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ABSTRACT

The Price of Warm Glow*

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 sacrificed 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 primed between-subjects the emphasis on the donation value to the charity (pure altruism) or the sacrifice to the donor (impure warm-glow altruism). Consistent with the model's predictions, the experiment shows that priming pure altruism increases the efficiency of donation choices, 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.

JEL Classification: D64, D78, H41, C91

Keywords: altruism, warm glow, volunteering, monetary donations, laboratory experiments

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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).

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 comparative static predictions on how behavior changes in response to variation in several parameters (e.g., private wages, taxes and matching donations) depending on the extent to which agents are motivated by pure and impure altruism. The most important model predictions are that agents will donate in a manner which is

more efficient for increasing charity, will pay less for warm glow, and will suffer greater crowd out the more they are motivated by pure rather than impure altruism. The model also offers a comprehensive explanation for the volunteering puzzle (Handy and Katz, 2008).[1] The puzzle emerges whenever people volunteer time despite monetary donation being the more efficient method for providing the charity. To explain the volunteering puzzle, the 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 sacrificed solely in order to consume warm glow effects. This cost of impure altruism measure in essence captures the loss in donations to charitable organizations as donors inefficiently allocate resources to satisfy warm glow rather than purely 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 primed 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 the 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 were primed for pure than impure motives. Second, the inefficiency in donors' allocation choices was significantly higher when subjects were primed for impure than pure motives. We also find a significantly higher price of impure altruism among subjects in the impure than pure prime. Despite the higher degree of inefficiency, subjects gave more to charity overall in the impure than pure prime. This occurs because the impure prime 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. We then

[1] 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).

present our experimental results and discuss implications for future work and policy.

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 sacrifice of money, a separable 'warm glow' from their personal sacrifice 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 sacrifice.

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 *A **impure altruist** is an agent who derives the value of donating to charity solely from the warm glow effects from the costs of their personal sacrifices 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 sacrifices of money and/or time*[2].

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

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

[2] Our definition of a pure, impure and mixed altruist corresponds to Andreoni's (1990) definition of a pure altruist, a pure egoist and an impure altruist, respectively. We thus use the term impure altruist to reflect the utility derived strictly from the warm glow effects derived from the sacrifice of time and money, and the term mixed altruist to conceptually capture the utility from both the pure and impure warm glow motives.

where E is to 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 change the price of warm glow which is proportional only to the sacrifice 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. We use $\{\alpha, \beta\}$ as scaling parameters for the degree of pure and impure utility in her altruistic motivation, where $\{\alpha, \beta\} \in [0, \infty)$

The first argument of the utility function, $x = E - g + (H - h_v)(1 - t)w_p$, is a composite consumption good equal to the income agents keep for themselves. The second argument, $p = P_{-i} + g(1 + m) + (H - h_v)t\lambda w_p + h_v w_v$, is the provision of charity after including the agent's donation. The third and fourth arguments, $q = g \; and \; r = h_v$, respectively, represent inputs to her warm glow from monetary donations and volunteering time. We assume the utility function is separable and increasing in all arguments, twice continuously differentiable and concave.[3]

2.1.1 Pure Altruist

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

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

Proposition 1 *A pure altruist will never simultaneously donate money and time if* $(1 + m)(1 - t)w_p \neq w_v - \lambda t w_p$. *She will never donate time if* $(1 + m)(1 - t)w_p > w_v - \lambda t w_p$ *and she will never donate money if* $(1 + m)(1 - t)w_p < w_v - \lambda t w_p$. *Note that the constraint is generic in the sense that with continuous variables, it should always be satisfied.*

Proof: See Appendix.

A pure altruist is only choosing between the scale of the public good and their own income – as they derive no egoistic satisfaction from donations of money or time, they will 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 $\frac{dU}{dg} = -U_x^{'} + (1 + m)U_p^{'} = 0$

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

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

2.1.2 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 such that, $(1-t)w_p U_x^{'} = (1-t)w_p U_q^{'} = U_r^{'}$. We arrive at the following three comparative statics implicitly differentiating the above equilibrium conditions:

$$(a)\ \{\tfrac{dg^*}{dE}, \tfrac{dh_v^*}{dE}\} > 0, \quad (b)\ \tfrac{dg^*}{dw_p} > 0;\ \tfrac{dh_v^*}{dw_p} \gtreqless 0 \ \text{ and } \quad (c)\ \tfrac{dg^*}{dm} = \tfrac{dh_v^*}{dm} = 0$$

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 total volunteering is ambiguous, however, since an income effect allows agents to afford greater volunteer hours but raises the opportunity cost causing a substitution effect away from volunteering. A change in the matching donation (c) has no effect on donation behavior since the agent has no utility over the size of the 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 agent has no utility over the increase in charity, thus neither the policy variable nor the matching donation appear in the optimal first order conditions.

2.1.3 Mixed altruist

Definition 2.4 *The **cost of impurity** is defined as the additional amount of income an agent sacrifices to give in the dimension that maximizes her utility, rather than the level of the public good, subject to the same level of charitable donation. 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 the agent's choice of $\{\hat{g}, \widehat{h_v}\}$*. , denote the value of this donation choice to the charity as* $V(\hat{g}, \widehat{h_v})$ *and the private cost of this donation to the agent as* $C(\hat{g}, \widehat{h_v})$.

