

Information Effect Regarding Inequality of Opportunities on Redistribution: A Lab Experiment

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Abstract

This paper presents evidence from a laboratory experiment regarding the effect of information about opportunities and effort in redistributive behaviour. In the experiment, individuals are randomly selected into one of two groups, each endowed with differing probabilities of earning \$20. By exerting effort, individuals increase their probability of earning the \$20 but conditional on effort the difference in probabilities remain constant so groups are determining opportunities. After initial earnings are determined, I examine redistribution using a dictator game where the dictator earned \$20 and the receiver earned \$0. Treatments vary the level of inequality of opportunities and information regarding receivers' opportunities and effort. I find dictators consistently rewarding receivers' high effort. However, dictators do not consider receivers' opportunities nor their own opportunities when redistributing.

Keywords: Information, redistribution, inequality of opportunities, lab experiment.

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1 Introduction

Income inequality has been rising for more than 30 years in the United States and more than 20 years in Canada ([Lynch and Miske, 2013](#)). However, it wasn't until the recent global economic crisis that the public and policy makers significantly increased their concern over income inequality. Moreover, the current level of income inequality in the United States is as high as the one observed in the period preceding the great depression in the 1930's ([Piketty and Saez, 2014](#)). This is particularly important as the evidence suggest that "high income inequality can be detrimental to achieving macroeconomic stability and growth" ([International Monetary Fund, 2014](#)). If income inequality is considered to be too high it could be that redistribution has been insufficient.

One potential explanation for low redistribution is that individuals do not have sufficient information about the level of income inequality, a hypothesis explored by [Kuziemko et al. \(2013\)](#) and [Zilinsky \(2014\)](#). They find that providing more information regarding the level of income inequality increased recognition of the issue, but did not change stated preferences towards redistribution. In this paper I explore an alternative explanation for low redistribution in face of high inequality. Namely, individuals have insufficient information regarding the determining factors of income inequality. This information is relevant as a given level of income inequality will be judged differently depending on the process generating the inequality.

Since the early works of [Vickrey \(1945\)](#) and [Mirrlees \(1971\)](#), it has been acknowledged that at the core of the problem of redistribution is the fact that income is jointly determined by various factors and that this information is largely private. Traditionally, these factors have been broadly categorized into either (i) talent and effort or (ii) luck ([Alesina and Angeletos, 2005](#)). The problem resides in that individuals desire to reward the former but not the latter. Moreover,

it has been argued that in face of information suggesting otherwise, individuals may adjust their beliefs regarding the relative roles of these factors to maintain the belief they live in a just world (Benabou and Tirole, 2006). Hence, the unresponsiveness of redistribution preferences, found by Kuziemko et al. (2013) and Zilinsky (2014), to information about the current level of income inequality may be the result of rationalizing behaviour.

This paper presents evidence from a lab experiment studying the effect of information regarding determining factors of income inequality on redistribution behaviour. Among these factors, the inequality of opportunities (IofOs) is receiving greater interest from both the academia and policy makers (The World Bank, 2012). There is an increasing amount of evidence linking individual success in life to circumstances out of one's control such as gender, race, and one's upbringing. Paes de Barros et al. (2009) summarizes the most common view about the effect of IofOs in redistribution behaviour pointing out that "people usually tolerate (and maybe agree with) income inequality arising from differences in choices made, effort extended, and talents put to use by individuals, while they view as fundamentally unfair inequality arising from differences in opportunities." Even so, experimental evidence in this regard is scant.

In this experiment, participants are randomly assigned to an advantaged or disadvantaged group where being advantaged is designed as having a higher initial probability of receiving (earning) \$20. Individual probabilities can be increased by exerting effort in a multiplication questions task and probability gains are equal for both groups. Therefore, conditional on effort the difference in probabilities remain constant. In fact, a defining characteristic of inequalities of opportunities is the existence of consistently different individual chances of success related to membership in a group of society. Hence in this experiment the group (initial probabilities) determine opportunities and the difference in probabilities

between groups measures the inequality of opportunities (IofOs).¹

Participants are informed about their group, i.e. opportunities, and the possible probabilities obtained given their actions before deciding how much effort they will exert in the task. They are presented with 50 randomly selected multiplication questions to choose from and answer as many questions as desired. Those correctly answering more than 12 see their probabilities of receiving \$20 increased.

Participants receiving \$20 (dictators) engage in a one-shot Dictator Game with a participant receiving zero (receivers). Treatments vary (i) the degree of IofOs and (ii) the amount of information available to dictators about receivers effort and opportunities. In the treatment of full information, dictators were asked to allocate a share of their \$20 to every potential receiver.² It is noteworthy that in my design both the dictator and the receiver might exert effort while facing varying opportunities. Also, I focus on the case where decisions are made once incomes are known as this is the case for many charitable giving and policy decisions in real life (e.g. current budget allocation).³

In order to analyze dictator's decision, I extend the [Fehr and Schmidt \(1999\)](#) model of inequality aversion to reflect the current view on IofOs. This view implies two effects. First, amounts sent should be lower from dictators in disadvantaged groups and higher to receivers in disadvantaged groups. Second, amounts sent should decrease with dictator's effort and should increase with receiver's effort.

