lambda = 0$, $\gamma = 1$, $\theta_M = 2/3$, $\mu = 0.5$, $\omega_M = 0.75$ and $\omega_m = 0.25$.

The policy-maker selects private consumption levels for all endowment groups denoted by $(x_1, \cdots, x_n)$. For any given λ, a choice of $(x_1, \cdots, x_n)$ implies the choice of public-good spending, K_g:

$$K_g = \left(\frac{1}{1+\lambda}\right)\left[\Omega - \sum_{i \in I} \theta_i x_i\right], \tag{4.17}$$

where the society's total private-good endowment is denoted by $\Omega = \sum_{i \in I} \theta_i \omega_i$ and the tax burden of each endowment group (for all $i \in I$) is implicitly given by $\theta_i(\omega_i - x_i)$.

A *policy choice* consists of a consumption plan for members of all endowment groups $(x_1, \cdots, x_n)$. A policy is *feasible*, therefore, if

$$0 \leq x_i \leq \omega_i \ , \quad \text{for all } i \in I. \tag{4.18}$$

The utilitarian social planner's optimization problem is given by

$$\max_{(x_1, \cdots, x_n)} \quad W(x_1, \cdots, x_n) = \sum_{j \in I} \theta_j \left[u(x_j) + \left(\frac{\gamma}{1+\lambda}\right)\left[\Omega - \sum_{i \in I} \theta_i x_i\right]\right]$$

$$\text{subject to} \quad 0 \leq x_i \leq \omega_i, \ \forall i \in I.$$

Due to the Inada Conditions, the choice of $x_i = 0$ is not socially optimal. Moreover, by Inequality (4.16), $x_i = \omega_i$ cannot be socially optimal. To find the optimal solution, we examine the first-order conditions with respect to x_i and we obtain

$$u'(x_i^s) = \left(\frac{\gamma}{1+\lambda}\right), \quad \forall i \in I. \tag{4.19}$$

The optimal level of private-good consumption optimally chosen for all endowment groups by the social planner is denoted by x^s. Due to the strict concavity of $u(\cdot)$, there exists a unique value of x^s that satisfies Equation (4.19).

The socially optimal level of public-good spending is given by

$$K_g^s = \frac{1}{1+\lambda}\left[\Omega - x^s\right].$$

We assume there is a majority endowment group—indexed by $M \in I$—and the policy-maker belongs to this group. The share of citizens belonging to the policy-maker's endowment group is denoted by $\theta_M \geq \frac{1}{2}$. The policy-maker maximizes his utility function by choosing a policy from the feasible set. The policy-maker's optimization problem is therefore,

$$\max_{(x_1,\cdots,x_n)} \quad U(x_1,\cdots,x_n) = u(x_M) + \left(\frac{\gamma}{1+\lambda}\right)\left[\Omega - \sum_{i\in I}\theta_i x_i\right]$$
$$\text{subject to} \quad 0 \leq x_i \leq \omega_i,\ \forall i \in I.$$

We denote the solution to the above problem by x^p_M and x^p_{-M}, respectively. The superscript in x^p_M and x^p_{-M} denotes the policy-maker's choice. In other words, x^p_M refers to the private-good consumption of the policy-maker's (majority) endowment group and x^p_{-M} refers to the private-good consumption of all the endowment groups except for the policy-maker's.

The policy-maker does not derive utility from the private good consumption of those citizens who do not belong to the majority endowment group. Therefore, the policy-maker taxes them as much as possible, $x^p_{-M} = 0$.

Due to the Inada Conditions, it is not optimal for the policy-maker to set $x^p_M = 0$. To ensure that every citizen contributes to the public-good provision, we assume

$$u'(\omega_M) < \frac{\gamma\theta_M}{1+\lambda}. \tag{4.20}$$

Inequality (4.20) eliminates the case where $x^p_M = \omega_M$ is the optimal choice for the policy-maker. Thus, the optimal choice of x^p_M is interior. Examining the first-order condition with respect to x^p_M, we obtain

$$u'(x^p_M) = \left(\frac{\gamma\theta_M}{1+\lambda}\right). \tag{4.21}$$

Public-good spending is given by

$$K^p_g = \frac{1}{1+\lambda}\left[\Omega - \theta_M x^p_M\right].$$

The public-good provision depends on the society's total private-good consumption, as stated in Inequality (3.10). Since $x^p_{-M} = 0$, the total private-good consumption in the society is given by $\theta_M x^p_M$. Since the results from Proposition 3.1 solely depend on the majority endowment group's private-good consumption, and given Equation (4.21) is equal to x^p_M from Equation (3.7), we can generalize Proposition 3.1 to n endowment groups. Given our assumption that $u'''(\cdot) \geq 0$ and by Proposition 3.1, we can see that the public good is under-provided in a society with n endowment groups.

We introduce incentive contracts to alleviate the under-provision of the public good. The incentive contract aims at maximizing the social welfare, taking the exploitation of the minority endowment group as given. The contract here has all the properties described in

Section 3.5.

The cost of the contract enters the budget constraint of the society. For any given consumption plan, the implied public-good spending is inferred from the budget constraint

$$K_g + \mu\theta_M\beta K_g = \frac{1}{1+\lambda}\left[\Omega - \sum_{i\in I}\theta_i x_i\right].$$

With the incentive pay, the majority-endowment-group Elites receive a reward of $\beta(1+\lambda)K_g^p$ —in private-good consumption—which the majority-endowment-group Non-elites do not receive. We distinguish between the consumption levels within the policy-maker's endowment group: it is x_{MN} for the Non-elites and

$$x_{ME} = x_{MN} + \beta(1+\lambda)K_g, \tag{4.22}$$

for the Elites. With the incentive pay, the policy-maker's optimization problem is therefore

$$\max_{(x_1,\cdots,x_n)} \quad U(x_1,\cdots,x_{MN},\cdots,x_n) = u\left(x_{MN} + \beta\frac{\left[\Omega - \sum_{i\in I\setminus M, i=MN}\theta_i x_i\right]}{1+\mu\theta_M\beta}\right) + \gamma\frac{\left[\Omega - \sum_{i\in I\setminus M, i=MN}\theta_i x_i\right]}{(1+\lambda)(1+\mu\theta_M\beta)}.$$

subject to $0 \le x_i \le \omega_i,\ \forall i \in I\setminus M, \quad 0 \le x_{MN} \le \omega_M.$

We immediately see that $x_{-M}^p = 0$.

Within the majority endowment group, we denote the policy-maker's choice of private-good consumption for the Elites and the Non-elites by x_{ME}^p and x_{MN}^p, respectively. The basic argument in Section 3.5, why the choice of $x_{MN}^p = \omega_M$ is not optimal for the policy-maker, is valid here as well. The choice of $x_{MN}^p = 0$ might be optimal if β is high enough. To derive the interior solution, we examine the first-order condition for the incentivized policy-maker with respect to x_{MN}^p. We obtain

$$u'(x_{ME}^p) = u'\left(x_{MN}^p + \beta\left(1+\lambda\right)K_g^p\right) = \left(\frac{\gamma\theta_M}{(1+\lambda)\left[1-\beta\theta_M\left(1-\mu\right)\right]}\right). \tag{4.23}$$

And the public-good spending is given by

$$K_g^p = \frac{\left[\Omega - \theta_M x_{ME}^p\right]}{(1+\lambda)\left[1-\beta\theta_M\left(1-\mu\right)\right]}. \tag{4.24}$$

We note that majority endowment group's private-good consumption and the public-good provision (Equations (4.23) and (4.24)) are the same as the results for two endowment group (Equations (3.29) and (3.30)). Given the results in Proposition 3.3, Lemma 3.1 and Theorem 3.1 are derived from Equations (3.29) and (3.30) they do not depend on the number of endowment groups in this economy. Thus, given $\theta_M \ge \frac{1}{2}$, our results hold true

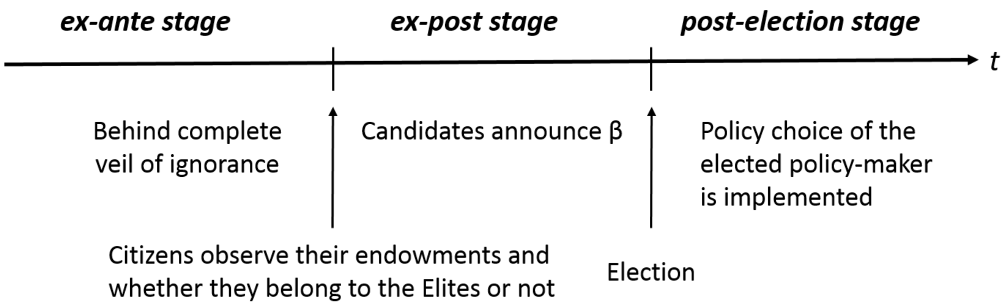


Figure 4.8: Timeline of the information revelation and the events.

also for n endowment groups.

4.4 Stability to Majority Voting

In this section we investigate a possible way to determine β, namely during campaigns and under political competition.

So far, we have assumed the majority endowment group is in power in our framework. Furthermore, in Section 3.7, we have shown that setting the incentive parameter at the interim stage in the constitution is implementable and improves welfare. We now relax the assumptions that the majority endowment group is in power and that the incentive contract is set in the constitution at the interim stage.

We consider the same society described in Section 3.3 but we assume the policy-maker is chosen by a simple majority vote. There are two candidates $k = \{M, m\}$ running for election, one from the majority-endowment-group Elites and the other from the minority-endowment-group Elites.[2] We refer to the candidate from the majority group by C_M and to the candidate from the minority group by C_m.

We assume the election takes place ex-post, i.e. after citizens have observed their initial endowment and after knowing whether they belong to the Elites or not. The timeline is given in Figure 4.8.

The political game has three stages:

Stage 1: Campaign with β announcements (ex-post stage)

Stage 2: Election

Stage 3: Policy choice is realized (post-election stage)

[2] The candidates do not belong to the same endowment group. This is due to the fact that if both candidates belonged to the same endowment group, there would not be any competition between them. If one is elected, the other candidate, being an Elite citizen of the same group, would be participating in government, together with the elected candidate.

In the first stage, we allow the candidates to compete in one policy dimension by announcing β before the election. The β each candidate proposes is denoted by β_k for $k = \{M, m\}$. Each candidate announces $\beta_k \in [0, \bar{\beta}_k]$, where $\bar{\beta}_k$ uniquely satisfies

$$u'\left(\frac{\bar{\beta}_k \Omega}{1 + \mu\theta_k\bar{\beta}_k}\right) = \frac{\gamma\theta_k}{(1+\lambda)\left[1 - \bar{\beta}_k\theta_k(1-\mu)\right]}. \tag{4.25}$$

In the second stage, the election takes place. Voters observe β_M and β_m and infer all other policy dimensions from that, given all exogenous parameters are common knowledge. We assume the voters vote sincerely. Given the reward parameters announced by the candidates, the voters maximize their post-election utility to choose whom they are going to vote for.
The winner of the election has to win the majority of the voters.[3] As a tie-breaking rule, if both candidates obtain exactly half of the votes, the candidate that belongs to the majority endowment group wins the election.
In the third stage, the society consists of three main groups: (i) the Elites of the elected policy-maker's endowment group, (ii) the Non-elites of the elected policy-maker's endowment group and (iii) those citizens who do not belong to the elected policy-maker's endowment group. We refer to the first and second group by *Group–p* Elites and *Group–p* Non-elites. The share of *Group–p* citizens in the society is denoted by θ_p and their initial endowment by ω_p. We note that the *Group–p* can be the majority or the minority endowment group, depending on the election results. We refer to the third group as the "outsiders" or the *Group–q*. The outsiders are the majority (or the minority) endowment group if the elected policy-maker is from the minority (or the majority) endowment group. We do not distinguish between the Elites and the Non-elites of the *Group–q*, as they have identical private good and public good consumptions as well as initial endowments. The share of the outsiders is denoted by θ_q and their initial endowment by ω_q.
In this stage, the elected policy-maker chooses the private-good consumption of all three groups given β_p, the reward parameter he has announced in the first stage, by maximizing his own utility. The private-good consumption of the *Group–p* Elites, the *Group–p* Non-elites and the outsiders is denoted by x^p_{pE}, x^p_{pN} and x^p_q, respectively. The elected policy-maker fully taxes the outsiders, since he does not derive utility from their private-good consumption. Thus,

$$x^p_q = 0. \tag{4.26}$$

[3] Given the candidates do not belong to the same endowment group, if we had required the candidates to win the majority of their own endowment groups, the candidates would not have to compete with each other.

As discussed at length in Section 3.5, for any given $\beta_p \in [0, \bar{\beta}_p]$, the optimal solution for the elected policy-maker is the interior solution. By examining the first-order conditions with respect to x^p_{pN}, we obtain

$$u'\left(x^p_{pN} + \beta_p (1+\lambda) K^p_g\right) = \frac{\gamma\theta_p}{(1+\lambda)\left[1-\beta_p\theta_p(1-\mu)\right]}. \tag{4.27}$$

The *Group–p* Elites' private-good consumption is given by

$$x^p_{pE} = x^p_{pN} + \beta_p(1+\lambda)K^p_g(\beta). \tag{4.28}$$

Public-good spending is implied by

$$K^p_g = \frac{\Omega - \theta_p x^p_{pE}}{(1+\lambda)(1-\beta_p\theta_p(1-\mu))}. \tag{4.29}$$

We take $x^p_{pN}(\beta)$, $x^p_{pE}(\beta)$ and $K^p_g(\beta)$ as the solution to the system of Equations (4.27)–(4.29). Next, we study the post-election preferences of the three main groups. The post-election utility of the *Group–p* Elites, the *Group–p* Non-elites and the outsiders is given by Equations (4.30)–(4.32), respectively.

$$U_{pE}(\beta) = u\left(x^p_{pE}(\beta)\right) + \gamma K^p_g(\beta), \tag{4.30}$$

$$U_{pN}(\beta) = u\left(x^p_{pN}(\beta)\right) + \gamma K^p_g(\beta), \tag{4.31}$$

$$U_q(\beta) = u\left(x^p_q\right) + \gamma K^p_g(\beta). \tag{4.32}$$

Next, we establish how each group's post-election utility changes with β.

Lemma 4.2
The following holds post-election:

(i) $\frac{\partial U_q}{\partial \beta} > 0$,

(ii) $\frac{\partial U_{pE}}{\partial \beta} > 0$,

(iii) $\frac{\partial U_{pN}}{\partial \beta} < 0$.

Proof of Lemma 4.2 is given in Appendix B.
The next proposition follows immediately from Lemma 4.2.

Proposition 4.2
Let $k, k' \in \{M, m\}$ and $k \neq k'$. Suppose C_k proposes β_k and $C_{k'}$ proposes $\beta_{k'}$.

(i) The Elite citizens from C_k's endowment group have $U_{pE}(\beta_k) \geq U_q(\beta_{k'})\ \forall \beta_k, \beta_{k'}$.

(ii) Let Ω be large enough. The Non-elite citizens from C_k's endowment group have $U_{pN}(\beta_k) > U_q(\beta_{k'}) \, \forall \beta_k, \beta_{k'} \iff \theta_k > \theta_{k'}$.

The proof of Proposition 4.2 is given in Appendix B.
From Statement (i) in Proposition 4.2, we infer that each candidate always has the support of the Elites from his own endowment group, independent of the β he proposes. In other words, at the post-election stage, any Elite citizen is better off belonging to the majority-endowment-group Elites than to the outsiders.
However, Statement (ii) in Proposition 4.2, establishes that for large Ω only the majority-endowment-group Non-elites are in favor of the candidate from their own endowment group. Even if the reward is too costly for the majority-endowment-group Non-elites, they prefer to vote for the candidate from their own endowment group because the public-good provision is higher if the majority-endowment-group is elected, given Ω is large enough. Thus, C_M also has the support from the majority-endowment-group Non-elites.
In the next corollary, we show that there exists a campaign strategy with $\beta > 0$ under which the majority-endowment-group candidate wins the election.

Corollary 4.1
Let Ω be large enough. In equilibrium, $\beta_m \in [0, \bar{\beta}_m]$ is proposed by C_m, and C_M wins the election by proposing $\bar{\beta}_M$.

Proof of Corollary 4.1 is given in Appendix B.
It is useful to provide some intuition about the results above. Both candidates are Elite citizens. Thus, by Lemma 4.2, Statement (ii), conditional on being elected, they prefer to propose the highest β possible. For C_M, who has the support of the majority-endowment-group Elites and the majority-endowment-group Non-elites, there is no profitable deviation from proposing $\bar{\beta}_M$. Moreover, C_m is indifferent between proposing $\beta_m \in [0, \bar{\beta}_m]$. Thus, he proposes the highest possible reward parameter, $\bar{\beta}_m$.

4.5 Conclusion

In this chapter, we relaxed two of our assumptions from the benchmark model, first by assuming that the policy-maker is not purely self-interested and has altruistic concerns for social welfare and second by allowing more than two endowment groups in the society. For an altruistic policy-maker, the optimization problem becomes more complex. We explored the results by solving for the problem numerically. We illustrated that the welfare-improving results of incentive pay extend to the altruistic policy-maker as well. In a society governed by an altruistic policy-maker, we showed that the welfare improving effects of the incentive pay are more pronounced in societies with lower wealth.

Moreover, we established that our results can be generalized to a society with more than two endowment groups, where one endowment group has the majority. Finally, we investigated what happens when candidates compete for election by announcing their desired incentive contract. We showed that in a rich society, there exists an equilibrium where the candidate from the majority endowment group wins the election by announcing the highest possible incentive pay for which, to be financed, he has to fully tax both endowment groups.

5 Citizen Participation in Democratic Decision-making

5.1 Introduction

As discussed in the previous chapters, in a political principal-agent problem, reelection incentives are insufficient to keep office-holders accountable. As a result, the office-holders' policy choices often do not comply with public interests. Often, citizens perceive a mismatch between what is in their own best interest and what is practiced by politicians—a problem that has become more acute with globalization. This generates unresolved issues such as the failure to integrate immigrants—an issue aggregated over decades—, and rising public budget deficits. This situation is worsened by ambiguous decision-making procedures or lobbying, which render decision-making complex and intransparent. The widening gap between the public and its elected office-holders endangers democratic values: An office-holder who makes choices perceived as illegitimate because he is systematically manipulated or is serving personal interests, for instance,—instead of serving the citizens he claims to represent—stimulates cynicism, public distrust in office-holders and growing frustration over the inefficiency of democracy.

Thus, additional incentive tools and mechanisms could help bridge the gap between the public interest and the office-holders' actions in democracy. In Chapter 3, we examined the potential of tax protection and "incentive pay" to mitigate two main inefficiencies in representative democracy, namely exploitation of minorities from their private-good consumption and under-provision of public goods.

Tax protection and incentive pay are unable to achieve a first-best solution according to Chapter 3 of this thesis. In Chapter 3, we showed that tax protection alone protects minority from their private-good consumption being exploited but generates public-good under-provision. Additionally, we show that incentive pay, although effective in increasing the level of public-good provision, is ineffective with respect to the expropriation of the minority. Moreover, the effectiveness of incentive pay is limited to tasks with measur-

able output.[1] Furthermore, the combination of incentive pay and tax protection, although welfare improving, does not yield the socially optimal solution to the problem.
In the present chapter, we explore some problems that cannot be easily overcome by re-election incentives, tax protection or incentive pay in democracy: We study citizen participation and its ability to enhance the legitimacy of policies and the trust that a—possibly doubting—public grants its office-holders. Moreover, we illustrate the interplay between incentive pay and citizen participation by exploring a particular form of citizen participation, "Co-voting".

5.2 Democratic Values

"*Entscheidend ist, was hinten rauskommt*", the dictum of Helmut Kohl, then German Chancellor, on "politics of delivery" used to suffice to foster successful and socially beneficial policy decisions. In the politics of delivery, citizens were clients, assumed to be solely interested in final outcomes. But politics of delivery are not sufficient anymore, as the rigid concept of nation-state is not valid any longer and economic growth is merely one concern of citizens among others. Successful governance is not limited to efficiency or delivery. There are other values and societal goals that democracy is expected to achieve. Three important democratic values seem to be constantly at risk: (i) legitimacy, (ii) equality and (iii) effective governance. In this section, we first discuss these values. Later, we explore the growing interest in new decision-making procedures, which entail more power, i.e. involvement and participation of citizens.

Legitimacy: According to Fung (2006), "*A public policy is legitimate when citizens have a good reason to support or obey it.*" The public must be either convinced that the office-holder delivers what he (or his party) promised during the election campaign or that there has been good reasons for the office-holder to deviate from these promises. Then, the office-holder's policy is perceived as legitimate. However, there seems to be a gap between what office-holders do and what the public wants in today's democracies. Strictly speaking, such a gap would yield illegitimate policy-making.
Besides this desirable consistency, some issues that arise between election rounds have not been addressed by conventional parties' ideologies, and they might generate controversy. In such cases, the office-holder might be unable to assess the public's opinion and is thus likely to make choices perceived as illegitimate.

[1] There is growing distrust in the private sector about managerial incentive pay, see examples in Gersbach and Schmutzler (2014). This makes it more challenging to convince the public that incentive pay for politicians can generate positive outcomes.

Equality: In a society, some groups cannot influence policy-making, and their interests are neglected in decision-making. For them, equality is not served. For a democracy to promote equality, no group should be neglected because of its being too weak, poorly organized or because other groups have special relationships with politicians—especially if such a "neglected" group is the one most affected by that policy.[2]

Effective Governance: Occasionally, the choice of a just and legitimate policy might be evident but for some reason, the decision that would put it into effect is not taken or implemented. Lack of skills, information, or resources might prevent the just and legitimate policies from being realized by the government. Cohen and Sabel (1997) explain this issue—in a game-theoretic sense—as a coordination problem. They argue that such problems arise when both parties i.e. citizens and politicians, benefit from the decision but fail to reach an agreement about the decision and therefore abandon the solution.

