Doors and perceptions: motivations, beliefs, and the returns to canvassing

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Abstract

A large empirical literature has documented that canvassing significantly affects voting behaviour. This paper proposes a formal model of canvassing to understand the relationship between the motivations of activists, the beliefs of voters, and the information transmitted through canvassing campaigns. Activists, who differ in their motivations for engaging in political activities, decide how often to participate in canvassing, and what message to share with voters if they do. Both the participation decision and the message shape the voters' beliefs and their voting behaviour. I derive normative results on the optimal mix of activists that parties should recruit and implications for field experiments that artificially control participation. While field experiments accurately capture the returns from individual canvassers' messages, they do not capture the equilibrium effect of canvassers' participation on the information learned by voters. This can lead to underestimating or overestimating the returns to canvassing.

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Introduction

Door-to-door and telephone canvassing are widely-employed campaign tactics in countries such as the US and the UK, but still relatively uncommon in most European countries. However, the demonstrated success of this tactic has encouraged more parties to include it as a central campaign strategy. For instance, the French Socialist Party included it as a key tool for their successful 2012 presidential and legislative election campaigns (see Pons 2018). The Social Democratic Party of Germany also introduced the strategy to their campaign in 2013, and canvassing is becoming increasingly common in electoral campaigns.

One reason this tactic is popular is that empirical evidence has shown its effectiveness in increasing turnout (see e.g. Gerber & Green (2000), Green et al. (2013), Barton et al. (2014)) or affecting vote choice (Pons 2018). In a meta-analysis of 71 canvassing studies, Green et al. (2013) find that door-to-door canvassing increased the turnout of treated households by an average of 2.54 percentage point. Such a large effect could affect the outcome of a national election, if the increased turnout disproportionately favoured one party.

In this paper, I propose a theoretical framework to interpret this empirical evidence. I focus in particular on the interaction between the decision of activists to participate in canvassing, the message they share with voters, and the resulting effect on turnout. The voluntary participation of large numbers of activists is necessary to successfully scale up the campaigns studied in field experiments.[1] In turns, this participation depends on the activists' perceived likelihood of success. The feedback between successful persuasion and motivation is at the core of this paper.

Using this framework allows me to address the following questions. First, I analyse how activists with different motivations strategically choose whether to participate in door-to-door canvassing and what message to share. Second, I evaluate what voters can learn from meeting a canvasser and from the message they receive. Finally, I use these results to understand what determines the returns to canvassing and how these returns differ between small-scale experiments and wide-scale electoral campaigns.

I develop a stylised model where activists attempt to persuade voters to turn out. Activists target only voters that are likely to support their preferred candidate, so their objective is to

[1] For instance, Gillespie (2010) notes that 'Despite the apparent groundswell of enthusiastic and capable foot soldiers that Barack Obama's 2008 presidential campaign recruited to canvass for him, many other organizations face routine obstacles to recruiting enough quality volunteers to undertake an effective canvass'.

convince voters that the election is sufficiently important for them to turn out. Activists have some private information about the stakes of the election (for example how bad the opposition candidate is). Voters have some privately known cost of turning out and only vote if the stakes of the election is above their cost.

Activists make two decisions: whether to participate in canvassing and if they do, what message to share. They only participate if the expected returns from canvassing is above the cost of participation. The message they share is cheap talk: they are free to lie about the stakes of the election.

Activists differ in their motivations for campaigning. A share of activists are instrumentally-motivated: they enjoy persuading voters to turn out and value participating in canvassing as long as their message increases the turnout of voters they meet. I call those activists instrumental activists. The remaining activists, which I call intrinsically-motivated, simply enjoy participating in campaign activities or feel a civic duty to talk to voters, independently of the effectiveness of their message. As a result, intrinsically-motivated activists are happy to communicate truthfully about the stakes of the election. Because voters cannot perfectly distinguish the type of activists they face, they attribute some truth to any message they receive. Instrumental activists take advantage of this to persuade voters by always exaggerating the true stakes. Since voters rationally discount high messages in proportion to the share of instrumental activists, the probability of persuading them decreases in this share.

Instrumental activists internalise the effect of their participation on the persuasiveness of their message because their motivation is proportional to their persuasiveness. This generates differences in participation across types of activists which allows a voter to imperfectly learn about the motivations of an activist from the fact that she turns up at the voter's door. In turn, these beliefs about the type of activist affects how voters interpret the message. As a result, both the participation decision and the message shape the voters' beliefs about the stakes of the election.

I first show that there exists an equilibrium in which instrumental activists can persuade voters to turnout even when the stakes are low. This occurs even though voters rationally anticipate that these activists will lie because voters can never distinguish perfectly which type of activist they face. As a result, instrumentally-motivated canvassers are more effective than intrinsically-motivated canvassers. However, as the motivation of instrumentally-motivated canvassers depends on the persuasiveness of their message, instrumental canvassers can be less motivated. The first result is therefore that there exists a trade-off between recruiting instrumental canvassers who are more effective but less motivated than intrinsically-motivated canvassers. The optimal share of instrumental canvassers is therefore not too low, nor too high. Campaigns should carefully select their pool of activists to increase their returns.

Second, I show that explicitly modelling the motivation of activists has important implications for the returns to canvassing. If activists do not internalise the effect of their participation on the effectiveness of their message, returns to canvassing can be negative. This occurs when a high share of instrumentally-motivated activists leads voters to discount messages about high stakes. This hurts the returns of both types of activists and can lead to lower turnout than with no information transmission. This can no longer happen when motivation is taken into account. Since the participation of instrumentally-motivated activists decreases with returns to canvassing, the share of these activists will always be such that canvassing generates positive returns.

Finally, I show that small-scale field experiments accurately capture the returns to individual canvassers, but can generate the wrong average total returns to canvassing. As a result, they can over- or underestimate returns to canvassing. While various scaling-up problems are generally acknowledged in the empirical literature, I identify a particular issue with canvassing. Since voters do not know that they are taking part in an experiment, they adjust their beliefs as if the canvassers they meet face the motivation issues described above. This has the advantage of replicating the correct environment to measure the effectiveness of individual messages. However, the effectiveness of a campaign also depends on how many voters get exposed to an effective message which cannot be studied independently of the effectiveness of the message.

These results are consistent with empirical patterns identified in the literature. First, the result that canvassing can generate positive returns when other forms of campaigning strategies would not is in-line with the significant effect of get-out-the-vote campaigns identified in the literature (see e.g. Green et al. (2013) for a meta-analysis). Second, the non-monotonicity in the share of instrumentally-motivated activists is consistent with the differences in effectiveness across campaigning strategies. Green et al. (2013) show that door-to-door canvassing is the most effective method (with a 2.54 percentage point average treatment effect), followed by phone canvassing by volunteers (1.94 percentage points), commercial phone canvassing (0.98 percentage points) and mail or e-mail (0.16 percentage points). If the share of intrinsically-motivated canvassers (those happy to go ‘off-script’) is higher in door-to-door campaigns than phone calls, the model indeed shows that returns should be higher in the former. Similarly, campaigns that only deliver a carefully scripted message, such as mail or e-mail campaigns (with no intrinsically-motivated activists delivering the message), are ineffective. However, completely uncoordinated campaigns with a large share of intrinsically-motivated activists are also ineffective. Third, the model allows me to relate returns to canvassing to the average costs of turnout, and to shed light on a possible link between the low returns of canvassing in Europe relative to the US (Bhatti et al. 2019) and the relatively high costs of voter registration in the US.

Section 1 introduces the model. Section 2 derives the equilibrium communication and participation strategies, and shows that instrumental activists are more effective but can be less motivated than intrinsically-motivated activists. Section 3 derives comparative statics on the returns to canvassing, relates the model to stylised facts, and derives implication for interpreting empirical evidence. Section 5 concludes. All proofs are presented in appendix.

Related literature. This paper is related to two strands of literature: models of communication in electoral campaigns and studies of the motivation of activists. It contributes to this literature by explicitly linking the two questions: how does the expected effectiveness of communication motivates activists, and how does their motivation affect the effectiveness of their communication.

Papers studying how information is communicated in electoral campaigns address the following challenge: how can information be transmitted when talk is cheap and candidates have a clear incentive to say whatever it takes to get elected. Callander & Wilkie (2007) and Kartik & McAfee (2007) show that information can be transmitted even when candidates can lie about their intended actions in office because the choice of platform in a political competition game can signal the candidate’s propensity to lie. Schnakenberg (2016) shows that informative cheap talk equilibria about policies can exist because candidates can send messages about the direction of their preferences rather than their intensity. Kartik & Van Weelden (2019) show that candidates may reveal their preferences to voters using cheap talk to credibly commit to future policies and avoid temptations for pandering. I contribute to that literature by showing that parties can benefit from campaigns if communication is delegated to activists, a portion of whom naively shares the truth. By endogenising the share of truthful activists who communicate information with voters, this paper suggests strategies for parties to communicate effectively independently of their platform choices.

Existing studies on the motivation of political activists and party members document the following sources of incentives: intrinsic motivations (Whiteley 2011, Webb et al. 2020), career concerns (Whiteley et al. 1994), and policy concerns (Aldrich 1983, Moon 2004, Venkatesh 2020).[2] This paper focuses on an another source of motivation: the expected success of the campaign. While the literature has focused on how parties can affect the motivation of activists through their platform choice, I show that they can also affect it by controlling the composition of the group of activists itself.

Two closely related papers are Hager et al. (2020a) and Hager et al. (2020b), which show empirically that activists become demotivated when they obtain news that competing candidates are increasing their campaigning effort or that other canvassers are more actively participating. The authors show that the theoretical effect of such information is unclear, but do not look at the message choice of activists. In this paper, I formalise the relationship between different sources of activists motivation when these motivations interact with their communication strategy.

Finally, this paper is related to information transmission models where the receiver faces uncertainty about both the payoff-relevant state and the sender's preferences (e.g. Sobel 1985, Morgan & Stocken 2003, Esteban & Ray 2006, Frankel & Kartik 2019), as well as models where information is transmitted both through costless messages and through costly action choices (e.g Austen-Smith & Banks 2000). Among those, the closest is Austen-Smith (1995). In that paper, lobbyists use monetary contributions to get access to legislators, but these monetary contributions provide a signal of the lobbyist's preferences. This paper differs because the participation behaviour of the activist does not directly benefit the voter, unlike the legislator who benefits from the lobbyist's campaign contributions in Austen-Smith (1995). In addition, total returns to canvassing depend both on the motivation of activists and the persuasiveness of their message, while the returns to lobbying do not depend directly on the amount spent by the lobbyist, conditional on getting access.

[2] A large literature in economics has also studied the interaction between intrinsic and extrinsic motivations (e.g Frey 1997, Benabou & Tirole 2003, Besley 2005). This literature shows that in many cases, extrinsic incentives can crowd out intrinsic incentives. Here, the participation of more instrumentally-motivated activists reduces their own motivation. It does not affect the motivation of intrinsically-motivated activists but reduces their effectiveness.

