The Price Elasticity of Charitable Giving: A Systematic Review and Meta-analysis

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Abstract

Background: Given the threshold role of the unit elasticity in determining whether the current tax policy is effective in terms of encouraging charitable giving, a clear conclusion on the relationship between the estimated price elasticity and unit elasticity is required. However, studies on this topic report mixed results in terms of the magnitude of price elasticity. To investigate the heterogeneity between studies on estimating the price elasticity of charitable giving, we identify and synthesize 81 studies with 113 point estimates. By doing so, we updated the robust estimation of the elasticity. We also contribute a better understanding of the current mixed results on this topic by exploring the potential moderators. These moderators in turn shed light on the future research direction.

Methods: Published peer-reviewed studies that report the price elasticity of charitable giving up to April 30, 2022, are included. ProQuest Dissertations Theses Global, Business Source Ultimate, APA PsycINFO, ScienceDirect, ERIC ProQuest, EconLit, and JSTOR datasets are searched. Hand searches for papers that cited previous system reviews on this topic through Google Scholar and Web of Science, along with reference lists of all included studies are reviewed. We use random-effects models using data from each study. For each study, the effect size, heterogeneity, and risk of bias will be determined.

Discussion: This systematic review and meta-analysis identifies and synthesizes the sources of heterogeneity in terms of the magnitude of price elasticity between studies, as well as sheds light on future research direction on this topic.

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1 Introduction

The current deductibility of charitable giving in calculating taxable income in the US Treasury remains a subject of ongoing debate regarding its efficiency. Treasury efficiency is achieved when there is a greater increase in contribution than the forgone tax revenue. Steinberg (1990) argues that charitable giving is treasury efficient only if it is price elastic.[1] The unit elastic, characterized as a "golden rule" by Fack and Landais (2010a), is the threshold in the price elasticity for treasury efficiency. When the price elasticity is larger than unity (in absolute value), the portion of the revenue foregone as a result of the deduction is matched by a greater amount of charitable giving. Studies, however, have reported mixed results in terms of the elasticity of charitable giving with respect to its tax cost. Peloza and Steel (2005) analyze 69 studies of the tax elasticity of charitable giving, and their tabulated estimates range from -6.15 to 0.06.

Furthermore, the question of whether the charitable donation tax deduction is treasury efficient is extremely important in regard to policies. On one hand, the amount of tax deduction for charitable giving is substantial. The estimated government tax expenditure on the tax deduction for charitable giving from 2018 to 2028 is \$677.93 billion.[2] On the other hand, the charitable donation tax deduction is considered as a close substitute for government direct funding for nonprofit organizations (therefrom NGOs)(Clotfelter and Steuerle, 1981). For this reason, if the deductibility of charitable giving is not treasury efficient, the government might switch back to direct funding for NGOs just like what the government historically did.[3] Given the significance of determining the efficiency of current tax deductibility of charitable giving and the mixed conclusions on its criteria, investigating the source(s) of

[1]The price elasticity of giving is defined as the percentage change in donations that results from a 1% change in the price of giving, all else being equal.

[2]https://home.treasury.gov/system/files/131/Tax-Expenditures-FY2020.pdf

[3]That assumes, though, that a dollar of government spending is a direct substitute for charitable activity and the goal of the deduction is simply to encourage the production of the public goods that government would provide. If the goal instead is to stimulate public good provided only by private institutes or to encourage individual generosity, then a dollar-by-dollar comparison with government direct funding may not be the best measure of efficacy.

this wide range of price elasticity and shedding light on future research direction on precisely estimating it is an exigent and necessary task for researchers.

In this meta-analysis, amongst other issues, we address the following questions: (1) What is the weighted mean of the price elasticity of charitable giving across studies? (2) Does the subsidy form influence the estimated elasticity? (3) Are the elasticity estimates sensitive to data resources (e.g. administrate data, survey data)? (4) Are the estimated elasticity sensitive to data shapes (i.e. panel and cross-sectional data)? (5) Do estimation methods, such as ordinary least squares or maximum likelihood estimation, impact the estimate of elasticity? (6) Are donor characteristics, such as income or itemization status, significant factors in estimating elasticity? (7) Is there heterogeneity in estimated elasticity across charity types? Answering these seven research questions will help to figure out the heterogeneity in estimating the price elasticity of charitable giving.

Since 1917, individual tax has allowed the deduction of contributions of cash or other assets made to eligible organizations up to certain limits. Since then, researchers and policymakers have been interested in determining how individual charitable giving reacts to changes in the tax deductibility of charitable donations. The reaction has been expressed in terms of a price elasticity since Taussig (1967), this is a scale-free measure of association that can be used to compare across studies. In an effort to obtain more precise estimates of the elasticity, researchers have utilized different types and shapes of data and econometric modeling methodologies. To the extent that the magnitude of such measure varies across studies, a systematic review may serve as a valid tool for researchers and policymakers. This tool is used to make inferences about the robustness of estimated elasticities to variations in study design as well as to identify the boundaries of the magnitude of it. Three systematic literature reviews estimating the price elasticity of charitable giving exist in the literature, Clotfelter (1985), Steinberg (1990), and Peloza and Steel (2005). This article updates the robust estimation of the elasticities of charitable giving with respect to changes in tax deductibility. Additionally, we identify many of the moderators that have been investigated

in this literature, which in turn will shed light on the future research direction. Lastly, we address a few gaps mentioned in Peloza and Steel (2005), including the effect of tax deductibility on donations to specific charity types and the estimations of price elasticity across time periods.

To address all of these questions, we organize the article into several sections. In Section 2, we provide a brief overview of the path of estimating the price elasticity of charitable giving. Next, in Section 3, we develop hypotheses about the effects of change in tax deductibility of charitable giving on the amount of charitable giving based on previous studies in this literature. In Section 4, we list all the studies included in this meta-analysis and the corresponding information that we will use in the analysis. The results and discussion are presented in Sections 5 and 6, respectively, and the conclusion is in Section 7.

2 Moderators

The literature on estimating the price elasticity of charitable giving is heterogeneous not only in terms of measurement characteristics but also in several potentially critical aspects. These include data characteristics, mechanism of price, recipient characteristics, donor/donation characteristics, estimation methods, measurement characteristics, and cost characteristics. In this meta-analysis, we examine the following potential moderator variables to account for heterogeneity in the literature.