Tax protection and incentive pay are both imperfect tools to help realize the three key values of democracy, legitimacy, equality, and effective governance. Although tax protection promotes equality of private-good consumption among citizens, it fails to foster equality in other aspects such as education or health care. Incentive pay proves a useful tool to align the office-holder's interest with the public interest. However, it cannot influence inclusiveness, legitimacy or effectiveness of democratic decision-making procedures.

We thus examine *citizen participation* as a tool to foster core values in democracy. Citizen participation is important because in a society where (a) institutional constraints prevent fundamental political reforms and (b) it is hard for the citizens to see who could be held accountable for which decision and (c) various global and national levels of political influence are at play, the gap between what citizens want and what politicians do is widening. But what *is* citizen participation?

Citizens' participation in their own government is fundamental to democracy. It is a redistribution of power from those who have the power to decide in economic and political processes to those who do not. In a first step, we will define citizen participation as a share of decision power that is held by citizens on particular decisions. This has nothing to do with election power, from which it is separated. But who is to be considered a "citizen"—only voters or all individuals affected by the decision? And how much decision power should this "participation" entail? It could vary greatly, as well as the form in which this participation takes place. What is <u>not</u> meant by citizen participation are those forms of participation that are outside the organization scope of the government, such as strikes or riots.

The benefits of citizen participation depend on the form of implementation. For example,

[2] See for example Stigler (1971) and Wilson (1984).

participation could consist of facilitated information exchange from the so-called powerless to the power-holders. It could also be the more accurate aggregation of citizens' preferences, which, in turn, would guide politicians with regard to their choice of campaign promises. Alternatively, participation could be to involve and mobilize citizens in setting goals and determining both the program and the plan for achieving their own goals. If implemented properly, such forms of participation could reduce the gap between the politicians and the public by involving and empowering citizens in political decision-making. Moreover, by involving citizens in policy-making procedures, citizen participation could increase the politician's accountability. As a result, citizen participation could also reduce the risk of severe polarization, distrust and cynicism in the society.

5.3 Citizen Participation: General Considerations

The notion of citizen participation has been largely addressed in the context of the tyranny of the majority on the minority.[3] In this chapter, we address citizen participation in the more general context of "tyranny" of the office-holders on citizens during their term in office. As such, citizen participation is a typical tool for representative democracies.

The practice of citizen participation can take various forms. In its weakest form, citizen participation can be reduced to informing the powerless about their own rights—a task that would be performed by the powerful. In its strongest form, citizen participation shifts real decision-making power towards citizens, similar to what is practiced in direct democracies such as Switzerland and California. The most currently-practiced forms of citizen participation are polls that collect the citizens' opinions about various issues and policies, as well as referenda. We will discuss all possible forms of citizen participation in this section.

There is not much enthusiasm for citizen participation in contemporary democracies. Citizen participation, and in particular its pervasive variant applied in direct democracies, entails much skepticism and criticism: Direct democracy is costly and time-consuming and can be problematic in emergencies, as its decision-making processes can be dangerously slow.

Vospernik (2014), for instance, emphasizes the controversial nature of referenda. Referenda can be misused by authoritarian rulers for oppressing minorities on one hand and by the opposition for increasing political pressure on government on the other hand, to the extent that referenda used to be considered a threat to liberal government.

Other existing forms of citizen participation are not perceived as more beneficial by citizens either, since they often yield no tangible change. Citizens are often frustrated with

[3] See for example Buchanan and Tullock (1962).

the practice of citizen participation, due to lack of clear objectives, transparent procedures, and honest communication. They have often been disappointed with the small impact they have and by the instrumentalization of their participation by the politicians.
Politicians, similar to the citizens, are not very keen on implementing citizen participation either. They associate citizen participation with opposition, since it was mainly used by the opposition for the main part of the twentieth century (see Hierlemann et al. (2014)). Nevertheless, politicians might be willing to adopt limited forms of citizen participations for two main purposes: (1) as a poll to aggregate public opinion and (2) as a legitimating tool for their decisions.
Citizen participation has been experimented with in the past, in particular in Athens. In Athenian democracy, for instance, many important governing tasks were not performed by the elected officials but by randomly-selected individuals chosen among a group of volunteers.[4] Later, in the 20th century, for example, citizen participation was one of the main demands of the German student movement in 1968.[5] Moreover, citizen participation was formally introduced and implemented in the 1960s and 1970s in Germany and the US in specialized areas such as urban planning.[6]
Arnstein (1969) is the most cited piece of literature on participatory democracy. She describes three examples of federal social programs in the US to illustrate the various levels of participation that exist, and assesses their effectiveness. In the context of power and powerlessness, she illustrates the participation levels with a ladder, the "ladder of citizen participation". This ladder divides modes of participation into three main categories and each of the three into more subcategories. In total, eight rungs of participation are established by Arnstein.
The first category is called *Non-participation*. *Non-participation* consists of two rungs: *Manipulation* and *Therapy*. *Non-participation* methods are not designed to empower the citizens but to allow the power-holders to educate and cure the citizens instead of granting them genuine citizen participation. In this category the power-holders assume the powerlessness of the citizens is due to their lack of education or due to a mental illness that prevents them from being able to participate in the decision-making process.
The second category is *Tokenism*. The name refers to a superficial or symbolic effort to do something for the sake of appearance. This category consists of three rungs: *Informing*, *Consultation* and *Placation*. The first rung, *Informing*, ensures that citizens are informed about the perspectives and plans of power-holders and their own rights and responsibilities. The second rung, *Consultation*, is a form of citizen participation where the power-holders consult the citizens about the issues and hear their opinions. *Placation*,

[4] For more on Athenian democracy, see Stockton (1990) and Manin (1997).
[5] The movement is also known as 68er-Bewegung.
[6] See Hierlemann et al. (2014).

on the other hand, is a form of citizen participation where the citizens are encouraged to give advice to the power-holders. In this category, citizens can hear the perspective of the power-holders and they are being heard. However, this does not ensure that the citizens' opinions are taken into account when the power-holders make the decisions: it merely makes them feel they are being taken seriously. This results from the fact that the right to make the decision always remains with the power-holders.

In this category, no distribution of power takes place. This can lead to the powerless citizens' frustration. In any form of *Tokenism*, citizens finally receive a verdict from higher levels in the power hierarchy. The only way to oppose this verdict is by filing a lawsuit. However, the result of such a lawsuit is, again, a verdict from above.

The third category is *Citizen Power* which consists of three rungs: *Partnership*, *Delegated Power* and *Citizen Control*. The *Partnership* rung corresponds to a situation where the citizens can negotiate with the power-holders. Arnstein (1969) explains how in Cambridge, Massachusetts, the citizens' frustration with ineffective forms of citizen participation led to citizens negotiating—and attaining—a share of power from the city hall.

The second rung in this category, *Delegated Power*, ensures that citizens have more bargaining power, or more seats than the traditional power-holders. Arnstein (1969) accounts for various examples where the dominant decision-making role was given to the citizens in the Model Cities Program in Ohio, New Haven, and Oakland.[7]

Finally, *Citizen Control*, delegates all the managerial power to the citizens, which corresponds to direct democracy in all but the name and it is limited to specific decisions. *Citizen Control* has generated a lot of criticism. For instance, one of the arguments against it is that such a high level of citizen participation invites separatism, i.e. the separation of a group of citizens from a larger body based on race, ethnicity, or religion. Altshuler (1970), for instance, discusses the risk of racial separatism in large American cities where community control is given to black citizens. Additionally, it is also more costly and less efficient, compared to weaker forms of participation or to no participation at all. Furthermore, it does not promote professionalism for decision-makers or a merit-based system. Arnstein (1969) discusses examples of *Citizen Control* which were funded by federal agencies in the US for research and demonstration purposes in Cleveland, Southwest Alabama and Harlem, New York.

Arnstein's classification of citizen participation, while proven useful, has been criticized by scholars because it was perceived as too enthusiastic about citizen participation and being defective because it lacked institutional design considerations of citizen participation. Arnstein implicitly assumes that higher rungs in the ladder of citizen participation are generally more desirable—an assumption that was not shared by everyone on every issue.

[7] See Goldfield (2006) for more information on the Model Cities Program.

However, not everybody would agree with this assumption. For instance, Heiner Geissler, Germany's former Federal Minister for Youth, although an advocate of citizen participation, considers taxation laws, foreign policy and deployment of military to be cases where *Tokenism* is more appropriate than *Citizen Power* (See Hierlemann et al. (2014)).
Additionally, since the publication of Arnstein's work in 1969, many advances and experiments have been made in the area of citizen participation. The empirical and theoretical research performed since Arnstein's research explores the importance of institutional design in citizen participation. For this purpose, newer research addressed three main questions:

- Who can participate and how are the participants selected?
- How do participants communicate with each other and reach a decision?
- How does the participants' decision affect and influence the policy and actions of government?

In the next section, we introduce a tool which answers the above questions about citizen participation.

5.4 Citizen Participation: Democracy Cube

In an attempt to understand the forms of citizen participation that are useful for each context and circumstance, Fung (2006) maps any possible mechanism of participation in a three-dimensional space, a *democracy cube*. The democracy cube is a tool for studying governance choices. Figure 5.1 illustrates the democracy cube. It spans along *participant selection* in one direction, *communication and decision* in the other, and *authority and power* in the third direction. Let us discuss each dimension, based on the work of Fung (2006), which explores the consequences of participation in governance, given the position of the participation mechanism in the democracy cube.

Participant Selection Whether or not citizen participation can improve governance greatly depends on *who* participates. Are the participants experts or do they represent the different bodies of society? Do they participate voluntarily or are they selected based on certain agreed-upon rules? Are the participants accountable to the society? Are they being paid to participate and how much?
The most inclusive form of participation, in which everybody in the society participates, is called *Public Participation*. This form of participation, although inclusive and representative, can be very costly and inefficient. If one does not want to implement *Public*

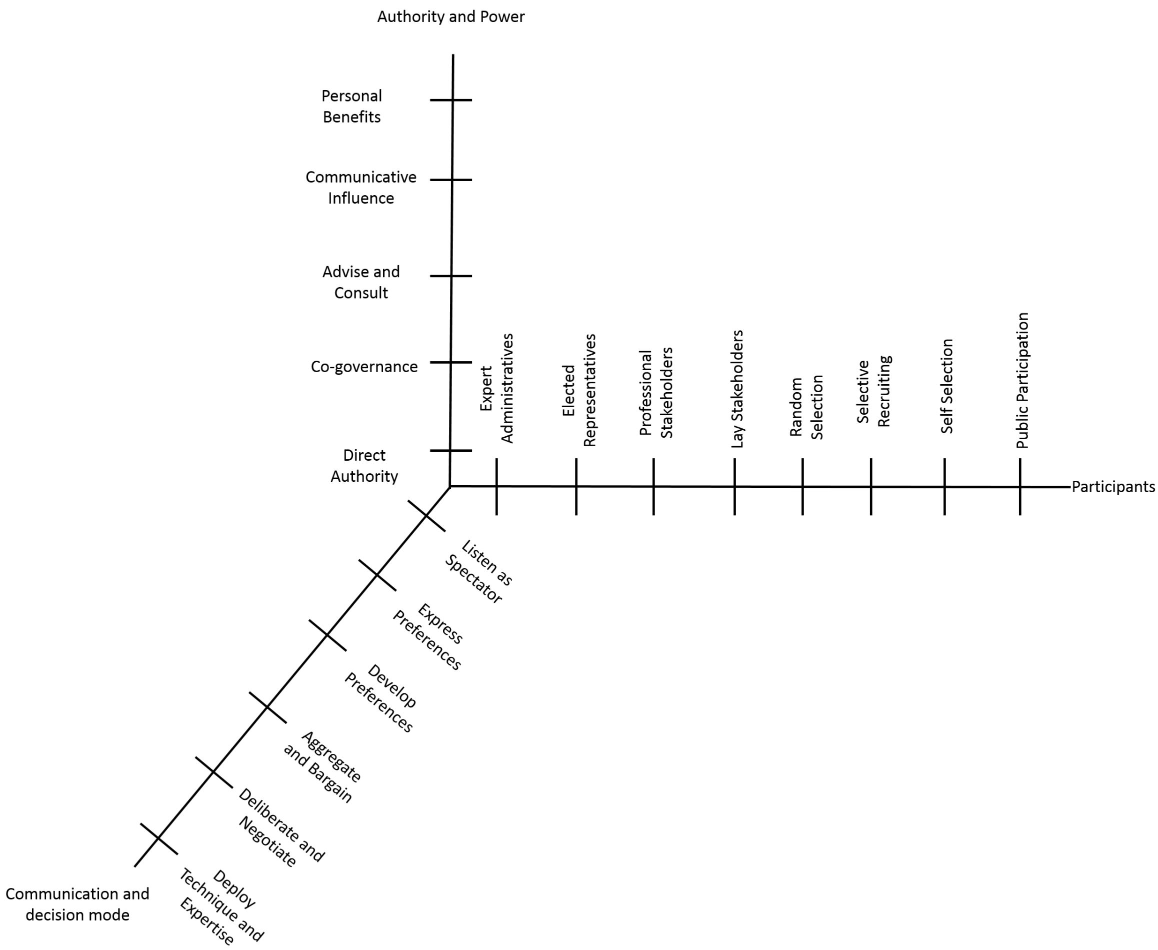


Figure 5.1: Democracy Cube (own illustration, based on Fung (2006)).

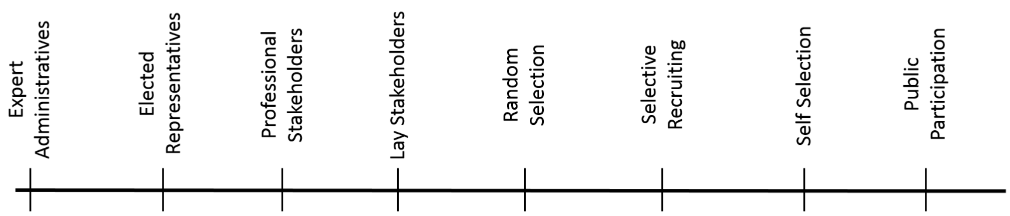


Figure 5.2: Participant Selection Methods (own illustration, based on Fung (2006)).

Participation, then one needs a method to limit participation and select the participants. Many participation mechanisms allow voluntary participation. We call this *Self Selection*. Fiorina (1999) shows that in self-selecting mechanisms, more educated and wealthier citizens are more likely to participate. Thus, the participants might not be representative of the society.

An alternative selection method would be *Selective Recruiting*. Organizing events among the low-income individuals or other under-represented groups could promote higher participation of those citizens that would usually not participate in politics.

Fishkin (1995) and Smith and Wales (2000) argue that for certain applications of citizen participation such as jury duty or polls, it is important to have participants that are good representatives of the society. In such cases *Random Selection* would be the suitable selection method.

Sometimes there are citizens with deep concerns about certain public issues who are willing to participate in the time-consuming participation mechanisms, even without being paid. A selection method enabling such citizens to participate is called *Lay Stakeholders*. *Lay Stakeholders* are good representatives of these citizens who are concerned, but do not have the time to participate. School councils or neighborhood planning associations are examples where lay stakeholders would be the suitable selection method. If the participants are paid to professionally represent the concerned citizens, then we call this method of participation *Professional Stakeholders*.

If these professional representatives are elected, then we have an *Elected Representative* selection method. They are elected to represent the public interests, and themselves select the *Expert Administratives* who are technical experts, selected to serve in bureaucratic positions. Similar to *Professional Stakeholders*, both the *Elected Representatives* and the members of *Expert Administratives* are being paid.

The eight selection methods are depicted in Figure 5.2, sorted from the most inclusive method on the right to the most exclusive method on the left.

Communication and Decision How participants interact and how they reach a decision is another important dimension of citizen participation. We have six modes of communication and decision-making, each with a different level of intensity. The term

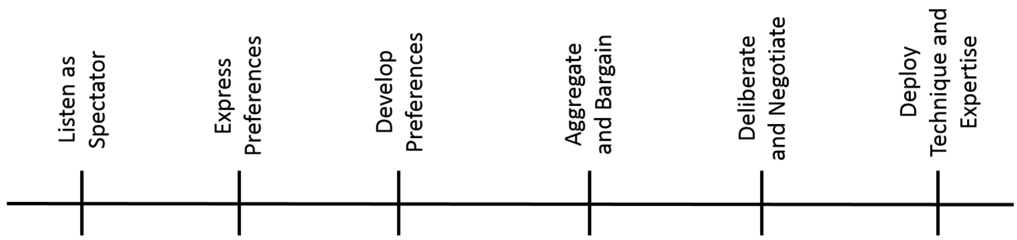


Figure 5.3: Modes of Communication and Decision-Making (own illustration, based on Fung (2006)).

"intensity" comprises the amount of time investment, knowledge and commitment expected from the participants.

The first mode is to *Participate as Spectators* and be **informed** about the issues and policy choices at hand in the society. This is the least intense mode of communication and decision-making.

In the second mode, some participants are allowed to **communicate their preferences** or the preferences of the community they represent, in addition to the information they receive about the issues at hand.

The third mode, in addition to the possibilities offered in the first two modes, allows the participants to gain more insight and **develop their preferences** through **discussions with other participants**.

The first three modes are mainly informative and the participants are not making any decisions themselves. These modes closely resemble the first two categories in the ladder of citizen participation: *Non-participation* and *Tokenism*.

The fourth mode is *Aggregation and Bargaining*. In this mode, participants collectively decide what they want through discussions and bargaining, and aggregate their own preferences.

The fifth mode is *Deliberation and Negotiation*. In this mode, participants try to reach a consensus over their preferences through deliberation and negotiation with other participants.

The sixth mode is to *Deploy Technique and Expertise*. If a decision cannot be reached through aggregation or deliberation among the participants, then professionals and experts in the field of the issue at hand can help reach a decision about what the participants want, by using their specific training and techniques.

Figure 5.3 depicts the range of communication and decision-making modes, ranging from the most intense (on the right) to the least intense (on the left).

Authority and Power It is important to implement the right extent of authority and power for citizen participation. Neither is pure direct democracy the answer, nor the mere information exchange between the powerless and the powerful: the range in between these extreme forms presents a number of challenges that need to be appraised carefully before starting a citizen participation process.

Many commonly-practiced participation mechanisms such as Citizen Advisory Committees do not grant the participants real decision-making power (see Courter (2010)). In such cases, participants mainly attend the events to obtain "personal benefit" from information, to voice their opinion in the hope of being taken into account, as well as to satisfy their curiosity or their sense of obligation towards their community. They do not expect to have any direct influence on the policy choices. If the participation mechanism is of the *Personal Benefit* type, then the communication mode implemented is likely to be one of the three informative modes—*Listen as Spectator*, *Express Preferences* and *Develop Preferences*.

Alternatively, there are participatory mechanisms that have quite a real impact on policy choices, through *Communicative Influences*. They raise awareness among the participants, mobilize public opinion and thus indirectly influence the power-holders' decision. Another way to influence policy choices is by giving *Advice and Consultation*. In this case, the public officials hold all the decision-making power, but they consult the citizens or their representatives. Such a consultative process comprises some extent of commitment on the power-holders' part: if the power-holders do not take the participants' opinions into account at all, their credibility would be endangered, and no citizen would be willing to participate a second time.

There are participatory mechanisms that give more power and authority to the participants, namely *Co-governance* and *Direct Authority*. In *Co-governance*, the citizens are awarded a share of the officials' power. In the US, for example, many public schools are jointly administrated by the school's principal and a local council consisting of parents and community members.

In *Direct Authority*, the citizens have sole decision-making power. In some US cities, neighborhood councils have complete control over the budget and planning of local projects (see Berry et al. (2002)).

Figure 5.4 depicts the range of impact of participation and the authority and impact of the participants, ranging from participants having the least authority (on the left) to having the most authority (on the right).

5.5 Citizen Participation: Internet

In this section we discuss how Internet has assisted the public in holding the politicians accountable. Social media have changed citizen participation in a revolutionary way in

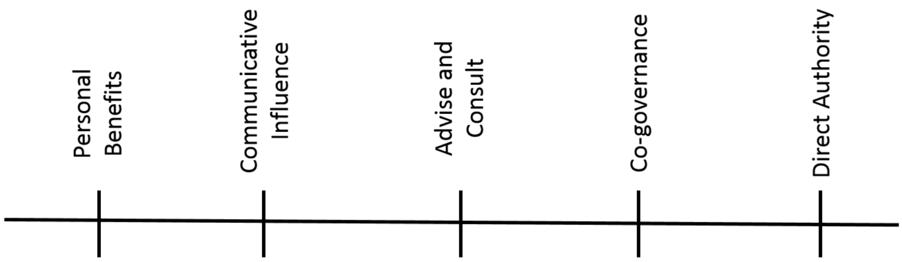


Figure 5.4: Extent of Authority and Power (own illustration, based on Fung (2006)).

the past few year, by facilitating communication between politicians and the public. It allows office-holders to maintain transparency in informing the public about policies or just to advocate issues to be taken up. And web communication also flows from the public to the politicians. The public can aggregate and voice its opinion, often in an organized way, and thus has direct, influential access to power-holders.

Social media are changing the structure of social networks and their functions, and in particular, the time and place parameters. Social interactions do not necessarily take place in public places as they used to do, but in the social media sphere, which renders them ubiquitous and time-independent. This generates new opportunities and entirely new phenomena. On the one hand, it can greatly facilitate mobilizing citizens. The Arab Spring, for instance, which started in 2010, took place because of the great organizational power that Facebook and other major social media platforms provided to the protesters in Egypt and other Arab countries.

On the other hand, social media can lead to the so-called "bubbles" in social communities. Bubbles, in social media contexts, refer to how social interactions, especially political ones, take place in partial environments that are disconnected from one another. The influence of social media bubbles on the Brexit referendum and the formation of polarized groups in the UK is currently studied by Del Vicario et al. (2017).