1 Model

An activist decides whether to participate ($x = 1$) or not ($x = 0$) in a canvassing round, and what message $m \in \{l, h\}$ to share with voters when canvassing.

Activists are privately informed about the state of nature, which captures the stakes of the election to voters. The state is denoted $\omega \in \{L, H\}$. When $\omega = L$, the stakes of the election are low. For example, the opposition candidate is not very different from that of the party canvassing (in competence or proposed policies), or the district where the voter lives will not have a big impact on the outcome of the election. Conversely, $\omega = H$ indicates that the election in this district is important. Activists observe ω before deciding to participate in canvassing and sharing a message. Voters do not observe ω, and believe that $\mathbb{P}(\omega = H) = p$ in the absence of additional information.

Activists are meeting voters that they know support their candidates, but who might prefer to stay at home rather than vote. Let $v = 1$ denote the voter's decision to vote, and $v = 0$ the decision to stay at home. Voters vote sincerely and expressively, but their turnout decision depends on their perceptions of the election's stakes. Voters turn out to vote if the cost of voting c is lower than the stakes of the election ω. The cost of turning out is private information to each voter. Activists believe that the cost of turnout is distributed on $[\underline{c}, \bar{c}]$ according to the CDF F_c.

Formally, given a belief $\hat{p}(x, m)$ that the stakes are high ($\omega = H$), the voter's expected utility is

$$U(v, \omega) = v\left(\hat{p}(x, m)u_H + (1 - \hat{p}(x, m))u_L - c\right) + (1 - v) \times 0,$$

where u_ω is the voter's payoff from turning out when the state is ω. I normalise $u_L = 0$.

Activists differ in their motivations. A share α of activists have instrumental motivations: they want to persuade voters to turn out. The value they attach to participating in canvassing is proportional to the probability that a voter is persuaded to turn out by the activist's canvassing (relative to the probability of turnout in the absence of canvassing). I call these activists instrumental and denote their type by $\tau = S$. A share $1 - \alpha$ of activists have intrinsic motivations. They get a fixed reward R from participating in canvassing, independently of the probability of persuading voters. I call these activists intrinsically-motivated, $\tau = N$. Both types of activists face a cost $k \in [\underline{k}, \bar{k}]$ of participating in canvassing. Once a canvasser is at the voter's door, she can costlessly share any message $m \in \{l, h\}$. The expected utilities of the two types of activists are therefore:

$$V_S(x, m) = x\left([\mathbb{P}(v = 1|x = 1, m) - \mathbb{P}(v = 1|x = 0)] - k\right) + (1 - x) \times 0$$
$$V_N(x, m) = x \times (R - k) + (1 - x) \times 0$$

The cost of canvassing k is private information to the canvasser. Voters believe that this cost is distributed according to the CDF F_k on $[\underline{k}, \bar{k}]$. I assume that $F_k(R) \in (0, 1)$, so there is always a positive mass of intrinsically-motivated canvassers, and some positive probability that the cost of canvassing is high enough to deter canvassing.

Voters know the distribution of activists' types (α), but cannot distinguish between different types of activists when meeting one. When an activist turns up at a voter's door, the voter forms beliefs about the type of the activist and about the stakes of the election, given the message shared by the activist and given the activists' equilibrium reporting strategy. I denote these posterior beliefs by $\hat{\alpha}(m, x = 1) = \mathbb{P}(\tau = S|m, x = 1)$ and $\hat{p}(m, x = 1) = \mathbb{P}(\omega = H|m, x = 1)$.

Formally, a strategy for an activist of type τ is a pair of functions (χ_τ, μ_τ) that maps the state ω into a distribution over messages and effort: $\chi_\tau : \{L, H\} \to \Delta(0, 1)$ and $\mu_\tau : \{L, H\} \to \Delta(\{l, h\})$. In an informative equilibrium, the activist would never mix over messages. In addition, there is only a measure zero of activists (from the perspective of voters, who do not know k) that are willing to mix over the decision to participate. We can therefore focus on pure strategies.

A belief function for the voter maps the presence of the activist (x) and her message (m) into probability distributions over the type of the activist (τ) and the state (ω), $\rho : \{0, 1\} \times \{l, h\} \to \Delta(\{L, H\}) \times \Delta(\{S, N\})$. Beliefs of the activists are probability distributions over the voters' costs of voting. The equilibrium concept is Weak Perfect Bayesian Equilibrium: activists' messages and canvassing strategies are optimal given their beliefs, voters' voting choices are optimal given their beliefs, and beliefs are derived via Bayes'rule whenever possible.

Finally, note that the canvassers' beliefs about the distribution of intrinsically-motivated and instrumental types (α) in the population also matter for their choice of message and effort. I assume that both types have correct beliefs about that share.

To summarise, the timing is as follows.

1. Nature determines the stakes of the election $\omega \in \{L, H\}$, the type of the activist τ, the cost

of canvassing of canvassers $k \in [\underline{k}, \bar{k}]$ and the cost of voting of voters $c \in [\underline{c}, \bar{c}]$.

2. The activist learns her type τ, the stakes ω, and her cost k, and chooses whether to canvass $x \in \{0, 1\}$ and what message to share m.

3. The voter privately learns his cost of voting c, observes whether an activist shows up and if so, hears the message of the activist m.

4. The voter forms beliefs about the activists's type τ and the stakes of the election ω and decides whether to vote: $v \in \{0, 1\}$.

The motivation of instrumental activists depends only on whether their message affects the behaviour of the voters they personally meet. The model abstracts from more general instrumental motivations such as the effect canvassers have on the overall election result. This means in particular that canvassers do not consider the pivotality of the voters they meet, or the fact that other canvassers (both from their party and the opposition) are meeting other voters. Similarly, canvassers do not explicitly account for the fact that the voters they meet might be contacted by canvassers from another party. While all these are important considerations in practice, the model captures them in a reduced form through the distribution of turnout costs F_c. Information from a competing party that discourages turnout would correspond to shifting up the distribution, while information from the same party would shift it down. The incentive to free-ride induced by higher participation of fellow party members would instead correspond to shifting up the distribution of canvassing costs F_k.

2 Canvassing message and participation decision

I begin by solving for the voter's beliefs and turnout decision. I then solve for the optimal message that different types of canvassers would send, given that they have decided to canvass. I show that canvassers' expected returns in equilibrium are independent of the stakes of the election. As a result, their canvassing decision carries no information about the state, only information about their type, so we can analyse the message and canvassing choice independently.

2.1 Voter

Upon meeting a canvasser, the voter updates his beliefs about both the type τ of the canvasser and the state ω. It is useful to break down the updating process into two steps. Let $\tilde{\alpha}(x=1)$ the voter's interim belief that the canvasser is instrumental upon meeting a canvasser, and $\tilde{p}(x=1)$ his interim belief about the expected stakes. Let $\hat{\alpha}(m, x=1)$ and $\hat{p}(m, x=1)$ denote the posterior beliefs given both the canvasser's decision to show up and the message she sends. For clarity, and since the only relevant voter's beliefs are when $x=1$, I drop the dependence on x.

Given these beliefs, the voter chooses to turn out to vote if the stakes are greater than the cost of turnout. Recall that since $u_L = 0$, $v = 1$ if and only if:

$$\hat{p}(m)u_H \geq c$$

From the point of view of the canvasser, the probability that the voter turns out to vote is therefore $F_c(\hat{p}(m)u_H)$.

2.2 Canvassing message

The instrumental canvassers always prefer to induce the highest possible belief, since their returns to canvassing are increasing in that belief. On their own, they would not be capable of persuading the voters. Each instrumental canvasser would prefer to send the message inducing the highest belief independently of the true state, so voters would not learn anything from that message.

However, intrinsically-motivated voters do not care about the voters' beliefs about the stakes of the election. As a result, these canvassers are happy to share the truth. When they do, their presence allows the instrumental canvassers to persuade the voters and for some information to be transmitted. Because each message contains a grain of truth, the voters learn something from the message, even though they adjust for the possibility that the message came from an instrumental canvasser.

There are several equilibria in this game. Since intrinsically-motivated canvassers do not care about the beliefs of the voters, they would be equally happy to send messages unrelated to the stakes of the election. In this case, no information could be transmitted at all. I focus on equilibria where the intrinsically-motivated canvassers are truthful because these equilibria generate the most interesting interactions between communication and incentives.[3] In these equilibria, intrinsically-motivated canvassers tell the truth (i.e. share message $m = l$ when $\omega = L$ and $m = h$ when $\omega = H$) and instrumental canvassers persuade voters that the stakes are high by always sharing message $m = h$.

I state this result formally in the following Lemma. Suppose that a voter holds interim beliefs $\tilde{\alpha}$ and $\tilde{p}$ upon meeting a canvasser but before hearing a message. I refer to the game starting from this point onwards as the *communication subgame.*

Lemma 1. *In the communication subgame, there exists an equilibrium in which:*

- *Intrinsically-motivated canvassers share the truth with voters:* $\mu_N(H) = h$ *and* $\mu_N(L) = l$.
- *Instrumental canvassers always share message* $m = h$*:* $\mu_S(\omega) = h, \forall\, \omega \in \{L, H\}$.
- *Following message* $m = l$*, voters are certain that the state is* $\omega = L$*. Following message* $m = h$ *they believe the state is* $\omega = H$ *with probability:*

$$\hat{p}(h) = \frac{\tilde{p}}{\tilde{\alpha} + \tilde{p}(1 - \tilde{\alpha})}$$

An instrumental activist would never deviate to sending message $m = l$ as this would induce a lower belief and therefore reduce the probability that the voter turns out: $F_c(u_L) \leq F_c(\hat{p}(h)u_H)$. An intrinsically-motivated activist is always indifferent between any message so has no incentives to deviate from her truth-telling strategy.

The voter's posterior belief reflects two dimensions of learning: about the type of the activist (τ) and about the state (ω). Since an instrumental type is more likely to share message $m = h$, the voter believes the activist is more likely to be instrumental when he hears that message and adjusts his beliefs about the state. As a result, an increase in the probability of meeting an instrumental canvasser ($\tilde{\alpha}$) decreases the expected utility of turning out upon hearing message $m = h$.

The activists' motivations therefore shape their message. Because the messages act as a signal of the state, we do not have to interpret them literally as containing hard information about the election. Instead one can think of intrinsically-motivated activists demonstrating different levels

[3] Minor modifications to the model, such as introducing even the smallest cost of lying for intrinsically-motivated canvassers (e.g. Kartik 2009, Kartik & McAfee 2007), or allowing intrinsically-motivated canvassers to care about the utility of the voters would induce them to tell the truth.

of enthusiasm or being more or less likely to go off-script and have an open discussion depending on the stakes of the election. Instead, instrumental activists would always appear particularly enthusiastic independently of the state. Voters are uncertain whether this enthusiasm is always genuine, but believe that it sometimes is.

