

# Pocketbook Voting, Social Preferences, and Expressive Motives in Referenda\*

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## Abstract

We develop and test a theory of voting and turnout decisions that integrates self-interest, social preferences, and expressive motives. Our model implies that if pocketbook benefits are relevant, voters either perceive their impact on the outcome to be non-negligible, or expressive motivations do not play a role in the decision on how to vote. Conversely, if own pocketbook benefits do not explain voting, then voting is expressive. If the perceived probability of being pivotal is non-negligible, social preferences and expressive concerns are observationally equivalent. Our empirical analysis studies collective choices which are analogous to decisions on local public goods.

Keywords: pocketbook voting, social preferences, expressive voting, instrumental voting, public goods, altruism, referendum

JEL classification: D72, H41, D64

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# 1 Introduction

Referenda are an integral part of democracy in several jurisdictions, such as California and Switzerland. Prominent examples include Proposition 13 in 1978 which decisively shaped local public finances in California by bounding the property tax rate (see California State Board of Equalization, 2012, p. 1) and the referendum on the Gotthard train tunnel in Switzerland in 1992. In recent years, also other countries such as Germany, Italy, and the United Kingdom have increasingly held referenda.

Despite their increasing popularity, referenda are controversial. Proponents welcome the broad public debate and the democratic legitimacy of decisions ensured by referenda. In this spirit, Rousseau (2012 [1762], p. 65) argued 250 years ago, “Every law the people has not ratified in person is null and void – is, in fact, not a law.” Opponents fear that uninformed or ideologically biased citizens either do not bother to vote or make inefficient or inequitable decisions. Schumpeter (1994 [1942], p. 261) was convinced that “[the private citizen] expends less disciplined effort on mastering a political problem than he expends on a game of bridge.”

We contribute to this debate by theoretically and empirically analyzing the motives for participating in a referendum and for voting against or in favor of a proposal. Our set-up is particularly tailored to public policy decisions at the local level, where referenda are especially frequent. The importance of local direct democracy was already highlighted by De Tocqueville (1981 [1835], p. 124-127), who emphasized that citizens can and should be trusted to decide independently on their own affairs. In the same spirit, Tiebout (1956) shows that independent local jurisdictions take efficient decisions on local public goods as long as there are no external effects. By analyzing voters’ motives in such decisions, we contribute to the understanding of local democracy. Nevertheless, the comparison with other studies (see Section 2) suggests that the motives we examine are likely to be relevant also in referenda at a larger scale.

We propose a simple theoretical model describing the decisions on whether and how to vote on a tax-financed provision of a public good. The motives we consider are ‘pocketbook voting’, that is, voting along monetary interests, social preferences, and expressive concerns. The latter two motives relate to the same aspects of the voting outcome, but differ in one crucial aspect. Agents with social preferences want to affect the outcome of the vote, for example because they have altruistic or paternalistic feelings towards other members of society, or because they care for the common good. In this sense, social preferences, like pocketbook motives, are instrumental. In contrast, expressive voters derive utility from the act of voting in a way which is in line with such feelings, independently of whether their vote affects

the actual outcome.

Using this model, we characterize the individual voting decision as a function of the size of monetary gains or losses conferred by the public good, the strength of social or expressive motives, and the perceived probability of changing the referendum outcome. When expressive motives are relevant, they will dominate the voting decision as long as the voter considers the probability of being pivotal to be negligible. Conversely, in the presence of expressive concerns, pocketbook benefits affect the voting decision only if voters put a sufficiently high estimate on this probability.

If this is the case, however, voters also expect to affect social outcomes. Hence, when pocketbook voting is observed, an empirical finding that voters care about common goods or benefits of others cannot unequivocally be attributed to expressive voting, but may as well reflect social preferences, or both motives. Thus, our main theoretical result states that if voters consider the probability of being pivotal to be strictly positive, social preferences and expressive motives are observationally equivalent. This implies that expressive voting can be shown to exist only in the case where pocketbook voting is not observed: If voters do not react to pocketbook benefits they must believe that their influence on the outcome of the vote is negligible, and any concern for common goods or benefits of others must therefore be expressive.

When there are no expressive motives, we show that pocketbook voting affects the voting decision even when the probability of being pivotal is arbitrarily small. This is because in the absence of expressive voting, all remaining benefits of voting are instrumental, and hence weighted down with the same probability. As a consequence, a theory without expressive motives is consistent with empirically observing pocketbook voting without placing restrictions on the subjective probability of affecting the outcome.

The decision to participate in the referendum is driven by the same variables as the voting decision together with benefits and costs which are unrelated to how one votes, such as a civic duty motive for voting and time cost to cast one's ballot. We show that when expressive motives are relevant, abstention can be a rational choice even when voting is costless. This arises when monetary benefits and expressive concerns suggest different voting decisions, for example when the individual gains in monetary terms from the public good but thinks that others lose from it. Then, abstaining is a cheaper way of satisfying expressive motives than voting against one's own pocketbook interest.

We test our theory with the help of referenda on flat rate tickets for students at Goettingen University in Germany. If passed, these tickets give all students the right to unlimited use of a facility, such as public transportation or cultural amenities. The price of each ticket is very attractive compared with that for individual purchases;

however, buying a ticket becomes compulsory for every student if the majority vote is in favor. These tickets therefore share essential features with tax-financed public projects or local public goods. Collectively procuring a ticket reduces the per capita cost of the respective facility so that frequent users stand to gain substantially from approval by the majority. At the same time, some voters use the facility in question very little or not at all but are still forced to pay as much for it as anyone else.

Investigating these referenda is particularly promising because they involve easy-to-understand public policy decisions. In particular, in our setting, the voters knew exactly what a ticket would cost, and the benefits were clearly defined. This setting fits particularly well to local democracy in an independent, self-financed jurisdiction in the sense of Tiebout (1956). In fact, the student body is quite similar to the citizens of a small jurisdiction, who decide democratically on a public good which is used and financed exclusively by them. In contrast, if the vote had involved, for example, a large infrastructure project, then the costs and benefits would have been more widespread and uncertain. Different voting decisions could also then reflect different subjective expectations for possible deviations from projections and differences in risk attitudes. In this sense, the referenda that we study are like a ‘laboratory’ for direct democratic decisions, where confounding influences are reduced to a minimum.

Our first dataset is on a referendum regarding a ticket for regional trains held in 2010. This dataset was collected online. It also encompasses students who did not participate in the referendum, allowing for an analysis of the decision whether to vote. The second dataset covers votes on tickets for regional trains, cultural facilities and local buses held in 2013. It was collected with a paper-based exit poll, therefore being restricted to voters.

Each dataset contains detailed information on usage behavior, votes, political preferences and other characteristics of over a thousand respondents. In the first dataset, we construct a monetary measure of the individual benefits conferred by the ticket. To do so, we combine information on the number of trips to visit parents with regular ticket prices that we derive from parental address data. Subtracting the price of the flat rate ticket yields a measure of the net monetary savings an individual student obtains from the ticket. An attractive feature of this measure arises from the fact that the ticket in question covered only rail tracks served by one company, while tracks served by other operators were not included. Hence, residence of parents on either subset of tracks induces a quasi-random variation which is unrelated to the variation created by distance to the university. In the second dataset, usage is reported in categorical variables.

Additionally, students were asked the extent to which the interests of others shaped their voting decisions. Other motives included social goals, such as pro-

moting local cultural life, and expressing protest against the pricing policy of the railway company. These variables capture social preferences and expressive motives of students.

Our primary focus is on the probability of voting in favor of these tickets. We find strong evidence for pocketbook voting. Most students vote in line with their monetary interests. In the first dataset, among those who gain from the train ticket, a 10 percent increase in net savings raises the probability of voting in favor by 0.5 to 0.7 percentage points. This finding translates into widely differing predictions, given that positive net savings vary between zero and more than three thousand euros per year. Also among those who benefit less from the ticket than it costs, a lower net loss tends to increase the probability to support the ticket, even though the results mostly are not statistically significant. In the second dataset, a student who uses a facility very often is between 52 and 77 percentage points more likely to vote in favor of the corresponding ticket than one who never uses it.

However, our results show that monetary self-interest is not the entire story. Variables capturing social preferences or expressive motives, such as stated altruism and merit good considerations, show highly significant and economically relevant effects. A sizable share of students who do not stand to gain from a ticket in monetary terms vote in favor because of such motives. The analysis suggests that these motives were likely pivotal in one of the four referenda and close to being pivotal in another. Together with pocketbook voting, they can rationalize almost all votes cast. In contrast, party preferences are mostly not relevant to the voting decision.

Based on our theory, the presence of pocketbook voting means that we cannot distinguish whether the significance of the variables related to other students or public good considerations stems from social preferences, expressive motives, or both. However, our theory also implies that if monetary benefits affect the voting decision then voters either perceive the probability to change the outcome to be non-negligible, or expressive motives are absent. From this we conclude that observed behavior is inconsistent with a theory of purely expressive voting. For that reason, we have a certain sympathy for attributing the significance of variables such as stated altruism or common good considerations to social preferences rather than expressive voting. This view is also supported by Occam's razor, which requires that among two competing theories, one should opt for the simpler one as long as it can explain facts equally well as the more complicated alternative.

In the last part of the paper, the dependent variable is participation in the referendum. We find that among those who gain from the ticket, the probability of taking part increases with net savings. This result suggests some degree of instrumental turnout. Furthermore, our analysis shows that students with substantial positive

benefits drive this result.

Stated altruism is also found to affect the participation decision, albeit in a specific way. Students who expect that their preferred outcome would cause losses to others and, at the same time, mention concern for others are less likely to participate. A possible explanation for this finding is that abstaining is an attractive compromise when own monetary gains and expressive concerns for others call for different voting decisions. Additionally, there is evidence that some students did turn out to protest the train company's pricing policy. This behavior could be tactical to improve students' bargaining position. In this case, it reflects an instrumental selfish or social preference to improve the situation for the voter or for all students. Alternatively, it could be motivated by expressive concerns. Again, the empirical observation does not allow to discern which of these motives is prevalent.

The remainder of the paper is structured as follows. In Section 2, we relate our work to the literature on voting motives. Section 3 contains the theoretical model on which we base our empirical work. Section 4 presents the data and some background information. In Section 5, we give a descriptive overview of voting and participation motives. Econometric results on voting and participation decisions are presented in Sections 6 and 7, respectively. Section 8 concludes the paper.

## 2 Related literature

Our paper contributes to the literature on the motives of voters. A central question in this literature is the extent to which citizens vote according to their narrowly defined self-interest and to which voting decisions are driven by social considerations or expressive motives. In addition, research has investigated whether such motives determine the participation decision. Ours is the first paper that analyzes both the decisions whether to vote and how to vote in the presence of self-interest and social considerations.

Pocketbook voting is the starting point in models of income redistribution that build on Meltzer and Richard (1981), in the theory of probabilistic voting (Lindbeck and Weibull, 1993; Dixit and Londregan, 1996) and in the median voter models of local public finance (Romer et al., 1992; Epple and Romano, 1996; Epple et al., 2001). The empirical literature on economic voting has mostly focused on representative democracy. Lewis-Beck and Stegmaier (2007) survey more than 400 studies without finding much evidence for pocketbook voting. Most of these studies suffer from severe identification problems: they assume that voters attribute all changes in their financial situation to the policies of the incumbent government. When analyzing well defined past policies, Levitt and Snyder (1997) and Manacorda et al. (2011) find that voters increase their support for the government if they have benefited from

its transfers in the past. Elinder et al. (2015) find strong evidence for prospective pocketbook voting: voters are already reacting when reforms appear as electoral promises.

Several authors specifically seek to empirically detect pocketbook motives in referenda. In an early contribution, Deacon and Shapiro (1975) find that voters in cities connected to the BART transport system in the San Francisco area were more likely to favor a proposition that would shift gas tax revenues to public transportation. Similarly, voters in precincts that are located near sports stadiums feel more positively toward subsidizing them (Coates and Humphreys, 2006). Intriguingly, according to Potrafke (2013), this finding does not hold for concert halls. Vlachos (2004) concludes that voting patterns in the Swedish referendum on EU membership are in line with conflicting regional interests.

Pocketbook voting has been challenged by the theory of expressive voting, proposed by Tullock (1971) and Brennan and Buchanan (1984) and further developed by Brennan and Hamlin (1998) and Hillman (2010). This theory maintains that voters perceive their probability of being pivotal to be negligible, and that they derive utility from voting in a particular way irrespective of the outcome. In this view, a voter who supports a proposal which benefits other members of society does not aim at actually raising others' utility, as social preferences would imply, but wants to sustain an image as a socially-minded person at low cost.

Social preferences and expressive motives have to date been neglected in the empirical analysis of real world referenda. This neglect contrasts with experimental studies on voting behavior that typically find that in addition to monetary self-interest, voting reflects various types of social preferences. In particular, Tyran and Sausgruber (2006) show that inequity aversion in the sense of Fehr and Schmidt (1999) is important in laboratory elections. Introducing a novel random price voting mechanism, Messer et al. (2010) conclude that subjects' behavior is better explained by pure altruism than by inequity aversion. Balafoutas et al. (2013) find that while voting on redistribution is mostly predicted by self-interest, there is greater support for redistribution when inequalities are arbitrary than when they reflect performance in an experimental task. This finding is in line with the theoretical insights in Piketty (1995) and Bénabou and Tirole (2006) and the conclusions derived by Fong (2001) and Alesina and Angeletos (2005) from survey evidence.

In contrast, experimental evidence on expressive voting is mixed. Several studies confront subjects with a vote between an own monetary payout and a gift to charity. In such a setting, Carter and Guerette (1992) and Fischer (1996) exogenously vary the probability that the individual's choice is decisive. While this has only very limited impact on support of the charitable option in the experiment conducted by Carter and Guerette (1992), Fischer (1996) finds that subjects are more likely to

support charity if they anticipate not to affect the outcome. Tyran (2004) allows voters who voted against the proposal to withhold their contribution to charity when the proposal passes. He does not find any difference in behavior between this treatment and the low-cost situation where the contribution almost surely is independent of the individual vote, contradicting expressive voting.

In general, it should be noted that pocketbook voting does not exclude taking into account what is good for others, or expressing a concern for others. Fiorina (1978) and Markus (1988) conclude that both self-interest and convictions on what benefits society matter to American voters. In Sweden, most survey respondents admitted that their own interest mattered either as much as or more than their convictions regarding what benefits society when they chose which party to vote for (Carlsson and Johansson-Stenman, 2010).

We also contribute to the literature on voter turnout. Downs (1957) and Riker and Ordeshook (1968) already presented the idea that the more that is at stake, the more likely an individual is to vote. Indeed, Andersen et al. (2014) observe that turnout in Norwegian local elections is higher in jurisdictions with high hydropower income. Alternative explanations suggest that voting is driven by ethical concerns (Harsanyi, 1980; Coate and Conlin, 2004), social pressure (Gerber et al., 2008; Funk, 2010), expressive motivations (Brennan and Buchanan, 1984; Brennan and Hamlin, 1998; Coate et al., 2008; Hillman, 2010), or social identity (Akerlof and Kranton, 2000; Ben-Bassat and Dahan, 2012; Hillman et al., 2015).

Finally, our paper is also broadly related to the literature that investigates the impact of direct democracy on the public budget. Referenda are associated with lower public spending in both the US (Matusaka, 1995) and Switzerland (Feld and Kirchgässner, 2001; Feld and Matusaka, 2003; Funk and Gathmann, 2011). The focus of our paper differs from these contributions in that we do not aim to compare direct and representative democracy. Nevertheless, our finding that those who benefit most are most likely to vote suggests that direct democracy does not necessarily result in underspending.