Additionally, social media are a highly effective tool for raising awareness. It provides citizens a digital platform to organize and strengthen their voice, so that they have to be heard by politicians. The effect of the so-called "hashtag trends" on Internet has become as effective as street protests—and is much simpler to obtain. They turn the politicians' attention towards those issues that strongly matter to the public, in a rapid and effective way. However, similar to the bubble phenomena, such campaigns can be partial or blown up out of proportion, as not all levels of society—with regard to age, education or income—use them as a tool.

More specialized tools such as webpages provide platforms for politicians to design their desired citizen participation mechanisms. For instance, CitizenLab Blog[8], with its slogan:

[8] https://www.citizenlab.co/blog/ retrieved on 02.08.2017

"*Fresh perspectives on the future of our democracies*", provides user-friendly softwares and insightful data analytics to politicians who want to encourage citizen participation—also an expert way to influence politicians indirectly, from the programmers' and providers' perspective.

5.6 Citizen Participation: Co-voting

Let us now examine an example of citizen participation described by Gersbach (2017). In this paper, Gersbach proposes a mechanism called "Co-voting". Co-voting is a participation mechanism that locates in the democracy cube at *Random Selection* in the participant-selection dimension, *Aggregate and Bargain* in the communication-and-decision dimension and at *Co-governance* in the authority-and-power dimension.
The mechanism proposed is designed to improve political decision-making in representative democracies when between election rounds, office-holders face issues that are either unheard of and have not been addressed in political campaigns, or have strong effects on citizens' lives. Recent safety issues (such as the Bataclan incident in Paris in 2015) and the refugee crisis in Europe, the decision whether to enter a military conflict or to bail out other countries in monetary unions are typical examples of such decisions.
The Co-voting mechanism consists of two voting rounds. A randomly-selected subset of voters—called the "Vote-holders"—votes on the issue at hand. So does the parliament. The two votes are weighted according to a predefined key, and the final decision is implemented accordingly.
Gersbach shows that Co-voting is an improvement both for the citizens and the office-holders. He argues that when it comes to important policy decisions, citizens want to be informed and need to be influential. Thus, they embrace Co-voting because it offers them a limited form of decision-making power. Additionally, Gersbach shows that Co-voting assists governments in making crucial decisions by maintaining the trust and the support of the citizens and preventing deselection in the next elections. Gersbach argues that for the citizens to share the responsibility and consequences of a decision with their government, Co-voting—although more complex—is a better, more powerful mechanism than simpler tools like polls or referenda. In a poll, citizens know that their opinion might not influence the government's decision. Thus, they might not reflect sufficiently on the consequences of their choice before expressing their opinion. A referendum, on the other hand, is as costly to conduct as a fully-fledged voting by the entire citizenry, and might yield results that are too costly for the government to implement—as in the Brexit referendum. Thus, governments are reluctant to organize referenda.
To avoid both the costs of conducting a referendum and the complications of direct

democracy, the Co-voting process limits voting to a randomly-selected representative sample of citizens. These Vote-holders are solely chosen to vote on one specific issue. The parliament votes on this same issue separately. Thus, only the Vote-holders' voting generates extra costs. The results of the two votes determines the final decision, based on a given weighting factor.

The two votes can take place either simultaneously or sequentially. A simultaneous voting guarantees that the Vote-holders' and the parliament's decision are not influenced by each other. Sequential voting, where the Vote-holders vote first and the parliament later, would also have a benefit, as it would provide politicians with the citizens' aggregated opinion. Then, the parliament could even choose not to vote and abide with the Vote-holders' decision.

In Co-voting, random selection and the group size of participating Vote-holders is important for an accurate and well-accepted representation of the citizenry. An algorithm would be necessary to make the random selection of Vote-holders for each decision. Moreover, to reduce the costs of voting and to encourage participation, electronic voting could be very useful. Electronic voting—if it fulfills the highest possible security standards—would ensure that the Vote-holders can remain anonymous, if desired, and neither lobbying nor vote-selling could take place.

Gersbach (2017) shows that Co-voting improves the citizens' representation in the decision-making process. By shifting some decision-making power from the office-holders to the citizens, Co-voting increases the citizens' interest and sense of responsibility about the decision. Even if they have not been selected as Vote-holders, they will still feel represented in the decision-making process. Herewith, Co-voting improves the transparency and legitimacy of the decision and it helps to make government accountable.

5.7 Citizen Participation and Incentive Contract

We have addressed the existing problems in democracies and we have proposed two main classes of corrective measures, incentive contracts and citizen participation. We would like to discuss the synergy between citizen participation and incentive contracts. One important question which arises is whether citizen participation is a substitute or a complement to incentive contracts. Do we need incentive contracts less if we have more citizen participation? Does citizen participation help to design better incentive contracts? Do strong incentive contracts discourage office-holders from citizen participation and from sharing power with the citizens?

These questions are important and have various aspects that should be addressed carefully. The answers would highly depend on the form of citizen participation implemented

and the particular design of the incentive contract.
Let us focus on the interplay between incentive pay and Co-voting, as a concrete case.

5.8 Co-voting and Incentive Pay

The important issue is what effect Co-voting can have on the implementation mechanism for incentive pay and whether through Co-voting, we could design better incentive contracts.
The discussion of this section develops on the model constructed in Chapter 3. In particular we use the following parameters of the model: μ, $\bar{\beta}$, and β^*. We recall from Chapter 3 that μ denotes the size of the Elites in the society and in each endowment group. Moreover, $\bar{\beta}$ is given by Equation (3.31) and denotes the highest possible incentive parameter for which the policy-maker's optimization problem has a unique interior solution. Moreover, β^* denotes the socially optimal level of incentive parameter as defined in Theorem 3.1.
As discussed in Section 3.7, the interim stage is the stage when the citizens know whether they belong to the Elites or not, but the Elites do not know yet to which endowment group they belong. In Proposition 3.5, we established that at the interim stage, the Elites' expected utility is strictly increasing in β. Thus, they would prefer the incentive contract with $\bar{\beta}$ to be implemented. Moreover, we showed that for the Non-elites, incentive pay is interim desirable if the cost of the contract is small enough, i.e. if β and μ are small enough. For the discussion in this section, for a small enough μ, we denote the incentive parameter which is small enough to make the Non-elites interim better off by $\tilde{\beta}$. In Corollary 3.1, we further established that the optimal incentive contract with β^* makes the Non-elites interim worse off. From our analysis in Chapter 3, we recall that $\tilde{\beta} < \beta^* < \bar{\beta}$.
We assume the decision about the implementation of incentive pay takes place at the interim stage. Conventionally, the implementation mechanism can be either a referendum or a parliamentary vote. Let us first consider a referendum. Given our results in Section 3.7, at the interim stage, a referendum about the implementation of incentive pay has two possible outcomes:

- If $\mu \in \left[\frac{1}{2}, 1\right)$, the incentive contract with $\bar{\beta}$ will be implemented.
- If $\mu \in \left[0, \frac{1}{2}\right)$, the incentive contract with $\tilde{\beta}$ will be implemented,

Alternatively, the implementation of the incentive pay can be decided by a parliamentary vote. We recall the definition of the Elites: those citizens involved in policy-making. We assume for the considerations in this section that the members of the parliament are all Elites. Thus, given our results in Proposition 3.5 and Corollary 3.1, a parliamentary vote at the interim stage, would yield the implementation of the incentive contract with $\bar{\beta}$, independent of the value of μ. This is in contrast to the outcome of the referendum, which varies depending on the size of μ.

We observe that neither parliamentary vote nor a referendum can lead to the socially optimal contract with β^*. Moreover, all the issues and criticism described in this chapter about the referendum as a citizen participation form, and about parliamentary decisionswithout citizen participation persist. More precisely, a referendum is a costly and time-consuming decision-making process. Since it can have extreme outcomes, power-holders are reluctant to implement it. No citizen participation to the parliamentary decision-making process, on the other hand, can damage public trust in office-holders and can lead the public to perceive the decision as illegitimate and therefore, refuse to share the consequences of the decision.

We now illustrate how a variant of Co-voting can implement a better incentive pay compared to those implemented by either referendum or parliamentary vote.

Suppose the two voting rounds in Co-voting take place sequentially and at the interim stage. First, the Vote-holders are randomly selected. Then, they vote at the interim stage and announce their desired β for the incentive contract. Since they are randomly chosen, they have the same distribution of Elites and Non-elites in the society at large. Thus, there is a share μ of Elite citizens among the Vote-holders and a complementary share of Non-elites. Depending on the size of μ, the Vote-holders' aggregate choice of β at the interim stage is

- $\bar{\beta}$, if $\mu \in \left[\frac{1}{2}, 1\right)$, or
- $\tilde{\beta}$, if $\mu \in \left[0, \frac{1}{2}\right)$.

Next, given the parliament's dominant choice of incentive parameter is $\bar{\beta}$, the parliament chooses to vote or not.

If $\mu \in \left[\frac{1}{2}, 1\right)$, the Vote-holders' aggregate choice is $\bar{\beta}$. In this case, the parliament will not vote, to save the costs of the second voting round. Compared to a parliamentary vote, Co-voting, in this case, does not improve social welfare but it increases the legitimacy of the choice of $\bar{\beta}$ among citizens. Compared to a referendum, if $\mu \in \left[\frac{1}{2}, 1\right)$, Co-voting is the less costly and less time-consuming mechanism, and yields the same result.

On the other hand, if $\mu \in \left[0, \frac{1}{2}\right)$, the Vote-holders' aggregate choice is $\tilde{\beta}$. In this case, the parliament votes and the Vote-holders' decision is added to the parliament's choice, $\bar{\beta}$, according to a pre-determined weighting factor, denoted by τ ($0 < \tau < 1$). We refer to the value of β determined according to Co-voting by $\hat{\beta}$. Hence, we have

$$\hat{\beta}(\tau) = \tau\tilde{\beta} + (1 - \tau)\bar{\beta}.$$

First, since $\tilde{\beta} < \bar{\beta}$ we observe that $\hat{\beta}(\tau)$ is a strictly decreasing function of τ. Moreover, since $\tilde{\beta} < \beta^* < \bar{\beta}$, and given $\hat{\beta}(0) = \bar{\beta}$ and $\hat{\beta}(1) = \tilde{\beta}$, there exists a τ^*, such that $\hat{\beta}(\tau^*) = \beta^*$. Finally, we observe that for all $\tau \geq \tau^*$, we have $\hat{\beta} \leq \beta^*$ and we recall from the proof of Corollary 3.1 that the welfare function is increasing with β for all $\beta \leq \beta^*$. Thus, we observe that a strong form of citizen participation, where the weight of Vote-holders' decision is large enough ($\tau \geq \tau^*$), improves welfare. And if chosen optimally, the appropriate weighting factor (τ^*) can yield the socially optimal incentive pay.[9]

5.9 Discussion and Conclusion

We began by drawing attention to the widening gap between the citizens' demands and the office-holders' actions in democracies. We described globalization and intransparent policy-making procedures as the main reasons for the public to distrust the office-holders and to perceive their choices as illegitimate.
Then we described three important democratic values: legitimacy, equality and effective governance. We established that conventional corrective measures such as tax constraints or innovative political contracts such as incentive pay, despite fostering efficiency and improving welfare, are not effective tools in fostering these democratic values. Thus, we turned to citizen participation as a tool to advance the democratic core values.
Starting from the approach of Arnstein (1969), we discussed the different aspects of implementing the appropriate form of citizen participation. As a next step, we introduced the democracy cube and explored the consequences of different forms of participation. Moreover, we discussed the role of Internet and how it assists citizen participation through social media. Finally, we presented Co-voting as a novel mechanism of citizen participation and summarized how Co-voting improves policy-making by redistributing limited decision-making power to a group of randomly-chosen citizens. As an illustrative example, we explored the interplay between Co-voting and incentive pay. We established that Co-voting, as an implementation procedure, improves the design of incentive pay.

[9] If the two voting rounds take place simultaneously, the results are the same. However, the society cannot save the costs of the parliamentary voting round when $\mu \in \left[\frac{1}{2}, 1\right)$ and both the Vote-holders and the parliament members choose $\bar{\beta}$.

6 Conclusions and Outlook

6.1 Summary

We motivated this dissertation by a review of politicians' incentives to run for election: private interest, power, public good concerns, altruism, and public image. Inspired by the prominent role of agents' private interest in the design of incentive contracts for the private sector, we focused on politicians' pay as a tool to improve their performance.
To examine incentive pay for politicians, we constructed a simple model of political multi-task problems in democracy, in which the policy-maker is in charge of taxing the citizens' private good and choosing the level of public-good spending in a society constituting of two groups, endowed with a different level of private good but having the same preferences over the private good and public good consumption.
We assessed the inefficiencies arising in this setting, namely the exploitation of minorities and sub-optimal provision of the public good. We analyzed the effect of a constitutional limit on taxes and discussed how incentive pay can improve public-good provision and social welfare. We showed how social welfare can improve by using a combination of tax limits and incentive pay.
Additionally, we examined how an altruistic policy-maker would be affected by incentive pay. Furthermore, we showed that our results hold in a generalized setting with n endowment groups. To explore election concerns in an economy that rewards its policy-maker with incentive pay, we allowed candidates to compete at the campaign stage by announcing their desired level of incentive pay.
Finally, we discussed the importance of citizen participation in a representative democracy as a tool to legitimate the policy-maker's choices and foster equality in the society. In particular, we introduced a novel form of citizen participation, Co-voting, and we discussed various aspects of its possible implementation. We explored the interplay between incentive contracts and citizen participation. Finally, we came full circle by discussing the interaction between incentive pay and Co-voting to establish that Co-voting is beneficial in designing a better incentive pay for the policy-maker.

6.2 Outlook

Future research could be carried out along various avenues, to extend the scope of this dissertation beyond what has already been analyzed.

The results of our model rely on the fact that we assume everything is common knowledge. It is worthwhile to study political multi-task problems and the effect of incentive pay in a setting with uncertainty and incomplete information. For instance, one interesting case would be an economy in which the shock that affects the endowment level of citizens happens with a given probability and in which the Elites have more information about this probability than the Non-elites.

Another interesting extension would be to consider a policy-maker who is better informed but is potentially biased in his preferences. In such a setting, there is a trade-off between allowing the policy-maker to have autonomy and choose the policy according to his private information and his personal preferences or to discipline him by incentive contracts or citizen participation, disregarding the contingencies.

Another interesting area of research would be a case where no endowment group has the majority in a society with n endowment groups. In this case, endowment groups have to form coalitions and bargain for their desired policy. The analysis would be within a cooperative game theory paradigm.

Furthermore, one could relax the assumption that the public good is desired by all endowment groups and study the problem of financing public-good provision using cooperative games and a cost-sharing framework. Additionally, if public-good spending is not desired by everybody in the society, the redistribution concerns could be integrated in the model. The ruling group, for instance, might prefer to subsidize itself instead of contributing to public-good provision.

Another avenue for future research might be to consider the other motivations politicians have to run for election as well and to study how a disciplining mechanism that targets one of these incentives could change the interplay between different incentives and whether it can have a crowd-out effect.

These extensions could further enrich our understanding of political multi-task problems and help with the design of mechanisms that improve the office-holders' accountability in democracy.

A Appendix to Chapter 3

Proof of Proposition 3.1

Suppose $u'''(.)$ is non-negative. Since $u'(.)$ is convex, the definition of convex function implies

$$u'(tx) \geq tu'(x) \quad \forall t \geq 1.$$

Since $\frac{1}{\theta_M} > 1$ and $u'(.)$ is convex, we obtain

$$u'\left(\frac{x^s}{\theta_M}\right) \geq \frac{1}{\theta_M} u'\left(x^s\right). \tag{A.1}$$

Additionally, since $\frac{1}{\theta_M} > 1$, we obtain

$$\frac{1}{\theta_M} u'\left(\frac{x^s}{\theta_M}\right) > u'\left(\frac{x^s}{\theta_M}\right), \tag{A.2}$$

$$\frac{1}{\theta_M} u'\left(x^s\right) > u'\left(x^s\right). \tag{A.3}$$

From Inequalities (A.1)–(A.3), we obtain

$$\frac{1}{\theta_M} u'\left(\frac{x^s}{\theta_M}\right) > u'\left(\frac{x^s}{\theta_M}\right) \geq \frac{1}{\theta_M} u'\left(x^s\right) > u'\left(x^s\right),$$

$$\frac{1}{\theta_M} u'\left(\frac{x^s}{\theta_M}\right) > u'\left(x^s\right). \tag{A.4}$$

Thus, we have established that if $u'(\cdot)$ is convex, Inequality (3.12) holds.
Moreover, we can rewrite Inequality (A.4) by using Equation (3.9), to obtain

$$u'\left(\frac{x^s}{\theta_M}\right) > u'\left(x_M^p\right). \tag{A.5}$$

Since $u'(\cdot)$ is strictly decreasing, we obtain from Inequality (A.5)

$$\frac{x^s}{\theta_M} < x_M^p.$$

By the definition of under-provision as given in Inequality (3.10), the public good is under-provided if $u'(\cdot)$ is convex.

Proof of Proposition 3.2

We examine the maximization problem of $W(b)$ on $[0,1]$.
The ex-ante social welfare as a function of b is given by Equation (3.18). The function $W(b)$ is defined over the compact set $[0,1]$. To prove that $W(b)$ is continuous, we first prove that $x^p_M(b)$ is continuous over $[0,1]$. For this purpose, we define

$$f(b) := (1-b)\omega_M - x^p_c,$$

over $[0,1]$. At $b=0$, $f(0)=\omega_M - x^p_c$. By Assumption 3.2, we know that $\omega_M > x^p_c$. Thus, $f(0)>0$. At $b=1$, $f(1) = -x^p_c$. Since x^p_c is the interior solution to the policy-maker's problem, it is strictly positive. Thus, $f(1)<0$. The function $f(b)$ is continuous over the compact set $[0,1]$. By the Intermediate Value Theorem, there exists $b_c \in (0,1)$ such that $f(b_c)=0$. From $f(b_c)=0$, we obtain

$$b_c = 1 - \frac{x^p_c}{\omega_M}. \tag{A.6}$$

By using the critical value for b, b_c, we rewrite $x^p_M(b)$ as a piecewise function,

$$x^p_M(b) = \begin{cases} x^p_c & b_c < b \leq 1, \\ (1-b)\omega_M & 0 \leq b \leq b_c. \end{cases} \tag{A.7}$$

The function $x^p_M(b)$ is continuous for both $b \in [0, b_c)$ and $b \in (b_c, 1]$. To show that $x^p_M(b)$ is continuous, we next establish continuity at b_c.
For all $b > b_c$, we have $x^p_M(b) - x^p_M(b_c) = 0$. Let $\varepsilon > 0$. There exists $\delta > 0$ such that if $0 < b - b_c < \delta$, then $x^p_M(b) - x^p_M(b_c) = 0 < \epsilon$. Thus, $\lim_{b \to b_c{}^+} x^p_M(b)$ exists.
For all $b < b_c$, we have $\mid x^p_M(b) - x^p_M(b_c) \mid = \mid b - b_c \mid \omega_M$. Let $\varepsilon > 0$. There exists $\delta = \frac{\varepsilon}{\omega_M}$ such that if $\mid b - b_c \mid < \delta$, then $\mid x^p_M(b) - x^p_M(b_c) \mid < \delta\omega_M = \varepsilon$. Thus, $\lim_{b \to b_c{}^-} x^p_M(b)$ exists. We observe that

$$\lim_{b \to b_c{}^+} x^p_M(b) = x^p_c, \text{ and}$$
$$\lim_{b \to b_c{}^-} x^p_M(b) = (1-b_c)\omega_M = x^p_c.$$

Thus, we have $\lim_{b \to b_c{}^+} x^p_M(b) = \lim_{b \to b_c{}^-} x^p_M(b) = x^p_M(b_c)$. We have established that $x^p_M(b)$ is continuous.

Since $x_m^p(b)$ and $x_M^p(b)$—as given in Equations (3.14) and (A.7), respectively—are continuous over $b \in [0,1]$ and given our assumptions on $u(\,\cdot\,)$, $W(b)$ is continuous over $b \in [0,1]$. Thus, there exists at least one maximizer of $W(b)$ on the compact set $[0,1]$.
To establish that there is a unique maximizer for $W(b)$, we examine the welfare optimization problem in detail for two separate cases: Case 1 for $b \in [b_c, 1]$, and Case 2 for $b \in [0, b_c]$.

Case 1. The optimization problem is as follows:

$$\max_{b_1 \in [b_c,1]} \quad W(b_1) = \theta_M u(x_c^p) + \theta_m u\left((1-b_1)\omega_m\right) + \frac{\gamma\left[\Omega - \theta_M x_c^p - \theta_m \omega_m (1-b_1)\right]}{1+\lambda},$$

where we have substituted for $x_M^p(b_1)$ and $x_m^p(b_1)$ from Equations (3.14) and (A.7), respectively, into Equation (3.18).
This is a constrained optimization problem. Thus, we construct the Lagrangian

$$L \equiv \theta_M u(x_c^p) + \theta_m u\left((1-b_1)\omega_m\right) + \frac{\gamma\left[\Omega - \theta_M x_c^p - \theta_m \omega_m (1-b_1)\right]}{1+\lambda} + r_1\left(b_c - b_1\right) + r_1'(1-b_1).$$

Due to the Inada Conditions, we know that $b_1 = 1$ cannot be optimal and thus it is not binding. By the complementary slackness conditions, we have $r_1' = 0$. From the first-order condition with respect to b, we obtain

$$\frac{\partial L}{\partial b_1} = -\theta_m \omega_m u'\left((1-b_1)\omega_m\right) + \theta_m \omega_m \frac{\gamma}{1+\lambda} - r_1 = 0. \tag{A.8}$$

Next, we establish (i) the corner solution and (ii) the interior solution by using the complementary slackness conditions.