Denote the choice of money and time donations which would maximize the agent's disposable income, x, subject to the value of their donation, $V(\hat{g}, \widehat{h_v})$*, 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:* $C(\hat{g}, \widehat{h_v}) - C(g^*, h_v^*)$.

Since the cost of impurity is, by definition, income the agent chose not to allocate to themselves nor the

charity, by revealed preferences it must be the *minimum amount* they sacrificed to consume *warm glow* utility.

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

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

The price of impurity defines the *minimum proportion* of the agent's sacrifice that was paid for consuming warm glow effects. It is bounded in 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 a donation to charity reduces the voluntary donation of the agent from money or time. The level of crowding out will be considered* ***incomplete*** *if the net provision of charity increases.*

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.

A pure altruist is indifferent to how the charity is provided, whether it is by a voluntary sacrifice or by an involuntarily tax, hence the two are perfect substitutes. However, an impure altruist only obtains warm glow from her voluntary sacrifice; 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 since a taxed donation is an imperfect substitute for voluntary donations.

Proposition 4 *The Slutsky cross price effect (excluding income changes) of the price of the price of donating money on donations of time is decreasing with the scale of warm glow,* α*. I.e., the net substitutability is increasing in* 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 will vary two factors. The first is a prime to exogenously shift the distribution of α; in the pure prime subjects get a certificate which indicates the total value the charity receives from their donation decision and in the impure prime the certificate indicates the

amount of time and money that the subjects donated. The second factor exogenously varied is the use of the tax; it will either be donated to the charity in whole ($\lambda = 1$) or not at all ($\lambda = 0$).

H1: Hypothesis 1. *The cost of impurity and price of impurity will be lower if subjects are primed for pure than impure motives.*

H1 follows directly from Proposition 2. Agents will have heterogeneous α, but if the pure prime successfully reduces α, then large sample properties will ensure that under the pure prime the distribution of α is lower in the pure than impure conditions. We therefore expect the average *cost of impurity* and *price of impurity* will be lower.

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

H2 follows directly from Proposition 3. Assuming the pure prime successfully reduces the scale of α, then large sample properties will ensure that under the pure prime the distribution of α is lower in the pure than impure conditions, and the degree of *crowding out* will be larger.

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

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 priming 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 to dominate, and for the substitutability of money and time donations to increase under a pure prime.

H4: Hypothesis 4. *The effect of the matching donation on donations of money will be greater under a pure priming.*

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 (for example, under 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 sacrifice, the matching donation has no affect on the amount one derives

from impure utility.

Predicting the sign of the effect of the matching donation on the voluntary donation of an altruist with some pure motivation is not possible since increasing the matching donation has two contrasting effects. The first is that by altering the matching donation, the level of the public good is higher for any level of donation – therefore the match allows the agent to sacrifice less, 'crowding out' their initial sacrifice. The second effect is to lower the price of increasing the public good. While the direction is not known, we conjecture that the price effect will dominate the crowding effect (since the price effect may be more salient), and thus the effect of the matching donation will be larger under the pure prime.

4. Experimental Design

4.1 Overview and treatments

In the experiment subjects simultaneously chose how much money and time to give to a charity. Subjects were given a fixed monetary endowment and kept the amount not allocated to the charity. They also kept wages earned during a 40 minute work period which they did not allocate to volunteering 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 lists the *within-subject* allocation decisions given to every subject. The decisions included every combination of (a) two monetary endowment amounts (E = \$15 or \$25), (b) two levels of a match given to the charity based on the monetary donation (match = 50% or 100%),[4] (c) three private piece rate wages per completed envelope (\$0.10, 0.30 or \$0.45), and (d) two tax rates on the private wage (0% or 25%). Table 1 shows all the combinations of the endowment, match, private wage rate and tax rate. Each decision was given with each of the two endowment rates (not shown in the Table). We discuss below the implications of the allocation decision for the charity that is shown in the remaining columns.

We chose the parameters so that in the majority of the decisions money was the efficient dimension to donate (shown in the last column of Table 1) to reflect the conditions for the volunteering puzzle. After the 24 decisions were made, one was randomly chosen "to be played out." Subjects then completed the work for the charity and for the private wage and were paid based on the monetary and time choices they made for the condition randomly chosen.

[4] 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.

Table 1: 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

Table 2 shows the two *between-subjects* manipulations used to examine the effects of (1) pure vs. impure motives and (2) crowding out. Half of the subjects were primed to focus on the value of the donation from the perspective of the time and money they sacrificed. We refer to this condition as our *control/impure condition* 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 primed to focus on the value of the donation from the perspective of the amount that the charitable organization receives. We refer to this condition as our *treatment/pure prime condition* since it focuses subjects' attention on the overall (single) dollar value from the money and time that the charity receives. This directly corresponds to increasing the weighting to β (α) in the *pure prime (baseline)* treatment.

Figure 1 shows the certificates we used to prime subjects in each condition. In the pure prime the certificate showed the amount the charity received from their decisions and in the impure prime the certificate showed the personal sacrifices of money and time the subject made for the charity. The certificate for each prime 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.