Data Characteristics The impact of data can arise from the source of data, the shape of data, and the audit status of the data. Specifically, we find price elasticities reported in studies using survey data are higher than those in studies using tax filer data in this literature (Fisher, 2000). Studies such as Ribar and Wilhelm (1995) using panel data report lower elasticities than those using cross-sectional data; Regarding the audit status, studies reported mixed results. While Fack and Landais (2016) find the audit not only reduces the

total amount of charitable giving, it also decreases the magnitude of the price elasticity of charitable giving, some studies, such as Slemrod (1989) and Joulfaian and Rider (2004), find that the audit increases the magnitude of the price elasticity of charitable giving. That is the audited tax data results in higher elasticity compared to the reported tax data. Although the tax deduction for non-itemizers was enacted in 1981 and extended to 1986, the introduction of the standard deduction in 1944 limited the charitable deduction to the subset of those households who itemized. Besides, Fack and Landais (2010a) and Slemrod (1989) find itemizers overstate their contributions to evade taxation. Thus, it is reasonable to say that the price elasticity of reported tax return data is higher than it estimated from audited tax data. Based on these prior findings, we develop the three following hypotheses:

H_1: The reported price elasticity of charitable giving is larger in studies using panel data than it is in studies using cross-sectional data.

H_2: The studies using survey data report higher price elasticities than studies using tax return data.

H_3: Reported tax return data results in higher price elasticities compared to audited tax filer data due to the over-reporting incentive.

Mechanism of Price There are two price mechanisms (subsidy formats) in the literature. The first one is using tax-filer data varying the price of giving by the different marginal tax rates and/or tax credits, and the second one is experimentally manipulating the price of giving by either matching or rebate. Between these two approaches, since the charitable donation is a socially desirable good that would connect to donors' social image, we would expect data collected from the experimental way would suffer from socially desired pressure at least in lab experiments (Karlan and List (2007)). Furthermore, studies have found that the price elasticity of giving under matching is higher than it is under a rebate (Gandullia, 2019; Hungerman and Wilhelm, 2016; Scharf and Smith, 2015). Based on these findings, we

develop the following hypotheses:

H_4 Price elasticities reported in studies that use different price mechanisms are statistically different.

H_5: Price elasticities reported in studies that use an experimental approach are higher than those in studies that use real changes in a tax deduction for charitable giving.

Recipient Characteristics Recipients of charitable giving include a broad range of characteristics. Numerous studies have shown substantial variation in price elasticities across different types and sizes of charities. For example, Feldstein (1975) finds that the sensitivity of charitable giving to potential tax changes is substantially different among the types of donees. Specifically, gifts to educational institutions and hospitals are very sensitive to the cost of giving while religious organizations are much less sensitive than others. Apinunmahakul and Devlin (2004) find that donations to secular charities appear to be more responsive to changes in the tax price of donations in comparison to donations to places of worship. In addition, the below studies find the same result (Duquette, 2016; Feldstein, 1975; Kitchen and Dalton, 1990; Yetman and Yetman, 2013). Therefore, the following hypothesis was created:

H_6: The reported price elasticities of giving to religious organizations are lower than those to secular organizations.

Donor Characteristics Donors' different giving habits and itemization status matter in estimating the price elasticity of giving. Clotfelter (1980) investigates the heterogeneity in itemization status. He finds new itemizers are less price sensitive than long-standing itemizers. Duquette (1999) connects nonitemizers to lower education levels, which in turn leads to the lack of understanding of tax codes. He also says that nonitemizers are less sensitive to the price of giving than itemizers.

Donors have different income levels and researchers find the income level matters in estimating the price elasticity. Anderson and Beier (1999) find that lower-income donors have been found to be price insensitive. However, others have found that lower-income consumers are more prone to be highly responsive to the tax price of giving.[4] Although there is no consensus on how different income groups will react to tax incentives, it is reasonable to believe there is a possibility that the price elasticity would be different across different income groups. The previously mentioned findings lead to the following hypotheses:

H_7: Price elasticities of itemizers are higher than non-itemizers.

H_8: Price elasticities differ by income level.

Estimation Method Different econometric methodologies have been introduced in an effort to better estimate the magnitude of the price elasticity of charitable giving. However, studies have found that price elasticities vary across different estimation methods, as discussed in Almunia et al. (2020); Castillo and Petrie (2020) and Kingma (1989). For example, Bradley et al. (2005) note that the price elasticity varies from -0.73 to -3.06 across estimation methods. In addition, Posnett and Sandler (1989)conducted a study comparing four different estimation methods, which included ordinary least squares (OLS), one-way fixed and random models, and two-way fixed models. They found that the OLS method resulted in a significantly larger estimation of the price elasticity of giving compared to the other methods. Among the other three methods, the one-way random model was found to be the preferred method.

Moreover, from Taussig (1967) work to the late 1980s, researchers found a consensus that the magnitude of the price elasticity of charitable giving is larger than one, using the OLS method. Based on these findings, it is reasonable to develop the following hypothesis:

H_9: Price elasticities reported in studies using OLS are larger than those in studies using

[4]Also, Clotfelter and Steuerle (1981); Lankford and Wyckoff (1991) find income levels matter in estimating the price elasticity of charitable giving.

other econometric methodologies.

Measurement Characteristics/Time Horizon Some studies use the income of the year when charitable giving was made. However, some studies use the permanent income derived around the year in which charitable giving was made. Specifically, they use the average income over years around the year in which the giving occurred. Clotfelter (1980) finds price elasticities are different when using transitory income, the income the year contribution occurred and the average income around the giving year. Specifically, price elasticities range from -0.863 for 1970 to -1.401 for 1972 with an income of 1972. However, with permanent income, price elasticities are uniformly smaller, ranging from -0.433 for 1970 to -0.929 for 1972. From this information, one hypothesis was created:

H_{10}: Studies using transitory income to estimate the price elasticity of charitable giving report a larger magnitude of elasticity than studies using permanent income.

3 Data and Method

Several steps were taken to compile the literature for this meta-analysis. First, we searched through Google Scholar and the Web of Science for all the papers that cited the three significant literature reviews on this topic: Clotfelter (1985), Steinberg (1990), and Peloza and Steel (2005). Second, we search the following databases for all available years to the present: ProQuest Dissertations & Theses Global, Business Source Ultimate, APA PsycINFO, ScienceDirect, ERIC ProQuest, EconLit, and JSTOR. The keywords that we use are charitable giving, tax incentive, elasticity, and charity. Third, we performed a backward search and skimmed the reference lists of all included studies in steps (1) and (2) for any additional studies (backward search), and we screen studies that cited the included studies and relevant reviews. Finally, we perform hand searches such as searching major journals and using the website called connected papers.

