

1 Introduction

Working as a volunteer is a widespread social activity. Many people engage in it in order to help correct perceived social problems. But volunteers also benefit personally and economically from this kind of pro-social behaviour. The personal benefits include the “warm glow” that one feels when giving to society. The economic benefits of volunteering derive from the acquisition of human capital, an expanded network of contacts, and the signaling of potentially productive characteristics to the labour market. Hence, working for free not only brings a feeling of personal satisfaction, it may also have substantial investment value that leads to higher wage offers in paid work opportunities.

In this paper, we focus on measuring the investment value of volunteer work and offer the first instrumental variables (IV) estimates of the wage returns to unpaid work experience. The data on volunteering decisions and annual earnings that we use are drawn from the British Household Panel Study (BHPS) between the years 1996 and 2008. Information from the BHPS is supplemented with data on rainfall in England, Scotland and Wales during the same period. We construct an instrumental variable based on the rainfall data in order to explicitly address the endogeneity problems involved and identify the wage returns.

Rainfall data is particularly appropriate in this context since it has recently been shown to be a credible source of exogenous variation in the cost of participating in different types of outdoor activities. Examples include attendance at 4th of July celebrations, political rallies and riots (Collins and Margo (2007), Madestam and Yanagizawa-Drott (2011) and Madestam, Shoag, Veuger and Yanagizawa-Drott (2013)). Taking inspiration from these studies, we conjecture that rainfall also induces exogenous variation in the cost of engaging in volunteer work. Greater expected rainfall in a locality may lower the opportunity cost of volunteering, as alternative outdoor leisure activities become less attractive. This could increase the propensity to engage in unpaid work which mostly takes place indoors. Greater anticipated rainfall should also have no direct effect on earnings after controlling

for unobserved individual fixed effects and a detailed set of observables, including paid work hours.

According to OLS estimates that do not seriously address the endogeneity problem, the increase in mean annual earnings due to volunteer experience, in constant 1987 pounds sterling, is a very modest £394 for men and a negligible -£29 for women. However, specifications which make use of the longitudinal aspect of the data and include unobserved fixed effects yield higher and more precisely estimated returns of £1,372 for men and £649 for women. IV estimates that exploit the rainfall instrument in addition to including fixed effects produce still higher estimated annual returns of £4,859 for men and £3,096 for women. The IV wage returns to volunteer experience are precisely estimated and substantial in magnitude as sample average incomes are £11,725 and £7,007 for employed men and women, respectively.

It is interesting that in all of our specifications, the estimated returns to unpaid work experience for men exceed those for women. A standard decomposition indicates that the larger returns for men can account for up to 20.2% of the gender earnings gap. To put this contribution to the gender earnings gap in perspective, we find that that it is smaller than the (uncorrected) contribution of full-time paid work experience (25.3%) but greater than the (uncorrected) contribution of part-time paid work experience (8.4%). The implication of the decomposition exercise is that an unequal valuation of volunteer experience by gender may be relatively more important in explaining the gender earnings gap than is the unequal valuation of part-time paid work experience, and nearly as important as the unequal valuation of full-time paid work experience.

In order to explore possible mechanisms underlying the substantial wage returns to volunteer experience for both men and women, we also explore descriptive data from the UK Citizenship Survey (UKCS). The UKCS does not reveal strong evidence in favor of a human capital or networking explanation for the wage returns. For example, gaining a recognized qualification or improving employment prospects is not stated to be a main motivation for volunteering. Rather, volunteers appear to be seeking a sense of personal achievement, a

feeling of being needed and enjoyment from doing things at which they excel. Thus, signaling may be a more likely source of the returns if these latter personality characteristics are also productive in the workplace and not immediately observable. Disconcertingly, the UKCS data do not reveal obvious gender differences in sources of satisfaction, motivations, types of volunteering organizations and activities that might help explain the differential returns by gender.

The policy implications of the study are explored by formulating a simple model of optimal volunteering and linking the theory to the empirical work. The model implies that when there is negative selection, i.e., IV estimates exceed OLS estimates, a lower cost of engaging in unpaid work would lead to an expanded and higher-skilled pool of volunteers, and greater societal benefits from volunteer work. Thus, the model helps place the estimation results in a broader policy context.

The rest of the paper is organized as follows. The next section formulates the model of optimal volunteering. Section 3 describes the data, reports OLS and fixed effects estimates, and expands upon the rainfall instrument. Section 4 outlines the IV estimation strategy. Section 5 reports reduced-form and IV estimates. Section 6 decomposes the gender earnings gap, explores possible mechanisms underlying the wage returns, and the differential returns by gender, and discusses the broader implications of negative selection. Section 7 summarizes and concludes.

2 Model

The simple model of optimal volunteering is similar in spirit to the general model of training in Heckman, LaLonde and Smith (1999). It differs from a pure model of training or certification by incorporating simultaneous paid and unpaid work, and non-pecuniary benefits. The model helps interpret estimation results, establish identification, and place the results in a broader policy context.

2.1 Decision Problem

Suppose there is a continuum of workers of skill type η , where η is drawn from a distribution $F(\cdot)$ with support $[\underline{\eta}, \bar{\eta}]$. η is conceived of as a general skill that is applicable to both paid and unpaid work. Individuals live for two periods and have subjective discount rate r . In the first period, individuals work for pay and choose whether to volunteer. In the second period, individuals only work for pay.

Volunteer work in the first period generates non-pecuniary benefits referred to as warm glow (see Andreoni (1989)). Let $g_1(\eta)$ denote warm glow, where $g_1(\eta)$ can either increase or decrease with skill level. Volunteering in the first period also involves disutility of work effort and out-of-pocket costs. The disutility of work effort is equivalent to foregone leisure. The out-of-pocket costs include commuting and childcare expenses. These latter costs are in addition to those incurred from having a paid job.

Let $\frac{C_1}{\eta}$ denote the monetary equivalent of additional foregone leisure and out-of-pocket costs when choosing to volunteer. These costs decrease with skill level, reflecting the assumption that higher-skilled individuals have differentially lower disutility of work effort and greater assets (less liquidity constrained).

Unpaid work may also have opportunity costs in terms of foregone earnings if it leads to less hours being devoted to paid work. In contrast to the disutility of work effort and out-of-pocket costs, foregone earnings increase with skill level since wages increase with η . Note that less hours devoted to paid work also implies less disutility of work effort, while adding a volunteer job implies more. Hence, C_1 should be interpreted as the net change in the disutility of work effort. It is the variation in the disutility of work effort, out-of-pocket costs and foregone earnings with skill level η that generates selection into volunteering.

Individuals seek to maximize lifetime income by choosing whether or not to volunteer in

the first period. The value functions are

$$V_1^{nv}(\eta) = w_1^{nv}(\eta) + \left(\frac{1}{1+r}\right)w_2^{nv}(\eta) \quad (1)$$

$$V_1^v(\eta) = w_1^v(\eta) + g_1(\eta) - \frac{C_1}{\eta} + \left(\frac{1}{1+r}\right)w_2^v(\eta) \quad (2)$$

where $V_1^k(\eta)$, $k = nv, v$ are the present discounted values of lifetime income in the non-volunteering and volunteering options, respectively. $w_t^k(\eta)$, $k = nv, v$, $t = 1, 2$, are the corresponding earnings in each option and time period.¹

Individuals choose to volunteer when $V_1^v(\eta) > V_1^{nv}(\eta)$, or when

$$\frac{w_2^v(\eta) - w_2^{nv}(\eta)}{(1+r)} + g_1(\eta) > \frac{C_1}{\eta} + (w_1^{nv}(\eta) - w_1^v(\eta)). \quad (3)$$

Equation (3) states that volunteering is optimal when the discounted wage returns to volunteering plus warm glow exceed the costs of volunteering. The costs include the disutility of work effort, out-of-pocket expenses and foregone wages.

The decision rule can also be expressed in terms of the maximum C_1 that an individual of type η is willing to incur to volunteer. This is denoted by $C_{max}(\eta)$ and is found by solving for the C_1 that equates $V_1^v(\eta)$ and $V_1^{nv}(\eta)$, i.e.,

$$C_{max}(\eta) = \eta \left[\frac{w_2^v(\eta) - w_2^{nv}(\eta)}{(1+r)} - (w_1^{nv}(\eta) - w_1^v(\eta)) + g_1(\eta) \right]. \quad (4)$$

Individuals choose to volunteer when $C_{max}(\eta) > C_1$ and do not volunteer otherwise. For a given η , $C_{max}(\eta)$ decreases with a smaller discounted wage premium and a larger first period wage loss. $C_{max}(\eta)$ increases with the extent of warm glow.

¹Note that η might increase in period 2 to $\eta' > \eta$ if there is skill acquisition in period 1. Modeling this process and taking into account possible differential skill acquisition between paid and unpaid work would not change anything of substance. This is also true for explicitly adding an unemployment option to the model.