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

	Prime (Baseline)	
Tax Policy	**Impure**	**Pure**
Regular tax (= tax to nowhere)	N = 25	N = 25
Tax donated to charity	N = 25	N = 25

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

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 or would go to the charity. The model predicts that crowding will would increase (decrease) with pure (impure) motivations. Thus, the 2x2 between-subjects design lets us directly test the crowding hypothesis; we model predict that when taxes are increased from 0% to 25% overall voluntary donations (net of the tax) would decrease more in the pure than impure prime condition.

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.[5] Subject's and the charity's earnings are the following:

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

Charity Earnings = $g * (1 + m) + \lambda * t * w_p * v_i * (40 - h_v), + \$0.30 * v_i * h_v$,

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

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

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 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, λ * 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 sacrifice that was from the private wage (Columns 4 and 5) and from the monetary donation (Column 6) for each condition. 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.[6] 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 sacrifice 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 more efficient dimension.

4.2 Procedures[7]

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

[6] 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).

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

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 prime by tax to nowhere/charity) within each session so that there was roughly an equal number of subjects per condition in each session.

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 tax 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 online 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.

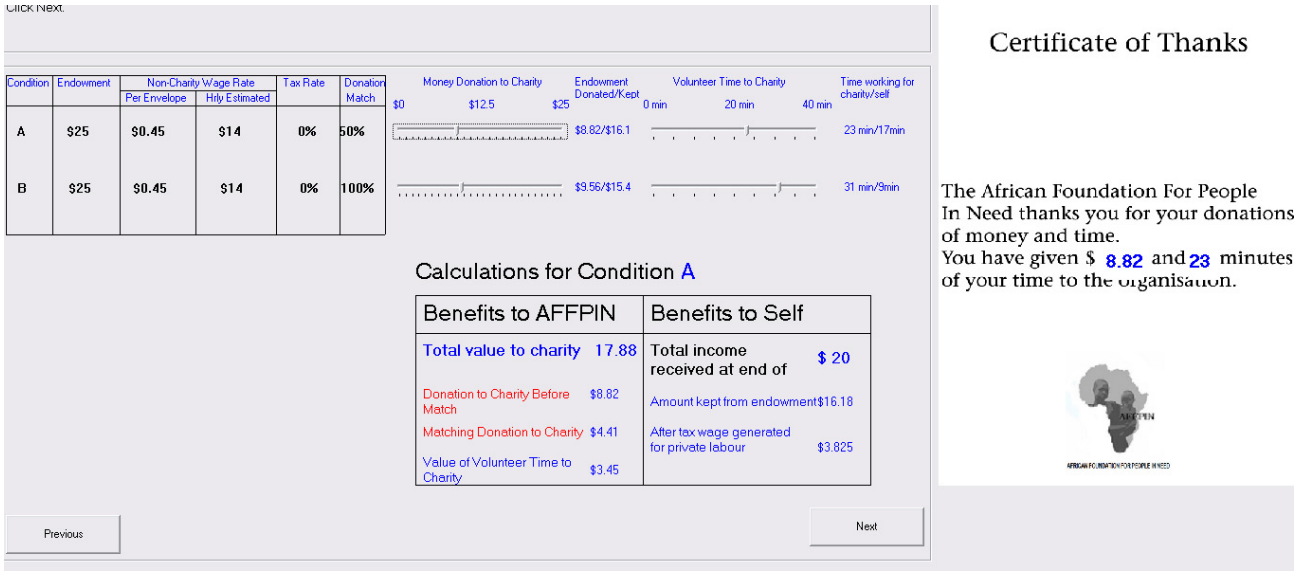
There was significant variance in the speed to complete the task between subjects during this initial task. On average, subjects completed an average of 1.1 envelopes per minute (standard deviation 0.6). Regressions (in Table A1 in the Appendix) shows that each subject's productivity during the piece rate time was a highly accurate predictor of their productivity during the volunteer and work time (adjusted $R^2 = 0.94$); on average subjects completed the task 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 was not significant. Thus, a subject's productivity during the initial four minute piece rate task provided an accurate measure of how productive they were going to 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 prime condition. The upper left part of each decision screen presents the parameter values for each decision including the endowment, private wage (per envelope and estimated hourly) rate, 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 sliders 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 was chosen. It was constantly updated as the subject moved the slider to indicate the choices they were considering. *The only difference between the pure and impure prime was the presence of the certificate.* In both primes, 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 primed subjects rather than assisted them 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. The order of the six screens was determined randomly in order to control for potential order effects. To further control for

order effects, we allowed subjects to move backwards and forwards across the decision screens and change their choices as often as they wished.[8]

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. We included the practice exercises and criteria[9] 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, and 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 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 would be unaware of the between subject variation in the pure/impure prime 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 (Table A2 in the appendix) in the pure and impure prime conditions for all the questions in our survey 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 a few small differences between the characteristics of the subjects in the pure and impure prime conditions, none reach a 5% level of significance and all but one reach significance at the 20% level.

[8] In regressions (not shown) we can never reject the null hypothesis of no order effect on choices.
[9] The practice questions are presented in the Supplemental Material.

5. Results

5.1 Overview of the experimental results and theoretical hypotheses

On average subjects conform to all four hypotheses of our model and exhibit diminishing warm glow effects on money and time donations. We also find that donors are motivated by a mixture of both pure and impure altruism and that no subject who contributed to charity consistently gave in the dimension that maximized the overall level of charity. Most importantly, policy variations change behavior in the predicted direction.