The search was completed by April 30, 2022. Initially, 789 studies have been found for review. We only include studies that satisfy the following 7 inclusion and exclusion criteria. The first includes studies that specifically examine the effects of changes in the tax deductibility of donations on monetary charitable giving from individuals. Second, we take into account the variation in the tax price of giving and whether it comes from either variation in the marginal tax rate or matching/rebate. Next, in this analysis, we define charitable giving as monetary donations to an individual cause or aggregate charitable giving of money to 501(3)(c) organizations. Fourth, the price elasticity of charitable giving (the percentage change in donations that results from a 1% change in the price of giving, all else being equal Steinberg (1990)) is assessed as a target outcome. Then, only studies that provide data can be included, which can be administrative data, survey data, or experimental data. The sixth criterion is that the article must be published in a peer-reviewed journal up to April 30, 2022. Specifically, we include published papers that appeared in a higher-rated economics journal.[5] Lastly, the journals must be written in English.

In the end, 81 different studies with 113 estimated price elasticities of charitable giving were retrieved.[6] These studies are presented in Table 1. If a given study reported multiple price elasticities that featured differences in time periods, subgroups, charity types, measures (i.e. transitory and permanent income), or income levels, and there is no pooled result reported, we treat each report as a separate estimate of the price elasticity. Similarly, if there are multiple reports from different price mechanisms (i.e. Match and rebate), or from different rates of a single price mechanism, for example, different match rates, we treat each report as a separate estimate of the price elasticity. However, when studies report multiple

[5]Specifically, we only included studies from (a) the top 5 economics journals–JPE, QJE, AER, Econometrica, and the Review of Economic Studies; (b) Next tier general interest: REStat, AEJ,EJ, and IER; (c) Public Focus journals: National Tax Journal, Journal of Public Economics, and Public Choice; (d) Experimental focus journals: Experimental Economics, JBEE, and JEBO; (e) others: Journal of Policy analysis and management, Non-profit studies and Accounting Review. For the studies in others, we checked the authors' degree, institution, department, and citation in Economics journals to decide whether we should include each study. Specifically, in others, we only include studies that have been cited in economics journals by economists, and in which their authors have a Ph.D. degree working in economics-related departments, such as accounting, statistics, and marketing.

[6]List the studies that report point esitimate of price elasticity, but not included since journal restriction.

estimates from different econometric specifications, we only use the authors' preferred results in the main analysis. We have two studies that failed to report the sample sizes. We substitute a sample size of 721 as a proxy. It reflects a sample size of the first quartile of the data, which allows these two studies to be included and avoids having them overweighed in the analysis as well.

Due to the growing availability of data and the refinement of econometric techniques, it is not a surprise to find significant differences in estimated price elasticities across studies. For example, the mean price elasticity across 81 studies is -1.24, while the standard deviation is quite large,1.06. Our goal is to detect the moderators that would raise heterogeneity in estimating the point price elasticity across studies. Similar to Peloza and Steel (2005), we extract data on the following categories: income level, itemized status, data type, data shape, price mechanism, charity type, and estimation method. After we found the limit common brackets in the income level across studies, we only collected the price elasticity below and above $100,000 in annual income. Also, we didn't adjust the inflation in the income threshold because there are even fewer common brackets in the income level across studies. Furthermore, given that studies are often motivated by prior work and are sensitive to the data, we also check whether the estimate of price elasticity is sensitive to the date of publication and the date of data used.

Two independent reviewers, Li Zhang and Michael Price, extract data from all included studies using the data extraction form (see Additional file 1). Letters a-e are different contents that are included in this form. Furthermore, this form includes (a) information about the study (which includes the author(s), the title, the data used, the sample size, and the effect size), (b) information about the population (which has been studied including the income level, age, gender, marital status, family size, and education), (c) information about approaches used to estimate the effect size (specifically, the econometric specification), (d) information about charity (including charity type and charitable giving information–whether it is aggregate level or specific charitable cause, and (e) information about the quality of this

analysis including a year of publication and the risk of bias.

The data has been entered into a word format of the data extraction form, with a separate one utilized for each study. After each reviewer finishes the data extraction, we compared the data for each study across reviewers and then re-review the study with different extracted data. After this re-review phase, all the data will be saved as a .csv file for meta-analysis in R. We code our analysis with R statistical software version 4.0.3 using dmetar, matapower, and robumeta packages. For studies reporting extreme estimates, we report both with and without these outliers in this analysis. We define the outliers as estimates that are more than three standard deviations from the mean. Figure 1 plots our data. The outliers are estimates that appear at the left-hand side of the red vertical line. For some studies, even though they do not have extreme reports, they have significant weight either because they have a very big sample size or because they have an infinitesimal standard deviation. We call these studies influential studies. We present with and without these influential studies in this analysis.

In this analysis, we define effect size as the price elasticity of charitable giving, in which charitable giving is measured by the monetary donations to an individual cause or aggregate charitable giving of money to 501(3)(c) organizations. Since individual studies vary substantially, for example, different data sources, panel vs. cross-section data, model specification, and heterogeneity control, it is not surprising to see the magnitude of price elasticity of giving varies broadly. Thus, a random effects model is appropriate in the computation of summary effect size. A priori and post hoc summary effect size as well as confidence interval and statistical significance of effect size will be computed in R. Using 1/50 of the standard deviation of the mean price elasticity of charitable giving, 1.21, as the minimum detected effect, the sample size proxy in an individual study, 3966 form Peloza and Steel (2005), and mediate between-study heterogeneity, 0.5, we find out the number of studies that we need to find a statistically significant effect (0.8 in power) is 28 based on two-side t-test and Cohen's d.

The Q-statistic developed by Cochran (1954) is often used to test the variation among effect sizes from different experiments. Thus, it is usually used to assess the heterogeneity of effect sizes in research synthesis methodology with a Q value that is higher than the critical point for a given significance level. This indicates significant heterogeneity between studies. In this meta-analysis, we use the significance level (α) of 0.05 for the Q-statistic. The I^2 statistic describes the percentage of variation across studies that is due to heterogeneity rather than chance. The Q-statistic and I^2 statistics are both computed and reported.

We use the way proposed by Egger et al. (1997b) to test publication bias. Following Duval and Tweedie (2000b), we use trim and fill to adjust for the publication bias if it exists. Specifically, the asymmetric right side of the funnel is the side expected to be affected by publication bias in the present meta-analysis. This is because the price elasticity of giving is commonly expected to be negative, so studies that find positive price elasticity of giving are less likely to be published.