Extending this literature, our paper enhances both the theoretical and the empirical understanding of the motives for voting. We propose a theoretical model of the decisions whether and how to vote which integrates pocketbook motives, instrumental social preferences and expressive concerns. Empirically, we find evidence for pocketbook voting and show that the likelihood of participating increases with the personal stake. These results are broadly in line with the contributions mentioned above. However, we go further by analyzing individual voting decisions in referenda rather than relying on regional vote shares. Moreover, we study the role of social preferences and expressive concerns in real world referenda. This complements existing literature on such motives which to date has mostly been confined to laboratory



experiments.

### 3 Theoretical framework

We present a simple theoretical framework on how voters decide whether to vote in a referendum, and then how to vote, provided that they decide to vote. We solve the model backwards, analyzing first the decision on how to vote, conditional on voting. Voting takes place on whether to collectively purchase a public good. If the proposal is passed, all voters get access to the public good and have to pay for it. We denote the case in which the public good is passed by superscript 1, and the case in which the public good is not passed by superscript 0.

#### 3.1 How to vote if voting

The utility of voters is driven by pocketbook benefits, social preferences, and expressive motivations. Pocketbook benefits arise from the individual's use of the public good and the monetary cost he or she has to pay for it, and relate to the outcome of the vote. Social preferences relate to how the voter values the effects of the voting outcome on other people. They include the valuation of the benefits which other members of the polity enjoy when the public good is provided, the quality of local culture, the public transportation system, and the environment. Expressive motivations are based on personal utility from the act of voting in a certain way, independently on whether this affects the outcome of the vote. We describe these components of utility one after the other, starting with pocketbook benefits.

In the context of the collectively purchased tickets we analyze, providing the public good amounts to granting free and unlimited use of some facility, financed by a compulsory fee  $t$  collected from every member of society. In contrast, if the public good is not provided, individuals have to pay a price  $\tau > 0$  per use of the facility.<sup>1</sup> Once the decision on the public good is taken, voter  $i$  will choose the intensity of use  $h_i$ , which is non-negative and varies continuously. He or she maximizes a quasi-linear benefit  $b_i = w_i(h_i) + m_i - T_i$ . In this expression,  $m_i$  is voter  $i$ 's income and  $T_i$  is voter  $i$ 's payment for the use of the facility. The function  $w_i$  is strictly increasing and strictly concave up to some satiation point, where the marginal benefit  $w_i'$  is zero, and stays zero for higher intensities of use. Since some agents may have no preference at all for the public good, we allow the satiation point to be  $h_i = 0$ .

If the public good is (is not) provided, we have  $T_i = t$  ( $T_i = \tau h_i$ ), and the resulting optimal use is denoted by  $h_i^1$  ( $h_i^0$ ). Since any additional use is costless once

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<sup>1</sup>The price  $\tau$  is to be interpreted as a payment for a normalized unit of use, say one visit to a local theater, one bus ride, or traveling a certain distance on local trains.

the public good is provided,  $h_i^1$  is the satiation point, i.e.,  $w_i'(h_i^1) = 0$ . The optimal value  $h_i^0$  is given by the solution to the first order condition  $w_i'(h_i^0) = \tau$  if  $w_i'(0) > \tau$ , and is  $h_i^0 = 0$  if  $w_i'(0) \leq \tau$ . Using these values in the benefit  $b_i$ , we find the indirect utility of individual  $i$  in case the public good is provided,  $b_i^1 = w_i(h_i^1) + m_i - t$ , and in case it is not provided,  $b_i^0 = w_i(h_i^0) + m_i - \tau h_i^0$ .

We capture the other characteristics of the vote by a vector  $\mathbf{a}_i$  for voter  $i$ . This vector has  $K$  components labelled  $k = 1, 2, \dots, K$ . For any vector  $\mathbf{x}$ , we define  $\mathbf{x}_{(-k)}$  as the vector  $\mathbf{x}$  without the component  $k$ . The vector  $\mathbf{a}_i^1$  ( $\mathbf{a}_i^0$ ) gives voter  $i$ 's estimate of the situation with (without) the public good. Components  $a_{ki}^1$  ( $a_{ki}^0$ ),  $k = 1, 2, \dots, K$ , describe, for example, voter  $i$ 's estimate of other voters' monetary utility, the situation of local culture, environmental quality, or the supply and the quality of local transportation, if the public good is passed (is not passed). These aspects of the vote may give rise to social preferences or to expressive utility. In the first case, voter  $i$  enjoys utility from the actual provision of the public good. For example, altruism in this sense means that voter  $i$  casts his or her vote in order to change the outcome in the way others prefer. Voting based on social preferences is therefore necessarily instrumental, i.e., the voter wants to and expects to influence the decision with some probability larger than zero.

In contrast to this view, an influential strand of public choice literature (see Tullock, 1971; Hillman, 2010) has argued that voting tends to be expressive, at least in large electorates. In this case, utility is derived from the act of voting in a particular way. Then, the estimates  $\mathbf{a}_i^1$  and  $\mathbf{a}_i^0$  provide utility if the voter votes in favor of (against) the public good, irrespective of the actual outcome of the referendum. Expressive motivations could include voting which is like cheerleading (Brennan and Hamlin, 1998), a preference for expressing one's preference, or protest voting for the sake of protesting.

We assume that voter  $i$  combines pocketbook and other considerations with linear preferences. Monetary benefits yield a marginal utility of  $\lambda_i > 0$ , the weights of instrumental social concerns are given by the vector  $\boldsymbol{\zeta}_i$ , and the weights of expressive motives are given by the vector  $\boldsymbol{\psi}_i$ . Here, we assume that  $\zeta_{ki}\psi_{ki} \geq 0$ . This means that people do not have expressive benefits from voting against the outcome they find socially desirable. Moreover, we adopt the notational convention that  $a_{ki}^1 - a_{ki}^0 \geq 0$  for all  $k = 1, 2, \dots, K$ . This is without loss of generality since, if voter  $i$  has a negative social or expressive valuation of component  $k$ , this is expressed by weights  $\zeta_{ki} \leq 0$  and  $\psi_{ki} \leq 0$ . Furthermore, if a variable like savings of others can take on positive and negative values, we can always split it in two non-negative variables. Depending on individual  $i$ 's vote and the referendum outcome, four cases can arise, with utilities collected in Table 1.<sup>2</sup>

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<sup>2</sup>We discuss abstention in Section 3.2.

		public good	
		is passed	is not passed
$i$ votes	in favor	$\lambda_i b_i^1 + (\zeta_i + \psi_i) \cdot \mathbf{a}_i^1$	$\lambda_i b_i^0 + \zeta_i \cdot \mathbf{a}_i^0 + \psi_i \cdot \mathbf{a}_i^1$
	against	$\lambda_i b_i^1 + \zeta_i \cdot \mathbf{a}_i^1 + \psi_i \cdot \mathbf{a}_i^0$	$\lambda_i b_i^0 + (\zeta_i + \psi_i) \cdot \mathbf{a}_i^0$

Table 1: Utility of voter  $i$  resulting from his or her vote and the outcome.

Voter  $i$  anticipates that by voting in favor of the public good rather than abstaining he or she increases the probability that the public good passes by  $p_i^1$ . Similarly, by voting against the public good rather than abstaining he or she decreases the probability that the public good passes by  $p_i^0$ . Then, by switching his or her vote from no to yes he or she increases the probability that the public good passes by  $p_i = p_i^1 + p_i^0$ . These subjective probabilities may but need not coincide with objective probabilities. We allow for the case where an individual considers his or her influence on the outcome to be negligible or zero, i.e.  $p_i = 0$ .<sup>3</sup>

In line with Card et al. (2012), we derive  $i$ 's preference on how to vote by comparing his or her expected utility if he or she votes in favor of or against the public good. From Table 1, the change in expected utility procured by switching from ‘no’ to ‘yes’ is  $y_i = p_i [\lambda_i (b_i^1 - b_i^0) + \zeta_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)] + \psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)$ , or, equivalently,

$$y_i = p_i \lambda_i (b_i^1 - b_i^0) + (p_i \zeta_i + \psi_i) \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0). \quad (1)$$

Individual  $i$  votes for the public good if and only if  $y_i \geq 0$ .

In equation (1), the equivalent variation  $b_i^1 - b_i^0 = w_i(h_i^1) - w_i(h_i^0) + \tau h_i^0 - t$  is a monetary measure of the private gain individual  $i$  obtains if the public good is provided, and the vector  $\mathbf{a}_i^1 - \mathbf{a}_i^0$  captures how the variables describing social and expressive motives change if the voter switches from ‘no’ to ‘yes’.

The voting decision depends both on instrumental and expressive motivations:

**Proposition 1.** (i) For  $p_i > 0$ :  $y_i \geq 0 \iff b_i^1 - b_i^0 \geq -\frac{(p_i \zeta_i + \psi_i) \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)}{p_i \lambda_i}$ .

(ii) For  $k = 1, 2, \dots, K$ :

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<sup>3</sup>In our empirical application, the decision rule stipulates that the public good fails in case of a tie. Then,  $p_i^1$  is the probability that among the voters other than  $i$ , there is an equal number of votes in favor and against the public good. Similarly,  $p_i^0$  is the probability that among the other voters the number of favorable votes exceeds the number of negative votes by 1. For an equilibrium analysis of the probability of affecting the voting outcome in a finite electorate, see B6rgers (2004) and Taylor and Yildirim (2010).

(a) if  $p_i \zeta_{ki} + \psi_{ki} \geq 0$ , then  $y_i \geq 0 \iff$

$$a_{ki}^1 - a_{ki}^0 > - \frac{p_i \lambda_i (b_i^1 - b_i^0) + (p_i \zeta_{(-k)i} + \psi_{(-k)i}) \cdot (\mathbf{a}_{(-k)i}^1 - \mathbf{a}_{(-k)i}^0)}{p_i \zeta_{ki} + \psi_{ki}};$$

(b) if  $p_i \zeta_{ki} + \psi_{ki} = 0$ , then  $\forall a_{ki}^1 - a_{ki}^0$  :

$$y_i \begin{matrix} \geq \\ \leq \end{matrix} 0 \iff p_i \lambda_i (b_i^1 - b_i^0) + (p_i \zeta_{(-k)i} + \psi_{(-k)i}) \cdot (\mathbf{a}_{(-k)i}^1 - \mathbf{a}_{(-k)i}^0) \begin{matrix} \geq \\ \leq \end{matrix} 0.$$

(iii) (a) If  $\psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) \geq 0$ , then  $y_i \geq 0 \iff \lambda_i (b_i^1 - b_i^0) + \zeta_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) \begin{matrix} \geq \\ \leq \end{matrix} 0$  or

$$\left( \lambda_i (b_i^1 - b_i^0) + \zeta_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) \leq 0 \text{ and } p_i < - \frac{\psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)}{\lambda_i (b_i^1 - b_i^0) + \zeta_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)} \right);$$

(b) if  $p_i = 0$ , then  $y_i \begin{matrix} \geq \\ \leq \end{matrix} 0 \iff \psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) \begin{matrix} \geq \\ \leq \end{matrix} 0$ .

**Proof.** Each of the three claims follows from solving the relevant cases of  $y_i \begin{matrix} \geq \\ \leq \end{matrix} 0$ , using (1).  $\square$

The first item in this proposition states that if the probability of being pivotal is strictly larger than zero, the individual will vote in line with own monetary interest provided this is sufficiently large. Point (a) in the second item states that if social or expressive preferences are present related to some aspect of voting, their joint effect will determine the voting decision provided they are strong enough. For completeness, point (b) says that if social and expressive weights attached to some aspect are zero, the voting decision is independent of this aspect. The third item addresses the relative importance of expressive and instrumental motives. A voter who has expressive concerns which are strictly different from zero will always vote in line with these concerns when the probability of changing the outcome is sufficiently small. Then pocketbook benefits and instrumental social concerns should have no impact on the decision in an estimation based on equation (1).

The following corollary shows that for a voter without expressive concerns, the trade-off between pocketbook considerations and social preferences does not depend on the probability of changing the outcome:

**Corollary 1.** If  $\psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) = 0$  and  $p_i > 0$ , then

$$y_i \begin{matrix} \geq \\ \leq \end{matrix} 0 \iff b_i^1 - b_i^0 \begin{matrix} \geq \\ \leq \end{matrix} - \frac{\zeta_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)}{\lambda_i}.$$

(a) $\psi_i = 0$ .		(b) $\psi_i \neq 0$ .								
		$\zeta_i = 0$	$\zeta_i \neq 0$							
$p_i \rightarrow 0$	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\alpha_i = 0</math></td> <td style="padding: 2px 5px;"><math>\alpha_i \neq 0</math></td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\beta_i &gt; 0</math></td> <td style="padding: 2px 5px;"><math>\beta_i &gt; 0</math></td> </tr> </table>	$\alpha_i = 0$	$\alpha_i \neq 0$	$\beta_i > 0$	$\beta_i > 0$	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\alpha_i \neq 0</math></td> <td style="padding: 2px 5px;"><math>\alpha_i \neq 0</math></td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\beta_i = 0</math></td> <td style="padding: 2px 5px;"><math>\beta_i = 0</math></td> </tr> </table>	$\alpha_i \neq 0$	$\alpha_i \neq 0$	$\beta_i = 0$	$\beta_i = 0$
$\alpha_i = 0$	$\alpha_i \neq 0$									
$\beta_i > 0$	$\beta_i > 0$									
$\alpha_i \neq 0$	$\alpha_i \neq 0$									
$\beta_i = 0$	$\beta_i = 0$									
$p_i > 0$	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\alpha_i = 0</math></td> <td style="padding: 2px 5px;"><math>\alpha_i \neq 0</math></td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\beta_i &gt; 0</math></td> <td style="padding: 2px 5px;"><math>\beta_i &gt; 0</math></td> </tr> </table>	$\alpha_i = 0$	$\alpha_i \neq 0$	$\beta_i > 0$	$\beta_i > 0$	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\alpha_i \neq 0</math></td> <td style="padding: 2px 5px;"><math>\alpha_i \neq 0</math></td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px 5px;"><math>\beta_i &gt; 0</math></td> <td style="padding: 2px 5px;"><math>\beta_i &gt; 0</math></td> </tr> </table>	$\alpha_i \neq 0$	$\alpha_i \neq 0$	$\beta_i > 0$	$\beta_i > 0$
$\alpha_i = 0$	$\alpha_i \neq 0$									
$\beta_i > 0$	$\beta_i > 0$									
$\alpha_i \neq 0$	$\alpha_i \neq 0$									
$\beta_i > 0$	$\beta_i > 0$									

Table 2: Coefficients implied by the model when expressive motives are absent (a) and present (b).

**Proof.** The corollary follows directly from Proposition 1(i).  $\square$

The corollary arises since all benefits from changing the outcome are weighed down equally. Notice that, while this argument does not literally hold if  $p_i$  is exactly zero, by a trembling hand argument, a rational voter should still vote as if this probability were positive.

An econometric investigation of (1) will deliver estimates for the coefficient  $\beta_i := p_i \lambda_i$ , which measures the impact of pocketbook motives, and the coefficients  $\alpha_i := p_i \zeta_i + \psi_i$ , which measure the joint impact of social and expressive concerns. It is worth noting that these coefficients are determined only up to a common scaling factor, since the sign of (1) is not affected if coefficients are multiplied by a positive constant. If voting depends on monetary benefits, we will estimate a positive coefficient  $\beta_i > 0$ , provided the sample contains, among individuals with similar values of the variables  $\mathbf{a}_i^1 - \mathbf{a}_i^0$ , both observations with  $b_i^1 - b_i^0$  small enough such that  $y_i < 0$  and large enough such that  $y_i \geq 0$  (Proposition 1(i)). Similarly, if voting depends on  $\mathbf{a}_i^1 - \mathbf{a}_i^0$  and the sample contains, for similar values of monetary benefits, both observations with realizations of these variables such that  $y_i < 0$  and such that  $y_i \geq 0$ , we will estimate  $\alpha_i \neq 0$  (Proposition 1(ii)).