(i) *Corner Solution:*
If $r_1 > 0$, we have $b_1^* = b_c$. Equation (A.8) for $r_1 > 0$ at $b_1 = b_c$ becomes

$$\underbrace{\frac{\gamma}{1+\lambda}}_{=u'(x^s)} - \frac{r_1}{\theta_m \omega_m} = u'\left(x_c^p \frac{\omega_m}{\omega_M}\right),$$

where we have substituted for $(1-b_c)\omega_m = x_c^p \frac{\omega_m}{\omega_M}$ by using Equation (A.6). From Equation (3.4), we recall that $u'(x^s) = \frac{\gamma}{1+\lambda}$. Since $r_1 > 0$, we observe that $u'(x^s) < u'\left(x_c^p \frac{\omega_m}{\omega_M}\right)$. Given $u'(\,\cdot\,)$ is strictly decreasing, we obtain $x^s > x_c^p \frac{\omega_m}{\omega_M}$. On the contrary, if $\frac{x^s}{x_c^p} \leq \frac{\omega_m}{\omega_M}$, then $r_1 \leq 0$ and the constraint is not binding. We discuss this next.

(ii) *Interior Solution:*

If $r_1 = 0$, Equation (A.8) becomes

$$u'\left(\left(1-b_1^*\right)\omega_m\right) = \frac{\gamma}{1+\lambda}.$$

We recall from Equation (3.4) that $u'\left(x^s\right) = \frac{\gamma}{1+\lambda}$. Reordering and rewriting Equation (A), we obtain

$$b_1^* = 1 - \frac{x^s}{\omega_m}.$$

Additionally, the second-order condition is

$$\underbrace{\theta_m \omega_m^2}_{>0} \underbrace{u''\left(\left(1-b_1^*\right)\omega_m\right)}_{<0} < 0.$$

Since the second-order condition is strictly concave. there is at most one interior maximizer of $W(b)$.

Thus, in Case 1, if $\frac{x^s}{x_c^p} > \frac{\omega_m}{\omega_M}$, the constraint is binding and $b_1^* = b_c$ where $b_c = 1 - \frac{x_c^p}{\omega_M}$ as given in Equation (A.6). However, if $\frac{x^s}{x_c^p} \leq \frac{\omega_m}{\omega_M}$, then the constraint is not binding and the optimization problem in Case 1 has a unique interior solution given by $b_1^* = 1 - \frac{x^s}{\omega_m}$.

Case 2. The optimization problem is as follows:

$$\max_{b_2 \in [0, b_c]} \quad W(b_2) = \theta_M u\left((1-b_2)\omega_M\right) + \theta_m u\left((1-b_2)\omega_m\right) + \frac{b_2 \gamma \Omega}{1+\lambda},$$

where we have substituted for $x_M^p(b_2)$ and $x_m^p(b_2)$ from Equations (3.14) and (A.7), respectively, into Equation (3.18).

This is a constrained optimization problem. Thus, we construct the Lagrangian

$$L \equiv \theta_M u\left((1-b_2)\omega_M\right) + \theta_m u\left((1-b_2)\omega_m\right) + \frac{b_2 \gamma \Omega}{1+\lambda} + r_2\left(b_c - b_2\right) - r_2' b_2.$$

By Assumption 3.1, we know that $b_2 = 0$ cannot be optimal and thus it is not binding. By the complementary slackness conditions, we have $r_2' = 0$.

From the first-order condition with respect to b_2, we obtain

$$\frac{\partial L}{\partial b_2} = -\theta_M \omega_M u'\left((1-b_2)\omega_M\right) - \theta_m \omega_m u'\left((1-b_2)\omega_m\right) + \Omega \frac{\gamma}{1+\lambda} - r_2 = 0. \quad \text{(A.9)}$$

Next, we establish (i) the corner solution and (ii) the interior solution by using the complementary slackness conditions.

(i) *Corner Solution:*

If $r_2 > 0$, we have $b_2^* = b_c$. Equation (A.9) for $r_2 > 0$ and $b_2 = b_c$ becomes

$$-\theta_M \omega_M u'\left(x_c^p\right) - \theta_m \omega_m u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) + \Omega \frac{\gamma}{1+\lambda} = r_2. \quad \text{(A.10)}$$

where we have substituted for $(1-b_c)\omega_m = x_c^p \frac{\omega_m}{\omega_M}$ and $(1-b_c)\omega_M = x_c^p$. There are two cases, where Equation (A.10) holds for $r_2 > 0$. We consider these two cases in the following:

(a.) We first establish that if $\frac{\omega_m}{\omega_M} \geq \frac{x^s}{x_c^p}$, then $b_2^* = b_c$.
We have $x_m^p(b_c) = x_c^p \frac{\omega_m}{\omega_M}$. If $\frac{\omega_m}{\omega_M} \geq \frac{x^s}{x_c^p}$, then $x_c^p \frac{\omega_m}{\omega_M} \geq x^s$. Since $u'(\,\cdot\,)$ is strictly decreasing, $u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) \leq u'(x^s)$. We recall from Equation (3.4) that $u'(x^s) = \frac{\gamma}{1+\lambda}$, and we obtain

$$u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) < \frac{\gamma}{1+\lambda}. \quad \text{(A.11)}$$

Additionally, we have $x_M^p(b_2) = x_c^p$. From Assumption 3.2, we know that

$$u'(x_c^p) < \frac{\gamma}{1+\lambda}. \quad \text{(A.12)}$$

If we multiply Equation (A.11) by $\theta_m \omega_m$ and Equation (A.12) by $\theta_M \omega_M$ and we take the sum, we obtain

$$\theta_m \omega_m u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) + \theta_M \omega_M u'(x_c^p) < \frac{\gamma}{1+\lambda} \underbrace{\left[\theta_m \omega_m + \theta_M \omega_M\right]}_{=\Omega}. \quad \text{(A.13)}$$

If we reorder Inequality (A.13), we obtain

$$-\theta_M \omega_M u'\left(x_c^p\right) - \theta_m \omega_m u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) + \Omega \frac{\gamma}{1+\lambda} > 0. \quad \text{(A.14)}$$

If Inequality (A.14) holds, the left hand side of Equation (A.10) is strictly positive. Thus, $r_2 > 0$. Thus, if $\frac{\omega_m}{\omega_M} > \frac{x^s}{x_c^p}$, the constraint is binding and $b_2^* = b_c$.

(b.) We now establish that if $\frac{\omega_m}{\omega_M} < \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p \frac{\omega_m}{\omega_m}\right)}{u'(x^s)} < 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right)$ then $r_2 > 0$ and $b_2^* = b_c$.
In Equation (A.10), we substitute for $u'(x_c^p)$ from Equation (3.16). Reordering, we obtain

$$-\theta_m \omega_m u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) + \underbrace{\frac{\gamma}{1+\lambda}}_{=u'(x^s)} \left[\theta_m \omega_m + \underbrace{(1-\theta_M)}_{=\theta_m} \theta_M \omega_M\right] = r_2. \quad \text{(A.15)}$$

The left hand side of Equation (A.15) is strictly positive if

$$u'\left(x_c^p\frac{\omega_m}{\omega_M}\right) < u'(x^s)\left[1+\theta_m\left(\frac{\theta_M\omega_M}{\theta_m\omega_m}\right)\right].$$

Thus, if $\frac{\omega_m}{\omega_M} < \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p\frac{\omega_m}{\omega_M}\right)}{u'(x^s)} < 1+\theta_m\left(\frac{\theta_M\omega_M}{\theta_m\omega_m}\right)$, the left hand side of Equation (A.15) is strictly positive. Thus, $r_2 > 0$ and the constraint is binding, $b_2^* = b_c$.

However, if $\frac{\omega_m}{\omega_M} < \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p\frac{\omega_m}{\omega_M}\right)}{u'(x^s)} \geq 1+\theta_m\left(\frac{\theta_M\omega_M}{\theta_m\omega_m}\right)$, then $r_2 \leq 0$ and the constraint is not binding. We discuss this next.

(ii) *Interior Solution:*
If $r_2 = 0$, Equation (A.9) becomes

$$\frac{\gamma\Omega}{1+\lambda} = \theta_M\omega_M u'\left((1-b_2^*)\omega_M\right) + \theta_m\omega_m u'\left((1-b_2^*)\omega_m\right). \tag{A.16}$$

The problem has an interior solution which is implicitly given by Equation (A.16). Additionally, the second-order condition is

$$\underbrace{\theta_m\omega_m^2}_{>0}\underbrace{u''\left((1-b_2^*)\,\omega_m\right)}_{<0} + \underbrace{\theta_M\omega_M^2}_{>0}\underbrace{u''\left((1-b_2^*)\,\omega_M\right)}_{<0} < 0.$$

Since the second-order condition is strictly concave. there is at most one interior maximizer of $W(b)$.

Thus, in Case 2, the constraint is binding and $b_2^* = b_c$ if (a) $\frac{\omega_m}{\omega_M} \geq \frac{x^s}{x_c^p}$ or (b) $\frac{\omega_m}{\omega_M} < \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p\frac{\omega_m}{\omega_M}\right)}{u'(x^s)} < 1+\theta_m\left(\frac{\theta_M\omega_M}{\theta_m\omega_m}\right)$. However, if $\frac{\omega_m}{\omega_M} < \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p\frac{\omega_m}{\omega_M}\right)}{u'(x^s)} \geq 1+\theta_m\left(\frac{\theta_M\omega_M}{\theta_m\omega_m}\right)$, the optimization problem has a unique interior solution $b_2^* \in (0, b_c)$, implicitly given by Equation(A.16).

To summarize the results in Case 1 and Case 2,

- if $\frac{\omega_m}{\omega_M} \leq \frac{x^s}{x_c^p}$, the solution to Case 1 is interior $b_1^* \in (b_c, 1)$. We have $W(b_1^*) \geq W(b)$ for all $b \in [b_c, 1]$. In particular, we have $W(b_1^*) > W(b_c)$. Additionally, if $\frac{\omega_m}{\omega_M} \leq \frac{x^s}{x_c^p}$, $b_2^* = b_c$ and $W(b_c) > W(b)$ for all $b \in [0, b_c)$. We recall that $W(b)$ is continuous at b_c. Thus, if $\frac{\omega_m}{\omega_M} \leq \frac{x^s}{x_c^p}$, we have $W(b_1^*) \geq W(b)$ for all $b \in [b_c, 1]$ and $W(b_c) > W(b)$ for all $b \in [0, b_c)$. We conclude that

$$W(b_1^*) \geq W(b),\ \forall b \in [0,1],$$

where $b_1^* = 1 - \frac{x^s}{\omega_m}$.

- if $\frac{\omega_m}{\omega_M} > \frac{x^s}{x_c^p}$, the solution to Case 1 is at the corner, $b_1^* = b_c$ and $W(b_c) > W(b)$ for all $b \in (b_c, 1]$.
  - Additionally, if $\frac{\omega_m}{\omega_M} > \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p \frac{\omega_m}{\omega_m}\right)}{u'(x^s)} < 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right)$, the solution to Case 2 is at the corner, $b_2^* = b_c$ and $W(b_c) > W(b)$ for all $b \in [0, b_c)$. Thus, if $\frac{\omega_m}{\omega_M} > \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p \frac{\omega_m}{\omega_m}\right)}{u'(x^s)} < 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right)$, we conclude

    $$W(b_c) \geq W(b) \ \forall b \in [0, 1],$$

    where $b_c = 1 - \frac{x_c^p}{\omega_M}$.
  - Moreover, if $\frac{\omega_m}{\omega_M} > \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p \frac{\omega_m}{\omega_m}\right)}{u'(x^s)} \geq 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right)$, the solution to Case 2 is interior $b_2^* \in (0, b_c)$. We have $W(b_2^*) \geq W(b)$ for all $b \in [0, b_c]$. In particular, we have $W(b_2^*) > W(b_c)$. Thus, if $\frac{\omega_m}{\omega_M} > \frac{x^s}{x_c^p}$ and $\frac{u'\left(x_c^p \frac{\omega_m}{\omega_m}\right)}{u'(x^s)} \geq 1 + \theta_m \left(\frac{\theta_M \omega_M}{\theta_m \omega_m}\right)$, we have $W(b_c) > W(b)$ for all $b \in (b_c, 1]$ and $W(b_2^*) > W(b_c)$. We conclude that

    $$W(b_2^*) \geq W(b) \ \forall b \in [0, 1],$$

    where b_2^* is implicitly given by Equation (A.16).

Proof of Lemma 3.1

Let $\beta < \frac{1}{\theta_M(1-\mu)}$ and $\mu \in [0, 1)$.

(i) Equation (3.29) gives x_{ME}^p as an implicit function of β. Given our assumptions on $u(\,\cdot\,)$, we know that $u'(\,\cdot\,)$ is differentiable. Applying the implicit function theorem to Equation (3.29) yields

$$\frac{\partial u'\left(x_{ME}^p(\beta)\right)}{\partial \beta} = \underbrace{\frac{\partial u'\left(x_{ME}^p\right)}{\partial x_{ME}^p}}_{<0} \cdot \frac{\partial x_{ME}^p}{\partial \beta} = \underbrace{\frac{\gamma \theta_M^2 (1-\mu)}{(1+\lambda)\left[1 - \beta \theta_M (1-\mu)\right]^2}}_{>0}.$$

We see that the marginal utility of x_{ME}^p is increasing in β. Given $u''(\,\cdot\,) < 0$, we conclude that $\frac{\partial x_{ME}^p}{\partial \beta} < 0$.

(ii) From Equation (3.30), we have

$$K_g^p(\beta) = \frac{\Omega - \theta_M x_{ME}^p(\beta)}{(1+\lambda)(1 - \beta\theta_M(1-\mu))}.$$

For $\beta < \frac{1}{\theta_M(1-\mu)}$, the function $\frac{1}{1-\beta\theta_M(1-\mu)}$ is differentiable. Additionally, $x_{ME}^p(\beta)$ is a differentiable function of β. Thus, we conclude that $K_g^p(\beta)$ is a differentiable function. We take the derivative of the equation above with respect to β. We obtain

$$\frac{\partial K_g^p}{\partial \beta} = \underbrace{\frac{\theta_M(1-\mu)\left[\Omega - \theta_M x_{ME}^p\right]}{(1+\lambda)\left[1-\beta\theta_M\left(1-\mu\right)\right]^2}}_{>0} - \underbrace{\frac{\theta_M\left(\frac{\partial x_{ME}^p}{\partial \beta}\right)}{(1+\lambda)\left[1-\beta\theta_M\left(1-\mu\right)\right]}}_{<0}.$$

Thus, $\frac{\partial K_g^p}{\partial \beta} > 0$.

(iii) From Equation (3.21), we see that $x_{MN}^p\left(\beta\right)$ is given by

$$x_{MN}^p\left(\beta\right) = x_{ME}^p\left(\beta\right) - \beta(1+\lambda)K_g^p\left(\beta\right). \tag{A.17}$$

By using Equation (A.17), we see that $x_{MN}^p\left(\beta\right)$ is a sum of two differentiable functions. Thus, it is a differentiable function of β. Finally, we take the derivative of Equation (A.17) with respect to β and we obtain

$$\frac{\partial x_{MN}^p}{\partial \beta} = \underbrace{\frac{\partial x_{ME}^p}{\partial \beta}}_{<0} - \underbrace{\left[(1+\lambda)K_g^p(\beta) + \beta(1+\lambda)\frac{\partial K_g^p}{\partial \beta}\right]}_{>0}.$$

With the right hand side being negative, we conclude that $\frac{\partial x_{MN}^p}{\partial \beta} < 0$.

Proof of Proposition 3.3

Let $\mu \in [0,1)$. To prove (i), we consider the interior solution to the policy-maker's problem. Equation (3.29) gives x_{MN}^p as an implicit function of β. If we substitute for $K_g^p(\beta)$ from Equation (3.23) into the left hand side of Equation (3.29) and we rewrite and reorder Equation (3.29), we obtain

$$x_{MN}^p(\beta) = \underbrace{\left(\frac{1+\mu\theta_M\beta}{1-\beta\theta_M(1-\mu)}\right)}_{>0}\left[(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{\beta\Omega}{1+\mu\theta_M\beta}\right]. \tag{A.18}$$

We note that for all $\beta \in \left[0, \frac{1}{\theta_M(1-\mu)}\right)$, $x_{MN}^p(\beta)$ can only be zero if the term in the large bracket is equal to zero. We next establish the existence of $\bar{\beta}$ such that $x_{MN}^p(\bar{\beta}) = 0$. For this purpose, we define

$$F(\beta) := (u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{\beta\Omega}{1+\mu\theta_M\beta}. \tag{A.19}$$

We first show that $F(0)$ and $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} F(\beta)$ have different signs. To calculate $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} F(\beta)$, we fist recall from the Inada Conditions that $\lim_{x\to 0} u'(x) = \infty$.

Consequently, $\lim_{x\to\infty}(u')^{-1}(x) = 0$. Thus, we obtain

$$\begin{aligned}\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} F(\beta) &= \lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} \left[(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{\beta\Omega}{1+\mu\theta_M\beta}\right], \\ &= \lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} (u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{\Omega}{\theta_M}, \\ &= 0 - \frac{\Omega}{\theta_M}.\end{aligned}$$

Thus, we have established $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} F(\beta) < 0$. To calculate $F(0)$, we substitute for $\beta = 0$ in Equation (A.19). We obtain

$$F(0) = (u')^{-1}\left(\frac{\gamma\theta_M}{1+\lambda}\right).$$

We can see that $F(0) > 0$. We have established that $F(0)$ and $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} F(\beta)$ have different signs. Given our assumptions on $u(\,\cdot\,)$, $F(\beta)$ is a continuous function for all $\beta \in \left[0, \frac{1}{\theta_M(1-\mu)}\right)$. Since $F(\beta)$ is continuous, there exists $c \in \left[0, \frac{1}{\theta_M(1-\mu)}\right)$ which is as close as we want it to $\frac{1}{\theta_M(1-\mu)}$ such that $F(c)$ and $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} F(\beta)$ have the same sign. Consequently, $F(0)$ and $F(c)$ have opposite signs. Thus, by the Intermediate Value Theorem, there exists a $\bar{\beta} \in [0, c] \subset \left[0, \frac{1}{\theta_M(1-\mu)}\right)$, such that $F\left(\bar{\beta}\right) = 0$. By Equation (A.18), we observe that if $F(\bar{\beta}) = 0$, then $x^p_{MN}(\bar{\beta}) = 0$.
The preceding analysis proves that there exists a $\bar{\beta}$ such that $x^p_{MN}(\bar{\beta}) = 0$ and which satisfies $F(\bar{\beta}) = 0$, i.e.

$$(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\bar{\beta}\theta_M(1-\mu))}\right) = \frac{\bar{\beta}\Omega}{1+\mu\theta_M\bar{\beta}}. \tag{A.20}$$

To show that $\bar{\beta}$ is unique, we recall from Lemma 3.1 that $x^p_{MN}(\beta)$ is strictly decreasing. Thus, there is a unique $\bar{\beta}$ such that $x^p_{MN}(\bar{\beta}) = 0$. Given Equation (A.18), the unique $\bar{\beta}$ that sets $x^p_{MN}(\bar{\beta}) = 0$ satisfies Equation (A.20). Equation (A.20) gives us a unique expression of $\bar{\beta}$ as an implicit function of exogenous parameters. The preceding proves (i). Next, we prove (ii).
($\Rightarrow$) Let (x^p_{MN}, x^p_m) be optimal and let x^p_{MN} be the interior maximizer. The proof is by contradiction. Suppose $\exists\tilde{\beta} \in \left(\bar{\beta}, \frac{1}{\theta_M(1-\mu)}\right)$ such that $x^p_{MN}(\tilde{\beta})$ is the interior optimal solution to the policy-maker's problem. By Lemma 3.1, we know that x^p_{MN} is a strictly decreasing function of β. Thus, given $\tilde{\beta} > \bar{\beta}$, we have $x^p_{MN}(\tilde{\beta}) < x^p_{MN}(\bar{\beta})$. Since $x^p_{MN}(\bar{\beta}) = 0$, we conclude $x^p_{MN}(\tilde{\beta}) < 0$. Thus, $x^p_{MN}(\tilde{\beta}) \notin C'$ and consequently $x^p_{MN}(\tilde{\beta})$

is not a feasible policy and cannot be the optimal solution. This contradicts our initial assumption.
($\Leftarrow$) Let $0 \leq \beta \leq \bar{\beta}$. Equation (3.29) gives the interior solution to the policy-maker's problem, $x^p_{MN}(\beta)$, as an implicit function of β. We want to prove that the interior solution is the unique optimal solution. For this purpose, we next establish that $x^p_{MN}(\beta)$ is positive for all $\beta \in [0, \bar{\beta}]$.
First, we recall that $x^p_{MN}\left(\bar{\beta}\right) = 0$. Second, from Equation (3.21), at $\beta = 0$ we have $x^p_{MN}(0) = x^p_{ME}(0)$. By using Equation (3.29) to calculate $x^p_{ME}(0)$, we obtain $x^p_{ME}(0) = x^p_M$, where x^p_M is given by Equation (3.7). Finally, by Lemma 3.1, we know that x^p_{MN} is a strictly decreasing function of β. Since x^p_{MN} is a strictly decreasing and continuous function of β, we have $x^p_{MN} \in [0, x^p_M]$ for all $\beta \in \left[0, \bar{\beta}\right]$, i.e. $x^p_{MN}(\beta)$ is positive for all $\beta \in [0, \bar{\beta}]$.
Since $x^p_{MN} \geq 0$ for all $\beta \in [0, \bar{\beta}]$, given Equation (A.18), we obtain

$$(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{\beta\Omega}{1+\mu\theta_M\beta} \geq 0. \tag{A.21}$$

Since $(u')^{-1}(\cdot)$ is strictly decreasing, if Inequality (A.21) holds, we obtain

$$\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))} \leq u'\left(\frac{\beta\Omega}{1+\mu\theta_M\beta}\right). \tag{A.22}$$

Inequality (A.22) is the same as Inequality (3.28). Since Inequality (3.28) holds, the optimal solution to the policy-maker's problem is interior.
Additionally, we note that the second-order condition for the policy-maker's problem is given by

$$\frac{\partial^2 U}{\partial x^2_{MN}} = \frac{1}{1+\mu\theta_M\beta}\left[-\theta_M(1-\mu)\underbrace{u'\left(x^p_{ME}(\beta)\right)}_{>0} + \frac{\left(1-\beta\theta_M(1-\mu)\right)^2}{1+\mu\theta_M\beta}\underbrace{u''\left(x^p_{ME}(\beta)\right)}_{<0}\right].$$

Since the second-order condition is strictly decreasing, the policy-maker's problem has a unique interior solution. Finally, we observe that the interior solution to the policy-maker's problem uniquely maximizes the policy-maker's utility.