This communication strategy shapes how likely the canvassers think they are of persuading voters. This, in turn, affects their motivation to get involved in canvassing in the first place. The next section evaluates how the optimal choice of effort is affected by these beliefs.

2.3 Participation decision of the activist

An intrinsically-motivated activist participates in canvassing as long as her motivation R is above her cost k. By contrast, an instrumental activist's decision to participate in canvassing depends on her expectation of the net persuasive effect of canvassing. In particular, given a belief $F_c(\hat{p}(h)u_H)$ that her message is effective, an instrumental canvasser participates in canvassing if

$$F_c(\hat{p}(h)u_H) - F_c(pu_H) \geq k \tag{1}$$

This inequality depends on equilibrium objects, such as the interim beliefs about the activist's type $\tilde{\alpha}$ and about the state $\tilde{p}$ upon seeing a canvasser. However, the decision to engage in canvassing conveys no information about the state for either type of activist. From Lemma 1, we know that the communication strategy of an instrumental activist is independent of ω, so her perception of the success of that strategy is also independent of the state. The communication of intrinsically-motivated activists does depend on the state, but their decision to participate does not. Finally, there is no separating equilibrium in which instrumental activists could signal the state through their choice of participation.[4] This implies that the interim belief about the state, upon meeting a canvasser, is equal to the prior $\tilde{p} = p$.

However, note that the voter's belief about the type of activist he is facing does change when the activist is standing in front of him. Formally, given the decision rules above, the voter believes that there is a probability $F_k(R)$ that an intrinsically-motivated activist decides to canvass, and a probability $F_k(F_c(\hat{p}(h)u_H) - F_c(pu_H))$ that an instrumental activist decides to canvass. His belief

[4] Suppose that such a separating equilibrium existed, where participation signalled a higher state. Then an activist who observes a lower state than the equilibrium belief would have an incentive to deviate and participate (for a given cost of canvassing).

upon meeting a canvasser that this canvasser is instrumental is therefore:

$$\tilde{\alpha}(x=1) = \frac{\alpha F_k(F_c(\hat{p}(h)u_H) - F_c(pu_H))}{\alpha F_k(F_c(\hat{p}(h)u_H) - F_c(pu_H)) + (1-\alpha)F_k(R)}$$

Therefore, an equilibrium exists if there exists some belief $\tilde{\alpha}$ that solves:

$$\tilde{\alpha} = \frac{\alpha F_k\left(F_c\left(\frac{pu_H}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)\right)}{\alpha F_k\left(F_c\left(\frac{pu_H}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)\right) + (1-\alpha)F_k(R)} \tag{2}$$

I show in the appendix that this belief exists and is unique so the strategies are well-defined. The following Lemma summarises the equilibrium strategies of different canvassers.

Lemma 2. *For any share $\alpha \in [0,1)$ of instrumental activists and any prior $p \in (0,1)$, there exists an equilibrium in which*

1. *Canvassers use the communication strategies described in Lemma 1.*
2. *An intrinsically-motivated activist participates in canvassing ($x_N(\omega) = 1$) if and only if $R \geq k$,*
3. *An instrumental activist participates in canvassing ($x_S(\omega) = 1$) if and only if*

$$F_c\left(\frac{pu_H}{\tilde{\alpha} + p(1-\tilde{\alpha})}\right) - F_c(pu_H) \geq k$$

Intuitively, in this equilibrium, voters first update their beliefs about the type of activist they are facing when canvassers show up at their doors. They then further update their beliefs about both the type of the canvasser and the stakes of the election after hearing the canvasser's message. Different types of activists use different communication strategies because they have different motivations, which also leads them to participate in canvassing at different rates.

2.4 Activists' effectiveness and motivation

Lemma 1 shows how different types of canvassers choose different messages, which translate into different ex-ante probabilities of persuading a voter to turnout. I call the probability that a voter turns out after hearing the message of a canvasser of type τ, relative to the probability that the voter turns out in the absence of any message the *effectiveness* of a type τ canvasser.

Definition 1. *The effectiveness of an activist of type* τ *is* $r_\tau = \mathbb{E}\left[F_c(\hat{p}(m)u_H)|x=1\right] - F_c(pu_H)$. *The expectation is taken over the state* $\omega \in \{L, R\}$ *and the messages* m *induced by type* τ*'s communication strategy* $\mu_\tau(\omega)$ *given a state.*

Lemma 2 relates the participation choice of an activist of type τ, to her choice of message, given some cost of canvassing k. I refer to the expected participation of an activist of type τ as the *motivation* of this activist.

Definition 2. *The motivation of an activist of type* $\tau = S$ *is* $m_S = \mathbb{E}[F_k(F_c(\hat{p}(m)u_H) - F_c(pu_H))]$, *where the expectation is taken over stakes* $\omega \in \{L, R\}$ *and over messages* m *induced by* $\mu_S(\omega)$. *The motivation of an activist of type* $\tau = N$ *is* $m_N = F_k(R)$.

The number of voters that are persuaded to turnout depends on both the effectiveness and the motivation of the activists. The next proposition shows that, holding the share of instrumental activists α constant, there can be a trade-off between motivation and effectiveness across different types of canvassers. It also shows that there are complementarities between the motivation of intrinsically-motivated canvassers and that of instrumental canvassers.

Proposition 1. *In any informative equilibrium,*

- *Instrumental activists are more effective than intrinsically-motivated ones:* $r_S > r_N$, *but can be more or less motivated than intrinsically-motivated ones.*

- *The motivation of instrumental activists is decreasing in their share of the population* (α) *and increasing in the motivation of intrinsically-motivated activists* (R).

The higher effectiveness of the instrumental canvassers arises because of their ability to persuasively lie. When the stakes of the election are low ($\omega = L$), an instrumental canvasser will persuade the voter that the stakes are higher than they really are. An intrinsically-motivated canvasser, on the other hand, will truthfully reveal the state to be $\omega = L$. There is therefore a share of voters who will turnout when hearing the message of an instrumental canvasser, but not when hearing the message of an intrinsically-motivated canvasser. All, else equal, this would imply that the returns to canvassing are increasing in the share of instrumental canvassers.

However, the effectiveness of both types of activists depends on the share of instrumental canvassers: the voter only gives credit to high messages to the extent that there are sufficiently many intrinsically-motivated canvassers also sharing these messages. This implies that type-specific returns are decreasing in the share of instrumental activists. Therefore, increasing the share of instrumental canvassers can reduce the returns of both types of canvassers. In turns, a lower expected effectiveness reduces the motivation of instrumental canvassers. There is therefore a trade-off between increasing the share of the more effective instrumental canvassers and decreasing the effectiveness of all the types of canvassers.

Finally, Proposition 1 shows that the motivation of instrumental activists is a substitute with respect to the participation of other instrumental activists, but complementary with that of intrinsically-motivated ones. As intrinsically-motivated activists become more motivated (R increases), voters believe that the canvasser at their door is relatively more likely to be an intrinsically-motivated activist. This increases the persuasiveness of message $m = h$, and therefore the expected returns to canvassing. The higher expected returns increase the benefits of canvassing for the instrumental canvassers and therefore their motivation. Conversely, the more instrumental canvassers there are in the population, the lower the instrumental canvassers expect their returns to be, and the less motivated they will be.

Relationship to empirical evidence. Enos & Hersh (2015) document that canvassers tend to be more partisan and ideologically extreme than the voters they meet. We can think of these very partisan activists as the instrumentally-motivated canvassers in the model. These activists engage in canvassing because they hope to make a difference for their party and to persuade voters. Under this interpretation, more partisan activists are less likely to distort the campaign message and signal the true state. If voters could identify them, they would trust these activists less. However, when voters cannot distinguish them, these activists are more effective. This is consistent with evidence that voters trust more canvassers that are similar to them when they can identify them (e.g. based on ethnicity or location, see Michelson 2003, 2006, Sinclair et al. 2013). In the model, the less partisan, intrinsically-motivated activists communicate the state truthfully. Voters should therefore trust them more if they could identify them. Because voters cannot distinguish them easily from instrumental canvassers, they end up being less effective at persuasion individually. However, their presence is necessary for canvassing to be successful. Therefore, while the political psychology literature shows that the receivers of a message are more likely to be convinced if they feel that the sender shares some of their beliefs or attitudes (Brock 1965, Berscheid 1966, Burger et al. 2004, Gino et al. 2009, Faraji-Rad et al. 2015), this does not necessarily imply that the less partisan activists are more effective when different types of activists co-exist and voters cannot easily distinguish them. Enos & Hersh (2015) conjecture that these more extreme activists might be less effective because voters trust them less, but can be valuable if they are more enthusiastic. The model above shows that indeed it is possible for these activists to be more motivated, which increases returns. However, it shows that they can also be more effective when they are mixed with less extreme activists. This difference arises even though the voter is aware of the incentives of different types of canvassers. It persists only because the voter cannot perfectly distinguish between the two types.

Proposition 1 shows that the motivation of instrumental activists is decreasing in their share of the population and increasing in the motivation of intrinsically-motivated activists. Under the interpretation above, we should therefore see that partisan (instrumentally-motivated) activists are relatively more motivated when they learn that other, less partisan (intrinsically-motivated), activists are participating. Hager et al. (2020b) find that there is an overall substitution effect when activists are informed that other activists intend to canvass more. They propose that this captures a classic free-riding effect. The free-riding effect is ruled out in this model by the assumption that activists care about their own impact and not the overall success of the campaign. In practice, activists are likely to care to some extent about the overall effectiveness of the campaign on the election result, which would lead to some substitution of effort across activists. However, Hager et al. (2020b) also note that the effect is heterogeneous across activists. The effect is less pronounced for activists with closer ties to the party (longer years of membership, prior canvassing experience). Their interpretation of the relative complementarity of effort for this group is that these activists derive values from social ties with other party members. The model above suggests another (complementary) interpretation. Canvassers with closer ties to the party are the ones more interested in persuading voters (instrumental canvassers). If these canvassers anticipate higher participation from newer members who are more likely to be candid in their interaction, then their motivation would indeed be relatively higher, balancing out the free-riding effect. One way to distinguish the two explanations would be to test whether the effect found by Hager et al. (2020b) differs when activists are informed that more partisan activists are expected to participate and when they are told that less partisan activists are expected to participate.

3 Total returns to canvassing campaigns

The previous section evaluated returns and motivations from the perspective of an individual canvasser. It showed that the effectiveness of their message and their motivation depended on the behaviour of other types of canvassers. However, a campaign manager seeking to maximise turnout should be more interested in the total returns to canvassing campaigns than individual returns.