Table 2 summarizes the signs of the coefficients as implied by Proposition 1 and Corollary 1. The table is organized according to alternative assumptions about the parameters of the model. The two panels (a) and (b) distinguish the cases where expressive motives are not or are present,<sup>4</sup> and the columns distinguish the cases where social motives are not or are present. The rows relate to the voter's perception of his or her influence on the voting outcome. Here,  $p_i \rightarrow 0$  ( $p_i > 0$ ) means that this influence is considered to be negligible (non-negligible).

Each cell gives the signs of the coefficients which an empirical analysis will yield if the assumptions defining the cell are satisfied. For example, in the upper-left

<sup>4</sup>In Table 2, we associate the absence of expressive motives with the vector of weights being zero,  $\psi_i = 0$ . This is stronger than assuming  $\psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) = 0$ , since the latter may arise also if conflicting expressive concerns happen to cancel each other out.

cell of panel (a), neither social motives nor expressive concerns are present, so that one will find  $\alpha_i = 0$  as implied by Proposition 1(iii)c. In addition, the voter does not think that he or she has a noticeable influence on the outcome. According to Corollary 1, however, his or her vote will still depend on monetary interests and hence the estimation will yield  $\beta_i > 0$ . As is apparent from Table 2, different cells may yield the same prediction. This is highlighted by the lines in the two panels, which group constellations which lead to the same coefficients, that is, are observationally equivalent.

To test the implications of the model, we formulate two simple null-hypotheses about the coefficients:

**H1**  $\beta_i = 0$ ,

**H2**  $\alpha_i = 0$ .

The corresponding alternative hypotheses are  $\beta_i > 0$  for **H1** and  $\alpha_i \neq 0$  for **H2**.

These hypotheses yield four possible cases. First, it may turn out that we cannot reject either of the two null-hypotheses. As is apparent from Table 2, this case cannot arise in the model, and hence, if this is the empirical outcome, the model must be considered as invalidated. This is the consequence of the assumption  $\lambda_i > 0$ , which states that voters have a taste for money.

Second, we might reject Hypothesis **H1** but not reject Hypothesis **H2**, as in the left half of Table 2 (a). This is the case of pure pocketbook voting. In this case, neither social nor expressive motives can be identified in the data.

Third, when Hypothesis **H1** is not rejected and Hypothesis **H2** is rejected, as in the upper half of Table 2 (b), we must conclude that voters consider the probability to affect the outcome to be negligible. This is the case of purely expressive voting mentioned above. In this case, since voters believe that their influence on the outcome of the vote is negligible, also social preferences have a negligible impact. Thus, if voters care about benefits of others, this must be expressive, i.e., we can conclude that  $\psi_i \neq 0$ . In this circumstance, we would have proved the existence of expressive motives.

Fourth, the empirical analysis may reject both null-hypotheses, lending support to the alternative hypotheses of non-zero coefficients for both kinds of variables. As can be seen in Table 2, this can arise in two circumstances. In the right half of panel (a), expressive motives are absent, but social motives alone produce a significant coefficient for the variables  $\mathbf{a}_i^1 - \mathbf{a}_i^0$ . In the bottom half of panel (b), expressive motives are present and voters perceive the probability to affect the decision to be non-negligible. An empirical finding which rejects both hypotheses would be in contrast to the logic of purely expressive voting: The fact that pocketbook benefits are relevant in a large electorate indicates that either voters do *not* perceive their

impact on the outcome to be negligible, or expressive motivations are negligible for the decision on how to vote.

In the fourth case, one has only information on the composite weight  $\alpha_i = p_i \zeta_i + \psi_i$ . One then cannot determine whether the aspects collected in the vector  $\mathbf{a}_i$  are relevant because the individual cares about implemented policies, possibly including paternalism and other social preferences like the environment, or because of expressive behavior relating to the same aspects. Hence, voting based on instrumental social preferences and voting based on expressive motives are observationally equivalent, as long as  $p_i > 0$ .

To sum up, rejecting Hypothesis **H1** establishes the relevance of pocketbook considerations for voting. Rejecting Hypothesis **H2** shows that expressive motives, social preferences, or both affect the voting decision. A sufficient condition implying that this effect is due to expressive motives, however, would require that at the same time Hypothesis **H1** is not rejected, i.e., one should not find an impact of monetary benefits on the voting decision.

### 3.2 Participation decision

We now turn to the decision whether to vote. As the decision how to vote, this decision depends on monetary benefits, social preferences, and expressive motivations. If the individual abstains, the variables describing expressive motives take on values  $\mathbf{a}_i^-$ , which in general may differ from the values  $\mathbf{a}_i^0$  taken on if  $i$  votes against and  $\mathbf{a}_i^1$  taken on if  $i$  votes in favor of the public good. In addition, as already observed by Riker and Ordeshook (1968), participation may induce costs and benefits unrelated to how the individual votes, which we denote by  $c_i$  and  $d_i$ , respectively. Examples for costs  $c_i$  are the time needed to cast one's ballot or the effort to make up one's mind on how to vote. Examples for benefits  $d_i$  are a civic duty motive for voting, the utility conferred by adhering to a social norm which advocates participation, or the benefit derived from not breaking with a long-formed habit of participating. We assume that the voter does not obtain the benefit  $d_i$  if he or she casts an empty or spoiled ballot but that he or she still incurs the cost  $c_i$  of voting. Therefore, casting an empty ballot is dominated by not turning out.

When calculating his or her utility, the voter anticipates that he or she will vote in favor of (against) providing the public good if  $y_i \geq 0$  ( $y_i < 0$ ). The utilities resulting from the voter's choices in these two cases are collected in Tables 3(a) and (b). From Table 3(a), when  $y_i \geq 0$ , the difference between the expected utilities derived from participation and from abstention is

$$z_i = p_i^1 [\lambda_i (b_i^1 - b_i^0) + \zeta_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)] + \psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^-) + d_i - c_i. \quad (2)$$

		public good	
		is passed	is not passed
voter $i$	participates	$\lambda_i b_i^1 + (\zeta_i + \psi_i) \cdot \mathbf{a}_i^1 + d_i - c_i$	$\lambda_i b_i^0 + \zeta_i \cdot \mathbf{a}_i^0 + \psi_i \cdot \mathbf{a}_i^1 + d_i - c_i$
	abstains	$\lambda_i b_i^1 + \zeta_i \cdot \mathbf{a}_i^1 + \psi_i \cdot \mathbf{a}_i^-$	$\lambda_i b_i^0 + \zeta_i \cdot \mathbf{a}_i^0 + \psi_i \cdot \mathbf{a}_i^-$
(a) $y_i \geq 0$ .			
		public good	
		is passed	is not passed
voter $i$	participates	$\lambda_i b_i^1 + \zeta_i \cdot \mathbf{a}_i^1 + \psi_i \cdot \mathbf{a}_i^0 + d_i - c_i$	$\lambda_i b_i^0 + (\zeta_i + \psi_i) \cdot \mathbf{a}_i^0 + d_i - c_i$
	abstains	$\lambda_i b_i^1 + \zeta_i \cdot \mathbf{a}_i^1 + \psi_i \cdot \mathbf{a}_i^-$	$\lambda_i b_i^0 + \zeta_i \cdot \mathbf{a}_i^0 + \psi_i \cdot \mathbf{a}_i^-$
(b) $y_i < 0$ .			

Table 3: Utility of voter  $i$  resulting from participating or abstaining. In panel a (b), the voter anticipates to vote in favor of (against) the public good.

Similarly, from Table 3(b), we find for  $y_i < 0$ :

$$z_i = p_i^0 [\lambda_i (b_i^0 - b_i^1) + \zeta_i \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1)] + \psi_i \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^-) + d_i - c_i. \quad (3)$$

Using the indicators

$$I_i^1 = \begin{cases} 1 & \text{if } y_i \geq 0 \\ 0 & \text{otherwise} \end{cases} \quad \text{and} \quad I_i^0 = \begin{cases} 1 & \text{if } y_i < 0 \\ 0 & \text{otherwise} \end{cases}$$

for the expected vote, equations (2) and (3) can be presented as

$$z_i = (p_i^1 I_i^1 - p_i^0 I_i^0) [\lambda_i (b_i^1 - b_i^0) + \zeta_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)] + \psi_i \cdot [I_i^1 (\mathbf{a}_i^1 - \mathbf{a}_i^-) + I_i^0 (\mathbf{a}_i^0 - \mathbf{a}_i^-)] + d_i - c_i. \quad (4)$$

Individual  $i$  will participate in the vote if  $z_i \geq 0$ .

Equation (4) takes a particularly simple form if one makes the additional assumption that expressive feelings created from abstention are the same as those created from voting against one's preferences, that is,  $\mathbf{a}_i^- = \mathbf{a}_i^0$  if  $y_i \geq 0$  and  $\mathbf{a}_i^- = \mathbf{a}_i^1$  if  $y_i < 0$ . Using this, (4) becomes

$$z_i = (p_i^1 I_i^1 - p_i^0 I_i^0) \lambda_i (b_i^1 - b_i^0) + [(p_i^1 \zeta_i + \psi_i) I_i^1 - (p_i^0 \zeta_i + \psi_i) I_i^0] \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) + d_i - c_i. \quad (5)$$

Combining Proposition 1 and equation (5) shows how pocketbook considerations, social preferences, and expressive motives together with other benefits and costs of voting determine participation decisions:



**Proposition 2.** (i) (a) For  $p_i^1 > 0$ ,  $z_i > 0$  and  $y_i > 0$  if and only if

$$b_i^1 - b_i^0 > \max \left\{ \frac{(p_i \zeta_i + \psi_i) \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1)}{p_i \lambda_i}, \frac{(p_i^1 \zeta_i + \psi_i) \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1)}{p_i^1 \lambda_i} + \frac{c_i - d_i}{p_i^1 \lambda_i} \right\};$$

(b) for  $p_i^0 > 0$ ,  $z_i > 0$  and  $y_i < 0$  if and only if

$$b_i^0 - b_i^1 > \max \left\{ \frac{(p_i \zeta_i + \psi_i) \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)}{p_i \lambda_i}, \frac{(p_i^0 \zeta_i + \psi_i) \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0)}{p_i^0 \lambda_i} + \frac{c_i - d_i}{p_i^0 \lambda_i} \right\}.$$

(ii) For  $k = 1, 2, \dots, K$ :

(a) if  $p_i^1 \zeta_{ki} + \psi_{ki} > 0$ , then  $z_i > 0$  and  $y_i > 0$  if and only if

$$a_{ki}^1 - a_{ki}^0 > \max \left\{ \frac{p_i \lambda_i (b_i^0 - b_i^1) + (p_i \zeta_{(-k)i} + \psi_{(-k)i}) \cdot (\mathbf{a}_{(-k)i}^0 - \mathbf{a}_{(-k)i}^1)}{p_i \zeta_{ki} + \psi_{ki}}, \frac{p_i^1 \lambda_i (b_i^0 - b_i^1) + (p_i^1 \zeta_{(-k)i} + \psi_{(-k)i}) \cdot (\mathbf{a}_{(-k)i}^0 - \mathbf{a}_{(-k)i}^1)}{p_i^1 \zeta_{ki} + \psi_{ki}} + \frac{c_i - d_i}{p_i^1 \zeta_{ki} + \psi_{ki}} \right\};$$

(b) if  $p_i^0 \zeta_{ki} + \psi_{ki} < 0$ , then  $z_i > 0$  and  $y_i < 0$  if and only if

$$a_{ki}^1 - a_{ki}^0 > \max \left\{ \frac{p_i \lambda_i (b_i^1 - b_i^0) + (p_i \zeta_{(-k)i} + \psi_{(-k)i}) \cdot (\mathbf{a}_{(-k)i}^1 - \mathbf{a}_{(-k)i}^0)}{-(p_i \zeta_{ki} + \psi_{ki})}, \frac{p_i^0 \lambda_i (b_i^1 - b_i^0) + (p_i^0 \zeta_{(-k)i} + \psi_{(-k)i}) \cdot (\mathbf{a}_{(-k)i}^1 - \mathbf{a}_{(-k)i}^0)}{-(p_i^0 \zeta_{ki} + \psi_{ki})} + \frac{c_i - d_i}{-(p_i^0 \zeta_{ki} + \psi_{ki})} \right\}.$$

**Proof:** Claim (i)(a). Observe first that  $p_i^1 > 0$  implies  $p_i > 0$ . Thus, by Proposition 1(i),  $b_i^1 - b_i^0 > (p_i \zeta_i + \psi_i) \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1) / (p_i \lambda_i)$  is equivalent to  $y_i > 0$ . Hence,  $I_i^1 = 1$  and  $I_i^0 = 0$ . Inserting these indicators in (5) and solving  $z_i > 0$  yields  $b_i^1 - b_i^0 > (p_i^1 \zeta_i + \psi_i) \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1) / (p_i^1 \lambda_i) + (c_i - d_i) / (p_i^1 \lambda_i)$ . The two conditions given in the claim are jointly satisfied if and only if  $y_i > 0$  and  $z_i > 0$ . The other claims follow from the same logic.  $\square$

The first part of this proposition states that sufficiently large monetary gains guarantee participation and voting in favor of the public good, and sufficiently large monetary losses guarantee participation and voting against. The second part states that if some social or expressive concern is sufficiently strong, the individual will participate and vote in line with his or her evaluation of this concern.

If  $c_i - d_i > 0$ , implying a net cost of voting, participation requires either a sufficiently strong expressive motivation, or sufficiently different valuations of outcomes combined with a sufficiently large subjective probability of affecting the outcome. In particular, if expressive concerns are absent, then even substantial monetary stakes do not guarantee participation if that probability is negligible. This contrasts with the voting decision where, as shown in Corollary 1, the probability of changing the outcome is not relevant when the individual has no expressive preferences. Consequently, the overestimation of small probabilities which is often found in experiments<sup>5</sup> can be expected to play a bigger role in the turnout than in the voting decision.

If one finds that pocketbook motives play a role in determining participation, then this suggests that the subjective probability of changing the outcome is not negligible. Consequently, in this case, it is not possible to disentangle instrumental social preferences and expressive motives. Like in the voting decision, these two motivations are observationally equivalent if pocketbook considerations contribute to explaining participation. If, instead, pocketbook considerations are not found to affect the participation decision, then it is plausible that the joint effect of instrumental social concerns and expressive motives is driven by the latter.

Even for  $c_i - d_i = 0$ , the individual may abstain. Proposition 2(i) implies:

**Corollary 2.** *If  $c_i - d_i = 0$ , then  $z_i < 0$  if*

(a)  $\psi_i \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1) > 0$  and

$$\left( \frac{\zeta_i}{\lambda_i} + \frac{\psi_i}{p_i \lambda_i} \right) \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1) < b_i^1 - b_i^0 < \left( \frac{\zeta_i}{\lambda_i} + \frac{\psi_i}{p_i^1 \lambda_i} \right) \cdot (\mathbf{a}_i^0 - \mathbf{a}_i^1) ; \quad \text{or}$$

(b)  $\psi_i \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) > 0$  and

$$\left( \frac{\zeta_i}{\lambda_i} + \frac{\psi_i}{p_i \lambda_i} \right) \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) < b_i^0 - b_i^1 < \left( \frac{\zeta_i}{\lambda_i} + \frac{\psi_i}{p_i^0 \lambda_i} \right) \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) .$$

If pocketbook and expressive motivations go in opposite directions the individual will vote in line with expressive concerns if potential private gains or losses are small, and in line with pocketbook concerns if private gains or losses are large. However, there is an intermediate range, as given in the corollary, where rational abstention may occur. This is because casting a different vote affects the probability of the outcome which

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<sup>5</sup>Already Kahneman and Tversky (1979) mention that people often overestimate probabilities of rare events. For experimental evidence on overestimation of the probability to affect an election outcome, see Duffy and Tavits (2008).

is better from a pocketbook perspective by more than abstaining, i.e.  $p_i > p_i^0, p_i^1$ . The result from Corollary 2 depends on the assumption that expressive feelings from abstention are the same as expressive feelings from voting differently than one would have actually done. Then, in a situation where there is a conflict between pocketbook and expressive concerns, abstaining is a cheaper way of obtaining the expressive benefit than voting against one's pocketbook interest.

