The Price of Warm Glow*

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Abstract: This paper presents a model and experimental evidence to explain the "volunteering puzzle" where agents prefer volunteering time to donating money when monetary donations are, *ceteris paribus*, more efficient for providing resources to charity. In the model agents receive heterogeneous utility from pure and impure altruism (Andreoni 1989) that permits warm glow to vary between monetary donations and volunteering, thus allowing preferences for impure altruism to rationalize inefficient allocation decisions. We define a measure of the **price of impure altruism** as the additional proportion of income contributed by a donor to give in the dimension that maximizes her utility, holding the overall charitable contribution constant. To test the predictions of the model we ran an experiment in which we varied *within-subjects* the costs and benefits of monetary and volunteer donations. We also varied *between-subjects* the emphasis on either the donation value to the charity (pure altruism) or the contribution of the donor (impure warm-glow altruism). Consistent with the model's predictions, the experiment shows that framing the donation decision from a pure perspective increases the efficiency of donation choices, the substitutability of donations between money and time, and crowding out. Nonetheless, while greater impurity results in a more inefficient allocation of resources, empirically we find it increases overall charitable donations. We discuss the implications of our experimental results for both theory and policy.

Key Words; Altruism, Warm Glow, Volunteering, Monetary Donations; Laboratory Experiments
JEL Classification: D64, D78, H41, C91.

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1. Introduction

Smith (1759) recognized the existence of altruism in economic behavior long ago, "How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it except the pleasure of seeing it." Becker (1974) more recently noted that the motives for charitable behavior that may appear pure could be strategic and selfish. Understanding the motives for helping others has many policy implications. For instance, Andreoni and his colleagues (1989, 1990, 1993, 2003, 2011) have argued that the extent of crowding out of charitable behavior depends on how much people are motivated by pure motives rather than impure warm glow motives (Andreoni 1989).[1]

Despite the importance of understanding the motives for charitable behavior, researchers have generally been unable to determine the *degree* to which people are affected by pure and impure motives. The key difficulty is finding situations where the motives can be observed in isolation. The literature, however, does provide evidence of both pure altruism and warm glow. For instance, Tonin and Vlassopoulous (2010) compare the public good donations of agents by eliciting both pure and impure responses, and find that warm glow motivation is a significant motivator for volunteering (though only for women). Andreoni and Payne (2003, 2011) estimate the effect of crowding out of voluntary donations resulting from pure motivations and find that the crowding out coefficient ranges from 0% to 30%. Null (2011) shows that donors only respond marginally to matching donations, indicating that warm glow motives lead to inefficiencies in resource allocation.

Focusing on the relationship between monetary donations and volunteering time, the literature generally finds evidence suggesting that the utility from donations and volunteering are separable (e.g., Freeman 1997; Bauer et al 2012). One of the most common explanations is that the signaling effect differs between monetary donations and volunteering. For instance, Carpenter and Myers (2010) find that image concerns are a significant motivating factor among volunteer firefighters and Ariely et al. (2009) experimentally show that the visibility of a charitable donation has a significant effect on donor effort. Brown et al. (2013), controlling for signaling effects, experimentally examine the separable intrinsic warm glow of money and time donations. They find that subjects prefer giving 'effort' directly to charity rather than donating earned income. They posit that volunteering must have an innately stronger warm glow than monetary donations.

In this paper, we introduce a new, more nuanced model of altruism, based on the existing empirical evidence and the theoretical work of Andreoni, Gale and Sholz (1996), in which agents have separable utility over pure and impure motives that vary across monetary donations and volunteering time. In the model, we solve for the optimal allocation of time and money an agent gives to themselves and charity. We then derive several comparative static predictions based on the optimal choice of money and time donations. The model predicts that the more agents are motivated by pure rather than impure altruism, the more they will (1) donate in

[1] Dye (1980) was one of the earliest to study multiple reasons for volunteer giving.

a manner which is more efficient for increasing charity, (2) pay less for warm glow, and (3) suffer greater crowd out. The model also offers a comprehensive explanation for the volunteering puzzle (Handy and Katz, 2008).[2] The puzzle emerges whenever people volunteer time despite monetary donation being the more efficient method for providing the charity. To explain the volunteering puzzle, our model shows that agents are less likely to substitute away from volunteering towards the more efficient monetary donations the more they are motivated by warm glow.

To test the model's predictions, we ran a laboratory experiment in which subjects simultaneously allocated money and work time to themselves and a charity. All subjects were given 24 decisions that involved every combination of (a) three private wages, (b) two tax levels on the private wage, (c) two endowment levels and (d) two matching levels on monetary donations. These factors let us estimate for each subject a novel measure of inefficiency associated with donations motivated by impure altruism. We define this inefficiency measure, the *cost of impure altruism***,** as the minimum amount of income we can be sure that a donor contributed solely to consume warm glow. This cost of impure altruism measure captures the loss in donations to charitable organizations as donors inefficiently allocate resources to satisfy warm glow rather than pure altruistic motives.

To examine the effects of pure and impure motives on crowding out and on the price of impure altruism, we varied both the use of a tax (to no one or to the charity) and framed their decision under either pure or impure altruistic motives. To make the laboratory environment reflect a natural environment, we partnered with both a small non-profit (to be the beneficiary of any monetary donations and volunteer work) and with a small private business (to pay a private wage for actual work). The work was identical for the non-profit and private business and involved addressing, folding and inserting a one page letter (for soliciting a donation for the charity and for customer appointments for the private business).

The experimental results support all of our model's predictions with respect to the comparative statics tested. The two most important predictions of the model were strongly supported. First, crowding was significantly larger when subjects' choices were framed under pure rather than impure motives. Second, the inefficiency in donors' allocation choices was significantly higher for subjects within the impure rather than the pure frame. We also find a significantly higher price of impure altruism among subjects in the impure rather than pure frame. Despite the higher degree of inefficiency, subjects gave more to charity overall in the impure rather than pure frame. This occurs because the impure frame motivated more overall charitable giving across both monetary donations and time volunteering. This result provides one reason why charitable organizations often do not attempt to make donors aware of the inefficiency in their choices.

The following two sections present the theoretical model, hypotheses and experimental design. Section 4 presents the experimental results and Section 5 concludes and discusses implications for future work and policy.

[2] The magnitude of the inefficiency in donations due to the volunteer puzzle may be very substantial. For instance, in 2010 approximately 26% of the US population volunteered time with an estimated value of $173 billion (Independent Sector 2010) and volunteer time is estimated to be worth over twice the value of monetary donations in Australia (ABS 2006).

2. Theoretical Model and Hypotheses

We present a theoretical model that is motivated by the evidence and based in part on the model in Andreoni, Gale and Scholz (1996). In their model, agents derive utility from increases in the public good with separable utility over their warm glow from monetary donations and volunteering. We adopt the same approach, but also allow agents to receive separable utility over the value of their contribution to the public good (charity).

In our model, an agent who donates money and time to charity may receive three types of utility from their choice: 'warm glow' from their personal contribution of money, a separable 'warm glow' from their personal contribution of time, and a third separable utility over the provisioning of the public good. We extend the model to allow for two policy choices, matching donations from a third party and government provision of charity (financed by taxation). Consistent with the standard model (Andreoni, 1990), in our model if a third party offers to match an agent's donation of money one for one *ex post* to his donation decision, then the agent would *ceteris paribus* receive greater utility from the public good provision (increased by the match), but the match would not influence the agent's 'warm glow' utility since it did not change the agent's personal contribution.

We now define the agent's utility function and derive four central (comparative static) predictions that we will test in our experiment. Appendix 1 presents the technical proofs of the propositions and hypotheses.

2.1 Model Description

Definition 2.1 *A **pure altruist** is an agent who derives the value of donating to charity solely from the increase in value of the provisioning of the charity itself.*

Definition 2.2 *An **impure altruist** is an agent who derives the value of donating to charity solely from the warm glow effects from her personal donations of money and/or time.*

Definition 2.3 *A mixed **altruist** is an agent who derives the value of donating to charity both from the increase in value of the public good itself and the warm glow effects of their own contributions of money and/or time.*[3]

The mixed altruist derives utility over her composite consumption good, x, the size of charity or public good, p, the warm glow from her monetary donation, q, and the warm glow from her volunteer time, r. We denote her utility from consumption U_x, from the size of charity U_p, and from the warm glow of monetary and time donations as U_q and U_r respectively. We describe her utility function with the following form:

$$u(x,p,q,r) = U_x\left[E - g + (H - h_v)(1-t)w_p\right] + \beta U_p\left[P_{-i} + g(1+m) + (H-h_v)t\lambda w_p + h_v w_v\right] + \alpha U_q[g] + \alpha U_r[h_v]$$

where E is the agent's monetary endowment, g is her monetary donation and m is a 'matching' donation rate (hence $\frac{1}{1+m}$ is the price the donor pays to increase the public good with a monetary donation but does not

[3] Our pure, impure and mixed altruist definitions correspond to Andreoni's (1990) pure altruist, pure egoist and impure altruist definitions, respectively. The term impure altruist reflects the utility derived strictly from the warm glow effects derived from private contributions of time and money, and the term mixed altruist captures the utility from both the pure and impure warm glow motives.

change the price of warm glow which is proportional only to the contribution made). w_p and w_v are the agent's private wage and value of her volunteer labor, respectively. *H* is the total time available and h_v is the time spent volunteering (hence H-h_v is the time spent working for a private wage) and *t* is the tax on private wages. λ is the proportion of tax given to the charity ($0 \leq \lambda \leq 1$). P_{-i} is the current size of the public good, which we assume is exogenous. α and β are scaling parameters for the degree of pure and impure utility in her altruistic motivation, respectively, which are positive and bounded away from zero.[4]

The first argument in the utility function, $x = E - g + (H - h_v)(1 - t)w_p$, is a composite consumption good equal to the income an agent keeps for herself. The second argument, $p = P_{-i} + g(1 + m) + (H - h_v)t\lambda w_p + h_v w_v$, is the provision to the charity after including the agent's donation. The third and fourth arguments, $q = g \; and \; r = h_v$, respectively, are her warm glow inputs from monetary donations and volunteer time. We assume the utility function is separable and increasing in all arguments, twice continuously differentiable and concave.[5]

2.1.1 Mixed altruist – part i; the general case (model solution):

The mixed altruist's equilibrium allocation is characterized by the following two first order conditions:

$$\beta U_p'(1 + m) + \alpha U_q' = U_x'$$

$$\beta U_p'\left(w_v - \lambda t w_p\right) + \alpha U_r' = U_x'(1 - t)w_p$$

The first FOC shows a mixed altruist's optimal monetary donation is where its marginal benefit (the LHS), i.e. the sum of her marginal utilities over the increase in the public good and her private warm glow from monetary donations, equals her marginal utility of income (the RHS). The second FOC shows her optimal time donation is where its marginal benefit (the LHS), i.e. the sum of her marginal utilities over the increase in the public good and her private warm glow, equals her marginal utility of income times her after-tax private wage (the RHS).

The following comparative statics summarize the marginal effects of changes in the key exogenous variables on her optimal donations of money and time.

(a) $\{\frac{dg^*}{dE}, \frac{dh_v^*}{dE}\} > 0$, (b) $\{\frac{dg^*}{dw_p}, \frac{dh_v^*}{dw_p}\} \lesseqgtr 0$, (c) $\left\{\frac{dg^*}{dm}, \frac{dh_v^*}{dm}\right\} \lesseqgtr 0$ and (d) $\left\{\frac{dg^*}{d\lambda}, \frac{dh_v^*}{d\lambda}\right\} < 0$

Derivations of these comparative statics are provided in the supplementary material. It trivially follows that the pure income effect (a) increases money and time donations. While the sign of the comparative statics on the own and cross price effects of donations of money and time (b, c) are ambiguous,[6] we show below that the marginal

[4] While our utility function lets agents' utilities vary separately over warm glow from money (U_q) and time (U_r), we do not attempt to manipulate their individual exogenous weights (α) over warm glow. The critical insights derived from our model would not change if we used distinct weights (e.g., α_q and α_r).

[5] We assume standard limit and Inada conditions: $U' > 0$, $U'' < 0$, $\lim_{x \to 0} U' = \infty$ and $\lim_{x \to \infty} U' = 0$.

[6] Intuitively, (b) is unsignable as a change in the private wage increases both income (leading to higher g* and h*) and the size of the public good via the government's partial donation of taxation, $\lambda t w_p$ (leading to lower g* and h*). (c) is unsignable as a change in the matching donation both increases the size of the public good (leading to lower g* and h*) and decreases the price of contributing to the public good (leading to higher g* and an ambiguous effect on h*). Thus, both (b) and c) have ambiguous effect on g^* and h_v^*.

substitution effect $\frac{dh_v^*}{dm}$ with respect to the degree of warm glow, α, can be signed. Government provisioning of charity (d) crowds out voluntary donations of money and time, and we show that its marginal effect is increasing in the degree of warm glow α. The model predictions and intuition of the marginal effects with respect to the degree of warm glow α are best understood after first examining the pure and impure altruist special cases.

2.1.2 Pure Altruist

An altruist who is only concerned with his personal consumption and the size of charity is a 'special case' of the mixed altruist, possessing no warm glow utility (i.e., $\alpha = 0$):

$$u_{pure}(x,p) = U_x\big[E - g + (H - h_v)(1-t)w_p\big] + \beta U_p\big[P_{-i} + g(1+m) + (H-h_v)t\lambda w_p + h_v w_v\big]$$

Proposition 1 *A pure altruist never simultaneously donates money and time if* $(1+m)(1-t)w_p \neq w_v - \lambda t w_p$. *She never donates time if* $(1+m)(1-t)w_p > w_v - \lambda t w_p$ *and she never donates money if* $(1+m)(1-t)w_p < w_v - \lambda t w_p$. *This constraint is generic; with continuous variables it should always be satisfied.*

Proof: See Appendix.