4 Results

4.1 Weighted Mean

The weighted mean is reported in Table 2. The weighted mean of the price elasticity of charitable giving is -1.24 with a standard deviation of 1.06. After removing outliers that are three standard deviations away from the mean, the weighted mean of the price elasticity falls to -1.14, with a standard deviation of 0.83.[7] Compare to the three systematic reviews in this literature, our finding has a narrower range. Peloza and Steel (2005) report a weighted mean that ranges from -1.11 to -1.44 in a meta-analysis using 69 studies without and with outliers respectively. Before then, the accepted range of it is -1.1 to -1.3 coming from

[7]When comparing price elasticities, we focus on the magnitude of the elasticity. For example, for price elasticities of -2.5 and -1.2, we say -2.5 is larger than -1.2 because it is larger in absolute value. Thus, at here we say that a price elasticity of -1.24 is larger than a unit elastic price elasticity of -1.14.

Clotfelter (1985).

τ^2 is an estimate of the variance in the true price elasticity of charitable giving. Based on the estimate of τ^2, we see that the confidence interval of τ^2 (0.88-1.49) does not include zero, meaning that it is significantly greater than zero. All of this indicates that between-study heterogeneity exists in our data and that the random-effects model was a good choice.

The between-study heterogeneity of variance was estimated at $Q = 4736151087.73$, with an I^2 value of 100%. The Q is much higher than the expected value of 112, based on the $K - 1 = 112$ degrees of freedom in this analysis. The prediction interval ranges from -3.35 to 0.87, indicating that the positive price elasticity of charitable giving cannot be ruled out for future studies. These results suggest that there is significant between-study heterogeneity in our data, which should be taken into account when interpreting the findings.

To explore what causes this heterogeneity, we investigated a few possibilities. First, we examined whether there were studies that could inflate this heterogeneity since they had extremely large or small price elasticities in terms of magnitude. To address this concern, we detected and removed three outliers that were more than three standard deviations from the mean. We identified the same three outliers by running Mahalanobis' distance. Once we removed these three outliers from our analysis, the weighted mean of the price elasticity fell slightly to -1.14 with a standard deviation of 0.83.

Second, we used Graphic Display of Heterogeneity (GOSH) plots to detect and remove influential studies that had a large impact on the weighted mean of the price elasticity or the between-study heterogeneity, regardless of what the magnitude of price elasticity was. We detected six influential studies.[8] Once we removed these six influential studies from our analysis, the weighted mean of the price elasticity did not change. It remained at -1.14 with a bit smaller standard deviation of 0.81.

Following the graphic approach - funnel plot proposed by Egger et al. (1997a), we test the possibility of publication bias in our data. In this approach, if the funnel plot gives us a

[8]The six influential studies are:Bönke et al. (2013), Brooks (2002), Eckel and Grossman (2017), Duquette (2016), Duquette (1999), and Reece and Zieschang (1989).

symmetrical and upside-down funnel, it implies there is no significant publication bias. The analysis of publication bias in our data is reported in Figure 2. If there is no publication bias, our studies should roughly follow the shape delineated by the funnel displayed in the plot. However, the majority of our studies do not seem to follow the funnel pattern well, indicating an asymmetry. We also tested whether the funnel plot was symmetrical by Eger's regression test, which resulted in a big intercept, indicating that the funnel plot was asymmetrical.[9] Therefore, there may be publication bias in our analysis. We then follow Duval and Tweedie (2000a) trimming and filling to adjust the possible publication bias. However, the trim and fill procedure adds zero studies, implying that the asymmetry was not driven by publication bias. This is because we cannot measure the publication bias directly, but use the small-study effects as a proxy that may point to it. A funnel plot is an approach testing the small-study effects. If the effect size asymmetry was indeed caused by publication bias, correcting for this imbalance would yield an estimate that better represents the true effect when all evidence is considered. Thus, our estimate is valid.

4.2 Between-study Analysis

Given the substantial heterogeneity across studies indicated by the Q and I^2 in 4.1, we run a few subgroup analyses trying to identify the potential moderators in estimating the price elasticity of charitable giving by following two steps. First, we pool the effect in each subgroup. Even when we partition studies into smaller groups, it is still unrealistic to assume studies in the same subgroup are homogeneous. In line with this, we still use random effects models to pool effects in subgroup analyses. Table 5 shows the frequencies and mean elasticity values across the selected variables from the 113 studies. Second, the elasticities of the subgroups are compared using a weighted T-test.

[9]The Eger's regression test result is as follows: The intercept is 346.98 with the t-value, 0.54, and the p-value, 0.60.

Panel vs. Cross-sectional data The weighted mean of price elasticities in studies using panel data is $-0.82(0.72)$ and -1.47 (1.14) for studies using cross-sectional data.[10] We run a weighted T-test, and the difference in the weighted mean of the price elasticities is significant at five percent degrees ($p = 0.0004$). That is, the H_1 is supported.

Tax vs. Survey data The weighted mean of price elasticities in studies using tax filer data is $-1.09(0.83)$, while the mean is $-1.57(1.27)$ across studies with survey data. Based on a weighted T-test, we could not reject that studies with survey data have a higher elasticity than studies with tax return data ($p = 0.05$). Thus, H_2 is supported.

Reported vs. audited tax data Although studies find mixed results about the effect of audit on the estimate of price elasticity, we find that audit does not have a significant impact on the magnitude of price elasticity. From Table 4, the means of these two samples are -1.39 for the unaudited sample and -1.42 for the audited sample. However, the number of studies that takes audit into account is very small ($k = 3$). More studies are necessary to conclude the impact of audit on estimating price elasticity. Thus, H_3 is not supported.

Match vs. Rebate vs. Marginal tax rate The weighted means are $-1.41(1.32)$ for match; $-0.95(1.52)$ for rebate,[11] and $-1.34(1.06)$ for marginal tax rate. We do pairwise comparisons among these three price mechanisms and do not find them to be different from one another.[12]. So, it does not appear that the price elasticities reported in studies using different price mechanisms are statistically different. After we removed the outliers in each price mechanism, the magnitude of the price elasticities falls to $-1.07(0.55)$ for the match, $-0.53(0.66)$ for the rebate, and $-1.25(0.86)$ for marginal tax rate. Then, we compare the means between each pair of all the price mechanisms. Again, the price elasticities between

[10] When reporting the mean of price elasticity, we include the standard deviation of the mean in parentheses for clarity and precision.

[11] We treat tax credit as rebate.

[12] Match vs. Rebate, $p = 0.44$; Match vs. Marginal tax rate, $p = 0.86$; Rebate vs. Marginal tax rate, $p = 0.42$.

the match and marginal tax rate are not statistically different ($p = 0.35$). However, this time, the price elasticities between match and rebate ($p = 0.05$), and between the rebate and marginal tax rate ($p = 0.01$) are statistically different. Thus, H_4 is partially supported.