## 4 Data

### 4.1 Institutional background

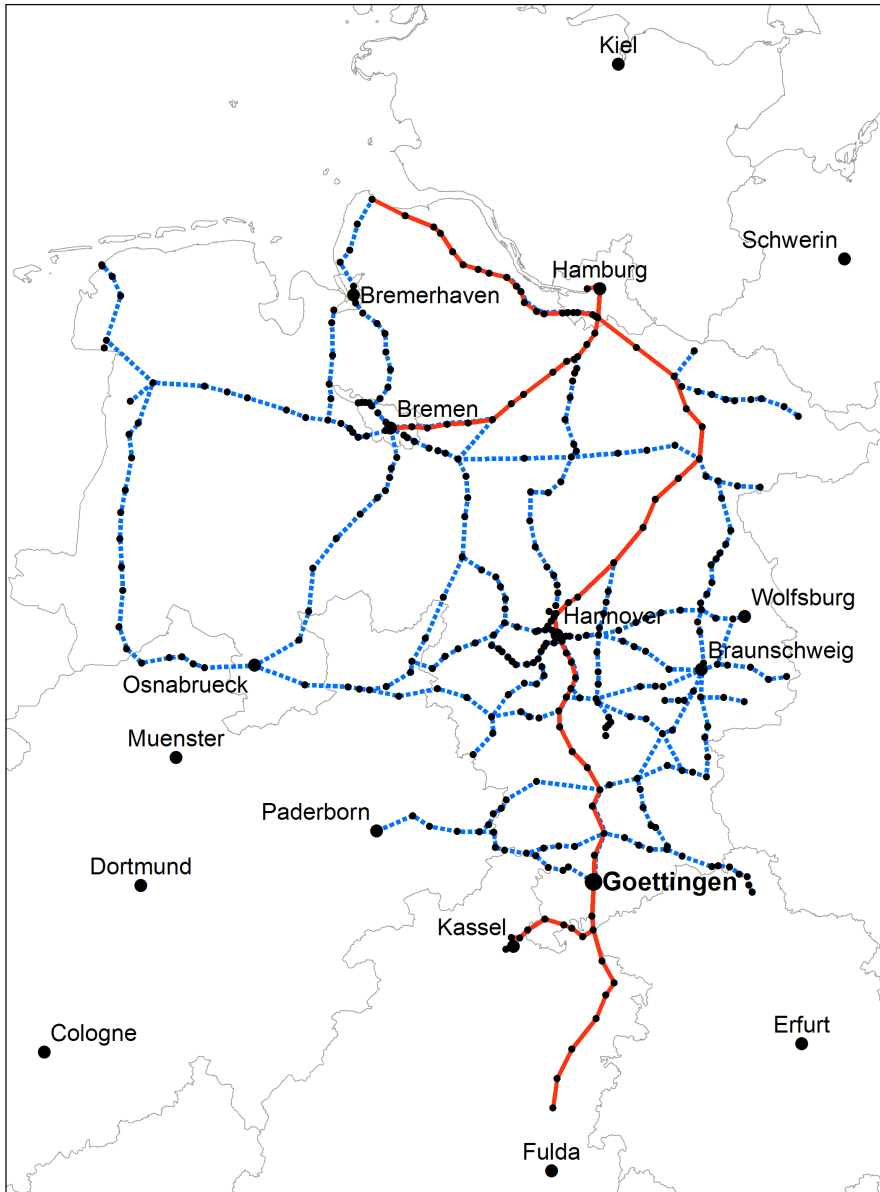
Goettingen University holds referenda among students on whether they should collectively purchase flat rate tickets, called '*Semestertickets*'. These tickets give all students at the university the right to use a specific service as often as they wish. The price of a ticket is very attractive compared with prices for individual use; however, once a ticket is accepted in the referendum, its price is collected as part of the registration fee from all students with very few exemptions.

Referenda are usually held yearly over at least three consecutive days in January at several locations on campus, and voting by mail is possible. For a ticket to be accepted, a double threshold must be passed: more than 50% of the votes must be in favor of the ticket, and, at the same time, at least 15% of the total number of students must vote in favor.

We analyze votes on tickets for regional trains, local buses, and cultural amenities. The most important of these is the train ticket which grants free travel on local trains. It was introduced in 2004. Until 2010, it covered, with only minor changes, all of the tracks depicted in Figure 1, served by several operators. The vote in 2010, however, was preceded by complaints from student representatives about the price charged by Deutsche Bahn for its section of the tracks. As a result, the ticket was split in two. The first ticket covered the offer by the two companies Metronom and Cantus, henceforth called the MetroCan ticket (the tracks are depicted as solid red lines in Figure 1), and was approved in January 2010. The second ticket covered the tracks served by Deutsche Bahn and two smaller companies (depicted as blue dashed lines in Figure 1). The latter companies are jointly referred to as Bahn throughout this paper. After some negotiations with Bahn, a referendum on the Bahn ticket was held in May 2010. The ticket cost 42.24 euros per semester. Of approximately 22,800 students registered at that time, 25% participated in the referendum, of whom 77% voted yes.

In subsequent years the train ticket proposal again covered all tracks. The culture ticket was introduced in October 2012. It offers free or highly discounted entrance to

Figure 1: Map



The tracks covered by the Bahn (dashed blue lines) and MetroCan (solid red lines) tickets. The gray lines are state boundaries.

a number of cultural institutions and events, such as theaters, museums and concerts. The bus ticket, which covers all buses within Goettingen and two nearby villages, would have been a novelty in 2013. In the 2013 referenda, the prices per semester amounted to 8.55 euros for the culture ticket, 25.80 euros for the bus ticket and 95.04 euros for the train ticket, and approximately 36% of almost 25,600 students took part in each referendum. Two of the three referenda were close. While the culture ticket just passed with 53% approval, the bus ticket failed with 46% support. An overwhelming majority of 82% voted in favor of the train ticket.

## 4.2 Dataset I

Information in Dataset I refers to the referendum on the train ticket covering the Bahn tracks in May 2010. To obtain data on the voting and traveling behavior of students, an anonymous online survey was conducted. Unlike exit polls, this method allows non-voters to be included in the dataset. To incentivize participation, students were invited to take part in a lottery with prizes including 250 euros and 15 pairs of tickets to a local cinema. The survey was open from July 6 until November 11, 2010.

Summary statistics for Dataset I are reported in Table 4. This dataset consists of 1,189 observations after cleaning the data.<sup>6</sup> Of these, 828 students took part in the referendum, showing an overrepresentation of voters in our sample. At the same time, these data allow us to base our analysis on detailed information on almost one sixth of all voters in the referendum. Among the voters in the sample, the share of yes votes is 68% and hence smaller than the share of yes votes in the polling box.

The key variable in this dataset which allows us to measure pocketbook benefits is the individual savings of each student. We construct an objective measure of the savings associated with the Bahn ticket by combining the number of trips to visit the respondent's parents using this ticket within the previous 12 months with the price that would have been paid in the absence of the ticket.<sup>7</sup> As seen in Table 4, the savings variable exhibits a large variation. We focus on trips to visit parents because this is the most common trip students make. Moreover, the two larger cities close to Goettingen, namely Hannover and Kassel, which might be attractive leisure destinations, can be reached using the MetroCan ticket (Figure 1). We define the difference between savings and the ticket price as net savings. In the econometric analysis, we use a transformation of net savings to measure pocketbook benefits  $b_i^1 - b_i^0$ . This is explained in Section 6.1.

<sup>6</sup>See Appendix A.I in the supplementary material for a detailed description.

<sup>7</sup>A detailed description of the calculation of savings is included as Appendix A.II in the supplementary material.

Table 4: Summary statistics Dataset I

Variable	All		Vote on Bahn ticket=1	
	N	Mean	N	Mean
Vote on Bahn ticket	1189	0.70	828	1.00
Bahn ticket: yes	818	0.68	818	0.68
Savings <sup>◇</sup>	1189	255.09	828	302.92
Own price threshold <sup>♣</sup>	1125	69.76	783	72.31
Exp. ave. price threshold <sup>♡</sup>	1099	63.20	764	63.03
Leisure/work	1189	0.06	828	0.06
Visiting others	1174	0.65	819	0.67
Female	1176	0.57	817	0.54
Freshman	1099	0.15	768	0.18
Altruist(−)	1074	0.14	741	0.13
Altruist(+)	1074	0.34	741	0.33
Protest	1189	0.21	828	0.24
Christian Democrats	911	0.21	645	0.22
Social Democrats	911	0.24	645	0.27
Liberal Democrats	911	0.11	645	0.11
Green	911	0.35	645	0.33
Left	911	0.03	645	0.02
Other parties	911	0.05	645	0.05

<sup>◇</sup>Savings are between 0 and 3,800 with a std. dev. of 449.72 within the entire sample and 487.99 among the voters; <sup>♣</sup>own price thresholds are between 0 and 750 with a std. dev. of 65.22 and 64.14, respectively; <sup>♡</sup>and expected average price thresholds are between 10 and 720 with a std. dev. of 47.92 and 46.76, respectively.

A limitation of the savings variable is that students can also use the ticket for other trips than visiting their parents. To complement the savings measure, we asked whether the respondent visited people other than his or her parents using the ticket. We coded this information as a binary variable since quantifying monetary savings from these trips would have required the addresses of other people visited and the number of times each destination was visited.

The key variables measuring social preferences or expressive concerns describe whether a student considered benefits of others in his or her voting decision and his or her evaluation of these benefits. These variables are based upon the answers to three questions. The first asks what is the highest price at which the respondent would vote in favor of the Bahn ticket. The second asks what is the respondent's belief about the corresponding average of fellow students. The third question asks how the respondent weighted these two considerations in his or her vote. If the voting decision is influenced by the belief about the average preferences of other students, then the respondent is classified as an altruist. The resulting group of altruists is then split into those who think that students on average will gain from this ticket and those who think that students on average will lose. Accordingly, *altruist(+)* is equal to one if the student is an altruist and believes that the price threshold of fellow

students is on average at least as large as the price, and zero otherwise. We define  $altruist(-)$  analogously. If the student did not vote, then the third question on the actual voting decision is replaced by a corresponding question about a hypothetical voting decision. In the econometric analysis, the binary variables  $altruist(+)$  and  $altruist(-)$  are components of the vector  $(\mathbf{a}_i^1 - \mathbf{a}_i^0)$  representing social preferences or expressive concerns.

The questionnaire also allowed students to enter free text regarding the primary reasons to vote for or against the Bahn ticket. To use this qualitative information, a content analysis was performed to identify the relevant topics. Afterward, three raters independently coded all of the answers with respect to whether a topic did appear. Finally, an indicator variable was defined that is equal to one if at least two of the three raters independently identified the topic in the statement given and zero otherwise. We use two variables resulting from this qualitative analysis. The first item, *leisure/work*, complements our measures of pocketbook benefits. It captures whether the student mentioned leisure activities other than visiting people, such as exploring the region, or work-related usage. The second item emerging from the content analysis is *protest*: some students expressed their unwillingness to accept the price of the ticket or feared that accepting the conditions would foster future price increases. It is plausible that this variable represents primarily expressive concerns, but it can also be viewed as a social consideration if students strategically cast a protest vote. Among the voters, the shares of students referring to *leisure/work* and *protest* are approximately 6% and 24%, respectively.

The control variables in this dataset include gender, the party for which the student voted in the federal election in 2009 and whether the student is a freshman. Being a freshman is relevant because the first-year students in the dataset only began university in October 2009. Thus, they could not use the ticket for a full year which biases the savings variable downwards.

### 4.3 Dataset II

Dataset II covers the referenda on all three tickets that took place in January 2013 and was collected using exit polls. After leaving the polling place, students were approached by members of the survey team and asked to take part in a paper-based survey. To preserve anonymity, cubicles similar to polling booths were installed. Participation was incentivized by a lottery with prizes of 200, 100 and 50 euros.

After excluding those students who did not provide any voting decision, Dataset II contains 1,334 observations. Summary statistics are shown in Table 5. Within our sample, the shares of yes votes for all three tickets are slightly higher than the respective overall shares. The students in the dataset would have just passed the

bus ticket, which narrowly missed the 50% approval threshold in the referendum. However, because our sample contains detailed information on one seventh of all the votes cast, we are confident that these deviations are of minor importance when analyzing individual voting decisions.

Pocketbook benefits  $b_i^1 - b_i^0$  are measured by categorical variables on the intensity of use, defined differently for the tickets (Table 5). For the train and culture tickets, students were asked about their use of these amenities within the last 12 months and the year before the ticket had been introduced, respectively. For the bus ticket, the intensity of use refers to teaching periods during term. In addition, students were asked if they would buy the ticket for themselves if the ticket were rejected in the referendum but were available for purchase at the same price on an individual basis. This provides a revealed preference measure of to what extent pocketbook benefits alone rationalize voting decisions on each ticket.

For each of the three tickets, the vector  $(\mathbf{a}_i^1 - \mathbf{a}_i^0)$  representing social preferences or expressive concerns contains as a common component information on whether the respondent considered savings to other students to be important in his or her vote. The answers to these questions were given on a four-point Likert scale ranging from ‘not important’ to ‘important’. Furthermore, we asked about other motives, such as environmental aspects in the case of the train ticket or strengthening local transportation or local cultural life in the case of the bus or culture tickets, respectively, using the same Likert scale. In Table 5, we give the shares of students who replied that these other considerations were important. This binary coding is also used in the regression analysis presented in Section 6.

Additional control variables include gender, fields of study and being a freshman.<sup>8</sup> Moreover, political preferences were captured by a question on how the respondent would vote in a federal election if this election were to take place the following Sunday.

## 5 The big picture

In this section, we take a closer look at the data in a descriptive analysis.

### 5.1 The voting decision

The big picture that emerges is that there is strong evidence for pocketbook voting but that social preferences or expressive motivations also play an important role. In

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<sup>8</sup>Due to the high number of polling stations, the survey team could not cover all of the stations during open hours on all three days. Therefore, the faculties of Law, Humanities, Economic Sciences and Social Sciences are overrepresented in the dataset.



Table 5: Summary statistics Dataset II

Variable	N	Mean
<b>Train ticket</b>		
Train ticket: yes	1252	0.86
Would buy it	1248	0.64
Never	1321	0.07
Rarely ( $\leq 5$ /year)	1321	0.17
Sometimes (monthly)	1321	0.32
Often (weekly)	1321	0.21
Very often ( $\geq 2$ /week)	1321	0.24
Savings to others important	1292	0.47
Environment important	1284	0.38
<b>Bus ticket</b> <sup>◇</sup>		
Bus ticket: yes	1246	0.51
Would buy it	1276	0.37
Never	1329	0.40
Rarely (1 or 2/semester)	1329	0.24
Sometimes (monthly)	1329	0.13
Often (weekly)	1329	0.09
Very often ( $\geq 2$ /week)	1329	0.14
Savings to others important	1280	0.23
Strengthening bus important	1245	0.12
<b>Culture ticket</b>		
Culture ticket: yes	1283	0.54
Would buy it	1233	0.44
Never	1234	0.56
Rarely (1 or 2/year)	1234	0.25
Sometimes (3 to 5/year)	1234	0.12
Often (6 to 10/year)	1234	0.04
Very often ( $> 10$ /year)	1234	0.03
Savings to others important	1235	0.24
Others should go important	1201	0.29
Strengthening local culture important	1229	0.39
<b>Control variables</b>		
Female	1276	0.50
Freshman	1318	0.30
Christian Democrats	1140	0.26
Social Democrats	1140	0.29
Liberal Democrats	1140	0.04
Green	1140	0.31
Left	1140	0.05
Other parties	1140	0.05
Economic sciences	1322	0.30
Social sciences	1322	0.24
Forestry/Agriculture	1322	0.06
Humanities	1322	0.27
Geology/Geography	1322	0.03
Law	1322	0.11
Natural sciences	1322	0.08
Other fields	1322	0.03

<sup>◇</sup> Intensity of the use of the bus ticket refers to the lecture period.

