On Time and Money Donations
(preliminary)

Lorenzo Cappellari Paolo Ghinetti Gilberto Turati

September 7, 2006

Tutt'e tre stesero la mano verso colui che usciva [dall'osteria] con passo franco, e con l'aspetto rianimato: nessuno parlò; che poteva dir di più una preghiera? <<La c'è la Provvidenza!>> disse Renzo; e, cacciata subito la mano in tasca, la votò di que' pochi soldi; li mise nella mano che si trovò più vicina, e riprese la sua strada. La refezione e l'opera buona (giacchè siam composti d'anima e di corpo) avevano riconfortati e rallegrati tutti i suoi pensieri.

[A. Manzoni, I promessi sposi, Cap. XVII, 1840-42]

The three beggars stretched out their hands to Renzo, as he left the inn with a free step and reinvigorated air, but none of them spoke; what more could language have expressed? <<There's a God-send for you!>> said Renzo, as he hastily thrust his hand into his pocket, and, taking out his last pence, put them into the hand that was nearest to him, and went on his way. The refreshment, and this good work together (since we are made of both soul and body), had gladdened and cheered all his thoughts.

[A. Manzoni, I promessi sposi (The bethrothed), Vol. XXI. The Harvard Classics. New York: P.F. Collier & Son, 1909–14; Bartleby.com, 2001]

1 Introduction

It is commonly observed that, while sharing a common orientation toward democracy and a free market economy, Europe and U.S. differ widely about the role assigned to the State. One dimension in which differences are marked is in the numerous taxes, transfers and regulations that may be grouped under the label "Welfare State", i.e. all the public activities devoted to helping and protecting the poor. Recent papers (e.g. Alesina, Glaeser, Sacerdote, 2001) have argued that European and U.S. Welfare States differ because American society is more racially fragmented, and this - in turn - might have shaped individual beliefs about what determines income. In particular, the authors suggest that according to data provided by the World Values Survey, U.S. citizens seem to believe personal income and wealth are mainly driven by individual effort, whereas Europeans are more prone to the idea that luck determines personal success.

Given these premises, it is not at all surprising that another much less explored, but highly interrelated dimension along which Europe and U.S. differ is in giving and volunteering. Comparative studies are quite rare, due to data constraints, and explanations of the huge variations across countries are often linked to differences in government social spending; see e.g. the macro-structural approach discussed in Salamon and Sokolowski (2001), analysing differences in volunteering. Exploring dissimilarities in money giving between U.S. and U.K., Wright (2002) claims that "philanthropy" (in the U.S.) differ from "charity" (in the U.K.) with respect to the level of donations, the characteristics of donors, and even the methods used to donate; in particular, while the overwhelming majority of donations in the U.S. can be seen as a "planned activity" (with instalments to be paid on a regular time base), giving in U.K. is more spontaneous and based on "spare change" methods. Once again, these differences are explained by the author with cultural diversities as for the role of the State and the attitudes toward money and wealth, as well as by the tax treatment of donations. More specifically, tax incentives for money giving are well established and of significant size in the U.S. tax code since the eighteenth century, while until very recently, no general tax benefits were available in the U.K.

Coherently with these stylised facts, a large body of the empirical literature on time and money donations - mainly based on U.S. data - has been devoted to the estimation of the tax-price elasticity of money (and time) donations, while much less attention has been devoted to developing a behavioural model accounting for a full set of individual choices with respect to the allocation of income and time, more coherent with a "spare-change" approach to giving. In this paper we try to fill this gap. We first present an extended labour supply framework accounting for both types of donations. Endogenous income can be used for consumption of private goods or donations to charities, while time can be allocated to labour, volunteering, housework and leisure. Consistently with previous literature, the main goal of the theoretical model is to derive a set of predictions, in particular on the expected relationship between the two forms of giving. These predictions are tested in the second part of the paper, which contains the empirical analysis and considers a cross-section of individual data drawn by the year 2000 "Multipurpose Survey" conducted by ISTAT (the Italian National Statistic Institute) to collect information on many dimensions of households' everyday life.

The contribution of the paper to the growing literature on time and money donations is twofold. First, we build a theoretical and empirical version of a model that accounts simultaneously not only for choices about the two types of giving, but also for choices about other two important activities - household and market work - that are likely to have an important impact on charitable gifts. Second, we investigate the relationship between time and money donations by looking at the extent to which the two processes are correlated through unobservervables across equations. In this respect, we slightly depart from the standard approach, according to which two choice variables are positively or negative related depending on whether they are, at the margin, complements or substitutes (e.g.

Andreoni, Gale, Scholtz, 1996). However, at the empirical level it is often not obvious how elasticities can be obtained for giving activities, since their (shadow) prices and opportunity costs are typically unobservable, and can only be approximated. For this reason, a direct estimate of the correlation between voluntary labour and pecuniary gifts may add additional insights on the way in which individuals are likely to substitute between contributions of time and of money.

Knowledge of whether time and money donations are correlated is important for at least two reasons. From a positive point of view, it allows to shed additional light on the determinants of individuals' (optimal) behaviour into important fields, where economic factors and social norms, as well as cultural effects, are intrinsically interconnected, and of which much more needs to be known. From a normative point of view, a better understanding of the mechanisms through which, taking into account choices about both domestic and market work, people reallocate time and money resources between voluntary work and money donation may have important policy implications, both for charities and the government alike (e.g. for the design of a optimal fund-raising scheme, or of a optimal tax-deduction scheme).

Controlling for a set of observable individual characteristics - capturing individual tastes and economic constraints - as well as for the (negative) latent relationship between hours of work in the market and at home, main results indicate that (unobserved determinants of) voluntary work and money donation are positively related, i.e. a positive shift of time donations brings about a shift of the same sign in money donations. In the light of our theoretical model, this would imply that, under the assumption that volunteers are at most as productive as paid workers, the largest fraction of people do not have intrinsic preferences for one activity against the other.

The paper is organised as follows. In the next section we review the literature focusing on time and money donations, from different perspectives (i.e. from an economic, sociological and psychological point of view) The third Section introduces the theoretical framework and discusses some implications for the empirical analysis. Section four describes the data and some descriptive facts about the relationship between volunteering and gifts of money, which are further investigated in Section five, that presents, in sequence, the econometric model and the main results. Concluding remarks follow.

2 Literature review

The theoretical and empirical literature has identified several variables that can affect the amount of money donations and of time volunteered. In this section we briefly review the relevant papers, grouping all the works according to the variables they consider. In particular, we focus on whether they consider individual preferences and attitudes, charities behaviour, or government behaviour as determinants of donations.

Individual preferences and attitudes. A first group of determinants of money and time donations is represented by people preferences and attitudes. However, identifying such variables within the utility maximisation framework, and distinguishing between different explanations, is not an easy task. Indeed, in his review, Andreoni (2005) suggests that philanthropy is one of the greatest puzzles for economics, because a science based on precepts of self-interested behaviour does not easily accommodate a behaviour of such clearly unselfish sort. How can one reconcile unselfish actions with self–interest? Andreoni proposes five answers: a) charitable giving is not unselfish at all, because giving is directed at buying a certain (future) service (e.g. donations to opera houses to obtain new and better performances in the future); b) "enlightened self-interest" (a sort of "expected" reciprocity) suggests that people donate because they hope - in the event of being in needs in the future - to receive help from others; c) altruism, i.e. people care about well-being of others or of society at large; d) "warm glow", i.e. people get utility

from the *act* of giving itself; e) moral motivations and moral codes of conduct, that make economics ill-suited to explain philantropic activities.

All these variables - even the last (e), that represents the "last refuge" for the economic theorist - has been considered in the theoretical literature by including additional terms to the utility function. For instance, (a), (b) and (d) above can be modelled by adding the amount of money donations (as e.g. in Smith and Chang, 2002), and the amount of hours volunteered or the value of time volunteered (as e.g. in Andreoni, Gale and Scholz, 1996). Variable (c) can be included by either considering the individual contribution to the provision of a (pure) public good (e.g. Duncan, 1999; Marcuello and Salas, 2000; Andreoni, 2005), or the "total" utility derived from the contribution of both time and money. The implicit assumption is that the utility of other people is directly influenced by the amount of public good supplied, or by the total amount of charitable giving. Finally, variable (e) is related to a more rich model of human behaviour, and can be taken into account by modelling "intrinsic motivation", as in Benabou and Tirole (2003, 2005), building on psychological literature.

Indeed, a great deal of theoretical research has been devoted in the last years by economists to include psychological factors as explanatory variables of philantropic activity into a model of individual behaviour. And the idea that psychological factors might play a role in explaining non-selfish behaviour is well grounded in the empirical literature. For instance, Lee, Piliavin and Call (1999) study similarities and differences in time, money and blood giving by referring to the concept of role-identity. The basic idea is that everyone of us has a role-identity as a donor, insofar it is inserted in a network of social relationships. They identify several variables that can have an impact on role-identity: the expectations of others on our behaviour; the presence of a close parent acting as a "model"; the past receipt of help, that can activate reciprocal behaviour; personal norms of moral obligations. All these variables influence individual preferences and attitudes, and impact on the utility people get from their decisions on how and to what extent donate.