I find that when dictators have information about receivers' factors, dictators

¹A reader has suggested that luck might be a better term given my design. As mentioned before, having certain opportunities in life can be considered a type of luck, however the systematic bias against a group, present in my design, makes this case very particular. Also, disagreements in this regard might reflect the fact that the literature itself has not narrowly defined what is luck (See the discussion in [Alesina and Giuliano, 2010](#), p. 10).

²That is, the strategy method was used. An advantage being that this method allows the study of variation of choices within individuals.

³It could also be argued that this case can also be applied to decisions about future redistribution when income mobility is very low.

consistently redistribute more to receivers who exerted high effort.⁴ However, dictators do not use information regarding receivers' opportunities nor their own opportunities when redistributing. That is, conditional on effort, they send the same portion of their earnings to receivers regardless their opportunities.

There are two potential reasons why participants do not respond to receivers' opportunities. First, unresponsiveness towards opportunities may be driven by general beliefs regarding the relative roles of the factors that determine success and income. [Alesina and Angeletos \(2005\)](#) argues that North-American societies have less redistribution than European countries because of their beliefs regarding the role of luck and effort in determining income. In fact, our sample of participants, while different in terms of age and education—as expected—hold similar beliefs with respect to income determining factors when compared to a representative Canadian sample. Second, in the experiment, and other similar experiments, opportunities affect participants only once, a feature which may affect dictators' concern with respect to opportunities.

One thing to notice about the current prevailing view on IofOs is that it is uninformative about the size of the effect that IofOs would have nor the relative importance with respect to other sources of inequality. This gap exists because this view is largely based on inferences made from surveys or individual introspection. Surveys suffer from the limitations of stated preference mechanisms ([Horowitz, 2006](#)) while introspection only provides insights about the potential significance of the effect and are subject to bias.

A rigorous study outside the lab would require the observation of the same variables unobservable to the rest of the society. Indeed, even if we were able to observe decisions and individual income determining factors (i.e. working hours, level of education and health) there is a great number of other potential factors that affect income outside the lab. Hence beliefs over which are the

⁴Given the design, very few dictators exerted low effort thus I cannot study the effect of dictator's effort.

relevant factors and how much each of them contributes to the observed income may confound observed redistribution behaviour. The lab permits to control the number of potential factors while also provides an accurate measure of them.

This document continues as follows: Section 2 presents selected experimental literature. Section 3 outlines the design of the lab experiment and reviews what different existing theoretical approaches imply about the decision made by the dictators. Additionally, it presents an extension to the theory of inequality aversion by [Fehr and Schmidt \(1999\)](#) which adjusts concerns over differences in factors and lays out the hypotheses to be tested. Section 4 presents the results found and discusses them in light of the existing literature. Section 5 concludes.

2 Previous Experiments

Much work has been done in studying the issue of redistribution when luck or effort vary between individuals. A first group of papers inquire into the effect of differences in luck or effort income-determining roles on redistribution decisions. When effort is the only factor that varies, effort creates property rights—that are recognized by all players—and redistribution favours those who exerted more effort ([Hoffman et al., 1994](#); [Cherry et al., 2002](#); [Hoffman et al., 2008](#); [Oxoby and Spraggon, 2008](#)).

Luck has been primarily studied as the likelihood for individuals finding themselves in an arbitrary part of a predetermined income distribution, reproducing the “veil of ignorance” situation suggested by [Vickrey \(1945\)](#), [Harsanyi \(1953\)](#) and [Rawls \(1999\)](#) ([Thum and Weichenrieder, 2000](#); [Michelbach et al., 2003](#); [Krawczyk, 2010](#)). In these experiments, the “veil of ignorance” situation generates a strong support for redistribution. In this line, a typical experiment asks individuals to determine rates of redistribution without knowing their payoffs. Nonetheless, “[d]espite its importance in Rawls’s argument and its bearing

on related arguments, the original position is an ideal construct: one which may never be realized” (Frohlich et al., 1987, p.619).⁵

Recent studies have focused on the effects of having more than one factor determining income and hence inequality. A first line of research studies approaches the issue as one of agency (e.g. Cappelen et al., 2013; Möllerström et al., 2014). They present a dichotomy between chance and choice in a framework of risk taking. They find that, when making redistribution decisions participants focus mostly on the choices that net receivers made while the rewards for bad luck are relatively small, though significant. However, the choice to take more or less risk does not entail the same degree of costs as an effort choice while underlying risk preferences may affect choices and consequently beliefs regarding receiver’s actions.