Proof of Proposition 3.4

The proof follows from the fact that the private-good consumption of all endowment groups remains unchanged with the introduction of the incentive contract when $\mu = 1$.
At $\mu = 1$, every citizen in the majority endowment group belongs to the Elites. Setting

$\mu = 1$ in Equations (3.29), we obtain

$$u'\left(x^p_{ME}\right) = \frac{\gamma\theta_M}{1+\lambda}.$$

We note that this is equal to Equation (3.7). Applying the implicit function theorem yields

$$\frac{\partial u'\left(x^p_{ME}\right)}{\partial\beta} = \underbrace{\frac{\partial u'\left(x^p_{ME}\right)}{\partial x^p_{ME}}}_{<0} \cdot \frac{\partial x^p_{ME}}{\partial\beta} = 0.$$

Since $u''(\cdot) < 0$, we obtain $\frac{\partial x^p_{ME}}{\partial\beta} = 0$. With $\mu = 1$ and every citizen in majority endowment group being an Elite citizen, we have $x^p_{ME} = x^p_{MN}$. Thus, we can conclude that $\frac{\partial x^p_{MN}}{\partial\beta} = 0$. Moreover, the minority endowment group's private-good consumption is always set to zero, $x^p_m = 0$, and does not change with β. Finally, using Equation (3.30), the public-good spending at $\mu = 1$ is given by

$$K^p_g = \frac{\Omega - \theta_p x^p_M}{1+\lambda}.$$

Given at $\mu = 1$, we have $u'\left(x^p_{ME}\right) = u'\left(x^p_M\right)$, the above equation is equal to Equation (3.8). Taking the derivative of K^p_g with respect to β, we obtain $\frac{\partial K^p_g}{\partial\beta} = 0$.
Given $\frac{\partial x^p_{ME}}{\partial\beta} = \frac{\partial x^p_{MN}}{\partial\beta} = \frac{\partial x^p_m}{\partial\beta} = \frac{\partial K^p_g}{\partial\beta} = 0$, we conclude that the incentive contract has no impact at $\mu = 1$.

Proof of Theorem 3.1

We examine the maximization problem of $W(\beta)$ over $[0, \bar{\beta}]$.

$$\max_{\beta\in[0,\bar{\beta}]} \quad W(\beta) =$$
$$\theta_M(1-\mu)u(x^p_{MN}(\beta)) + \theta_M\mu u(x^p_{ME}(\beta)) + \theta_m u(x^p_m) + \frac{\gamma}{1+\lambda}\frac{[\Omega - \theta_M x^p_{ME}(\beta)]}{1-\beta\theta_M(1-\mu)}. \tag{A.23}$$

The ex-ante welfare function is given by Equation (3.32). We note that for $\beta \in [0, \bar{\beta}]$, by Proposition 3.3, the policy-maker's problem has a unique interior solution given by Equations (3.21), (3.29) and (3.30). We have substituted for $K^p_g(\beta)$ from Equation (3.30) in Equation (3.32). The welfare function $W(\beta)$ is a continuous function on the closed interval $[0, \bar{\beta}]$. By the Extreme Value Theorem, $W(\beta)$ has a maximum and a minimum on $[0, \bar{\beta}]$.
We first show that W is not maximized at either of the corner values for β.
We take the derivative of the ex-ante welfare function with respect to β. Reordering and

rewriting we obtain

$$\frac{\partial W}{\partial \beta} = \theta_M(1-\mu)u'\left(x^p_{MN}(\beta)\right)\frac{\partial x^p_{MN}}{\partial \beta} + \theta_M \mu u'\left(x^p_{ME}(\beta)\right)\frac{\partial x^p_{ME}}{\partial \beta}$$

$$+ \frac{\gamma}{1+\lambda}\left[\frac{\theta_M(1-\mu)\left[\Omega - \theta_M x^p_{ME}(\beta)\right]}{\left(1-\beta\theta_M(1-\mu)\right)^2} - \frac{\theta_M \frac{\partial x^p_{ME}}{\partial \beta}}{1-\beta\theta_M(1-\mu)}\right]. \tag{A.24}$$

At $\beta = 0$, the welfare is equal to the one under the policy-maker's policy choice without any incentives. To see that $\beta = 0$ is not optimal, we need to show that $\left.\frac{\partial W}{\partial \beta}\right|_{0+} > 0$. For this purpose, by using Equation (3.21), we first establish

$$\left.\frac{\partial x^p_{ME}}{\partial \beta}\right|_{0+} = \left.\frac{\partial x^p_{MN}}{\partial \beta}\right|_{0+} + \left[\Omega - \theta_M u'(x^p_M)\right]. \tag{A.25}$$

We have substituted for $x^p_{ME}(0) = x^p_M$ in Equation (A.25).
We now calculate Equation (A.24) at $\beta = 0^+$. By using Equation (A.25) and rewriting and reordering, we obtain

$$\left.\frac{\partial W}{\partial \beta}\right|_{0+} = \frac{\gamma\theta_M}{1+\lambda}\underbrace{(\theta_M - 1)}_{<0}\underbrace{\left.\frac{\partial x^p_{ME}}{\partial \beta}\right|_{0+}}_{<0} \tag{A.26}$$

$$+ \frac{\gamma\theta_M}{1+\lambda}(1-\mu)(1-\theta_M)\left[\Omega - \theta_M u'(x^p_M)\right]. \tag{A.27}$$

From Lemma 3.1, we know that $\frac{\partial x^p_{ME}}{\partial \beta} < 0$ for $\mu \in [0,1)$. Thus, Line (A.26) is positive. Given our assumptions on all exogenous parameters, Line (A.27) is also positive. We conclude that $\left.\frac{\partial W}{\partial \beta}\right|_{0+} > 0$. Thus, $\beta = 0$ cannot be optimal.
Next, we show that $\bar{\beta}$ does not maximize $W(\beta)$. We consider Equation (A.24) again and

we obtain

$$\lim_{\beta\to\bar{\beta}^-}\frac{\partial W}{\partial \beta} = \theta_M(1-\mu)\left.\frac{\partial x^p_{MN}}{\partial \beta}\right|_{\bar{\beta}^-}\underbrace{\lim_{\beta\to\bar{\beta}^-} u'\left(x^p_{MN}\left(\bar{\beta}\right)\right)}_{=+\infty}$$

$$+ \theta_M \mu u'\left(x^p_{ME}\left(\bar{\beta}\right)\right)\left.\frac{\partial x^p_{ME}}{\partial \beta}\right|_{\bar{\beta}^-}$$

$$+ \frac{\gamma}{1+\lambda}\left[\frac{\theta_M(1-\mu)\left[\Omega - \theta_M x^p_{ME}(\bar{\beta})\right]}{\left(1-\bar{\beta}\theta_M(1-\mu)\right)^2} - \left(\frac{\theta_M}{1-\bar{\beta}\theta_M(1-\mu)}\right)\left.\frac{\partial x^p_{ME}}{\partial \beta}\right|_{\bar{\beta}^-}\right].$$

From Lemma 3.1, we know that $\frac{\partial x^p_{MN}}{\partial \beta} < 0$ for $\mu \in [0,1)$. While the second and the third summands remain finite, the first summand goes to $(-\infty)$ when $\beta \to \bar{\beta}^-$. This is due to the fact that $x^p_{MN}(\bar{\beta}) = 0$ and that by the Inada Conditions, $u'(0) \to \infty$. Thus, at $\bar{\beta}$, the function $W(\,\cdot\,)$ is decreasing in β, and $W(\bar{\beta}-\varepsilon) > W(\bar{\beta})$, with ε having a small positive value. Consequently, $\bar{\beta}$ is not the maximizer of $W(\,\cdot\,)$.
Given that the maximum of $W(\,\cdot\,)$ is not at the corners, there exists $\beta^* \in (0,\bar{\beta})$ which is the interior maximizer of $W(.)$.

Proof of Proposition 3.5

- Proof of Statement (i):
  To see if the Elites are better off with the incentive contract, we take the derivative of the Elites' interim expected utility (Equation (3.33)) with respect to β and we obtain

$$\frac{\partial \mathcal{U}_E}{\partial \beta} = \theta_M \underbrace{\frac{\partial x^p_{ME}(\beta)}{\partial \beta}}_{<0}\underbrace{u'\left(x^p_{ME}(\beta)\right)}_{>0}$$
$$+ \underbrace{\frac{\gamma\theta_M}{1+\lambda}\left(\frac{1}{1-\beta\theta_M(1-\mu)}\right)\left[-\frac{\partial x^p_{ME}(\beta)}{\partial \beta} + (1-\mu)\left(\frac{\Omega-\theta_M x^p_{ME}(\beta)}{1-\beta\theta_M(1-\mu)}\right)\right]}_{>0}.$$

  Here, we have substituted for the public-good spending from Equation (3.30) and we have used our assumption about the utility of private-good consumption which is normalized to zero at $x^p_m = 0$.
  From Lemma 3.1, we know that $\frac{\partial x^p_{ME}(\beta)}{\partial \beta} < 0$ for $\mu \in [0,1)$. We see that the first line is negative and the second line is positive. Reordering and rewriting the equation

above, we obtain

$$\frac{\partial \mathcal{U}_E}{\partial \beta} = \frac{\gamma\theta_M(1-\mu)}{1+\lambda}\frac{[\Omega - \theta_M x^p_{ME}(\beta)]}{(1-\beta\theta_M(1-\mu))^2}$$

$$+ \theta_M \frac{\partial x^p_{ME}(\beta)}{\partial \beta}\left(u'\left(x^p_{ME}(\beta)\right) - \frac{\gamma}{1+\lambda}\left(\frac{1}{1-\beta\theta_M(1-\mu)}\right)\right).$$

While the first line is positive, the second line is the sum of a negative and a positive term. For $\frac{\partial \mathcal{U}_E}{\partial \beta}$ to be positive, ($\frac{\partial \mathcal{U}_E}{\partial \beta} > 0$), the second line has to be positive. Given $\frac{\partial x^p_{ME}(\beta)}{\partial \beta} < 0$, it is sufficient to show that

$$u'\left(x^p_{ME}(\beta)\right) - \frac{\gamma}{(1+\lambda)\left[1-\beta\theta_M(1-\mu)\right]} < 0.$$

Substituting from Equation (3.29), we see that the above inequality corresponds to

$$\frac{\gamma\theta_M}{(1+\lambda)\left[1-\beta\theta_M(1-\mu)\right]} - \frac{\gamma}{(1+\lambda)\left[1-\beta\theta_M(1-\mu)\right]} < 0. \tag{A.28}$$

Given $\frac{1}{2} \leq \theta_M < 1$, the above inequality always holds.

- Proof of Statement (ii):
  To see if the Non-elites are better off with the incentive contract, we take the derivative of the Non-elites' interim expected utility (Equation (3.34)) with respect to β and we obtain

$$\frac{\partial \mathcal{U}_{NE}}{\partial \beta} = \theta_M \left[\underbrace{\frac{\partial x^p_{MN}(\beta)}{\partial \beta}}_{<0}\underbrace{u'\left(x^p_{MN}(\beta)\right)}_{>0}\right.$$

$$\left. + \underbrace{\frac{\gamma}{1+\lambda}\left(\frac{1}{1-\beta\theta_M(1-\mu)}\right)\left[-\frac{\partial x^p_{ME}(\beta)}{\partial \beta} + (1-\mu)\left(\frac{\Omega - \theta_M x^p_{ME}(\beta)}{1-\beta\theta_M(1-\mu)}\right)\right]}_{>0}\right].$$

In the above, we have substituted for the public-good spending from Equation (3.30) and we have used our assumption about the utility of private-good consumption which is normalized to zero at $x^p_m = 0$.
From Lemma 3.1, we know that $\frac{\partial x^p_{MN}(\beta)}{\partial \beta} < 0$ for $\mu \in [0, 1)$. We see that the first line is negative and the second line is positive. For $\frac{\partial \mathcal{U}_{NE}}{\partial \beta}$ to be positive, $\frac{\partial \mathcal{U}_{NE}}{\partial \beta} \geq 0$, given $\frac{1}{2} \leq \theta_M < 1$, we have to show that the term in the large bracket above is

positive,

$$\frac{\partial x^p_{MN}(\beta)}{\partial \beta} u'\left(x^p_{MN}(\beta)\right) - \frac{\partial x^p_{ME}(\beta)}{\partial \beta} \frac{\gamma}{1+\lambda} \left(\frac{1}{1-\beta\theta_M(1-\mu)}\right) + \left(\frac{\gamma(1-\mu)}{1-\beta\theta_M(1-\mu)}\right) K^p_g(\beta) \geq 0.$$

In the above inequality, we substitute for $\frac{\partial x^p_{MN}}{\partial \beta} = \frac{\partial x^p_{ME}}{\partial \beta} - (1+\lambda)K^p_g(\beta) - \beta(1+\lambda)\frac{\partial K^p_g}{\partial \beta}$. We obtain

$$u'\left(x^p_{MN}\right)\left[\frac{\partial x^p_{ME}}{\partial \beta} - (1+\lambda)K^p_g(\beta) - \beta(1+\lambda)\frac{\partial K^p_g}{\partial \beta}\right]$$

$$- \frac{\partial x^p_{ME}}{\partial \beta}\frac{\gamma}{1+\lambda}\left(\frac{1}{1-\beta\theta_M(1-\mu)}\right) + \left(\frac{\gamma(1-\mu)}{1-\beta\theta_M(1-\mu)}\right)K^p_g \geq 0.$$

We substitute for $\frac{\partial K^p_g}{\partial \beta} = \frac{\theta_M(1-\mu)}{1-\beta\theta_M(1-\mu)}K^p_g - \frac{\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\frac{\partial x^p_{ME}}{\partial \beta}$ and for $u'\left(x^p_{ME}\right)$ from Equation (3.29). With further reordering, we obtain

$$\frac{\partial x^p_{ME}}{\partial \beta}\underbrace{\left[\left(\frac{1+\beta\theta_M\mu}{1-\beta\theta_M(1-\mu)}\right)u'\left(x^p_{MN}\right) - \frac{1}{\theta_M}u'\left(x^p_{ME}\right)\right]}_{\leq 0}$$

$$+K^p_g\underbrace{\left[\frac{(1-\mu)}{1-\beta\theta_M(1-\mu)}\left[\frac{\gamma}{1+\lambda} - \beta\theta_M u'\left(x^p_{MN}\right)\right] - (1+\lambda)\right]}_{\geq 0} \geq 0. \qquad \text{(A.29)}$$

Inequality (A.29) holds when the first bracket is negative and the second bracket is positive. The former requires $\frac{\theta_M(1+\beta\theta_M\mu)}{1-\beta\theta_M(1-\mu)} < \frac{u'\left(x^p_{ME}\right)}{u'\left(x^p_{MN}\right)}$. For small β values, this is always the case, since $\theta_M < 1$.

Similarly, for the second bracket to be positive, it is necessary for β to be small. At the limit, when β is very small, the term in the second bracket approaches $\frac{(1-\mu)\gamma}{(1+\lambda)} - (1+\lambda)$. And for $\frac{(1-\mu)\gamma}{(1+\lambda)} - (1+\lambda)$ to be positive, μ has to be $\mu \leq 1 - \frac{(1+\lambda)^2}{\gamma}$. Given our assumption that $\gamma \geq (1+\lambda)^2$, we ensure $0 \leq \mu < 1$.

Proof of Corollary 3.1

(i) To prove ($\Rightarrow$), we show that if $\mu \in \left[0, \frac{1}{2}\right)$, then β^* is not implementable.
We begin by rewriting the social welfare function in Equation (3.32) in terms of the sum of the Elites' and the Non-elites' interim expected utilities (as in Equations

(3.33) and (3.34)).

$$\begin{aligned}W(\beta) &= \theta_M(1-\mu)u(x^p_{MN}(\beta)) + \theta_M\mu u(x^p_{ME}(\beta)) + \theta_m u(x^p_m(\beta)) + \gamma K^p_g(\beta)\\ &= \mu\left[\theta_M u\left(x^p_{ME}(\beta)\right) + \theta_m u\left(x^p_m\right) + \gamma K^p_g\left(\beta\right)\right]\\ &+ (1-\mu)\left[\theta_M u\left(x^p_{MN}(\beta)\right) + \theta_m u\left(x^p_m\right) + \gamma K^p_g\left(\beta\right)\right]\\ &= \mu\mathcal{U}_E\left(\beta\right) + (1-\mu)\mathcal{U}_{NE}\left(\beta\right).\end{aligned}$$

Taking the derivative with respect to β leads to

$$\frac{\partial W(\beta)}{\partial\beta} = \mu\frac{\partial\mathcal{U}_E}{\partial\beta} + (1-\mu)\frac{\partial\mathcal{U}_{NE}}{\partial\beta}. \tag{A.30}$$

Since β^* is an interior solution to the problem of maximizing $W(\beta)$, the left-hand side of Equation (A.30) at β^* is equal to zero. By Statement (i) in Proposition 3.5, $\frac{\partial\mathcal{U}_E}{\partial\beta}$ is strictly positive for all β values. Consequently, $\frac{\partial\mathcal{U}_{NE}}{\partial\beta}$ at β^* has to be strictly negative.
Given $\frac{\partial\mathcal{U}_{NE}(\beta^*)}{\partial\beta} < 0$, the Non-elites are not in favor of the contract. If the Elites do not have the majority and $\mu \in [0, \frac{1}{2})$, the contract β^* is not implementable. Equivalently, if the contract β^* is implementable, then $\mu \in [\frac{1}{2}, 1)$.
To prove ($\Leftarrow$), we recall from Proposition 3.5 that the Elites are better off with the contract for all $\beta \in [0, \bar{\beta}]$. We note that if $\mu \in [\frac{1}{2}, 1)$, the Elites have the majority in the society. Thus, the contract β^* has the support of the majority and it is implementable.

(ii) We first establish that any contract that makes the Non-elites interim better off is implementable.
From Statement (i) in Proposition 3.5 we know that the Elites are in favor of the contract for all $\beta \in [0, \bar{\beta}]$. Given Statement (ii) in Proposition 3.5, for $\mu \le 1 - \frac{(1+\lambda)^3}{\gamma}$ and β small enough, the Non-elites are interim better off with the incentive contract. If the Non-elites are in favor of the contract, the contract has the support of everyone in the society and it is implementable.
We now establish that any contract that makes the Non-elites interim better off is welfare improving. This is clear from Equation (A.30). On the right-hand side, the Elites' interim utility is strictly increasing for all $\beta \in [0, \bar{\beta}]$ and the Non-elites' interim utility is increasing in β for $\mu \le 1 - \frac{(1+\lambda)^3}{\gamma}$ and β small enough. Thus, the left-hand side is strictly positive, $\frac{\partial W}{\partial\beta} > 0$.

Proof of Proposition 3.6

To establish Statement (i), we first examine Inequality (3.45) at $\beta = 0$. We obtain

$$u'\left((1-b)\omega_M\right) \geq \frac{\gamma\theta_M}{1+\lambda}. \tag{A.31}$$

We recall from the proof of Proposition 3.2 that Inequality (A.31) does not hold if $b < b_c$ and b_c is given by Equation (A.6). We observe that for $b < b_c$, Inequality (3.45) does not hold. Thus, the policy-maker's problem at $\beta = 0$ does not have any interior solution, and the solution is described by the corner solution in Case 2.

Next, we examine Inequality (3.45) for $\beta > 0$. We define

$$h(\beta) := (u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - (1-b)\omega_M - \frac{\beta b\Omega}{1+\mu\theta_M\beta}. \tag{A.32}$$

As defined $h(\beta)$ is a continuous function for any given $b \in [0,1]$ and for all $\beta < \frac{1}{\theta_M(1-\mu)}$. We take the derivative of $h(\beta)$ with respect to β. We obtain

$$\frac{\partial h(\beta)}{\partial \beta} = \frac{\gamma\theta_M(1-\mu)}{(1+\lambda)\left(1-\beta\theta_M(1-\mu)\right)^2}(u'^{-1})'\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{b\Omega}{1+\mu\theta_M\beta}.$$

Given our assumption on $u(\,\cdot\,)$, $(u'^{-1})'(\,\cdot\,)$ exists and it is negative. We observe that $\frac{\partial h(\beta)}{\partial \beta} < 0$.

First, we note that $h(0) = (u')^{-1}\left(\frac{\gamma\theta_M}{1+\lambda}\right) - (1-b)\omega_M$. Given Inequality (3.45) at $\beta = 0$ and $b < b_c$ does not hold, we conclude $h(0) < 0$ for all $b < b_c$. Since for all $b < b_c$, $h(0) < 0$ and $h(\beta)$ is a strictly decreasing function, we conclude that $h(\beta) < 0$ for all $\beta \geq 0$ and $b < b_c$.

If $h(\beta) < 0$ for all $\beta \geq 0$ and $b < b_c$, then Inequality (3.45) cannot hold for all $\beta \geq 0$ and $b < b_c$. Thus, the policy-maker's problem does not have any interior solution for all $\beta \geq 0$ and $b < b_c$ and the solution to the policy-maker's problem is described by the corner solution in Case 2.