Perhaps the most comprehensive theoretical model of prosocial behaviour is that proposed by Benabou and Tirole (2006). They identify three different channels through which people can get utility from donations: intrinsic motivation, self-image, and social esteem. Intrinsic motivation refers to people being altruistic, i.e. people caring about the overall level of public good produced by a given organisation. The interest in their self-image can be interpreted as "warm glow". In this way, individuals get satisfaction from the very act of giving as in Andreoni (1990) and Menchik and Weisbrod (1987). Social esteem is a more novel concept - at least in the economic literature - since it refers to people's reputational concerns, i.e. to the fact that they care about how the others perceive them (i.e. whether they consider them as being altruistic or not). In this framework, donations act as a "signal" and are driven by the desire to appear generous and to receive social approval (e. g. Harbaug, 1998; Ellingsen and Johannesson, 2003). Ellingsen and Johannesson (2003) show that the informational content of time and money donation is different; in particular, giving time is better than giving money when signalling is the primary goal. Benabou and Tirole (2006) study how monetary and non-monetary incentives interact with these three behavioural determinants.

Charities behaviour. A second group of determinants is represented by charities' actions. Suppose a given nonprofit organization pursues the goal of increasing donations. The economic literature has analysed two different strategies, one based on fund-raising expenditures, the other based on publicly reporting the amount of past donations. As for the first strategy, Khanna and Sandler (2000) has suggested two countervailing effects of fund-raising expenditures: on the one hand, they can increase the amount of donations by giving relevant information to potential donors; on the other hand, individual contributions can decrease the higher is the fraction of donations spent for fund-raising, as this reduces their "effectiveness". The empirical literature generally finds the first effect to dominate the second one (e.g. Khanna and Sandler, 2000; Marcuello and Salas, 2000). As for the second

strategy, Harbaugh (1998) studies the optimal reporting scheme for not-for-profits organisations that want to maximise the volume of collected donations. Benabou and Tirole (2006) suggest that greater publicity has a counter effect on pro-social behaviour, since it introduces additional noise in the "signal", as donations become suspected of being motivated just by social esteem.

Government behaviour. A third group of determinants of time and money donations is government behaviour. Governments can influence individuals by using both sides of the public budget. On the one hand, a strand of literature has explored the crowding-out effect of government grants, on the premise that public and private donations are close substitutes. Khanna and Sandler (2000) has shown that - contrary to expectations - public grants crowd-in private donations, since they can be considered a signal of quality for the services produced by not-for-profit organisations. On the other hand, many authors have considered the impact of tax deductibility on money donations, by calculating the elasticity to their tax price. For instance, Andreoni, Gale and Scholtz (1996) have determined that eliminating tax deductibility in the U.S. would imply a 5.7% loss in donations.

While we accept that, especially in the U.S., both government and charities behaviour can have a sizeable impact on time and money donations for the presence of widespread tax incentives, in this paper we follow a "spare-change" approach to giving, and claim that choices are primarily driven by individual preferences and attitudes. Coherently, in the next section, we develop a general theoretical framework for understanding charitable giving, and derive some testable predictions on individual behaviour.

3 Theoretical framework

As discussed in the introductory section, our behavioural model extends the static labour supply framework to account for both time and money donations, as well as for domestic work. The primary scope of the model is to derive a set of working implications to be tested in the empirical analysis. Accordingly, detailed derivations are confined to a specific appendix.

Following Benabou and Tirole (2006) we assume that charitable contributions of time and money can affect utility through three different channels. First, directly from the very act of giving, i.e. by "warm-glow" private consumption motives as in Andreoni (1990). Second, indirectly through a "social signal" or the "prestige motive", according to which giving is driven by the desire to appear generous and to receive social approval (e. g. Harbaug, 1998; Ellingsen and Johannesson, 2003). Finally, through the consumption of an (impure) public good produced by a charity using volunteer labour and money donations from a community of individuals.

Since we focus on on a particular form of prosocial behaviour which requires time (i.e. volunteering), differently to previous studies we also want to explicitly account for the fact that time donation is not the sole relevant alternative to non-market labour. More specifically, we keep both hours volunteered and time devoted to domestic work distinguished from leisure. In particular, we assume that houseworking is used to produce services that may have (imperfect) market substitues (see Gronau,1977 for home production; Menchik and Weisbrod, 1987 for volunteer labour supply).

We proceed as follows. We first present a set of results for a simplified version of the model - which we label the "basic model" -, where: people do not have specific preferences for time versus money donations; the production of the public good depends on the value of overall donations; what matters for social prestige is the value of individuals' time and money contributions. While, taken toghether, these assumptions impose quite strong restrictions on individual and social behaviuors, they considerably simplify the analysis and, more

importantly, allow in many cases to derive sharp predictions for the empirical analysis. A similar approach has been used in many relevant papers in the literature (Andreoni, Gale, Schultz, 1996; Duncan, 1999).

Next, we also explore what happens if, for whatever reason, agents do not perceive time and money donations as perfect substitutes. This is done by assuming that agents, both at the individual and at the social level, may have specific preferences for volunteering. This allows to develop a deeper understanding of the factors underlying optimal decisions about the two forms of giving and to get insights on the way which individuals optimally adjust the supply of volunteering in response to shocks that exogenously affect tastes for money donations, which are key points for the empirical analysis.

3.1 The Model

We assume well-informed and rational individuals who seek to maximise their utility subject to a time constraint and an (endogenous) budget constraint[1]. For a generic person living in a community populated by J individuals, individual preferences may be represented by the following utility function[2]:

$$U = U\left(c, s, t^l, d, q, G\right) \tag{1}$$

where c is the money value of a composite consumption good, s are expenditures for a (composite) commodity of domestic services, t^l are hours of leisure, d is the total value of donations, q is a non tradeable "reputational good" or "social esteem", and G is an (impure) public good produced by a charity[3]. By now, we assume that U is continuous, twice differentiable, and (strictly) quasi-concave. Additional restrictions on the shape of the utility function will be introduced whenever needed.

We further assume that domestic services can be either purchased on the market (s^m) or produced within the household (s^h) using a certain amount of time (t^h), given the (strictly) concave function $f(\cdot)$:

$$s = s\left(s^m + s^h\right) = s\left[s^m + f\left(t^h\right)\right] \tag{2}$$

Thus, s^m and s^h are perfectly substitutable, and hours of housework do not provide *per se* utility to the individual - as it would be for example in the case of childcaring activities - but only to the extent that they provide market services[4].

As in Duncan (1999), by now we further assume that (i) people care only about the total value of donations, but not on the way in which they are divided into their money and time components: $d = v + m$, where v is the value of time giving, m is the amount of money donations, (ii) the value of volunteering v is given by the product of hours of giving (l^v) and their contribution to the production of the charity, i.e. the individual productivity of

[1] In our theoretical framework we do not model explicitly the behaviour of charities, i.e. the demand side of volunteering and money donation. We make the assumption that charity organisations are willing to assume as many volunteers as supplied at the prevailing wage. This implies that we can treat observed hours of volunteering as coming from optimal supply decisions and not from a mixture of demand and supply forces. We argue that this simplifying assumption might be plausible if the cost of volunteers was zero. We also note that, in practice, the behaviour of charities seems to be primarily driven by the availability of volunteers, so that an excess of supply in volunteering is quite rare. Moreover, as Duncan (1999) has shown, not-for-profit organisations will never be "constrained", i.e. receive more time donations than they actually require. Finally, in our (public and private) consumption model we also abstract from investments motives in donations as in Menchik and Weisbrod (1987).

[2] To simplify the notation, we suppress the individual-specific index i.

[3] Nested in this formulation there is also the case of people caring about the total value of donations: $v + d$. This restrictive assumption has been used, among others, by Duncan (1999) in his mixing public-private consumption model of money and time gifts. Here, altruistic activities are imperfectly substituable, that is, individuals are interested not only in the total amount of donations, but also in the way in which they are divided into their money and time components.

[4] The extension to the case in which domestic work yields directly utility it is quite straightforward. See Kooreman and Kaptein (1987) for a model where homework also contribute to leisure.

voluntary labour (α):

$$v = \alpha l^v \tag{3}$$

In other words, if a doctor decides to donate time, it is not indifferent for himself, for the others and for the charity if he works a certain number of hours for Doctors Without Borders or, say, for feeding homelesses[5].

Moreover, according to the literature on volunteering and money donations, "social esteem" is produced by both the (individual) value of time volunteered and charitable money contributions:

$$q = q\left(v + m\right) \tag{4}$$

Finally, individuals derive utility also from the total amount of the (impure) public good produced by charities using the (total) collected value of time (as labour input) and money donations (as capital input) in the community:

$$G = G\left(V + M\right) = G\left(\sum_j \alpha_j t_j^v + \sum_j m_j\right) \tag{5}$$

Thus, we allow for different individuals to be different inputs in the production of the charity, and that the total labour input V is measured in efficiency terms. Both q and G are assumed to be (strictly) quasi-concave functions[6].

Individual choices are subject to time and money constraints as follows:

$$t^l + t^h + t^v + t^n = T \tag{6}$$

$$c + m + s^m + w(t^l + t^h + t^v) = wT + y \tag{7}$$

where T is total time available for economic activities - maybe net of the (fixed) amount of time devoted to commuting -; t^n are paid working hours, w is the (exogenous) wage rate, y is the (exogenous) unearned income[7]. The wage rate is individual-specific, as we claim that individuals are heterogeneous in both their preferences and their productivity in the labour market.