I define the returns to canvassing as the probability that voters are persuaded to turnout by a canvasser, relative to the probability that they turnout in the absence of canvassing. Persuading a voter requires that a canvasser meets him, and that the message shared by the canvasser persuades the voter. Given definitions 1 and 2, the returns to a canvassing campaign are therefore equal to the motivation multiplied by the effectiveness of canvassers, weighted by the share of different canvasser types. In the rest of this section, I focus on the more interesting case where there is a positive probability of both types of activists canvassing, at least for some posterior belief of the voter. That is, there is a sufficiently high voter belief and a sufficiently low cost of canvassing such that the instrumental activists would want to canvass: $F_k(F_c(1 \times u_H) - F_c(pu_H)) > 0$. I also assume that instrumentally-motivated canvassers would not turn out if they expect no returns: $F_k(0) \leq 0$.[5]

Definition 3. *The total returns to canvassing are equal to*

$$TR = \alpha \times m_S \times r_S + (1 - \alpha) \times m_N \times r_N \tag{3}$$

Given Lemmas 1 and 2, the total returns in equilibrium are given by the following expression:

$$\begin{aligned} TR(\alpha) = \alpha \times & \underbrace{F_k\left(F_c(\hat{p}(h)u_H) - F_c(pu_H)\right)}_{\text{S motivation}} \times \underbrace{\left[F_c(\hat{p}(h)u_H) - F_c(pu_H)\right]}_{\text{S effectiveness}} \\ & + (1 - \alpha) \times \underbrace{F_k(R)}_{\text{N motivation}} \times \underbrace{\left[p \times F_c(\hat{p}(h)u_H) + (1 - p)F_c(0) - F_c(pu_H)\right]}_{\text{N effectiveness}} \end{aligned}$$

3.1 Positive returns to canvassing

The first result I establish is that total returns to canvassing are strictly positive for a large class of distributions of costs. This is in contrast with situations where activists do not need to exert effort to share messages with voters, which can have zero returns for the same cost distributions.

[5] Otherwise we should classify those activists as intrinsically-motivated canvassers.

In these situations, if the share of instrumental activists is too high, the message shared by these activists can induce beliefs that are strictly below the lowest voter turnout cost. When activists need to exert effort to share their message, this can no longer occur because activists internalise the effect of their participation on the beliefs of the voters. A sufficient (but not necessary) condition for returns to be positive is that the distribution of voting costs is sufficiently convex around the prior.[6]

Assumption 1. *Given parameters α, R, and F_k, and the corresponding equilibrium belief $\hat{p}$, the distribution of turnout costs is sufficiently convex on the interval $[0, \hat{p}u_H]$, so that: $pF_c(\hat{p}u_H) + (1-p)F_c(0) \geq F_c(pu_H)$.*[7]

For example, this assumption is satisfied if no voter turns out at the prior, $F_c(pu_H) = 0$, but a positive mass of voters do if they know the state is $\omega = H$: $F_c(u_H) > 0$. Substantially, it is satisfied whenever the lower bound of turnout costs for voters is sufficiently high, but not too high. If candidates face resource constraints, it is likely that they would target areas where turnout is expected to be low (so $F_c(pu_H) = 0$), but where they have a chance of persuading voters to turnout (so $F_c(u_H) > 0$) and this assumption would be satisfied.

Proposition 2. *Under assumption 1, the returns to canvassing are strictly positive for any $\alpha \in (0, 1)$ and for any p.*

This result shows how endogenising the motivation of activists can generate positive returns even when voters have relatively high costs of turnout and simple cheap talk persuasion (such as through telephone calls) would not be sufficient to persuade them. Instrumental activists internalise the effect of their presence on the returns to canvassing. When returns are close to zero, instrumental activists are very unlikely to turnout, voters adjust their beliefs accordingly which increases the effect of positive messages. Since instrumental activists always adjusts their behaviour optimally in this way, returns remain positive for any share of activists α and any prior p.

[6] If the distribution of voting costs was everywhere convex, then even a population of only intrinsically-motivated voters sharing the truth would generate positive returns, since sharing the truth is effectively a lottery over possible posteriors of the voter centred around the prior. However, the presence of instrumental canvassers can generate positive returns even if the distribution of costs is too concave for intrinsically-motivated canvassers to generate positive returns on their own.

[7] This requires convexity of F_c as otherwise we would have $pF_c(\hat{p}u_H) + (1-p)F_c(0) < F_c(p \times \hat{p}u_H + (1-p) \times 0) < F_c(pu_H)$.

To see why motivation matters, notice that if motivation was not endogenised, the returns to communication would be:

$$\begin{aligned} R =& \alpha \left(F_c \left(\frac{u_H p}{\alpha + (1-\alpha)p} \right) - F_c(pu_H) \right) \\ &+ (1-\alpha) \left(pF_c \left(\frac{u_H p}{\alpha + (1-\alpha)p} \right) + (1-p)F_c(0) - F_c(pu_H) \right) \end{aligned}$$

These returns can be zero (or even negative) if, for example, $F_c \left(\frac{u_H p}{\alpha+(1-\alpha)p} \right) = 0$, which is possible even under assumption 1.[8]

This result rationalises one of the most consistent stylised fact about canvassing: that it is an effective method of making voters turnout (Green et al. 2013). Proposition 2 shows that even when canvassers are free to lie, and conversations should carry little information, canvassing can increase turnout. This arises because voters are uncertain about the type of canvassers they face, and therefore about their incentives to persuade them. Some canvassers take advantage of this uncertainty and exaggerate the importance of the election when meeting voters. Because sharing the message involves some costly action, the share of such canvassers can never be so high that voters stop trusting them. As a result, canvassing always generates positive returns. By explicitly modelling the motivation of canvassers, this model therefore provides a rationale for this stylised facts, while a model of pure cheap talk would fail to generate positive returns for a range of parameters.

3.2 Returns to canvassing, activists types, and cost of voting

I now analyse how the total returns defined above depend on the share of different types of activists and the voters' costs of voting. To derive these comparative statics in a tractable way, I make further assumptions on the distributions of canvassing and turnout costs.

Assumption 2. *The costs of canvassing k are distributed uniformly on $[0, 1]$. The costs of turnout are distributed uniformly on $[\underline{c}, \bar{c}]$. Let $c_M = \frac{\underline{c}+\bar{c}}{2}$ denote the average cost of turnout.*

The following proposition establishes that, under these assumptions, returns to canvassing are non-monotonic in both the share of instrumental canvassers and in the average cost of turnout.

[8] For instance, suppose that the support of the distribution of costs is $[\underline{c}, \bar{c}]$ such that $pu_H < \underline{c}$, then there exists some values of α and p such that $\frac{u_H p}{\alpha+(1-\alpha)p} < \underline{c}$.

Proposition 3. *Under assumption 2, total returns are*

- *Increasing in the share of instrumental canvassers α for low levels of α and decreasing at higher levels.*
- *Increasing in the average cost of turnout c_M at low levels and decreasing at high levels.*

The non-monotonicity of returns with respect to the share of canvassers follows from Proposition 1. At low levels of α, the effective share of instrumental canvassers $\tilde{\alpha}$ is also low, so the returns following message $m = h$ are very high. In particular, if $\hat{p}u_H > \bar{c}$ then the returns following message $m = h$ are maximised and independent of the share of instrumental activists (α). In this case, increasing the share of instrumental canvassers increases returns.

However, as α continues to increase, the posterior expected utility of the voter can fall to $\hat{p}u_H < \bar{c}$. In this case, increasing the share of instrumental activists decreases returns through two combined effects: a decrease in the posterior expectation and therefore in the returns of both types of activists, and a decrease in the motivation of instrumental activists that results from this decrease in returns. As a result, the returns to canvassing decrease in the share of instrumental activists.

The model therefore predicts that returns to canvassing should be highest when the proportion of intrinsically-motivated activists is not too low nor too high. This is consistent with the empirical evidence on the returns to different canvassing methods. In their meta-analysis, (Green et al. 2013) find that door-to-door canvassing has the largest average treatment effect with a 2.54 percentage point increase in turnout, on average. This is followed by volunteer phone calls (1.94 pp), 'Commercial' phone calls (0.98 pp), and mail or e-mail (0.16 pp). Nickerson (2007) also highlights that phone canvassers also tend to stick more to a prepared script than door-to-door conversations. within the model, this would correspond to a higher proportion of instrumental canvassers in phone canvassing than door-to-door canvassing, and a higher proportion of instrumental canvassers in commercial phone banks than volunteer ones. The results are therefore consistent with being on the decreasing section of returns as a function of the share of instrumental canvassers. In fact, Nickerson (2007) shows that when volunteer phone callers are instructed to stick to the script carefully and commercial ones encouraged to have a more natural conversation, the results are reversed, and commercial phone banks generate higher turnout. This suggest that the information learnt by voter from the delivery of the message is important. Mail campaigns are the most extreme example since the script is completely fixed and independent of the type of the messenger. The model predicts that returns should be zero when there are only instrumental canvassers ($\alpha = 1$), consistent with the low returns measured empirically.

Within door-to-door campaigns, variations in the share of instrumental voters depend on the perceptions of voters. Voters may form beliefs about the composition of groups of activists through past interactions with campaigners. For instance, Bashir et al. (2013) find that subjects tend to view activists as dissimilar to themselves and are less likely to respond to the activist's message when the activists bears stereotypical traits associated with their cause (e.g. feminism or environmentalism). Similarly, Kutlaca et al. (2020) find that non-activists feel closer to activists who expressed moral and collective motivations to explain their activism than those who expressed instrumental motivations. However, they also find that non-activists did not find any of these types of activists more representative of the general population of activists, suggesting a relatively balanced perception of the two types (i.e. α close to 0.5).

Proposition 3 also shows that when turnout costs are not too high, an increase in these costs can increase the returns to canvassing. This is consistent with the higher returns to canvassing measured in the US than in Europe. In their meta-analysis of 9 field experiments conducted in European countries, Bhatti et al. (2019) find an average treatment effect of 0.78 percentage points on turnout, much lower than the 2.54 average treatment effect measured by Green et al. (2013) in US studies. This could be explained by higher costs of voting in the US than in Europe.[9] The cost of voting also depends on how burdensome the registration process is (see e.g. Schraufnagel et al. 2020). While most of the studies in Green et al. (2013) target already-registered voters, Nickerson (2015) looks specifically at the effect of canvassing to increase voter registration and finds that this leads to a 2 percentage points increase on turnout using field experiments in 10 US cities. Similarly, Braconnier et al. (2017) estimate that canvassing to increase voter registration can increase participation by 4 to 5 percentage points in France where, as in the US, registration is not automatic. These effects on turnout are higher than those found in countries with automatic

[9] Estimates of voting costs in the US and Europe available in the existing literature are not directly comparable. However, Blais et al. (2019) show a strong correlation between their survey-based estimate of subjective voting cost and turnout in European countries and in Canada. If this correlation also applies to the US, the generally lower turnout in US elections could reflect higher costs of voting. Of course, there are many other determinants of turnout, including the canvassing strategies modelled here, so this is not direct evidence. A number of studies compare estimates of voting costs across states within the US using either geographical distance (Haspel & Knotts 2005, Brady & McNulty 2011), waiting times (Pettigrew 2017), or administrative requirements (Schraufnagel et al. 2020), and show that these measures correlate with turnout.

voter registration (Italy, Sweden, Denmark, Spain, see Rosenberg & Chen (2009)) listed in Bhatti et al. (2019).