The weighted mean is -1.09 (1.14) in studies using experimental approaches, while the mean is -1.30 (1.04) across studies using the real change in the marginal tax rate. According to a weighted T-test, the means are not statistically different ($p = 0.45$). Since experimental participants are more likely to be aware of the social desired pressure in lab experiments, we also test the means between lab experiments and studies using the real change in the marginal tax rate. After we removed the field experiments, the means of the experimental approach decreases to -0.89 (0.85). Again, the means between these two approaches are not statistically different based on a weighted T-test ($p = 0.26$). Thus, H_5 is not supported.

Religious vs. Secular First, we only use the studies that specifically divided charity types as religious and secular. We find the means of price elasticity are $-1.53(1.16)$ for religious giving and $-2.78(1.27)$ for secular giving. Based on a weighted T-test, they are not statistically different ($p = 0.34$). Second, we include all the studies that investigate heterogeneity arising from charity types (religious, education, health, environmental issues, etc.) and treat "religious" as religious giving and all the other specified individual charity types as secular giving. We find the magnitudes are $-1.53(1.16)$ and $-2.04(1.70)$ for religious and secular giving respectively. Still, they are not statistically different($p = 0.29$). Thus, the data fails to support H_6.[13]

Itemization Status This analysis finds a mean price elasticity of $-1.61(0.90)$ for itemizers and $-1.86(0.88)$ for non-itemizers. Although the means between those two groups of taxpayers are large, they are not statistically different based on a weighted T-test ($p = 0.64$). The possible reason is that the number of studies using non-itemizers as subjects is relatively small ($k = 4$). Thus, H_7 is not supported.

[13]See more heterogeneity arising from charity type in Table 3.

Income Level Due to data limitations, we divide income levels into high and low-income groups at $\$100,000$. We find the reported mean of price elasticity is $-1.08(1.22)$ for the high-income group and is $-0.97(0.97)$ for the low-income group. They are not statistically different based on a weighted T-test ($p = 0.79$). Thus, H_8 is not supported.

Estimation Method The weighted means of price elasticity of different econometric specifications are listed in Table 4. We ran weighted T-tests between the OLS approach and all the other approaches. We only find that the mean in studies using OLS estimation is statistically different from means in studies using either fixed-effect ($p = 0.04$) or structural estimation ($p = 0.03$). Although the magnitude of means between OLS and either Probit or time serial specifications are large, they are statistically the same. The possible reason again is that the number of studies using either Probit or time serial models is relatively small. Thus, H_9 is partially supported.

Transitory vs. Permanent On the basis of a weighted T-test, it appears that choosing the permanent or transitory measurement of the income of taxpayers does not have a significant impact on the estimate of the price elasticity of charitable giving. The mean estimate from the sample using permanent measure is -1.23 with a standard deviation of 0.88, and the mean estimate from the sample that uses transitory measures is $-1.29(1.16)$. The difference between these two mean estimates is not statistically significant ($p = 0.84$). Thus, H_{10} is not supported.

5 Discussion

Our analysis finds that the tax deduction for charitable giving is an effective treasury measure. However, substantial variance exists in the magnitude of price elasticity estimates across the studies included. We investigate ten potential moderators that may induce heterogeneity in price elasticity across studies. However, the data only supports the notion that

the data shape, price mechanism, and estimation methodology matter in estimating price elasticity, rather than the rest of the six moderators.

By identifying moderators that matter in estimating price elasticity, we have identified research gaps in the existing literature. To our knowledge, all the studies in this field obtain only an aggregate point estimate of price elasticity for a specific group of people, as they have only one observation for each person. However, some researchers have realized that a more precise estimate of price elasticity calls for individual-level estimation (Chay and Greenstone, 2005; Vesterlund, 2006). Therefore, further studies are needed to uncover the heterogeneity arising within a specific group by obtaining individual-level estimates of price elasticity.

Furthermore, income level is known to impact the price elasticity of charitable giving, and some studies estimated the price elasticity at different income brackets (Duquette, 1999; Fack and Landais, 2010b; Feldstein and Taylor, 1976; **?**). However, there is no consensus on what the threshold(s) are in income level that will significantly change the magnitude of price elasticity. In this meta-analysis, we only are able to identify one threshold with a small sample size on each side. We did not adjust for the inflation, even when we dealt with this only identified income threshold. The ideal way to define an income threshold is to set up a base year first, then adjust for inflation in income. However, since there are data limitations, there is no common income bracket after inflation adjustment. Thus, additional studies are necessary to identify precise threshold(s) if there are any.

Similarly, studies have found that reported price elasticity in studies sampling from itemizers is different from non-itemizers. However, we do not find a significant difference in price elasticity between itemizers and non-itemizers in our analysis, possibly due to the small number of studies that sample non-itemizers. Further studies are needed to confirm this finding and uncover the moderator in estimating price elasticity.

Another potential future research topic is the impact of audit on price elasticity, which is still unclear in the literature. On one hand, there are only three studies that took it into

account when estimating price elasticity; On the other hand, these three studies reported mixed results. In the future, to conclude the impact of audit on the price elasticity of charitable giving, more studies are needed.

Furthermore, limitations in this analysis can be future potential research direction in this topic. For example, the price elasticity of charitable giving is expected to be negative. In line with this, it is reasonable to imagine that studies that find tax deduction has no effect or a negative effect on charitable giving would be less likely to get published. Then we face the "File Drawer" problem in this analysis. Although the trim and fill procedure did not change our overall estimate, the trim and fill method could be problematic when the heterogeneity in our analysis is substantial. In our analysis, this might be the case because I^2 is 1. To check the robustness of the weighted mean of price elasticity in the main analysis, we perform a limit meta-analysis proposed by Rucker et al. (2011) to calculate an estimate of the adjusted effect sizes. This method provides us with the adjusted weighted mean of -1.23, which is not significantly different from the initial estimate of -1.24. Thus, the publication bias in our analysis is negligible.

One more limitation is that we did not include any studies that were conducted after the recent policy change that increased the standard deduction for charitable giving in our meta-analysis.[14] This is because there are no studies available at this time that specifically investigate the effects of the policy change on the price elasticity of charitable giving. While we could not directly incorporate the effects of the policy change into our meta-analysis, we believe it is important to discuss the potential effects of the policy change on charitable giving. The increase in the standard deduction may result in fewer taxpayers itemizing their deductions, and therefore, fewer taxpayers will be incentivized to make charitable donations. It is also possible that the policy change may affect the generalizability of our results, particularly if the price elasticity of charitable giving is different for taxpayers who itemize their

[14]The detail of the policy change is as follows"The standard deduction for married couples filing jointly for tax year 2023 rises to $27,700 up $1,800 from the prior year. For single taxpayers and married individuals filing separately, the standard deduction rises to $13,850 for 2023, up $900, and for heads of households, the standard deduction will be $20,800 for tax year 2023, up $1,400 from the amount for tax year 2022."

deductions compared to those who take the standard deduction.