Table 3 presents summary statistics on the monetary donations and volunteer time, the amount of money the charity receives and the price of impurity. We first discuss the *between-subject* treatment effects. Rows 1 and 2 show that subjects donated 7% ($6.07/5.60) and 32% (17.0/12.9) more money and time, respectively, in the impure than pure prime. The impure prime thus resulted in a 12% ($1.83/$15.53) additional value to the charity. Rows 3-6 show that the greater amount of money and time donated to charity in the impure prime is especially large when the tax is given to the charity; rows 5 and 6 show that subjects donated 12% ($5.99/5.36) and 58% (17.7/11.2) more money and time, respectively, in the impure than pure prime when the tax was given to the charity.

The two between subject manipulations show that crowding effects are stronger in the pure than impure treatment. In the pure prime, subjects gave less money and time to charity when the tax was given to the charity whereas in the impure treatment subjects gave only a little less money and donated more time to charity than when the tax was given to charity. This behavior resulted in a 15% greater provision of the public good where the tax was donated to charity under the impure prime, but only a 6% greater provision under the pure prime. Figure 3 shows that the crowding out is very pronounced under the pure priming, resulting in no statistical difference in the overall provision to the charity, but is negligible under the impure prime. Figure 4 shows that the sacrifice in donations is accordingly lower in the pure prime with the tax going to the charity than to no where while the sacrifice in donations is essentially the same in the impure prime condition whether the tax is given to the charity than to no one.

The lower half of Table 3 shows the comparative static results for the *within subject* manipulations. All four within subject manipulations show the anticipated substitution and cross price effects. First, higher wages led to less time volunteering and greater monetary donations. Second, increasing the endowment increased both the monetary donation and time volunteering. Third, increasing the tax on private wage resulted in subjects working more for the charity (less for themselves) and giving less money to the charity. Fourth, increasing the match rate resulted in giving more money but less time to the charity. The cross price effects suggest that donating time and money are substitutes but not perfect substitutes because subjects are not pushed into a corner solution of donating all money or all time. The imperfect substitution highlights the importance of distinct impure motives across volunteering time and donating money. On the other hand, since subjects exhibit substitution effects when the price of charity is altered via the matching donation, pure motives must exist also. In the regressions below we will further show that these cross price effects persist

after controlling for the income effect.

Table 3: Summary statistics

Conditions	Money Donation ($)	Time Donation (minutes)	Total value to charity ($)	Income Kept ($)	Income Sacrificed ($)	Cost of Impurity ($)	Price of Impurity ($)
Between Subjects							
Impure Prime	6.07	17.0	17.36	20.96	9.90	1.42	0.212
Pure Prime	5.60	12.9	15.53	21.94	8.18	2.12	0.158
Impure: Regular Tax	6.15	16.2	16.16	21.32	9.89	1.61	0.169
Pure, Regular Tax	5.84	14.5	15.11	21.91	8.90	1.00	0.111
Impure, Tax to Charity	5.99	17.7	18.56	20.60	9.92	2.62	0.256
Pure, Tax to Charity	5.36	11.2	15.95	21.97	7.46	1.84	0.205
Within Subjects							
Low Wage	4.33	20.2	15.19	17.58	6.12	1.70	0.215
Medium Wage	6.02	13.9	16.51	21.41	9.70	1.24	0.14
High Wage	7.15	10.6	17.64	25.35	11.31	2.36	0.199
Low Endow	4.45	13.0	13.49	18.32	7.17	1.44	0.181
High Endow	7.23	16.8	19.40	24.58	10.91	2.09	0.189
No Tax	6.18	13.7	15.10	22.46	9.52	1.68	0.164
25% Tax	5.49	16.1	17.79	20.44	8.55	1.85	0.206
50% Match	5.32	15.5	14.24	21.83	8.66	1.70	0.184
100% Match	6.35	14.3	18.65	21.07	9.42	1.84	0.186
μ	5.84	14.9	16.45	21.45	9.04	1.77	0.185

Figure 3: Average Public Good Value Raised per subject

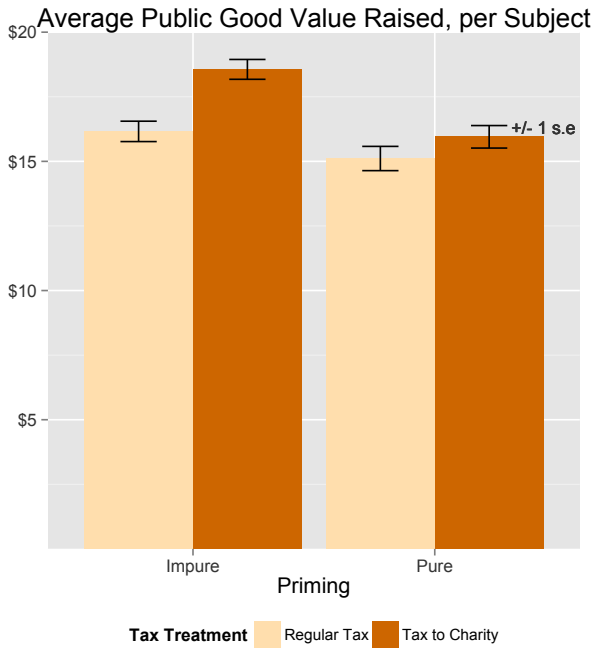
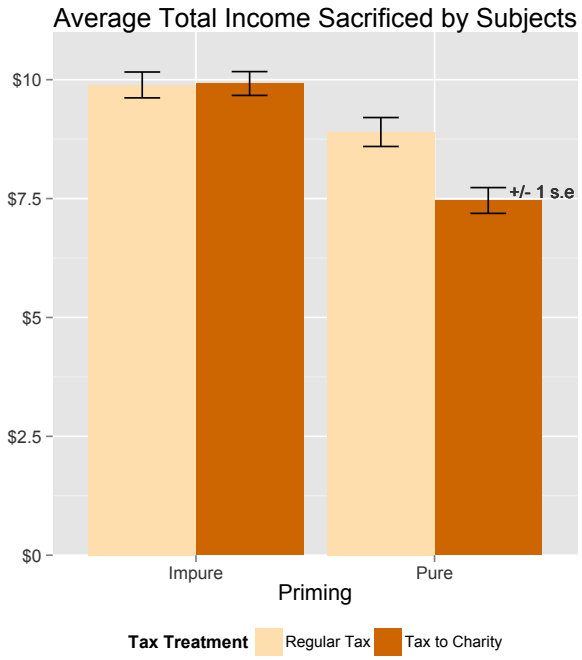