This result also provides additional testable predictions: any characteristic of a district that increases the cost of turnout (rural vs. urban, distances to voting station, quality of roads, availability of postal votes, weather, etc.) should affect the returns to canvassing. The relationship should be positive in areas with lower turnout cost, and negative in areas with high turnout costs.

4 Implications for empirical studies of canvassing

External validity is a well-known limitation of field experiments. While many factors can affect the external validity of a study, the model in this paper provides a framework to think about particular issues in field experiments about canvassing. In a small-scale field experiment, the motivation of activists has a lower impact on returns, compared to a full-fledged electoral campaign. The number of voters contacted is determined by the experimental setup, not by how long activists agree to go knock on doors. Instead, wide scale campaigning activities rely on the goodwill of activists, and motivation becomes an important factor in the campaign's success. This has three consequences for the return measured in a field experiment.

First, aggregate returns will be less than the sum of individual returns because some activists will become discouraged. This straightforward observation is not specific to canvassing and applies to any situation where scaling up increases the costs of treating subjects.

Second, the proportion of different types of activists will be different in the experiment than in an actual campaign. Since different types of canvassers generate different returns, the average returns depend on the proportion of each type. So even adjusting for the relatively lower motivation at higher scale, the average return would be different than in experiments.

Finally, voters' beliefs about the type of activists they face will be different than the actual proportions of different types of activists in the experiment. Voters do not know that they are part of an experiment and adjust their beliefs for the relative rate of participation of different types as if they were in a large-scale campaign. This, in turn, affects how they interpret the message shared by activists. This disconnect between the perceived and actual proportion is, in fact, good as it means that field experiments accurately capture the returns of individual canvassers.

The total returns in wide-scale campaigns depend on motivation

One difference between small-scale experiments and large scale campaigns is that large-scale campaigns depend more on the goodwill of activists. To make the comparison starker, suppose that activists are always motivated in a small-scale experiment: $m_S = m_N = 1$.[10] In this case, the probability that a canvasser turning up at someone's door is an instrumental activist is the same as the probability that a canvasser randomly selected from the population is an instrumental activist, α. However, since voters do not know that they are taking part in an experiment their beliefs about the type of a canvasser will be the same as in a large scale experiment: $\tilde{\alpha}$.

Formally, returns in a field experiment are measured as the average percentage point increase in turnout between households treated ($T = 1$) and households in the control group ($T = 0$) (Green et al. 2013). If the beliefs of voters are the same as in a real campaign, then the expected returns to each type of activists are the same as in a real campaign, so the experimental returns (ER) are:

$$ER(\tilde{\alpha}) = \mathbb{E}[R|T = 1] - \mathbb{E}[R|T = 0] = \alpha \times r_S(\tilde{\alpha}) + (1 - \alpha) \times r_N(\tilde{\alpha}) \tag{4}$$

Comparing the experimental returns in expression (4) to the total returns in an actual campaign given by expression (3), we see that the only difference is the motivation of activists (and therefore the probability of being treated). Since total returns are increasing in motivation, and the motivation of activists is higher in small-scale experiments, experimental total returns are higher than in a large-scale campaign.

As a result, the returns on a large scale campaign are not simply the aggregated version of returns in field experiments. They need to be adjusted for the lower motivation of activists. This issue could be addressed by using data on the participation rate of activists (e.g Hager et al. 2020a,b) to adjust the returns.

The proportion of activists in experiments is different than in wide-scale campaigns

The direct effect of motivation on returns is straightforward and can, in principle, be addressed with additional data. However, the difference in motivation also has a more subtle indirect effect on returns. Suppose that campaign managers had a large pool of activists, so that when a canvasser

[10] Of course field experiments can also face difficulties in recruiting participants, but it is natural to think that these issues become more severe the larger the scale of the campaign.

stops canvassing she can be replaced immediately. In this case, the direct effect of motivation discussed above is no longer an issue. However, since motivation differs across types, one type of canvasser would be replaced more often and the proportion of activists canvassing would be different than their proportion in the population (α). Eventually, the proportion of instrumental activists would correspond to to the equilibrium probability that a canvasser turning up at a voter's door is an instrumental type ($\tilde{\alpha}$). We can therefore evaluate this indirect effect by comparing the experimental returns (expression (4)) to the following hypothetical returns:

$$HR(\tilde{\alpha}) = \tilde{\alpha} \times r_S(\tilde{\alpha}) + (1 - \tilde{\alpha}) \times r_N(\tilde{\alpha}) \tag{5}$$

I define the *indirect effect of motivation* as the difference between these two quantities: $ER(\tilde{\alpha}) - HR(\tilde{\alpha})$. Comparing the two expressions gives the following result.

Proposition 4. *The indirect effect of motivation is positive if and only if intrinsically-motivated activists are more motivated than instrumental ones:* $ER(\tilde{\alpha}) > HR(\tilde{\alpha}) \iff m_N > m_S$.

When intrinsically-motivated activists are more motivated than instrumental ones, voters believe that they are more likely to turn up at their doors, so $1 - \tilde{\alpha} > 1 - \alpha$. Since instrumental activists have higher individual returns than intrinsically-motivated one, artificially increasing the proportion of instrumental activists (using α instead of $\tilde{\alpha}$) exaggerates the total returns to canvassing. Intuitively, when intrinsically-motivated activists are more motivated, voters incorrectly believe that they are more likely to be faced with a truthful activist (relative to their true share of the population). As a result, they trust positive messages more than they should, and returns to canvassing appear higher.

This result implies that the size of the returns we measure can be exaggerated, even holding the direct effect of motivation constant. However, note that the indirect effect can also depress the experimental returns relative to the true returns. This happens when intrinsically-motivated activists are the less motivated ones. In that case, the incorrect proportion of instrumental activists partially corrects for the artificially higher total participation in experiments. The indirect effect is larger when motivation matters more, for instance when the cost of canvassing are high. This issues should be less problematic in large-scale field experiments, such as Pons (2018) (where the experiment is based on a nationwide campaign) or Gerber et al. (2008).

Experiments accurately capture the returns of individual canvassers

As mentioned above, voters adjust their beliefs about canvassers' types as if the canvassers were part of a large-scale campaign, because they do not know that they are taking part in an experiment. Therefore, in an experiment, voters think that there is a probability $\tilde{\alpha}$ that a canvasser showing up at their door is instrumental when that probability is actually α (if motivation is not an issue in the experiment). Thus, voters will have incorrect beliefs relative to the proportion of canvassers in the experiment, but these incorrect beliefs are the ones they would have in a wide-scale campaign.

Since these beliefs affect how voters interpret the message they receive from a given canvasser, they affect the measured returns from an individual canvasser: $r_\tau(\alpha)$. The individual returns measured in an experiment are therefore a good estimate of the individual returns in a wide-scale campaign if the voters do not know that they are part of an experiment.

If voters knew they were in an experiment, the individual returns would be computed using the overall share of activists in the population, α. We can evaluate the difference between the two by replacing $r_\tau(\tilde{\alpha})$ by $r_\tau(\alpha)$ in expression (4). Since individual returns are decreasing in α for both types, and since $\tilde{\alpha} > \alpha$ if and only if intrisically-motivated activists are more motivated, then telling voters that they are in an experiment would exaggerate individual returns if and only if intrisically-motivated activists are more motivated.

5 Conclusion

This paper examined how differences in the motivation of activists affect both their participation in campaigning activities and their effectiveness. Activists who are motivated by the possibility of making a difference (instrumental motivations) are more effective at persuading voters than activists who enjoy participating in campaigns for its own sake (intrinsic motivations). However, increasing the share of instrumentally-motivated activists can reduce the effectiveness of the campaign for both types of activists, and reduce their own motivation. An interesting consequence is that the motivation of the two types of activists can be complementary, in contrast with the free-riding and crowding out effects that are common in group activities.

I showed that these results are consistent with stylised facts about the returns from campaigning across different countries and different methods. The paper offers some normative implications for campaign organisers to consider. While getting as many activists on the field as possible may seem a promising campaign strategy, this paper shows that careful recruitment of the right type of candidate can yield better returns.

Finally, the model offers a framework to think about issues that can arise when scaling up field experiments and extrapolating their results to national campaigns. In particular, it shows that while field experiments correctly capture the returns to individual canvassers, the average returns to canvassing can differ in large-scale campaigns.

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A Appendix

A.1 Proofs of results in the text

Preliminary results. Suppose that the canvasser's strategy is $\chi(\tau, \omega)$. Then the voter's belief that the canvasser is instrumental, given that the canvasser showed up ($x = 1$) is

$$\tilde{\alpha}(x = 1) = \frac{\mathbb{E}_{\omega}[\mathbb{P}(x = 1|S, \omega, \chi(S, \omega))]\alpha}{\mathbb{E}_{\omega}[\mathbb{P}(x = 1|S, \omega, \chi(S, \omega))]\alpha + \mathbb{E}_{\omega}[\mathbb{P}(x = 1|N, \omega, \chi(S, \omega))](1 - \alpha)}$$

The voter also updates his beliefs on the stakes:

$$\tilde{p}(x = 1, \chi(S, \omega), \chi(N, \omega)) = \frac{\mathbb{E}_{\tau}[\mathbb{P}(x = 1|H, \tau, \chi(\tau, H))]p}{\mathbb{E}_{\tau}[\mathbb{P}(x = 1|H, \tau, \chi(\tau, H))]p + \mathbb{E}_{\tau}[\mathbb{P}(x = 1|L, \tau, \chi(\tau, L))](1 - p)}$$

Secondly, upon hearing a message m, the voter further updates both beliefs to:

$$\hat{\alpha}(m, x = 1) = \frac{\mathbb{E}_{\omega}[\mathbb{P}(m|S, \omega, \mu_S(\omega))]\tilde{\alpha}}{\mathbb{E}_{\omega}[\mathbb{P}(m|S, \omega, \mu_S(\omega))]\tilde{\alpha} + \mathbb{E}_{\omega}[\mathbb{P}(m|N, \omega, \mu_N(\omega))](1 - \tilde{\alpha})}$$