Another crucial assumption we make is that $\alpha \leq w$, i.e. that people's productivity when volunteering can be at best equal to their productivity in the market.

Finally, since consumption of market goods and services will not be explicitly treated in the empirical analysis, for simplicity we also assume that they are both strictly positive in the optimum[8]. The other choice variables of the individual - labour supply, hours of domestic work, volunteering and money donations - can be either zero or positive in the optimum, depending on preferences and exogeneous parameters (wages, productivity when volunteering and non labour income)[9].

[5] Thus, our model contains both private and public motives in the supply of gifts of time and money as in Duncan (1999). The difference is that here utility stems from two soureces: joy of giving and social esteem.

[6] Under this assumption, given the parameters, a unique cost-minimising solution in the production of the impure public-good exists.

[7] For simplicity, we thus assume that the opportunity cost of volunteering, as well as of other non market activities (leisure and houseworking) is the the market wage. Duncan (1999) shows that, in a model where money and time contribution serve just to provide a public good, the wage equals the opportunity cost of time: otherwise, the charity would be better hiring someone else to do the job and the contributor would give only money. See also Brown and Lankford (1992) for a discussion over this issue. Moreover, we abstract from the debate about the role of tax and deductions on the supply of charity activities.

[8] Thus, we assume that there is a minimum of domestic services that must be bought in the market, i.e. that even using all the time endowment and given the production function of self-produced services, the generic individual cannot produce the desired level of services. This is made for convenience. However, predictions concerning key variables for the empirical analysis are robust to more general specifications.

[9] Corner solutions implicily define a set of reservation wages (price for money donations) - one for each constrained choice variable

Using the time constraint to have the model expressed in hours of paid work instead of leisure and substituting the budget constraint into the utility function for goods consumption, utility maximisation for each individual in the community implicitly define best response time demands and money donation functions. Accounting for strategic interactions in the provision of the "impure" public good and for the heterogeneity of preferences across individuals, $i-th$ person they may be expressed as follows:

$$t_i^{j*} = t^{j*}\left(\alpha_i, w_i, y_i, G_{-i}; Z_{ij}, \varepsilon_{ij}\right) \geq 0, \quad j = n, h, v; \qquad m_i^* = m^*\left(\alpha_i, w_i, y_i, G_{-i}; Z_{ij}, \varepsilon_{ij}\right) \geq 0 \tag{8}$$

where $G_{-i} \equiv G\left(\sum_{j\neq i}\alpha_j t_j^v + \sum_{j\neq i} m_j\right)$ and the Z's are standard vectors of demographic factors accounting for heterogeneity of individuals' preferences and ε's are individual-specific taste shifters, which are unobserved to the researched and that influence optimal decisions[10]. Iin this formulation unobserved individual effects are specific to each optimal decision rule, as well as the set of observed choice determinants may not exactely overlap. However, we expect unobservable demand determinants to be correlated across equations.

Details on the derivation of optimality conditions are given in the appendix. As regards decisions about domestic work, in equilibrium we find that, given the perfect substituability between home-produced and purchased services, agents work at home to thye extent that their marginal productivity of an hour of this type of work is higher than an hour's market wage: $\partial f(t^h)/\partial t^h > w$. Otherwise they are better off by earning labour income to purchase domestic services in the market[11]. As in the standard labour supply model, paid work decisions are driven by the comparison of total marginal costs (in terms of leisure reduction) and benefits (the value of goods consumption): denoting U_x the frst derivative of the utility function with respect to a generic x argument, individuals offering a positive amount of hours $U_{t^l} = wU_c$; otherwise $U_{t^l} > wU_c$ and time for paid work is zero.

About donations, our results are similar to that of Duncan (1999) except for the fact that here we explicitly account for an additional motive to donate - i.e. signalling altruism to receive social approval. As shown in the appendix, first order conditions for time and money donations take the following form:

$$[l^v] \quad : \qquad \alpha A \leq U_{t^l} \tag{9}$$

$$[m] \quad : \qquad wA \leq wU_c \tag{10}$$

where $A = U_d + U_q + U_G$ is the marginal utility of both types' donations. Equality holds whenever either l^v or m are positive. Given the perfect substituability between volunteering and money gifts, it is relatively straighforward to show that only three types of strategies can be optimal and part of a Nash equilibria: a first one, where the above conditions are not binding and individuals do not contribute at all ($l^v = 0; m = 0$); a second one, where money donations are positive but there is no volunteering. This occurs when volunteering is either less productive than paid work ($\alpha < w$), and, therefore, less attractive than money gifts): or as productive as working ($\alpha = w$) but when optimal hours of work are zero. Finally, when $\alpha = w$ the two first order conditions collapse into a single equation which defines only the total value of contributions, so that any combination of positive time and positive money giving which amounts to that value is optimal. In this respect, the two forms of giving are perfect sustitutes. However, if $\alpha \leq w$ there are no equilibria with positive volunteering and zero money donations.

The intuition is that optimal choices of m and l^v are driven by efficiency considerations: since agents do not

- replacing market wages, depending on preferences. An explicit allowance for corner solutions will be made in the empirical analysis.

[10] Variation in demographic characteristics and unobserved factors is aimed at capturing differential preferences in dimensions likely to affect supply decisions, whereby individuals with certain characteristics and preferences select different combinations of paid work, domestic work, donations and volunteering.

[11] However, if an individual prefers consuming self-produced services (think to caregiving), he or she may work at home even if his or her productivity at home is lower than in the market.

have specific tatses for one specific charitable activity against the other, preferences play a little role and decisions are purely a matter of oppurtinity costs.

However, this modelling of preferences would neglet at least two important aspects. First, all else equal, some people may not be totally indifferent between "warm-glow" volunteering and money donations motives. In particular, a direct involvement in the provision of charity's services through the supply of unpaid work may deliver *per se* more utility than the simple offering of a money gift. Second, as discussed in the previous section, there are several reasons why signalling altruism through voluntary work or money does make a difference for individulas' reputation: indeed, Ellingsen and Johannesson (2003) suggest that "time is not money", in the sense that gifts of time are valued more than gifts of money because they signal more altruism. Similarly, Lee et al. (1999) argue that voluntary work is more affected by others' expectation than gifts of money. In a slightly different setting, Prendergast and Stole (2001) show that in many circumstances non monetary gifts such as time gifts are offered by a donor instead of more efficient cash trasfers because the latter are seen as impersonal and carrying some stigma effect. Indeed, in equilibrium the signalling power of time gifts arise exactly because, in principle, they are inefficient relative to cash.

In the light of our framework, preferences for time donations versus cash transfers can be accounted for by means of the following modified utility function:

$$U\left(c, s\left(s^m, f\left(t^h\right)\right), t^l, v, m, q\left(v, m\right), G\left(V+M\right)\right)$$

where for simplicity we have retained the assumption that what matters for the provision of the public good is the total value of the endowment available to charities. However, this extended model allows for the two giving activities being different goods, at least from the private consumption perspective. In particular, we assume that for some people volunteering may matter more than money donations for warm glow motives ($U_v > U_m$) and/or reputation mechanisms ($\partial q/\partial v > \partial q/\partial m$).

Quite intuitively, the result is that agents with preferences for volunteering of for whom donating time is more effective in the production of social esteem may find optimal to volunteer even if the opportunity cost of time is higher than the value of money contributions. In the appendix it is shown that this happens whenever the voluntary work possesses a larger utility pay off in terms of intrinsic preferences and/or signaling motives than the difference in opportunity costs between paid and unpaid work.

Otherwise, individual or social preferences for volunteering do not necessarily invalidate the qualitative results obtained in the perfect substituability case. For example, suppose that the utility premium from volunteering is positive but small in absolute value. Then, the fact that the opportunity cost associated to the supply of voluntary work is higher than its productive contribution would be enough to prevent some people from donating.

In the remaining part of the section we discuss what equilibrium conditions imply for observed behaviours, both within the benchmark and the extended model. This will allow us to derive interesting insights for the empirical analysis.

3.2 Implications

Given the heterogeneity of individuals, it is interesting to ascertain what optimality conditions would imply in terms of observed aggegate outcomes.

All else equal, if individuals behave according to the basic model, as long as their largest fraction possesses a productivity in volunteering lower than the wage, we should observe a higher proportion of money donations than time donations. Moreover, the conditional probability of $m > 0$ given $t^v > 0$ should be equal to 1, while

that of $t^v > 0$ given $t^n = 0$ should be zero (e. g. Andreoni et al., 1996). The same result emerges also in the unrestricted model, as long as for all agents the utility pay off of volunteering is lower than its opportunity cost.

In general, we expect that, when there are specific tastes for volunteering as in the extended model, some agents may find profitable to "deviate" by supplying hours of voluntary labour despite if $\alpha < w$. Still, whenever the largest fraction of individuals possesses a productivity in volunteering which is much lower than market productivity, the number of individuals deviating from what it predicts may be negligible. In this occurrence, our model predicts that he conditional probability of $m > 0$ given $t^v > 0$ should be larger than that of $t^v > 0$ given $t^n = 0$ Of course, the opposite happens when the distance between α and w is small: in that case, even a weak preference for volunteering may be enough to increase the supply of time donated.