Table 6: Pocketbook voting – Dataset II

Train ticket				Bus ticket				Culture ticket			
Buy it	Vote		Total	Buy it	Vote		Total	Buy it	Vote		Total
	No	Yes			No	Yes			No	Yes	
No	158	256	414	No	572	160	732	No	519	147	666
Yes	11	755	766	Yes	21	441	462	Yes	27	495	522
Total	169	1,011	1,180	Total	593	601	1,194	Total	546	642	1,188

terms of the theory, this means that both null-hypotheses **H1** and **H2** are refuted. As discussed in Section 3.1, this rules out the case of purely expressive voting. Furthermore, our findings suggest that either voters expect to have a non-negligible impact on the outcome, or that expressive voting is weak for a vast majority of voters.

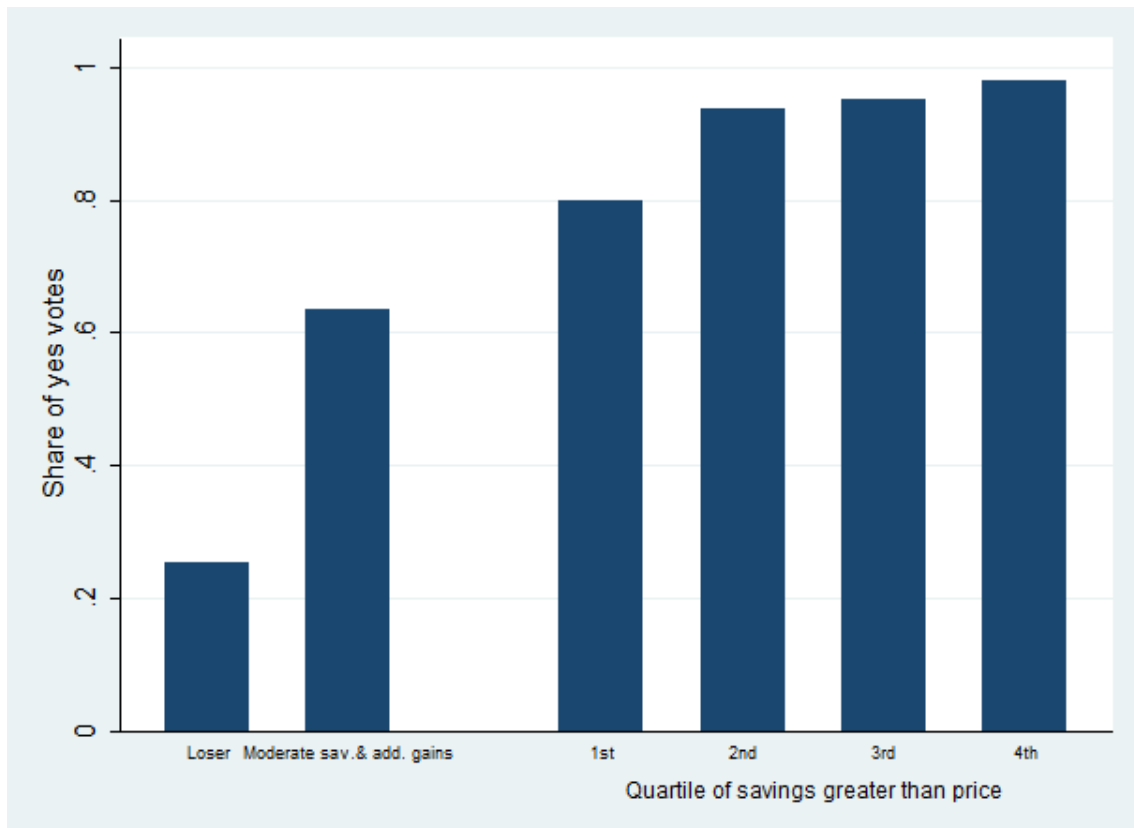
We first give the evidence for pocketbook voting in the 2010 vote on the Bahn ticket. For this purpose, we combine the savings variable with the information on whether students used the ticket for visits other than those to their parents. This allows us to define those for whom savings from visiting parents were less than the price of the ticket and who neither visit other people using the ticket nor mention leisure or work-related trips as losers in terms of private benefits and those for whom the savings from visiting parents exceeded the price of the ticket clearly as winners. Those for whom savings from visiting parents fell short of the price of the ticket but who also mentioned other trips are a middle category, in which we cannot say for sure whether the student in question privately gained or lost from the ticket. Of the 815 voters in Dataset I, 24% are classified as losers and 49% as winners.

Figure 2 depicts the share of yes votes for losers, the middle category and winners. To illustrate how voting depends on the magnitude of pocketbook gains, the share of yes votes is calculated separately for each quartile of savings among the winners. The picture that we find is very much in line with pocketbook voting. Overall, 92% of the winners voted in favor of the ticket and 75% of the losers against. Among the winners, we see that the share of yes votes increases from 80% in the first quartile to 98% in the last.

A corresponding picture of strong pocketbook voting arises also from Dataset II. Figure 3 depicts the share of yes votes depending on how intensively the voter used the service that was the subject of the vote. For each ticket, more than 90% of those who very often used the service voted in favor, while the share of yes votes varies between 24% and 32% for those who never used the service.

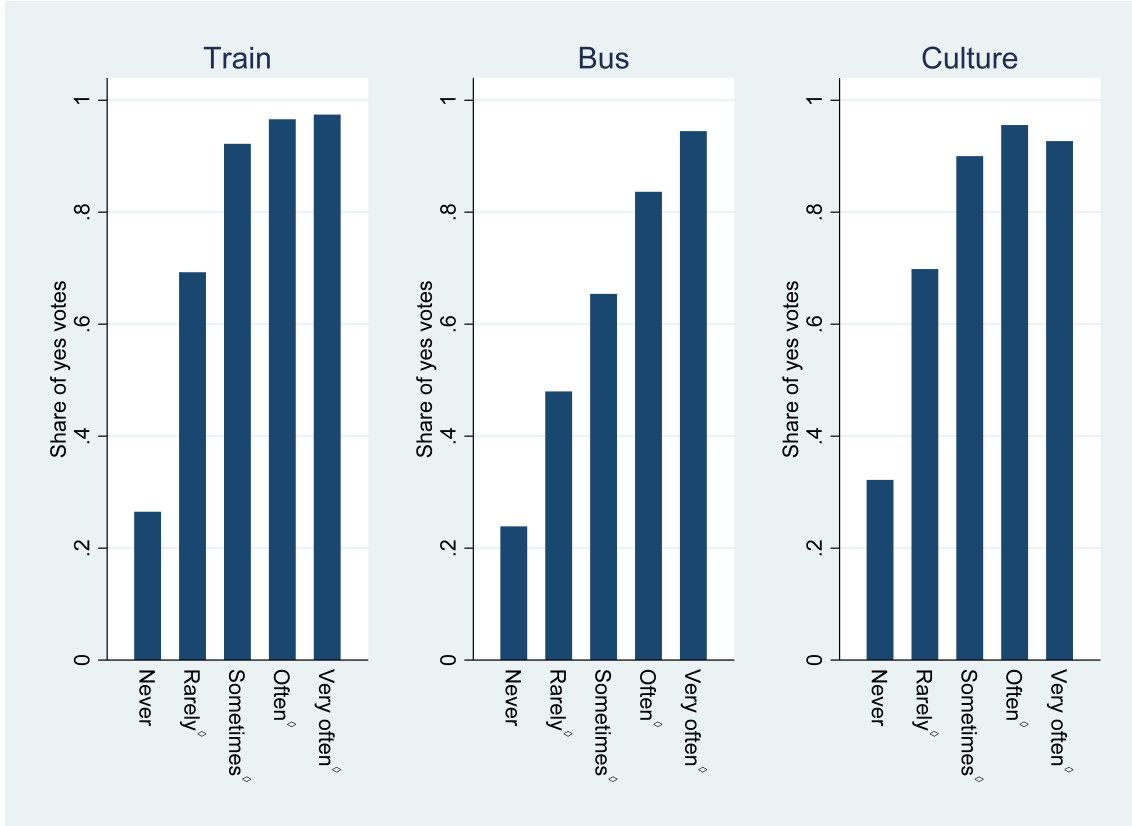
We complement the analysis of to what extent objective measures of use can explain voting with a comparison between actual voting and hypothetical choices as private consumers. In Dataset II, we asked respondents whether they would have bought the ticket individually if it were rejected in the referendum but available

Figure 2: Savings and share of yes votes – Dataset I



Losers' savings do not cover ticket costs, and they neither visit other people using the ticket nor mention leisure/work usage. The savings of the second group alone do not cover ticket costs; however, they mention other trips. The last four bars refer to respondents whose savings exceed ticket costs.

Figure 3: Intensity of use and yes votes – Dataset II



◇ Definitions of the intensity of use differ: Rarely, Sometimes, Often, and Very often correspond to at most 5 times a year, monthly, weekly, and at least twice a week, respectively, for the train ticket; once or twice a semester, monthly, weekly, at least twice a week, respectively, during the lecture period for the bus ticket and once or twice a year, 3 to 5 times a year, 6 to 10 times a year, > 10 times a year, respectively, for the culture ticket.

for individual purchase at the same price. If voting exclusively followed pocketbook considerations, we would expect those who voted in favor to also be willing to buy the ticket and those who voted against to be unwilling to do so. Table 6 shows that 93% to 96% of those who voted against a semester ticket would also decline the opportunity to buy it privately. Remarkably, 23% to 27% of those who voted in favor of a ticket would not be willing to buy it privately for the same price. Taken together, approximately 30% of the respondents voted differently as citizens than they would have chosen as private consumers.

We next analyze those votes which are not in line with pocketbook considerations. We conjecture that social preferences and expressive motives explain most of these. To test this conjecture in Dataset I we use the variables  $altruist(+)$  and  $altruist(-)$ .

Table 7: Social preferences and protest among winners and losers – Dataset I

Bahn ticket, only losers				Bahn ticket, only winners			
Altruist(+)	Vote		Total	Altruist(-) or protest	Vote		Total
	No	Yes			No	Yes	
No	119	17	136	No	9	239	248
Yes	12	23	35	Yes	23	100	123
Total	131	40	171	Total	32	339	371

Losers' savings do not cover ticket costs, and they neither visit other people using the ticket nor mention leisure/work usage. Winners' savings cover ticket costs.

These variables describe students who stated that they cared about other students' benefits in their votes and at the same time thought that students on average would gain or lose, respectively, when the ticket was introduced. As seen in Table 7, the majority of respondents who voted in favor of the ticket even if they lost privately thought that other students gained from it and reported that they cared about this gain. Among those who voted against the ticket, even if it promised them higher private savings than the price of the ticket, a clear majority was either of the view that other students would lose from the ticket or mentioned protest motives regarding price or pricing policy in the questionnaire's write-in section.

In Dataset II, we calculated the fraction of those who voted in favor of each ticket but would not buy it privately who also reported at least one social or expressive motive. Here, we consider a social or expressive motive to be present if the respondent stated that an item was at least somewhat important for his or her decision. The motives that we consider relate to altruistic concerns toward other students and to common good considerations. The former are relevant when a respondent notes that savings to others are a motivation to vote in favor of a ticket. The latter is present when a respondent supports the service in question because it benefits the environment (in the case of the train ticket), because he or she wants to strengthen local culture or the bus system, or states, paternalistically, that other students should use cultural services more often.<sup>9</sup> Table 8 shows that everyone who supported the culture ticket without being willing to buy it privately and more than

<sup>9</sup>Strengthening local cultural institutions or the bus system can also be self-interested, to improve the choices that one has as a private consumer. Similarly, wanting other students to consume more culture might also reflect a desire to have more company at cultural events. Yet another reason for supporting the culture ticket could be related to problems of self-control. Students may want to commit themselves to consuming more culture, just as a flat rate gym membership can be seen as a commitment device to exercise more often (DellaVigna and Malmendier, 2006). Note, however, that buying this ticket privately would also provide a commitment device. The fact that a substantial number of respondents voting in favor of the ticket would not make this private purchase but at the same time state that others should attend cultural events more often suggests that most students saw the self-control problem in their fellow students rather than in themselves.

Table 8: Voting in favor but unwilling to buy: importance of social preferences

	Train	Bus	Culture
Social preferences or expressive motives	235	147	147
Neither social preferences nor expressive motives	21	10	0
Total	256	157	147

The social preferences and expressive motives considered include for all three tickets savings to other students. They also include environmental aspects for the train ticket, strengthening local public transportation for the bus ticket, and strengthening local cultural life and the belief that others should visit cultural institutions more frequently for the culture ticket.

90% of those voting in favor of the train or bus ticket despite not being willing to buy it privately claimed at least one social or expressive motive.

Figure 4: Rationalizing votes – Datasets I and II

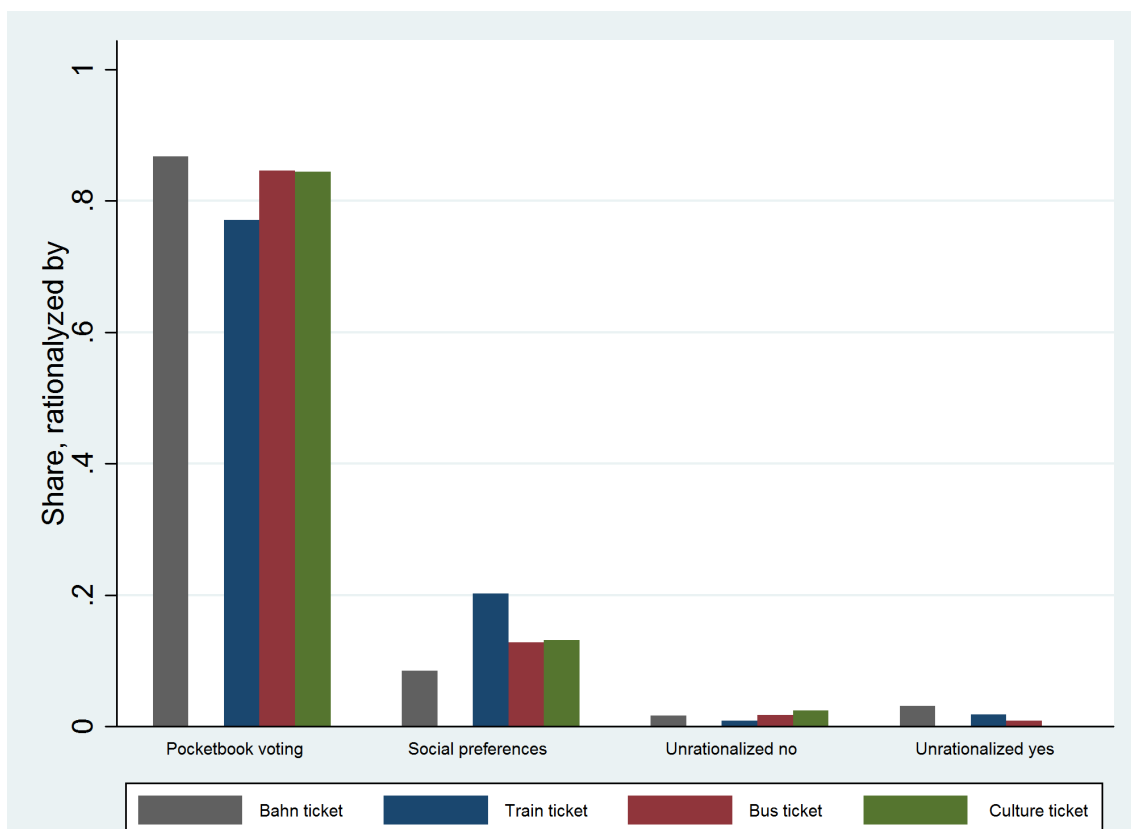


Figure 4 summarizes our findings. It shows that 77% to 87% of all votes can be rationalized by pocketbook voting. In Dataset I this corresponds to losers voting

against the ticket and winners voting in favor (see Table 7). Here, we disregard the middle category since it is not clear whether these respondents gain or lose from the ticket. In Dataset II a vote is rationalized by pocketbook considerations if the respondent votes in favor of a ticket if and only if he or she would buy it privately at the price charged (see Table 6). Almost all of the votes that cannot be rationalized in this way can be rationalized by social preferences or expressive motives. The shares of unrationalizable no votes are between one and two percent, and the shares of unrationalizable yes votes are between zero and three percent.