2.2 Selection into Volunteering

If individuals who volunteer have lower intrinsic earnings potential (in the absence of volunteering) than those who do not, then there is negative selection into volunteering. Positive selection occurs when those with higher earnings potential individuals choose to volunteer. The type of selection into volunteering can be determined by examining how $C_{max}(\eta)$ varies with η .

Differentiating equation (4) with respect to η yields

$$\frac{\partial C_{max}(\eta)}{\partial \eta} = \frac{C_{max}(\eta)}{\eta} + \eta \left[\frac{\frac{\partial(w_2^v(\eta) - w_2^{nv}(\eta))}{\partial \eta}}{(1+r)} - \frac{\partial((w_1^{nv}(\eta) - w_1^v(\eta)))}{\partial \eta} + \frac{\partial g_1(\eta)}{\partial \eta} \right]. \quad (5)$$

As can be readily seen in equation (5), the sign of $\frac{\partial C_{max}(\eta)}{\partial \eta}$ is theoretically ambiguous. It depends on how the discounted wage premium, the first period wage loss and warm glow vary with skill level. If the signs and magnitudes of the derivatives on the right hand side are such that $\frac{\partial C_{max}(\eta)}{\partial \eta} > 0$, then higher-skilled individuals are willing to pay more to volunteer, and there is positive selection into volunteering. In this case, individuals with $\eta \in (\underline{\eta}, \eta^*)$ do not volunteer and individuals with $\eta \in (\eta^*, \bar{\eta})$ volunteer. η^* is the point in the skill distribution where $C_{max}(\eta) = C_1$. If $\frac{\partial C_{max}(\eta)}{\partial \eta} < 0$, then higher-skilled individuals are willing to pay less to volunteer, and there is negative selection into volunteering. In this latter case, individuals with $\eta \in (\underline{\eta}, \eta^*)$ volunteer and individuals with $\eta \in (\eta^*, \bar{\eta})$ do not volunteer.

The type of selection into volunteering has important implications for the effects of policy interventions. Consider a policy aimed at encouraging volunteer work, say through a tax credit for childcare expenses incurred while volunteering. This corresponds in the model to a decrease in C_1 . If there is positive selection into volunteering, a smaller C_1 implies $C_{max}(\eta) = C_1$ at a lower η^* . Hence, more low-skilled individuals choose to become volunteers. An expanded pool of volunteers increases societal benefits but the average quality of the volunteer pool, or the average quality of privately-provided social services, will be lower.

Under negative selection, a decrease in C_1 leads to $C_{max}(\eta) = C_1$ at a higher η^* and more high-skilled individuals enter the pool of volunteers. This means there will be an expanded pool of volunteers, a higher average quality of social services, and unambiguously greater societal benefits. Hence, it is an important empirical matter to identify the type of selection into volunteering.²

2.3 Identification

Identification of the wage returns to volunteer experience can be understood by establishing a link between the decision model and its implications for selection into volunteering, and the population means estimated by OLS and IV. The decision model characterizes a volunteer as having $C_{max}(\eta) > C_1$ and a wage $w_2^v(\eta)$, while a non-volunteer has $C_{max}(\eta) \leq C_1$ and a wage $w_2^{nv}(\eta)$. OLS yields a regression-adjusted estimate of

$$\begin{aligned}
 E(w_2^v(\eta) \mid C_{max}(\eta) > C_1) - E(w_2^{nv}(\eta) \mid C_{max}(\eta) \leq C_1) = \\
 E(w_2^v(\eta) - w_2^{nv}(\eta) \mid C_{max}(\eta) > C_1) + \\
 (E(w_2^{nv}(\eta) \mid C_{max}(\eta) > C_1) - E(w_2^{nv}(\eta) \mid C_{max}(\eta) \leq C_1)).
 \end{aligned} \tag{6}$$

The term to the left of the equals sign in equation (6) is the difference in mean wages between volunteers and non-volunteers according to the model's selection rule. The first term after the equals sign is the mean return to volunteering amongst individuals who choose to volunteer. It is the effect of treatment on the treated. The second term is the difference in mean non-volunteer wages between those who select into volunteering and those who do not. This term is the selection bias. Clearly, OLS does not identify the causal effect of volunteer experience on mean wages.

²The model abstracts from any social costs of providing tax relief and focuses only on the social gains derived from a greater number of volunteers and their productivity as captured by η . For studies on the relationship between taxation, government expenditures and charitable giving/volunteering, see Auten, Sieg and Clotfelter (2002), Feldman (2010) and Bartels, Cozzi and Mantovan (2012).

In contrast to OLS, IV yields a regression-adjusted estimate of the local average treatment effect (LATE), which is a causal expression (Angrist, Imbens and Rubin (1996)). In terms of the model, LATE is

$$E\left(w_2^v(\eta) - w_2^{nv}(\eta) \mid C_1'' > C_{max}(\eta) > C_1'\right) \quad (7)$$

where C_1'' and C_1' are exogenously high and low costs of volunteering, respectively. In the empirical work, the rainfall instrument serves as the exogenous cost shifter.

Assuming that the rainfall instrument is valid, and LATE yields a good approximation to the effect of treatment on the treated, i.e.,

$$E\left(w_2^v(\eta) - w_2^{nv}(\eta) \mid C_1'' > C_{max}(\eta) > C_1'\right) \approx E\left(w_2^v(\eta) - w_2^{nv}(\eta) \mid C_{max}(\eta) > C_1\right), \quad (8)$$

the difference between IV and OLS estimates is the selection bias. If IV exceeds OLS, selection bias is negative, and according to the model, the least-skilled individuals choose to volunteer. The opposite holds true if OLS exceeds IV. Selection bias is positive and individuals who choose to volunteer are the highest-skilled.

3 Data

The individual level data are drawn from the British Household Panel Survey (BHPS). The BHPS began in 1991 with a representative sample of 5,500 households (10,300 individuals) residing in 250 different regions in England, Scotland and Wales. Each adult member of the original sample (aged 16 and over) is interviewed face-to-face and re-interviewed annually. Wave 1 sample members are followed into new households if they move out or their original household breaks up. The BHPS ended with wave 18 in 2008.³

³The set of followed households was expanded in 1999 to include 1,500 additional households residing in Wales and 1,500 additional households living in Scotland. Further expansion took place in 2001 with the addition of 1,900 households residing in Northern Ireland. The BHPS was also augmented with 1,000 low-income households interviewed between 1997 and 2001 as part of the European Community Household

In 1996, the BHPS began asking about voluntary activities, but only every two years. This yields seven waves of information on unpaid work between 1996 and 2008. As a result of additional sample restrictions, the estimation sample contains 4,995 men and 5,870 women, corresponding to 12,811 man-years and 15,776 woman-years. The additional restrictions are standard ones for the BHPS. We only consider respondents between the ages of 21 and 60. Retirees, the long-term sick and disabled, and individuals who did not reply to the employment questions are excluded from the analysis. Men and women on paternity or maternity leave are kept in the sample as long as they provide information on usual employment status (part-time or full-time).

The exact wording of the volunteering question in the BHPS is, “We are interested in the things people do in their leisure time. I’m going to read out a list of some leisure activities. Please look at the card and tell me how frequently you do each one...unpaid voluntary work.” The options on the card are, i) at least once a week, ii) at least once a month, iii) several times a year, iv) once a year or less and v) never/almost never.

In the regression analysis, a dummy variable is set equal to one if the individual reports having done any unpaid voluntary work in the current survey or any past survey, and zero otherwise. Day and Devlin (1997,1998) define their volunteering dummy analogously in their cross-sectional Canadian data. This proxy for accumulated volunteer experience allows past volunteering to affect future earnings as in the theoretical model. We do not distinguish the number of years (greater than one) that an individual volunteers over the sample period. Assigning an exact value for accumulated years of volunteer experience is impossible due to unobserved initial conditions and missing data during the sample period. Missing data during the sample period derives from temporary attrition as well as the fact that the volunteering questions are asked every two years.

Panel. Because there is relatively little information available on the volunteering outcomes of residents of Northern Ireland, they are eliminated from the sample.

3.1 Descriptive Statistics

Table (1) reports information on the frequency of unpaid work by year and gender in the current wave only (ignoring voluntary activities further in the past). Pooled over all years, the mean volunteering rate is 18.7% for men and 21.1% for women. Amongst the volunteers, women engage in unpaid work more frequently than men. Between the years 1996 and 2008, the yearly volunteering rate fluctuates in a fairly tight range, except for a noticeable jump amongst both genders in the 2002 wave. The jump is fully reflected in the increase in the volunteer “once a year or less” category. In the regression analysis, year controls capture this anomaly.

The differences in the characteristics of volunteers and non-volunteers by gender is shown in Table (2). The figures illustrate that both male and female volunteers are more educated, more likely to be employed in a paid job, have higher earnings and spousal income, are slightly older, more likely to be married and have older children than non-volunteers of the same gender. Male volunteers are more likely to be employed in full-time paid work while female volunteers are more likely to be employed in part-time paid work compared to non-volunteers of the same gender. Differences-in-differences estimates by characteristic show significant gender differentials between volunteers and non-volunteers in full-time paid employment, earnings and spousal income. These patterns are highly consistent with previous findings in the volunteer labor supply literature (see Menchik and Weisbrod (1987) and Freeman (1997)).