Closely related to my research, other experiments study simultaneous differences in effort and luck (Krawczyk, 2010; Ray-Biel et al., 2012; Durante et al., 2014). Durante et al. (2014) presents a situation reproducing the level of pre-tax income inequality of the U.S. Either subjects affected by redistribution or unaffected subjects decide on a tax rate. Individual positions in the distribution are assigned by random, by performance in a quiz or by a game of skill, with variations in the efficiency of redistribution and whether redistribution decisions are made ex-ante or ex-post (i.e. knowing one’s position in the distribution). To our interest are treatments where decisions are made ex-post and effort or skill were involved. They find that “when uncertainty about income is resolved, subjects show a strong tendency to select the level of redistribution that maximizes their own post-tax earnings, although social concerns continue to matter.” However in their experiment both effort/skill varies along with expected income, potentially confounding their results. This issue is also present in the experiment by Ray-Biel et al. (2012). For this reason, in my experiment, opportunities and the

⁵Nevertheless it has to be acknowledged that under very high levels of income mobility this case would be more relevant.

returns to effort are measured in probabilities so the level of inequality remains constant across treatments.

[Krawczyk \(2010\)](#) also introduces luck and effort in terms of probabilistic returns. However, his methodology introduces the effects of effort in manner not easily understood by participants. Indeed he states that “it was in fact difficult for the participants to judge in which way their actual probability would diverge from the [Probability of Winning].” Unlike his experiment, here the effects of effort are easily understood by participants. Additionally, in his experiment, redistribution decisions were made for groups and not individuals. This meant that participants had to rely on beliefs regarding effort and luck of multiple individuals when making their decisions. This poses a problem as, beliefs can vary greatly between subjects ([Alesina and Giuliano, 2010](#)) while individuals may also strategically adjust their beliefs in order to justify decisions more centered in themselves ([Benabou and Tirole, 2006](#)). Similar to many of the above mentioned, I use a Dictator Game (DG hereafter) as introduced by [Forsythe et al. \(1994\)](#) when analyzing redistribution decisions.

Finally, there are two aspects to highlight on how effort is introduced in this experiment when compared to existing experiments. First, the task used to measure effort (multiplications of two 3-digits numbers) requires relatively less ability than previously used activities.⁶ Specially as participants in this experiment have a table with all 1 digits multiplications, a reminder of one method to answer these questions and what is considered as sufficient time.

Second, while information regarding effort could be more accurate if the experiment relied in tournaments to delineate a high and low effort levels, tournaments are avoided as they may introduce biases.⁷ For example [Gneezy et al. \(2003\)](#) find evidence suggesting women may behave differently than men in tour-

⁶Examples includes GMAT-type ([Cherry et al., 2002](#); [Oxoby and Spraggon, 2008](#)) and IQ-type questions ([Krawczyk, 2010](#)).

⁷From the aforementioned experiments, [Hoffman et al. \(1994, 2008\)](#) and [Durante et al. \(2014\)](#) used some type of tournament to assign roles in the redistribution decision.

naments under mixed competition. Therefore, for the purpose of this experiment I classify high effort based on a—admittedly arbitrary—performance cutoff allowing for an exogenous classification of behaviour.⁸ In fact, the threshold of performance that defines a high effort, though high enough to be considered as a significant amount of effort, is combined with sufficient time so a typical subject should be able to achieve a high effort regardless their ability at solving mathematical questions.⁹

3 Experiment and Hypotheses

This experiment is designed to study how preferences over redistribution change when IofOs is one of the determinants of income inequality and perfect information regarding the potential factors that determine a fixed income inequality may become available. The experiment has three stages.

In the first stage participants are randomly divided into one of two possible levels of initial probabilities (opportunities) of earning \$20. Then, participants are provided with the option to increase their assigned probability by engaging in an effort task. The increase in their probabilities, i.e. returns to effort, are by an amount independent of the participant’s group. Therefore, conditional on effort differences in opportunities between groups remain constant. A combination of opportunities and returns to effort define an IofOs environment. The experiment considers one low and one high IofOs environments. Finally, earnings (either \$20 or \$0) are realized.

⁸Cherry et al. (2002) and Oxoby and Spraggon (2008) use predetermined thresholds in their experiments.

⁹This is not to say that ability may not have a role determining high or low effort, at least in the margin. In this regard, following the suggestion of a reader of an early draft, an additional question was made to all participants in the last four sessions. They were asked how much they agreed with the fact that only effort determined solving more than 12 questions correctly. 52% agreed or strongly agreed to this statement while 38% disagreed or strongly disagreed. The remainder would not agree or disagree. It is noteworthy that this distribution is not very different when we analyze only receivers, whose percentages were 61% and 33% correspondingly. Moreover, effects of ability are not clear as some individuals could interpret ability as talent or luck.

In a second stage (the redistribution stage), participants who earned \$20 are assigned the role of dictators in a DG where the receiver is a participant that earned \$0. At the moment of the decision, they are provided with a certain level of information regarding the opportunities and effort of the receiver—either they know all (the full information environment) or none (the no information environment) of the receiver’s opportunities and effort. In the full information environment, dictators are asked to decide how much they would send to every possible receiver. A treatment consists on the combination of an information and inequality of opportunities environment. Once they have made their decision, dictators have a final profit corresponding to \$20 minus their offer while receivers obtain the offer.