When interpreting Figure 4, it is notable that individual financial interests and social preferences are not mutually exclusive but, rather, may coincide. Therefore, the figure does not state that around 80% of all voters would base their decisions only on their own financial benefit. Rather, it shows that there are very few votes that cannot be rationalized by either pocketbook voting or social or expressive considerations or these types of motivations together. We also performed the analysis summarized in Figure 4, splitting the sample by gender and by political orientation. We find that the differences between men and women and between supporters of the left and those of the right are minor.

To observe the full power of social preferences or expressive motives, note in Table 6 that although only a minority of students in the sample would have bought the culture ticket or the bus ticket, a majority supported them in the referenda. As Figure 4 shows, for a sizable minority of the voters, social preferences or expressive motives were the decisive factor in their decision. The closeness of the results in the actual referenda on the culture and bus tickets suggests that such motives were pivotal in the former vote and close to pivotal in the latter.

The evidence presented in this section is consistent with an explanation based on pocketbook voting combined with social preferences or expressive motives or both. However, combining insights from our theory, Figure 4, and the election outcomes sheds light on the relative plausibility of social preferences and expressive motives as explanations. We first note that two referenda (bus and culture) were close and two referenda (both train tickets) were decided by a large margin. Voters with rational expectations should therefore have considered their likelihood of being pivotal to be much larger in the former votes than in the latter. This conclusion arises also if students form their expectations retrospectively. Before the ticket was split in two in 2010, the train ticket had been approved by 80% in 2008 and 84% in 2009. In the referenda in 2011 and 2012, the approval rates were 80% and 82%. The culture ticket passed only narrowly in 2012 with a 51% share of yes votes.

In a trade-off between pocketbook benefits and expressive motives, pocketbook considerations are weighted by the probability to change the outcome, and should therefore become less important if this probability is low (see Proposition 1(iii)).

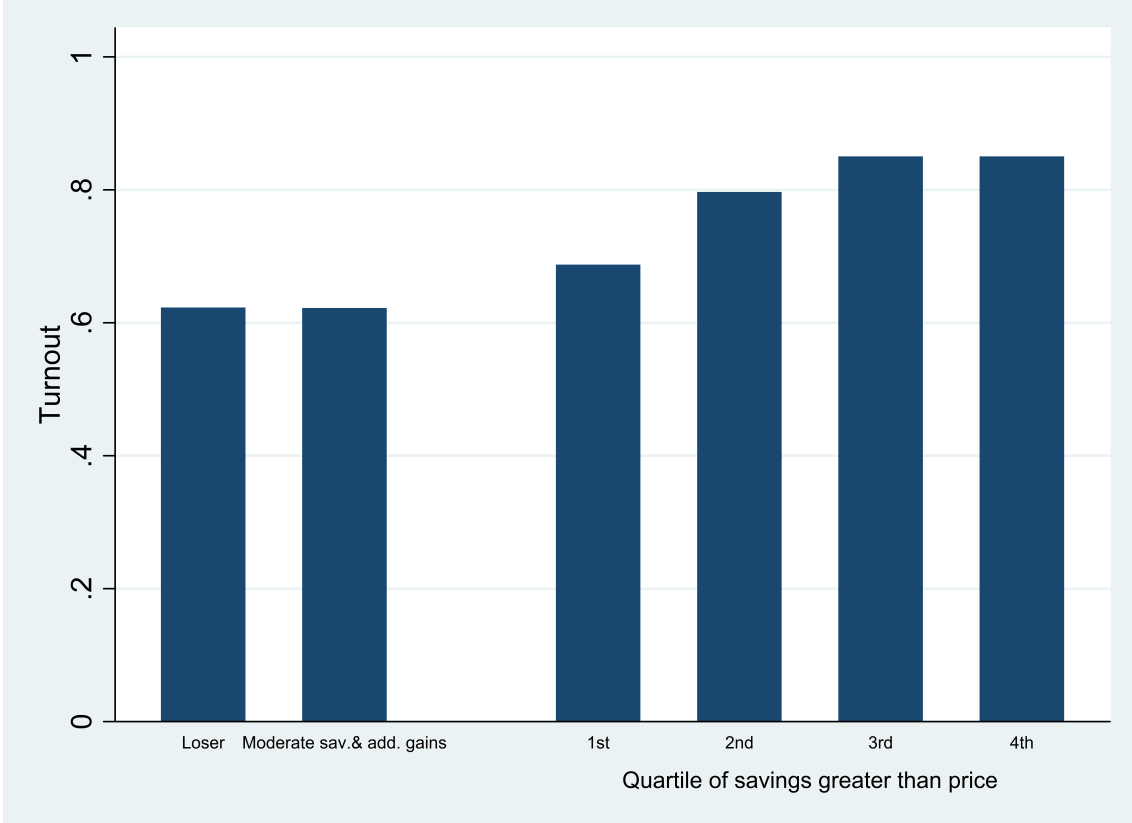
In contrast, in a trade-off between pocketbook benefits and social preferences, this probability cancels out, and hence should not affect the relative importance of these motives (see Corollary 1). The finding that pocketbook voting explains around 80% of votes in each election, irrespective of whether it was close or not, suggests that social preferences play a substantially bigger role than expressive concerns.

## 5.2 The turnout decision

We next analyze how the decision to participate in the vote is related to savings when visiting parents. Figure 5 presents turnout separately for three groups defined above in Figure 2 according to the monetary gains conferred by the ticket: those who lost from the ticket; those with moderate savings who may also have netted personal gain from trips other than those to visit parents; and those whose savings from visiting parents exceeded the price. Those with zero and moderate savings are least likely to vote; after that, turnout increases monotonically. As predicted by Proposition 2(i), this finding suggests that those with higher stakes are more likely to vote, in line with the rational calculus of voting. It is noteworthy that gains and losses are asymmetrically distributed: the maximum loss is the price of a ticket (84.48 euros), while among the winners, the average savings just from visiting parents is 586 euros. This asymmetry explains why turnout is substantially higher among winners.



Figure 5: Turnout and savings – Dataset I



Losers' savings do not cover ticket costs, and they neither visit other people using the ticket nor mention leisure/work usage. For the middle group, the savings when visiting parents do not cover ticket costs; however, they mention other trips.

## 6 The vote

### 6.1 Estimating the voting decision

We now describe how we arrive from equation (1) at an equation which can be estimated. For the empirical analysis, we assume that the weights in the utility function and the perceived probability of changing the outcome are the same for all individuals,  $\lambda_i = \lambda$ ,  $\zeta_i = \zeta$ ,  $\psi_i = \psi$ , and  $p_i = p$  for all voters  $i$ . Moreover, in line with Card et al. (2012) we allow for an additive impact of a vector of individual covariates  $\mathbf{x}_i$  such as gender, political affiliation or fields of study, with the vector  $\boldsymbol{\rho}$  measuring the effects of the various covariates. Finally, we add an error term  $\mu_i$  with a standard normal distribution, which also includes any considerations not captured

by our model.

Combining these elements, we modify (1) to

$$y_i = \beta (b_i^1 - b_i^0) + \boldsymbol{\alpha} \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) + \boldsymbol{\rho} \cdot \mathbf{x}_i + \mu_i. \quad (6)$$

Equation (6) is the basis for the empirical analysis, where we estimate the coefficients  $\beta$ ,  $\boldsymbol{\alpha}$  and  $\boldsymbol{\rho}$  using a probit regression. Individual  $i$  votes in favor of the ticket if and only if  $y_i \geq 0$ , that is,  $\mu_i \geq -\beta (b_i^1 - b_i^0) - \boldsymbol{\alpha} \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) - \boldsymbol{\rho} \cdot \mathbf{x}_i$ . Making use of the symmetry of the normal distribution, the probability that  $i$  votes in favor of the ticket is

$$\Phi\left(\beta (b_i^1 - b_i^0) + \boldsymbol{\alpha} \cdot (\mathbf{a}_i^1 - \mathbf{a}_i^0) + \boldsymbol{\rho} \cdot \mathbf{x}_i\right),$$

where  $\Phi$  is the cumulative distribution function of the standard normal distribution.

The estimated coefficient  $\beta = p\lambda$  measures the impact of pocketbook motives on the gain from switching from a negative to a positive vote. The coefficients  $\boldsymbol{\alpha} = p\boldsymbol{\zeta} + \boldsymbol{\psi}$  are the joint impact of instrumental social preferences and expressive motives on this gain. Note, however, that due to the standardization of the error term inherent in the probit model only the relative sizes of the coefficients can be interpreted.

We cannot observe the exact monetary benefit  $b_i^1 - b_i^0$  since we do not have information about the shape of the function  $w_i$  and the counterfactual intensity of use in case the ticket is not provided. In Dataset I (see Section 4.2), we have a continuous variable for the savings  $\tau h_i^1$  provided by the ticket, measured by what would have been the price of the trips that were actually taken with the ticket in the absence of the ticket. We use savings net of the ticket price,  $\tau h_i^1 - t$ , to approximate<sup>10</sup> the equivalent variation by

$$b_i^1 - b_i^0 = \begin{cases} \ln(\tau h_i^1 - t + 1) & \text{if } \tau h_i^1 - t \geq 0 \\ \tau h_i^1 - t & \text{if } \tau h_i^1 - t < 0. \end{cases} \quad (7)$$

By using net savings directly we would risk overestimating the benefit which heavy users derive from the ticket, since individual use might drop considerably if marginal cost were positive instead of zero. Therefore, we use the logarithm of net savings in the empirical analysis for individuals whose savings exceed the ticket price. Here, we add +1 to ensure that even net savings smaller than one are valued positively. In contrast, since negative net savings occur only with individuals who use the ticket rarely or not at all, we do not transform negative net savings. In the empirical application, we prefer not to force a common coefficient on the two branches of (7), and hence introduce both of them as separate regressors.

<sup>10</sup>See the Appendix A.III for a detailed discussion of this approximation.

In Dataset II, the pocketbook benefit is quantified by categorical variables. The coefficients associated with these variables measure by how much the utility of a voter who uses the facility according to the respective category exceeds the utility of a voter who never uses it.<sup>11</sup>

Social preferences and expressive motives are measured by survey responses which are coded in binary variables. In all cases, these variables state whether an individual cares for some issue linked to the outcome of the vote, such as benefits of others or the environment. In Dataset I, we use the variables *altruist(+)*, *altruist(-)*, and *protest*, as explained in Section 4.2. In Dataset II, we code an individual as having a certain social or expressive motive if he or she mentioned, in the four-point Likert scale used in the survey (see Section 4.3), that the corresponding item is important. Thus, in the notation from above, for a voter who states (does not state) that an issue is important, the corresponding component of the vector  $\mathbf{a}_i^1 - \mathbf{a}_i^0$  is set to one (zero). The estimated coefficient then gives the aggregate effect of social and expressive benefits of an individual who states that he or she cares for the specific issue. Notice that the estimated social or expressive valuation of a ticket may be negative not only if an individual thinks that it is not valued by other students, but also if the individual has libertarian reservations against forcing a collective choice upon individuals. Such libertarian concerns may be social or expressive or a combination of the two, just as with arguments in favor of the ticket.

## 6.2 Empirical results

We now turn to the regression analysis of the voting decisions. The dependent variable is the probability of voting in favor of the respective ticket, which we estimate using probit models. We report results for Dataset I in Table 9. The main explanatory variables measuring monetary self-interest are *log pos. net savings* and *neg. net savings*, which refer to the two branches of (7). The table shows the corresponding marginal effects for the benchmark student who is defined by all indicator variables being zero. However, to account for the high variation with respect to individual savings on trips to visit parents, we also incorporate the individual values of the net savings variable in the calculation of marginal effects. Hence, we display average marginal effects for benchmark students.<sup>12</sup>

The variable *log pos. net savings* shows the expected positive sign and is significant at the 0.1 percent level. The corresponding marginal effect remains virtually

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<sup>11</sup>Formally, this amounts to approximate the linear function  $\beta(b_i^1 - b_i^0)$  by a step function. The coefficients estimate the vertical jumps from the lowest category “never” to the various categories of more intensive use, rather than a unique slope  $\beta$ .

<sup>12</sup>We calculate marginal effects as discrete changes from zero to one for all indicator variables. Coefficients for all regressions are reported in Tables A.1-A.6 in the supplementary material.

Table 9: Bahn ticket – Dataset I

Dependent Variable: Supporting Bahn Ticket					
	(1)	(2)	(3)	(4)	(5)
Log pos. net savings	0.054*** (4.84)	0.072*** (5.67)	0.069*** (5.18)	0.057*** (3.79)	0.056*** (3.67)
Neg. net savings	0.0015* (1.97)	0.0002 (0.18)	0.0005 (0.52)	0.0016 (1.48)	0.0018 (1.58)
Leisure/work		0.073 (0.97)	0.030 (0.39)	0.030 (0.39)	0.034 (0.44)
Visiting others		0.304*** (8.83)	0.313*** (8.67)	0.279*** (6.86)	0.281*** (6.99)
Female			0.055 (1.57)	0.037 (0.98)	0.035 (0.94)
Freshman			0.079 (1.58)	0.106* (2.01)	0.114* (2.18)
Altruist(-)				-0.143** (-2.98)	-0.140** (-2.88)
Altruist(+)				0.283*** (6.66)	0.281*** (6.70)
Protest					-0.080* (-1.96)
Pseudo R <sup>2</sup>	0.232	0.321	0.344	0.438	0.442
Log likelihood	-392.2	-344.4	-302.2	-234.5	-232.6
Observations	818	810	741	669	669

Probit estimation; marginal effects for benchmark students; discrete changes from 0 to 1 for indicator variables; z-statistic in parentheses. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

the same if we include additional variables. This implies that a benchmark student is on average 0.5-0.7 percentage points more likely to vote in favor if net savings increase by 10%. Given the range of the variable, this translates into sizable differences in the prediction: based on the full specification, column (5), the probability of a positive vote is 32% if the benchmark student's savings only cover ticket costs. The predicted probability is 71% if his net savings are of average size and 82% if he saves one thousand euros more than the ticket price. Additionally, visiting others using the ticket significantly increases the probability of voting in favor. This finding confirms the high importance of personal monetary benefits to individual votes. Hence, for the observations contained in Dataset I, we clearly reject null-hypothesis **H1**, which says that pocketbook motives do not influence the voting decision.