To prove (ii), we first prove that there exists a unique $\bar{\beta}_b$ for all $b \in [b_c, 1]$ given by Equation (3.46). For this purpose, we consider the interior solution to the policy-maker's problem. We rewrite the interior solution of $x^p_{MN}(\beta)$ by using Equation (3.38). We obtain

$$x^p_{MN}(\beta) = \frac{1+\mu\theta_M\beta}{1-\beta\theta_M(1-\mu)}\left[(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{(1-b)\beta\theta_M\omega_M}{1+\mu\theta_M\beta} - \frac{\beta b\Omega}{1+\mu\theta_M\beta}\right]. \tag{A.33}$$

By using Equation (A.33), we define

$$I(\beta) := x^p_{MN}(\beta) - (1-b)\omega_M$$
$$= \underbrace{\frac{1+\mu\theta_M\beta}{1-\beta\theta_M(1-\mu)}}_{>0} \underbrace{\left[(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - (1-b)\omega_M - \frac{\beta b\Omega}{1+\mu\theta_M\beta}\right]}_{=h(\beta)}. \tag{A.34}$$

We note that $I(\beta)$ can only be zero if the term in brackets is zero, and that the term in brackets is, in fact, equal to $h(\beta)$ from Equation (A.32). Moreover, $I(\beta)$ and $h(\beta)$ have the same sign.

Next, we establish that there exists $\bar{\beta}_b$ such that $x^p_{MN}(\bar{\beta}_b) = (1-b)\omega_M$. For this purpose, we show that $h(0)$ and $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} h(\beta)$ have different signs.

To calculate $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} h(\beta)$, we first recall from the Inada Conditions that

$$\lim_{x\to 0} u'(x) = \infty.$$

Consequently, $\lim_{x\to\infty}(u')^{-1}(x) = 0$. Thus, we obtain

$$\begin{aligned}\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} h(\beta) &= \lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} \left[(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - (1-b)\omega_M - \frac{\beta b\Omega}{1+\mu\theta_M\beta}\right],\\ &= \lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} (u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) - \frac{b\Omega}{\theta_M} - \omega_M(1-b),\\ &= 0 - \frac{b\Omega}{\theta_M} - (1-b)\omega_M.\end{aligned}$$

Thus, we have established $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} h(\beta) < 0$.

To calculate $h(0)$, we substitute for $\beta = 0$ in Equation (A.32). We obtain

$$h(0) = (u')^{-1}\left(\frac{\gamma\theta_M}{1+\lambda}\right) - (1-b)\omega_M.$$

Since $b \in [b_c, 1]$ and by using Equation (A.7) and Equation (3.16), we observe that at $b = b_c$, $h(0) = 0$ and consequently, $I(0) = 0$. Moreover, for $b \in (b_c, 1]$, we observe $h(0) > 0$ and consequently, $I(0) > 0$. We have established that $I(0)$ and $\lim_{\beta\to\left(\frac{1}{\theta_M(1-\mu)}\right)^-} I(\beta)$ have different signs.

Given our assumptions on $u(\,\cdot\,)$, $I(\beta)$ is a continuous function for all $\beta \in \left[0, \frac{1}{\theta_M(1-\mu)}\right)$.

Since $I(\beta)$ is continuous, there exists $d \in \left[0, \frac{1}{\theta_M(1-\mu)}\right)$ which is as close as we want it to $\frac{1}{\theta_M(1-\mu)}$ such that $I(d)$ and $\lim_{\beta \to \left(\frac{1}{\theta_M(1-\mu)}\right)^-} I(\beta)$ have the same sign. Consequently, $I(0)$ and $I(d)$ have opposite signs. Thus, by the Intermediate Value Theorem, there exists a $\bar{\beta}_b \in [0, d] \subset \left[0, \frac{1}{\theta_M(1-\mu)}\right)$ such that $I\left(\bar{\beta}_b\right) = 0$.[1] By Equation (A.34), we observe that if $I(\bar{\beta}_b) = 0$, then $x^p_{MN}(\bar{\beta}) = (1-b)\omega_M$.

The preceding analysis proves that there exists a $\bar{\beta}_b$ such that $x^p_{MN}(\bar{\beta}_b) = (1-b)\omega_M$ and satisfies $h(\bar{\beta}_b) = 0$, i.e.

$$(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\bar{\beta}_b\theta_M(1-\mu))}\right) = \frac{\bar{\beta}_b\Omega}{1+\mu\theta_M\bar{\beta}_b} + (1-b)\omega_M. \tag{A.35}$$

To show that $\bar{\beta}_b$ is unique, we recall from Lemma 3.1 that $x^p_{MN}(\beta)$ is strictly decreasing. Thus, there is a unique $\bar{\beta}_b$ such that $x^p_{MN}(\bar{\beta}_b) = (1-b)\omega_M$. Given Equation (A.33), the unique $\bar{\beta}_b$ that sets $x^p_{MN}(\bar{\beta}_b) = (1-b)\omega_M$, satisfies Equation (A.35). Equation (A.35) gives us a unique expression of $\bar{\beta}_b$ as an implicit function of exogenous parameters.

Next, we prove that for all $b \in [b_c, 1]$ and $\beta \in [0, \bar{\beta}_b]$, Case 1 describes the solution to the policy-maker's problem.

Let $0 \le \beta \le \bar{\beta}_b$ for all $b \in [b_c, 1]$. Equation (3.29) in Case 1 gives the interior solution to the policy-maker's problem, $x^p_{MN}(\beta)$, as an implicit function of β. We want to prove that the interior solution is the unique optimal solution. For this purpose, we next establish that $x^p_{MN}(\beta)$ is positive for all $\beta \in [0, \bar{\beta}_b]$.

First, we recall that $x^p_{MN}\left(\bar{\beta}_b\right) = (1-b)\omega_M$. Second, from Equation (3.36), at $\beta = 0$ we have $x^p_{MN}(0) = x^p_{ME}(0)$. By using Equation (3.37) to calculate $x^p_{ME}(0)$, we obtain $x^p_{ME}(0) = \max\{x^p_c, (1-b)\omega_M\}$, where x^p_c is given by Equation (3.16). Since $b \in [b_c, 1]$, we obtain $x^p_{ME}(0) = x^p_c$ and given $x^p_{MN}(0) = x^p_{ME}(0)$, we have $x^p_{MN}(0) > 0$. Finally, by Lemma 3.1, we know that x^p_{MN} is a strictly decreasing function of β. Since x^p_{MN} is a strictly decreasing and continuous function of β, we have $x^p_{MN} \in [0, x^p_c]$ for all $\beta \in \left[0, \bar{\beta}_b\right]$, i.e. $x^p_{MN}(\beta)$ is positive for all $\beta \in [0, \bar{\beta}_b]$.

Since $x^p_{MN}(\beta) \ge (1-b)\omega_M$ for all $\beta \in [0, \bar{\beta}]$, given Equation (A.34), $I(\beta) \ge 0$. Thus, $h(\beta) \ge 0$. From $h(\beta) \ge 0$, by using Equation (A.32), we obtain

$$(u')^{-1}\left(\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}\right) \ge \frac{\beta b\Omega}{1+\mu\theta_M\beta} + (1-b)\omega_M. \tag{A.36}$$

Since $(u')^{-1}(\,\cdot\,)$ is strictly decreasing, if Inequality (A.36) holds, we obtain

$$\frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))} \le u'\left(\frac{\beta b\Omega}{1+\mu\theta_M\beta} + (1-b)\omega_M\right). \tag{A.37}$$

[1] We note that for $b = b_c$, $\bar{\beta}_{b_c} = 0$ such that $I(0) = 0$ and for all $b \in (b_c, 1]$, $\bar{\beta}_b > 0$ such that $I(\bar{\beta}_b) = 0$.

Inequality (A.37) is the same as Inequality (3.45). Since Inequality (3.45) holds, the optimal solution to the policy-maker's problem is interior.
Additionally, from the proof of Proposition 3.3, we know that the second-order condition for the policy-maker's problem is strictly decreasing, and that the policy-maker's problem has a unique interior solution. Finally, we observe that the interior solution to the policy-maker's problem uniquely maximizes the policy-maker's utility for $\beta \in [0, \bar{\beta}_b]$ and for all $b \in [b_c, 1]$.
To prove (iii), we return to $h(\beta)$ and examine it for $b \in [b_c, 1]$ and $\beta \geq \bar{\beta}_b$. From the proof of statement (ii), we know that for any given $b \in [b_c, 1]$ and at $\bar{\beta}_b$, we have $h(\bar{\beta}_b) = 0$. Since $\frac{\partial h(\beta)}{\partial \beta} < 0$, for any given $b \in [b_c, 1]$ and $\beta > \bar{\beta}_b$, we have $h(\beta) < 0$. From Equation (A.32), we can see that if $b \in [b_c, 1]$ and $\beta \geq \bar{\beta}_b$, then Inequality (3.45) cannot hold. Thus, the solution to the policy-maker's problem is described by the corner solution in Case 2.

Proof of Theorem 3.2

We examine the maximization problem of $W(\beta)$ over $[0, \bar{\beta}_b]$, $\forall b \in (b_c, 1)$.

$$\max_{\beta \in [0, \bar{\beta}_b]} \quad W(\beta) = \theta_M(1-\mu)u(x^p_{MN}(\beta)) + \theta_M \mu u(x^p_{ME}(\beta)) + \theta_m u(x^p_m) + \frac{\gamma}{1+\lambda} \frac{[\Omega - \theta_M x^p_{ME}(\beta)]}{1 - \beta\theta_M(1-\mu)}. \tag{A.38}$$

The ex-ante welfare function is given by Equation (3.32). We note that for $\beta \in [0, \bar{\beta}_b]$, by Proposition 3.6, the policy-maker's problem has a unique interior optimal solution given by Equations (3.36), (3.37) and (3.44). We have substituted for $K^p_g(\beta)$ from (3.44) in Equation (3.32).
The function $W(\beta)$ is continuous on $\beta \in [0, \bar{\beta}_b]$, $\forall b \in (b_c, 1)$. By the Extreme Value Theorem, $W(\beta)$ has a maximum and a minimum on $[0, \bar{\beta}_b]$.
At the lower-bound, $W(0)$ is not maximized.

$$\lim_{\beta \to 0} \frac{\partial W}{\partial \beta} = \frac{\partial x^p_{ME}}{\partial \beta} \theta_M u'(x^p_{MN})$$

$$+ \gamma \frac{\partial K^p_g}{\partial \beta}$$

$$- \theta_M(1-\mu)\left[\Omega - \theta_M x^p_{ME} - \theta_m x^p_m\right] u'(x^p_{MN}).$$

Substituting for $\lim_{\beta\to 0} u'(x^p_{MN}) = \frac{\gamma\theta_M}{1+\lambda}$, we obtain

$$\lim_{\beta\to 0}\frac{\partial W}{\partial \beta} = \underbrace{\frac{\partial}{\partial x}u'^{-1}\left(\frac{\gamma\theta_M}{1+\lambda}\right)}_{<0}\left[\frac{\gamma\theta_M^2(1-\mu)}{1+\lambda}\underbrace{\left(\frac{\gamma\theta_M^2}{1+\lambda}-\frac{\gamma\theta_M}{1+\lambda}-1\right)}_{<0}\right]$$

$$+\,\Omega\frac{\gamma\theta_m\theta_M(1-\mu)}{1+\lambda}$$

$$+\,\theta_M(1-\mu)\frac{\gamma\theta_M}{1+\lambda}\left[x^p_{MN}+\theta_m\omega_m(1-b)\right].$$

We can see that $\lim_{\beta\to 0}\frac{\partial W}{\partial\beta} > 0$. This implies that $W(\varepsilon) > W(0)$ with ε having a very small positive value. Therefore, $W(0)$ is not the maximum. Given that the maximum of $W(.)$ is not at the lower-bound, there exists $\beta_b^* \in \left(0, \bar{\beta}_b\right]$.

B Appendix to Chapter 4

Proof of Lemma 4.1

First, we prove $x_m^{p_{alt}} < x^s$. As required by Equation (3.4), the optimal private-good consumption is given by $u'(x^s) = \frac{\gamma}{1+\lambda}$. For a finite $\eta > 0$ and using Equation (4.2) for $x_m^{p_{alt}}$, we see

$$u'\left(x_m^{p_{alt}}\right) > u'(x^s).$$

Given, $u'(\,\cdot\,)$ is strictly decreasing, $x_m^{p_{alt}} < x^s$. Next, we prove $x_M^{p_{alt}} < x_M^p$. This follows from the majority endowment group's private-good consumption $u'(x_M^p) = \frac{\gamma\theta_M}{1+\lambda}$, as given by Equation (3.7). For any finite $\eta > 0$ and given that $\frac{1}{2} \leq \theta_M < 1$, we have $\frac{1+\eta}{1+\eta\theta_M} > 1$. Thus, we have

$$\frac{\gamma\theta_M}{1+\lambda} < \left(\frac{\gamma\theta_M}{1+\lambda}\right)\frac{1+\eta}{1+\eta\theta_M}.$$

The left hand side is equal to $u'(x_M^p)$ and the right hand side is equal to $u'\left(x_M^{p_{alt}}\right)$. Given, $u'(\,\cdot\,)$ is strictly decreasing, we have $x_M^{p_{alt}} < x_M^p$. Next, we prove $x^s < x_M^{p_{alt}}$. For any finite $\eta > 0$ and given that $\frac{1}{2} \leq \theta_M < 1$, we have $\frac{\theta_M(1+\eta)}{1+\eta\theta_M} < 1$. Thus, we have

$$\frac{\gamma}{1+\lambda} > \left(\frac{\gamma}{1+\lambda}\right)\frac{\theta_M(1+\eta)}{1+\eta\theta_M}$$

The left hand side is equal to $u'(x^s)$ (as required by Equation (3.4)) and the right hand side is equal to $u'\left(x_M^{p_{alt}}\right)$ (as given by Equation (4.3)). Given, $u'(\,\cdot\,)$ is strictly decreasing, we have $x^s < x_M^{p_{alt}}$.
Finally, we prove $0 < x_m^{p_{alt}}$. Given Equation (4.2), the marginal utility of consumption at $x_m^{p_{alt}}$ for a finite $\eta > 0$ is finite. Since the Inada Conditions require $\lim_{x\to 0} u'(x) = +\text{"}\infty\text{"}$, it is clear that $x_m^{p_{alt}}$ is non-zero. Since $x_m^{p_{alt}}$ is a solution to the altruistic policy-maker's problem, which is constrained to $0 \leq x_i \leq \omega_i,\ i = M, m$, $x_m^{p_{alt}}$ is not negative either. Thus, $0 < x_m^{p_{alt}}$.

Proof of Proposition 4.1

Under the altruistic policy-maker, the public-good under-provision is characterized by Inequality (4.6). To show that the public good is under-provided, we have to show that $\theta_M x_M^{p_{alt}} + \theta_m x_m^{p_{alt}} > x^s$. By Lemma 4.1, we know that $x_M^{p_{alt}} > x^s$ and that $x_m^{p_{alt}} > 0$. Given $x_M^{p_{alt}} > x^s$ and $x_m^{p_{alt}} > 0$, to prove under-provision, it is enough to show that $\theta_M x_M^{p_{alt}} > x^s$. Since $u(.)$ is strictly concave, $u'(.)$ is strictly decreasing. Therefore, the inverse function of $u'(.)$, i.e. $u'^{-1}(.)$, is also strictly decreasing. Since $\frac{1}{2} \leq \theta_M < 1$ and $u'^{-1}(.)$ is strictly decreasing, and substituting for $x_M^{p_{alt}}$ from Equation (4.3), it holds true that

$$u'^{-1}\left(\left[\frac{\gamma\theta_M}{1+\lambda}\right]\frac{1+\eta}{1+\eta\theta_M}\right) > u'^{-1}\left(\left[\frac{\gamma}{1+\lambda}\right]\frac{1+\eta}{1+\eta\theta_M}\right) > u'^{-1}\left(\left[\frac{\gamma}{1+\lambda}\right]\frac{1+\eta}{1+\eta\theta_M}\theta_M^{-1}\right). \quad \text{(B.1)}$$

Suppose $u'''(.)$ is non-negative. Since $u'(.)$ is strictly decreasing and convex, $u'^{-1}(.)$ is also convex. For $\frac{1}{2} \leq \theta_M < 1$, this implies

$$u'^{-1}\left(\left[\frac{\gamma}{1+\lambda}\right]\frac{1+\eta}{1+\eta\theta_M}\theta_M^{-1}\right) \geq \theta_M^{-1}u'^{-1}\left(\left[\frac{\gamma}{1+\lambda}\right]\frac{1+\eta}{1+\eta\theta_M}\right). \quad \text{(B.2)}$$

Combining Inequalities (B.1) and (B.2), we obtain

$$x_M^{p_{alt}} \geq \theta_M^{-1}u'^{-1}\left(\left[\frac{\gamma}{1+\lambda}\right]\frac{1+\eta}{1+\eta\theta_M}\right). \quad \text{(B.3)}$$

Moreover, since $\frac{1+\eta}{1+\eta\theta_M} > 1$ and u'^{-1} is strictly decreasing, we have

$$u'^{-1}\left(\left[\frac{\gamma}{1+\lambda}\right]\frac{1+\eta}{1+\eta\theta_M}\right) > u'^{-1}\left(\frac{\gamma}{1+\lambda}\right) = x^s. \quad \text{(B.4)}$$

Finally, combining Inequalities (B.3) and (B.4), we obtain $\theta_M x_M^{p_{alt}} > x^s$. Since $\theta_m x_m^{p_{alt}} > 0$, we observe that

$$\theta_M x_M^{p_{alt}} + \theta_m x_m^{p_{alt}} > x^s.$$

Proof of Lemma 4.2

(i) The outsiders' post-election utility is given by Equation (4.32). Taking the derivative of the outsiders' post-election utility with respect to β, we have

$$\frac{\partial U_q}{\partial \beta} = \underbrace{\frac{\partial x_q^p}{\partial \beta}}_{=0} u'\left(x_q^p\right) + \gamma \underbrace{\frac{\partial K_g^p}{\partial \beta}}_{>0}.$$

By Lemma 3.1, Statement (ii), we know that $\frac{\partial K_g^p}{\partial \beta} > 0$. Thus, the outsiders' post-election utility is strictly increasing with β.

(ii) We next show that $\frac{\partial U_{pE}}{\partial \beta} > 0$. The *Group-p* Elites' post-election utility is given by Equation (4.30). Taking the derivative with respect to β, we have

$$\frac{\partial U_{pE}}{\partial \beta} = \frac{\partial x_{pE}^p(\beta)}{\partial \beta} u'\left(x_{pE}^p(\beta)\right) + \gamma \frac{\partial K_g^p}{\partial \beta}. \tag{B.5}$$

By using Equation (4.29), we calculate $\frac{\partial K_g^p}{\partial \beta}$ and we obtain

$$\frac{\partial K_g^p}{\partial \beta} = \frac{\partial x_{pE}^p(\beta)}{\partial \beta}\left(\frac{-\theta_p}{(1+\lambda)(1-\beta\theta_p(1-\mu))}\right) + \frac{\theta_p(1-\mu)\left[\Omega - \theta_p x_{pE}^p(\beta)\right]}{(1+\lambda)(1-\beta\theta_p(1-\mu))^2}. \tag{B.6}$$

Substituting for $\frac{\partial K_g^p}{\partial \beta}$ from Equation (B.6) into Equation (B.5), and reordering it, we obtain

$$\frac{\partial U_{pE}}{\partial \beta} = \underbrace{\frac{\partial x_{pE}^p(\beta)}{\partial \beta}}_{<0} \underbrace{\left[u'\left(x_{pE}^p(\beta)\right) - \frac{\gamma\theta_p}{(1+\lambda)\left[1-\beta\theta_p(1-\mu)\right]}\right]}_{<0} \tag{B.7}$$

$$+ \underbrace{\frac{\gamma\theta_p(1-\mu)\left[\Omega - \theta_p x_{pE}^p(\beta)\right]}{(1+\lambda)\left(1-\beta\theta_p(1-\mu)\right)^2}}_{>0}. \tag{B.8}$$

By Lemma 3.1, Statement (i), we know that $\frac{\partial x_{pE}^p}{\partial \beta} < 0$. Moreover, substituting for $u'\left(x_{pE}^p(\beta)\right) = u'\left(x_{pN}^p(\beta) + \beta(1+\lambda)K_g^p\right)$ and by using Equation (4.27), we see that the term in brackets in Line (B.7) is equal to zero,

$$\frac{\gamma\theta_p}{(1+\lambda)\left[1-\beta\theta_p\left(1-\mu\right)\right]} - \frac{\gamma\theta_p}{(1+\lambda)\left[1-\beta\theta_p(1-\mu)\right]} = 0.$$

We see that Line (B.7) is equal to zero and Line (B.8) is strictly positive. Consequently, $\frac{\partial U_{pE}}{\partial \beta} > 0$.

(iii) We next show that $\frac{\partial U_{pN}}{\partial \beta} < 0$. The majority-endowment-group Non-elites' post-election utility is given by Equation (4.31). We take the derivative with respect to β,

$$\frac{\partial U_{pN}}{\partial \beta} = \frac{\partial x_{pN}^p}{\partial \beta} u'\left(x_{pN}^p\right) + \gamma \frac{\partial K_g^p}{\partial \beta}.$$

In $\frac{\partial x_{pN}^p}{\partial \beta}$, we substitute for x_{pN}^p from Equation (4.28). This yields

$$\frac{\partial U_{pN}}{\partial \beta} = u'\left(x_{pN}^p\right)\frac{\partial x_{pE}^p}{\partial \beta} - u'\left(x_{pN}^p\right)(1+\lambda)K_g^p(\beta) - u'\left(x_{pN}^p\right)\beta(1+\lambda)\frac{\partial K_g^p}{\partial \beta} + \gamma\frac{\partial K_g^p}{\partial \beta}.$$

Reordering, we obtain

$$\begin{aligned}\frac{\partial U_{pN}}{\partial \beta} = & \underbrace{-u'\left(x_{pN}^p\right)\left[-\frac{\partial x_{pE}^p}{\partial \beta} + (1+\lambda)K_g^p(\beta)\right]}_{<0} \\ & + \gamma\frac{\partial K_g^p}{\partial \beta}\left[1 - \frac{u'\left(x_{pN}^p\right)\beta(1+\lambda)}{\gamma}\right]. \end{aligned} \tag{B.9}$$

By Lemma 3.1, Statement (iii), we know that $\frac{\partial x_{pN}^p}{\partial \beta} < 0$. Given $K_g^p \geq 0$, in the right hand side of Equation (B.9), the first line is always negative. The second line in the right hand side of Equation (B.9) can be positive or negative. If it is negative then it is clear that $\frac{\partial U_{pN}}{\partial \beta} < 0$. In the following, we show that if the second line is positive, it is smaller than the first line (in absolute values).