In the final stage, participants are informed about their final profits from the experiment and answer a short survey providing basic descriptive variables: age, gender and undergraduate major. Additionally I include selected questions from the 2009 International Social Survey Programme (ISSP) regarding Social Inequality ([ISSP, 2009](#)).

3.1 Experimental procedures

When all subjects have arrived, a consent form is read aloud by the experimenter while subjects read their own copy and a first round of questions is allowed. At this moment, all subjects are entitled to a show-up fee of \$5 for arriving on time which they can keep regardless of participation. The experimenter continues to distribute to the participants detailed instructions of the experiment which are read aloud along the participants.¹⁰ The instructions also include the presentation of a guided example of one method for solving multiplication questions which is shown in the blackboard.¹¹ A second round of questions from participants is allowed and all answers are given aloud.

¹⁰The instructions read are available in the Online Annex [A](#).

¹¹We solved the 123×401 multiplication in the blackboard with the traditional method.

As soon as all questions are answered, participants are instructed to refrain to speak among themselves during the duration of the experiment and further questions must be made directly to the experimenter. They are provided with one pencil, one white sheet (more are available to participants if needed) and a table with all one-digit multiplications. Subjects who agree to participate go on to the first stage of the experiment. The experiment is computerized using z-Tree (Fischbacher, 2007).

3.1.1 First stage: opportunities, effort and earnings

In the first stage, participants are randomly divided into one of two groups: P and Q.¹² The group assignment determines base probabilities of earning \$20. By exerting effort, participants can increase their individual base probabilities by an amount which is fixed and predetermined for a session. Nevertheless, the increase in probabilities is independent of the participant's group so, conditional on effort, the difference in probabilities remain constant. That is, the group determines a consistent bias in chances or "opportunities".¹³

There are two possible levels of inequality of opportunities between participants in a given session. I define the low IofOs environment when the difference in opportunities is relatively low and the returns to effort are relatively high. Conversely, in the high IofOs environment the difference in opportunities is relatively high and the returns to effort are relatively low. Table 1 present base probabilities for participants in each group as well as the probabilities faced when exerting a high effort. Panel (a) presents the low IofOs treatment while panel (b) presents the high IofOs treatment. For example, a participant assigned to group Q under the low IofOs environment starts with a probability of 10% of earning \$20. If she exerts a high effort then her probability increases to 60%.

¹²Names for the groups were chosen to avoid the introduction of biases due to focal points, e.g. beliefs that group A is better or more deserving than B.

¹³As group Q consistently has lower opportunities it will be referred to as the disadvantaged group in the analysis.

Table 1: Probabilities in each environment.

	Group			Group	
	P	Q		P	Q
High Effort	90%	60%	High Effort	90%	40%
Low Effort	40%	10%	Low Effort	60%	10%

Note that the probability is an increasing function of effort and opportunity, where those in group P have more opportunities.

Notice that there is a qualitative difference between these two environments. While in the low IofOs environment a high-effort participant of the disadvantaged group has a higher probability than a low-effort participant of the advantaged group of earning the \$20, in the high IofOs environment a participant from the disadvantaged group will have a lower probability than a low-effort participant from the advantaged group regardless of their effort.

Participants are informed about their group and the session treatment (explained below) before deciding how much effort to exert. Information, regarding the participant’s opportunities and the corresponding probability of receiving the \$20 if they exert a high effort, is displayed in their screen during the duration of the decision stages. The effort task consists of manually solving as many multiplication questions of two 3-digit numbers (similar to [Brüggen and Strobel, 2007](#)) from 50 questions in a period of 25 minutes. Participants can use this time to solve the questions or, as it is highlighted in the instructions, to “do something else as long as [they] do not use a cell-phone, calculator or web browser”.

For the purpose of this experiment, I classify high effort as those solving 12 or more questions correctly. After 25 minutes, the number of correct answers is verified and participants are categorized as having exerted either low or high effort. Finally, participants earnings are determined according to the corresponding probabilities in [Table 1](#).

3.1.2 Second stage: the redistribution decision

In this stage, participants who earn \$20 are assigned the role of dictators and paired with participants who has zero earnings to play a DG.¹⁴ Therefore, a dictator (net contributor) has the decision to unilaterally determine the final level of inequality. When dictators make the redistribution decision they face an information treatment so they have either 1) no information on the receiver besides knowing that the receiver has zero earnings from the first stage (the no information treatment) or 2) information regarding receiver’s opportunities, effort and zero earnings (the full information treatment).¹⁵

In the full information environment I use the strategy method so dictators are asked about the amounts sent to every possible receiver as characterized by effort and opportunities. Namely, they are asked how much they would send to a low-effort receiver in group P, a low-effort receiver in group Q, a high-effort receiver from group P and a high-effort receiver in group Q. This allows the observation of changes in amounts sent with respect to receiver’s characteristics within subjects.