Figure 4: Average sacrifice per subject, by Treatment



5.2 Pure and Impure Effects

The asynchronous relationship between the money and time sacrifices each donor makes and the amount the charity receives implies that donors must be paying for something that does not increase in the provision of the charity. This behavior can be clearly explained by impure altruism that has been discussed throughout the literature and presented in our model. We now go one step further to estimate the price that donors paid in order to maximize their *own* utility of donation at the expense of maximizing the public good.

In Section 3 we defined this shadow cost as the *Cost of Impurity* – the amount of income subjects sacrificed in their choice which is above the minimum amount they could have sacrificed, while still providing the same level of charity (i.e. if they donated in the efficient dimension). To normalize this cost (since subjects sacrifice different amounts), we divide this amount by their total sacrifice, and call this the *price of impurity*. Therefore, the *price of impurity* is the *minimum proportion of their total sacrifice* that must have gone to maximizing their utility from 'warm glow.' The *first hypothesis* predicts that this *cost of impurity* and proportion (the *price of impurity*) would be lower under the pure prime. We find support for this hypothesis.

In two thirds of conditions (Table 2, last eight rows), if a donor wanted to make a personal sacrifice to increase the level of charity, the efficient dimension was to work for herself and donate some of this wage to charity. Hence in these conditions, the cost of impurity arises from volunteering. In the remaining third of the conditions (Table 2, first four rows), it arises from monetary donations. Figure 5 shows that the average cost of impurity for subjects in the baseline (impure prime) is notably higher than in the pure prime; on average, the cost is $0.70 higher, or nearly 50% (2.1/1.4) relatively higher, in the impure than pure prime.

Figure 6 shows density functions for the shadow price of impurity, per subject, in each condition, and shows significant heterogeneity in the prices paid for impurity. Under the impure prime, the distribution of the average prices each subject paid for impurity is relatively normal (though censored at 0 for subjects who chose not to donate). In the impure prime the average price paid for impure motives per dollar sacrificed was about 0.21, though under the pure prime the average price paid per dollar sacrificed decreased on average by about 25% to 0.16. Figure 6 shows that subjects had a large degree of heterogeneity in the strength of their impure motives, but the prime effectively shifted the distribution to the left fairly uniformly. Thus, the manipulation to change the preview of the certificate that agents would receive was sufficient to considerably reduce the inefficiency of allocation decisions.

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

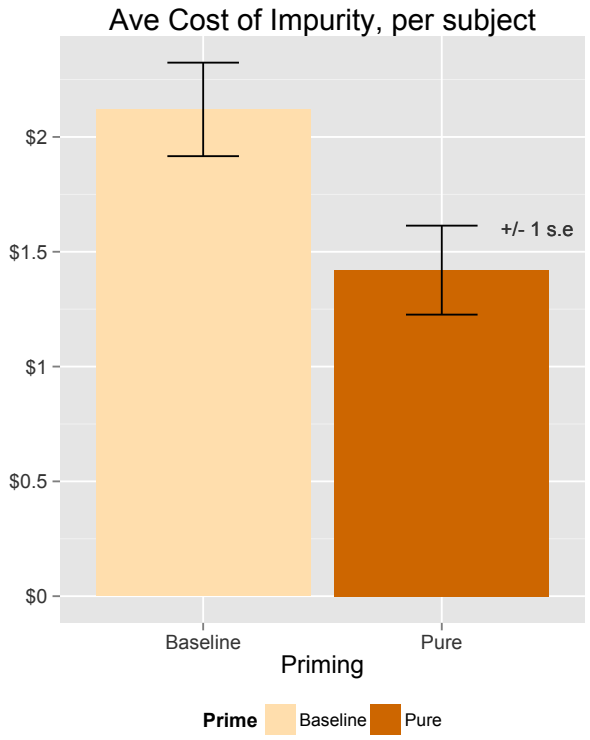
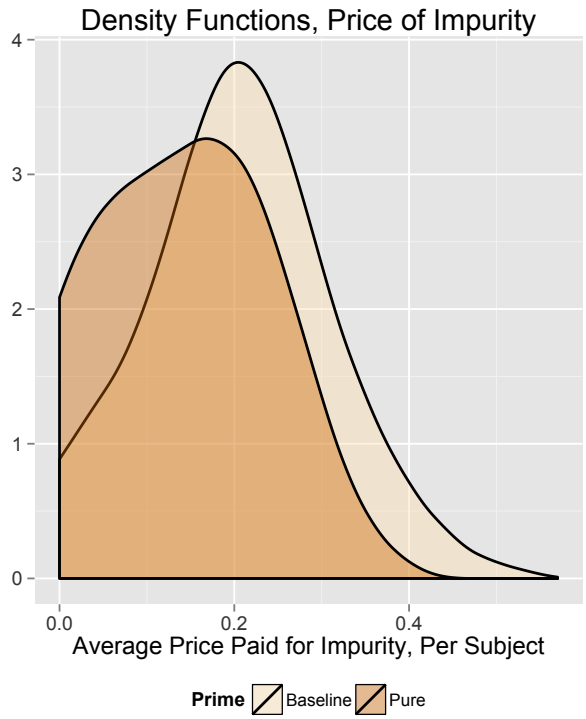