And

$$\hat{p}(m, x = 1) = \frac{\mathbb{E}_{\tau}[\mathbb{P}(m|H, \tau, \mu_{\tau}(H))]\tilde{p}}{\mathbb{E}_{\tau}[\mathbb{P}(m|H, \tau, \mu_{\tau}(H))]\tilde{p} + \mathbb{E}_{\tau}[\mathbb{P}(m|L, \tau, \mu_{\tau}(L))](1 - \tilde{p})}$$

Proof of Lemma 1. Suppose the voter holds interim beliefs $\tilde{p}$ and $\tilde{\alpha}$. The communication strategy in which the instrumental type always shares message $m = h$ and the intrinsically-motivated type shares $m = h$ if and only if $\omega = H$, induces the following beliefs: $\hat{\alpha}(l) = 0$ and,

$$\begin{aligned}
\hat{\alpha}(h) &= \mathbb{P}(\tau = S|m = h) \\
&= \frac{\mathbb{P}(m = H|\tau = S)\tilde{\alpha}}{\mathbb{P}(m = H|\tau = S)\tilde{\alpha} + \mathbb{P}(m = H|\tau = N)(1 - \tilde{\alpha})} \\
&= \frac{\tilde{\alpha}}{\tilde{\alpha} + \tilde{p}(1 - \tilde{\alpha})}
\end{aligned}$$

As well as $\hat{p}(l) = \mathbb{P}(\omega = H|m = l) = 0$ and

$$\begin{aligned}
\hat{p}(h) &= \mathbb{P}(\omega = H|m = h) \\
&= \mathbb{P}(\omega = H \cap \tau = S|m = h) + \mathbb{P}(\omega = H \cap \tau = N|m = h) \\
&= \frac{\mathbb{P}(H|\tau = S, m = h)\, \mathbb{P}(\tau = S|m = h)\, \mathbb{P}(m = h)}{\mathbb{P}(m = h)} + \frac{\mathbb{P}(H|\tau = N, m = h)\, \mathbb{P}(\tau = N|m = h)\, \mathbb{P}(m = h)}{\mathbb{P}(m = h)} \\
&= \hat{\alpha} p + (1 - \hat{\alpha}) \times 1 \\
&= \frac{\tilde{p}}{\tilde{\alpha} + \tilde{p}(1 - \tilde{\alpha})}
\end{aligned}$$

These beliefs induce the following behaviour:

$$\begin{aligned}
v(m = h) = 1 \quad &\text{iff} \quad u_H \times \frac{\tilde{p}}{\tilde{\alpha} + \tilde{p}(1 - \tilde{\alpha})} \geq c \\
v(m = l) = 1 \quad &\text{iff} \quad u_L \geq c
\end{aligned}$$

This communication strategy is therefore an equilibrium since:

- **Type N** is always indifferent between $m = l$ and $m = h$
- **Type S** does not want to deviate (recall $u_L = 0$): $\forall \omega \in \{L, H\}$

$$\begin{aligned}
U_S(x = 1, m = h|\omega) &= F_c\left(\frac{u_H \tilde{p}}{\tilde{\alpha} + \tilde{p}(1 - \tilde{\alpha})}\right) \\
&\geq F_c(0) = U_S(x = 1, m = l|\omega)
\end{aligned}$$

□

Proof of Lemma 2. From Lemma 1, we know that if the voter holds beliefs $\tilde{\alpha}$ and $\tilde{p}$, then there exists a well-defined equilibrium strategy for the activist in the communication subgame, $\mu_\tau(\omega)$. Given this strategy, the voter updates further his beliefs to $\hat{\alpha}(m)$ and $\hat{p}(m)$ and his turnout strategy ($v = 1$ if and only if $\hat{p}(m)u_H \geq c$) is optimal given these beliefs.

Therefore, we only need to show that there exists beliefs $\tilde{\alpha}$ and $\tilde{p}$ that are consistent with the activist's participation strategy: $x(S) = 1$ if and only if $\mathbb{P}(\hat{p}(\mu_S(\omega))u_H \geq c|\omega) \geq k$ and $x(N) = 1$ if and only if $R \geq k$, and that this strategy is indeed optimal for the activist given these beliefs.

Step 1: I start by showing that $\tilde{p} = p$. Using the expression from above, we have:

$$
\begin{aligned}
\tilde{p}(x=1,\chi(\tau,\omega)) &= \frac{\mathbb{E}_\tau[\mathbb{P}(x=1|H,\tau,\chi(\tau,H))]p}{\mathbb{E}_\tau[\mathbb{P}(x=1|H,\tau,\chi(\tau,H))]p + \mathbb{E}_\tau[\mathbb{P}(x=1|L,\tau,\chi(\tau,L))](1-p)} \\
&= \frac{p[\tilde{\alpha}F_K(F_c(\hat{p}(h)u_H)) + (1-\tilde{\alpha})F_k(R)]}{p[\tilde{\alpha}F_K(F_c(\hat{p}(h)u_H)) + (1-\tilde{\alpha})F_k(R)] + [\tilde{\alpha}F_K(F_c(\hat{p}(h)u_H)) + (1-\tilde{\alpha})F_k(R)](1-p)} \\
&= p \times \frac{\tilde{\alpha}F_K(F_c(\hat{p}(\mu_S(H))u_H)) + (1-\tilde{\alpha})F_k(R)}{\tilde{\alpha}F_K(F_c(\hat{p}(\mu_S(H))u_H)) + (1-\tilde{\alpha})F_k(R)} \\
&= p
\end{aligned}
$$

Step 2: I then show that, given the activist's strategy, there exists $\tilde{\alpha}$ such that:

$$
\tilde{\alpha}(x=1) = \frac{\alpha F_k\left(F_c\left(\frac{u_H\tilde{p}}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)\right)}{\alpha F_k\left(F_c\left(\frac{u_H p}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)\right) + (1-\alpha)F_k(R)}
$$

For simplicity, let $\tilde{\alpha} = \tilde{\alpha}(x=1)$. This equation can be re-written as:

$$
\frac{\tilde{\alpha}}{1-\tilde{\alpha}} = \frac{\alpha}{1-\alpha} \times \frac{F_k\left(F_c\left(\frac{u_H p}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)\right)}{F_k(R)}
$$

Let $LHS(x) = \frac{x}{1-x}$ and $RHS(x) = \frac{\alpha}{1-\alpha} \times \frac{F_k\left(F_c\left(\frac{u_H\tilde{p}}{x+\tilde{p}(1-x)}\right) - F_c(pu_H)\right)}{F_k(R)}$. We have $LHS(0) = 0$, $\lim_{x\to 1} LHS(x) = +\infty$, and $LHS'(x) > 0$.

In addition, $\lim_{x\to 0} RHS(x) = \frac{\alpha}{1-\alpha}\frac{F_k(F_c(u_H)-F_c(pu_H))}{F_k(R)} > 0$. We also have $\lim_{x\to 1} RHS(x) = \frac{\alpha}{1-\alpha}\frac{F_k(0)}{F_k(R)} < +\infty$. Finally, $RHS'(x) \leq 0$ since $F_c(x)$, $F_k(x)$ are increasing in x.

Therefore, we can conclude that $\lim_{x\to 0} L(x) - R(x) > 0$, $\lim_{x\to 1} LHS(x) - RHS(x) < 0$, and $LHS(x) - RHS(x)$ is strictly decreasing in x. So by the intermediate value theorem, there exists a unique $\tilde{\alpha} \in (0,1)$ such that $LHS(\tilde{\alpha}) = RHS(\tilde{\alpha})$.

Finally, given these interim beliefs induced by the activist's participation strategy, this participation strategy is indeed optimal. For an intrinsically-motivated activist, participating in canvassing gives a payoff of $R-k$ and not participating gives a payoff of 0, so an intrinsically-motivated activist should participate if and only $k < R$. For an instrumental activist, given these equilibrium beliefs and her communication strategy, participating in canvassing gives an expected payoff of $\left[F_c\left(\frac{u_H\tilde{p}}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)\right] - k$, not participating gives a payoff of 0, so the instrumental activist should participate if and only if $k < F_c\left(\frac{u_H\tilde{p}}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)$. □

Proof of proposition 1. The **effectiveness** of the two types are:

$$r_S = F_c\left(\frac{u_H p}{\tilde{\alpha} + p(1-\tilde{\alpha})}\right) - F_c(pu_H)$$
$$r_N = p \times F_c\left(\frac{u_H p}{\tilde{\alpha} + p(1-\tilde{\alpha})}\right) + (1-p) \times F_c(0) - F_c(pu_H)$$

Since $\frac{u_H p}{\tilde{\alpha}+p(1-\tilde{\alpha})} > 0$, we get $F_c\left(\frac{u_H p}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) > p \times F_c\left(\frac{u_H p}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) + (1-p) \times F_c(0)$, so $r_S > r_N$.

The **motivation** of the two types are:

$$m_S = F_k\left[F_c\left(\frac{u_H p}{\tilde{\alpha} + p(1-\tilde{\alpha})}\right) - F_c(pu_H)\right]$$
$$m_N = F_k(R)$$

First note that m_S is strictly decreasing in $\tilde{\alpha}$. From the proof of Lemma 2, we know that an increase in α shifts up $RHS(\tilde{\alpha})$ but leaves $LHS(\tilde{\alpha})$ unchanged, so $\tilde{\alpha}$ is increasing in α. Similarly, an increase in R shifts down $RHS(\tilde{\alpha})$ but leaves $LHS(\tilde{\alpha})$ unchanged, so an increase in R decreases $\tilde{\alpha}$. Therefore, an increase in α decreases m_S and an increase in R increases m_S.

Finally, this results implies that both $R > F_c\left(\frac{u_H p}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)$ and $R < F_c\left(\frac{u_H p}{\tilde{\alpha}+p(1-\tilde{\alpha})}\right) - F_c(pu_H)$ are possible. For example, taking $\alpha \to 1$ implies $\tilde{\alpha} \to 1$, so $m_S \to 0 < R$. Similarly, taking $\alpha \to 0$ implies $\tilde{\alpha} \to 0$, so $m_S \to F_c(u_H) - F_c(pu_H)$ which can be above R for p low enough and u_H large enough. □

Proof of proposition 2. The returns to canvassing are:

$$TR = \alpha \times F_k\left(F_c(\hat{p}(h)u_H) - F_c(pu_H)\right)\left[F_c(\hat{p}(h)u_H) - F_c(pu_H)\right]$$
$$+ (1-\alpha)F_k(R)\left[pF_c(\hat{p}(h)u_H) + (1-p)F_c(0) - F_c(pu_H)\right]$$

Suppose by contradiction that expected returns are zero. Given that $F_k(R) > 0$ and that $pF_c(\hat{p}u_H) + (1-p)F_c(0) \geq F_c(pu_H)$, $TR = 0$ implies that:

$$\alpha \times F_k\left(F_c(\hat{p}(h)u_H) - F_c(pu_H)\right)\left[F_c(\hat{p}(h)u_H) - F_c(pu_H)\right] = 0.$$

Therefore, $TR = 0$ implies that either $F_k\left(F_c(\hat{p}(h)u_H) - F_c(pu_H)\right) = 0$ or $F_c(\hat{p}(h)u_H) - F_c(pu_H) =$

0, or both. However, note that if $F_c(\hat{p}(h)u_H) - F_c(pu_H) = 0$ but $F_k\left(F_c(\hat{p}(h)u_H) - F_c(pu_H)\right) > 0$, then we must have $F_k\left(0\right) > 0$. In other words, these canvassers would canvass even in the absence of positive returns, which we ruled out. As a result, it must be that $F_k\left(F_c(\hat{p}(h)u_H) - F_c(pu_H)\right) = 0$.