While there are limitations to our analysis, it has important policy implications. Our findings indicate that the current tax deduction for charitable giving in the individual income tax is an effective way to encourage individual charitable giving. This is supported by the fact that the price elasticity of charitable contributions is larger than one overall. However, given the heterogeneity in price elasticity across different dimensions, governments should allocate their resources strategically. In areas where the price elasticity is larger than one, governments should consider applying the current or even stronger tax deduction for charitable giving, such as. In areas where the price elasticity is less than one, governments should consider alternative methods, such as direct funding, to encourage private charitable giving.

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Tables

Table 2: The weighted mean of price elasticity across studies

Analysis	ϵ	95%CI	τ^2	95%CI	Q
Main Analysis	-1.24	-1.44 – -1.05	1.12	0.88 – 1.49	$4.7*10^9$
Outlier Removed	-1.14	-1.30 – -0.98	0.69	0.54 – 0.91	$4.7*10^9$
Influential studies Removed	-1.14	-1.30 – -0.98	0.81	0.71 – 0.93	$3.8*10^9$

Notes: The number of observations is 113.
Removed as outliers: Brooks (2002), Eckel and Grossman (2017), and **?**.
Removed as influential studies: Bönke et al. (2013), Brooks (2002), Eckel and Grossman (2017), **?**, Duquette (1999), and Reece and Zieschang (1989).

Table 3: The price elasticity across charity types

Charity Types	Mean	Standard Deviation	Number of Studies
Social Welfare	-2.05	1.63	9
Education	-1.13	1.27	6
Health	-1.07	2.27	7
Political	-2.96	0.03	1
Philanthropy	-3.20	0.40	2
Scientific Research	-2.12	1.14	2
Animal Welfare	-1.53	1.34	2
Art and Culture	-2.42	1.14	2
Oversea	-3.36	4.61	2
Environmental Protection	-3.63	1.10	1

All the results in this table are estimated by Random-effects models in R statistical software version 4.0.3 using dmetar package.

Table 4: The price elasticity across estimation methods

Econometric Specification	Mean	Standard Deviation	Number of Studies
OLS	-1.43	0.99	40
Tobit	-1.66	1.35	22
IV	-1.64	0.09	3
FE	-0.91	0.51	8
RE	-1.15	0.62	6
MLE	-1.30	1.04	4
DID	-1.82	1.48	3
Probit	-0.88	0.68	4
MA()	-0.86	0.67	3
Structure	-0.69	0.35	3
Others	-1.20	0.89	4

All the results in this table are estimated by Random-effects models in R statistical software version 4.0.3 using dmetar package.
Others includes Hurdle, RCR, OLS-FD, and quantile regression.

Table 1: Studies included

Study	Elasticities		Data	Data shape	Permanent/Transitory
	Price	Income			
Bradley et al., 2005	-0.78	0.56	Survey	Cross-section	Permanent
Kingma, 1989	-0.43	0.99	Survey	Cross-section	Transitory
Slemrod, 1989	-1.7	0.26	Tax filer	cross-section	Transitory
Fack and Landais, 2010b	-0.2 to -0.6	1.29 to 3.00	Tax filer	Panel	Transitory
Feenberg, 1987	-1.63	0.74	Tax filer	Cross-section	Transitory
Christian and Frischmann, 1989	-2.08 to -2.92	-	Tax filer	cross-section	Transitory
Choe and Jeong, 1993	-2.45 to -2.53	0.83-0.96	Tax filer	cross-section	Transitory
Yen and Zampelli, 2017	-2.10 to -2.68	0.33-0.41	Survey	Cross-section	Transitory
Ribar and Wilhelm, 1995	-1.71	1.55	Survey	Panel	Transitory
Wu, 2007	-2.21	0.77	Tax filer	Cross-section	Transitory
Reece, 1979	-1.40	0.55	Survey	Cross-section	Permanent
Apinunmahakul and Devlin, 2004	-2.73	0.04	Survey	Transitory	
Bönke et al., 2013	-0.45 to -1.44	-	Tax filer	Cross-section	Transitory
Brooks, 2002	-6.68	2.78	Survey	Cross-section	Transitory
Auten et al., 2002	-0.4 to -1.26	0.29-0.87	Tax filer	Panel	Transitory/Permanent
Khanna et al., 1995	-0.52	-	Survey	Panel	Transitory
Eckel and Grossman, 2017	-5.12 to -5.43	0.19	Field	Cross-section	Transitory
Reece and Zieschang, 1985	-0.85	1.43	Survey	Panel	Transitory
Posnett and Sandler, 1989	-1.41	0.17	Tax filer	Cross-section	Transitory
Kitchen and Dalton, 1990	-1.07	1.29	Survey	Cross-section	Transitory
Marudas and Jacobs, 2004	0.04 to -1.32	-	Tax filer	Panel	Transitory
Duquette, 2016	-3.50	-	Tax filer	Panel	Transitory
Karlan and List, 2007	-0.31	-	F	Cross-section	Transitory
Randolph, 1995	-0.51 to -1.55	0.09-1.3	Tax filer	Panel	Permanent/Transitory
Taussig, 1967	0 to -0.1	1.31-3.10	Tax filer	Cross-section	Transitory
Hood et al., 1977	-0.86	0.52	Tax filer	Panel	Transitory
Boskin and Feldstein, 1977	-1.38	0.72	Survey	Cross-section	Transitory
Meer, 2014	-0.78 to -0.95	-	F	Cross-section	Transitory
Joulfaian and Rider, 2004	-1.21	0.78	Tax filer	Cross-section	Transitory
Barrett et al., 1997	-1.18	0.19	Tax filer	Panel	Permanent
Brown and Lankford, 1992	-1.71	0.36	Survey	Cross-section	Transitory

Table 1: Studies included (Continued)