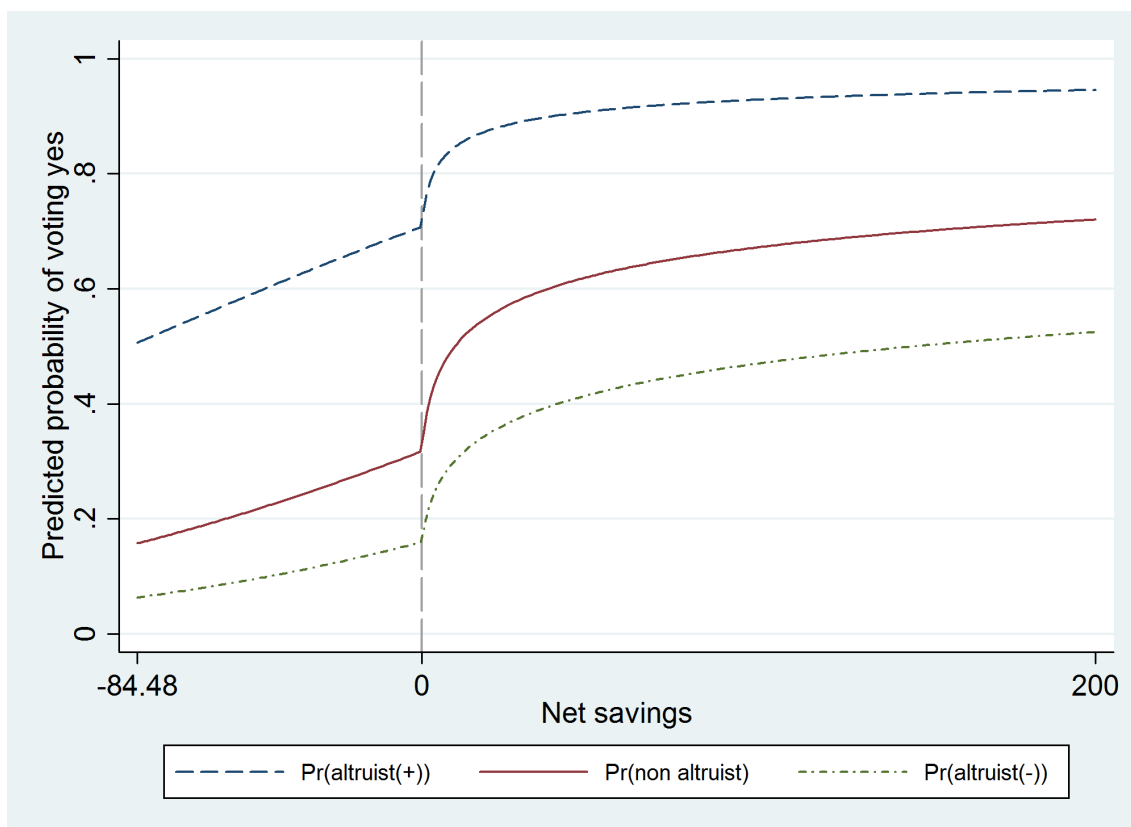
However, social preferences and/or expressive concerns also play a role in this vote: both altruism variables carry the expected sign and are significant at least at the 1 percent level. Approximately half of the students consider their fellow students' gains and losses in their votes. According to their own perception of whether the other students will on average gain or lose, these students are, *ceteris paribus*, respectively more or less likely than the benchmark to vote in favor of the ticket. Expecting other students to gain from the ticket and considering this expectation increases support for the ticket as much as using it oneself to visit other people aside from one's parents. Furthermore, the protest variable carries a negative sign and is significant at the 5 percent level. This suggests that some students protested against the train company's pricing policy by voting against the ticket. From these results we conclude that null-hypothesis **H2**, which states that social or expressive motives have no impact on the voting decision, is rejected for Dataset I.

To examine whether general political attitudes contribute to explaining individual votes, we include party preferences in the regressions. This does not change our main results. All else being equal, supporters of the left are not more likely to vote in favor of the ticket; we do not find significant effects for any of the parties (Table A.7 in the supplementary material). This finding also holds true when grouping parties on the left (Social Democrats, Greens, and Left Party) and on the right (Liberal Democrats and Christian Democrats) into blocs.

We summarize the quantitative results on the voting decision in Figure 6, based on the specification of column (5) in Table 9. In this figure, we restrict attention to monetary savings and altruism since these variables are our main focus of interest. Moreover, without placing too much emphasis on this, it is noted that the private savings and altruism variables particularly contribute to the pseudo R-squared in Table 9.

The solid red line in Figure 6 plots the predicted probability of voting in favor of

Figure 6: Predicted probability to vote in favor of Bahn ticket – Dataset I



◇ Prediction based on Table 9, column (5), as function of net savings in euros. All binary variables except *altruist(+)* and *altruist(-)* are set to zero. The line labelled Pr(non altruist) refers to an individual who states that he did not consider the benefits of others in his vote. The line Pr(altruist(+)) (Pr(altruist(-))) refers to an individual who considered benefits of others in his vote and estimates that others on average gain (lose) from the Bahn ticket.

the Bahn ticket for a benchmark student as a function of net savings. This student’s predicted probability of voting yes reaches 50% at net savings of 10 euros, which is plausible since students with very small net gains should be fairly indifferent between the alternatives. The broken blue line labelled  $\text{Pr}(\text{altruist}(+))$  shows that the predicted probability to support the ticket is shifted upwards by a substantial amount when the respondent cares about the benefit of others and anticipates that other students benefit from the ticket. Even when he does not use the ticket at all, such a student is more likely to support the ticket in the referendum than to reject it. The dotted line labelled  $\text{Pr}(\text{altruist}(-))$  shows the predicted voting behavior of an altruist who estimates that the ticket is harmful to the interests of others. Even with substantial net savings of 140 euros, such a student is more likely to vote against the ticket than in favor of it.

We present the results for the train, bus and culture tickets in Tables 10, 11 and 12, respectively. To interpret the results right away, we display the marginal effects for the benchmark students in the regression tables. These students are characterized by all indicator variables being zero. Thus, the benchmark is male and not a freshman, and savings to other students are not important to his decision. The base category for the intensity of use is “never”.

Our econometric results confirm the impressions gathered in Section 5: the probability of voting in favor of a ticket strongly increases with the intensity of personal use, suggesting a high degree of pocketbook voting. The effects are significant at the 0.1 percent level and of an economically relevant size. For example, concerning the bus ticket, estimations imply that an otherwise identical student who uses the bus several times per week is more than 70 percentage points more likely to vote in favor of this ticket than the benchmark student who does not use the bus. Thus, also for Dataset II, null-hypothesis **H1** is rejected.

However, variables capturing social preferences and/or expressive concerns also show highly significant and positive effects. Those who consider savings to other students important to their decisions vote in favor of the respective ticket with a higher probability. Additionally, students who consider environmental aspects or strengthening local public transportation to be important are more likely to vote in favor of the train ticket or the bus ticket, respectively. The same holds true regarding the culture ticket for those who indicate that strengthening local cultural life or that encouraging others to visit these institutions more frequently is important to them in their voting decisions.<sup>13</sup> From these results, null-hypothesis **H2** is also rejected

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<sup>13</sup>A similar picture emerges from the regression analysis if we use indicator variables encompassing motives that were at least somewhat important rather than focusing on motives that were important. In line with expectations, these variables capturing less pronounced social preferences or expressive concerns in general display smaller marginal effects than those shown in Tables 10-12. We have also included complete sets of indicator variables containing information on whether

Table 10: Train ticket – Dataset II

Dependent Variable: Supporting Train Ticket				
	(1)	(2)	(3)	(4)
Rarely ( $\leq 5$ /year)	0.428*** (7.35)	0.389*** (6.36)	0.393*** (6.73)	0.373*** (6.21)
Sometimes (monthly)	0.657*** (13.05)	0.648*** (11.72)	0.680*** (13.56)	0.676*** (13.14)
Often (weekly)	0.701*** (14.10)	0.698*** (12.45)	0.749*** (14.61)	0.745*** (14.19)
Very often ( $\geq 2$ /week)	0.709*** (14.39)	0.709*** (12.70)	0.766*** (15.19)	0.760*** (14.69)
Female		0.119** (3.01)	0.090* (2.44)	0.074* (2.04)
Freshman		-0.075* (-2.10)	-0.043 (-1.39)	-0.029 (-0.92)
Savings to others			0.285*** (5.48)	0.198*** (3.65)
Environment				0.242** (3.25)
Pseudo R <sup>2</sup>	0.285	0.297	0.342	0.364
Log likelihood	-356.2	-334.4	-298.1	-277.9
Observations	1247	1191	1163	1145

Probit estimation; discrete effects for benchmark students due to changes from 0 to 1 for all variables; z-statistic in parentheses. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

in Dataset II.

Freshmen are, *ceteris paribus*, more likely to vote in favor of the bus and culture tickets. However, because for freshmen, the questions on the intensity of use refer to a shorter time period or might cover some time when they were not yet in Goettingen, we refrain from emphasizing this finding.

As a robustness check, we also control for the field of study (Table A.8 in the supplementary material). The overall picture is that it does not appear to matter much for individual votes. Only a small number of fields show significant effects on the voting decisions, and our main results remain robust. All else being equal, students of the humanities and social sciences are more likely to vote in favor of the culture ticket. One explanation for this finding may be the large share of students in these fields who study culture-related subjects.

The strong empirical support for both pocketbook voting and social or expressive considerations is robust to the inclusion of party preferences or to the inclusion of both fields and party preferences in the regressions (Tables A.9 and A.10 in the supplementary material). Furthermore, for both the train and the bus tickets, we

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someone considered a motive unimportant, somewhat important, or important, and the conclusions remained the same (not reported for brevity).



Table 11: Bus ticket – Dataset II

<b>Dependent Variable: Supporting Bus Ticket</b>				
	(1)	(2)	(3)	(4)
Rarely (1 or 2/semester)	0.241*** (6.94)	0.237*** (6.67)	0.217*** (6.15)	0.203*** (5.64)
Sometimes (monthly)	0.415*** (9.81)	0.439*** (9.84)	0.416*** (8.79)	0.411*** (8.19)
Often (weekly)	0.597*** (14.88)	0.613*** (14.45)	0.617*** (13.58)	0.587*** (11.38)
Very often ( $\geq 2$ /week)	0.706*** (27.55)	0.726*** (26.15)	0.744*** (24.39)	0.728*** (20.17)
Female		-0.001 (-0.04)	-0.006 (-0.27)	0.007 (0.29)
Freshman		0.079** (2.75)	0.081** (2.92)	0.067* (2.44)
Savings to others			0.204*** (5.36)	0.158*** (4.07)
Strengthening bus system				0.418*** (5.87)
Pseudo R <sup>2</sup>	0.224	0.232	0.252	0.285
Log likelihood	-668.1	-629.3	-589.1	-539.1
Observations	1242	1183	1137	1090

Probit estimation; discrete effects for benchmark students due to changes from 0 to 1 for all variables; z-statistic in parentheses. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

Table 12: Culture ticket – Dataset II

<b>Dependent Variable: Supporting Culture Ticket</b>				
	(1)	(2)	(3)	(4)
Rarely (1 or 2/year)	0.376*** (11.67)	0.389*** (11.18)	0.355*** (9.60)	0.290*** (6.83)
Sometimes (3 to 5/year)	0.578*** (18.57)	0.611*** (15.83)	0.597*** (13.28)	0.572*** (7.80)
Often (6 to 10/year)	0.634*** (17.78)	0.687*** (14.68)	0.693*** (12.09)	0.649*** (4.94)
Very often ( $> 10$ /year)	0.605*** (13.59)	0.675*** (12.42)	0.640*** (7.96)	0.522** (2.95)
Female		0.073** (2.65)	0.071* (2.53)	0.019 (0.80)
Freshman		0.101** (3.01)	0.109** (3.17)	0.084* (2.58)
Savings to others			0.262*** (6.21)	0.104* (2.40)
Others should go				0.433*** (5.83)
Strengthening local culture				0.453*** (8.74)
Pseudo R <sup>2</sup>	0.192	0.191	0.215	0.440
Log likelihood	-664.7	-633.7	-571.1	-378.7
Observations	1189	1131	1055	988

Probit estimation; discrete effects for benchmark students due to changes from 0 to 1 for all variables; z-statistic in parentheses. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

find almost no significant effects for any of the parties.<sup>14</sup> Thus, party politics in general does not drive the voting decisions here. However, we find that support for the culture ticket, *ceteris paribus*, is larger among supporters of parties on the left.

A general concern with survey data is the reliability of answers. In our setting, this problem may arise particularly with regard to social preferences because of social desirability. For example, one might wonder whether the respondents genuinely care for others or if they just feel social pressure to state this concern. However, both the descriptive and econometric analyses show that stated social preferences, altruism in particular, or expressive concerns have a substantial impact on the voting decision, explaining most votes that cannot be rationalized by monetary benefits.

From an econometric perspective, one might be concerned with reverse causality, omitted variables, or sample selection. A reverse causality problem would arise if those respondents who voted in favor of a ticket against their monetary interest *ex post* rationalized their decision by mentioning social preferences or expressive concerns. However, this argumentation leaves open the question of why they voted in favor of the ticket in the first place. Given the extensive set of controls that we use, there is no obvious candidate for an omitted variable that affects the voting decision and is correlated with the explanatory variables. An issue of sample selection could arise if the respondents in the surveys systematically differ from the student population. As shown in Section 4, voters are somewhat overrepresented in Dataset I. This is not, however, a problem because we exclude nonvoters from the analysis of voting decisions. Finally, semester tickets should only play a minor role in the decision whether to enroll at Goettingen University. Taken together, we do not think that any of these issues is likely to seriously bias our results.

Summarizing our empirical analysis so far, we find that in both datasets, the null-hypotheses **H1** and **H2** are rejected. Thus, pocketbook voting is an important determinant of referendum outcomes, but social preferences or expressive concerns also have measurable and sizeable effects on the voting decision. As explained in Section 3.1, we cannot determine which of these two motives is prevalent; they are observationally equivalent. We can, however, conclude that voting is not purely expressive. The strong impact of monetary benefits on voting shows that either voters assigned a non-negligible probability to their being decisive in the referendum, as in the bottom half of Table 2(b), or expressive motives are absent and altruism and protest motives are necessarily instrumental, as in the right half of Table 2(a).

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<sup>14</sup>The only exceptions are the negative effects of supporting Liberal Democrats, which are significant at the 10 and 5 percent levels in Tables A.9 and A.10, respectively. The results are similar if we group parties into a left bloc and a right bloc.

## 7 Participation

We now turn to the second part of our analysis, which is to understand what induced students to vote in the referendum. For this purpose, we use Dataset I, which also contains responses by non-voters.

### 7.1 Estimating the participation decision

For the estimation, we assume as before that marginal utilities and perceived probabilities to affect the referendum outcome are the same for all individuals,  $\lambda_i = \lambda$ ,  $\zeta_i = \zeta$ ,  $\psi_i = \psi$ ,  $p_i^1 = p^1$ , and  $p_i^0 = p^0$  for all  $i$ . Moreover, we use (7) to quantify  $b_i^1 - b_i^0$ , we measure  $\mathbf{a}_i^1 - \mathbf{a}_i^0$  by the same categorical variables as in the regression on the decision how to vote, and we introduce the same controls  $\mathbf{x}_i$  and an error term  $\nu_i$  with a standard normal distribution. In the participation equation, the controls also capture  $d_i - c_i$ , the net benefit from voting which is unrelated to how one votes.

There are two alternative measures for the indicators of the intended vote. First, a natural measure is provided by the actual vote of those who participated, and the self-reported hypothetical vote of those who did not participate. However, the stated hypothetical vote of non-participants might differ from the vote they would have cast in a real vote. In contrast to this, we have an objective measure for the monetary benefits. Exploiting this information, we define that the indicator  $I_i^1$  ( $I_i^0$ ) equals one if the sign of net savings  $\tau h_i^1 - t$  is non-negative (negative). Relating to pocketbook benefits, we prefer to use this objective indicator. It would, however, be problematic to interact the variables measuring social and expressive motives with an indicator based exclusively on monetary benefits. Therefore, in our preferred specification, we attribute the two definitions to the two types of regressors separately. That is, we interact monetary benefits with an indicator based on the sign of net savings, while the variables  $\mathbf{a}_i^1 - \mathbf{a}_i^0$  are interacted with indicators based on actual or intended votes.