If this was the case, then no instrumental activist would participate. The voter's interim belief upon seeing a canvasser would therefore be: $\tilde{\alpha} = \frac{0}{0+F_k(R)} = 0$, and his posterior about the state following message $m = h$ becomes:

$$\hat{p}(h) = \frac{p}{\tilde{\alpha} + (1-\tilde{\alpha})p} = 1$$

But then, the expected returns following message $m = h$ are positive $F_c(u_H\hat{p}(h)) - F_c(pu_H) > 0$, and by assumption the motivation of an instrumental activist would be positive:

$$F_k\left(F_c(\hat{p}(h)u_H) - F_c(pu_H)\right) > 0$$

This implies that total returns should be positive, a contradiction. □

Proof of proposition 3. We start by deriving comparative statics with respect to α and then with respect to c_M. Recall that $c_M = \frac{\underline{c}+\bar{c}}{2}$ and $v = \bar{c} - \underline{c}$.

<u>Share of instrumental:</u>

Let $\underline{\alpha}$ such that: $\frac{pu_H}{p+\tilde{\alpha}(\underline{\alpha})(1-p)} > \bar{c}$. Note that $\frac{pu_H}{p+\tilde{\alpha}(\alpha)(1-p)} > \bar{c}$ implies $m_s(\alpha) = 1 > R$, so $\tilde{\alpha}(\alpha) = \frac{\alpha}{\alpha+R(1-\alpha)}$, and $\frac{pu_H}{p+\alpha(1-p)} > \bar{c}$.

<u>Case 1:</u> Suppose $pu_H < \underline{c}$.

Case 1.1: If $\alpha < \underline{\alpha}$, we have $\hat{p}u_H > \bar{c}$, so that $\mathbb{P}(v = 1|m = h) = 1$. Returns are therefore:

$$TR = \alpha \times 1 \times 1 + (1-\alpha) \times R \times p \times 1 = \alpha(1-pR) + pR$$

Which is strictly increasing in α since $pR < 1$.

Case 1.2: If $\alpha \geq \underline{\alpha}$. Then $\hat{p}u_H < \bar{c}$, so $\mathbb{P}(v = 1|m = h) = \frac{\frac{pu_H}{p+\tilde{\alpha}(\alpha)(1-p)} - \underline{c}}{\bar{c}-\underline{c}}$. Returns are therefore:

$$TR = \alpha\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)^2 + (1-\alpha)Rp\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)$$

We can then derive:

$$\begin{aligned}\frac{\partial TR}{\partial \alpha} &= 2\alpha\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)\times\frac{\partial\hat{p}}{\partial\alpha}\times\frac{u_H}{v}+\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)^2+(1-\alpha)Rp\times\frac{\partial\hat{p}}{\partial\alpha}\times\frac{u_H}{v}-Rp\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)\\ &= \frac{\partial\hat{p}}{\partial\alpha}\times\frac{u_H}{v}\left[2\alpha\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)+(1-\alpha)Rp\right]+\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)\left[\frac{\hat{p}u_H - \underline{c}}{v}-Rp\right]\end{aligned}$$

We can show that this derivative is negative as follows.

First, notice that since $\frac{\partial\hat{p}}{\partial\alpha}<0$, then if $Rp \geq \frac{\hat{p}u_H-\underline{c}}{v}$ we have $\frac{\partial TR}{\partial\alpha}<0$ directly.

Therefore, consider the case $Rp < \frac{\hat{p}u_H-\underline{c}}{v}$, or equivalently $Rpv+\underline{c}<\hat{p}u_H$. In this case, $\frac{\partial\hat{p}}{\partial\alpha}<0$ if and only if:

$$\left(\frac{\hat{p}u_H - \underline{c}}{v}\right)\left[\frac{\hat{p}u_H - \underline{c} - Rpv}{v}\right] < -\frac{\partial\hat{p}}{\partial\alpha}\times\frac{u_H}{v}\left[\frac{\alpha\left(\hat{p}u_H-\underline{c}\right)+\alpha\left(\hat{p}u_H-\underline{c}-RpV\right)+Rpv}{v}\right]$$

Or,

$$\frac{-1}{u_H\frac{\partial\hat{p}}{\partial\alpha}} < \frac{\alpha\left(\hat{p}u_H-\underline{c}\right)+\alpha\left(\hat{p}u_H-\underline{c}-RpV\right)+Rpv}{(\hat{p}u_H-\underline{c})(\hat{p}u_H-\underline{c}-Rpv)}$$

Using implicit differentiation on the expression that defines $\tilde{\alpha}$: $\frac{\tilde{\alpha}}{1-\tilde{\alpha}}=\frac{\alpha}{1-\alpha}\times\frac{(u_H\hat{p}-\underline{c})}{Rv}$, we obtain:

$$\frac{\partial\tilde{\alpha}}{\partial\alpha}=\frac{(1-\tilde{\alpha})^2(\hat{p}u_H-\underline{c})}{(1-\alpha)\left[Rv(1-\alpha)-\alpha u_H(1-\tilde{\alpha})^2\left(\frac{\partial\hat{p}}{\partial\tilde{\alpha}}\right)\right]}$$

Therefore,

$$\frac{\partial\hat{p}}{\partial\alpha}=\frac{\partial\hat{p}}{\partial\tilde{\alpha}}\times\left[\frac{(1-\tilde{\alpha})^2(\hat{p}u_H-\underline{c})}{(1-\alpha)\left[Rv(1-\alpha)-\alpha u_H(1-\tilde{\alpha})^2\left(\frac{\partial\hat{p}}{\partial\tilde{\alpha}}\right)\right]}\right]=\frac{\left(\frac{\partial\hat{p}}{\partial\tilde{\alpha}}\right)(\hat{p}u_H-\underline{c})(1-\tilde{\alpha})^2}{(1-\alpha)\left[Rv(1-\alpha)-\alpha u_H(1-\tilde{\alpha})^2\left(\frac{\partial\hat{p}}{\partial\tilde{\alpha}}\right)\right]}$$

We can then re-write,

$$\begin{aligned}
\frac{-1}{u_H \frac{\partial \hat{p}}{\partial \alpha}} &< \frac{\alpha\left(\hat{p}u_H - \underline{c}\right) + \alpha\left(\hat{p}u_H - \underline{c} - RpV\right) + Rpv}{(\hat{p}u_H - \underline{c})(\hat{p}u_H - \underline{c} - Rpv)} \\
\Leftrightarrow \frac{Rv(1-\alpha)^2 + \alpha(1-\alpha)u_H(1-\tilde{\alpha})^2\left(-\frac{\partial \hat{p}}{\partial \tilde{\alpha}}\right)}{u_H\left(-\frac{\partial \hat{p}}{\partial \tilde{\alpha}}\right)(\hat{p}u_H - \underline{c})(1-\tilde{\alpha})^2} &< \frac{\alpha(\hat{p}u_H - \underline{c}) + \alpha\left(\hat{p}u_H - \underline{c} - RpV\right) + Rpv}{(\hat{p}u_H - \underline{c})(\hat{p}u_H - \underline{c} - Rpv)} \\
\Leftrightarrow \frac{Rv(1-\alpha)^2}{u_H\left(\frac{p(1-p)}{(\tilde{\alpha}(1-p)+p)^2}\right)(1-\tilde{\alpha})^2} &< \alpha^2 + \frac{\alpha(\hat{p}u_H - \underline{c}) + Rpv}{\hat{p}u_H - \underline{c} - Rpv}
\end{aligned}$$

Finally, notice that

$$\begin{aligned}
& \frac{Rv(1-\alpha)^2}{u_H\left(\frac{p(1-p)}{(\tilde{\alpha}(1-p)+p)^2}\right)(1-\tilde{\alpha})^2} < \alpha^2 + \frac{\alpha(\hat{p}u_H - \underline{c}) + Rpv}{\hat{p}u_H - \underline{c} - Rpv} \\
\Leftrightarrow \quad & \frac{Rv(1-\alpha)^2 p}{u_H\hat{p}^2(1-p)(1-\tilde{\alpha})^2} < \alpha^2 + \frac{\alpha(\hat{p}u_H - \underline{c} - Rpv) + (1+\alpha)Rpv}{\hat{p}u_H - \underline{c} - Rpv} \\
\Leftrightarrow \quad & Rvp\left[\frac{(1-\alpha)^2}{u_H\hat{p}^2(1-p)(1-\tilde{\alpha})^2} - \frac{(1+\alpha)}{\hat{p}u_H - \underline{c} - Rpv}\right] < \alpha(1+\alpha)
\end{aligned}$$

I show that this holds because $\frac{(1-\alpha)^2}{u_H\hat{p}^2(1-p)(1-\tilde{\alpha})^2} - \frac{(1+\alpha)}{\hat{p}u_H - \underline{c} - Rpv} < 0$.

Both sides of the inequality are strictly decreasing in α when $Rpv + \underline{c} < \hat{p}u_H$. In addition, at $\alpha = 0$, the left-hand side is $u_H - Rpv - \underline{c}$. This is therefore the maximum value of the left-hand side. Finally, suppose $\alpha = \alpha^*$ such that $Rpv + \underline{c} = \hat{p}(\alpha^*)u_H$. The right-hand side at $\alpha = \alpha^*$ is

$$\frac{(1+\alpha^*)}{(1-\alpha^*)} \times u_H\hat{p}^2(1-p)(1-\tilde{\alpha})^2 = \frac{(1+\alpha^*)(1-\tilde{\alpha})^2}{(1-\alpha^*)} \times (Rpv + \underline{c})\hat{p}$$

This is the minimum of the right-hand side. Since this minimum is greater than $u_H - Rpv - \underline{c}$, the maximum of the left-hand side, then the right-hand side is always above the left-hand side.

From Proposition 2, we always have $\hat{p}u_H \geq \underline{c}$ so cases 1.1 and 1.2 cover all possible cases when $pu_H < \underline{c}$.