3.1.3 Treatments

Treatments in the experiment vary the level of IofOs and the amount of information dictators have about receiver’s effort and opportunities when making their redistribution decision. The 2x2 design is summarized in Table 2.

For example in treatment 1, the low IofOs and no information treatment, this means two things. First, a participant from group P exerting low effort faces a

¹⁴Given that the ratio of dictators to receivers could not be known in advance, dictators or receivers could be paired with more that one other participant. In these cases an offer was randomly selected and implemented. This same flexibility allowed to have sessions with an odd number of participants. All the transactions not realized in the lab—for one side of the pair—were aggregated and converted into a donation of 142 CAD made to the student’s food bank.

¹⁵A further extension worth exploring is to give the sender the option to decide whether or not she wants to have this information.

Table 2: Treatments Matrix

		Information about the receiver	
		None	Detailed
IofOs	Low: (P)90%-40% (Q)60%-10%	T1	T2
	High: (P)90%-60% (Q)40%-10%	T3	T4

The numbers to the right of the group name state the probabilities of high earnings when solving more or fewer than 12 multiplication questions, respectively.

40% probability to earn \$20 while a similar participant from group Q faces a probability of 10%. If the same participants exert high effort their probabilities are 90% and 60% correspondingly. Second, once earnings are realized and pairs between dictators and receivers are done, dictators will not be able to know the effort and group of the receiver when making their redistribution decision. Sessions are run in one treatment, randomly selected in advance, and participants are not informed about other treatments.

3.1.4 Stage three: Survey and payment

Finally, participants are informed about their final profits from the experiment and answer a short survey providing basic descriptive variables (age, gender and undergraduate major) and selected questions from the 2009 International Social Survey Programme regarding Social Inequality (ISSP, 2009). These questions inquire about beliefs over determinants to get ahead (sources of inequality), social conflict, social mobility, taxation, and the role of the government in decreasing inequality.

With respect to beliefs over determinants of getting ahead, they are questioned about 1) how important is coming from a wealthy family, 2) how important is having ambition, and 3) how important is hard work. Additionally, the questions regarding social conflict include 1) how much conflict is there between poor people and rich people, and 2) how much conflict is there between poor

people and rich people.

Questions regarding the beliefs on the level of inequality and the role of government include the level of agreement with the following statements: 1) differences in income in Canada are too large, 2) it is the responsibility of the government to reduce the differences in income between people with high incomes and those with low incomes, and 3) whether the government should spend less on benefits for the poor. Lastly, we include a question whether the participants think that people with high incomes should pay a larger share of their income and one regarding the social class they think belong to.

3.2 Theoretical Analysis and Hypotheses

As the objective is the study of changes in redistribution behaviour, the following discussion is restricted to the decision made by dictators.

First, an individual with preferences only over own wealth is believed to send nothing to any of the possible receivers as in this manner she is able to maximize her own profit. This would be true regardless of the factors that lead the receiver—or the sender—to her role so any related information should have no effect. However, this type of behavior has been found to be more of an exception where “usually more than 60 percent of subjects pass a positive amount of money, with the mean transfer roughly 20 percent of the endowment” (List, 2007, p. 483).

One of the first and most influential explanations of other-regarding preferences, aimed at explaining positive transfers in the DG among others, was put forward by Fehr and Schmidt (1999, F&S hereafter) . An individual averse to inequality is expected to send a positive amount that is, nevertheless, invariant to information about effort and opportunities.¹⁶ In their theory of fairness, they

¹⁶While extensions to this model have been made to incorporate different action sets such as in Charness and Rabin (2002), given the action set of the experiment the model of F&S is adequate for analysis. The application to other models is straightforward.

argue that “people resist inequitable outcomes ... [that is] they are willing to give up some material payoff to move in the direction of more equitable outcomes” (ibid , p. 819). Additionally they also postulate that people’s feelings towards the same level of inequality may differ whether one is above or below; with a higher concern over an inequality against them.

Below is presented their model in the case of two players when the receiver has no initial earnings. A dictator i with earnings of ω_i maximizes her utility $U_i(\omega_i, x_j)$ which depends on her own profit ($\omega_i - x_j$) and the receiver’s j profit x_j —which is the amount sent—in the following manner:

$$\max_{x_j \in (0, \omega_i)} U_i(\omega_i, x_j) = u(\omega_i - x_j) - \alpha_i v(2x_j - \omega_i) - \beta_i w(\omega_i - 2x_j) \quad (1)$$

where $\beta_i \leq \alpha_i$ and $0 < \beta_i < 1$ is assumed. Also $v', w' > 0$ and $v'', w'' > 0$ where $v(\cdot) = 0$ if $2x_j - \omega_i \leq 0$ and $w(\cdot) = 0$ if $\omega_i - 2x_j \leq 0$.