Study	Elasticities		Data	Data shape	Permanent/Transitory
	Price	Income			
Bakija and Heim, 2011	-0.72 to -1.10	-	Tax filer	Panel	Transitory/Permanent
Yetman and Yetman, 2013	-1.03	0.05	Tax filer	Panel	Transitory
Backus and Grant, 2019	-0.08	0.17	Survey	Panel	Transitory
Hungerman and Ottoni-Wilhelm, 2021	-0.20 to -1.21	-	F	Panel	Transitory
Brooks, 2007	-2.67 to -2.73	0.20	Survey	Cross-section	Permanent/Transitory
Duquette, 1999	-0.64 to -1.24	0.72-0.87	Tax filer	Cross-section	Transitory
Huck and Rasul, 2011	-0.53 to -1.12	-	F	Cross-section	Transitory
Lankford and Wyckoff, 1991	-1.68	0.58	Tax filer	Cross-section	Transitory
Almunia et al., 2020	-0.16	0.20	Tax filer	Panel	Transitory
Ricketts and Westfall, 1993	-1.06	0.65	Tax filer	Panel	Permanent
Long, 2000	-1.21	1.33	Tax filer	Cross-section	Transitory
Barrett, 1991	-1.09	0.23	Tax filer	Panel	Transitory
Dye, 1977	-2.25	0.53	Survey	Cross-section	Transitory
Heist and Cnaan, 2018[a]	-2.16	-	F	Cross-section	Transitory
Greenwood, 1993	-1.17	0.86	Tax filer	Cross-section	Transitory
O'NEIL et al., 1996	-0.47	0.60	Tax filer	Cross-section	Transitory
Eckel and Grossman, 2003	-0.30 to -0.94	0.68-0.74	L	Cross-section	Transitory
Blumenthal et al., 2012	-0.23 to -0.75	-	L	Cross-section	Transitory
Eckel and Grossman, 2008	-0.11 to -1.05	0.03	F	Cross-section	Transitory
Eckel and Grossman, 2006	-1.22 to -2.59	0.80-0.82	L	Cross-section	Transitory
Wu, 2004	-1.44	0.89	Tax filer	Panel	Permanent
Feldstein and Clotfelter, 1976	-1.55	0.80	Survey	Cross-section	Transitory
Clotfelter, 1980	-0.24 to -1.55	0.47	Tax filer	Panel	Transitory/Permanent
Brown, 1987	-2.53	-	Survey	Cross-section	Transitory
Glenday et al., 1986	-0.15	0.69	Survey	Panel	Transitory
Tiehen, 2001	-0.15	0.30	Survey	Cross-section	Transitory
Newsome et al., 2001	-0.43	0.17	Tax filer	Panel	Transitory
Fisher, 1977	-2.31	2.31	Tax filer	Cross-section	Transitory
Abrams and Schitz, 1978	-1.10	0.81	Tax filer	Cross-section	Transitory
Abrams and Schmitz, 1984	-1.44	0.54	Tax filer	Cross-section	Transitory
Fack and Landais, 2016	-1.08	-	F	Cross-section	Transitory

[a]Calculated by the definition of price elasticity of charitable giving

Table 1: Studies included (Continued)

Study	Elasticities		Data	Data shape	Permanent/Transitory
	Price	Income			
Auten et al., 1992	-1.11	0.67	Tax filer	Cross-section	Transitory
Lawrence and Saghafi, 1984	-1.18	0.79	Tax filer	Cross-section	Transitory
Jones and Posnett, 1991	-0.07	0.75	Survey	Panel	Transitory
Zampelli and Yen, 2017	-2.16	-	Survey	Panel	Transitory
Sheremeta and Uler, 2021	-0.18	0.03	L	Cross-section	Transitory
Feldstein and Taylor, 1976	-1.09 to -1.29	0.70-0.76	Tax filer	Cross-section	Transitory
Feldstein, 1975	-1.24	0.82	Tax filer	Cross-section	Transitory
Scharf and Smith, 2015	-0.31 to -1.20	-	Survey	Panel	Transitory
Gandullia and Lezzi, 2018	-0.18 to -1.12	0.62-0.76	Survey	Cross-section	Transitory
Gandullia, 2019	-0.17 to -1.15	0.60-0.77	Survey	Cross-section	Transitory
Hickey et al., 2019	-1.8	-	Tax filer	Panel	Transitory
Auten and Rudney, 1990	-1.08	0.76	Tax filer	Panel	Transitory/permanent
Feldman, 2010	-1.16	0.09	Survey	Cross-section	Transitory
Feigenbaum, 1980	-0.44	0.50	Tax filer	Panel	Transitory
Reece and Zieschang, 1989	-2.72	0.14	Tax filer	Cross-section	Transitory
Schiff, 1985	-2.79	0.76	Survey	Cross-section	Transitory
Schwartz, 1970	-0.41 to -0.76	-	Tax filer	Cross-section	Transitory
Steinberg, 1985	-0.08	0.82	Survey	Cross-section	Transitory
Broman, 1989	-0.22	0.24	Tax filer	Panel	Transitory

Table 5: The frequencies and mean elasticity values across the selected variables

Moderator Variable	Number of Studies	Mean of Elasticity	P-value
Data Shape			
Panel	39	-0.82	0.0004
Cross-section	74	-1.47	
Data Source			
Tax file	57	-1.09	0.05
Survey	36	-1.57	
Audit			
Reported	3	-1.39	0.96
Audited	3	-1.42	
Price Mechanism			
Match	13	-1.41	Match vs. Rebate 0.05
Rebate	11	-0.95	Rebate vs. MTR 0.01
Marginal tax rate	88	-1.34	Match vs. MTR 0.35
Approaches			
Experiment	20	-1.09	
Nonexperiment	93	-1.30	0.45
Charity Type			
Rinigious	9	-1.53	0.29
Secular	42	-2.04	
Itemize Status			
Itemizer	14	-1.61	0.64
Non-itemizer	4	-1.86	
Income Level			
Above $100,000	14	-1.08	0.79
Below $100,000	18	-0.97	
Estimation Method			
FE	8	-0.91	0.04
OLS	40	-1.43	0.03
Structural estimation	3	-0.69	
Measurement			
Permanent	13	-1.23	0.84
Transitory	102	-1.29	

All the results in this table are estimated by Random-effects models in R statistical software version 4.0.3 using dmetar package.