In particular,we claim that in this context reputation mechanisms, mostly neglected by existing studies, might offer key insights for a better understanding of contributors' decisions. For example, if the value that people attach to social esteem is large, we might expect higher overall donations than in the previous case. We may thus think that social esteeem drives choices when the judgment of others is important, for example when the person is part of a social network. Moreover, if time matters more than money gifts in the production of reputation, we also expect a higher impact of social networks on the probability of volunteering than of cash donations. In the light of our theoretical model, the net impact of social esteem mechanisms on charitable contributions can be analysed by explitily accomplishing the heterogeneity in preferences towards the importance of social esteem, for example by explicitly including measures of the importance of reputation mechanisms in the vector of observed characteristics Z.

The extended model is useful also to shed light on another issue which is at the core of the empirical analysis, i.e. whether the two forms of giving are either positively or negatively related. Indeed, information on that can be used to predict the expected sign of the correlation between the unobserved (to the researcher) determinants of volunteering and money donations. More precisely, suppose that an individual endowed with a given set of observable characteristics Z and other exogenous parameters is exposed to a shock in his or her unobserved tastes ε_d which increases his/her level of money donations. How he/she would optimally adjust, at the margin, his or her supply of volunteered hours, i.e. what can we say about the expected sign of the shift in ${\varepsilon_v}$[12]? In principle, it is hard to say much about the "comparative static" effect of small changes in m on t^v induced by unobserved differences among individuals endowed with a given set of observable characteristics, since such changes alter marginal utilities of all goods. However, suppose for simplicity that cross-derivaties are zero, so that the utility function is separable in its arguments except v and m, and that the same occurs in the production function for reputation. Moreover, let's restrain the analysis to those agents who supply a positive amount of both types of giving, so that first order conditions for money and time donations are distinguishable each other. By simply rearranging focs and using the implicit function theorem, it turns out that, as long as the difference between α and w is small and/or the second order direct impact of donations on utility is higher than its indirect impact through reputation and public good motives so that $U_{kk} > (U_{qq} + U_{GG})$ $, k = m, v$ - which, indeed, seems to us a quite reasonable assumption -, an increase in money donations would cause an increase in volunteering. Given the premises, this result implies that we expect the two processes to be positively correlated.

These predictions can be summarised and formalised in the following set of working hypothesis for the empirical

[12]In this respect, we slightly depart from the mainstream One approach is to check whether the two activities are, at the margin, complements or substitutes. Indeed, this is what has been done by several authors. However, this exercise involves the evaluation of cross-price elasticities, and, at the empirical level, it is often not obvious which is the relevant price (or opportunity cost) of, for example, volunteering

n particular, the computation of elasticities of substitution may be problematic when hours of work are constrained. For example, let's assume an individual who does not work but donate both time and money. From an empirical point of view, the wage, which is here and in many other models the implicit price of time gifts, is not observable.

analysis. Assuming that $\Pr(\alpha < w) > \Pr(\alpha = w)$, then:

- **Hypothesis 1:** If some people have specific preferences for volunteering for both warm glow or reputation mechanisms but the largest fraction is such that: (i) volunteering is valued more than money donations, but only to a small extent; and/or (ii) the opportunity cost of volunteering is much higher than its contribution to charities, we expect that $\Pr(m > 0) > \Pr(t^v > 0)$ and that:

$$\Pr(t^v > 0 | m > 0) > \Pr(t^v > 0 | m = 0)$$

i.e. that, among those who work in the market, the probability of volunteering is higher among those who also give money; and also that

$$\Pr(m > 0 | t^v > 0) > \Pr(m > 0 | t^v = 0)$$

[13]. Thus, if only the total value of gifts matter and money and time domations are perfect substitutes, optimality conditions are determined by efficiency considerations. But if we assume that the two types of giving are different goods, so that the way they are combined also matter, individuals heterogeneity in preferences plays a key role

- **Hypothesis 2:** If agents care about the others and/or he/she belongs to a social network, so that social esteem is an important determinant of satisfaction, the probability to optimally choose a positive amount of donations is higher because of the reputation motive:

$$\begin{aligned} \Pr(m &> 0 | network\_yes) > \Pr(m > 0 | network\_no) \\ \Pr(t^v &> 0 | network\_yes) > \Pr(t^v > 0 | network\_no) \end{aligned}$$

Moreover, since time matters more than money, we also expect that[14]:

$$\Pr(m > 0 | network\_yes) > \Pr(l^v > 0 | network\_yes)$$

- **Hypothesis 3**: Assuming an utility function separable in its arguments, $corr(\varepsilon_d, \varepsilon_m) > 0$ whenever the second order "warm-glow" effect of both time and money donations on satisfaction dominate the sum of reputation and public good effects of the same order.

Besides predictions about money charitable activities, our behavioural model gives several additional interesting insights concerning, for example, the relationship between market and domestic work. For example, under the assumption that productivity at home is lower than productivity (or, more precisely, wages) in the market, we also expect that $\Pr(t^h = 0 | t^n = 0) > 0$, $\Pr(t^h = 0 | t^n > 0) = 1$. Moreover, because of wage discrimination, it might also be that $\Pr(t^n > 0 | female) < \Pr(t^n > 0 | male)$.

More in general, even if productivity in domestic work was lower than its oppurtunity cost, an individual

[13] Under the perfect substituability of time and money donations for all individuals, the corresponding last two conditions would appear as follows: $\Pr(m > 0 | t^v > 0) = 1$; $\Pr(t^v > 0 | m = 0) = 0$ and $\Pr(m > 0 | t^n = 0) > 0$; $\Pr(t^v > 0 | t^n = 0) = 0$

[14] We stress that these probability shifts should not be interpreted as causal effects. While in our model we have treated the production of reputation, and, therefore, the size of the community to which each individual belongs, as an exogenous mechanism; in practice, the social network may be partly endogenously determined. For example, it may be that individulas more altruistic are more likely to enlarge their network and, at the same time, to be more concerned about social esteem motives. For this reason, particular care should be used in the empirical evaluation of these effects.

could decide to work at home but not in the market if he/she preferred the services probuced by him/herself, instead of those purchased on the market.

The remaining part of the paper contains the empirical analysis, which has the primary scope to ascertain to what extent the results implied by the theory fit the data. To this pupose, the next sections contains an introductory descriptive analysis, which will be integrated and completed by the econometric investigation of Section 5.

4 Data and Descriptive Statistics

As discussed above, our primary aim is to analyse the determinants of and the relationship between four activities: time spent in paid market work, domestic work and volunteering work; money donations.

The data used in this paper originate from the 2000 wave of the "Multi-purpose Survey of the Everyday Life of Italian Households", a cross-sectional survey yearly administered by the National Statistical Office (ISTAT) since 2003 to representative sample of the Italian population. The survey is designed to provide micro-level information on several aspects of everyday life, from dwelling conditions, to education, health, labour market behaviour and time use. Each year, a sample of nearly 20,000 households (60,000 individuals) is interviewed. Detailed information on the sampling frame and other aspects of the Survey may be found in ISTAT (2001)

For the purposes of the present paper, the estimation sample has been restricted to household heads and spouses aged 25-60 if men and 25-55 if women. The resulting sample includes 11,331 men and 11,038 women, with an employment rate of 85% and 54% respectively. On the other hand, 39% of the sample of women report being a housewife.

The survey enables identification of individual time and money donations thanks to specific items of the questionnaire. On the money donations front, individuals are asked whether they have given any money to associations or charities over the last 12 months. It is important to stress that the survey contains a separate question on whether interviewees gave money to political parties, and we do not count these as cases of money donations. Coming to time donations, the survey asks individuals if (overt the last 12 months) they volunteered for volunteering associations, non volunteering associations, political parties or the trade union, and we exclude the two latter possibilities from our definition of volunteering[15]. Our definitions are aimed at isolating charitable behaviour from donations that may have some indirect personal return for the individual, e.g. by 'investing' in representation. In each case, we are only able to observe whether donations took place, but not their amounts.

The survey also report detailed information on aspects of the individual use of time, and as seen in the theoretical section, such information plays a crucial role for characterising donations, as long as individuals decide whether or not to donate while managing also other dimensions of theiur life, namely time in the labour market and time at home. Both variables are recorded in the ISTAT survey in terms of (average) weekly hours of market and domestic work, separately. In particula, the latter includes both house work and caregiving activities.

Table 1 provides some descriptive statistics on time and money donations in the sample, separately for men and women. Money donations are more frequent than time donations, and men donate more than women do. By looking at the two outcomes in conjunction, the Table indicates that the vast majority of either sub-sample does not donate, whereas some 13 percent chooses to donate money but not time. Looking at conditional frequencies suggests that donations on the two fronts are positively associated: the incidence of money donations rises by

[15] We also experimented using a restrictive definition of volunteering (i.e. volunteering for volunteering associations only) and found results to be robust to the change of definition. Throughout the paper, we refer to results obtained using the enlarged definition of volunteering.