Pure altruists only choose between the scale of the public good and their own income – since they derive no egoistic satisfaction from donations of money or time, they simply donate in the dimension which is most efficient. They will allocate resources such that their marginal utility of income is equal to their marginal utility of the public good. Thus, the pure altruist's solution is characterized by the following first order conditions:

If $(1+m)(1-t)w_p > w_v - \lambda t w_p$ then $\frac{dU}{dg} = -U_x^{'} + (1+m)\beta U_p^{'} = 0$

If $(1+m)(1-t)w_p < w_v - \lambda t w_p$ then $\frac{dU}{dh_v} = -(1-t)w_p U_x^{'} + (w_v - \lambda t w_p)U_p^{'} = 0$

2.1.3 Impure altruist

An impure altruist's desire to donate is due solely to the warm glow effects of donating money and time. Hence, an impure altruist's utility is represented by the following:

$$u_{impure}(x,g,h_v) = U_x\big[E - g + (H-h_v)(1-t)w_p\big] + \alpha U_q[g] + \alpha U_r[h_v]$$

For an impure altruist, the choice between donating money and time is solely based on equal warm glow at the margin from both dimensions. As such, in equilibrium $(1-t)w_p U_x^{'} = (1-t)w_p \cdot \alpha U_q^{'} = \alpha U_r^{'}$. We arrive at the following three comparative statics by implicitly differentiating the above conditions:

(a) $\{\frac{dg^*}{dE}, \frac{dh_v^*}{dE}\} > 0$, (b) $\frac{dg^*}{dw_p} > 0$; $\frac{dh_v^*}{dw_p} \lessgtr 0$ and (c) $\frac{dg^*}{dm} = \frac{dh_v^*}{dm} = \frac{dg^*}{d\lambda} = \frac{dh_v^*}{d\lambda} = 0$

The *pure income effect* (a) increases 'warm glow' consumption of money and time donations. From *an increase in private wage* (b), the income effect increases demand for the 'warm glow' of monetary donations. The effect on time volunteered is ambiguous since the income effect increases volunteered time, but a higher private wage

raises the opportunity cost of volunteering, causing substitution away from volunteering. A change in the matching donation or government's provision of charity (c) has no effect on donation behavior since the impure altruist has no utility over the size of charity.

Observation 1 *An impure altruist's choice is unaffected by a matching donation.*

Observation 2 *An impure altruist's choice is unaffected by government policy that increases charity. There is no crowding out effect.*

Proof: Immediate. As the impure altruist has no utility over the increase in charity, thus neither the policy variable nor the matching donation appears in the optimal first order conditions.

2.1.4 Mixed altruist – part ii; the general case (the effects of the degree of warm glow, α)

We now examine the effects of the degree of warm glow α on a mixed altruist's donation of money and time. We will first formally define the inefficiency in charitable donations that arises due to warm glow, and show that it is increasing in α. We then show that, ceteris paribus, warm glow decreases crowding out, and decreases the substitutability of donations of money and time.

Definition 2.4 *The **cost of impurity** is defined as the additional amount of disposable income an agent uses to give in the dimension that maximizes her utility, rather than the level of the public good, subject to keeping the value of her charitable donation unchanged. It is thus the amount that a pure altruist would consider the deadweight loss of a choice. Formally, the cost of impurity is defined as follows:*

Given an agent's choice of $\{g^*, h_v^*\}$. *, denote the value of this donation choice to the charity as* $V(g^*, h_v^*)$ *and the private cost of this donation to the agent as* $C(g^*, h_v^*)$.

Denote the choice of money and time donations which would maximize the agent's disposable income, x, subject to the value of her donation, $V(g^*, h_v^*)$*, remaining constant as* $\{g^{**}, h_v^{**}\}$ *and denote the private cost of this donation as* $C(g^{**}, h_v^{**})$. *The Cost of impurity is then equal to:* $C(g^*, h_v^*) - C(g^{**}, h_v^{**})$.

Since the cost of impurity is, by definition, income the agent chose not to allocate to themselves nor the charity, by revealed preference it must be the *minimum amount* of disposable income the agent gave up to consume *warm glow* utility.

Definition 2.5 *The price of impurity is defined as the cost of impurity, per dollar of income sacrificed by the agent. This transformation is made to normalize the proportion of impurity observed in terms of the agent's overall contribution. Formally, the price of impurity is defined by the following expression:*

$$Price\ of\ Impurity = \frac{C(g^*, h_v^*) - C(g^{**}, h_v^{**})}{C(g^*, h_v^*)}$$

The price of impurity defines the *minimum proportion* of the agent's contribution that was paid for consuming warm glow effects. It is bounded on the interval [0,1).

Proposition 2 *The cost of impurity is increasing in the warm glow argument,* α.

Proof: See Appendix.

Definition 2.6 ***Crowding out*** *of donations is where a government policy providing charity reduces the voluntary donation of the agent from either money and/or time.*

Proposition 3 *The degree of crowding out due to an increase in the government provisioning of charity, λ, is decreasing in the scale of warm glow, α.*

Proof: See Appendix.

Intuitively, a pure altruist is indifferent to how the charity is provided, whether it is by a voluntary contribution or by an involuntarily tax, hence the two are perfect substitutes. However, an impure altruist only obtains warm glow from her voluntary contribution; she gains no utility from a tax which she did not choose to donate. Thus, the greater the degree of impurity in a donor's motivations, the less her choice will be affected by a government donation to charity.

Proposition 4 *The Hicksian cross price effect (excluding income changes) of the price of donating money on donations of time is decreasing with the scale of warm glow, α.*

Proof: See Appendix.

For a pure altruist, donations of time are a perfect substitute for donations of money – the agent will donate in whichever dimension is more efficient at increasing the public good. However, as the weighting to heterogeneous warm glow (α) increases, their substitutability declines.

2.2 Hypotheses

To examine the model's core predictions, the lab experiment varied two factors between subjects. The first was a framing to exogenously shift the distribution of α; in the pure frame subjects got a certificate which indicated the total value the charity receives from their donation decision and in the impure frame the certificate indicated the amount of time and money subjects donated. The second factor we varied between subjects was the use of the tax; it was either donated to the charity in whole ($\lambda = 1$) or not at all ($\lambda = 0$). We tested the first hypothesis with the between subjects framing manipulation and we tested the remaining hypotheses using the interaction of the two between subject manipulations and several within subject manipulations. For all hypotheses, we implicitly assume a population of heterogeneous mixed altruists, $\alpha \geq 0$ and $\beta \geq 0$.

H1: Hypothesis 1. *The cost and price of impurity will be lower if subjects are directed to focus on pure rather than impure motives.*

H2: Hypothesis 2. *The degree of crowding out due to the tax being provided to charity will be larger in the pure frame.*

H1 and H2 follow directly from Propositions 2 and 3, respectively. Assuming agents have heterogeneous α and the pure frame reduces α, large sample properties ensure that the distribution of α will be lower in the pure

rather than impure frame (H1) and the degree of *crowding out* will thus also be larger in the pure frame (H2).

To examine the next two hypotheses, the lab experiment also varied within subjects the level of a match for the monetary donation. This variation lets us examine not only the main effects of the price of giving money on both monetary donations and substitution effects on time donations, but also whether the cross price effects are larger in the pure rather than impure frame.

H3: Hypothesis 3. *Donations of money and time are likely to be substitutes, i.e. as the matching donation increases, donations of time decrease. This cross price effect should be greater in the pure frame.*

H3 follows from Propositions 1 and 4.

Proposition 1 showed that for a *pure altruist*, g and h_v must be perfect substitutes, given that the donation choice completely depended on the cost of each good. Under our specification, an *impure altruist* treats the goods as neither substitutes nor complements since warm glow is heterogeneous and the agent derives no utility from the public good. Therefore, if $\beta > 0$, the goods must be Hicksian substitutes.

A stronger *gross* price effect (i.e. including income changes) in the pure frame is not conclusive, but is likely to hold. The cross price effect arises only due to the provision of the public good, which has a stronger weight with lower α. A stronger *gross* price effect may not hold, however, if the utility over the size of the public good is sufficiently concave relative to the utility over the warm glow of volunteering, which would result in a decrease in monetary donations. We expect the price effect should dominate, and for the substitutability of money and time donations to be greater in the pure frame.

H4: Hypothesis 4. *The effect of the matching donation on donations of money will be greater in the pure frame.*

Hypothesis 4 follows from *Observation 1* since for a impure altruist, $\frac{dg}{dm} = 0$. The matching donation alters the price of increasing the public good via monetary donations (e.g., with a matching donation of 50%, an agent must pay 0.66 to increase the public good by a unitary amount). However, since warm glow utility is created by one's personal contribution, the matching donation has no affect on the amount one derives from impure utility.

For an altruist with some pure motivation, we cannot predict how increasing the matching rate will affect her voluntary monetary donation, as it gives rise to two contrasting effects. The negative effect arises since increasing the matching donation increases the level of the public good for any level of donation, therefore reducing the marginal utility derived from pure motives. The positive effect arises because increasing the matching donation lowers the price of increasing the public good. While the direction is thus ambiguous, we conjecture that for the donation sizes in our experiment, the price effect will dominate, and thus the effect of the matching donation will be larger in the pure frame.

3. Experimental Design

3.1 Overview and treatments

In the experiment subjects simultaneously chose how much money (g) and time (h_v) to give to a charity. Subjects were given a fixed monetary endowment (E) and kept the amount not allocated to the charity. They also kept wages earned during a 40 minute work period (H) which they did not use to volunteer for the charity. The volunteer work for the charity and the work to earn a wage for themselves were identical and involved addressing, folding, stuffing and sealing envelopes.

Table 1 shows the two *between-subjects* manipulations we used to examine the effects of (1) pure vs. impure motives and (2) crowding out. Half of the subjects were encouraged to focus on their donation choices from the perspective of *their contributions* of time and money. We refer to this condition as our *control/impure frame* since it reflects the feedback a charitable organization typically provides (how much money and many hours were donated) and since it focuses subjects' attention on what they are giving up. The remaining subjects were encouraged to focus on their donation choices from the perspective of the value to the charity. We refer to this condition as our *treatment/pure frame* since it focuses subjects' attention on the overall (single) dollar value from the money and time that the charity receives.[7]

Figure 1 shows the certificates we used to frame subjects' choices in each condition. In the pure frame the certificate showed the amount the charity received from their decisions and in the impure frame the certificate showed the personal contributions of money and time the subject made for the charity. The certificate in the impure frame was designed to put more weight on the impure motives (i.e., to increase α) but not activate them exclusively. The certificate in each frame was visibly displayed on each subject's decision screen as they made their choices and would automatically update as the subjects made (or modified) their choices. Subjects were told in the instructions that they would get their certificate at the end of the experiment.[8]

The second between-subjects manipulation was used to examine crowding effects. To examine crowding, we varied whether the tax on the private wage would go to no one ($\lambda = 0$) or would go to the charity ($\lambda = 1$).[9] The model predicts that crowding out increases (decreases) with pure (impure) motivations. Thus, the 2x2

[7] To experimentally test our hypotheses, we alternatively could have only attempted to measure each subject's relative preferences for impure altruism. However, relying solely on this approach may fail either if we fail to accurately measure subjects' true preferences, or if these estimated measures are correlated with (unobservable) characteristics which pose an alternative explanation for behavior we want to attribute to pure preferences. Our approach, attempting to manipulate subjects' preferences, has the advantage of providing an exogenous instrument that we can be sure is independent of subject characteristics. The risk of our approach is that if the manipulation is too weak then we could find a lack of support for our hypotheses that was due to the weak manipulation rather than a violation of the theory. However, since we find unambiguously clear support for the hypotheses, we are confident that the manipulation was successful.

[8] We used the two certificates to focus subjects' attention on different aspects of their utility (pure or impure). However, they may have also signalled information about the experimenter's or AFFPIN's preferences. This signal could have affected subjects' choices to satisfy the experimenter's or charity's preferences (i.e. causing a demand effect). We cannot rule out this potential additional certificate effect since it yields the same effects on subjects' behaviour. Note that charity communications (e.g., how they thank donors) may also signal information about the charity's preferences that similarly affect donor choices. We conjecture, however, that donors would respond more to a charitable organization's signal of their preferences than subjects would respond to an experimenter's signal of their preferences; i.e., we presume that donor and charity motives are more similar than subject and experimenter motives for donation choices.

[9] We varied the tax destination between subjects to avoid demand effects and to limit the number of choices to 24 rather than 48 to reduce the likelihood of subjects getting fatigued with too many decisions.

between subjects design lets us directly test the crowding hypothesis; the model predicts that when taxes are increased, overall voluntary donations (net of the tax) will decrease more in the pure rather than impure frame.

Table 1: Between-Subjects Treatment Conditions: 2x2 design

	Frame (Baseline)	
Tax Policy	**Impure**	**Pure**
Regular tax (= tax to nowhere) (λ=0)	N = 25	N = 25
Tax donated to charity (λ=1)	N = 25	N = 25

Figure 1: The baseline impure (left) and treatment pure condition (right) certificates

Table 2 lists the *within-subject* allocation decisions given to every subject. Table 2 shows all combinations of the private wage w_p (column 1), tax rate t (column 2) and match m (column 3). The decisions included every combination of (a) three private piece rate wages per completed envelope (w_p = \$0.10, 0.30 or \$0.45), (b) two tax rates (t = 0% and 25%) on the private wage and (c) the two levels of the match given to the charity based on the monetary donation (m = 50% or 100%).[10] For each of these 12 conditions we also varied the monetary endowment at two levels (E = \$15 or \$25) for a total of 24 decisions (for brevity, Table 2 shows only 12 conditions (without showing the two endowment levels, but all 24 are shown in the Supplemental Material). We discuss below the implications of the allocation decisions for the charity that is shown in the remaining columns.

We chose the specific parameter values so that in the majority of the decisions money (g) was the efficient dimension to donate (see last column of Table 2) to reflect the conditions for the volunteering puzzle. After the 24 decisions were made, one was chosen at random "to be played out." Subjects then completed the work for the

[10] We set the match from any monetary donation to be at least 50% in order to avoid any arbitrage opportunity in which it would have been more effective to donate money outside of the experiment and receive a tax benefit.

charity and for their private wage and were paid based on the monetary and time choices they made for the condition randomly chosen.