Though this model can explain positive amounts sent, as it only considers the level of inequality, the optimal amount sent x_j^* is invariant with respect to information regarding factors that generate a given level of inequality.

I extend [F&S](#) model to adjust concerns about the determining factors of income inequality. My starting point is the fact that, as [O&S](#) states, “the legitimizing of assets creates property rights which participants’ observe, regardless of who accumulates these rights.” In line with theories of IofOs, higher effort increases legitimacy of advantageous inequalities while higher opportunities decrease the legitimacy. Hence, α_i and β_i are modified to be functions of both dictator’s and receiver’s effort and opportunities. As in my experiment opportunities are determined by the group, I will indicate them accordingly. Thus

equation (1) rewrites as

$$\max_{x_j \in (0, \omega_i)} U_i(\omega_i, x_j) = u\left(\frac{\omega_i - x_j}{\omega_i}\right) - \alpha_i(e_i, g_i, e_j, g_j)v\left(\frac{2x_j - \omega_i}{\omega_i}\right) - \beta_i(e_j, g_j, e_i, g_i)w\left(\frac{\omega_i - 2x_j}{\omega_i}\right) \quad (2)$$

where $e_k \in \{High, Low\}$ denotes the effort level and $g_k \in \{P, Q\}$ their group. Note that in this experiment the group determines opportunities. As in F&S I assume $v(\cdot)$ and $w(\cdot)$ are increasing in the level of inequality and are convex functions. Additionally, these functions only take a positive value when the expression inside is positive. I further assume that, in the absence of differences in effort and opportunities between the dictator and the receiver this model is equivalent to the inequality averse individual of F&S.

In order to make the analysis more tractable, I will consider the case where $u(\cdot)$ is linear and $v(\cdot) = w(\cdot) = (\cdot)^2/2$. In this case the two possible amounts sent that solve this problem are:¹⁷

$$x_j^* = \begin{cases} 0 & \text{if } \frac{1}{2} < \frac{1}{4\beta_i(e_j, g_j, e_i, g_i)} \\ \omega_i \left(\frac{1}{2} - \frac{1}{4\beta_i(e_j, g_j, e_i, g_i)} \right) & \text{otherwise} \end{cases} \quad (3)$$

The current view on IofOs implies the following assumptions regarding the effects of effort:

Assumption 1 *A higher effort exerted by a receiver strengthens the concern (disutility) of having more money than the receiver, i.e. $\delta\beta_i(\cdot)/\delta e_j > 0$.*

Assumption 2 *A higher effort exerted by the dictator weakens the concern of having more money than the receiver, i.e. $\delta\beta_i(\cdot)/\delta e_i < 0$.*

¹⁷The solution to the problem is presented in Annex A. A possible, though less likely, case is $x_j = \omega_i$ which nevertheless require the function $\alpha_i(\cdot)$ changing sign, i.e. for a given level of relative effort and opportunities the dictator would experience positive utility by being below the receiver.

These assumptions naturally lead to Hypothesis 1 or the meritocracy hypothesis.

Hypothesis 1 *For a given pair of opportunities, the amount sent by a dictator increases with receiver's effort but decreases with dictator's effort.*

Similarly, the current view regarding IofOs implies that:

Assumption 3 $\beta_i(g_j = P) < \beta_i(g_j = Q)$ so an increase of receiver's opportunities weakens the concern of having more money than the receiver.

Assumption 4 $\beta_i(g_i = P) < \beta_i(g_i = Q)$ so an increase in dictator's opportunities strengthens the concern of having more money than the receiver.¹⁸

Therefore we can state Hypothesis 2 or the justice hypothesis.

Hypothesis 2 *For a given level of effort, the amount sent is higher for receivers with relatively lower opportunities but they will be lower if the dictator has relatively lower opportunities.*¹⁹

An uninformed dictator, on the other hand, has to rely on information or beliefs about the distributions of effort and/or group membership (opportunities) of potential receivers. In this case the amount sent is

$$x_j^*(E[e_j], E[g_j], e_i, g_i, \omega_i) = \omega_i \left(\frac{1}{2} - \frac{1}{4\beta_i(E[e_j], E[g_j], e_i, g_i)} \right) \quad (4)$$

where $E[\cdot]$ is the expectation operator. Notice that this represents a weighted average of the possible cases with full information. Whether this average depends on the real distributions or is based on beliefs depend in turn on the information available on the aggregate.²⁰

¹⁸ In a more general setting, denoting Opp_k as individual k opportunities, we would expect $\delta\beta_i(\cdot)/\delta Opp_j < 0$ and $\delta\beta_i(\cdot)/\delta Opp_i > 0$.

¹⁹In our experiment, the justice hypothesis becomes: for a given level of effort, the amount sent is higher for members of less advantaged groups but they will be lower if the dictator is in the disadvantaged group.

²⁰In the experiment, participants know they are evenly distributed between groups but are not provided any information about the distribution in efforts.

Table 3: Descriptive statistics.