Figure 6: Kernel density functions for *the average price of impurity* across subjects[10]



To test the significance of the prime on the shadow price of impurity, we regress this price on the prime and control for demographic and educational factors. Since only the certificate to prime either pure or impure motivations differed, a negative significant response in the dummy variable for the pure prime supports the hypothesis that subjects chose inefficient methods of donating due to (diminishing) warm glow effects. Table 4 presents the regression results which support the *first hypothesis*. The regressions include one observation

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

per subject and include robust standard errors at the subject level since each subject worked independently in the experiment. We estimate left-censored tobit regression models since nine percent of the observations are censored at 0.[11] Column 1 shows the average effect of the pure prime, Column 2 includes all the survey variables we collected and Column 3 shows the estimates with only the significant survey variables.

The estimates indicate that the effect of the pure prime is statistically significant, economically large and robust across all three specifications with or without controls. The pure prime resulted in subjects paying 5.5 cents less on each dollar of their total sacrifice for impure effects, which is 25% less than the baseline (pure prime) average price of 21 cents on each dollar of their sacrifice.

[11] For robustness we re-estimated the models in Columns 1-3 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.

Table 4: Determinants of Price Paid for Impurity

	Dependent Variable: Subject's Average Price of Impurity		
	(Tobit)	(Tobit)	(Tobit)
Baseline (Impure) Average	*0.21*	*0.21*	*0.21*
Constant	0.210***	0.348***	0.200***
	(0.018)	(0.133)	(0.011)
Pure Prime	-0.063**	-0.055**	-0.055**
	(0.033)	(0.028)	(0.028)
***Survey Data*:**			
Money Donated (100s)		-0.000	
		(0.000)	
Hours Volunteered		-0.001*	-0.002**
		(0.001)	(0.001)
Weekly spend		-0.000	
		(0.001)	
Female		0.013	
		(0.032)	
Difficulty Understanding		-0.027	
		(0.052)	
Economics Major		-0.101*	-0.102**
		(0.052)	(0.051)
Business Major		-0.095*	-0.103**
		(0.050)	(0.048)
Math/Sci/Eng Major		-0.069	-0.084*
		(0.054)	(0.052)
Arts Major		-0.065	-0.067
		(0.058)	(0.056)
ATAR/UAI: (range 70-100)		-0.002	
		(0.001)	
Hrs Paid Work		-0.001	
		(0.002)	
Household Income (100,000s)		0.063**	0.038*
		(0.026)	(0.022)
Worthwhile Charity (1-7)		0.003	
		(0.010)	
Survey Impure Proxy (1-7)		0.030***	0.028***
		(0.009)	(0.009)
Research charities before donating		-0.013	
		(0.068)	
Log-likelihood^	35.8	47.1	44.7
N	100	100	100

Standard errors in parentheses/p-values; * p < 0.1, ** p < 0.05, *** p < 0.01
^ Positive log-likelihood values (Canette, 2011)

The estimates in Column's 2 and 3 reveal two other factors that explain the price of impurity. First, students majoring in economics, business, math or sciences (rather than arts and humanities) and students with higher university entrance exam scores (ATAR/UAI) had a lower price of impurity. While these characteristics could reflect heterogeneous preferences for warm glow, they may alternatively reflect more attention to the decisions or cognitive ability to avoid making inefficient choices. Second, the estimates also show that subjects with higher income and those who indicated that they had higher impure motives on our survey question[12] paid a significantly higher price for impurity. The higher income result is interesting as it is consistent with subjects coming from wealthier families that may derive greater benefits from appearing altruistic and thus garnering more utility from warm glow (e.g., Becker 1974).

5.3 Donations of Money and Time

Demand for donations of money and time $\{g, h_v\}$ are functions of all of the experimental variables. To directly link the experimental variables to the theory, we make the following transformations:

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

The first transformation constructs the *total potential income* available to the agents and is thus their budget set from which they "consume" monetary donations and volunteer time. The income effect can thus be cleanly estimated using the exogenously determined experimental factors. The second term is the opportunity cost for each minute of volunteer time – the after-tax private wage rate. The third term is the "price" of giving money to charity.