Table 2: Within subject treatment parameters and the efficient donation dimension

Experimental Parameters			Charity gain for each marginal Dollar of income subjects 'give up:'			Efficient donation dimension
			Time donation		Money donation	
Private Wage w_p ($/envelope)	Tax	Monetary donation Match	Tax to Nowhere	Tax to Charity		
$0.10	0%	50%	$3.00	$3.00	$1.50	Time
$0.10	0%	100%	$3.00	$3.00	$2.00	Time
$0.10	25%	50%	$4.00	$3.75	$1.50	Time
$0.10	25%	100%	$4.00	$3.75	$2.00	Time
$0.30	0%	50%	$1.00	$1.00	$1.50	Money
$0.30	0%	100%	$1.00	$1.00	$2.00	Money
$0.30	25%	50%	$1.33	$1.08	$1.50	Money
$0.30	25%	100%	$1.33	$1.08	$2.00	Money
$0.45	0%	50%	$0.67	$0.67	$1.50	Money
$0.45	0%	100%	$0.67	$0.67	$2.00	Money
$0.45	25%	50%	$0.89	$0.64	$1.50	Money
$0.45	25%	100%	$0.89	$0.64	$2.00	Money

For each of these 12 combinations, we also varied the endowment E to be either $15 or $25 dollars, so that there were 24 decisions in total.

Subject and charity earnings:

For each of the 24 decisions, let g ($\$0 \leq g \leq \$15$) and h_v ($0 \leq h_v \leq 40$) be the monetary donation and volunteer time a subject allocates for the charity, respectively. We limited the monetary donation to the smaller endowment level so that all subjects had the identical choice set for all decisions.[11] Subjects' private earnings and the value of the charitable donation are the following:

Subject earnings = $E - g + (1 - t) * w_p * v_i * (40 - h_v c)$, and

Value of donations to charity = $g * (1 + m) + \lambda * t * w_p * v_i * (40 - h_v c), + \$0.30 * v_i * h_v$,

where λ is a binary indicator for the between subjects condition where the tax is given to the charity ($\lambda = 1$) or is given to no one ($\lambda = 0$), and v_i is a heterogeneous productivity factor representing the number of envelopes the subject folded per minute. Each subject was given an estimate of his/her own productivity based on an initial piece rate stage of the experiment. We will show that this expected estimate of productivity for each subject provided an extremely accurate prediction of subject's actual performance.

Subjects' earnings included their endowment, *E,* minus any amount they donated, *g,* plus their earnings working for the private wage net of taxes $(1 - t) * w_p * v_i * (40 - h_v)$. The charity earnings included any money

[11] The $15 constraint was in general not binding since less that 10% of subjects ever chose to donate the maximum amount.

given to them including the match, $g * (1 + m)$, plus any money that was taxed from the subject's private wage in the treatment where tax was donated to the charity, $\lambda * t * w_p * v_i * (40 - h_v)$, plus the value of the subjects' volunteer time (by reducing the amount that AFFPN had to pay to hire workers to complete each envelope outside of the experiment), $\$0.30 * v_i * h_v$. AFFPN estimated that it would have to pay \$0.30 per envelope not completed during the experiment, which was communicated to the subjects. In this way, there was no uncertainty regarding the relative values of each agent's private labor and volunteering time.

Table 2 shows how much money the charity gained for each one-dollar contribution that was from the private wage (Columns 4 and 5) and from the monetary donation (Column 6) for each condition.[12] Column 7 indicates which dimension is more efficient from the charity's perspective. If subjects get differential utility from volunteering rather than donating money, however, they will potentially deviate from this behavior, and this will lead to a lower amount received by the charity for the same monetary cost to the subject.[13] For instance, row 5 in Table 2 shows that when there is no tax, a wage of \$0.30 per envelope and a match of 50%, then a \$1.00 contribution from the subject from the time and money dimensions increases the benefit to the charity by \$1.00 and \$1.50, respectively. In this case, the inefficiency in the allocation of income from donating time is \$0.50 (= \$1.50 - \$1.00) per \$1.00 cost to the donor. Column's 4 to 6 show that the inefficiency increases (decreases) with higher taxes, a higher match and a lower private wage when donating money (time) is the efficient dimension.

3.2 Procedures[14]

Subjects were recruited from university students who had elected to receive e-mail invitations to participate in economics experiments. Invitations were sent to a randomly selected 1,200 students in the database. The invitation indicated the time and location of the sessions, the expected duration (90 minutes) and that they would earn money for themselves and have the option to perform a task and donate to a charity. Four sessions were advertised and run. We ran the experiment with 25 subjects per condition and 100 subjects overall.

When subjects arrived at the lab they were randomly assigned to private work areas in which they could not observe, nor be observed by, other subjects. Since there was no interaction, subjects were randomly assigned to one of the four treatments (pure/impure framing by tax to nowhere/charity) within each session so that there was roughly an equal number of subjects per condition in each session.

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[12] Note that when the tax is present, the marginal gain for the charity is lower when the tax is given to charity (Column 5) rather than when the tax goes to nowhere (Column 4). To see this, recall that when subjects volunteer more time in the condition where the tax goes to charity, they also reduce their private earnings which generates less tax for the charity. Therefore, the marginal value to the charity of volunteering for charity is lower when the tax on private wages is donated to charity.

[13] For example, in the condition where an agent received an endowment of \$15, with a 50% match, a \$0.30 wage piece rate and no tax, assume they allocate \$5 from their endowment to charity and 30 minutes of their available work time (working 10 minutes for a private wage). With their time, they fold 1 envelope per minute while working for charity and themselves. The agent would receive \$3 (10 × \$0.30) in private wages based on envelopes completed, and keep \$10 from their endowment. The charity would receive \$7.50 from their donation (including the match) and \$9 of value due to the replacement cost of folding 30 envelopes. In total, the agent receives \$13 in income and generates \$16.50 for the charity. The agent could have generated the same value for charity donating \$11 (worth \$16.50 with the 50% match) and working for themselves the entire time, earning \$16 in total income (they would have folded 40 envelopes, earning \$12 and keeping \$4 from the endowment).

[14] The full experimental protocols and recruitment letter for the experiment are presented in the Supplemental Material.

Subjects worked at their own pace throughout the experiment. Subjects were given written instructions that began with an overview of the experiment that explained that they would be making decisions that would affect the amount of money they would earn for themselves and for a charity by allocating money and work time for themselves and for the charity. Subjects were instructed that there would be a 40 minute work period in which they would address, fold, and insert a one-page letter into an envelope. This was identical whether they were working for themselves or for the charity. Subjects were then given a page of information to read on the charity *African Foundation For People in Need* (AFFPIN). AFFPIN provides small-scale education for children of primary school age in Uganda. We chose an obscure charity to minimize the heterogeneity in past experience with the organization. Subjects were also instructed that a small private for-profit optometry firm would pay them to fold envelopes and that the context of the letter was "to remind patients to schedule a regular appointment." Subjects learned nothing else about the firm to minimize noise regarding the value of the work.

Subjects were also instructed that the charity would pay for the remaining envelopes to be folded and that all envelopes would be mailed following the conclusion of the experiment. Subjects were further instructed that all monetary donations would be mailed as a single check after the final session and they could verify payment by e-mailing or visiting in-person Professor Slonim to obtain a receipt (and the instructions provided the e-mail and office contact information).

Subjects next went through an online demonstration that explained how to do the work. The demonstration took approximately three minutes to complete and went through the procedures for addressing and folding the one-page flyer. Subjects were able to practice while viewing the instructions. Subjects were then given four minutes to address, fold, insert and seal flyers into envelopes in a piece-rate task. Subjects were told that they had a 1 in 10 chance of receiving $2 for every envelope they correctly completed during this time. Since heterogeneous earnings from this task could differentially affect each subject's endowment, the outcome of the lottery was determined at the conclusion of the experiment. The objective of this task was to provide a measure of each subject's productivity to themselves and for us. We used this measure to indicate their expected wage rate and the value of their volunteering to the charity when they were later making their decisions.

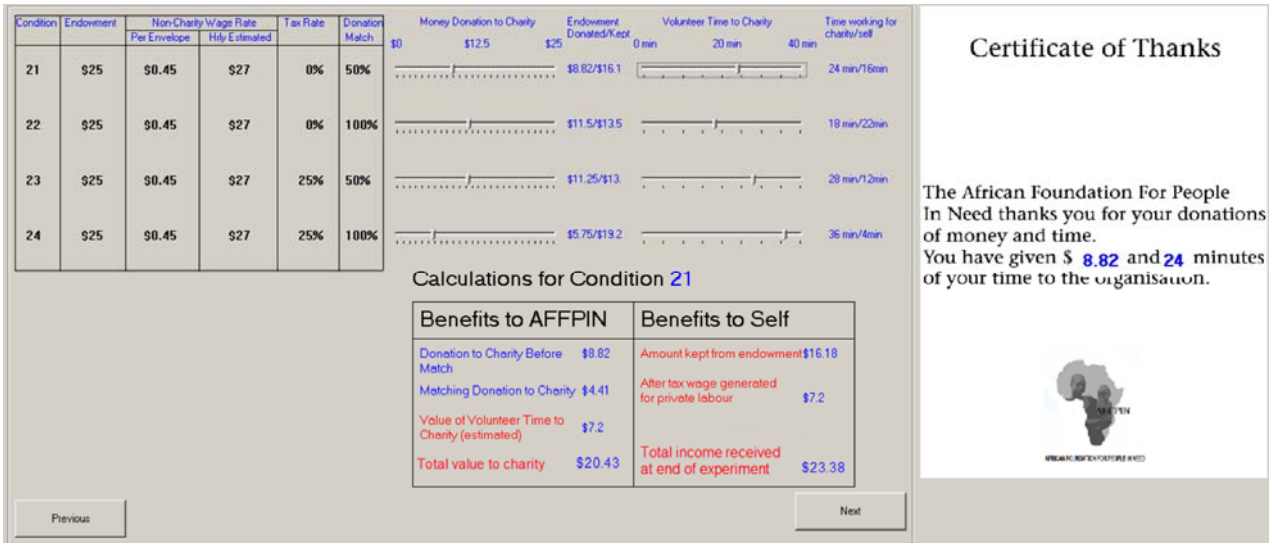
There was significant variance between subjects' work speed during this initial task. On average, subjects completed 1.1 envelopes per minute (standard deviation 0.6). Regressions (in Table A1 in the Appendix) show that each subject's productivity during the piece rate time was a highly accurate predictor of their productivity during the volunteer and work time (adjusted $R^2 = 0.94$); on average subjects did the work eight percent faster during the volunteer and work time. The slightly higher speed is likely due to gaining experience over time. The regressions also show that subjects worked a little faster when working for the private wage than for charity, though the difference is not significant. Thus, a subject's productivity during the initial four minute piece rate task provided an accurate measure of how productive they would be during the later work and volunteer time.

After the piece-rate task subjects made their 24 time and money allocation decisions. Figure 2 shows an example of the decision screen for a subject in the impure frame. The upper left part of each decision screen

presents the parameter values for each decision including the endowment, private wage rate per envelope and estimated hourly, the tax rate and the monetary donation match. Next to these details, subjects had two sliders to make choices for the monetary donation and volunteer time. Below the sliders in larger font we prominently displayed the benefits of each decision for the charity and for the subject with the details for how the final amounts are determined. Subjects could move the slider bars as often as they wanted in order to see how each choice affected the benefits to the charity and to themselves.

The right side of the screen displayed the certificate the subject would receive if the decision she was working on was chosen. Specifically, whenever a subject updated the position of the slider for one of the decisions, either the money or time allocation, then the certificate would be updated in real time to reflect this new decision value and condition. *The only difference between the pure and impure frame was the last sentence on the certificate (recall Figure 1).* In both frames, subjects could identically see the benefits to themselves and to the charity for all the choices they made. We wanted subjects to always see the benefits to themselves and to the charity to ensure the certificate only framed the donation decision, rather than assisted subjects to either calculate the effects of their choices or make it easier to determine the efficient decision.

Figure 2: Choice screen example



The 24 decisions were presented across six decision screens with four decisions per screen. We randomly determined the order of the screens to control for potential order effects. To reduce order effects, we let subjects move backwards and forwards across the decision screens and change choices as often as they wished.[15]

Before any decisions were made, we gave subjects an example decision screen to practice making choices. During this time subjects were asked to make a series of decisions that would satisfy a list of different criteria.

[15] In regressions (not shown) we can never reject the null hypothesis of no order effect on choices.

We included the practice exercises and criteria[16] for three purposes: (1) to train subjects with the mechanism of making choices, (2) to have subjects observe the consequences of their choices, and (3) to have subjects observe inefficiencies in choices from the perspective of donating the same money for different costs, and from the perspective of donating different amounts of money for the same cost. We used these procedures to minimize the possibility that subjects were making inefficient choices due to either not understanding the consequences of their choices or not realizing they were making inefficient choices. Subjects could not advance to the 24 decisions until they had correctly completed all of the practice exercises. Ninety-two of the subjects passed the demonstration screens without any assistance while eight asked for assistance at least one time.

Once all 24 decisions were made, an electronic die was rolled for each subject to randomly determine the decision to be played out and to pay subjects. After the die roll the screen displayed the relevant information including the time chosen to be spent working for the business and charity. To maintain anonymity, the work time was self-monitored; a stopwatch appeared on screen which informed the subjects of the time they had remaining to work for the charity and then the business. When the time for each task ended, the screen flashed to alert each subject. Once the 40 minute work time was complete, subjects were asked to complete a short survey regarding demographics and past monetary and volunteering behavior.

All decisions were single anonymous and single blind – no subject was ever aware of the choices any other subject made, and no subject was ever aware of the research objectives. While subjects were aware of the within-subject manipulations since they made choices for 24 conditions, they were unaware of the between subject variation in the pure/impure frame as well as the tax to nowhere/charity that form the key manipulations to test the core predictions of the model.

The experiment was run at the Behavioral Laboratory at the University of Sydney. Subject characteristics across the four between-subject conditions (Appendix Table A2.1) and between the aggregated pure and impure frames (Table A2.2) for all the survey questions were very similar. On average, subjects donated approximately $120 and 18 hours to charitable organizations over the past year and spent $77 per week on non-housing and food expenses. Slightly over half of the subjects were either economics or business students and the family they grew up in had annual earnings slightly over $90,000. Although there are small differences between the characteristics of the subjects in the pure and impure frame, none reach a 5% level of significance.