The distribution of accumulated volunteer experience by gender is displayed in the bottom panel of Table (2). The accumulation is highly inaccurate for the reasons mentioned earlier. Nonetheless, it is useful for purely descriptive purposes and establishing bounds. The figures show that 59.9% of men never volunteered, compared to 55.4% of women. These are clearly upper bound figures due to the initial conditions and missing data problems. Amongst those who are observed to volunteer at least one year, 72.5% of men volunteered at least one or

two years. The corresponding figure for women is 66.2%. Thus, there is no strong reason to believe that one particular gender is relatively more persistent in volunteering behavior. This implies that the definition of the volunteering dummy used in the regression analysis should not be problematic for inferring gender differences.

3.2 OLS and Fixed Effects Estimates

OLS and fixed effects estimates of the increase in mean annual earnings due to volunteer experience are reported in Table (3). In the OLS regressions, standard errors are heteroskedasticity-robust, and in the fixed effects regressions, standard errors are clustered at the individual level. This yields the largest standard errors amongst the various alternatives and is therefore the most conservative strategy from the viewpoint of statistical significance. In order to reduce selection bias in a relatively innocuous way, we do not select the sample based on employment status and include zero earnings in the regressions for those without paid employment. Further, we take a more non-parametric approach than usual by eschewing log-linear specifications. That is, we focus on income levels rather than logs and calculate percentage impacts of the covariate of interest (See Kugler and Sauer (2005)).

With year and region dummies included, OLS yields an estimated increase in annual earnings of £1,698 for men (column (1)). For the purpose of translating this level increase into percentage terms, we use a “treatment on the treated” percentage impact figure. The percentage impact is defined as the ratio of the coefficient on volunteering to predicted earnings. Predicted earnings is the fitted value of earnings amongst individuals that have volunteer experience (the treated) with the volunteering dummy counterfactually set to zero. The resulting percentage impact corresponding to £1,698 is 15.7%.

Column (2) includes employment, education and ethnicity variables as well as other covariates, such as the number of children, whether the individual is a student, spousal income, dummies for age, marital status, age of children, belonging to a union, being a professional/manager, working for a nonprofit organization, the size of the firm, and having

use of a car. Adding these covariates reduces the estimated return to £394. The percentage impact is 2.4%.

Column (3) reports fixed effects estimates for men without any time-varying controls. The estimated return is £1,537, corresponding to a percentage impact of 14.9%. Adding paid employment indicators and other time-varying regressors to the fixed effects regression yields a return of £1,372, or a percentage impact of 12.1% (column (4)). The returns to volunteer experience in these specifications are precisely estimated.

The estimated returns for women, reported in columns (5) through (8), are consistently lower than those obtained for men. With year and region dummies, OLS yields an estimated return of £320, or a percentage impact of 5.8%. Adding other regressors, the return decreases to -£29 and loses statistical significance. The percentage impact is -3.7%.

Including individual fixed effects, the estimated returns for women become larger in magnitude and precisely estimated. Without any time-varying controls, the estimated return is £646, corresponding to a percentage impact of 12.4%. Adding controls, the estimated return increases slightly to £649, implying a percentage impact of 14.1%. The results also indicate that the paid employment variables are particularly important covariates for both men and women. The age of children dummies (not shown in the table) have a strong impact on the earnings of women but not men.

3.3 The Rainfall Instrument

Rainfall data have been used before, quite extensively, in studies of economic growth and conflict. Miguel, Satyanath and Sergenti (2004) examine a cross-section of 41 African countries and find that economic growth is a negative predictor of conflicts, using rainfall as instrument. Bruckner and Ciccone (2011) use rainfall as an instrument to show that transitory economic shocks can trigger democratic transitions in Sub-Saharan countries (see also Paxson (1992), Rosenzweig and Wolpin (1993) and Maccini and Yang (2009)). The validity of the rainfall instrument in this context has not gone unquestioned. For example,

Sarsons (2015) finds a strong effect of rainfall on conflicts in Indian districts that are irrigated through dams, suggesting that income is not the only channel through which rainfall is affecting conflict.

Rainfall has only recently been used as an instrument for participation in outdoor activities such as 4th of July celebrations, political rallies and riots. Collins and Margo (2007) use rainfall as an instrument for rioting in the US. They find that an increase in rainfall decreased the propensity for riots to occur in the 1960s, which in turn affected the value of houses in African-American neighbourhoods. Similarly, Madestam Shoag, Veuger and Yanagizawa-Drott (2013) use rainfall as instrument for attendance at Tea Party rallies in order to evaluate the success of the political movement. Madestam and Yanagizawa-Drott (2011) use rainfall as an instrument for childhood attendance at 4th of July celebrations to explain political preferences. There are no studies yet which have seriously questioned the validity of the rainfall instrument in this alternative context.

In the spirit of these latter studies, we conjecture that rainfall also induces exogenous variation in the cost of volunteering. Greater expected rainfall is likely to lower the opportunity cost of volunteering, as alternative outdoor leisure activities become less attractive. This should increase the propensity to engage in unpaid work. However, more rainfall should have no direct effect on earnings after controlling for a detailed set of observables and individual fixed effects.

There is indeed evidence that volunteering in the UK is mainly an indoor activity. From the volunteering websites do-it.org.uk and volunteering.co.uk, one can readily examine the range of volunteer job openings. While a few volunteer posts do involve outdoor work, for example serving as a summer camp counselor, the overwhelming majority of posts are associated with indoor work. Obvious examples include volunteering opportunities in museums and libraries.

In order to illustrate that there is sufficient variation in the proposed instrument, Figure (1), obtained from the Met Office website, displays average yearly rainfall levels across the

UK. In the south, the southeast (including London) and East Anglia, less than 700 millimeters of rain usually fall per year. In Essex, rainfall can be below 450 millimeters annually, which is less than the average annual rainfall in Jerusalem and Beirut. The mountains of Wales, Scotland, the Pennines and the moors of southwest England are the wettest parts of the UK. As much as 4,500 millimeters of rain can fall annually in these areas, making them some of the wettest locations in all of Europe.

The Met Office releases its rainfall data via the Met Office Integrated Data Archive System (MIDAS), accessed through the British Atmospheric Data Centre. For the years covering our sample period, we obtained daily rainfall information from every available weather station in England, Scotland and Wales that operated during the entire year. Measurements were obtained from a yearly average of 2,027 weather stations.

The BHPS contains information on the Local Authority District (LAD) in which a respondent lives. Using GeoConvert, a service available from the UK Data Service, it is possible to match LADs to postcode districts. Weather stations can also be linked to a postcode district. After merging the BHPS and the MIDAS datasets, we obtained 50,419 person-year observations distributed across 364 different LADs.

The rainfall instrument for each individual is then defined as a three-year moving average of mean daily rainfall (previous, current and following year) in the person's LAD of residence. The three-year moving average has both theoretical and practical appeal. On the theoretical level it allows for adaptive expectations that are also forward looking. Use of a yearly moving average also recognizes that volunteer work is a time commitment that is likely to be based on longer-term weather trends rather than very short-term weather shocks. On the practical side, it smooths the rainfall data while still producing substantial variation in the instrument over time.

Table (4) reports the mean three-year moving average, by year, in eight large regions in the UK. There is clearly quite a bit of cross-sectional and time variation in the instrument. The mean daily rainfall (in millimeters) in 1996 is considerably lower than in 2008 across all

regions. The amount of rainfall fluctuates from year to year but does tend to grow over time. Pooling over all years, it is evident that Wales and North England are the wettest regions, while East England and London are the driest. The table also shows the number of LADs in the data, in each one of the major regions.

As will be shown in the first-stage regressions of the IV procedure, there is a strong positive correlation between regional rainfall and the propensity to volunteer in wetter areas. The main threat to identification when using rainfall as an instrument rests in the possibility that rainfall may also directly affect earnings through the choice to work more hours in a paid job. This threat is reduced by including flexible controls for hours of paid work in all our specifications. Importantly, an alternative first stage regression that uses hours of paid work per week as the dependent variable also indicates no correlation between hours of paid work and rainfall. The results of several placebo first-stage regressions are reported below.

4 Estimation Strategy

The estimation framework that we consider is a linear, constant-effects model that connects the annual earnings of individual i at time t , Y_{it} , with a proxy for volunteer experience, V_{it} , a vector of individual characteristics, X_{it} , an individual time-invariant effect, u_i , and a random error component specific to individuals at time t , ϵ_{it} :

$$Y_{it} = X_{it}\beta + V_{it}\alpha + u_i + \epsilon_{it} \tag{9}$$

Equation (9) describes the earnings of individuals under alternative assignments of volunteer experience, controlling for any effects of X_{it} and u_i . X_{it} contains a large set of observables described earlier. u_i captures unobserved time-invariant skill and preference characteristics while ϵ_{it} represents unobserved time-varying skill and preference shocks.