Table 1: Sample probabilities of time and money donation

Probabilities	**Men**	**Women**
$\Pr(l^v > 0)$	12.88	9.95
$\Pr(m > 0)$	21.71	19.30
$\Pr(m > 0, l^v > 0)$	7.78	5.70
$\Pr(m = 0, l^v = 0)$	73.20	76.45
$\Pr(m > 0, l^v = 0)$	13.92	13.61
$\Pr(m = 0, l^v > 0)$	5.10	4.25
$\Pr(m > 0 \mid l^v = 0)$	15.98	15.11
$\Pr(m > 0 \mid l^v > 1)$	60.42	57.29
$\Pr(l^v > 0 \mid m = 0)$	6.51	5.26
$\Pr(l^v > 1 \mid m > 1)$	35.85	29.52

approximately four times if one compares individuals who does not donate time with does who do, and the increase in time donations is nearly six-fold contrasting non-donors with donors of money.

The selection of independent variables is based on the economic framework developed in the previous Section, as well as on previous research and data availability. In particular, we assume that observed outcomes of optimally behaving agents reflect both individual characteristics affecting preferences and economic constraints, as well as variables for the work status. A description of the regressors used in the empirical analysis and summary statistics are presented in Table 3 in the appendix. The meaning of the regressors is most cases self-evident. In addition to standard controls for personal characteristics and the economic situation, we have included two variables - having friends and participating to social activities such as religious functions - that, in the light of our theory, should capture whether the individual belongs to a social network. In turn, this should affect the concern to signal altruism because of prestige motivations and social pressure. Thus, we expect these variables to be positively correlated with donations, and, to the extent which volunteering is more valued than money gift, a stronger association with the former.

5 Empirical Strategy and Results

The descriptive information presented in Table 2 suggesting a positive association between time and money gifts is of course merely a cross tabulation. A fuller understanding of theis relationship requires a multivariate analysis. Our basic estimation model is a system of four reduced form equations for different time uses and money donations. This section contains a detailed description of the model and of results obtained from its estimation.

5.1 Econometric Modelling

The main features of the behavioural model presented in Section 3 are exploited by a four equation model that simultaneously accounts for individual decisions over: money donations (m), volunteering (t^v), hours of market work (t^n), hours of domestic work (t^h). Since, as discussed in the Data section, we have information on the continuous variable in the last two cases, but only on the (discrete) decision whether to donate time and/or money, the model consists of two probit and two tobit processes, which we allow to be correlated each other through unobservables. The parameters are then estimated by maximum likelihood methods.

The four latent outcomes are:

$$\begin{aligned} t_i^{j*} &= X_{ji}\beta_j + \varepsilon_{ji}, \quad j = n, h, v \\ m_i^* &= x_{mi}\beta_m + \varepsilon_{mi} \\ \varepsilon_i &= (\varepsilon_{ni}, \varepsilon_{hi}, \varepsilon_{vi}, \varepsilon_{mi}) \sim MVN(\mathbf{0}, \mathbf{\Omega}) \end{aligned} \tag{11}$$

where MVN is a four-variate normal distribution and $\mathbf{\Omega}$ the associated 4X4 covariance matrix. Equations in (11) are linear specifications of the demand functions in (**??**), where the X's vectors contains both individual characteristics (Z) and proxies for the wage and for the exogenous non labour income as in the theoretical model.

The mapping between latent propensities and observed behaviour is as follows. For processes t^v and d (volunteering and money donations) we only know whether the action took place, a $0-1$ variable. Therefore, we observe

$$t_i^v = I(t_i^{v*} > 0); \qquad m_i = I(m_i^* > 0)$$

where $I(\cdot)$ is an indicator function which takes value 1 whenever its argument is true. In the remaining two processes we observe continuous hours of work (either in the market and at home) but with a mass point at zero. According the labour supply model developed in the previous section, we can interpret those mass points as corner solutions in a welfare maximisation problem in which the unconstrained optimum would be negative. Therefore the observational rule is the following:

$$t_i^j = \max\left\{t_i^{j*}, 0\right\}, \quad j = n, h$$

The above implies that the first two variances in $\mathbf{\Omega}$ must be normalised to 1. The remaining coefficients in $\mathbf{\Omega}$ are free. A detailied description of the likelihood is in the appendix. The next Section we present the main results from the estimation of this model.

5.2 Main Results

The aim of this section is twofold. First, to present the probit/tobit estimates of our empirical model and to discuss the determinants of giving and both paid unpaid work in Italy, Secon, and more important, to shed light on the way which the four types of choices are simltaneously affected through unobserved taste shifters. In particular, we seek to shed understand whether, once we control for observed and unobserved heterogeneity, we can still observe a positive statistical association between the two processes, as it was suggested by the descriptive analysis undertaken in Section 4[16].

Moreover, since factors and tatstes underlying time allocation decisions typically have a strong gender component, the analysis is conducted separately for men and women.

The complete set of estimates of our four equation model is reported in the appendix, Tables from 4 to 7. In general, our findings are consistent with previous evidence on similar issues. According to probit results in Tables 4 and 5, key observable characteristics have similar effects on the two types of giving: overall, the probability of positive charitable gifts is generally increasing in schooling, age (with a concave profile), as well as when moving from the south to northern regions. Also living in urban areas is positively associated with giving. However, since data limitations do not allow us to control for wages, these effects may capture both taste heterogeneity and wealth effects. As long as gender diffrences are concerned, the number of kids has a negative impact on the

[16] This is important since observed time uses come from the same sample respondent. More time used in one activity may mean less time used in a different activity

probability of volunteering for females, maybe because they tend to allocate more time to child care. Further, contrary to men, females' time donations has not a creal relationship with age. As regards differences between types of giving , it seems that the financial situation matters more for money than for time gifts: the former decreases when the number of children increases- and, therefore, family expenditures. Unsurprisingly, individuals living in poor families, i.e. where there are problems in purchasing necessary goods such as food and health care. donate less than the others. On the contrary, a similar pattern does not emerge for volunteering supply, which seems less affected by economic contingencies and driven more by intrinsic motivations: even if it would have a positive money payoff, in bad times agents are on average not willing to substitute hours of unpaid volunteering with market activities.

We observe that the two variables intended to capture reputational concerns in the provision of voluntary work and money donations are significant and with the expected sign: the lack of friends and of religious participation reduces the incentives to contribute, and the effect is stronger for volunteering. Thus, implicit (i.e. non monetary) incentives matter in the provision of charitable contributions: ceteris paribus, a person tied to a social network has a higher probability to volunteer and give money. However, it hard to think at this effect as causal, as those who are intrinsically less motivated in giving (either for altruistic or egoistic motivations) may have also be less likely to develop (or being concerned about) social interactions.

Finally, we briefly comment tobit results for domestic and market working hours. First, we notice that in the supply equation for paid work we have included also sector and occupational dummies, aimed at capturing workplace conditions. For standard variables - education, age regions, etc... - results are unsurprising and in line with previous studies. In addition, we report a negative sign for dummies aimed at capturing difficult goods purchasing, but, in this case, there's a clear reverse causality problem. Interestingly, by comparing the effect of kids dummies between hours of domestic and paid works, it emerges that the higher their number, the lower (higher) are hours of domestic work supplied by men (women): that is, when the number of children increases, males optimally react by working more, while females reallocate more time to child care and domestic work. This is consistent with our behavioral predictions, i.e. that there is a negative correlation between working at home and in the market, and agents allocate to the one or the other depending on where they possess a comparative advantage, with femeales being more productive at home and men at work[17].

Besides the analysis of giving determinants, the second key purpose of our analysis is to ascertain whether, certeris paribus, the conditional probability of giving time increases when the gifts of money increase as well. In the context of our empirical strategy, this can be investigated by looking at the sign and the size of the correlation between the unobservable determinants of the two process[18]. This can be investigated by looking at Table 2, which reports the whole set of cross-equations correlation coefficients estimates, separately for men nad women.

Looking at men first, the unobserved correlation between alternative time uses is negative or insignificant. We interpret this result as indicating that time in one category competes with time in another one. However, the coefficient is statistically significant only for domestic/market work. Interestingly, we do not find a strong association between unpaid activites (voluntary and house work). This may indicate that volunteering has characteristics similar to leisure, and that, given the time constraint, an increase in the former reduces the latter, which is here the item excluded. For women, an increase in hours of work does not reduce the amount of domestic work: thus, women adjust for variations in (both paid and unpaid) working time by variation in the consumption of pure leisure.

Finally, time and money donations appear strongly and positively correlated: a positive shift in the supply of

[17] Or, under imperfect labour markets and wage discrimination, where their time is valued more.

[18] Of course, if the underlying latent processes for time and money donations are positively correlated we should expect that, conditional on positive donations, the probability of positive volunteering is higher than that of zero volunteering.

Table 2: Cross equation correlations between errors

	Men		**Women**	
	Coef.	z-stat	Coef.	z-stat
$corr(\varepsilon_m, \varepsilon_{l^v})$	.5734874	37.52	.5192259	24.66
$corr(\varepsilon_{l^n}, \varepsilon_{l^v})$	−.0166323	−1.02	−.012512	−0.70
$corr(\varepsilon_{l^h}, \varepsilon_{l^v})$	.0119255	0.50	.0219949	1.50
$corr(\varepsilon_{l^n}, \varepsilon_m)$	.0227808	1.18	−.0547187	−1.11
$corr(\varepsilon_{l^h}, \varepsilon_m)$	.3350978	5.37	.0228878	1.21
$corr(\varepsilon_{l^n}, \varepsilon_{l^h})$	−.7028726	−15.17	.0079198	0.43

volunteering causes an increase in money donations. We also observe that the correlation has a similar magnitude for males and females.