4. Results

We present the results for the four hypotheses in Sections 4.1 and 4.2. Section 4.1 tests Hypothesis 1. We find that the between-subjects frames caused the hypothesized shift in the cost and price of impurity. The framing, with the random assignment of subjects to conditions, is thus an appropriate exogenous instrument to test the remaining hypotheses. Section 4.2 presents these tests. We find that subjects act as if they are motivated by pure and 'warm glow' effects simultaneously, and we find support for all of our model's hypotheses. Moreover, we

[16] The practice questions are presented in the Supplemental Material.

find that policy variations change behavior in the predicted direction.

Before testing the hypotheses, we first very briefly describe (a) the mean choices of money (g) and time (h_v), (b) the resulting money the charity receives and (c) the simple mean cost and price of impurity in order to give a picture of the raw choices. Table 3 Rows 1 and 2 show that subjects donated directionally[17] more money and time in the impure rather than pure frame. This resulted in the charity receiving directionally more money in the impure frame. Rows 3-6 show that the directionally greater money and time donated in the impure frame is larger when the tax is given to the charity (λ=1) than to nowhere (λ=0). We also observe that crowding is directionally stronger in the pure frame; in the pure frame, subjects gave directionally less money and time to charity when the tax was given to the charity (Row 4 vs. 6) whereas in the impure frame subjects gave almost the same amount of money and donated directionally more time to charity when the tax was given to charity (Row 3 vs. 5). This resulted in directionally more public good provision when the tax was donated to charity in the impure than pure frame. Figure 3 shows that crowding is pronounced in the pure frame but negligible in the impure frame. Figure 4 shows that donations are accordingly directionally lower in the pure frame when the tax goes to the charity rather than to nowhere, whereas donations are nearly identical in the impure framing whether the tax goes to the charity or nowhere.

We also observe that the within subject manipulations directionally show substitution and cross price effects (presented in the Supplemental Material Table S3): higher private wages (w_p) led to directionally less time volunteering and more monetary donations; the higher endowment directionally increased monetary donations and time volunteering; higher taxes (t) on the private wage led subjects to directionally work more for the charity and give less money; and increasing the match (m) led to giving directionally more money but less time volunteering. These directional cross price effects suggest that volunteering time and donating money are substitutes but imperfect since we also observe that most subjects were not donating all money or all time. Imperfect substitution suggests distinct impure motives across giving time and money. However, pure motives must also exist since subjects directionally substitute time and money when the price of charity is altered via the matching donation. The regressions below show that these directional cross price effects are significant after controlling for income effects. Last, since most subjects chose interior solutions for the amount of time and money they gave, there must be diminishing marginal utility for giving both time and money.

[17] We call the effects reported in Table 3 'directional' since we do not include controls. However, note that all of the differences reported in this and the next paragraph are statistically significant in simple t-test pair-wise comparisons of means.

Table 3: Mean (standard error) choices and resulting outcomes for subjects and the charity

Conditions	Money Donation (g)	Time Donation (h_v)	Charity Earnings	Income Kept	Income Used For Donations	Cost of Impurity	Price of Impurity
Between Subjects							
Impure Frame	\$6.07 (0.13)	17.0 (0.34)	\$17.36 (0.28)	\$20.96 (0.22)	\$9.90 (0.18)	\$2.12 (0.07)	\$0.212 (0.01)
Pure Frame	\$5.60 (0.16)	12.9 (0.38)	\$15.53 (0.32)	\$21.94 (0.26)	\$8.18 (0.20)	\$1.42 (0.06)	\$0.158 (0.01)
Tax to Nowhere (λ=0):							
Impure Frame	\$6.15 (0.13)	16.2 (0.35)	\$16.16 (0.28)	\$21.32 (0.24)	\$9.89 (0.19)	\$1.61 (0.05)	\$0.169 (0.005)
Pure Frame	\$5.84 (0.16)	14.5 (0.41)	\$15.11 (0.33)	\$21.91 (0.26)	\$8.90 (0.22)	\$1.00 (0.05)	\$0.111 (0.004)
Tax to Charity (λ=1):							
Impure Frame	\$5.99 (0.12)	17.7 (0.33)	\$18.56 (0.27)	\$20.60 (0.19)	\$9.92 (0.18)	\$2.62 (0.07)	\$0.256 (0.01)
Pure Frame	\$5.36 (0.15)	11.2 (0.33)	\$15.95 (0.31)	\$21.97 (0.25)	\$7.46 (0.19)	\$1.84 (0.08)	\$0.205 (0.01)
Overall Mean	\$5.84 (0.10)	14.9 (0.26)	\$16.45 (0.21)	\$21.45 (0.17)	\$9.04 (0.14)	\$1.77 (0.05)	\$0.185 (0.005)

Figure 3: Public Goods Raised Per Subject

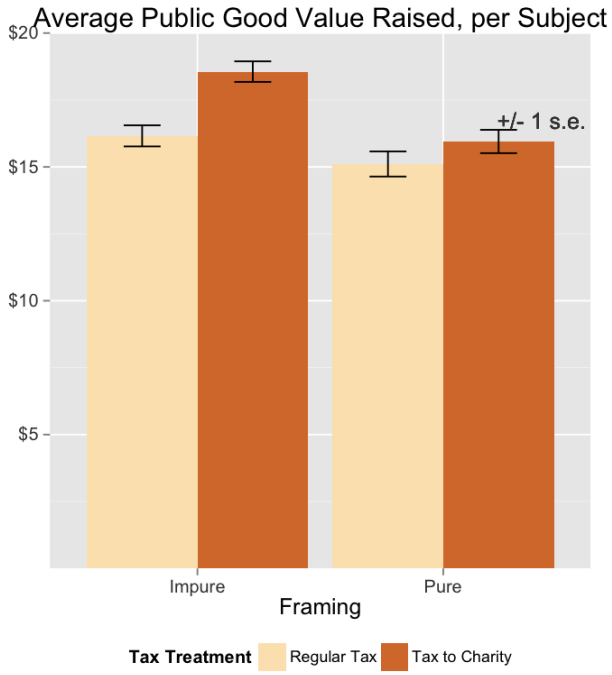
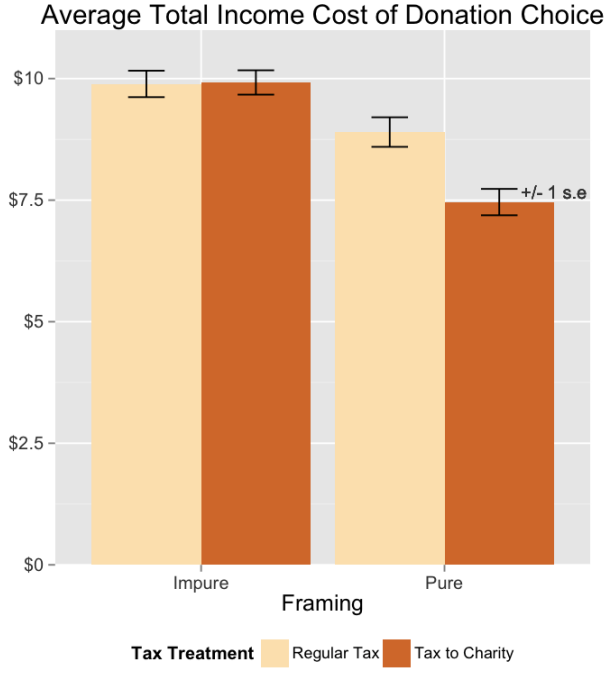


Figure 4: Contributions Per Subject



4.1 Pure and Impure Framing Effects: Hypothesis 1

The asynchronous relationship between the money and time contributions each donor makes and the amount the charity receives implies that donors must be paying for something that does not directly increase the provision to the charity. This behavior can be clearly explained by impure altruism as predicted in our model. We now go one step further to estimate the price that donors paid to maximize their *own* utility over donations that comes at the expense of maximizing the public good provision.

In Section 2.1.3 we defined this shadow cost as the *Cost of Impurity* – the amount of income subjects contributed which is above the minimum amount they could have contributed while providing the same level of charity had they donated in the efficient dimension. To normalize this cost (since subjects contribute different amounts), we divide it by each subject's total contribution, and call this relative cost the *price of impurity*. The *price of impurity* is the *minimum proportion of their total contribution* that must have gone to maximizing their utility from 'warm glow.' Hypothesis 1 predicts that this *price of impurity* will be lower in the pure frame.

In two thirds of the within subject conditions (Table 2, last eight rows), if a donor wants to make a donation to increase the level of charity, the efficient dimension would be to work for herself and donate some of this wage to charity. In these conditions, the cost of impurity arises from volunteering. In the remaining one third of the conditions (Table 2, first four rows), the cost of impurity arises from monetary donations. Figure 5 shows that the average cost of impurity for subjects in the baseline (impure frame) is notably higher than in the pure frame; on average, the cost is \$0.70 higher, or nearly 50% (2.1/1.4) relatively higher, in the impure rather than pure frame.[18] (We pool across the two tax treatments for brevity, though we show the effect persists across tax treatments in the supplemental material (Figure S5).)

Figure 6 shows density functions for the shadow price of impurity, per subject, in the pure and impure frames. In the impure frame, the distribution of each subject's average price paid for impurity is relatively normal (though censored at 0 for subjects who chose not to donate) and is on average about \$0.21 per dollar contributed. In the pure frame, however, the average price of impurity is on average about 25% lower, at \$0.16. Figure 6 shows that subjects had a large degree of heterogeneity in the strength of their impure motives and the pure frame effectively shifted the distribution to the left fairly uniformly. (We again pool across the two tax treatments for brevity, though we show the effect persists across tax treatments in the supplemental material (Figure S6). Thus, the pure frame directionally reduced the inefficiency in the allocation of money and time.

[18] To test the stability of the cost of impurity estimates for each subject, we calculated the cost of impurity for each of the 24 decisions that each subject made and the resulting standard error for each subject across the 24 decision. We find that this standard error across subjects was on average 30.0 cents. Thus, variation in the cost of impurity across decisions for each subject is substantially less than the 70.0 cent difference across the pure and impure treatments.

Figure 5: *Average cost of impurity* for each treatment, with standard errors.

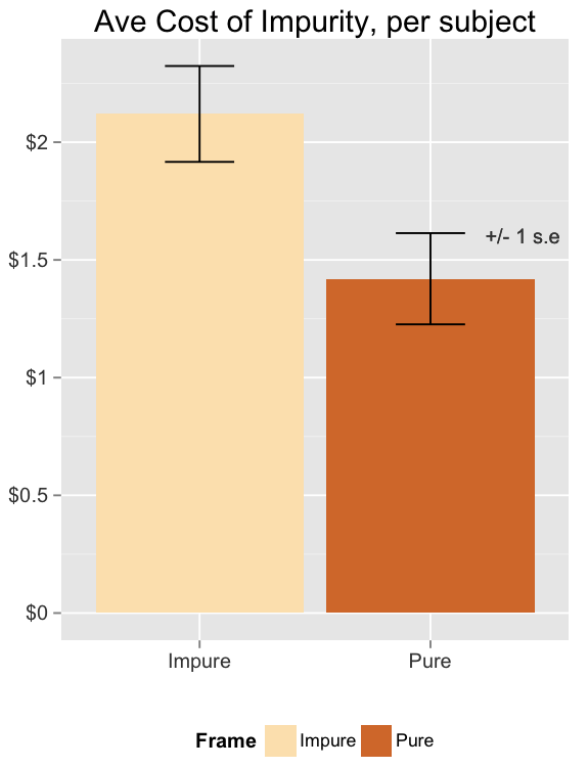
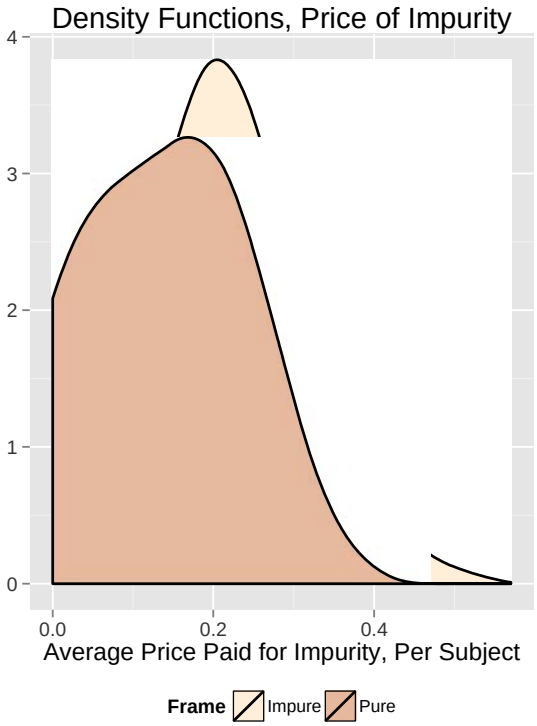


Figure 6: Kernel density functions for *the average price of impurity* across subjects[19]



[19] Three observations which were more than 3 standard deviations from the mean have been excluded from this chart.

Table 4: Determinants of Price Paid for Impurity

Baseline (Impure) Average	(Tobit) *0.21*	(Tobit) *0.21*	(Tobit) *0.21*	(Tobit) *0.21*
Constant	0.210*** (0.021)	0.166*** (0.024)	0.276** (0.125)	0.262** (0.010)
Pure Frame **(H1 test)**	-0.063** (0.030)	-0.062** (0.028)	-0.056** (0.026)	-0.058** (0.025)
Tax to Charity Frame		-0.088*** (0.028)	-0.099*** (0.026)	0.094*** (0.026)
***Survey Data*:**				
Money Donated (100s)			-0.000 (0.000)	
Hours Volunteered			-0.001 (0.001)	-0.001** (0.001)
Weekly spend			-0.000 (0.000)	
Female			0.025 (0.030)	
Difficulty Understanding			-0.024 (0.048)	
Economics Major			-0.923* (0.049)	-0.095** (0.047)
Business Major			-0.066 (0.047)	-0.074 (0.045)
Math/Sci/Eng Major			-0.047 (0.050)	-0.059 (0.049)
Arts Major			-0.030 (0.054)	-0.019 (0.053)
ATAR/UAI: (range 70-100)			-0.002 (0.001)	
Hrs Paid Work			-0.001 (0.002)	
Household Income (100,000s)			0.059** (0.024)	0.040* (0.021)
Worthwhile Charity (1-7)			0.001 (0.094)	
Survey Impure Proxy (1-7)			0.032*** (0.008)	0.029*** (0.008)
Research charities before donating			-0.035 (0.063)	
Log-likelihood^	35.8	40.5	53.8	51.5
N	100	100	100	100

^ *See* Canette (2011) for a discussion of positive log-likelihoods

To test the significance of the framing on the shadow price of impurity, we regress the price of impurity on the between-subjects conditions (pure/impure frame and tax to charity/nowhere) and control for subject characteristics. The regressions include one observation per subject with standard errors at the subject level since each subject made decisions independently during the experiment. We estimate left-censored tobit regression models since nine percent of the observations are censored at 0.[20] Table 4 presents the results. Column 1 shows the average effect of the pure frame, Column 2 adds a dummy variable for the Tax to Charity condition, Column 3 adds all survey variables and Column 4 shows estimates with only the significant variables.