As equation (4) in the decision model makes explicit, V_{it} is not randomly assigned. V_{it} is likely to be correlated with ϵ_{it} , even after controlling for X_{it} and u_i , due to time-varying

shocks to η , or warm glow $g_1(\eta)$. Therefore, OLS and fixed-effects estimates of equation (9) do not have a causal interpretation.

In IV estimation, the first-stage relationship between volunteer experience, X_{it} , u_i and the rainfall instrument, W_{it} , is

$$V_{it} = X_{it}\pi_0 + W_{it}\pi_1 + u_i + \xi_{it}. \quad (10)$$

The error term ξ_{it} is defined as the residual from the population regression of V_{it} on X_{it} , u_i and the instrument W_{it} . This residual captures other factors that are correlated with volunteer experience and may be correlated with ϵ_{it} , such as unobserved skill and warm glow preference shocks.

As mentioned earlier, the key identifying assumption is that rainfall affects the cost of volunteering but does not directly influence earnings, after controlling for X_{it} and u_i . IV estimates have a causal interpretation as long as the association between rainfall and earnings is solely due to the association between rainfall and the decision to volunteer. As in the OLS and fixed effects estimates, X_{it} contains the reported number of hours of paid work as well as dummies for part-time and full-time paid employment. This reduces the threat to identification deriving from rainfall having a direct effect on earnings through more hours being worked in a paid job. It is also important to reiterate that alternative first stage regressions that use hours of paid work per week as the dependent variable do not reveal any correlation between hours of paid work and rainfall. In addition, inclusion of the individual fixed effect u_i corrects for the possibility that highly-skilled individuals may sort to dryer locations.

5 Estimation Results

5.1 Reduced-Form Estimates

Reduced-form estimates of the effect of rainfall are reported in Table (5). Standard errors are clustered at the individual level. Clustering at the individual level produces the largest standard errors amongst the various alternatives and is therefore the most conservative strategy. The fixed effects regressions in columns (1)-(4) include a relatively large set of time-varying covariates. In addition to several controls for hours of paid work that are shown in the table, other regressors include the number of children, whether the individual is a student, spousal income, dummies for age, marital status, age of children, union membership, being a professional/manager, working for a non profit organization, firm size, and having use of a car.

Columns (1) and (3) show coefficients for the first stage described in equation (10). Estimates of fixed effects linear probability models reveal that a higher three-year moving average of rainfall increases the probability of having volunteer experience amongst both men and women. This is consistent with the conjecture that rainfall decreases the opportunity cost of volunteering. The relationship between rainfall and the propensity to volunteer is stronger for women than for men but the respective coefficients (.047 and .056) are not significantly different. The F-statistics at the bottom of the table indicate that the instrument is quite strong for both genders. An additional test for weak instruments is performed below.

Columns (2) and (4) report reduced-form effects of the rainfall instrument on mean annual earnings. More rainfall is associated with higher mean earnings. The relationship is relatively stronger for men than women. The effect of rainfall on mean annual earnings is precisely estimated for both genders.

5.2 Instrumental Variables Estimates

IV estimates of the effect of volunteer experience on mean annual earnings are reported in Table (6). Volunteer experience is instrumented with the three-year moving average of rainfall. Fixed effects are included as are the same set of time-varying controls described earlier in the context of the reduced form estimates.

The IV estimate of the returns to volunteer experience for men is £4,859 (column (1)). The effect is precisely estimated and implies a percentage impact of 45.5%. This is in contrast to the annual increase of £1,372, or percentage impact of 12.1%, produced by the corresponding fixed effects specification without the rainfall instrument (Table (3)).

The IV estimate of the returns to volunteer experience for women is £3,096 (column (2)). The effect is also precisely estimated and implies a percentage impact of 38.3%. This contrasts with the annual increase of £649, or percentage impact of 14.1%, produced by the corresponding fixed effects specification in Table (3). Even though the returns to volunteer experience are now more substantial in magnitude for women, they are still smaller than for men.

It is important to note that the returns to volunteer experience that we estimate are the returns among individuals who would not have volunteered had the expected long-term weather outlook been different. That is, they are local average treatment effects. Individuals who are the most sensitive to rainfall (the cost of volunteering) contribute the most to the average causal response (see Angrist, Graddy and Imbens (2000)). We attempted to say a bit more about who these compliers are by calculating the likelihood of being a complier for each individual characteristic in isolation. We found that compliers are not likely to have children, perhaps because parents are often required to do a certain amount of volunteering for their children's school. Being male and working part-time is strongly indicative of being a complier, although this represents a very small proportion of the sample. We did not find any other individual characteristics that are strong indicators of being a complier.

We believe the relatively large “treatment on the treated” percentage impacts produced are plausible. The additional monetary costs incurred when an individual volunteers, e.g., additional childcare expenses, can be considerable. These latter annual costs are generally within the range of the increase in annual earnings that the IV estimates produce. High marginal costs require sufficiently large returns in future paid work to make volunteer work economically viable.

Because we are identifying local average treatment effects, our estimates are also not directly comparable to the very few already existing estimates. Day and Devlin (1997,1998) obtain returns to volunteer experience in Canada of 6.6%. By gender, the returns are 9% for men and zero for women. These estimates are not corrected for biases due to nonrandom selection. However, they are roughly similar to our pooled OLS estimates.

Sauer (2012) estimates returns to volunteer experience for women in the US that amount to 8.2% in part-time work and 2.4% in full-time work. These latter estimates are corrected for nonrandom selection, but are derived from a discrete choice dynamic programming model and correspond to average treatment effects. Although these estimates are not directly comparable, there is now increasing evidence that the returns to volunteer experience are economically important.

5.3 Robustness Checks

Table (7) reports several robustness checks and additional IV results of interest. The 2SLS estimates of the returns to volunteer experience are reproduced from Table (6) in order to facilitate comparison. Below the 2SLS estimates, limited information maximum likelihood (LIML) estimates of the returns are reported. The 2SLS and LIML estimates are nearly identical. This further suggests that there is little worry of a weak instruments problem.

The table also reports IV estimates of the returns to volunteer experience produced when only individuals with greater than zero annual earnings are included. The returns increase

from £4,859 to £5,503 for men, and from £3,096 to £4,106 for women. The returns are precisely estimated. Ignoring selection bias thus leads to higher estimated returns. In this case, including the unemployed and assigning zero earnings not only addresses selection bias it is also a more conservative empirical strategy.

An additional robustness check excludes individuals that reside in London. The returns to volunteer experience decrease only slightly to £4,560 and £3,061 for men and women, respectively. The returns are precisely estimated even though there is a relatively large loss in sample size. Using mean daily rainfall in the year of the individual's current residence as the instrument instead of the three year moving average., the returns increase to £6,010 and £3,704 for men and women, respectively. The standard errors in this latter specification increase but the returns are still precisely estimated. Using the three-year moving average and smoothing out the rainfall data produces more conservative and less noisy estimates of the returns to volunteer experience. The final row of Table (7) reports estimates when a three-year moving average of temperature is used in place of the three-year moving average of rainfall. The IV estimates are even more substantial in magnitude and precisely estimated. However, the sample size is considerably reduced and the instrument is relatively weaker. Using data on sunshine in an analogous way reduces the sample size further and produces much noisier estimates (not shown).

There are additional IV results worth mentioning, but not shown for sake of brevity. Most important, there are no significant interactions between volunteer experience and other covariates for both men and women. Thus, there is little suspicion of heterogeneous treatment effects. Using an alternative definition of volunteer experience, which relies on reported volunteering only two years earlier, the length of time between questions in the survey, produces very imprecise estimates. As argued earlier, this latter definition is expected to produce a very noisy measure of volunteer experience. We also introduced time fixed effects, however they were difficult to identify individually. We were able to find a significant decade effect by introducing two year dummies, one for one for the years 2002 and 2004, and one for

the years 2006 and 2008. The base category contains years 1996, 1998, and 2000. Introducing these time fixed effects does not substantially change the results.⁴

In order to further explore the validity of the rainfall instrument, Table (8) presents the results of alternative, placebo-type first-stage regressions. The idea is that if rainfall were strongly correlated with several other important outcomes, besides volunteer experience, then volunteering would possibly not be the main channel through which rainfall is affecting income. Exogeneity of the rainfall instrument would then be more questionable. Using hours worked, full-time work status, marital status, spousal income and the number of children as alternative dependent variables, Table (8) clearly illustrates that none of the placebo first-stage regressions reveal any substantial or statistically significant effects of rainfall.