Case 2: If $\underline{c} < pu_H < \bar{c}$. Then:

Case 2.1: If $\alpha < \underline{\alpha}$, we have $\hat{p}u_H > \bar{c}$, so that $\mathbb{P}(v = 1|m = h) = 1$. Returns are therefore:

$$TR = \alpha\left[1 - \frac{pu_H - \underline{c}}{v}\right]^2 + (1-\alpha)R\left[p - \frac{pu_H - \underline{c}}{v}\right]$$

So $\frac{\partial TR}{\partial \alpha} = (1 - Rp) + \frac{pu_H - \underline{c}}{v}\left(R - 2 + \frac{pu_H - \underline{c}}{v}\right)$. This can be negative (but also positive) since $2 > R + \frac{pu_H - \underline{c}}{v}$.

Case 2.2: If $\alpha \geq \underline{\alpha}$, then $\hat{p}u_H < \bar{c}$, so $\mathbb{P}(v = 1|m = h) = \frac{\frac{pu_H}{p + \tilde{\alpha}(\alpha)(1-p)} - \underline{c}}{\bar{c} - \underline{c}}$. Returns are therefore:

$$TR = \alpha \left[\frac{\hat{p}u_H - \underline{c}}{\bar{c} - \underline{c}} - \frac{pu_H - \underline{c}}{\bar{c} - \underline{c}}\right]^2 + (1 - \alpha)R\left[p\left(\frac{\hat{p}u_H - \underline{c}}{\bar{c} - \underline{c}}\right) - \frac{pu_H - \underline{c}}{\bar{c} - \underline{c}}\right]$$
$$= \alpha \left[\frac{u_H(\hat{p} - p)}{v}\right]^2 + (1 - \alpha)R\left[\frac{pu_H(\hat{p} - p) + \underline{c}(1 - p)}{v}\right]$$

We can then derive:

$$\frac{\partial TR}{\partial \alpha} = 2\alpha\left(\frac{(\hat{p} - p)u_H}{v}\right)\frac{\partial \hat{p}}{\partial \alpha} \cdot \frac{u_H}{v} + \left(\frac{(\hat{p} - p)u_H}{v}\right)^2 + (1 - \alpha)Rp\frac{\partial \hat{p}}{\partial \alpha} \cdot \frac{u_H}{v} - R\left(\frac{p(\hat{p} - p)u_H + (1 - p)\underline{c}}{v}\right)$$
$$= \frac{\partial \hat{p}}{\partial \alpha} \times \frac{u_H}{v}\left[2\alpha\left(\frac{(\hat{p} - p)u_H}{v}\right) + (1 - \alpha)Rp\right] + \left(\frac{(\hat{p} - p)u_H}{v}\right)\left[\frac{(\hat{p} - p)u_H}{v} - Rp\right] - \frac{R\underline{c}(1 - p)}{v}$$

and show that this is negative.

Case 3: If $\bar{c} < pu_H$, then $\bar{c} < \hat{p}u_H$ so net returns (and therefore motivation) are zero for the instrumental, and negative for the intrinsically-motivated. Total returns are therefore $TR = \alpha \times 0 \times 0 + (1 - \alpha)R(p - 1) = -(1 - \alpha)R(1 - p)$. So $\frac{\partial TR}{\partial \alpha} = R(1 - p) > 0$.

Average cost of voting:

Case 1: $\bar{c} < pu_H$, in this case total returns are:

$$TR = (1 - \alpha)R(p \times 1 + (1 - p) \times 0 - 1) = -(1 - \alpha)R(1 - p)$$

The instrumental type expect no return above the prior so don't participate. The intrinsically-motivated are only effective when the share message $m = H$, whereas the probability of turnout would have been 1 without them. Therefore, $\frac{\partial TR}{\partial c_M} = 0$.

Case 2: $\underline{c} < pu_H < \bar{c} < \hat{p}u_H$, in this case total returns are:

$$TR = \alpha\left[1 - \frac{pu_H - \underline{c}}{\bar{c} - \underline{c}}\right]^2 + (1 - \alpha)R\left[p - \frac{pu_H - \underline{c}}{\bar{c} - \underline{c}}\right]$$
$$= \alpha\left[\frac{1}{2} + \frac{c_M}{v} - \frac{pu_H}{v}\right]^2 + (1 - \alpha)R\left[p + \frac{c_M}{v} - \frac{pu_H}{v} - \frac{1}{2}\right]$$

Therefore, $\frac{\partial TR}{\partial c_M} = \frac{2}{v}\alpha\left[1 - \frac{pu_H - \underline{c}}{\bar{c} - \underline{c}}\right] + (1-\alpha)\frac{R}{v} > 0$.

Case 3: $\underline{c} < pu_H < \hat{p}u_H < \bar{c}$, in this case total returns are:

$$TR = \alpha\left[\frac{\hat{p}u_H - \underline{c}}{\bar{c} - \underline{c}} - \frac{pu_H - \underline{c}}{\bar{c} - \underline{c}}\right]^2 + (1-\alpha)R\left[p\left(\frac{\hat{p}u_H - \underline{c}}{\bar{c} - \underline{c}}\right) - \frac{pu_H - \underline{c}}{\bar{c} - \underline{c}}\right]$$
$$= \alpha\left[\frac{u_H(\hat{p} - p)}{v}\right]^2 + (1-\alpha)R\left[\frac{(1-p)c_M - p(1-\hat{p})u_H}{v} - \frac{1}{2}\right]$$

Therefore,

$$\frac{\partial TR}{\partial c_M} = 2\alpha\left[\frac{u_H(\hat{p} - p)}{v}\right]\frac{\partial \hat{p}}{\partial c_M} + (1-\alpha)R\left[\frac{(1-p)}{v} + \frac{pu_H}{v}\frac{\partial \hat{p}}{\partial c_M}\right]$$

Finally, note that in this case, $\tilde{\alpha}$ is given by:

$$\tilde{\alpha} = \frac{1}{1 + \left(\frac{1-\alpha}{\alpha}\right)\left(\frac{R}{\frac{u_H(\hat{p}(\tilde{\alpha}) - p)}{v}}\right)}$$

Which is independent of c_M. Therefore, $\frac{\partial \hat{p}}{\partial c_M} = 0$, and we have:

$$\frac{\partial TR}{\partial c_M} = (1-\alpha)R\frac{(1-p)}{v} > 0$$

Case 4: $pu_H < \underline{c} < \bar{c} < \hat{p}u_H$, in this case total returns are: $TR = \alpha + (1-\alpha)Rp$. Therefore, $\frac{\partial TR}{\partial c_M} = 0$.

Case 5: $pu_H < \underline{c} < \hat{p}u_H < \bar{c}$, in this case total returns are:

$$TR = \alpha\left[\frac{\hat{p}u_H - \underline{c}}{\bar{c} - \underline{c}}\right]^2 + (1-\alpha)R\left[p\left(\frac{\hat{p}u_H - \underline{c}}{\bar{c} - \underline{c}}\right)\right]$$
$$= \alpha\left[\frac{u_H\hat{p} - c_M + \frac{v}{2}}{v}\right]^2 + (1-\alpha)Rp\left[\frac{u_H\hat{p} - c_M + \frac{v}{2}}{v}\right]$$

Therefore,

$$\frac{\partial TR}{\partial c_M} = 2\alpha\left[\frac{u_H\hat{p}-c_M+\frac{v}{2}}{v}\right]\left[\frac{u_H\frac{\partial\hat{p}}{\partial c_M}-1}{v}\right]+(1-\alpha)Rp\left[\frac{u_H\frac{\partial\hat{p}}{\partial c_M}-1}{v}\right]$$
$$= \left[u_H\frac{\partial\hat{p}}{\partial c_M}-1\right]\times\left(\frac{2\alpha}{v}\left[\frac{u_H\hat{p}-c_M+\frac{v}{2}}{v}\right]+(1-\alpha)\frac{Rp}{v}\right)$$

Therefore, $\frac{\partial TR}{\partial c_M}<0$ if and only if $u_H\frac{\partial\hat{p}}{\partial c_M}<1$. Using implicit differentiation on the expression that defines $\tilde{\alpha}$: $\frac{\tilde{\alpha}}{1-\tilde{\alpha}}=\frac{\alpha}{1-\alpha}\times\frac{\left(\frac{u_H\hat{p}-c_M-\frac{v}{2}}{v}\right)}{R}$, we obtain:

$$\frac{\partial\tilde{\alpha}}{\partial c_M}=-\frac{\alpha(1-\tilde{\alpha})^2(\tilde{\alpha}(1-p)+p)^2}{u_Hp(1-p)(1-\tilde{\alpha})^2\alpha+(1-\alpha)Rv(\tilde{\alpha}(1-p)+p)^2}$$

And since,

$$u_H\frac{\partial\hat{p}}{\partial c_M}=\frac{\partial\hat{p}}{\partial\tilde{\alpha}}\times\frac{\partial\tilde{\alpha}}{\partial c_M}u_H=-\frac{p(1-p)}{(\tilde{\alpha}(1-p)+p)^2}\frac{\partial\tilde{\alpha}}{\partial c_M}u_H$$

We have,

$$u_H\frac{\partial\hat{p}}{\partial c_M}<1\Leftrightarrow\frac{u_Hp(1-p)\alpha(1-\tilde{\alpha})^2}{u_Hp(1-p)\alpha(1-\tilde{\alpha})^2+(1-\alpha)Rv(\tilde{\alpha}(1-p)+p)^2}<1$$

Which always holds as $(1-\alpha)Rv(\tilde{\alpha}(1-p)+p)^2>0$.

Case 6: $\hat{p}u_H<\underline{c}$, for this to be true for any $\hat{p}$, we need $u_H<\underline{c}$. In this case, $TR=0$ and therefore, $\frac{\partial TR}{\partial c_M}=0$. □

Proof of proposition 4. Let $\tilde{\alpha}$ solve equation 2. Note that:

$$ER(\tilde{\alpha})-HR(\tilde{\alpha})=(\alpha r_S(\tilde{\alpha})+(1-\alpha)r_N(\tilde{\alpha}))-(\tilde{\alpha}r_S(\tilde{\alpha})+(1-\tilde{\alpha})r_N(\tilde{\alpha}))$$
$$=(\alpha-\tilde{\alpha})\left[r_S(\tilde{\alpha})-r_N(\tilde{\alpha})\right]+r_N(\tilde{\alpha})-r_N(\tilde{\alpha})$$
$$=(\alpha-\tilde{\alpha})\left[r_S(\tilde{\alpha})-r_N(\tilde{\alpha})\right]$$

Therefore, since $r_S(\tilde{\alpha})>r_N(\tilde{\alpha})$ by Proposition 1, then $ER(\tilde{\alpha})-HR(\tilde{\alpha})>0$ if and only if $\alpha>\tilde{\alpha}$. Finally, we know that $\alpha>\tilde{\alpha}$ if and only if $m_N>m_S$.

□