Consider the case where the second line is positive. From Lemma 3.1, Statement (ii), we know that $\frac{\partial K_g^p}{\partial \beta} > 0$. Given $\frac{\partial K_g^p}{\partial \beta} > 0$ and $\gamma > 0$, for the second line to be positive, the term in the brackets has to be positive. Given $u'(\cdot) > 0, \gamma > 0, 1+\lambda > 0$ and $\beta \geq 0$, the term in the brackets is positive only if $\beta < \frac{\gamma}{u'\left(x_{pN}^p\right)(1+\lambda)}$. Finally, if $\beta < \frac{\gamma}{u'\left(x_{pN}^p\right)(1+\lambda)}$, then the term in brackets is smaller than one $1 - \frac{u'\left(x_{pN}^p\right)\beta(1+\lambda)}{\gamma} \leq 1$. Using Equation (3.30) for $K_g^p(\beta)$, we have

$$\frac{\partial K_g^p}{\partial \beta} = -\frac{u'\left(x_{pE}^p\right)}{\gamma}\frac{\partial x_{pE}^p}{\partial \beta} + \frac{(1-\mu)(1+\lambda)u'\left(x_{pE}^p\right)}{\gamma}K_g^p(\beta).$$

We substitute for $\frac{\partial K_g^p}{\partial \beta}$ from the above in the second line of Equation (B.9). We obtain

$$\begin{aligned}\frac{\partial U_{pN}^p}{\partial \beta} = & \underbrace{-u'\left(x_{pN}^p\right)\left[-\frac{\partial x_{pE}^p}{\partial \beta} + (1+\lambda)K_g^p(\beta)\right]}_{<0} \\ & + u'\left(x_{pE}^p\right)\left[-\frac{\partial x_{pE}^p}{\partial \beta} + (1-\mu)(1+\lambda)K_g^p(\beta)\right]\underbrace{\left[1 - \frac{u'\left(x_{pN}^p\right)\beta(1+\lambda)}{\gamma}\right]}_{\leq 1}.\end{aligned}$$

We know that $x^p_{pN} < x^p_{pE}$ and with $u'(.)$ strictly decreasing, it holds true that $u'\left(x^p_{pN}\right) > u'\left(x^p_{pE}\right)$. Finally, since $\mu \in [0, 1)$, we have $(1-\mu)(1+\lambda)K^p_g(\beta) \leq (1+\lambda)K^p_g$. Since $1 - \frac{u'\left(x^p_{pN}\right)\beta(1+\lambda)}{\gamma} \leq 1$, we can conclude that the positive term (second line above) is smaller than the negative term (first line above) in absolute values. Consequently, $\frac{\partial U^p_{NE}}{\partial \beta} < 0$.

Proof of Proposition 4.2

(i) If C_k is elected, the Elite citizens of C_k's endowment group derive a utility of $U_{pE}(\beta_k)$ for all β_k. Given Statement (ii) in Lemma 4.2, we have

$$U_{pE}(\bar{\beta}_k) > U_{pE}(\beta_k) > U_{pE}(0). \tag{B.10}$$

We note that $U_{pE}(0)$ is equal to the policy-maker's utility when there is no incentive pay. With $\beta_k = 0$, if C_k is elected, the policy-maker's private-good consumption, as required by Equation (3.7), is given by $x^k_k = u'^{-1}\left(\frac{\gamma\theta_k}{1+\lambda}\right)$, and the public-good spending as required by Equation (3.8) is given by $\frac{\gamma}{1+\lambda}\left[\Omega - \theta_k x^k_k\right]$. In the notation, we set $p = k$ to account for the fact that C_k is elected and chooses the policy. Thus, we have

$$U_{pE}(0) = u(x^k_k) + \frac{\gamma}{1+\lambda}\left[\Omega - \theta_k x^k_k\right]. \tag{B.11}$$

Moreover, if $C_{k'}$ is elected, the Elite citizens of C_k's endowment group derive a utility of $U_q(\beta_{k'})$ for all $\beta_{k'}$. Given Statement (i) in Lemma 4.2, we have

$$U_q(\bar{\beta}_{k'}) > U_q(\beta_{k'}) > U_q(0), \tag{B.12}$$

where

$$U_q(\bar{\beta}_{k'}) = \underbrace{u(0)}_{=0} + \frac{\gamma\Omega}{(1+\lambda)(1+\mu\theta_{k'}\bar{\beta}_{k'})}. \tag{B.13}$$

The outsiders' private-good consumption and the public-good spending under $C_{k'}$ and given $\bar{\beta}_{k'}$ is given by Equation (3.26) and Equation (3.30), respectively. To account for the fact that $C_{k'}$ is elected, in the notation, we set $p = k'$.

We now show that $U_{pE}(0) > U_q(\bar{\beta}_{k'})$. This is true if

$$u(x^k_k) + \frac{\gamma}{1+\lambda}\left[\Omega - \theta_k x^k_k\right] - \frac{\gamma\Omega}{(1+\lambda)(1+\mu\theta_{k'}\bar{\beta}_{k'})} > 0.$$

We have substituted for $U_{pE}(0)$ and $U_q(\bar{\beta}_{k'})$ from Equations (B.11) and (B.13), respectively. Reordering, we obtain

$$\underbrace{u(x_k^k) - u'\left(x_k^k\right) x_k^k}_{(**)} + \Omega\left(\frac{\gamma}{1+\lambda}\right) \underbrace{\left[1 - \frac{1}{1+\mu\theta_{k'}\bar{\beta}_{k'}}\right]}_{(*)} \geq 0. \quad \text{(B.14)}$$

In the above, we have substituted for $u'\left(x_k^k\right) = \frac{\gamma\theta_k}{1+\lambda}$. We can see that $(*) \geq 0$. Additionally, since $u(\,\cdot\,)$ is strictly concave, $(**) > 0$. Thus, we obtain

$$U_{pE}(0) > U_q(\bar{\beta}_{k'}). \quad \text{(B.15)}$$

By Inequalities (B.10), (B.12) and (B.15), we conclude that

$$U_{pE}(\beta_k) > U_q(\beta_{k'})$$

for all β_k and $\beta_{k'}$.

(ii) The proof of Statement (ii) is more complex. We first prove $\Leftarrow$. We do the proof in five steps.

Step 1. In Step 1, we examine how public-good spending changes with the size of *Group–p*, at $\beta = 0$. Throughout this step, when speaking of policy choices, in the notation, we set $p = k$ to account for the fact that C_k is elected and chooses the policy.

We have assumed $u''(\,\cdot\,) < 0$ and $u'''(\,\cdot\,) \geq 0$. Since $u'(\,\cdot\,)$ is strictly decreasing and convex, $u'^{-1}(\,\cdot\,)$ also strictly decreasing and convex.

For $0 < \theta_k < 1$ we define $x_k^k(\theta_k)$ and $K_g^k(\theta_k)$ to be the solution to Equations (3.7) and (3.8). From Equation (3.7), we have $x_k^k = u'^{-1}\left(\frac{\gamma\theta_k}{1+\lambda}\right)$. Thus, x_k^k is a convex function of θ_k. By definition, for a strictly decreasing and convex function, we have

$$-\frac{\partial x_k^k}{\partial \theta_k} < \frac{x_k^k}{\theta_k}. \quad \text{(B.16)}$$

Thus, using Inequality (B.16), we can conclude that

$$\frac{\partial(\theta_k x_k^k)}{\partial \theta_k} = x_k^k + \theta_k \frac{\partial x_k^k}{\partial \theta_k}$$

is negative, $\frac{\partial(\theta_k x_k^k)}{\partial \theta_k} < 0$.

Next, we take the derivative of $K_g^p(\theta_k)$ with respect to θ_k by using Equation

(3.8). We obtain

$$\frac{\partial K_g^k}{\partial \theta_k} = \frac{-1}{1+\lambda} \underbrace{\left(\frac{\partial(\theta_k x_k^k)}{\partial \theta_k} \right)}_{<0}.$$

Since $\frac{\partial(\theta_k x_k^k)}{\partial \theta_k} < 0$, we observe that $\frac{\partial K_g^k}{\partial \theta_k} > 0$. Thus, at $\beta = 0$, if $\theta_k > \theta_{k'}$, then

$$K_g^k(0) > K_g^{k'}(0). \tag{B.17}$$

Step 2. In Step 2, we recall from Statement (ii) in Lemma 3.1 that

$$\frac{\partial K_g^k}{\partial \beta} > 0, \tag{B.18}$$

and is given by

$$\frac{\partial K_g^k}{\partial \beta} = \underbrace{\left(\frac{\theta_k}{(1+\lambda)(1-\beta\theta_k(1-\mu))} \right) \left[\underbrace{\frac{(1-\mu)\left[\Omega - \theta_k x_{pE}^k\right]}{1-\beta\theta_k(1-\mu)}}_{>0} - \underbrace{\frac{\partial x_{pE}^k}{\partial \beta}}_{<0} \right]}_{>0}. \tag{B.19}$$

Similar to Step 1, we have set $p = k$ in the notation to account for the fact that C_k is elected and chooses the policy.

Step 3. In Step 3, our goal is to show that for large Ω, $\frac{\partial \left(\frac{\partial K_g^k}{\partial \beta} \right)}{\partial \theta_k} > 0$. First, for a given β, we take Equation (B.19) to be a function of θ_k. And we take the derivative of this function with respect to θ_k.

$$\frac{\partial \left(\frac{\partial K_g^k}{\partial \beta} \right)}{\partial \theta_k} =$$

$$\underbrace{\frac{\partial \left(\frac{\theta_k}{(1+\lambda)(1-\beta\theta_k(1-\mu))} \right)}{\partial \theta_k}}_{:=(A)} \left[\underbrace{\frac{(1-\mu)\left[\Omega - \theta_k x_{kE}^k\right]}{1-\beta\theta_k(1-\mu)}}_{>0} - \underbrace{\frac{\partial x_{kE}^k}{\partial \beta}}_{<0} \right]$$

$$+ \underbrace{\left(\frac{\theta_k}{(1+\lambda)(1-\beta\theta_k(1-\mu))} \right)}_{>0} \left[(1-\mu) \underbrace{\frac{\partial \left(\frac{\Omega - \theta_k x_{kE}^k}{1-\beta\theta_k(1-\mu)} \right)}{\partial \theta_k}}_{:=(B)} - \underbrace{\frac{\partial \left(\frac{\partial x_{kE}^k}{\partial \beta} \right)}{\partial \theta_k}}_{:=(C)} \right]. \tag{B.20}$$

We now calculate (A), (B) and (C) to determine whether they are positive or negative.

First, we have

$$\begin{aligned}(A) =& \frac{\partial\left(\frac{\theta_k}{(1+\lambda)(1-\beta\theta_k(1-\mu))}\right)}{\partial\theta_k}\\ =& \frac{1}{(1+\lambda)\left(1-\beta\theta_k(1-\mu)\right)^2}.\end{aligned}$$

Thus, $(A) > 0$.

Next, we calculate (B). We have

$$\begin{aligned}(B) =& \frac{\partial\left(\frac{\Omega-\theta_k x^k_{kE}}{1-\beta\theta_k(1-\mu)}\right)}{\partial\theta_k}\\ =& \frac{1}{1-\beta(1-\mu)}\left[\left(\frac{\beta(1-\mu)}{1-\beta\theta_k(1-\mu)}\right)\Omega - \underbrace{\left[\left(\frac{1}{1-\beta\theta_k(1-\mu)}\right)x^k_{pE} + \theta_k\frac{\partial x^k_{kE}}{\partial\theta_k}\right]}_{>0}\right].\end{aligned}$$

Given, Equations (3.29) and (3.21), we have $\frac{\partial x^k_{kE}}{\partial\theta_k} = \frac{\gamma}{(1+\lambda)(1-\beta\theta_k(1-\mu))^2} > 0$. Thus, the term in the small brackets is positive. The term in the bigger bracket is only positive when $\Omega > 0$ is sufficiently large. We see that $(B) > 0$ for large Ω values.

Finally, we calculate (C). We have

$$\begin{aligned}(C) =& \frac{\partial\left(\frac{\partial x^k_{kE}}{\partial\beta}\right)}{\partial\theta_k}\\ =& \frac{\gamma\theta_k(1-\mu)}{(1+\lambda)\left(1-\beta\theta_k(1-\mu)\right)}\left[2\underbrace{\left(u'^{-1}\right)'\left(\frac{\gamma\theta_k}{(1+\lambda)\left(1-\beta\theta_k(1-\mu)\right)}\right)}_{<0}\right.\\ &\left. + \frac{\theta_k}{(1+\lambda)\left(1-\beta\theta_k(1-\mu)\right)^3)}\underbrace{\left(u'^{-1}\right)''\left(\frac{\gamma\theta_k}{(1+\lambda)\left(1-\beta\theta_k(1-\mu)\right)}\right)}_{\geq 0}\right].\end{aligned}$$

We can see that since u'^{-1} is strictly decreasing and convex, the term in the brackets can be positive or negative. We recall from Equation (B.20) that if Ω is very large and (B) is positive the sum of (B) and (C) can be positive. Therefore, we require Ω to be very large so that we have $\frac{\partial\left(\frac{\partial K^k_g}{\partial\beta}\right)}{\partial\theta_k} > 0$. If

$\theta_k > \theta_{k'}$, for any given β, we have

$$K_g^k(\beta) > K_g^{k'}(\beta). \tag{B.21}$$

Step 4. In Step 4, we first prove that $\frac{\partial \bar{\beta}_k}{\partial \theta_k} > 0$. By the Implicit Function Theorem and using Equation (4.25), we have

$$\frac{d\bar{\beta}_k}{d\theta}(\theta_k) = \mu \bar{\beta}_k^2 \Omega^2.$$

Clearly, $\frac{d\bar{\beta}_k}{d\theta} > 0$ around $(\bar{\beta}_M, \theta_M)$ and $(\bar{\beta}_m, \theta_m)$. If $\theta_k > \theta_{k'}$, then $\bar{\beta}_k > \bar{\beta}_{k'}$. Since $\frac{\partial K_g^k}{\partial \beta} > 0$, we have $K_g^k\left(\bar{\beta}_k\right) > K_g^k\left(\bar{\beta}_{k'}\right)$. Given Inequality (B.21), for $\beta = \bar{\beta}_{k'}$, we have $K_g^k\left(\bar{\beta}_{k'}\right) > K_g^{k'}\left(\bar{\beta}_{k'}\right)$. Combining the two, we obtain

$$K_g^k\left(\bar{\beta}_k\right) > K_g^{k'}\left(\bar{\beta}_{k'}\right). \tag{B.22}$$

Step 5. In Steps (1-4), we have shown that for large Ω, $K_g^k\left(\bar{\beta}_k\right) > K_g^{k'}\left(\bar{\beta}_{k'}\right)$. If C_k is elected, the Non-lite citizens of C_k's endowment group derive a utility of $U_{pN}(\beta_k)$ for all β_k. Their private-good consumption at $\bar{\beta}_k$ by Proposition 3.3 is given by $x_{kN}^k(\bar{\beta}_k) = 0$.

However, if $C_{k'}$ is elected, the Non-elite citizens of C_k's endowment group derive a utility of $U_q(\beta_{k'})$ for all $\beta_{k'}$ and their private-good consumption is equal to zero for all $\beta_{k'}$ since they are exploited.

By Equation (4.31) and Equation (4.32), we have

$$U_{pN}(\bar{\beta}_k) = \underbrace{u(0)}_{=0} + K_g^k\left(\bar{\beta}_k\right),$$
$$U_q(\bar{\beta}_{k'}) = \underbrace{u(0)}_{=0} + K_g^{k'}\left(\bar{\beta}_{k'}\right),$$

respectively. Thus, in Steps (1-4), we have shown that

$$U_{pN}(\bar{\beta}_k) > U_q(\bar{\beta}_{k'}). \tag{B.23}$$

By Lemma 4.2 we know that $\frac{\partial U_q}{\partial \beta} > 0$ and $\frac{\partial U_{pN}}{\partial \beta} < 0$. Thus, for all β_k and $\beta_{k'}$, we have

$$U_{pN}(\bar{\beta}_k) < U_{pN}(\beta_k), \tag{B.24}$$
$$U_q(\beta_{k'}) < U_q(\bar{\beta}_{k'}). \tag{B.25}$$

Combining Inequalities (B.23), (B.24) and (B.25), we observe that $\forall \beta_k, \beta_{k'}$, we have $U_{pN}(\beta_k) > U_q(\beta_{k'})$.

Thus, if Ω is large enough and given $\theta_k > \theta_{k'}$, $\forall \beta_k, \beta_{k'}$ $U_{pN}(\beta_k) > U_q(\beta_{k'})$.
Next, we prove $\Rightarrow$. The proof is by contradiction. Suppose $\theta_k \geq \theta_{k'}$. Since $\frac{d\bar{\beta}}{d\theta} > 0$, as shown in Step 4 above, we have $\bar{\beta}_k \leq \bar{\beta}_{k'}$. The utility of a citizen who belongs to the C_k's endowment group, when C_k proposes $\bar{\beta}_k$ and $C_{k'}$ proposes $\bar{\beta}_{k'}$ according to Equations (4.31) and (4.32) is given by

$$U_{pN}(\bar{\beta}_k) = 0 + \gamma \underbrace{\frac{\bar{\beta}_k \Omega}{(1+\lambda)\left(1+\mu\theta_k\bar{\beta}_k\right)}}_{=K_g^k(\bar{\beta}_k)},$$

$$U_q(\bar{\beta}_{k'}) = 0 + \gamma \underbrace{\frac{\bar{\beta}_{k'} \Omega}{(1+\lambda)\left(1+\mu\theta_{k'}\bar{\beta}_{k'}\right)}}_{K_g^{k'}(\bar{\beta}_{k'})}.$$

For $\Omega > 0$, $\gamma > 0$ and $\lambda \geq 0$ we can see that

$$\frac{\partial\left(\frac{\gamma\beta\Omega}{(1+\lambda)(1+\mu\theta\beta)}\right)}{\partial\beta} = \frac{\gamma\Omega}{(1+\lambda)(1+\mu\theta\beta)^2} > 0.$$

Since $\bar{\beta}_k \leq \bar{\beta}_{k'}$, we obtain

$$K_g^k(\bar{\beta}_k) \leq K_g^{k'}(\bar{\beta}_{k'}).$$

We can see that $U_{pN}(\bar{\beta}_k) \leq U_q(\bar{\beta}_{k'})$. This is in contradiction with our assumption that $\forall \beta_k, \beta_{k'}$, $U_{pN}(\bar{\beta}_k) > U_q(\bar{\beta}_{k'})$. Thus, it has to be that $\theta_k > \theta_{k'}$.

Proof of Corollary 4.1

C_M belongs to the majority endowment group, $\theta_M > \theta_m$. By Proposition 4.2, Statement (i) we know that C_M has the support of the majority-endowment-group Elites.
Additionally, by Proposition 4.2, Statement (ii), we know that for Ω large enough, C_M has the support of the majority-endowment-group Non-elites. Clearly, C_M wins the election. By Lemma 4.2, we know that $\frac{\partial U_{pE}}{\partial\beta} > 0$. Therefore, conditional on being elected, C_M is better off announcing the highest possible β, $\beta_M = \bar{\beta}_M$. C_m is indifferent because he does not win the election. Thus, he announces $\beta_m \in [0, \bar{\beta}_m]$.

C Discussion of Case 2 in Section 3.8

We now explore the results in Case 2. In Case 2, the policy-maker's optimal solution is to set $x^p_{MN} = (1-b)\omega_M$ and to spend

$$K^p_g = \frac{b\Omega}{(1+\lambda)(1+\mu\theta_M\beta)} \tag{C.1}$$

on public good, according to Equation (3.43).
By Proposition 3.6, Case 2 is the optimal solution to the policy-maker's problem if

(i) $b \in [0, b_c]$ and $\beta \geq 0$, or

(ii) $b \in [b_c, 1]$ and $\beta \geq \bar{\beta}_b$.

To analyze the results in Case 2(i), we take $x^p_{MN}(\beta)$, $x^p_{ME}(\beta)$ and $K^p_g(\beta)$ as the solution to the system of Equations (3.39), (3.40) and (C.1). The next proposition establishes that in Case 2(i) for any given $b \in [0, b_c]$, it is welfare improving to set $\beta = 0$.

Proposition C.1
If $b \in [0, b_c]$, $\beta = 0$ *maximizes* $W(\beta)$.