6 Discussion

6.1 The Gender Earnings Gap

In order to assess the extent to which gender differences in the returns to volunteer experience contribute to the gender earnings gap, we follow Day and Devlin (1997) and compute a standard Blinder (1973) and Oaxaca (1973) earnings decomposition. Although alternative decomposition methods have recently been explored (e.g., Card, Cardoso, and Kline (2013)), other methods are either not appropriate in our context or do not readily extend to a detailed decomposition into individual components. The standard decomposition is,

$$\bar{Y}^m - \bar{Y}^f = \hat{\beta}^m (\bar{X}^m - \bar{X}^f) + (\hat{\beta}^m - \hat{\beta}^f) \bar{X}^f \quad (11)$$

where \bar{Y}^j is mean earnings, $\hat{\beta}^j$ is a row vector of IV estimates, and \bar{X}^j is a column vector of sample means, for $j = m, f$ (males and females, respectively).

The first term after the equals sign in (11), referred to as the endowments effect, is the

⁴For men, the IV coefficient on volunteering with time fixed effects is 4.44, with a standard error of 2.2. For women, the corresponding IV coefficient is 3.89, with a standard error of 1.33.

part of the gender earnings gap attributable to differences in characteristics. The second term after the equals sign, referred to as the coefficients effect, is the part of the gap attributable to differences in the returns to those characteristics.

Table (9) reports the resulting endowment and coefficients effects for volunteer, part-time and full-time experience, as well as the percentage of the earnings gap due to the coefficients effect, using the IV estimates. The decomposition shows that 72.2% of the mean earnings gap of £3,624 is attributable to the coefficients effect. This is consistent with the wider literature on gender differences which suggests that differences in skill levels have become increasingly less important (see, e.g., Niederle and Vesterlund (2007)). It is also consistent with previous studies on the gender earnings gap in the UK. In particular, Wright and Ermish (1991) estimate that 48.8% of the gender earnings gap in the UK, in 1980, is due to the coefficients effect. Considering that skill differences have become less important over time, the coefficients effect should now be larger, as we indeed find.

Most important, the decomposition indicates that the differential returns to volunteer experience account for 20.2% of the total earnings gap. Interestingly, this lies between the corresponding contributions of part-time and full-time paid work experience. The differential returns to part-time and full-time experience account for 8.4% and 25.3% of the total earnings gap, respectively. The implication is that a more equal valuation of volunteer experience is relatively more important in closing the gender earnings gap than is a more equal valuation of part-time paid work experience. The unequal valuation of volunteer experience by gender is nearly as important as the unequal valuation of full-time paid work experience. A caveat to this conclusion is that the contributions of part-time and full-time experience are not corrected for non-random selection. It is possible that the ranking between the different returns to experience would be altered were good instruments available for part-time and full-time experience as well. Nonetheless, we believe the uncorrected ranking provides important information that has not yet been supplied in the literature.⁵

⁵The results in Table (9) are robust to changes in the base category for the categorical variables and to using the female earnings structure, rather than the male's, as the counterfactual (see Fortin, Lemieux and

6.2 Mechanisms

The decomposition results illustrate the importance of the differential returns to volunteer experience in explaining the gender earnings gap. However, they do not shed much light on why women receive lower returns to volunteer experience than men. In order to explore sources of the returns to volunteer experience, and possible reasons for gender differentials, we examine data from the UK Citizenship Survey (UKCS).

The UKCS ran every two years from 2001 until 2007. It was subsequently conducted on a quarterly basis until its cancellation in 2011. In each wave, approximately 15,000 adults living in England and Wales were interviewed. The UKCS contains more comprehensive questions on volunteering than the BHPS, but is purely cross-sectional and the volunteering questions tend to vary substantially each wave. However, it is quite useful for descriptive purposes. The UKCS sample we use closely mimics the BHPS sample. The total number of observations is 58,062.

In general, the UKCS does not reveal strong evidence in favor of a human capital or networking explanation underlying the wage returns to volunteer experience. Rather, volunteers appear to be seeking a sense of personal achievement, a feeling of being needed and enjoyment from doing things at which they excel. Thus, signaling may be a more likely source of the returns if these latter personality characteristics are also productive in the workplace and not immediately observable. The UKCS also does not reveal obvious gender differences that might help explain the differential returns by gender. This is illustrated in Tables (10) - (12).

Table (10) reports the types of organizations for which people volunteer. The most frequent organizations are those involved in education, sports, religion, the arts and social activities. A substantial proportion also choose the “other/none of these” category. Women engage more in educational activities, while men are more involved in sports related activities. However, gender differences are not quantitatively strong.

Firpo (2011)).

The top panel of Table (11) displays information on the types of formal volunteering activities in which individuals engage. The most common activities are fundraising, organizing activities, giving advice or counseling and other practical help. The most frequent choice is “none of the above”. Women are involved somewhat more in other practical help, while men provide more transportation services. However, this latter activity is not a frequent one. Strong gender differences are not apparent in this dimension either.

The middle panel of the table shows the distribution of informal volunteering activities. The most common categories are giving advice, looking after property, caring for children, and helping those who have difficulty shopping, paying bills, writing letters and getting out and about. Women do more shopping and paying bills and men engage more in home or car repairs. However, this latter category is not a frequent one. Gender differences are negligible. The bottom panel of the table shows that informal volunteering is more frequent than formal volunteering. But there are no substantial gender differences.

The top panel of Table (12) lists a set of volunteering motivations. The most common categories are wanting to help people and the cause being important. Among the least common categories are getting on in one’s career and having a chance to acquire a recognized qualification. Men are slightly more motivated if friends or family volunteered in the past, while women care more if the volunteering activity is connected with the needs of family or friends. Gender differences in motivations are small in magnitude.

The bottom panel of the table lists various types of satisfaction derived from volunteering. The frequencies indicate that gaining a recognized qualification or improving employment prospects is not a main motivation. Volunteers are more satisfied by meeting people, making friends, seeing results, having a sense of personal achievement and enjoying themselves. Women gain more satisfaction if they meet people, make friends and feel needed, while men are more interested in having a chance to do things at which they excel. Gender differences are once again small in magnitude.

In sum, the UKCS does not reveal substantial gender differences along several different

dimensions of volunteer experience. Volunteering as a means of acquiring human capital or expanding networks also does not figure prominently in the responses of volunteers. Volunteers appear to be individuals with social concerns that are motivated to help people and help correct perceived social problems. These may also be productive characteristics that are attractive to employers. If so, one may conclude that the most likely source of the returns to volunteer experience for both men and women is signaling. Disconcertingly, the signal may be less effective for women than for men.⁶

6.3 Negative Selection

The results in Tables (3) and (6) show that IV estimates of the returns to volunteer experience are consistently larger than in corresponding specifications estimated by OLS. This indicates negative selection into volunteering amongst both men and women. In other words, individuals who volunteer have lower intrinsic earnings potential (in the absence of volunteering) than those who do not.

The theoretical model of optimal volunteering presented earlier characterizes negative selection as a state in which those with intrinsic earnings potential $\eta \in (\underline{\eta}, \eta^*)$ volunteer and those with $\eta \in (\eta^*, \bar{\eta})$ do not. Under negative selection, $\frac{\partial C_{max}(\eta)}{\partial \eta} < 0$, or the maximum an individual is willing to pay to volunteer decreases with skill level. As equation (5) clearly illustrates, the sign of $\frac{\partial C_{max}(\eta)}{\partial \eta}$ depends on how the discounted wage premium, the monetary costs and warm-glow from volunteering vary with η . Since we find no empirical evidence of heterogeneous discounted wage premia, $\frac{\partial C_{max}(\eta)}{\partial \eta} < 0$ may be due to the wage loss from volunteering increasing with η , or warm glow decreasing with η , or a combination of the two.

Within the context of the theoretical model, negative selection also has important implications for the predicted effects of policy interventions. This is especially relevant in the

⁶As mentioned earlier, we did not find substantial interactions with volunteer experience besides gender. In particular, low education and high education individuals receive approximately the same returns to volunteering. Thus, there is no evidence that the volunteering signal is either substitutable or complementary with the education signal.

UK, where successive governments have been searching for ways to promote voluntary activities as part of a “Big Society” initiative. Consider a policy aimed at encouraging voluntary activity via a tax credit for childcare expenses incurred while volunteering. This translates into a decrease in C_1 , which leads to $C_{max}(\eta) = C_1$ at a higher η^* . This implies that more highly-skilled individuals would enter the pool of volunteers. Thus, in addition to the expanded pool of volunteers, there would also be a higher average quality of social services flowing from increased voluntary activities.

It is interesting to note that a childcare tax credit might also lead to a narrowing of the gender earnings gap. This could occur if the tax credit had the effect of reducing C_1 relatively more for women than for men. The increase in η^* would then be relatively greater for women, resulting in a composition effect that increased mean annual earnings for women by more than it increased mean annual earnings for men.

7 Conclusion

This study measures the future wage returns to volunteer experience. OLS estimates of the increase in mean annual earnings due to volunteer experience are £394 for men and -£29 for women. Fixed effects estimates yield higher estimated returns of £1,372 for men and £649 for women. IV estimates that include fixed effects and instrument volunteer experience with a three-year moving average of district level mean daily rainfall produce more substantial and precisely estimated returns of £4,895 and £3,096 for men and women, respectively. These latter estimates are local average treatment effects and should be interpreted as the returns amongst individuals who would not have volunteered had the weather been different.