With this assumption and our approximation of monetary benefits (7), one has  $I_i^1(b_i^1 - b_i^0) = 0$  if  $\tau h_i^1 - t < 0$  and  $I_i^0(b_i^1 - b_i^0) = 0$  if  $\tau h_i^1 - t \geq 0$ . For the variables representing social preferences or expressive concerns, we have  $I_i^0(\mathbf{a}_i^1 - \mathbf{a}_i^0) = 0$  if individual  $i$  voted in favor or stated that he or she would have voted in favor of the ticket, and  $I_i^1(\mathbf{a}_i^1 - \mathbf{a}_i^0) = 0$  if the individual's actual or stated hypothetical vote is negative. This allows to transform equation (5) into

$$z_i = \delta^1 I_i^1 \ln(\tau h_i^1 - t + 1) + \delta^0 I_i^0 (t - \tau h_i^1) + \gamma^1 \cdot [I_i^1(\mathbf{a}_i^1 - \mathbf{a}_i^0)] + \gamma^0 \cdot [I_i^0(\mathbf{a}_i^1 - \mathbf{a}_i^0)] + \boldsymbol{\sigma} \cdot \mathbf{x}_i + \nu_i. \quad (8)$$

Equation (8) is the basis of the probit estimation of the participation decision. It yields estimators for the coefficients  $\delta^1 = p^1 \lambda$ ,  $\delta^0 = p^0 \lambda$ ,  $\gamma^1 = p^1 \zeta + \psi$ ,  $\gamma^0 =$

$-(p^0\zeta + \psi)$ , and  $\sigma$ , the impact of controls on the net benefit of participation. In this estimation, for individuals with negative net savings, we use the net loss  $(t - \tau h_i^1)$  to have a positive coefficient associated with the regressor expressing monetary stakes. Moreover, like in the analysis of the voting decision, we find only a combined impact of instrumental social preferences and expressive motivations, quantified by the coefficients  $\gamma^1$  and  $\gamma^0$ .

## 7.2 Empirical results

The results from estimating equation (8) are presented in Table 13, which shows the average marginal effects for benchmark students.<sup>15</sup> We see a highly significant positive effect from the variable *log pos. stakes*, which stands for  $I_i^1 \ln(\tau h_i^1 - t + 1)$ , the monetary benefit of those who have positive net savings from the ticket on trips to parents. This effect is robust to the inclusion of additional motives and control variables. Quantitatively, a 10% increase in the net gain from the ticket raises the probability of participation by 0.3 to 0.5 percentage points. Using the specification from column (5), for a benchmark student, this results in an increase in the predicted probability of turnout from 54% at net savings of zero to 80% at average net savings and to 86% at net savings of a thousand euros.

The variable *neg. stakes*, which stands for  $I_i^0 (t - \tau h_i^1)$ , the absolute value of the monetary loss conferred by the ticket, also shows a positive sign. It is insignificant in the first columns but approaches significance when more explanatory variables are included. The difference in significance between both stakes variables may be due to the asymmetric distribution of gains and losses: the latter are limited to the yearly price of the ticket, 84.48 euros, whereas the stakes of someone who uses the Bahn ticket every weekend to visit his or her parents could be much higher. In terms of size, the estimated coefficient is again substantial. Based on the specification in column (5) of Table 13, a benchmark student whose savings just cover ticket cost is 14 percentage points less likely to participate in the referendum than someone who does not use the ticket at all.

These results are in line with Proposition 2(i) which states that sufficiently high monetary stakes induce an individual to participate in the referendum. As seen from the different significance levels, the empirical support for this statement is, however, stronger for individuals with pocketbook gains than for those with pocketbook losses.

Unlike in the decision to vote in favor or against, visiting others does not have a significant effect on the decision to take part (column 2). Being female reduces the probability of voting, whereas being a freshman increases it (column 3). However,

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<sup>15</sup>As in Section 6, all binary variables are zero for benchmark students. The continuous variables enter into the calculation of marginal effects at individual values.

Table 13: Taking part – Dataset I

Dependent Variable: Taking Part in Referendum					
	(1)	(2)	(3)	(4)	(5)
Log pos. stakes	0.035*** (3.35)	0.037*** (3.52)	0.041*** (3.89)	0.043*** (3.79)	0.045*** (3.83)
Neg. stakes	0.0002 (0.31)	0.0004 (0.51)	0.0008 (1.10)	0.0012 (1.46)	0.0014 (1.64)
Leisure/work		-0.012 (-0.21)	-0.003 (-0.05)	0.035 (0.64)	0.035 (0.62)
Visiting others		0.006 (0.22)	0.006 (0.20)	0.010 (0.32)	0.007 (0.21)
Female			-0.096*** (-3.32)	-0.105*** (-3.44)	-0.109*** (-3.48)
Freshman			0.132*** (4.27)	0.115*** (3.56)	0.113*** (3.30)
Altruist(-) (no)				0.008 (0.17)	0.003 (0.06)
Altruist(-) (yes)				-0.134 (-1.86)	-0.167* (-2.22)
Altruist(+)(no)				-0.194** (-2.79)	-0.204** (-2.83)
Altruist(+)(yes)				0.001 (0.02)	-0.003 (-0.09)
Protest (no)					0.060 (1.26)
Protest (yes)					0.126*** (3.53)
Pseudo R <sup>2</sup>	0.034	0.035	0.056	0.066	0.075
Log likelihood	-705.4	-694.4	-621.7	-551.9	-545.2
Observations	1189	1174	1075	963	962

Probit estimation; marginal effects for benchmark students; discrete changes from 0 to 1 for indicator variables; z-statistic in parentheses. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

we cannot disentangle alternative possible explanations driving the freshman effect. It could be based on the fact that the savings of freshmen refer to a shorter period of time, or alternatively, it may reflect that many freshmen are more easily reached by voting advertisements or more enthusiastic about taking the opportunity to vote in this referendum.

Columns (4) and (5) introduce variables measuring the joint effect of social preferences and expressive concerns. We find large and statistically significant negative effects for *altruist(-) (yes)* and *altruist(+)(no)*. The first of these variables equals one for an individual who states that he or she cares for the benefit of others, thinks that others on average lose out by the ticket, and voted or would have voted in favor of the ticket. According to column (5), such an individual is 17% less likely to participate than someone who does not mention that he or she cares for others. Similarly, an *altruist(+)(no)*, i.e. someone who mentions to care for others, thinks that other students gain from the ticket, and voted or would have voted against, is 20% less

likely to take part. These two effects show that students who consider the benefits of others but whose intended vote goes against the perceived interests of others are substantially less likely to participate. In contrast, the variables *altruist(-) (no)* and *altruist(+)* (*yes*) are not significantly different from zero.

This result can be explained by Corollary 2. To see this, consider a group of voters who have zero or very small net cost of participation  $c_i - d_i$ . Among these voters, everyone who has no social or expressive concern for others will participate and vote in line with his or her monetary interests. Those whose social or expressive concerns for others go in the same direction as their pocketbook motive will also participate. Thus, adding an altruistic motive which is in line with monetary interests does not change the participation decision if net costs of participation are very small. This explains why the variables *altruist(-) (no)* and *altruist(+)* (*yes*) have no impact. In contrast, voters whose expressive concern for others suggests voting against their monetary interests face a trade-off. As Corollary 2 shows, they may solve this conflict by abstaining. This explains the negative impacts of *altruist(-) (yes)* and *altruist(+)* (*no*). The fact that we find large and statistically significant effects suggests that among the voters who experience such a conflict a substantial number has zero or very low net cost of participation.

Those who mention protest motives took part in the referendum with higher probability (column 5), even if the corresponding variable is significant only for those whose actual or intended vote is yes. Possibly, students who mention protest motives are generally more engaged in the debate about the ticket, and therefore more likely to turn out. They may also want to support student representatives, who campaigned for accepting the ticket, and therefore felt compelled to vote in favor, even if they still considered the price too high. Altogether, we see this result in line with Proposition 2(ii), which states that stronger expressive or social concerns make participation more attractive.

We next examine whether students with high gains from the ticket drive the finding that pocketbook benefits are relevant for participation. For this purpose, we gradually remove observations with the highest net savings from the dataset. Table 14 contains corresponding average marginal effects for benchmark students. In regression (1), we omit the top 5% in terms of net savings, whereas in regression (6), we omit the top 30%. Positive stakes have a positive and highly significant effect if we use almost all of the observations. The more observations with high net savings we remove, the smaller the size and z-statistic of the marginal effects become. Looking at the bottom 75% only, the effect is no longer significantly different from zero. In contrast, the significance of most other variables suffers much less from this reduction of the sample, and the marginal effects are much more stable. This suggests that the loss of significance for the stakes variable should not be attributed

Table 14: Taking part, reduced sample – Dataset I

Dependent Variable: Taking Part in Referendum						
	(1)	(2)	(3)	(4)	(5)	(6)
Bottom	95%	90%	85%	80%	75%	70%
Log pos. stakes	0.046*** (3.47)	0.040** (2.82)	0.042** (2.74)	0.033* (1.96)	0.019 (1.03)	0.007 (0.34)
Neg. stakes	0.0014 (1.52)	0.0011 (1.23)	0.0012 (1.28)	0.0009 (0.94)	0.0006 (0.57)	0.0003 (0.27)
Leisure/work	0.040 (0.66)	0.037 (0.58)	0.032 (0.48)	0.040 (0.57)	0.027 (0.37)	-0.001 (-0.02)
Visiting others	0.009 (0.28)	0.010 (0.30)	0.016 (0.45)	0.018 (0.47)	0.002 (0.04)	-0.013 (-0.33)
Female	-0.109*** (-3.34)	-0.112*** (-3.29)	-0.111** (-3.18)	-0.104** (-2.87)	-0.110** (-2.91)	-0.099* (-2.53)
Freshman	0.119** (3.22)	0.122** (3.14)	0.117** (2.89)	0.126** (2.91)	0.127** (2.72)	0.130** (2.63)
Altruist (–) (no)	0.006 (0.11)	0.007 (0.13)	0.006 (0.10)	0.000 (0.01)	0.001 (0.02)	0.005 (0.08)
Altruist (–) (yes)	-0.111 (-1.38)	-0.107 (-1.30)	-0.148 (-1.70)	-0.144 (-1.56)	-0.151 (-1.54)	-0.123 (-1.16)
Altruist (+) (no)	-0.206** (-2.83)	-0.208** (-2.83)	-0.212** (-2.88)	-0.216** (-2.92)	-0.220** (-2.92)	-0.215** (-2.84)
Altruist (+) (yes)	-0.010 (-0.26)	-0.008 (-0.21)	-0.015 (-0.36)	-0.022 (-0.50)	0.000 (0.00)	0.030 (0.64)
Protest (no)	0.063 (1.28)	0.066 (1.31)	0.061 (1.18)	0.066 (1.23)	0.080 (1.47)	0.096 (1.74)
Protest (yes)	0.140*** (3.70)	0.145*** (3.69)	0.146*** (3.51)	0.150*** (3.37)	0.190*** (4.30)	0.183*** (3.72)
Pseudo R <sup>2</sup>	0.071	0.062	0.059	0.050	0.050	0.042
Log likelihood	-520.0	-508.2	-487.1	-469.2	-444.3	-422.8
Observations	902	862	817	769	719	673

Probit estimation; marginal effects for benchmark students; discrete changes from 0 to 1 for indicator variables; z-statistic in parentheses. Columns show percentiles with respect to net savings. e.g., column (1) contains those observations that belong to the bottom 95% with respect to net savings. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

to the smaller sample size alone. Instead, it appears that in particular students with very high gains from the ticket are responsible for the effect found for the full sample in Table 13, as they made sure to take part in the referendum. This is again in line with Proposition 2(i), which requires that, to induce participation, monetary stakes must exceed a certain threshold determined by social and expressive concerns as well as the net cost of participation.

There may arise some econometric issues related to the estimation of the participation equation. The indicator for the actual or intended vote might not be exogenous. This would arise if the error terms in the voting and the participation equations (6) and (8) were correlated, for example if there is an omitted variable which affects both decisions. A similar concern arises from sample selection, given the under-representation of non-voters in the sample. However, it is not clear what

such an omitted variable could be and in which direction it would bias our results. It should also be noted that the issue does not arise regarding the two variables for monetary stakes, since we just split them at zero.

Reverse causality should not be a problem here. The variables capturing travel patterns and demographics are clearly not affected by the decision to vote. The protest variable is derived from the write-in section; consequently, it appears unlikely that it captures ex-post rationalization of the participation decision. In contrast, stated altruism could be affected by the participation decision. One could argue that it is easy to claim noble motivations if one does not make an actual decision. In this case, we would expect the share of those who state that they care for others and would have voted in line with the perceived interest of others to be higher among non-voters than among voters. This would imply negative coefficients of the variables *altruist(-)* (*no*) and *altruist(+)* (*yes*). Similarly, we would expect that among those who did not vote a lower share would admit that they would have voted against the interest of others than among those that actually voted. This would lead to positive coefficients of the variables *altruist(-)* (*yes*) and *altruist(+)* (*no*). These predictions are opposite to the observed patterns in Table 13.

In summary, the results from this section shed some light on the motives for voting in referenda. First, our results are in line with the theory of instrumental voting, which predicts that for a given probability of being pivotal and a given cost of voting, participation should increase with stakes. More specifically, we conclude that those who gain substantially, and hence lose substantially if the ticket fails, particularly drive this result. Thus, in a referendum, one may expect disproportionately higher turnout by voters who stand to benefit or lose substantially when the proposal passes, whereas voters who are affected only moderately are more likely to abstain. Second, we also find evidence that social preferences or expressive considerations, for example protest motives or a concern for others, have an impact on participation.

## 8 Conclusion

We provide a theory of individual voting and turnout decisions which integrates monetary benefits, social preferences and expressive concerns. Social preferences are instrumental in the sense that voters want to change the outcome in a way that benefits others. The theory of expressive voting suggests that voters perceive their probability of being pivotal to be negligible, and that they derive utility from voting in a particular way irrespective of the outcome. A major challenge in previous literature on voting has been how to distinguish social preferences from expressive motivations, as both could be driven by what appears good for others. Our model



allows to identify conditions under which each of these motives can be shown to be relevant.

We show that pocketbook benefits being relevant indicates that either voters do not perceive their impact on the outcome to be negligible, or expressive motivations do not play a role in the decision on how to vote. Conversely, we show that if own pocketbook benefits do not explain voting, then voting is expressive. If the perceived probability of being pivotal is non-negligible, social preferences and expressive concerns are observationally equivalent. In terms of whether to vote, we show that if pocketbook motives and expressive concerns would require voting differently, abstention can be rational even if voting is costless. This would be the case if expressive feelings from abstention are the same as expressive feelings from voting differently than one would have actually done. Abstaining is then a cheaper way of obtaining the expressive benefit than voting against one's pocketbook.

We test our theory using individual data on referenda on deeply discounted flat rate tickets to train, bus and cultural services held among university students. The service becomes much cheaper by being bought collectively; however, all voters, including those who do not use the service, must pay to finance it. The same logic applies to any collective provision of a public good.

Our results show that monetary interests are a major driver of both turnout and voting decisions. However, we also find that in addition to this 'pocketbook voting', other motives such as the costs and benefits to other students, the desire to support local public transportation or cultural life, or dissatisfaction with the train company's pricing policy are also important and occasionally even decisive for the referendum outcome. In our theory, these findings can be rationalized in two ways, depending on how voters perceive the probability to affect the outcome. If voters perceive this probability to be non-negligible, our results show that social preferences, expressive concerns, or both are relevant, but we cannot distinguish empirically between these motives. Alternatively, if voters perceive the probability of being pivotal to be negligible, then expressive motives cannot play a role. Therefore, the strong empirical support of pocketbook voting rules out a purely expressive explanation of observed voting and participation behavior.

Our setting can be described as a real-world laboratory of direct democracy. Like in a laboratory, voters faced a clearly defined decision and had very good information on the individual costs and benefits associated with both outcomes. Thus, confounding influences such as asymmetric information should be minimized. At the same time, the polity to which the respondents belong is real and the social ties between the participants are independent of researchers. Since the decisions we study have strong parallels with decisions on local public goods, our results are particularly informative for direct democracy at the local level.

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