We also designed the experimental conditions to directly measure crowding effects. Specifically, recall that each decision that involves a compulsorily tax donation to the charity has an identical condition that does not involve the tax. This allows us to construct two variables which represent *complete* crowding out of donations – one for the endogenous change in money and one for the endogenous change in time that would completely crowd out the provision of the donations through the tax (we define these variables in Section 5.3.3 below). The coefficients for these variables measure the degree of crowding from 0 and 1, where 1 represents crowding out that fully offsets the contribution and 0 represents no crowding.

The three constructed variables plus the two crowding out variables make up the regressors, denoted $\widetilde{\mathbf{X}}_{\mathbf{it}}$. We estimate a joint Multivariate model[13] to allow for cross correlation of error terms since subjects

[12] 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)."
[13] Also referred to as Seemingly Unrelated Regression Equations

simultaneously chose money and time allocations for each condition.[14] 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. The relation is estimated by 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 (income and the price of giving money and time) using a log-linear model since it provided the best overall fit. For the two crowding variables we estimated their linear effects s that the coefficient can be directly interpreted as the degree of complete crowding out. 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.[15] Table 5 presents the results of the estimation (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 prime condition. Thus, the even rows show the effect of each variable in the impure prime condition and the odd rows show the additional (differential) effect in the pure prime condition.

[14] 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.

[15] 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)
1	Pure Prime	-8.87** (2.62)	-47.0** (5.32)
2	Y_{max} (potential income)	9.15*** (0.428)	12.7*** (1.28)
3	Y_{max}*Prime	0.770 (0.633)	-2.94 (1.85)
4	p_g (= price of money donation)	-3.08** (0.534)	3.78* (1.61)
5	p_g*Prime	-3.12*** (0.794)	2.18 (2.37)
6	p_v (= price of time donation)	-0.313 (0.174)	-10.5*** (0.526)
7	p_v*Prime	-0.052 (0.252)	-1.04 (0.754)
8	Crowding out	0.128 (0.13)	-0.018 (0.047)
9	Crowding out *Prime	-0.602** (0.199)	-0.146* (0.074)
	ρ	0.24***	
	N	2400	
	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 prime on monetary and time donations. Subjects donated significantly less time and money in the pure than impure prime. These estimates corroborate the lower amount given to charity shown in the top half of Table 3 and in Figures 3 and 4, and adds to those overall effects by showing that the effect occurs for both time and money donations. We now present the core analyses.

5.3.1 Income and own price effects:

Rows 2 and 3 show that donations of money are time are elastic at the mean level of donation (Row 2) and do not differ significantly between the two prime conditions (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.[16] We find that donations of time are relatively income

[16] The average money donations in the baseline (impure) and pure treatments were $6.07 and $5.60 respectively (Table 3). Thus, a

inelastic; a 1% change in total potential income has an expected marginal increase in volunteer time of 0.13 minutes in the baseline treatment, approximately 0.8% of the mean time donated[17]. Menchik and Weisbrod (1987) report similar estimates in their field study.

Rows 4 and 5 show the estimated effects of varying the price of the monetary donation (in the experiment, this occurred by exogenously varying the match rate). Row 4 unsurprisingly shows that the increase in the cost to donate leads to a significant decrease in monetary donations. Now, recall that since warm glow utility derives from one's personal sacrifice, the matching donation has no affect on the amount one derives from impure utility. As such, our model predicts that the effect of the matching donation will therefore be stronger under the pure prime. Our results confirm this hypothesis – Row 5 shows that the price effect of donating money (from the matching rate) is statistically and economically significant. Moreover, the marginal effect is twice as strong under the pure than impure priming, in support of *hypothesis 4*. We also find that the effect of the match is price-inelastic at the mean donation level under the impure prime (0.5), and price elastic at the mean donation in the pure prime (1.1) at the respective mean donation levels.[18]

Rows 6 and 7 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 under the pure priming.

5.3.2 Cross price effects:

To the extent that altruistic motivations have a pure element, donations of money and time will be substitutes. We find that *hypothesis three* has some support, though the evidence is mixed. Rows 4 and 5 show that an increase in the price of donating money to the public good increases the time volunteering. We find a 1% increase in the price of monetary donations increases demand for volunteering by about 0.04 minutes (Row 4) or approx 0.2% of the mean under the impure prime. Row 5 shows that this cross-price effect of monetary donations becomes 60% stronger under the pure prime, demonstrating that the two donations have become more substitutable. However, though the result is economically large, it does not reach the level of statistical significance within our sample.

Rows 6 and 7 show that the price of volunteering has an estimated negative marginal effect with respect to donations of money. This suggests that although donations of money are a gross substitute for volunteering, donations of time are a gross complement for donations of money - an inherent contradiction. This is likely due to the fact that the variable, Total Potential Income, is constructed so that the endowment and wage

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$0.09 increase in donations is an approximately 1.5% increase ($0.09 / $6.00), for an elasticity of 1.5 = 1.5% / 1%.

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

[18] 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 sacrifices 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.

earnings are treated identically. There is experimental evidence that donations during experiments are more readily parted with 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 polluted by subjects treating earned income differentially to "gifted" income.