In nearly all of our specifications men enjoy larger returns to volunteer experience than women. We show that the differentially larger returns for men account for up to 20.2% of the gender earnings gap. This lies between the contributions of the differential returns to part-time and full-time paid work experience (8.4% and 25.3%, respectively). The implication is that a more equal valuation of volunteer experience is relatively more important in closing the

gender earnings gap than is a more equal valuation of part-time paid work experience. The unequal valuation of volunteer experience by gender is nearly as important as the unequal valuation of full-time paid work experience in explaining the gender earnings gap.

Analysis of an additional data set, the UK Citizenship Survey, suggests that the most likely source of the returns to volunteer experience for both men and women is signaling. Volunteers appear to be individuals with social concerns that are motivated to help people and help correct perceived social problems. These may also be productive characteristics that are attractive to employers. The UKCS does not contain strong descriptive evidence of substantial differences in the types of volunteer organizations, activities, motivations or sources of satisfaction between genders that might explain the differential returns.

IV estimates that exceed OLS estimates of the returns to volunteer experience suggest that there is negative selection into volunteering for both genders. In order to give an economic interpretation to the OLS and IV estimates, we develop a simple model of optimal volunteering. According to the model, the negative selection that we empirically find implies that a reduction in the cost of volunteering would lead to an expanded and higher-skilled pool of volunteers, and greater societal benefits. Moreover, a reduction in the cost of volunteering could also help narrow the gender earnings gap.

References

- [1] Andreoni, J. 1990. "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving," *Economic Journal* 100: 464-477.
- [2] Angrist, J.D., K. Graddy, and G. Imbens. 2000. "The Interpretation of Instrumental Variables Estimators in Simultaneous Equations Models with an Application to the Demand for Fish," *Review of Economic Studies* 67: 499-527.
- [3] Angrist, J.D., G. Imbens, and D.B. Rubin. 1996. "Identification of Causal Effects Using Instrumental Variables," *Journal of the American Statistical Association* 91: 444-472.
- [4] Auten, G.E., Sieg, H., and C.T. Clotfelter. 2002. "Charitable Giving, Income and Taxes: An Analysis of Panel Data," *American Economic Review* 92: 371-382.
- [5] Bartels, K.P.R., G. Cozzi, and N. Mantovan. 2012. "The Big Society, Public Spending, and Volunteering," *Public Administration Review*.
- [6] Blinder, A.S. 1973. "Wage Discrimination: Reduced form and Structural Estimates," *Journal of Human Resources* 18: 436-455.
- [7] Brückner, M. and A. Ciccone. 2011, "Rain and the Democratic Window of Opportunity," *Journal of Human Resources* 79(3): 923-47.
- [8] Card, D., A. R. Cardoso, and P. Kline. 2013. "Bargaining and the Gender Wage Gap: A Direct Assessment," IZA Discussion Paper No. 7592.
- [9] Collins, W. J., and R. A. Margo. 2007. "The Economic Aftermath of the 1960s Riots in American Cities: Evidence from Property Values," *Journal of Economic History* 67: 849-883.
- [10] Day, K.M., and R.A. Devlin. 1997. "Can Volunteer Work Help Explain the Male-Female Earnings Gap?" *Applied Economics* 29: 707-721.
- [11] Day, K.M., and R.A. Devlin. 1998. "The Payoff to Work without Pay: Volunteer Work as an Investment in Human Capital," *Canadian Journal of Economics* 31: 1179-1191.
- [12] Feldman, N.E. 2010. "Time is Money: Choosing Between Charitable Activities," *American Economic Journal: Economic Policy* 2: 103-130.
- [13] Fortin, N., T. Lemieux and S. Firpo. 2011. "Decomposition Methods," in O. Ashenfelter and D. Card (eds.) *Handbook of Labor Economics*, Vol. 4A, Amsterdam: North-Holland, 1-102.
- [14] Freeman, R.B. 1997. "Working for Nothing: The Supply of Volunteer Labor," *Journal of Labor Economics* 15: 140-166.

- [15] Heckman, J.J., R.J. LaLonde, and J.A. Smith. 1999. "The Economics and Econometrics of Active Labor Market Programs," In *Handbook of Labor Economics*, vol. 3A, ed. O. Ashenfelter and D. Card. Amsterdam: North-Holland.
- [16] Kugler A.D, and R.M. Sauer 2005. "Doctors Without Borders: Relicensing Requirements and Negative Selection in the Market for Physicians," *Journal of Labor Economics* 23: 437-465.
- [17] Maccini, S., and D. Yang. 2009. "Under the Weather: Health, Schooling, and Socioeconomic Consequences of Early-life Rainfall," *American Economic Review* 99(3): 1006-1026.
- [18] Madestam, A., D. Shoag, S. Veuger, and D. Yanagizawa-Drott. 2013. "Do Political Protests Matter? Evidence From The Tea Party Movement," *Quarterly Journal of Economics*, 128(4): 1633-1685.
- [19] Madestam, A., and D. Yanagizawa-Drott. 2011. "Shaping the Nation: The Effect of Fourth of July on Political Preferences and Behavior in the United States," unpublished manuscript.
- [20] Menchik, P.L., and B.A. Weisbrod. 1987. "Volunteer Labor Supply," *Journal of Public Economics* 32: 159-183.
- [21] Miguel, E., S. Satyanath and E. Sergenti. 2004. "Economic Shocks and Civil Conflict: An Instrumental Variables Approach," *Journal of Political Economy* 112(41): 725-753.
- [22] Niederle, M., and L. Vesterlund. 2007. "Do Women Shy Away from Competition? Do Men Compete too Much?" *Quarterly Journal of Economics* 122(3): 1067-1101.
- [23] Oaxaca, R. 1973. "Male Female Wage Differentials in Urban Labor Markets," *International Economic Review* 14: 693-709.
- [24] Paxson, C.H. 1992. "Using Weather Variability to Estimate the Response of Savings to Transitory Income in Thailand," *American Economic Review* 82(1): 15-33.
- [25] Rosenzweig, M., and K.I. Wolpin. 1993. "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-Income Countries: Investments in Bullocks in India," *Journal of Political Economy* 101(2): 223 -44.
- [26] Sarsons, H. 2015. "Rainfall and Conflict: A Cautionary Tale," *Journal of Development Economics* 115: 62-72.
- [27] Sauer, R.M. 2015. "Does it Pay for Women to Volunteer?" *International Economic Review*, 56(2): 537-564.

- [28] Wright, R.E., and J.F. Ermisch. 1991. "Gender Discrimination in the British Labour Market: a Reassessment," *Economic Journal* 101(406): 508-522.

Figure 1: Average Annual Rainfall in the UK 1981-2010

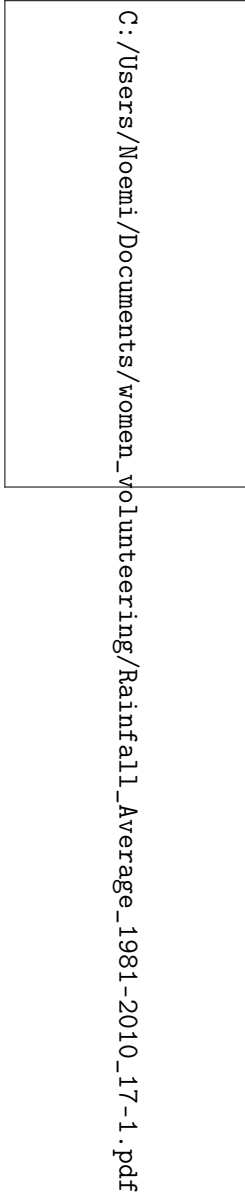


Table 1: Volunteering by Year and Gender

Year	Never/ Almost Never	Once a year or less	Several times a year	At least once a month	At least once a week	N
1996	.804	.047	.0488	.038	.063	4,036
Men	.823	.047	.047	.032	.051	1,814
Women	.788	.047	.049	.043	.073	2,222
1998	.826	.043	.046	.034	.052	4,434
Men	.846	.038	.045	.033	.038	1,952
Women	.809	.046	.046	.035	.063	2,482
2000	.831	.035	.045	.036	.053	5,859
Men	.848	.036	.042	.031	.042	2,590
Women	.817	.035	.047	.040	.062	3,269
2002	.699	.163	.049	.034	.055	4,906
Men	.690	.181	.047	.034	.048	2,178
Women	.706	.148	.050	.035	.061	2,728
2004	.829	.049	.042	.031	.049	4,745
Men	.837	.054	.043	.026	.039	2,097
Women	.822	.045	.041	.035	.057	2,648
2006	.817	.045	.052	.031	.055	3,376
Men	.833	.048	.050	.029	.041	1,487
Women	.805	.042	.054	.033	.066	1,889
2008	.794	.049	.065	.058	.035	3,660
Men	.822	.048	.055	.048	.028	1,633
Women	.771	.049	.073	.066	.040	1,027
Pooled	.800	.063	.049	.037	.052	31,016
Men	.813	.066	.047	.033	.041	13,751
Women	.789	.060	.050	.040	.060	17,265

Note: The figures are row proportions. N is the number of male and female respondents aged 21-60 that answered the volunteering question in the corresponding year that it was asked.