Overall, these results seem to confirm our previous descriptive findings. According to the predictions of the behavioural framework developed in Section 3, the fact that, even controlling for several individual characteristics (including proxies for social capital) and the correlation between giving and working decisions, time and money donations are (on average) positively related seems to be compatible with the hypothesis that, for the most part, individuals may not have strong preferences towards volunteering at the expences of monetary contributions to charities. If this was the case, according to our predictions, we would have found an insignificant correlation between the two forms of giving. However, this result is "net" of the effect of our (maybe poor) proxies for participation to community activities, which, as we have seen above, have a positive impact on donations through the production of social prestige and reputation. Summing up, the data suggest that the "benchmark model" may capture significant aspects of the individuals' unobserved attitudes toward donation activities.

6 Concluding Remarks

In this paper we develop, analyse, and empirically test a behavioural model of time and money donations, considering also labour supply and the time devoted to household production. After briefly reviewing economic, psychological and sociological literature on charitable giving - which emphasises three main groups of variables as determinants of donations (namely, individual attitudes and preferences, charitable behaviour, and government behaviour -, we propose a general framework for understanding individual choices, where utility for prosocial behaviours stems from three sources: "warm glow", social esteem, and intrinsic motivation. We derive some theoretical predictions, and test these by using data from the 2000 wave of the "Multi-purpose Survey of the Everyday Life of Italian Households", a cross-sectional survey yearly administered by the National Statistical Office (ISTAT) since 2003 to representative sample of the Italian population.

The results derived from our four equation model - that simultaneously accounts for individual decisions over money donations, volunteering, hours of market work, and hours of domestic work - show that money and time donations correlates positively. Moreover, most of the variables that the literature deems to be important determinants of individual behaviour turn out to be significantly associated with the decision on whether or not to volunteer.

References

[1] Andreoni J. (1990) Impure altruism and donations to public goods: a theory of warm-glow giving, The Economic Journal, 100(401): 464-477.

[2] Andreoni J. (2006) Philantropy, in L. A. Gerard-Varet, S. C. Kolm and J. Ythier (eds), Handbook of Giving, Reciprocity and Altruism, Elsevire: North-Holland.

[3] Andreoni J., Gale W.G. and Sholz J.K. (1996) Charitable contributions of time and money, mimeo.

[4] Becker G. S. (1965) A Theory of the Allocation of Time, The Economic Journal, 75: 493-517.

[5] Benabou R. and Tirole J. (2006) Incentives and Prosocial Behaviour, American Economic Review, forthcoming.

[6] Bergstrom T., Blume L., Varian H. (1986) On the private provision of public goods, Journal of Public Economics, 29:25-49.

[7] Duncan B. (1999) Modeling charitable contributions of time and money, Journal of Public Economics, 72: 213-242.

[8] Ellingsen T. and Johannesson M. (2003) Time is not Money, mineo.

[9] Freeman R. (1997) Working for nothing: the supply of volunteer labor, Journal of Labor Economics, 15: S140-S166.

[10] Gronau R. (1977) Leisure, home production and work - the theory of the allocation of time revisited, Journal of Political Economy, 85(6): 1099-1123.

[11] Harbaugh W.T. (1998) What do donations buy? A model of philatropy based on prestige and warm glow, Journal of Public Economics, 67: 269-284.

[12] Khanna and Sandler (2000) Partners in giving: The crowding-in effect of UK government grants, European Economic Review, 80: 1157-1167.

[13] Kooreman P. and Kapteyn A. (1987) A disaggregated Analysis of the Allocation of Time within the Household, Journal of Political Economy, 95(2):223-249.

[14] Lee L., Piliavin J.A. and Call V.R. (1999) Giving time, blood and money: similarities and differences, Social Psycological Quarterly, 62(3): 276-290.

[15] Marcuello C. and Salas V. (2000) Money and time donations to spanish non governamental organisations for development aid, Investigaciones Economicas, XXIV(1): 51-73.

[16] Menchik P.L. and Weisbrod B.A. (1987) Volunteer Labour Supply, Journal of Public Economics, 32: 159-183.

[17] Prendergast C. and Stole L. (2001) The non-monetary nature of gifts, European Economic Review, 45: 1793-1810.

[18] Smith W. and Chang C. (2002) Shipping the good apples out: a note on contributions of time and money, Economics Bulletin, 10(1): 1-14.

Appendix1: The model(s)

In this appendix, we solve and present a formal derivation of main predictions from the models presented in Section 3.

We start with the benchmark specification. Substituting (2)-(5) in (1), the individual utility maximisation problem can be stated as follows:

$$\begin{aligned} \max_{\{c,s^m t^h,t^n,t^v,m\}} & U\left(c, s\left(s^m + f\left(t^h\right)\right), t^l, \alpha t^v + m, q\left(\alpha t^v + m\right), G\left(V + M\right)\right) \\ & s.t.\ c = w(T - t^l - t^h - t^v) + y - m - s^m \\ & t^l = T - (t^h + t^v + t^n) \\ & 0 \leq t^l + t^h + t^v \leq T, \quad t^l, t^h, t^v, m \geq 0 \end{aligned} \tag{12}$$

Plugging the budget constraint into utility and using the time constraint to have utility expressed in terms of hours of paid, domestic and volunnter work, first order conditions from the maximisation problem are the following:

$$[s^m] \quad : \quad U_s = U_c \tag{13a}$$

$$\left[l^h\right] \quad : \quad U_s \frac{\partial f(t^h)}{\partial t^h} \leq U_{t^l} \tag{13b}$$

$$[l^n] \quad : \quad U_c w \leq U_{t^l} \tag{13c}$$

$$[l^v] \quad : \quad \alpha\left(U_m + U_q + U_G\right) \leq U_{t^l} \tag{13d}$$

$$[m] \quad : \quad U_m + U_q + U_G \leq U_c \tag{13e}$$

where U_k, which indicates marginal utility of $k = c, s, t^l, d, q, G$, is a function of all the variables affecting utility levels. Equality conditions hold whenever the corresponding variable is strictly positive in the optimum. However, non negativity constraints may be binding for some individuals leading to corner solutions.

Proposition 1 *Optimality conditions: (i) if $\alpha < w$ optimal hours volunteered cannot be positive, while money donations can be either zero or positive; (ii) if $\alpha = w$, both time and money donations can be positive. In this case, the contributor is indifferent between the way which they are divided because what matters for him/her is the total value of donations $(v + m)$.*

Proof. Let's consider the case of (i) $\alpha < w$ first. Denoting the marginal utility of donations as: $A = U_m + U_q + U_G$, suppose first that (13e) holds with inequality: $A < U_c$. Thus, the marginal utility of money donations is lower than that of goods and services, so that $m = 0$. But then $wA < wU_c$ and also $\alpha A < wU_c$. Using (13c) this means that, independently to the agent being working in the market or not (either $U_c w = U_{t^l}$ or $U_c w < U_{t^l}$), it is always true that $\alpha A < U_{t^l}$. But then, by the (13d), the optimal supply of voluntary work is zero hours. The opposite cannot be true: suppose that $\alpha A = U_{t^l}$. $(t^v > 0)$. Then, $wA > U_{t^l}$, which contradicts the condition for $m = 0$. Assume now $m > 0$, so that $wA = wU_c$. But then, $\alpha A < wU_c \leq U_{t^l}$, which means that hours volunteered will be always zero. Notice that it can also be that money donations are positive and hours of paid work are zero.

Let's now consider the case of: (ii) $\alpha = w$. Now the combination $(m > 0; t^v > 0)$ can be optimal: in fact, suppose $t^v > 0$, $\alpha A = wa = U_{t^l}$. Then, the chain of inequalities linking first order conditions for time and money donations (through paid work) takes the following form: $wA \leq wU_c \leq U_{t^l} = wA$: it is immediate to show that: first, donations cannot be zero $(wA < wU_c)$; second, agents would not donate hours without working

in the market. In other words, interior solutions require that $\alpha = w$: however, since (13d) and (13e) collapse into a single expression, focs only define the optimal total value of gifts ($m + \alpha l^v$), but not separately its two components. Thus they are perfect substitutes in the optimum from the individual's point of view ■

Proposition 2 *As far as decisions about the optimal amount of domestic work are concerned, we observe that:In the benchmark model, people do not work in the market but work at home only if they are more efficient in the latter than in the former activity*

Proof. Substituting (13a) in (13c), we have that $U_s \frac{\partial f(t^h)}{\partial t^h} \leq U_{t^l}$ and $U_s w \leq U_{t^l}$. Suppose that $\frac{\partial f(t^h)}{\partial t^h} < w$, then whenever $U_s w = U_{t^l}$ $(t^n > 0)$ it must be that $U_s \frac{\partial f(t^h)}{\partial t^h} < U_{t^l}$ $(t^h = 0)$, and viceversa. If $\frac{\partial f(t^h)}{\partial t^h} = w$, then $t^n > 0$ and $t^h > 0$. ■

To fully characterise optimal allocations we need to account for strategic interactions in the provision of the public good. As in any Nash-type game, in deciding her best strategy, any individual takes the actions of other community members as exogenously given. Thus, first order conditions result in Marshallian demand (supply) functions for the three different uses of time and for money donations, all depending on the value of gifts of others and on parameters: $t_i^{j*} = t_i^{j*}(\alpha_i, w_i, y_i, G_{-i}) \geq 0, \quad j = n, h, v; \qquad m_i^* = m_i^*(\alpha_i, w_i, y_i) \geq 0$

As shown by Bergstrom et al. (1986) and, more recently, Andreoni (1990) and Duncan (1999), a (maybe not unique) Nash equilibrium in pure strategies for this class of games exists under fairly general conditions, that here are assumed to hold.[19]. In our case, a Nash equilibrium is an allocation of private consumption of goods and services, paid hours of work, domestic work, volunteer labour and money gifts such that, given the donations of others, every person is donating her optimal amount.