The estimates support Hypotheses 1: the framing effect is statistically significant, economically large and robust across all four specifications. The pure frame resulted in subjects paying an estimated 5.6 to 6.3 cents less on each dollar of their total donation for impure effects, which is approximately 25% less than the baseline (impure frame) average price of 21 cents on each dollar they donated.[21] The estimates also show that the between-subjects tax to charity manipulation has a significant effect on the price of warm glow. However, we have no hypothesized economic interpretation for this effect and believe it is likely to be a context-specific technicality.[22] Moreover, we added the interaction term between the pure frame and the tax to charity to the models in Column's 2 and 3 (not shown) and found that the estimated interaction effect was 0.000 with standard error 0.053 and $p>0.90$; since the economic and statistical significance of the pure frame persists after controlling for the tax to charity, and since there is no interaction between the two manipulations, pooling the data across the tax to charity and tax to nowhere (as seen in Figures 5 and 6 and Table 4) is justified.

Result 1: *Hypotheses 1 is supported - the price of impurity is lower when subjects were directed to focus on pure rather than impure motives.*

The estimates in Table 4 Columns 3 and 4 reveal a few other factors that explain the price of impurity. First, students majoring in economics had a lower price of impurity. This characteristic may reflect heterogeneous preferences for warm glow, but may alternatively reflect greater ability to avoid making inefficient choices.

[20] For robustness we re-estimated the models in Columns 1-4 using two additional mods: OLS and RLM (which is a reweighted least squares method outlined in Huber (2005) to minimise the effect of outliers). Our results are qualitatively identical and the quantitative estimates only vary slightly across all three methods.

[21] To test the stability of the price of impurity estimates for each subject, we calculated the price of impurity for each of the 24 decisions each subject made and the resulting standard error for each subject across the 24 decision. We find that this standard error across subjects was on average 3.1 cents. Thus, variation in the price of impurity across decisions for each subject is nearly half as large as the estimated 5.6 to 6.3 cent difference between the pure and impure treatments.

[22] The positive effect of the Tax to Charity on the Price of impurity is more likely a technical effect than due to causality. To see this, note that the cost of impurity is greatest in decisions where volunteering time is inefficient since subjects appear to have a stronger preference for volunteering time. Under the tax to charity framing where the tax from private wages goes to charity, the difference in efficiency between donating money and donating time is larger than where the tax is a deadweight loss (under the tax to nowhere), because there is an additional charity benefit to working for a private wage (see Table 2). The interaction term between the two framings is not significant (coefficient of 0.000, standard error of 0.05, $p>.90$).

Second, subjects with higher income and those who indicated higher impure motives on our survey[23] paid a significantly higher price for impurity. The positive relationship we observe between household income and the price of impurity suggests that subjects from wealthier families may derive greater benefits from appearing altruistic and thus garner more utility from warm glow (e.g., Becker 1974).

4.2 Donations of Money and Time: Hypotheses 2-4

4.2.1 Mapping the experimental variables to the theory

To test Hypotheses 2-4, we must first link the experimental variables to the theory. To do this, we make the following transformations to the experimental variables so that they have direct economic interpretations:

$$Total\ Potential\ Income\ (x_{max}) = E + Hw_p(1-t)$$
$$Price\ of\ volunteering\ (p_v) = w_p(1-t)$$
$$Price\ of\ giving\ (p_g) = \frac{1}{1+m}$$

The first transformation constructs the *total potential income* (x_{max}) available to subjects that equals their endowment plus private wages if they work the whole time for themselves. Potential income is their budget set from which they "consume" monetary donations and volunteer time; the income effect can thus be derived using only the exogenously determined experimental factors. The second term, p_v, is the after-tax opportunity cost of volunteer time, i.e., the "price" of volunteering. The last term, p_g, is the "price" of giving money to charity.

To link the experimental variables to the theory to test crowding effects, we need to construct one more exogenous variable. Recall that for every choice in which a tax was levied (Table 2 Rows 3-4, 7-8, 11-12), an identical choice was made with no tax (Table 2 Rows 1-2, 5-6, 9-10). Also, recall that for half the subjects, this tax is given to charity (λ=1; Table 1). Observing each subject's choices in these otherwise ceteris paribus conditions with and without the tax, we can estimate a coefficient of crowding out to test Hypothesis 2.

Formally, recall that the monetary amount an agent donates to charity is *g,* and, with a matching rate of *1+m*, the value of her monetary donation that the charity receives is $g\cdot(1+m)$. Now suppose the government introduces a tax of *t* on private labor for which the agent earns a wage w_p and the proceeds of the tax are donated to the charity. If the agent keeps her monetary donation and volunteer time choices $\{g, h_v\}$ constant under the tax, she would generate a total value to the charity of $g\cdot(1+m) + (40-h_v)\cdot w_p\cdot t + w_v\cdot h_v$. We denote the donation choice which fully crowds out the tax imposed by the government as $\acute{g}$. Thus, the reduction in donated money which fully crowds out the tax is $\Delta_g = g - \acute{g}$. We can express Δ_g in terms of *m*, h_v, w_p *and t*. Assuming the agent's productivity is a folding rate of 1 envelope per minute,[24] to offset it fully, the agent must reduce her donation by:

[23] The survey question was: "How would you feel if you donated money or time to a charity, and later discovered that it was mostly unsuccessful at improving the welfare of its aid recipients? (1 = Wished I had not donated at all, 7 = No less glad that I had)."

[24] In our analysis, we use each subject's actual measured folding rate v_i.

$$\Delta_g = \frac{(40 - h_v) \cdot w_p \cdot t}{1 + m}$$

Note that this complete 'money crowding out' variable is derived strictly from the exogenous experimental variables m, w_p, *and* t, and the subject's choice of h_v, in the otherwise ceteris paribus (independent) condition with no tax. For all agents in the treatment where the tax is not donated to charity (Table 2, tax to nowhere), this variable is always 0.

Similarly for time volunteered, complete crowd out occurs when:

$$\Delta_{h_v} = \frac{(40 - h_v) \cdot w_p \cdot t}{w_v} \cdot \frac{1}{1 - t \cdot \frac{w_p}{w_v}}$$

To test hypotheses 2-4, we regress subjects' choices on the vector $\widetilde{\mathbf{X}}_{\mathbf{it}}$ consisting of the constructed variables x_{max}, p_v and p_g, and the two crowd out variables. We estimate a joint Multivariate model[25] for the choices of g and h_v to allow for cross correlation of error terms since subjects simultaneously chose money and time allocations for each condition.[26] Further, since each subject makes 24 decisions, a Least Squares Dependent Variable (Fixed Effects) estimator is used across the panel, where the FE matrix is denoted $\widetilde{\mathbf{D}}_{\mathbf{i}}$. Last, since there are many 0 donation choices, we use a joint Multivariate Tobit estimation with left-censoring. We thus estimated the following equations:

$$\begin{bmatrix} g_{it} \\ h_{v_{it}} \end{bmatrix} = \widetilde{D_i}' \gamma + \widetilde{X_{it}}' \beta + \widetilde{\epsilon_{it}}$$

$$where\ [\widetilde{\epsilon_{it}}] = \begin{bmatrix} \widetilde{\epsilon_{g_{it}}} \\ \widetilde{\epsilon_{h_{v_{it}}}} \end{bmatrix} = \tilde{0}\ and\ Var[\widetilde{\epsilon_{it}}] = \begin{bmatrix} \sigma_g^2 & \rho_{gh}\sigma_g\sigma_h \\ \rho_{gh}\sigma_g\sigma_h & \sigma_{h_v}^2 \end{bmatrix}$$

We estimated the effects of each of the three constructed independent variables (potential income, the price of giving money and the price of giving time) using a linear-log model since it provided the best overall fit. The coefficients can be interpreted as the marginal unitary change in the dependent variable (scaled by 100) for a 1% change in the value of the dependent variable.[27] For the two crowding variables we estimated their linear effects so that the coefficient can be directly interpreted as the degree of complete crowd out.

Table 5 presents the results; the reported coefficients are the unconditional marginal effects. Rows 2, 4, 6 and 8 show the main effect of each of the variables, and rows 3, 5, 7 and 9 show the interaction of each variable with the pure frame. Thus, the even rows show the effect of each variable in the impure frame and the odd rows show the additional (differential) effect in the pure frame.

[25] Also referred to as Seemingly Unrelated Regression Equations

[26] Breusch-Pagan tests for independence of errors rejected the null hypothesis of independence with a p-value < .001. If subjects have heterogeneous preferences over donations of money and time, there is likely to be negative cross correlation between the errors of the two estimates. If instead, subjects have homogeneous preferences over donations of money and time, but different levels of altruism overall, there should be positive cross correlation between errors of the two estimates.

[27] In the Tobit model, this is the unconditional marginal effect.

Table 5 Joint Estimation of money and time decisions

Row	Variable	Money donation (g)	Time donation (h_v)	Hyp. Tests
1	Pure Frame	-8.87** (2.62)	-47.0** (5.32)	
Income effects				
2	x_{max} (potential income)	9.15*** (0.428)	12.7*** (1.28)	
3	x_{max}* Pure Frame*	0.770 (0.633)	-2.94 (1.85)	
Crowding out effects				
4	Crowding out	0.128 (0.13)	-0.018 (0.047)	
5	Crowding out * Pure Frame	-0.602** (0.199)	-0.146* (0.074)	*H2*
Own price and cross price effects				
6	p_g (price of money donation)	-3.08** (0.534)	3.78* (1.61)	*H3*
7	p_g* Pure Frame	-3.12*** (0.794)	2.18 (2.37)	*H4*
8	p_v (price of time donation)	-0.313* (0.174)	-10.5*** (0.526)	
9	p_v* Pure Frame	-0.052 (0.252)	-1.04 (0.754)	
	ρ	0.24***		
	N	2400		
	Robust standard errors in parentheses; p-values: *p < 0.1, **p < 0.05, ***p < 0.01			

The first row in Table 5 shows the main effect of the pure frame on monetary and time donations. Subjects donated significantly less time and money in the pure frame relative to the impure frame. These estimates corroborate the directionally lower amounts given to charity in the pure frame that were shown in Table 3 and in Figures 3 and 4; the estimates in Table 5 go further by showing that the lower amounts given to charity occur for both time and money donations and are significant after including controls for the constructed variables. We now present the core analyses for Hypotheses 2-4.

4.2.2 Crowding out effects: Hypothesis H2

Row 4 presents the estimated coefficients on the two crowding variables in the impure frame and Row 5 presents the additional effects for the pure frame. The estimates in the money donation column indicate the crowding effects from the monetary donation Δ_g and the estimates in the volunteering donation column indicate the crowding effects from the time donation Δ_h. The sum of the estimated effects across the two columns forms the overall crowd out estimate over both the monetary donation and volunteering decision.[28]

Row 4 shows that *in the impure frame* there is no statistical or economic significance to the crowd out variable. This evidence suggests that taxed donations are not crowding out voluntary donations on average when subjects were encouraged to value charity donations impurely (i.e., in terms of their sacrifice).

Consistent with Hypothesis 2, however, *in the pure frame* we find that crowd out is statistically and economically significant for donations of both time and money; subjects donated significantly less money and significantly less time when a tax was introduced that went to the charity in the pure than impure frame. Moreover, these effects are economically substantial; we find that the overall degree of crowding out is 75% (60.2% + 14.6%) under the pure frame when we combine the crowding effects of money and time donations.

Note that the government provision of the charity crowded out the monetary donations more than time volunteering; the crowd out of monetary donations (60.2%) is more than four times the size of the crowd out of volunteering time (14.6%) in the pure frame. The government provision of charity is thus a weaker substitute for volunteer labor than for monetary donations, implying that the warm glow effect is stronger from volunteering than from donating money. This conclusion is corroborated by results presented in Brown et al. (2013).

Result 2: *Hypotheses 2 is supported - The degree of crowding out due to the tax being provided to charity is larger in the pure frame.*

4.2.3 The price of monetary donations: Hypotheses 3 and 4

Rows 6 and 7 show the estimated effects of varying the price of the monetary donation (i.e., the match rate *m*). Row 6 unsurprisingly shows that the increase in the price to donate money leads to a significant decrease in monetary donations. Now, since warm glow utility derives from one's personal contribution, the matching donation should have no effect on the amount one derives from impure utility. As such, Hypothesis 4 predicts that the effect of the matching donation will be stronger in the pure frame. The estimates confirm this hypothesis; Row 7 shows that the price effect of donating money is statistically and economically significant. Moreover, the marginal effect is twice as strong in the pure than impure frame. Further, note that the effect of the match is price-inelastic at the mean donation level in the impure frame (0.5), but price elastic at the mean

[28] For instance, consider a subject who chose to donate \$5.00 (assume a matching donation of 50%) and work for 20 minutes for the private wage (assume he folds one envelope per minute for a piece-rate of 30 cents per envelope) when there was no tax. Now, if a 25% tax is introduced, the entire benefits go to charity, and if the subject does not change his \$5 donation and 20 minute work decision, then the tax will produce an additional $\$1.50 = t * w_p * 20$ provision to the charity. Complete crowding out requires this subject to reduce his monetary donation (or volunteer time) such that the charity would receive \$1.50 less. If the crowd is complete on either one of the dimensions, then with a match rate of 100%, the subject would reduce his monetary donation \$1.00 (= 20*0.3*0.25 / (1+0.5)) *or* his volunteer time would fall 6.6 (= 20*0.3*0.25/0.3*(1/0.75)) minutes.

donation in the pure frame (1.1).[29]

To the extent that altruistic motives have a pure element, Hypothesis 3 predicts that donations of money and time will be substitutes. Rows 6 and 7 show that an increase in the price of donating money increases time volunteering; we find a 1% increase in the price of monetary donations increases demand for volunteering by about 0.04 minutes (Row 6) or about 0.2% of the mean in the impure frame, and this effect is marginally significant. Row 7 shows that this cross-price effect of monetary donations becomes 60% stronger in the pure frame (2.18/3.78), directionally showing that the two dimensions for donations have become more substitutable. While the total substitution effect in the pure frame of 5.96 (3.78 + 2.18) is significant ($p<.05$), the higher substitutability in the pure than impure frame (2.18) does not reach the level of statistical significance.