Proof. If $b \in [0, b_c]$, by Proposition 3.6, the optimal solution to the policy-maker's problem is given by the corner solution in Case 2. The policy choice in Case 2 is given by

$$\begin{aligned}
x^p_{MN} &= (1-b)\omega_M, \\
x^p_{ME} &= (1-b)\omega_M + \beta\frac{b\Omega}{1+\mu\theta_M\beta} \\
K^p_g &= \frac{b\Omega}{(1+\lambda)(1+\mu\theta_M\beta)}.
\end{aligned}$$

By using Equation (3.32), welfare as function is given by

$$W(\beta) = (1-\mu)\theta_M u(x^p_{MN}(\beta)) + \mu\theta_M u\left(x^p_{ME}(\beta)\right) + \theta_m u(x^p_m) + \gamma K^p_g(\beta).$$

If we take the derivative with respect to β, we obtain

$$\frac{\partial W}{\partial \beta} = (1-\mu)\theta_M \frac{\partial x^p_{MN}}{\partial \beta} u'\left(x^p_{MN}(\beta)\right) + \mu\theta_M \frac{\partial x^p_{ME}}{\partial \beta} u'\left(x^p_{ME}(\beta)\right) + \gamma \frac{\partial K^p_g}{\partial \beta}. \tag{C.2}$$

Taking the derivative of $K^p_g(\beta)$, $x^p_{ME}(\beta)$ and $x^p_{MN}(\beta)$ with respect to β, we obtain

$$\frac{\partial K^p_g}{\partial \beta} = \frac{-\mu\theta_M b\Omega}{(1+\lambda)\left(1+\mu\theta_M\beta\right)^2}, \tag{C.3}$$

$$\frac{\partial x^p_{ME}}{\partial \beta} = \frac{b\Omega}{\left(1+\mu\theta_M\beta\right)^2}, \tag{C.4}$$

$$\frac{\partial x^p_{MN}(\beta)}{\partial \beta} = 0. \tag{C.5}$$

Substituting for $\frac{\partial K^p_g}{\partial \beta}$, $\frac{\partial x^p_{ME}}{\partial \beta}$ and $\frac{\partial x^p_{MN}}{\partial \beta}$ from Equations (C.3), (C.4) and (C.5), respectively, into Equation (C.2), we obtain

$$\begin{aligned}\frac{\partial W}{\partial \beta} &= \frac{\mu\theta_M b\Omega}{\left(1+\mu\theta_M\beta\right)^2} u'\left(x^p_{ME}(\beta)\right) - \frac{\mu\theta_M b\Omega}{\left(1+\mu\theta_M\beta\right)^2}\left(\frac{\gamma}{1+\lambda}\right)\\ &= \underbrace{\frac{\mu\theta_M b\Omega}{\left(1+\mu\theta_M\beta\right)^2}}_{\geq 0} \underbrace{\left[u'\left(x^p_{ME}(\beta)\right) - u'(x^s)\right]}_{<0},\end{aligned}$$

where we have substituted for $u'(x^s) = \frac{\gamma}{1+\lambda}$ by using Equation (3.4). Given $x^p_{ME}(\beta) > x^s$ and since $u'(\,\cdot\,)$ is strictly decreasing, $u'\left(x^p_{ME}(\beta)\right) < u'(x^s)$ and the term in the bracket is always negative. We observe that $\frac{\partial W}{\partial \beta} \leq 0$ for all $\beta \geq 0$.
We conclude that

$$W(0) \geq W(\beta) \quad \forall \beta \geq 0.$$

□

Next, we consider Case 2(ii). For this purpose, we let $x^p_m(b)$, $x^p_{MN}(b)$ and $x^p_{ME}(b)$ be the solution to the system of Equations (3.35), (3.39) and (3.40).
For the incentive contract $\bar{\beta}_b$, we show that the right tax limit corrects the policy choice in such a way that the final policy is *weakly optimal*. First, we define weak optimality.

Definition C.1
A policy (x_{MN}, x_m) is weakly optimal if social welfare cannot be improved by a lump-sum tax on all endowment groups.

At the weak optimum, the average of the marginal utilities from private-good consumption across all citizens as a function of the constitutional tax limit is equal to the marginal

utility from a lump-sum tax on all endowment groups.
We denote the average marginal utility of private-good consumption across all citizens as a function of b by $\phi(b)$. The function $\phi(b)$ is given by

$$\phi(b) = \mu\theta_M u'\left(x^p_{ME}(b)\right) + (1-\mu)\theta_M u'\left(x^p_{MN}(b)\right) + \theta_m u'\left(x^p_m(b)\right). \tag{C.6}$$

For the incentive contract $\bar{\beta}_b$ and substituting for the private-good consumptions from Equations (3.35), (3.39) and (3.40) in Equation (C.6), we obtain

$$\phi(b) = \mu\theta_M u'\left((1-b)\omega_M + \bar{\beta}_b \frac{b\Omega}{1+\mu\theta_M\bar{\beta}_b}\right) + (1-\mu)\theta_M u'\left((1-b)\omega_M\right) + \theta_m u'\left((1-b)\omega_m\right). \tag{C.7}$$

Proposition C.2
If $u'\left(x^p_c \frac{\omega_m}{\omega_M}\right) < u'(x^s) + u'(x^p_c)$*, there exists a constitutional tax limit* $\hat{b} \in (b_c, 1)$ *such that this tax limit, together with the incentive contract* $\bar{\beta}_{\hat{b}}$*, implements a weakly optimal policy.*

Proof. We first examine the marginal welfare from a lump-sum tax ($MWLS$) on all endowment groups. With the incentive contract $\bar{\beta}_b$ for a given $b \in [b_c, 1]$, by using equation (C.1), we obtain

$$MWLS = \frac{\gamma}{(1+\lambda)(1+\mu\theta_M\bar{\beta}_b)}. \tag{C.8}$$

We take $MWLS(b)$ to be an implicit function of b as given by Equation (C.8). We recall from Equation (3.46) that $\bar{\beta}_b$ is an implicit function of $b \in [b_c, 1]$.
If $b = 1$, there is no constitutional tax limit and we are back in the case in Section 3.5. Given Statement (i) in Proposition 3.3, $\bar{\beta}$ uniquely satisfies Equation (3.31) at $b = 1$. Similarly, if $b = b_c$, given Statement (ii) in Proposition 3.6, $\bar{\beta}_{b_c} = 0$ uniquely satisfies Equation (3.46). We calculate $MWLS$ for $b = 1$ and $b = b_c$, we obtain

$$MWLS(1) = \frac{\gamma}{(1+\lambda)(1+\mu\theta_M\bar{\beta})}, \tag{C.9}$$

$$MWLS(b_c) = \frac{\gamma}{(1+\lambda)}. \tag{C.10}$$

Next, we examine the average marginal utility of private-good consumption across all citizens, $\phi(b)$. The function $\phi(b)$ is continuous over $b \in [b_c, 1]$. We evaluate $\phi(b)$ at $b = 1$ and $b = b_c$.

By setting $b = 1$ and $\bar{\beta}$ in Equations(3.35), (3.39) and (3.40), we obtain

$$x^p_m = x^p_{MN} = 0, \tag{C.11}$$

$$x^p_{ME} = \frac{\bar{\beta}\Omega}{1 + \mu\theta_M\bar{\beta}}. \tag{C.12}$$

Substituting Equations (C.11) and (C.12) into Equation (C.7) and given the Inada Conditions, we obtain

$$\phi(1) = \theta_M \mu u' \left(\frac{\bar{\beta}\Omega}{1 + \mu\theta_M\bar{\beta}}\right) + \theta_M(1-\mu)u'(0) + \theta_m u'(0) = +\infty. \tag{C.13}$$

By setting $b = b_c$ and $\bar{\beta}_{b_c} = 0$ in Equations (3.35), (3.39) and (3.40), we obtain

$$x^p_m = (1 - b_c)\omega_m = x^p_c \frac{\omega_m}{\omega_M}, \tag{C.14}$$

$$x^p_{ME} = x^p_{MN} = x^p_c. \tag{C.15}$$

Substituting Equations (C.14) and (C.15) into Equation (C.7), we obtain

$$\phi(b_c) = \theta_M u'(x^p_c) + \theta_m u'(x^p_c \frac{\omega_m}{\omega_M}). \tag{C.16}$$

Given Definition C.1, for a policy to be weakly optimal it has to be that

$$\phi(b) = \frac{\gamma}{(1+\lambda)(1+\mu\theta_M\bar{\beta}_b)}.$$

We now show that at $b = 1$ and $b = b_c$ the above equation does not hold and therefore, the policy is not weakly optimal.

1. At $b = 1$, $\phi(1) =$ "$+\infty$." It is easy to see that

$$\phi(1) > \frac{\gamma}{(1+\lambda)(1+\mu\theta_M\bar{\beta})}. \tag{C.17}$$

   Consequently, at $b = 1$, the policy-maker's choice of policy is not weakly optimal.

2. At $b = b_c$,

   – let $x^s \leq x^p_c \frac{\omega_m}{\omega_M}$. Since $u'(\cdot)$ is strictly decreasing, we have

$$u'(x^p_c \frac{\omega_m}{\omega_M}) \leq u'(x^s). \tag{C.18}$$

And since $u'(\cdot) > 0$,

$$u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) < u'(x^s) + u'(x_c^p)$$

holds automatically.
Additionally, from Equation (3.16), we know that $x_c^p > x^s$. Thus,

$$u'(x_c^p) < u'(x^s). \tag{C.19}$$

If we multiply Inequality (C.18) by θ_m and Inequality (C.19) by θ_M and we sum the results we obtain

$$\theta_M u'(x_c^p) + \theta_m u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) < \frac{\gamma}{1+\lambda}[\theta_M + \theta_m]. \tag{C.20}$$

We note that the left hand side in Inequality (C.20) is equal to $\phi(b_c)$ given by Equation (C.16). Moreover, the right hand side is equal to $MWLS(b_c)$ given by Equation (C.10). Thus, we observe that $\phi(b_c) < MWLS(b_c)$ and we conclude that the policy at b_c is not weakly optimal.

– let $x^s > x_c^p \frac{\omega_m}{\omega_M}$. If $u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) < u'(x^s) + u'(x_c^p)$, then by substituting for $u'(x^s)$ and $u'(x_c^p)$ from Equations (3.4) and (3.16), respectively, we obtain

$$\begin{aligned} u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) &< \frac{\gamma}{1+\lambda} + \frac{\gamma\theta_M}{1+\lambda}, \\ u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) &< \frac{\gamma}{1+\lambda}(1+\theta_M). \end{aligned} \tag{C.21}$$

If we multiply Inequality (C.21) by $(1-\theta_M)$, we obtain

$$\begin{aligned} (1-\theta_M)u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) &< \frac{\gamma}{1+\lambda}(1-\theta_M^2), \\ \theta_m u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) &< \frac{\gamma}{1+\lambda} - \theta_M \frac{\gamma\theta_M}{1+\lambda}. \end{aligned} \tag{C.22}$$

By rewriting and reordering Inequality (C.22), we obtain

$$\theta_M u'(x_c^p) + \theta_m u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) < \frac{\gamma}{1+\lambda}. \tag{C.23}$$

We note that the left hand side in Inequality (C.23) is equal to $\phi(b_c)$ given by Equation (C.16). Moreover, the right hand side is equal to $MWLS(b_c)$ given by Equation (C.10). Thus, we observe that $\phi(b_c) < MWLS(b_c)$ and we conclude that the policy at b_c is not weakly optimal.

To prove the existence of $\hat{b}$ such that the policy at $\hat{b}$ is weakly optimal, we define

$$K(b) := \phi(b) - MWLS(b),$$

over the compact set $b \in [b_c, 1]$.
From Equation (C.7) and given our assumptions on $u(\,\cdot\,)$, we can see that $\phi(b)$ is continuous function over $b \in [b_c, 1]$. To establish that $MWLS(b)$ is a continuous function, we have to prove that $\bar{\beta}_b$ is a continuous function of b. For this purpose, we define

$$B(\beta, b) = u'\left((1-b)\omega_M + \frac{\beta b \Omega}{1+\mu\theta_M\beta}\right) - \frac{\gamma\theta_M}{(1+\lambda)(1-\beta\theta_M(1-\mu))}.$$

We observe that $B : [0, \bar{\beta}_b] \times [b_c, 1]$ is continuous. By Equation (3.46), we know that

$$B(\bar{\beta}_b, b) = 0 \quad \forall b \in [b_c, 1].$$

Additionally, $\frac{\partial B}{\partial \beta}$ exists and it is given by

$$\frac{\partial B}{\partial \beta} = \frac{b\Omega}{(1+\mu\theta_M\beta)^2} u''\left((1-b)\omega_M + \frac{\beta b \Omega}{1+\mu\theta_M\beta}\right) - \frac{\gamma\theta_M^2(1-\mu)}{(1+\lambda)(1-\beta\theta_M(1-\mu))}.$$

Given our assumptions on $u(\,\cdot\,)$, we observe that $\frac{\partial B}{\partial \beta} < 0$ and thus it is invertible.
By the Implicit Function Theorem, there exists a function $\kappa : [b_c, 1] \to [0, \bar{\beta}_b]$ such that $\bar{\beta}_b = \kappa(b)$ and κ is continuous over $[b_c, 1]$.
Since $\bar{\beta}_b$ is a continuous function of b, we observe that $MWLS(b)$ is continuous.
Thus, $K(b)$ is continuous over the compact set $b \in [b_c, 1]$.
From Inequality(C.17), we observe that

$$K(1) > 0.$$

From Inequalities (C.20) and (C.23), we observe that

$$K(b_c) < 0.$$

We conclude that by the Intermediate Value Theorem there exists $\hat{b} \in (b_c, 1)$ such that $K(\hat{b}) = 0$. Since $K(\hat{b}) = 0$, we have

$$\phi(\hat{b}) = MWLS(\hat{b}).$$

As a result, the policy at $\hat{b}$ is weakly optimal. □

Thus, we have shown that the appropriate tax limit, corrects the policy chosen under the incentive contract $\bar{\beta}_b$ and improves welfare by implementing the weakly optimal policy. Since it is not possible to find $\hat{b}$ and $\bar{\beta}_{\hat{b}}$ analytically, in the following example we solve for $\hat{b}$ and $\bar{\beta}_{\hat{b}}$ which implement the weakly optimal policy numerically.

Example C.1

Suppose $\mu = 0$, $\lambda = 0$, $\gamma = 1$, $\theta_M = \theta_m = \frac{1}{2}$, $\omega_M = 4$, $\omega_m = 16$, and $u(x) = \sqrt{x}$.
Since $\omega_M < \omega_m$, then $x_c^p \frac{\omega_m}{\omega_M} > x_c^p$. Since $u'(\,\cdot\,)$ is strictly decreasing, then we have $u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) < u'(x_c^p)$. Consequently, we have $u'\left(x_c^p \frac{\omega_m}{\omega_M}\right) < u'(x^s) + u'(x_c^p)$. Thus, by Proposition C.2, there exists a $\hat{b} \in (b_c, 1)$, together with the incentive contract $\bar{\beta}_{\hat{b}}$, which implements the weakly optimal policy.
By Definition C.1, a policy is weakly optimal if

$$\phi(\hat{b}) = \frac{\gamma}{(1+\lambda)(1+\mu\theta_M\bar{\beta}_{\hat{b}})}.$$

Using Equation (C.7) and substituting for all the exogenous parameters, we obtain

$$\hat{b} = 0.96.$$

By using Equation (3.46) to solve for $\bar{\beta}_{\hat{b}}$ at $\hat{b} = 0.96$, we obtain

$$\bar{\beta}_{0.96} = 0.08.$$

Using Equation (3.40) for the policy-maker's private-good consumption, we obtain

$$x_{ME}^p(0.08) = 0.92.$$

To compare this with the socially optimal private-good consumption level, we use Equation (3.4) and we obtain

$$x^s = 0.25.$$

For the minority endowment group, the private-good consumption level, according to Equation (3.35), is equal to

$$x_m^p(0.96) = 0.56.$$

For $\bar{\beta}_{0.96} = 0.08$, we compare the public-good spending with the socially optimal level by *using Equation (C.1) and Equation (3.5), and we obtain*

$$K_g^p(0.08) = 9.65, \quad \textit{and}$$
$$K_g^s = 9.75,$$

respectively.

Finally, to show the combined effect of incentive pay and tax protection, on social welfare we calculate the ex-ante social welfare by using Equation (3.47). We obtain

$$W(0.08) = 10.21.$$

We calculate the social welfare under the utilitarian social planner and we obtain

$$W^s = 10.25.$$

To observe how imposing a tax limit affects social welfare in an economy where the policy-maker is rewarded by the incentive contract $\bar{\beta}_b$, we calculate social welfare as a function of $b \in [b_c, 1]$ for the given set of exogenous values. Figure (C.1) shows how welfare changes with different levels of tax protection when the policy-maker is rewarded by the incentive contract $\bar{\beta}_b$. We observe that combining the incentive contract $\bar{\beta}_{\hat{b}}$ with the right tax limit $\hat{b}$ improves social welfare and achieves the weakly optimal solution.

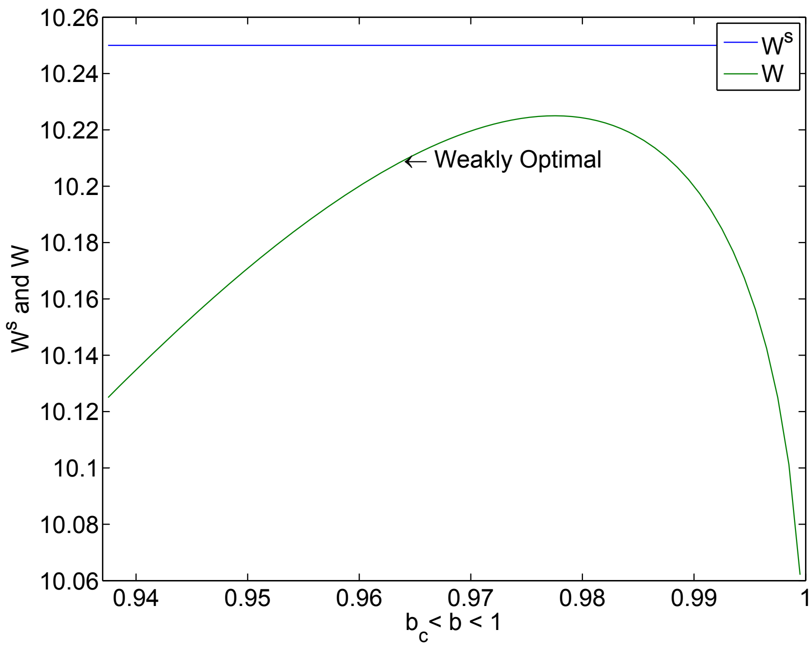


Figure C.1: Social welfare under tax protection b and the incentive contract $\bar{\beta}_b$.

Vocabulary	Definition
Group–i	group of citizens with endowment ω_i
Group–p	group of citizens belonging to policy-maker's endowment group
Outsiders	group of citizens not belonging to policy-maker's endowment group
Elites	citizens who participate in policy-making/supporting interest group of the policy-maker
Non-elites	citizens who do not participate in policy-making
Political multi-task problem	multi-task problem with the following characteristics: difficulties to measure the output of some tasks, budget determined by office-holder, conflicting interests of citizens in addition to conflict of interest between citizens and policy-maker
Policy	majority and minority endowment group's bundle of private good consumption
Feasible Policy	a policy with no subsidization or negative consumption
Ex-ante	behind complete veil of ignorance
Interim	information about the Elites and Non-elites is revealed
Ex-post	information about the Elites and Non-elites and endowments is revealed
Post-election	all information is revealed and the candidate who has the support of majority is elected
Social planner	utilitarian social planner
Verifiable variable	a variable for which a quantifiable dimension either exists or can be constructed
Weakly optimal policy	a policy (x_M, x_m) with which welfare cannot be improved by a lump-sum tax on all endowment groups

Table C.1: Vocabulary and Definition

Vocabulary	Notation
Majority endowment group's initial endowment	ω_M
Minority endowment group's initial endowment	ω_m
Total endowment	Ω
Index for different endowment groups	i
Index for candidates from different endowment groups	k, k'
Index for the endowment groups whose candidate has won in the election	p
Index for the endowment groups whose candidate has lost in the election	q
Share of citizens belonging to endowment *Group–i*	θ_i
Probability of being a member of the majority endowment group	θ_M
Probability of being a member of the minority endowment group	θ_m
Probability of being a member of Elite ("an Elite")	μ
Dead weight loss, degree of friction in taxation process	λ
Total-factor productivity of public good	γ
Private good consumption	x
Public good spending	K_g
Level of public-good provision	g
Social welfare function	W
Utility function representing citizens' preferences	$U(x, g) = u(x) + g$
Exemplary utility function is of the form $u(x) = x^\alpha$	α
Socially-optimal level of private good consumption	x^s
Policy-maker's choice of *Group–i*'s private good consumption	x_i^p
Altruistic policy-maker's choice of *Group–i*'s private good consumption	$x_i^{p_{alt}}$
Socially-optimal level of public-good spending	K_g^s
Policy-maker's choice of public-good spending	K_g^p
Altruistic policy-maker's choice of public-good spending	$K_g^{p_{alt}}$
Policy–maker's utility function	U^p
Altruistic policy–maker's utility function	$U^{p_{alt}}$
Elite's interim expected utility function	$\mathcal{U}_E$
Non-elite's interim expected utility function	$\mathcal{U}_{NE}$

Group–p Elite's post-election utility function	U_{pE}
Group–p Non-elite's post-election utility function	U_{pN}
Group–q citizen's (outsider's) post-election utility function	U_q
Constitutional limit on tax-rates	b
Optimal constitutional limit on tax-rates	b^*
Weakly optimal constitutional limit on tax-rates	$\hat{b}$
Policy-maker's reward per unit spending on public good	β
Policy-maker's optimal reward per unit spending on public good	β^*
Policy-maker's optimal reward per unit spending on public good with constitutional limit on taxation	β_b^*
Highest possible reward per unit spending on public good	$\bar{\beta}$
Highest possible reward per unit spending on public good with constitutional limit on taxation	$\bar{\beta}_b$
Policy-maker's level of altruism	η
Ex-ante average marginal utility of private-good consumption across all citizens as a function of the tax limit, b	$\phi(b)$
Share of citizens belonging to the majority endowment group	θ_M
Share of citizens belonging to the minority endowment group	θ_m
Candidate from the majority group	C_M
Candidate from the minority group	C_m
Reward parameter proposed by C_M	β_M
Reward parameter proposed by C_m group	β_m
Highest possible reward per unit spending on public good for C_M	$\bar{\beta}_M$
Highest possible reward per unit spending on public good for C_m	$\bar{\beta}_m$
Weighting factor in Co-voting	τ
Policy-maker's reward per unit spending on public good which makes the Non-elites interim better off	$\tilde{\beta}$
Policy-maker's reward per unit spending on public good chosen by Co-voting	$\hat{\beta}$

Table C.2: Vocabulary and Notation

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