Figures

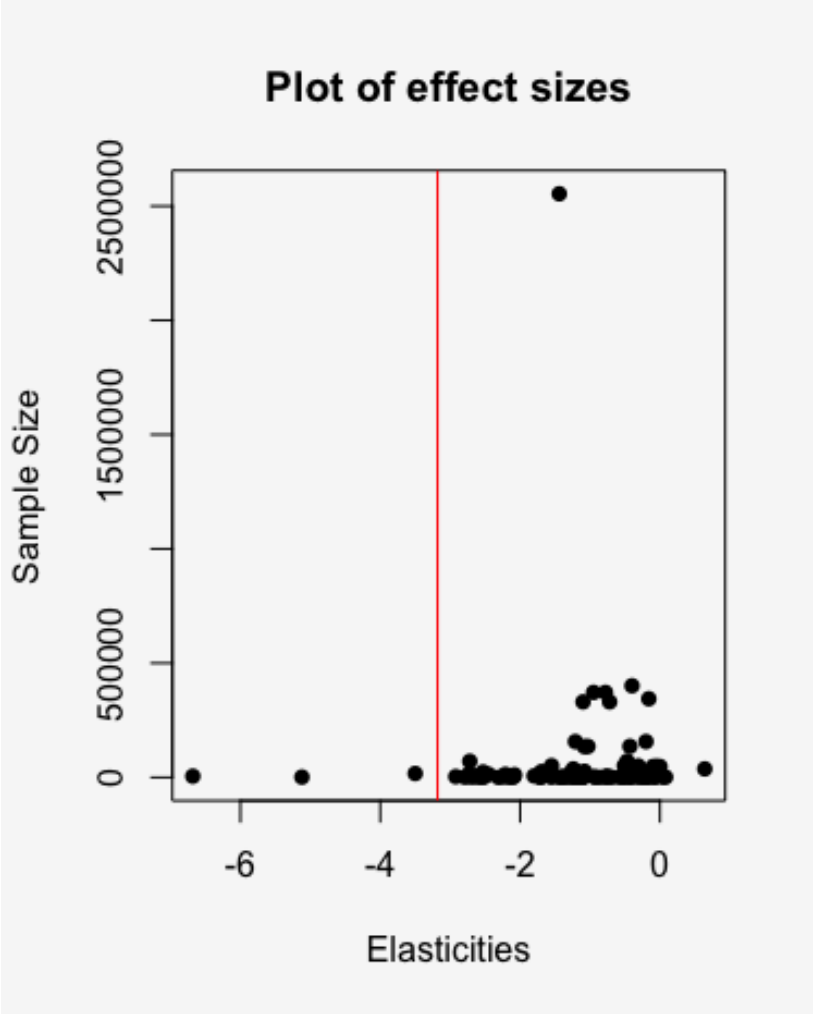

Figure 1: Plot of effect sizes

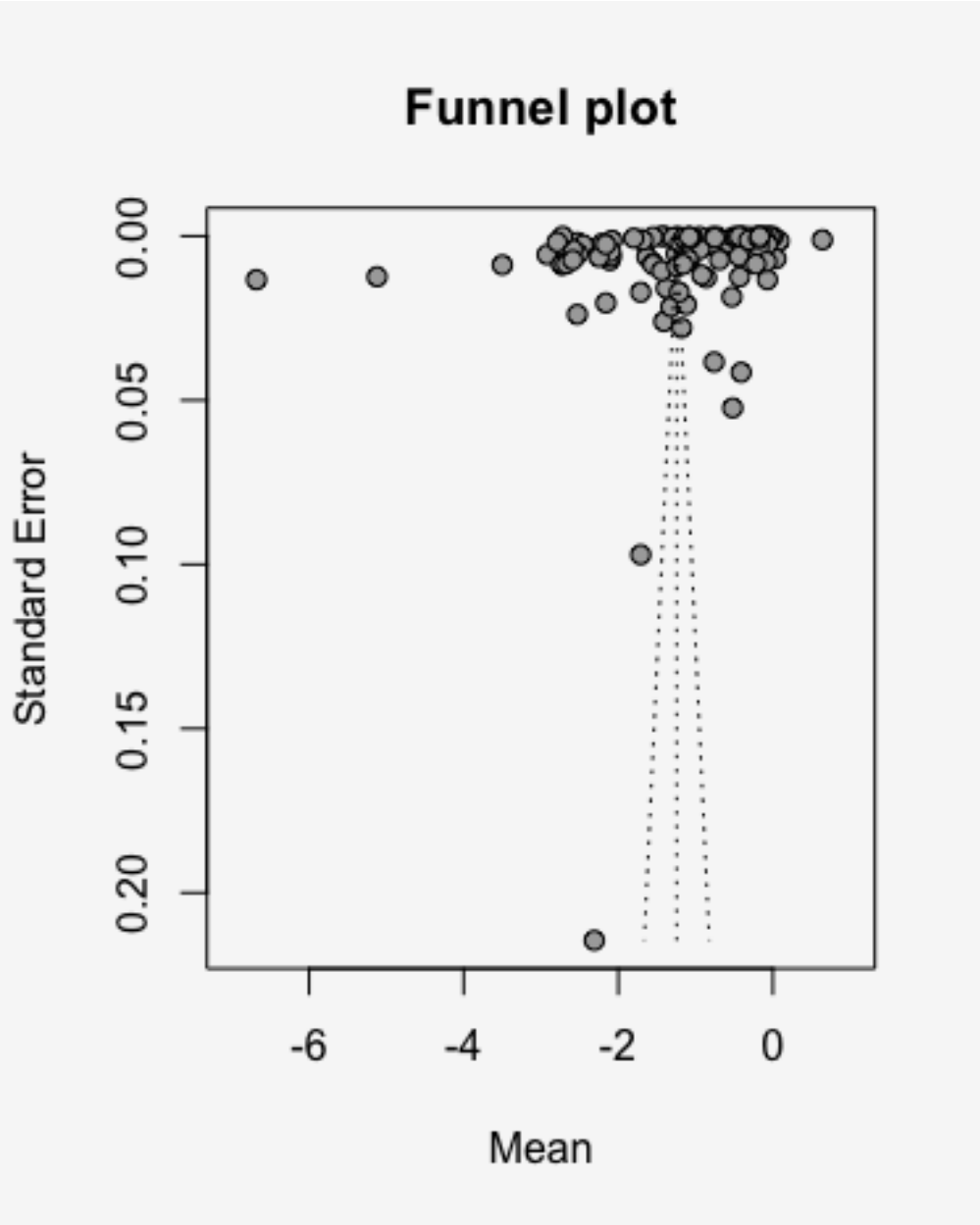

Figure 2: Funnel Plot
In a funnel plot, observed effect sizes are on the x-axis, and their corresponding standard errors are on the y-axis. The vertical line in the middle of the funnel shows the average effect size.

Appendix A. Additional files

Data extraction form for individual studies included in meta-analysis of the price elasticity of charitable giving

Categories	Values
A. Identification of study	
1. Citation from google scholar	
2. Abstract	
B. Primary values	
1. Data type	
2. Data shape	
3. Sample size	
4. The price elasticity and its mean and sd	
5. The income elasticity	
C. Population	
1. Subjects	
D. Moderators	
1. Income	
2. Age	
3. Gender	
4. Marital status	
5. Family size	
6. Education	
7. Mechanism of price	
8. Charity type	
9. Charitable giving	
9. Econometric specification	
10. Race	
E. Others	
1. Risk of bias	

B1 Tax-filer (national/state)/survey/experimental data; B2 Cross-sectional/panel data;

D5 The number of dependent; D7 Marginal tax rate/ tax credit/matching/rebate;