Result 3: Mixed support for hypothesis 3 - *Donations of money and time are substitutes, i.e. as the matching donation increases, donations of time decreased. However, the directionally greater level of substitutability in the pure rather than impure frame did not reach the level of significance.*

Result 4: Hypothesis 4 is supported - *The effect of the matching donation on donations of money is greater in the pure frame.*

4.2.4 Other results from the estimates:

The estimates in rows 2-3 and 8-9 help us further understand the underpinnings of altruistic donations of money and time. The estimates indicate that donations of money and time are income elastic at the mean level of donation (Row 2) and do not differ significantly between the two frames (Row 3). An exogenous 1% change in potential income results in an expected increase in monetary donations of $0.09, implying an elasticity at the mean levels of monetary donations of approximately 1.5.[30] Row 2 also shows that donations of time are relatively income inelastic; a 1% change in total potential income has an expected marginal increase in volunteer time of 0.13 minutes in the baseline (impure) treatment, approximately 0.8% of the mean time donated[31] (Menchik and Weisbrod (1987) report similar estimates in their field study).

Rows 8 and 9 show that the price of volunteering has an inelastic effect on volunteering time. An exogenous 1% change in the price of volunteering implies a decrease in volunteered time of 0.47 minutes on average, or 0.6% of the mean time donated in the baseline, and 0.8% of the mean time donated in the pure frame. Rows 8 and 9 also show that the price of volunteering has an estimated marginally significant effect with respect to donations of money. This indicates that donations of money are a gross complement for volunteering, although the Hypotheses 3 results indicate that donations of time are a gross substitute for donations of money - a potential contradiction. This is likely due to the fact that the total potential income (x_{max}) was constructed with

[29] Both price effects are weaker than the price elasticity (1.3) reported in Duncan (1999). There may be a difference in the field where the price of giving is constructed by the tax-deductible price. For example, when the donor contributes her money, it is arguable that she may get a warm glow over the entire donation at the time, even though the taxable proportion is returned later in the year as a deduction.

[30] The average money donations in the baseline (impure) and pure treatments were $6.07 and $5.60 respectively (Table 3). Thus, a $0.09 increase in donations is an approximately 1.5% increase ($0.09 / $6.00), for an elasticity of 1.5 = 1.5% / 1%.

[31] The average time donation in the baseline (impure) and pure treatments were 17 and 13 minutes respectively (Table 6).

the endowment and wage earnings being treated identically. There is experimental evidence that donations during experiments are higher if the money was given to the subject as an endowment rather than earned by them (List 2007). Therefore, the price of volunteering could be affected by subjects treating earned income differentially to “gifted" income.

5. Conclusion

We presented a theoretical model of altruism that allows agents to have utility over both pure and impure motives for charitable donations of money and time. We derived four hypotheses that were all confirmed with a laboratory experiment. Agents monetary donations and volunteering stem from a pure motivation to increase the public good (for which demand for giving money and volunteering is non-separable) and separable warm glow arguments. Simultaneous donations of money and time arise from diminishing marginal utilities over the individual warm glow effects. Our experimental results support the key predictions not normally observable. The experiment also shows that crowding effects are larger when donors made choices in our pure rather than impure framing. Further, we find donations of time are more strongly motivated by private warm glow benefits than monetary donations, and therefore the supply of volunteer labor is less impacted by policy variations than monetary donations.

We also find that donations of money and time are likely to be net substitutes. This result is potentially in contrast to the two past studies (Menchik and Weisbrod, 1987; Brown and Lankford, 1992) which concluded that donations of money and time are likely to be complements. However, our finding is corroborated by Feldman (2010) and Andreoni et al (1996) who argued that after controlling for income effects, money and time were likely to be Hicksian substitutes. We also find that donations of money and time are more substitutable when donation choices are framed as affecting the level of the public good rather than their own warm glow. Given this substitutability, future empirical studies of altruism will benefit by considering effects on both dimensions of altruistic giving when drawing conclusions and making policy recommendations.

The present paper shows that the degree of donation behavior that is motivated by pure and impure desires is not beyond the scope of measurement. We introduced a shadow price for estimating the weight of impure altruism in giving by measuring the amount of potential income that was allocated neither to the charity nor kept as income for the giver. The benefit to this measure is that it provides a minimum price agents paid for warm glow effects that relies on no assumptions about the functional form of utility. We estimated that in the impure frame at least 21% of subject donations were given solely to consume ‘warm glow.’ The pure frame reduced the shadow price of warm glow consumption by an estimated 5.8 cents per dollar of contribution, and was 25% less in the pure than in the impure frame.

The results also have implications for policy. We examined two policy tools here: a matching gift and a tax with proceeds given to the charity. Our results indicate that the level of donations stemming from donors’ own budget sets increased under the matching donation, but decreased under the taxed donation. Therefore, the

matching policy is not only more efficient for charities, but it can (under certain conditions) also decrease the cost of government support.

We also found that donations of time exhibit a cross-price substitution effect in response to the monetary match. The cross price effect was directionally 50 percent larger in the pure frame, demonstrating that as agents focus on purer motives, donations become more substitutable. The cross-price substitution effects highlight the dangers of drawing conclusions from studies focusing exclusively on either monetary donations or on volunteering time. For instance, the matching donation was effective at increasing monetary donations, but it also caused a substitution away from volunteering. Consider a policy of government donations financed by taxes that may crowd out monetary donations – we also find it would crowd out volunteer labor. Thus, focusing exclusively on the effects of policies on monetary donations will likely incorrectly estimate the overall effects since the policies will also affect volunteering decisions.

Our findings also seem to vindicate the approach of charities toward using a large degree of volunteer labor. On a casual examination, it may seem odd that charities do not simply inform donors of the low value of their volunteer labor and ask them to donate money instead to improve both the income of the donor and the provisioning of the charity. However, we find this approach would be counterproductive – our pure frame is a proxy for this strategy; while subjects who made their donation choices in the pure frame acted in a more efficient manner, they contributed less for the charity overall and consequently the total provisioning of charity declined by 10%.

Finally, our findings support a new method to examine the effects of different degrees of preferences for pure and impure motives. We introduced a certificate that recognized either the amount of time and money subjects contributed, or the amount of money that the charity received. Future research can use this framing method to manipulate subjects' preferences for pure and impure motives to study other questions regarding underlying altruism preferences and policy questions.

There are several important questions the current study has not addressed. In our study we do not account for social effects or signaling motives (Benabou and Tirole (2006). Signaling is likely to be a significant factor in volunteering (Ariely et al 2009) and impurity effects may be much greater with the potential utility from signaling. Signaling could, for instance, further exacerbate the asymmetric effects of donating time and money. Our charity was unknown to all participants and its beneficiaries were from a different nation and culture. The warm glow effects of donating to a known charity, to whom the donor may have closer attachment, may differ significantly. Future research can explore whether the level of attachment to a direct beneficiary, such as a school attended by one's children, affects the degree of pure vs. impure altruism; for example, Gee (2011) finds that warm glow is a large factor in giving to schools attended by one's children. This information would possess particular value to policy makers seeking to minimize crowding effects stemming from their contribution. Our findings imply that the optimal government policy includes supporting charities that have the strongest warm glow and weakest pure motivations to minimize crowding effects.

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Appendix for

The Price of Warm Glow

Andrew Lilley & Robert Slonim

Contents:

A1. Proofs of propositions

Proof of proposition 1:

The utility function of a pure altruist is given by:

$$u_{pure}(x,p) = U_x\left[E - g + (H - h_v)(1-t)w_p\right] + \beta U_p\left[P_{-i} + g(1+m) + (H-h_v)t\lambda w_p + h_v w_v\right]$$

where U_i satisfies the Inada conditions. Assume that

$$(1+m)(1-t)w_p \neq w_v - t\lambda w_p \qquad (C1)$$

Note that this constraint is 'generic' in that starting from a situation where $(C1)$ is not satisfied, if any of the parameters are changed slightly $(C1)$ will hold.

Let $\{g^*, h_v^*\}$ be the choice which maximizes $u_{pure}(x,p)$. The following will be shown to hold:

Under $(C1)$, at the optimal solution, either $g^* > 0$ or $h_v^* > 0$ (i.e. both cannot be positive).

Proof: let ∂U_x denote the partial of the utility function with respect to x and ∂U_p denote the partial with respect to p. If the result is not true, then $\{g^*, h_v^*\} > 0$. The first order condition for the choice of g^* and h_v^* are given by the following conditions:

$$-\partial U_x + \partial U_p \cdot \beta(1+m) = 0$$

$$-\partial U_x \cdot (1-t)w_p + \partial U_p \cdot \beta\left(w_v - t\lambda w_p\right) = 0$$

Combining these two FOCs, we arrive at $(1+m)(1-t)w_p = w_v - t\lambda w_p$ which contradicts $(C1)$.

To determine which of $g^* > 0$ or $h_v^* > 0$, consider a change in $\{g^*, h_v^*\}$ which keeps p at the same level. Recall that

$$\frac{dg}{dh_v} = -\frac{t\lambda w_p - w_v}{1+m}$$

In this case disposable income would change by $\frac{dx}{dh_v} = -\frac{dg}{dh_v} - (1-t)w_p = \frac{t\lambda w_p - w_v}{1+m} - (1-t)w_p$

Thus for a change in $\{g^*, h_v^*\}$ which holds p constant, $\frac{dx}{dh_v}$ is positive where $(1+m)(1-t)w_p < w_v - t\lambda w_p$ and negative where $(1+m)(1-t)w_p > w_v - t\lambda w_p$. Therefore a pure altruist will never donate time if $(1+m)(1-t)w_p > w_v - \lambda t w_p$ and will never donate money if $(1+m)(1-t)w_p < w_v - \lambda t w_p$.

Proof of proposition 2:

Consider the case where $(1+m)(1-t)w_p > w_v$ (and assume $\lambda = 0$). Under this condition, volunteering time is inefficient, and from *Proposition 1* a pure altruist must choose $h_v^{**} = 0$ and $g^{**} = \frac{V^{**}}{1+m}$ to provide any given level of

charitable contribution V^{**}. Given V^{**}, the disposable income x^{**} to the pure altruist ($\alpha = 0$) is $x^{**} = E - \frac{V^{**}}{1+m} + H(1-t)w_p$.

Next, consider the choice made by any other agent with $\alpha > 0$, whose donation choice results in the same V^{**} (we can only compare the *price of impurity* for the same V^{**}). He then chooses $\{g, h_v\}$ to maximize his own utility, which is of the form corresponding to: $u(x, p, q, r)$. For a mixed altruist's choice of donation, $V^{**} = g(1+m) + h_v w_v$. Now let $x(\alpha, \beta) = E - g^* + (H - h_v^*)(1-t)w_p$ denote the disposable income of an agent of preference α at his utility maximising choice, $\{g^*, h_v^*\}$. The standard Inada condition mandates that for $\alpha > 0$, $h^* > 0$ and as such the income $x(\alpha, \beta)$ that a mixed altruist can obtain is strictly less than x^{**}.

The disposable income will be shown to be continually decreasing in α. Note also that since $g(1+m) + h_v w_v = V^*$, $g = \frac{V^{**} - h_v w_v}{1+m}$. Substituting this identity into the utility function, an agent with preference $\{\alpha, \beta\}$ maximises

$$u(x, p, q, r) = U_x\left(E - \frac{V^{**} - h_v w_v}{1+m} + (H - h_v)(1-t)w_p\right) + \beta U_p(P_{-i} + V^{**}) + \alpha U_q\left(\frac{V^{**} - h_v w_v}{1+m}\right) + \alpha U_r(h_v).$$

Given the Inada conditions, the optimal choice h_v is greater than 0, and the FOC is:

$$U'_x \cdot \left(\frac{w_v}{1+m} - (1-t)w_p\right) + \alpha U'_q \cdot \frac{dg^*}{dh_v^*} + \alpha U'_r = 0$$

And since, in order to hold V^* constant, $\frac{dg^*}{dh_v^*} = -\frac{w_v}{1+m}$

The FOC can be rearranged using the above comparative static to yield:

$$\frac{U'_r - U'_q \cdot \frac{w_v}{1+m}}{U'_x} = \frac{-\frac{w_v}{1+m} + (1-t)w_p}{\alpha}$$

Given $(1+m)(1-t)w_p > w_v > 0$, the RHS of the above equation is positive and decreasing in α. The remaining parameters are exogenous.

Consider next the change to the LHS of this equation as a result of a change in α. The LHS must fall as α rises for the condition to hold with equality. Since both first derivatives are always positive, this requires U'_r to fall and U'_q to increase. According to the constraint $\frac{dg^*}{dh_v^*} = -\frac{w_v}{1+m}$, changes to the choices h_v^* and g^* must be opposite in direction. Since both U_r and U_q are concave, in order for U'_r to fall and U'_q to increase, this requires g^* to fall and h_v^* to increase.

The change to the agent's income from the increase in h_v^* is $-(1-t)w_p \cdot dh_v^*$. The change to the agent's income from the decrease in g^* is $-dg^*$. The net change in income is $-dg^* - (1-t)w_p \cdot dh_v^*$, or $\frac{w_v}{1+m} \cdot dh_v^* - (1-t)w_p \cdot dh_v^*$, which must be < 0 since $(1+m)(1-t)w_p > w_v$.

Since a higher h_v^* results in a lower net income to the agent, it follows that the *cost of impurity* must increase with α, for any observed donation of value V^*.

The proof for $(1+m)(1-t)w_p > w_v$ and continuous λ follows immediately with trivial differences.