The extended model possess a more complex structure of preferences, which can be summarised through the following utility function:

$$U\left(c, s\left(s^m, f\left(t^h\right)\right), t^l, v, m, q\left(v, m\right), G\left(V + M\right)\right)$$

while, of course, time and budget constraints are the same as in the benchmank model.

In this case, conditions for an optimum takes the following form

$$[s_i^m] \quad : \qquad U_s \frac{\partial s}{\partial s^m} = U_c \tag{14a}$$

$$\left[l_i^h\right] \quad : \qquad U_s \frac{\partial s}{\partial s^h} \frac{\partial f(t^h)}{\partial t^h} \leq U_{t^l} \tag{14b}$$

$$[l_i^n] \quad : \qquad U_c w \leq U_{t^l} \tag{14c}$$

$$[l_i^v] \quad : \qquad \alpha_i \left(U_v + U_q \frac{\partial q}{\partial v} + U_G\right) \leq U_{t^l} \tag{14d}$$

$$[m_i] \quad : \qquad U_m + U_q \frac{\partial q}{\partial m} + U_G \leq U_c \tag{14e}$$

We now use these conditions to prove the following results:

Proposition 3 *Suppose that $\alpha < w$ and (i) $U_v > U_m$; $\partial q/\partial v = \partial q/\partial m$. Then $l^v > 0$ whenever the value of the "warm glow" utility gain more than compensate the loss in the efficiency of producing the public good and social esteem. Suppose now that (ii) $\partial q/\partial v > \partial q/\partial m$; $U_v = U_m$. Then, $l^v > 0$ whenever the more efficient production of reputation more than compensate the loss in the efficiency in using volunteering instead of money gifts to produce the public good and for warm glow utility.*

[19] In particular that $0 < U_g < 1$.

Proof. Consider first the case in which (i) $U_v > U_m$. Define $C = U_q + U_G$. Assume $l^v > 0$. Then, combining the last three conditions we obtain: $wU_m + wC \leq wU_c \leq U_{t^l} = \alpha U_v + \alpha C$ and, therefore, $\alpha U_v - wU_m \geq (w - \alpha)C > 0$. The rhs is the value of the marginal utility gain, which must offset the value of the loss suffered in the components of utility others than warm glow. A similar line of reasoning can be used for (ii) $\partial q/\partial v > \partial q/\partial m$. In that case, the condition is: $(\alpha \frac{\partial q}{\partial v} - w\frac{\partial q}{\partial v})U_q \geq (w - \alpha)D > 0$, where $D = U_m + U_G$, which proves the result. ■

Appendix2: The Likelihood

In order to derive the likelihood function of this model it is useful to define the following set of indices:

$$\begin{aligned} k_{vi} &= 2t_i^v - 1; \quad k_{mi} = 2m_i - 1 \\ k_{ji} &= 2I(t_i^j > 0) - 1; \quad j = n, h \end{aligned}$$

For individuals on a corner solution in both work time and domestic time supply, the contribution to the likelihood function are as follows:

$$L_{1i} = \Phi_4(\Xi_i; \Sigma)$$

where Φ_p denotes the cumulative density function (c.d.f.) of the multivariate normal distribution of dimension p, Ξ is a vector of upper integration points with typical element $k_{ji}x'_{ji}\beta_j$, $j = v, d, n, h$; $\Sigma = K\Omega K$, and K is a diagonal matrix with non-zero elements equal to the k indices defined above.

When only the optimal hours of work (process t^n) are positive, we observe their optimal amount in the data. We can therefore condition the probability for the remaining three outcomes on the observed hours of work, and thence write the joint probability as the product of the conditional probability and the unconditional probability of the conditioning variable: $\Pr(m, t^v, t^h, t^n) = \Pr(m, t^v, t^h | t^n) \times \Pr(t^n)$. Likelihood contributions take the following form:

$$L_{2i} = \Phi_3(\Xi\_t^n; \Sigma\_t^n)\phi(\varepsilon_{ni})$$

Where $\phi(\cdot)$ denotes the density function of the univariate normal distribution, a $\_t^n$ suffix indicates conditioning on hours of work, and the arguments of the multivariate normal cdf are derived from the moments of the conditional multivariate normal distribution.

Likelihood contributions for the case in which only hours of domestic work are positive (L_{3i}) take an analogous form.

Finally, when the optimal hours of both market and domestic work are positive, the sequential conditioning can be expressed as follows: $\Pr(m, t^v, t^h, t^n) = \Pr(m, t^v | t^h, t^n) \times \Pr(t^h | t^n) \times \Pr(t^n)$. Resulting likelihood contributions are of the form:

$$L_{4i} = \Phi_2(\Xi\_t^h t^n; \Sigma\_t^h t^n)\phi(\varepsilon_{hi}|\varepsilon_{ni})\phi(\varepsilon_{ni})$$

Defined $j_i = I(k_{ji} > 0)$, $j = n, h$; the log-likelihood of the model is[20]:

$$\sum_i [n_i h_i \log L_{1i} + (1 - n_i)h_i \log L_{2i} + (1 - h_i)n_i \log L_{3i} + (1 - n_1)(1 - h_i) \log L_{4i}] \tag{15}$$

[20] Note that our model is analogous to Seemingly Unrelated Regression except we use a nonlinear estimation technique to account for lower limit constraints and partial obervability.

Appendix3: Full estimates's results

Table 3: Variables' names and description

Variable name	Description
eta	age
Children (base= no children)	
kids2	has 1 child
kids3	has 2 children
kids4	has 3 children
kids5	has 4 children or more
partner	has partner
part_emp	has partner * partner employed
Education (base=no/elementary education)	
edu_ba	has BA degree
edu_hs	has high school degree
edu_ls	has junior high school degree
edu_ms	has lower degree
Industry (base=metal manufacturing)	
sec1	agriculture
sec3	constructions
sec4	retail trade, hotels
sec5	transport and communication
sec6	services
sec7	public sector
sec8	health and education
sec9	other services
Lives in (base=inner city)	
city2	outer city
city3	town with size<2000
city4	town with 2.001 <size< 10.000
city5	town with 10.001 <size<50.000
city6	town with size >50.000
Nonemp	not employed
Region (base=North west)	
area2	North east
area3	Centre
area4	South
area5	Islands
Commuting costs	
Comm._var	Commuting time variable
Comm._mis	Commuting time missing
Time_comm.	Commuting time
Economic resources (base=worst)	
Sit_same	as last year
Sit_better	better than last year
Res_ok	adequate
Goods of difficult purchasing (base= no)	
from Num_diff2 to Num_diff5	from 1 item to 4 items
Preferences and social attitudes	
Ins_health	Health insurance
Ins_life	Life insurance
Bad_health	Perceives bad health
No_friends	Has not friends
No_church	Does not go to church

Table 4: Estimates of simultaneous model's equation 1: probit for volunteering

	$MALES$		$FEMALES$	
Eq1: volonteer	$Coef.$	$z-stat$	$Coef.$	$z-stat$
eta	.0376937	2.10	.0038676	0.14
eta2	−.000387	−1.89	.0001611	0.47
kids2	.0310373	0.51	−.070418	−0.85
kids3	.1208586	2.33	−.0842035	−1.13
kids4	.2341676	3.44	−.1611535	−1.55
kids5	.198681	1.72	−.077605	−0.45
partner	.0294501	0.59	.0131438	0.17
part_emp	.0425402	1.22	−.1274498	−1.89
edu_ba	.8621823	12.64	.8747858	9.94
edu_hs	.6284325	11.14	.5945018	8.12
edu_ls	.5671722	8.34	.415927	4.54
edu_ms	.325381	6.03	.2031602	2.88
chronic	.0757016	2.22	.1597786	3.60
area2	.2113986	4.82	.1674007	3.10
area3	−.0970387	−1.93	−.1664411	−2.78
area4	−.4492333	−8.97	−.4432843	−7.00
area5	−.181671	−2.93	−.3016618	−4.00
city2	.2876341	3.50	.2790245	3.20
city3	.7644835	9.58	.3963725	3.99
city4	.5901519	8.50	.449191	5.95
city5	.3764258	5.36	.1961534	2.57
city6	.1683065	2.23	.1976814	2.42
comm_var	13.3198	2.03	33.0723	2.97
comm_mis	.0813655	1.58	−.0213857	−0.39
time_comm	−.0022744	−2.05	−.0055826	−2.97
sit_same	−.0874662	−2.09	.0738756	1.38
sit_better	−.0397849	−0.70	.110652	1.53
res_ok	.1326719	2.95	.0690533	1.27
num_diff2	−.0325182	−0.44	.0748232	0.87
num_diff3	−.0084151	−0.09	.0775719	0.74
num_diff4	−.0961513	−0.75	.137796	1.02
num_diff5	−.0124146	−0.08	−.1420091	−0.66
ins_health	.1529604	4.43	.177961	3.56
ins_life	.1006484	2.98	.1216946	2.73
bad_health	−.1922871	−2.10	−.0571598	−0.59
no_friends	−.3541988	−6.24	−.3493166	−5.38
no_church	−.2126795	−4.74	−.1916263	−2.79
_cons	−2.893312	−7.36	−2.308187	−4.22