	Mean	SD	Min	Max
Dictators (70)				
Age	22.07	6.34	17	54
Questions tried	23.87	7.86	11	46
Correct answers	19.87	7.74	1	39
Profits (From the experiment)	15.96	4.11	0	20
Total				
Age	21.41	5.40	17	54
Questions tried	22.68	7.62	7	46
Correct answers	18.00	7.89	0	39
Profits (From the experiment)	11.35	7.23	0	20
Observations	111			

Hence one can expect that,

Hypothesis 3 *In the absence of information about individual factors the dictator will decide how much to send according to an expected receiver.*

4 Results

Undergraduate students from the University of Calgary were recruited using the Online Recruitment System for Economic Experiments (ORSEE) (Greiner, 2004). A total of 111 students (51% female) participated in nine sessions with 8 to 18 subjects per session between July 2013 and March 2014.²¹ Out of those, 70 participants made redistribution decisions. Table 3 presents a summary of the characteristics of all participants and in particular dictators. Only 15 (13%) were in the economics major, specifically 8 (11%) of the dictators. Participants received average profits of \$11 from the experiment which were added to the \$5 show-up fee.

It is noteworthy that, though the sample of participants is not representative of the Canadian population in terms of age and education, participants' beliefs

²¹The design has the flexibility to pair one participant with more than one counterpart as explained in 3.1.

regarding the sources of inequality, social mobility, taxation and the role of the government in decreasing inequality do not deviate significantly from those of the Canadian sample.²²

Overall, participants believe that “hard work and ambition are very important or essential when getting ahead.” Nevertheless the sample of students has a tendency to believe that coming from a wealthy family is less important when compared to the rest of Canada as only a minority believe that it is very important or essential. There are some differences in terms of beliefs whether income differences in Canada are too large or whether it is the responsibility of the government to reduce income differences but in all other cases the distribution of beliefs resemble those of the Canadian sample.

Regarding effort exerted in the experiment, 82% of participants reached the threshold and were classified as high effort. It is worth noting that 15% (16) of the 105 who tried to solve more than 12 questions did not meet the threshold despite all the steps made to minimize the role of ability in determining high effort.²³ Since the role of dictator accrued only to those who (probabilistically) received \$20 from the first stage, only 70 subjects made redistribution decisions in the role of dictator.

Regarding redistribution behavior, to begin with we observe dictators sent on average approximately 20% of the \$20 (\$3.91) when they lacked information regarding receivers opportunities or effort. This is consistent with previous research without differences in effort or opportunities suggesting dictators were expecting a receiver with opportunities and effort level similar to theirs. The amount sent varied slightly according to the level of IofOs with an average of \$4.47 sent in the

²²See Online Annex B.

²³The number of correct answers is approximately 80% of tries for most participants. In fact, less than one third (33) had a tries to correct ratio lower than 75%. However, even in the latter case 52% (17) managed to surpass the threshold. This suggests that participants were aware of their individual likelihood of answering incorrectly and were consequently answering extra questions to compensate. Also, some of these incorrect answers may be guesses introduced towards the end of the task. This is because we consider any non-missing answer as a try.

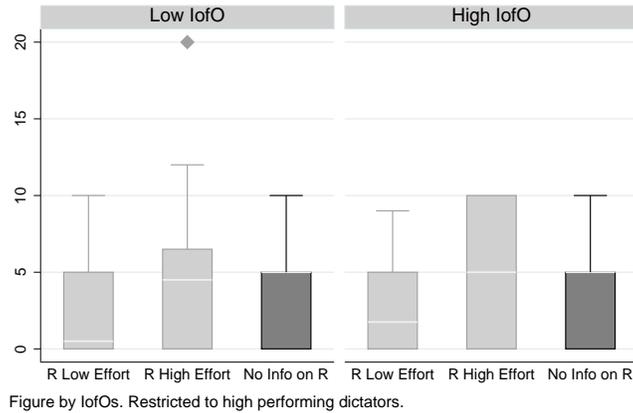


Figure 1: Variations of the amount sent by effort

case of low IofOs and \$3.2 under high IofOs.

I proceed to analyze the effect of effort under perfect information. Figure 1 presents box plots of the amounts sent by type levels of effort by dictators and receivers.²⁴ A caveat given the design and the sample size is that I cannot analyze the effect of dictators' effort as there are only eight dictators exerting low effort (four in each IofOs environment). Yet, I can study how dictators use the information regarding receivers' effort. I find that the amount sent varies significantly with receivers' effort.

When the receiver had exerted high effort they received the most (mean=\$4.44), if dictators had no information on effort or opportunities they sent slightly less (mean=\$3.91), and the lowest amounts were sent to low effort receivers (mean=\$2.95). Moreover, I can reject the null hypothesis that the amounts sent to high effort receivers are being drawn from the same distribution as the amounts sent to low effort receivers (signed-p=0.00).²⁵ The difference in means is 7.5% of

²⁴Box plots present a box which lower and upper limits are the first and third quartile respectively. Additionally the median is highlighted with a line. If the minimum is lower than the first quartile or the maximum is higher than the third, whiskers are placed outside the box going until the extremes. This has a limit: if a value is farther from the box than 1.5 times the interquartile range, i.e. the difference between the first and the third quartile. These cases are treated as outliers and presented as dots.