Proof of Proposition 3:

An agent's choice of g^* is characterised by the following first order condition:

$$\beta U_p^{'}(1+m) + \alpha U_q^{'} = U_x^{'}$$

Consider the dynamics of an increase in λ. As λ increases, if g^* is held constant then $U_q^{'}$ will remain constant, and as there will be no effect on disposable income the RHS will concurrently remain constant. However as λ increases, the provision of the public good, p, increases, therefore $U_p^{'}$ decreases since U_p is concave. Thus for the equality to hold, there must be an offsetting increase in $U_p^{'}$ and/or a decrease in $U_x^{'}$. Recall that $U_x^{'}$ is increasing and $U_p^{'}$ is decreasing in g. Therefore, this requires g to fall in order to maintain the equality. Therefore, $\frac{dg^*}{d\lambda} < 0$. For larger values of α the offsetting decrease required in $U_p^{'}$ is smaller, and therefore the offsetting decrease in g is smaller.

A similar proof can easily be constructed for $\frac{dh_v^*}{d\lambda}$.

Since total crowding out is equal to the sum of $\frac{dg^*}{d\lambda} \cdot (1+m) + \frac{dh_v^*}{d\lambda} \cdot (w_v - \lambda t w_p)$, crowding out is increasing in λ and decreases in magnitude as α increases. (We assume that $w_v > \lambda t w_p$ such that there is some incentive to volunteer.)

Proof of Proposition 4:

We seek to show that as the price of increasing charity via monetary donations decreases (i.e. as *m* increases), agents will substitute away from volunteering. Further, we show that the *hicksian* substitution effect is decreasing in α.

Let $\lambda = 0$ for parsimony. An agents choice of $\{g^*, h_v^*\}$ is characterised by the following first order conditions:

$$-U_x^{'} + \beta U_p^{'}(1+m) + \alpha U_q^{'} = 0$$

$$-U_x^{'}(1-t)w_p + \beta w_v U_p^{'} + \alpha U_r^{'} = 0$$

In order to isolate the *hicksian*, rather than *gross* substitution effect, we must exclude the change in income as a response to a change in $\{g^*, h_v^*\}$. Hence, we exclude any changes in $V_x^{'}$ as income is held constant. Let us denote the pure substitution effects on $\{g^*, h_v^*\}$, excluding any changes in income, as $\frac{d\dot{g}^*}{dm}$ and $\frac{d\dot{h}_v^*}{dm}$ respectively. By differentiating the first order conditions and excluding income effects, we arrive at the following:

$$\beta U_p^{'} + \beta U_p^{''}\left(\frac{d\dot{g}^*}{dm}(1+m) + g^* + \frac{d\dot{h}_v^*}{dm}w_v\right)(1+m) + \alpha U_q^{''}\frac{d\dot{g}^*}{dm} = 0$$

$$\beta w_v U_p^{\prime\prime} \left(\frac{d\dot{g}^*}{dm}(1+m) + g^* + \frac{d\dot{h}_v^*}{dm} w_v\right) + \alpha U_r^{\prime\prime} \frac{d\dot{h}_v^*}{dm} = 0$$

Hence

$$\frac{d\dot{h}_v^*}{dm} = \frac{\beta w_v U_p^{\prime\prime} (\beta(1+m)U_p^{\prime} - \alpha g^* U_p^{\prime\prime}}{\alpha\left(\alpha U_q^{\prime\prime} U_r^{\prime\prime} + \beta U_p^{\prime\prime}\left(w_v^2 U_q^{\prime\prime} + (1+m)^2 U_r^{\prime\prime}\right)\right)} < 0$$

Therefore donations of time are a hicksian substitute for donations of money.

Further, in examining the effect of the magnitude of α on the scale of the substitution effect

$$\frac{\partial \frac{\dot{d}h_v^*}{dm}}{\partial \alpha} = \frac{-\beta w_v U_p^{\prime\prime}\left(-\alpha^2 g^* \left(U_q^{\prime\prime}\right)^2 U_r^{\prime\prime} + \beta(1+m)U_p^{\prime}\left(2\alpha U_q^{\prime\prime} U_r^{\prime\prime} + \beta U_p^{\prime\prime}\left(w_v^2 U_q^{\prime\prime} + (1+m)^2 U_p^{\prime\prime}\right)\right)\right)}{\alpha^2\left(\alpha U_q^{\prime\prime} U_r^{\prime\prime} + \beta U_p^{\prime\prime}\left(w_v^2 U_q^{\prime\prime} + (1+m)^2 U_p^{\prime\prime}\right)\right)^2}$$

$$\therefore \frac{\partial \frac{\dot{d}h_v^*}{dm}}{\partial \alpha} > 0$$

A2. Appendix Table A1

Robustness checks:
Piece rate task Prediction of volunteer and work productivity
OLS estimates (robust SE in parenthesis)

	Envelopes completed *per minute* during 40 minute work time		
	All 40 minutes	Private Wage Work Time	Volunteer Work Time
Envelopes completed *per minute* during initial 4 minute piece rate period	1.079*** (0.025)	1.112*** (0.032)	1.064*** (0.046)
R^2	0.950	0.938	0.880
Adjusted R^2	0.940	0.925	0.867
N	96[a]	80[b]	73[b]
Average (s.d.) minutes working on task	40.00 (0.00)	29.73 (9.27)	19.54 (12.47)

*** p<.01 testing for $\beta \neq 1$; a: Four subject's work-time data was incorrectly coded; b: additionally, 16 and 23 subjects chose no private or no volunteer work time for the decision that was randomly chosen to be carried out.

A3. Appendix Table A2.1

Subject Characteristics, Overall and by Treatment

Survey Data	All Subjects	Impure Frame, Tax to Nowhere	Impure Frame, Tax to Charity	Pure Frame, Tax to Nowhere	Pure Frame, Tax to Charity	p-value*
N	100	25	25	25	25	N.A.
Annual donations to charity	$120 ($152)	$143 ($169)	$112 ($157)	$93 ($107)	$133 ($170)	0.723
Hours donated to charity	18.0 (23.7)	17.9 (24.2)	13.1 (18.6)	22.1 (25.8)	18.7 (25.9)	0.592
Weekly spending	$68 ($27.7)	$66 ($30.4)	$63 ($25.1)	$68 ($27.1)	$74 ($28.7)	0.248
Male	54%	44%	60%	44%	68%	0.226
Area of Study						
Economics	26%	20%	44%	16%	24%	
Business	32%	40%	20%	36%	32%	
Math/Eng/Sci	17%	16%	16%	20%	16%	
Arts	13%	20%	4%	16%	12%	
Other	12%	4%	16%	12%	16%	
F-Test*						0.552
ATAR/UAI: High school mark used for college admissions	85.0 (11.7)	87.8 (11.7)	82.1 (11.7)	81.7 (11.7)	88.2 (11.7)	0.953
Household income	$91,588 ($63,670)	$89,000 ($63,670)	$88,900 ($63,670)	$83,650 ($63,670)	$104,800 ($63,670)	0.516
Pure Proxy: "charity worthiness" (1-7)	5.3 (1.5)	4.8 (1.5)	4.8 (1.5)	4.3 (1.5)	4.7 (1.5)	0.078
Impure proxy: regret donating to unsuccessful cause (1-7)	3.0 (1.7)	3.6 (1.7)	2.7 (1.7)	2.9 (1.7)	3.0 (1.7)	0.239
Difficulty understanding experiment	10%	4%	8%	24%	4%	0.056

*p-values: One Way ANOVA F-tests for continuous variables; z-test for discrete variables; chi-sq for multinomial categorical variables

A4. Appendix Table A2.2

Subject Characteristics, Overall and by Treatment

Survey Data	All Subjects	Baseline: Impure Frame	Treatment: Pure Frame	p-value*
N	100	50	50	n.a.
Annual donations to charity	$120 ($152)	$127 ($162)	$112 ($142)	0.641
Hours donated to charity	18.0 (23.7)	15.5 (21.5)	20.4 (25.7)	0.301
Weekly Spending	$68 ($27.7)	$64 ($27.6)	$71 ($27.8)	0.251
Male	54%	44%	64%	0.841
Area of Study				
Economics	26%	32%	20%	
Business	32%	30%	34%	
Math/Science/Engineers	17%	16%	18%	
Arts	13%	12%	14%	
Other	12%	10%	14%	
F-test of unequal proportions				0.241
ATAR/UAI (High School Mark used for college admissions)	85.0 (11.7)	84.8 (11.5)	85.1 (12.0)	0.989
Household Income	$91,588 ($63,670)	$86,325 ($65,243)	$96850 ($62,689)	0.827
Pure Proxy: "charity worthiness" (1-7)	4.8 (1.5)	4.8 (1.5)	4.8 (1.5)	0.052
Impure Proxy: regret donating to unsuccessful cause (1-7)	3.0 (1.7)	3.2 (1.7)	2.8 (1.6)	0.473
Difficulty understanding experiment	10%	14%	6%	0.32

*p-values: t-tests for continuous variables; z-test for discrete variables; chi-sq for multinomial categorical variables

Supplemental Material for

The Price of Warm Glow

Andrew Lilley & Robert Slonim

(This material is intended to be included in online material and not part of the paper)

Contents:

S1. Derivations of the mixed altruist's comparative static results

The mixed altruist's equilibrium allocation is characterized by the following first order conditions:

$$\beta U_p'(1+m) + \alpha U_q' = U_x'$$

$$\beta U_p'\left(w_v - \lambda t w_p\right) + \alpha U_r' = U_x'(1-t)w_p$$

We arrive at the following comparative statics by implicitly differentiating the above first order conditions.

(a) $\{\frac{dg^*}{dE}, \frac{dh_v^*}{dE}\} > 0$, (b) $\{\frac{dg^*}{dw_p}, \frac{dh_v^*}{dw_p}\} \lesseqgtr 0$, (c) $\left\{\frac{dg^*}{dm}, \frac{dh_v^*}{dm}\right\} \lesseqgtr 0$ and (d) $\left\{\frac{dg^*}{d\lambda}, \frac{dh_v^*}{d\lambda}\right\} < 0$

(a) Implicitly differentiating the above two FOCs wrt E (assume $\lambda = 0$ for parsimony), and solving simultaneously yields:

$$\frac{dg^*}{dE} = \frac{U_x''\left(\beta w_v\left((1+m)(1-t)w_p + w_v\right)U_p'' + \alpha U_r''\right)}{\left(\beta(1+m)w_v U_p'' + (1-t)w_p U_x''\right)^2 + \left(\beta(1+m)^2 U_p'' + \alpha U_q'' + U_x''\right)\left(\beta w_v^2 U_p'' + \alpha U_r'' + (1-t)^2 w_p^2 U_x''\right)} > 0$$

$$\frac{dh_v^*}{dE} = \frac{U_x''\left(\beta(1+m)\left((1+m)(1-t)w_p + w_v\right)U_p'' + \alpha(1-t)w_p U_q''\right)}{\beta U_p''\left(\alpha w_v^2 U_q'' + \alpha(1+m)^2 U_r'' + \left((1+m)(1-t)w_p + w_v\right)^2 U_x''\right) + \alpha\left(\alpha U_q'' U_r'' + \left((1-t)^2 w_p^2 U_q'' + U_r''\right)U_x''\right)} > 0$$

(b) Since these two comparative statics are quite unweildly, we provide the intuition for why they are unsignable. Consider a change to the first FOC based on an increase in the private wage rate. With regard to the RHS of the equation, the marginal utility of her income would decrease, as a higher wage rate would increase her after tax income, ceteris paribus. On the LHS, the increased private wage would increase the size of the public good due to increased government financing of charity via taxation. Her optimal choice of g^* would increase (decrease) if the change in her marginal utility of income was greater (smaller) than the change in her marginal utility over the public good. As such, the comparative static $\frac{dg^*}{dw_p}$ is unsignable.

Consider a change to the second FOC based on an increase in the private wage rate. With regard to the RHS of the equation, the marginal utility of her income would decrease, as a higher wage rate would increase her after tax income, ceteris paribus (i.e. the income effect). Yet, an increase in w_p directly increases the RHS (i.e. the substitution effect). We do not know which will dominate, and as such, $\frac{dh_v^*}{dw_p}$ is unsignable.

(c) Implicitly differentiating the above two FOCs wrt m (assume $\lambda = 0$ for parsimony), we arrive at:

$$U_x''\left(\frac{dg^*}{dm} + \frac{dh_v^*}{dm}(1-t)w_p\right) + \beta U_p' + (1+m)\beta U_p''\left(\frac{dg^*}{dm}(1+m) + g^* + \frac{dh_v^*}{dm}w_v\right) + \alpha U_q''\frac{dg^*}{dm} = 0$$

$$U_x''\left(\frac{dg^*}{dm} + \frac{dh_v^*}{dm}(1-t)w_p\right)(1-t)w_p + \beta w_v U_p''\left(\frac{dg^*}{dm}(1+m) + g^* + \frac{dh_v^*}{dm}w_v\right) + \alpha U_r''\frac{dh_v^*}{dm} = 0$$

Solving these simultaneously yields:

$$\frac{dg^*}{dm} = \frac{-\left(\beta U_p'\left(\beta w_v^2 U_p'' + \alpha U_r'' + (1-t)^2 w_p^2 U_x''\right) + \beta g^* U_p''\left(\alpha(1+m)U_r'' - U_x''(1-t)w_p\left(-(1+m)(1-t)w_p + w_v\right)\right)\right)}{\left(\beta U_p''\left(\alpha w_v^2 U_q'' + \alpha(1+m)^2 U_r'' + U_x''\left(-(1+m)(1-t)w_p + w_v\right)^2\right) + \alpha\left(\alpha U_q'' U_r'' + U_x''\left((1-t)^2 w_p^2 U_q'' + U_r''\right)\right)\right)}$$

$\lesseqgtr 0$

$$\frac{dh_v^*}{dm} = \frac{\beta\left(U_p'\left(\beta(1+m)w_v U_p'' + (1-t)w_p U_x''\right) - g^* U_p''\left(\alpha w_v U_q'' + U_x''\left(-(1+m)(1-t)w_p + w_v\right)\right)\right)}{\left(\beta U_p''\left(\alpha w_v^2 U_q'' + \alpha(1+m)^2 U_r'' + U_x''\left(-(1+m)(1-t)w_p + w_v\right)^2\right) + \alpha\left(\alpha U_q'' U_r'' + U_x''\left((1-t)^2 w_p^2 U_q'' + U_r''\right)\right)\right)}$$

$\lesseqgtr 0$

(d) See *Proof of proposition 3*.