Table 2: Characteristics of Volunteers and Non-Volunteers by Gender

	Men				Women				Diff-in-Diff (8) - (4) (9)
	Full	Non-	Diff		Full	Non-	Diff		
	Sample (1)	Vol (2)	Vol (3)	(2) - (3) (4)	Sample (5)	Vol (6)	Vol (7)	(6) - (7) (8)	
Age	37.346(.160)	38.341	36.823	1.518(.336)	37.625(.147)	38.502	37.087	1.416(.303)	-1.02(.453)
Married	.492(.007)	.560	.456	.104(.014)	.496(.006)	.556	.459	.098(.013)	-.006(.019)
Children	.618(.013)	.660	.595	.065(.027)	.742(.013)	.810	.700	.110(.026)	.045(.038)
Young 0-4	.147(.004)	.138	.152	-.014(.009)	.166(.004)	.169	.165	.005(.008)	.018(.012)
Young 5-11	.147(.004)	.174	.133	.041(.009)	.181(.004)	.204	.167	.037(.008)	-.005(.012)
Young 12-18	.091(.003)	.099	.087	.013(.007)	.108(.003)	.127	.097	.030(.006)	.017(.009)
Employed	.901(.004)	.928	.887	.041(.009)	.916(.004)	.925	.910	.015(.007)	-.025(.011)
Part-time	.036(.002)	.046	.032	.014(.005)	.227(.005)	.248	.214	.033(.009)	.020(.011)
Full-time	.776(.005)	.793	.766	.027(.011)	.455(.006)	.428	.471	-.043(.012)	-.070(.017)
Hours	31.030(.209)	31.503	30.781	.721(.440)	20.515(.195)	19.726	20.999	-1.273(.402)	-1.994(.596)
Earnings	9.783(.090)	11.245	9.016	2.230(.186)	5.112(.061)	5.500	4.874	.627(.125)	-1.603(.218)
Spouse Inc.	2.689(.061)	3.380	2.326	1.053(.127)	5.769(.108)	7.361	4.793	2.569(.220)	1.515(.268)
Lower Edu	.063(.003)	.038	.076	-.038(.007)	.071(.003)	.051	.083	-.031(.007)	.007(.010)
High School	.311(.007)	.262	.335	-.073(.014)	.329(.006)	.289	.352	-.063(.013)	.010(.020)
Higher Edu	.483(.007)	.619	.416	.204(.015)	.426(.007)	.560	.348	.211(.014)	.008(.021)
Non-white	.030(.002)	.024	.033	-.009(.005)	.035(.002)	.034	.037	-.003(.005)	.006(.007)
Use Car	.808(.005)	.860	.780	.080(.011)	.695(.006)	.773	.647	.126(.011)	.046(.016)
Years Vol									
zero	59.90	-	100		55.44	-	100		
one	21.72	50.32	-		22.28	44.41	-		
two	8.57	22.28	-		9.21	21.78	-		
three	3.92	10.65	-		5.37	13.13	-		
four	2.38	6.63	-		3.10	7.80	-		
five	1.84	5.29	-		2.40	6.10	-		
six	.90	2.62	-		1.14	3.00	-		
seven	.76	2.21	-		1.06	2.78	-		
N	4,995	1,719	3,276	4,995	5,870	2,231	3,640	5,870	10866
NT	13,753	5816	7,937	13753	17,268	7,946	9,322	17268	31,021

Note: The figures are individual proportions (or averages) over time, averaged over the number of individuals. Robust standard errors are in parentheses. N is the number of individuals and NT is the number of person-year observations. The sample includes all male and female respondents aged 21-60 between the years 1996 and 2008. Volunteering data are available every other year starting in 1996. Earnings and spousal income are in thousands of constant 1987 pounds sterling. Earnings of the unemployed are included and set to zero.

Table 3: OLS and Fixed Effects Estimates of the Returns to Volunteer Experience

	Men				Women			
	OLS		Fixed Effects		OLS		Fixed Effects	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Volunteer	1.698 (.201)	.394 (.159)	1.537 (.186)	1.372 (.167)	.320 (.139)	-.029 (.090)	.646 (.125)	.649 (.105)
Part-time		1.420 (.461)		1.445 (.503)		-.3791 (.185)		.136 (.182)
Full-time		3.980 (.608)		3.241 (.604)		1.374 (.306)		.979 (.266)
Hours		.020 (.014)		.011 (.012)		.117 (.009)		.085 (.007)
Low Edu		.718 (.234)				.182 (.0996)		
High School		1.159 (.179)				.268 (.085)		
Higher Edu		2.486 (.184)				1.271 (.106)		
Non-white		-1.129 (.548)				-.391 (.214)		
Year and Region Effects	Yes	Yes	No	No	Yes	Yes	No	No
Other Regressors	No	Yes	No	Yes	No	Yes	No	Yes
\bar{R}^2	.041	.437	.018	.328	.026	.625	.003	.553
NT	14,885	12,811	14,594	12,811	19,133	15,706	19,133	15,706

Note: The dependent variable is earnings measured in thousands of constant 1987 pounds. Earnings are zero for the non-employed. The volunteering dummy is an indicator for having volunteered during the survey year or anytime in the past. Standard errors in parentheses. In the OLS regressions, standard errors are robust, and in the fixed effects regressions, standard errors are clustered at the individual level. Other regressors include number of children, whether the individual is a student, spousal income, dummies for age, marital status, age of children, belonging to a union, being a professional/manager, working for non profit organization, firm size, and having use of a car

Table 4: Rain by Region and Year

Year	North England	Yorkshire and Humber	Midlands	East England	London	West England	Wales	Scotland
1996	2.338(.811)	1.850(.384)	1.688(.247)	1.319(.112)	1.366(.167)	1.953(.603)	3.229(1.559)	2.561(.663)
1998	2.958(1.300)	2.227(.544)	2.183(.346)	1.725(.130)	1.714(.170)	2.406(.596)	4.746(2.933)	3.232(.961)
2000	3.406(1.444)	2.380(.536)	2.353(.378)	2.001(.154)	2.191(.132)	2.653(.527)	4.808(1.734)	3.180(.892)
2002	3.052(1.194)	2.190(.514)	2.018(.385)	1.853(.138)	2.032(.188)	2.356(.470)	3.993(1.308)	2.918(.794)
2004	3.444(1.606)	2.188(.577)	1.911(.540)	1.641(.292)	1.637(.336)	1.970(.458)	4.253(1.560)	3.004(1.039)
2006	4.226(1.884)	2.955(.792)	2.259(.580)	1.680(.175)	1.721(.009)	2.288(.497)	4.631(1.142)	3.361(1.344)
2008	4.568(1.926)	3.541(1.082)	2.524(.487)	1.969(.213)	1.799(.248)	2.693(.699)	6.035(2.655)	3.657(1.341)
Pooled	3.335(1.605)	2.437(.831)	2.141(.499)	1.743(.284)	1.746(.348)	2.334(.624)	4.689(1.976)	3.159(1.072)
LADs	56	21	67	44	19	103	22	30
N	6,280	4,452	6,640	3,978	1,510	10,057	8,556	10,483

Note: The figures are three-year moving averages of mean daily rainfall (in millimeters) and the number of LADs in each region. Standard deviations in parentheses.

Table 5: Reduced-Form Estimates of the Effect of Rain (Fixed Effects)

	Men		Women	
	Volunteer (1)	Earnings (2)	Volunteer (3)	Earnings (4)
Rain	.047 (.006)	.224 (.067)	.056 (.006)	.181 (.043)
Part-time	.040 (.035)	1.491 (.499)	.074 (.020)	.084 (.007)
Full-time	.015 (.046)	3.275 (.600)	.0515 (.028)	1.006 (.266)
Hours	-.0002 (.001)	.010 (.012)	-.002 (.001)	-.025 (.106)
Other Regressors	Yes	Yes	Yes	Yes
F-stat	69.07 (.000)	11.24 (.001)	103.80 (.000)	17.70 (.000)
R^2	.050	.073	.157	.315
NT	12,811	15,706	12,811	15,706

Note: The dependent variables are an indicator for having volunteered during the survey year or anytime in the past, and earnings measured in thousands of constant 1987 pounds. Earnings are zero for the non-employed. Standard errors in parentheses. Standard errors are clustered at the individual level. Other regressors include number of children, whether the individual is a student, spousal income, dummies for age, marital status, age of children, belonging to a union, being a professional/manager, working for non profit organization, firm size, and having use of a car. The F-stat is for the test of excluded instruments (p-values in parentheses).