Table 5: Estimates of simultaneous model's equation 2: probit for donations

	MALES		FEMALES	
Eq2: donations	Coef.	z-stat	Coef.	z-stat
eta	.0559571	3.47	.0680433	2.85
eta2	-.0005306	-2.88	-.0007715	-2.54
kids2	.0011989	0.02	.3094596	4.24
kids3	-.0147703	-0.31	.1042855	1.58
kids4	.0005282	0.01	-.0879442	-0.99
kids5	-.1049275	-0.93	-.1240739	-0.79
partner	.0318841	0.71	-.128752	-1.84
part_emp	.1320517	4.28	.0114153	0.19
edu_ba	.7859082	13.36	.9235124	-2.05
edu_hs	.5764097	12.04	.6847203	11.10
edu_ls	.4010053	6.49	.4394492	5.66
edu_ms	.2144172	4.70	.1873351	3.12
chronic	.1241132	4.06	.2374432	6.19
area2	.1543793	3.83	.075201	1.58
area3	.03235	0.73	-.1258215	-2.47
area4	-.3148469	-7.12	-.4564493	-8.44
area5	-.0882586	-1.60	-.4571847	-7.22
city2	.2543512	3.91	.2335542	3.27
city3	.3588951	5.23	.2411731	2.82
city4	.3729487	6.71	.2868973	4.68
city5	.225112	4.03	.2121213	3.45
city6	.1299297	2.17	.0657513	0.97
comm_var	9.60705	1.71	12.95123	1.39
comm_mis	-.114917	-2.43	-.1850424	-3.82
time_comm	-.0016476	-1.73	-.0021956	-1.40
sit_same	-.0454863	-1.24	-.0084306	-0.18
sit_better	.0057604	0.12	.0374206	0.62
res_ok	.15452	4.02	.121545	2.55
num_diff2	-.0247432	-0.39	-.0221388	-0.30
num_diff3	.0904362	1.14	-.0358782	-0.36
num_diff4	-.2251589	-2.04	.018723	0.15
num_diff5	-.3921419	-2.31	-.4402215	-2.06
ins_health	.1644658	5.25	.1981286	4.46
ins_life	.2166848	7.16	.236175	6.03
bad_health~f	-.1046678	-1.39	-.0071913	-0.08
no_friends	-.1896806	-4.04	-.1263777	-2.42
no_church	-.1210931	-3.16	-.1518373	-2.66
_cons	-2.91763	-8.27	-2.881547	-6.10

Table 6: Estimates of simultaneous model's equation 3: tobit for log hours worked

	MALES		FEMALES	
Eq3: ln_orelav	Coef.	z-stat	Coef.	z-stat
eta	.0793707	6.94	.0531766	2.14
eta2	-.0011693	-8.61	-.0007846	-2.47
kids2	.0104412	0.27	.1112541	1.46
kids3	.1135825	3.45	.0792837	1.18
kids4	.0990938	2.20	.109156	1.24
kids5	.3804224	4.75	.2905083	1.52
partner	-.0640302	-2.09	.0189766	0.23
part_emp	.0534619	2.63	-.1928795	-2.81
edu_ba	-.0160112	-0.31	-.1684166	-1.73
edu_hs	-.0568836	-1.54	-.1500006	-2.09
edu_ls	-.0958254	-2.17	-.1319705	-1.47
edu_ms	-.016238	-0.51	-.0256875	-0.43
chronic	.0428839	2.03	-.0452117	-1.20
sec1	.5249746	9.69	.8865963	7.02
sec3	.2669928	7.61	.5449975	1.97
sec4	.3009055	9.25	.5300784	7.46
sec5	.3144881	8.00	.5601346	7.05
sec6	.240455	5.36	.5802708	5.67
sec7	.2245255	6.90	.5493294	7.36
sec8	.1976161	5.10	.4546366	6.42
sec9	.2409848	6.59	.5441657	6.82
occ1	.4235616	8.00	.3001927	1.43
occ2	.1925599	4.16	.4582476	5.29
occ3	.1997195	7.37	.4770638	7.87
occ5	-.068292	-0.37	.9949613	3.52
occ7	.3213438	6.56	.7987454	7.08
occ8	.3155933	6.51	.618717	3.18
occ9	.3105435	9.57	.8068312	10.35
area2	.0582364	2.10	.06549	1.38
area3	-.0144405	-0.49	-.0193936	-0.38
area4	-.1184723	-3.95	-.2129457	-3.73
area5	-.174889	-4.68	-.3860444	-5.26
city2	.0729362	1.77	.119401	1.76
city3	.0013294	0.03	.1011112	1.20
city4	.04753	1.35	.2399307	3.95
city5	-.0076128	-0.22	.0766731	1.28
city6	-.0295855	-0.83	-.0275383	-0.44
comm_var	4.180955	1.50	.0825124	0.01
comm_mis	-2.651459	-45.64	-3.62254	-50.88
time_comm	-.000727	-1.55	-.0000481	-0.05
sit_same	.0248562	1.01	-.018748	-0.44
sit_better	.0804308	2.40	.1522283	2.65
res_ok	.0504071	1.95	.0119455	0.26
num_diff2	.0048258	0.11	-.1809981	-2.60
num_diff3	-.0842993	-1.38	-.0420946	-0.37
num_diff4	-.1488328	-2.45	-.0837682	-0.63
num_diff5	-.3258693	-3.18	-.538557	-2.11
ins_health	.0745985	3.38	.046291	0.99
ins_life	.0349952	1.72	.0235654	0.58
bad_health	-.1937234	-3.28	-.0468575	-0.49
no_friends	-.0270028	-0.86	-.0600953	-1.16
no_church	-.0417636	-1.70	.0388093	0.74
_cons	1.769673	7.24	1.824926	3.77

Table 7: Estimates of simultaneous model's equation 4: tobit for log hours of domestic work

	MALES		FEMALES	
Eq4: ln_oredom	Coef.	z-stat	Coef.	z-stat
eta	.0280293	1.26	.0723441	5.44
eta2	-.0002911	-1.09	-.0009602	-5.53
kids2	.04141	0.54	.1069401	2.25
kids3	-.0515716	-0.77	.2345017	5.90
kids4	-.2417924	-2.36	.2742361	5.48
kids5	-.1325972	-0.70	.2739915	3.74
partner	-.4187834	-7.42	.3150323	8.19
part_emp	.1883639	4.29	.0432354	1.44
edu_ba	.0039424	0.05	-.2073889	-5.06
edu_hs	.0196376	0.27	-.0728666	-2.33
edu_ls	.1480327	1.65	-.0002268	-0.01
edu_ms	.0692713	0.96	-.0146506	-0.49
chronic	.0998885	2.33	.0645274	3.14
area2	-.0237104	-0.46	.0349563	1.36
area3	.0055568	0.10	-.02862	-0.99
area4	-.1356087	-2.20	.1139293	4.32
area5	-.1678985	-2.05	.0085534	0.24
city2	.004414	0.06	.0807273	2.11
city3	-.0080747	-0.09	.0098113	0.21
city4	-.0333465	-0.48	.1118613	3.54
city5	-.0681574	-0.99	.0499432	1.57
city6	.0112717	0.16	-.0036569	-0.10
comm_var	5.866753	1.03	6.079969	1.27
comm_mis	-1.325949	-15.58	.3848846	15.53
time_comm	-.0009988	-1.04	-.0010289	-1.28
sit_same	.0049191	0.10	-.0576797	-2.40
sit_better	-.0386426	-0.61	-.0739879	-2.40
res_ok	.0986296	1.84	.0616253	2.48
num_diff2	.0099392	0.10	.0479964	1.29
num_diff3	.2029191	1.72	.0139699	0.28
num_diff4	-.1653729	-0.98	.0281741	0.55
num_diff5	-.3251058	-1.54	-.1501551	-1.62
ins_health	-.0085676	-0.21	.0032236	0.14
ins_life	-.0727892	-1.88	-.0442079	-2.08
bad_health~f	-.2909867	-2.42	-.1076507	-1.98
no_friends	-.1728464	-2.41	-.1018338	-3.14
no_church	-.0926279	-1.84	-.1121335	-3.44
_cons	1.641457	3.56	1.43993	5.56
n. obs.	11,331		11,038	