S2. Experimental Materials

a) Recruitment Procedures

Experiment on Monday 8 August
alil9145@uni.sydney.edu.au
Sent:11 August 2011 21:30
To: alil9145@uni.sydney.edu.au

Dear Andrew Lilley,

We would like to invite you to participate in an experiment in our laboratory.

You can view the Participant Information Statement for this study at:

http://webauth.econ.usyd.edu.au/__data/assets/pdf_file/0012/105132/Participant_Information_StatementAND.pdf

At this time, we are recruiting for sessions scheduled at the following times:

12/08/2011 16:00-17:45 Behavioural Research Laboratory, register before 12/08/2011 16:00
15/08/2011 10:00-11:45 Behavioural Research Laboratory, register before 15/08/2011 09:00

Please ensure that you have read and fully understood the Participant Information Statement before you register for a session. Please also ensure that you are free for the entire duration of the session for which you would like to register.

Places in each session are limited, and will be filled on a first-in-first-served basis. If you would like to participate in one of these sessions, please register at the following link:

http://orsee.econ.usyd.edu.au/public/participant_show.php?p=cdnJrh7Q3vcx2

When you follow this link, you will see a list of the sessions for which there are places still available. If you cannot see the session you would like to register for, this means that the session is already full. If you cannot see any sessions, this means that all of the sessions are already full. It is possible that we may advertise additional sessions for this study at a later date.

(If you are no longer a student of the University, or no longer wish to receive invitations, you can unsubscribe by following the link in the footer to this email. Click on "Edit my data", and then "Unsubscribe".)

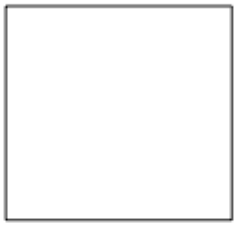
With kind regards,

Economics Experimental Research Group
The University of Sydney
http://sydney.edu.au/arts/economics/experiments

This email was sent to you by the experiment participant recruitment system.

b) Instructions + Charity Donation Information Sheet

Note: the box in upper left corner contained the each subject's unique ID number.



Instruction form for participants in an experiment on decision making

You are participating in an experiment on decision making. The entire amount of time the experiment should take is 90 minutes.

Please do not touch the materials on or underneath your table until instructed. Please do not attempt to communicate with the other participants in the experiment. Please turn off your mobile phone and/or any other communication equipment.

If you have any questions at any point during the experiment, please raise your hand and one of the assistants will come speak to you.

During the experiment, you will be asked to make a series of decisions that will benefit yourself and/or a charity that is described on the reverse of this page. You will be paid in cash at the end of the experiment according to the choices that you made during the experiment. Donations you may choose to make during the experiment will be made by an aggregate cheque. This can be verified from **19th August 2011** by contacting Professor Robert Slonim by email at robert.slonim@sydney.edu.au, or in person at Merewether Room 348.

Please turn over the page to familiarise yourself with the charity. After you have read the information about the charity, please turn on your computer monitor to begin.

AFRICAN FOUNDATION FOR PEOPLE IN NEED

www.affpin.org

The Organisation

The African Foundation for People in Need [AFFPIN] is a locally operated Ugandan organisation founded in 2002 with the primary objective of responding to the needs of those living in abject poverty in the Mukono district of Uganda. Rural Uganda is an area in particular need of international support, given the high prevalence of poverty and HIV/AIDS in the region. Uganda is home to 1.8 million orphans, of whom half are orphaned as a result of parental death from HIV/AIDS. As a result, children are frequently left without guardianship or education and are condemned to a life in poverty.

AFFPIN was founded by locals of the Mukono district with the intention of solving the socio-cultural problems faced by the local people. Though the organisation was founded on Christian values, the organisation does not discriminate against any religious of cultural groups. AFFPIN focuses its work on providing educational opportunities young children, particularly orphans whose parents have died as a result of HIV/AIDS. AFFPIN sees education as permanent solution to the cycles of illiteracy and poverty that are pervasive in the local community.

The majority of people living in rural areas of Uganda are not able to afford even the most basic education. Where education is provided, it is often of low standard. AFFPIN's major concern is that without external assistance, the cycle of poverty in rural communities will not end.

The Manjeri School

In response, AFFPIN founded the Manjeri Children's Home and School. The school aims to provide government standard primary education and accommodation to orphans and underprivileged children in the local community. There are currently 384 students enrolled at the Manjeri School. The difficulties faced by children in attending are large; many have to walk great distances and over 50% of students are not equipped with adequate stationary, books, lunch or uniforms by their parents or guardians.

At present, AFFPIN has only been able to construct two permanent classrooms. Education is provided under makeshift structures. It is clear that the educational facilities are inadequate and that assistance is needed to enable the organisation to provide the standard of education it aims to achieve.

AFFPIN is an organisation that has local interests at heart. The foundation and operation of the organisation lies in the hands of members of the local community. As such, the organisation has a comprehensive understanding of the needs of impoverished rural Ugandans and solutions to the cycle of poverty they face. This knowledge, combined with a substantial degree of international assistance, would benefit the organisation tremendously.

Australian volunteer work at AFFPIN

In recent years, much of the development of AFFPIN has been due to the work of Australian volunteers. A number of students have engaged in fundraising in Australia, before living at the organization for several months to oversee the construction of buildings for the school. In September 2008, Nick Harrington and James Paterson raised $16,000 for the construction of a chicken farm. The farm, which has continued to grow since 2008, provides the school with a sustainable source of revenue. In December 2010, Andrew Thomas and Jesse Buckingham were able to raise $40,000 for the construction of a 4-classroom building. While previously, the majority of the school's 250 students were taught under the shade of trees, with the completion of the project, now every student is able to learn with a roof over their head.

What will your donation be used for?

While the large projects have been imperative for the establishment of the school, the most pertinent issues facing the school now all require a more consistent flow of money spread over a sustained period of time. Your donation will contribute to:

Supplying food for children

Children currently receive one cup of porridge each day at the Manjeri school. For many, this will be only food they have before dinner. Supplying each child with a lunch of ugali (made from maize flour) and beans would drastically increase productivity, yet is quite inexpensive.

Ugali (600kg at 1500 UGS) and beans (400kg at 1450 UGS) = $870 AUD per term

Supplying textbooks to students

The school currently uses textbooks and exercise books that are several years old and that are shared among six or seven students each. Supplying each child with the adequate books that they need every year would greatly improve the rate of learning for children.

Each child receiving their own books (Seven books at 8000 UGS each): $32 AUD per child for the year.

How to donate

To sponsor a project, a needy family or small coffee farm, or to become a volunteer or partner, or if you have any further questions, please log on to www.affpin.org.

c) Practice Questions

A and B refer to two separate allocation decisions the subject was required to make.

1. Move the money slider in A) so that you would generate a 'Matching Donation To Charity' of (or approx) $5.
2. Move the time slider in A) so that the 'After tax wage generated for private labour' is equal to the 'Value of Volunteer Time to Charity'.
3. Move both sliders in B) so that the certificate shows you giving up the maximum you possibly can to charity.

d) All Donation Choices: Money and Time

Table S1: Within subject treatment parameters and the efficient donation dimension

Experimental Parameters				Charity gain for each marginal Dollar of income subjects 'give up:'			Efficient donation dimension
				Time donation		Money donation	
Private Wage w_p ($/envelope)	Monetary donation Tax	Monetary donation Match	Endowment	Tax to Nowhere	Tax to Charity		
$0.10	0%	50%	$15	$3.00	$3.00	$1.50	Time
$0.10	0%	100%	$15	$3.00	$3.00	$2.00	Time
$0.10	25%	50%	$15	$4.00	$3.75	$1.50	Time
$0.10	25%	100%	$15	$4.00	$3.75	$2.00	Time
$0.30	0%	50%	$15	$1.00	$1.00	$1.50	Money
$0.30	0%	100%	$15	$1.00	$1.00	$2.00	Money
$0.30	25%	50%	$15	$1.33	$1.08	$1.50	Money
$0.30	25%	100%	$15	$1.33	$1.08	$2.00	Money
$0.45	0%	50%	$15	$0.67	$0.67	$1.50	Money
$0.45	0%	100%	$15	$0.67	$0.67	$2.00	Money
$0.45	25%	50%	$15	$0.89	$0.64	$1.50	Money
$0.45	25%	100%	$15	$0.89	$0.64	$2.00	Money
$0.10	0%	50%	$25	$3.00	$3.00	$1.50	Time
$0.10	0%	100%	$25	$3.00	$3.00	$2.00	Time
$0.10	25%	50%	$25	$4.00	$3.75	$1.50	Time
$0.10	25%	100%	$25	$4.00	$3.75	$2.00	Time
$0.30	0%	50%	$25	$1.00	$1.00	$1.50	Money
$0.30	0%	100%	$25	$1.00	$1.00	$2.00	Money
$0.30	25%	50%	$25	$1.33	$1.08	$1.50	Money
$0.30	25%	100%	$25	$1.33	$1.08	$2.00	Money
$0.45	0%	50%	$25	$0.67	$0.67	$1.50	Money
$0.45	0%	100%	$25	$0.67	$0.67	$2.00	Money
$0.45	25%	50%	$25	$0.89	$0.64	$1.50	Money
$0.45	25%	100%	$25	$0.89	$0.64	$2.00	Money

S3. Table S3: Extension to Table 3 for within subject manipulations

Conditions	Money Donation ($)	Time Donation (minutes)	Total value to charity ($)	Income Kept ($)	Income Contributed ($)	Cost of Impurity ($)	Price of Impurity ($)
Within Subjects							
Low Wage	4.33 (0.16)	20.2 (0.45)	15.19 (0.34)	17.58 (0.20)	6.12 (0.17)	1.70 (0.07)	0.215 (0.01)
Medium Wage	6.02 (0.17)	13.9 (0.41)	16.51 (0.37)	21.41 (0.27)	9.70 (0.23)	1.24 (0.05)	0.14 (0.01)
High Wage	7.15 (0.18)	10.6 (0.40)	17.64 (0.38)	25.35 (0.32)	11.31 (0.27)	2.36 (0.11)	0.199 (0.01)
Low Endow	4.45 (0.12)	13.0 (0.35)	13.49 (0.27)	18.32 (0.22)	7.17 (0.18)	1.44 (0.06)	0.181 (0.01)
High Endow	7.23 (0.15)	16.8 (0.37)	19.40 (0.30)	24.58 (0.22)	10.91 (0.20)	2.09 (0.07)	0.189 (0.01)
No Tax	6.18 (0.14)	13.7 (0.35)	15.10 (0.30)	22.46 (0.25)	9.52 (0.20)	1.68 (0.06)	0.164 (0.01)
25% Tax	5.49 (0.14)	16.1 (0.37)	17.79 (0.30)	20.44 (0.21)	8.55 (0.19)	1.85 (0.07)	0.206 (0.01)
50% Match	5.32 (0.14)	15.5 (0.36)	14.24 (0.26)	21.83 (0.24)	8.66 (0.20)	1.70 (0.06)	0.184 (0.01)
100% Match	6.35 (0.14)	14.3 (0.36)	18.65 (0.33)	21.07 (0.24)	9.42 (0.20)	1.84 (0.07)	0.186 (0.01)
Overall Mean	5.84 (0.10)	14.9 (0.26)	16.45 (0.21)	21.45 (0.17)	9.04 (0.14)	1.77 (0.05)	0.185 (0,005)

S4. Extension of Figures 5 and 6: Unpooled summary figures

Figure S5: *Average cost of impurity* for each treatment, with standard errors.

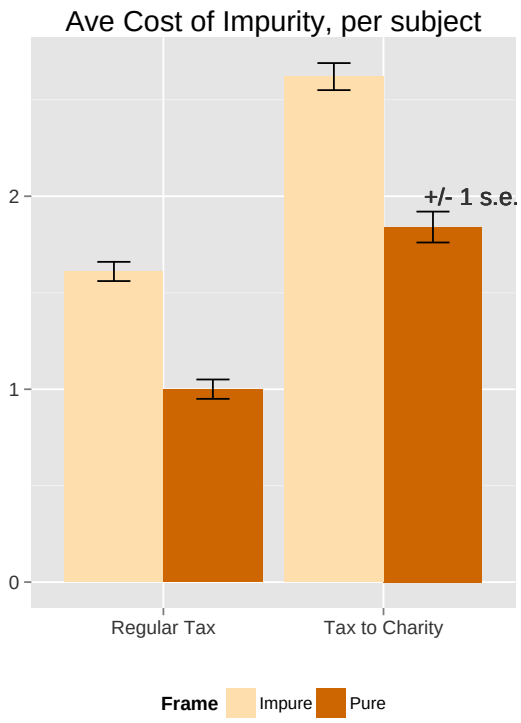
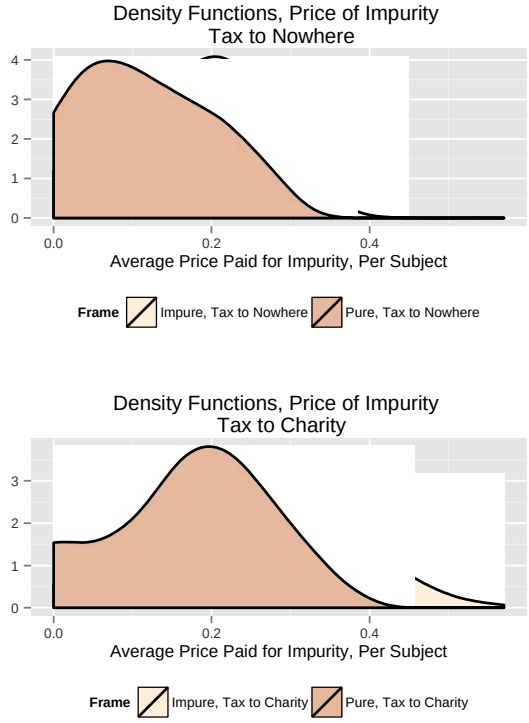


Figure S6: Kernel density functions for *the average price of impurity* across subjects[32]



[32] Three observations which were more than 3 standard deviations from the mean have been excluded from this chart.