Table 6: IV Estimates of the Returns to Volunteer Experience

	Men (1)	Women (2)
Volunteer	4.859 (1.498)	3.096 (.776)
Part-time	1.328 (.525)	-0.0576 (.203)
Full-time	3.184 (.636)	.836 (.280)
Hours	.012 (.013)	.089 (.008)
Other Regressors	Yes	Yes
NT	11,462	14,265

Note: The dependent variable is earnings measured in thousands of constant 1987 pounds. Earnings are zero for the non-employed. The volunteering dummy is an indicator for having volunteered during the survey year or anytime in the past, instrumented by a three-year moving average of rainfall. Standard errors in parentheses. Standard errors are clustered at the individual level. Other regressors include number of children, whether the individual is a student, spousal income, dummies for age, marital status, age of children, belonging to a union, being a professional/manager, working for non profit organization, firm size, and having use of a car.

Table 7: Alternative IV Estimates of the Returns to Volunteer Experience

	Men (1)	Women (2)
Baseline	4.859 (1.498)	3.096 (.776)
LIML	4.859 (1.498)	3.096 (.776)
Annual Earnings > 0	5.503 (1.452)	4.106 (.850)
London Excluded	4.560 (1.412)	3.061 (.707)
Current Rainfall Instrument	6.010 (2.102)	3.704 (1.118)
NT	11,462	14,265
Temperature Instrument	9.236 (.939)	5.429 (.620)
NT	7,497	9,599

Note: Alternative estimates of the returns to volunteering. Standard errors in parentheses. Standard errors are clustered at the individual level. The same covariates are included as in Table (6).

Table 8: Placebo First Stage Regressions

	Men		Women	
	Rainfall Coefficient (1)	Standard Error (2)	Rainfall Coefficient (3)	Standard Error (4)
Hours Worked	.039	(.079)	-.093	(.090)
Work Full Time	-.003	(.002)	-.005	(.004)
Married	.005	(.004)	.006	(.005)
Spousal Income	.033	(.053)	.156	(.094)
Number of Children	.000	(.007)	-.006	(.011)
N	12,840		15,741	

Note: First-stage regressions with alternative dependent variables. Standard errors are clustered at the individual level.

Table 9: Gender Wage Gap Decompositions

	IV Pooled		
	Endowments	Coefficients	Coefficients
	Effect (1)	Effect (2)	% (3)
Volunteer Experience	-.208	.732	20.2%
Part-time Experience	-.269	.302	8.4%
Full-time Experience	1.025	.916	25.3%
Total	1.007	2.618	72.2%
Mean Differential		3.624	

Note: The endowments and coefficients effects are in thousands of constant 1987 pounds. Standard errors in parentheses. The coefficients % is the percentage contribution to the gender earnings gap due to the coefficients effect. The total sums all components of the decomposition, including those not reported in the table. The IV estimates used to calculate the decompositions are the same as those (partially) reported in Table (6).

Table 10: Volunteer Organizations

	Full Sample (1)	Men (2)	Women (3)	Diff (3)-(2) (4)
Children/Education/Schools	.279	.195	.347	.152
Youth/children activities	.186	.170	.198	.027
Education for adults	.139	.109	.163	.053
Sports/exercise	.381	.438	.334	-.104
Religion	.290	.271	.305	.034
Politics	.030	.040	.021	-.019
The elderly	.079	.064	.092	.027
Health, Disability and Social welfare	.132	.099	.159	.060
Safety, First Aid	.076	.075	.076	.002
The environment, animals	.097	.092	.100	.008
Justice and Human Rights	.049	.051	.048	-.003
Local community or neighbourhood groups	.124	.122	.126	.004
Citizens Groups	.032	.034	.031	-.003
Hobbies, Recreation/Arts/Social clubs	.226	.250	.207	-.043
Trade union activity	.074	.086	.065	-.021
Other/none of these	.349	.351	.348	-.002
N	37,727	16,829	20,897	

Note: Data from the UK Citizenship Survey. The question is, "Which of the following groups, clubs or organizations have you been involved with during the last 12 months? That's anything you've taken part in, supported, or that you've helped in any way, either on your own or with others. Please exclude giving money and anything that was a requirement of your job." Individuals can choose more than one option.

Table 11: Formal and Informal Volunteering Activities

	Full Sample (1)	Men (2)	Women (3)	Diff (3)-(2) (4)
Formal Volunteering				
Raising or handling money/taking part in sponsored events	.193	.178	.205	.027
Leading the group/member of a committee	.092	.096	.089	-.007
Organising or helping to run an activity or event	.178	.169	.186	.018
Visiting people/befriending/mentoring people	.087	.080	.092	.012
Giving advice/information/counseling	.127	.132	.123	-.009
Secretarial, admin or clerical work	.056	.047	.063	.016
Providing transport/driving	.082	.093	.072	-.021
Representing	.049	.059	.042	-.017
Campaigning	.034	.038	.032	-.006
Other practical help	.130	.096	.157	.061
Any other help	.041	.040	.041	.001
None of the above/No volunteering	.613	.629	.599	-.030
N	58,058	26,156	31,900	
Informal Volunteering				
Keeping in touch with someone who has difficulty getting out and about	.158	.139	.173	.035
Doing shopping, collecting pension or paying bills	.143	.114	.167	.053
Cooking, cleaning, laundry, gardening or other routine household jobs	.115	.098	.129	.031
Decorating, or doing any kind of home or car repairs	.091	.147	.045	-.102
Baby sitting or caring for children	.204	.114	.277	.164
Sitting with or providing personal care	.033	.020	.043	.023
Looking after a property or a pet for someone who is away	.196	.180	.209	.029
Giving advice	.292	.305	.282	-.023
Writing letters or filling in forms	.173	.163	.180	.017
Representing someone	.057	.058	.057	-.001
Transporting or escorting someone	.178	.184	.173	-.012
Anything	.030	.036	.026	-.011
No help given in last 12 months	.337	.350	.326	-.024
N	58,062	26,163	31,897	
Formal vs. Informal Volunteering				
Formal Volunteering	.387	.371	.401	.030
Informal Volunteering	.663	.650	.674	.024
N	58,062	26,163	31,897	

Note: Data from the UK Citizenship Survey. The formal volunteering question is, "In the last 12 months, have you given unpaid help to any groups, clubs or organisations in any of the following ways?" The informal volunteering question is, "In the last 12 months have you done any of the following things, unpaid, for someone who was not a relative? This is any unpaid help you, as an individual, may have given to other people, that is apart from any help given through a group, club or organisation. This could be help for a friend, neighbour or someone else but not a relative." Individuals can choose more than one option.

Table 12: Volunteering Motivation and Satisfaction

	Full Sample (1)	Men (2)	Women (3)	Diff (3)-(2) (4)
Volunteering Motivation				
I wanted to improve things/help people	.592	.595	.589	-.006
I wanted to meet people/make friends	.267	.258	.274	.016
The cause was really important to me	.387	.378	.393	.015
My friends / family did it	.202	.228	.182	-.045
It was connected with the needs of my family/friends	.266	.228	.295	.067
I felt there was a need in my community	.269	.285	.256	-.029
I thought it would give me a chance to learn new skills	.180	.169	.189	.019
I thought it would give me a chance to use my existing skills	.250	.266	.237	-.029
It helps me get on in my career	.087	.074	.098	.023
It's part of my religious belief to help people	.182	.184	.181	-.002
It's part of my philosophy of life to help people	.224	.230	.220	-.009
It gave me a chance to get a recognised qualification	.025	.020	.029	.010
I had spare time to do it	.234	.234	.234	.000
I felt there was no one else to do it	.089	.091	.087	-.003
None of these	.040	.044	.037	-.008
N	7,269	3,211	4,058	
Volunteering Satisfaction				
I meet people and make friends through it	.439	.416	.457	.041
I get satisfaction from seeing the results	.623	.631	.617	-.014
It gives me a chance to do things I'm good at	.255	.268	.245	-.023
It makes me feel less selfish as a person	.219	.222	.217	-.005
I really enjoy it	.559	.540	.574	.033
It broadens my experience of life	.283	.280	.284	.004
It gives me a sense of personal achievement	.303	.299	.306	.008
It gives me the chance to learn new skills	.125	.110	.136	.027
It gives me a position in the community	.070	.071	.070	.000
It gets me "out of myself"	.094	.097	.093	-.004
It gives me the chance to get a recognised qualification	.019	.017	.021	.003
It gives me more confidence	.112	.098	.123	.026
It makes me feel needed	.103	.081	.121	.041
It gives me the chance to improve my employment prospects	.043	.035	.049	.014
It makes me feel less stressed	.089	.099	.081	-.018
It improves my physical health	.099	.130	.074	-.056
None of these	.028	.031	.025	-.006
N	7,263	3,211	4,052	

Note: Data from the UK Citizenship Survey. The motivation question is, "Thinking about all of the groups, clubs or organisations you have helped over the last 12 months did you start helping them for any of the reasons on this card." The satisfaction question is, "Thinking about the things that you do for all of the groups, clubs or organisations you have helped in the last year, would you tell me which of things on this card are most important to you." Only those who volunteer formally or informally respond. Individuals can choose more than one option.