5.3.3 Crowding out effects:

We designed the experiment to cleanly estimate crowding effects. Specifically, recall that for every choice in which a tax was levied (Table 1 Rows 3-4, 7-8 and 11-12), an identical choice was made where a tax was not levied (Table 1 Rows 1-2, 5-6 and 9-10) and, for half the subjects, this tax is compulsorily donated to charity (Table 2). Observing each agent's donation choices under ceteris paribus identical conditions with and without the tax to the charity, we can estimate a coefficient of crowding out using our panel of data.

Formally, let the monetary amount an agent has donated to charity be g with a matching rate of $1+m$, so the value of their monetary donation is $g\cdot(1+m)$. Now say the government introduce a tax of t on her private labor, for which she earns a wage w_p and the proceeds of the tax are donated to the charity. If she kept her monetary donation and volunteer time choices $\{g, h_v\}$ constant under the tax, she would generate a total value to the charity of $g\cdot(1+m)+(40-h_v)\cdot w_p \cdot t$. Now let us denote a choice of donation which fully crowds out the tax imposed by the government as g'. Thus, the reduction in donated money which fully crowds out the tax is $\Delta_g = g - g'$. We can express Δg in terms of h_v, w_p, g and t. Assuming the agent's productivity is a folding rate of 1 envelope per minute,[19] to offset it fully, the agent must reduce her donation by:

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

Note that this complete 'money crowding out' variable is derived strictly from the exogenous experimental variables h_v, w_p, and t, and the subject's choice g in a different (independent) condition. 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 volunteering, complete crowd out occurs when:

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

Table 5 Row 8 present the estimated coefficients on these variables for the impure prime and Row 9 presents the added effects for the pure prime condition. The sum of these variables forms the overall crowd out estimate over both the monetary donation and volunteering decision. [20]

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

[20] 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

Hypothesis 2 is supported by the estimated crowding out effects. Row 8 shows that with the impure prime there is no statistical or economic significance to the crowding out variable. This evidence suggests that taxed donations are not crowding out voluntary donations on average when subjects were primed to value charity donations impurely (in terms of their private sacrifice). Under the pure prime, however, we find that crowding out is statistically and economically significant for donations of both time and money separately; subjects donated significantly less money and significantly less time when a tax was introduced that went to the charity in the pure than impure prime. Moreover, these effects are economically substantial; we find that the overall degree of crowding out is almost 64% under the pure prime when we combine the effects of crowding out of both money and time donations.[21]

Finally, the government provisioning of the charity crowded out the monetary donations more than time donations. This suggests that the warm glow effect of volunteering is stronger than that of donating money since it makes government provisioning of charity a weaker substitute for volunteer labor than for donations. This conclusion is corroborated by the results presented in Brown et al. (2013).

6. 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. Joint donation behavior arises 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 subjects are primed on pure rather than impure motives. 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 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 donors are primed on the level of the public good rather than their own warm glow. Given this substitutability, future

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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.

[21] The overall degree of crowding out is the sum of the crowding out of money donations (-0.474 = -0.602 + 0.128) and the crowding out of volunteer donations (-0.164 = -0.146 – 0.018)

empirical studies of altruism will benefit by considering effects on both dimensions of altruistic giving in 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 prime at least 21% of subject donations were given solely in order to consume 'warm glow.' The pure prime reduced the shadow price of warm glow consumption by an estimated 5.5 cents per dollar of sacrifice (Table 4), and was 25% less in the pure than impure prime.

The results also have implications for policy. Two policy tools were examined 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 approximately one half times larger in the pure prime, demonstrating that as agents think in purer terms, 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. As another example, 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 prime is a proxy for this strategy; while subjects primed under a pure prime acted in a more efficient manner, they sacrificed less for the charity overall and consequently the total provisioning of charity declined by 10%.

There are several important questions the current study has not addressed. In our study we do not account include 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 volunteering 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. This information would possess particular value to policy makers seeking to minimize the crowding out effect 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:

1. 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:

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

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

Combining these two FOCs, we arrive at $(1+m)(1-t)w_p \neq w_v - t\lambda w_p$ 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

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

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

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

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

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

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.

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 $\hat{V}$.

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, the re 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 $\frac{dg^*}{d\lambda} \cdot (1+m) + \frac{dh_v^*}{d\lambda} \cdot \left(w_v - \lambda t w_p\right)$, 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 *net* 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 *Slutsky*, 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:

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

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

Hence

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

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

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

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

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

2. **Appendix Table A1**

Robustness check:
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.

3. Appendix Table A2

Demographics of Lab Subject, Overall and by Treatment

Survey Data	All Subjects	Baseline: Impure Prime	Treatment: Pure Prime	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%	52%	56%	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)	85.0 (11.5)	84.9 (12.0)	0.989
Household Income	$91,588 ($63,670)	$88,950 ($65,243)	$94,225 ($62,689)	0.827
Pure Proxy: "charity worthiness" (1-7)	4.8 (1.5)	5.1 (1.5)	4.5 (1.5)	0.052
Impure Proxy: regret donating to unsuccessful cause (1-7)	3.0 (1.7)	3.2 (1.7)	2.9 (1.6)	0.473
Difficulty understanding experiment	10%	6%	14%	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:

a. Recruitment Advertisement

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".)

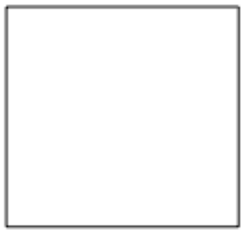
With kind regards,

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	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