²⁵Throughout this paper, in parenthesis I present the p-value of the unmatched (p) or signed

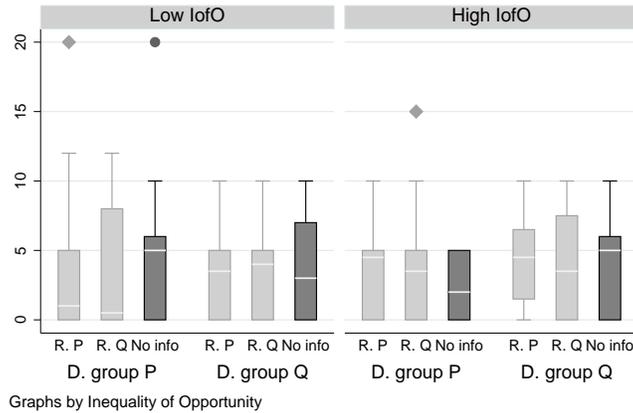


Figure 2: Variations in the amount sent by group

the total amount to split or 1/3 of the amount sent when the dictator is uninformed. This difference persists when analyzing each level of IofOs individually. Though the amounts sent by the uninformed dictator does not come from different distributions compared to that sent to either high ($p=0.61$) or low effort ($p=0.25$) receivers, the average is much closer to what is sent to the high effort receivers suggesting dictators were accurately predicting that a great percentage of receivers had exerted high effort (70%).

Figure 2 presents how the amount sent varies with respect to dictators' and receivers' opportunities (as characterized by group membership). Dictators' opportunities have no significant effect in the distribution where amounts sent are drawn ($p=0.83$). Nevertheless, dictators from the disadvantaged group in the low IofOs environment sent \$0.87 less on average when compared to dictators from the advantaged group while participants from the disadvantaged group in the high IofOs environment sent \$0.65 more. Yet, I fail to reject the null hypothesis that the amounts sent by dictators in the advantaged or the disadvantaged group

(signed-p) Wilcoxon ranksum tests, depending whether the analysis is between or within subjects correspondingly. In these tests the null hypothesis is that the amounts sent are drawn from the same distribution.

come from the same distribution ($p=0.83$ and $p=0.42$ correspondingly).²⁶

Receivers' opportunities have no significant effect in the amounts sent. When dictators had no information regarding receivers' opportunities they sent the highest amount (mean=\$3.91), a slightly lower amount to receivers in group Q (mean=\$3.7) and a similar amount to receivers in group P (mean=3.69). Moreover, I fail to reject the null hypothesis that the amounts sent to advantaged and disadvantaged receivers come from the same distribution (signed- $p=.94$). This insensitivity to receivers' opportunities holds when every level of IofOs is analyzed independently with p -values higher to 0.9 in all cases.

5 Conclusions

Amid the global economic crisis, there has been increased interest regarding income inequality. Specifically, questions exist as to whether redistribution has been too low. In fact, inequality has risen to levels only observed before the Great Depression which poses a challenge as there is evidence suggesting high levels of inequality may harm growth.

Nonetheless, the questions regarding the level of redistribution are inextricably related to the roles different factors (broadly categorized as effort or luck) have had in generating observed income inequality. Moreover, questions on redistribution are related to (i) beliefs—as individuals only have incomplete information on these factors—and (ii) how concerned individuals are about differences in luck and effort. Specifically, it has been proposed that people are averse to inequalities arising from inequalities in opportunities. Therefore efforts are being made to identify and quantify sources of IofOs. Granted individual behavior, these efforts are in hope that increasing the awareness of IofOs should expand the average willingness to redistribute.

²⁶ Given the relatively small effect of dictators' opportunities, the sample size may have been insufficient to accurately measure this effect.

The experiment presented here uses a novel design, addressing many of the limitations of previous experiments, to study the case of behavior towards inequalities of opportunities when individuals are aware of the sources of inequality. I find that individuals are predominantly concerned about differences in effort that cause inequality, and less concerned about inequalities in opportunities.

On the one hand, individuals redistribute more towards receivers who exert higher levels of effort independent of the opportunities they faced. This is because differences in effort change the legitimacy of an advantageous inequality. Therefore, one could expect more support for a high level of redistribution if individuals know (believe) redistribution is being directed towards individuals who are exerting effort or when redistribution policies are carefully designed to discourage sub-optimal levels of effort.

By contrast, information regarding differences in receivers' opportunities have no effect on participant's redistribution decisions. Dictators' opportunities may have complex, though relatively small, effects on redistribute decisions. Specifically, with a high level of inequality of opportunities, successful individuals of disadvantaged groups are willing to redistribute more compared to those from advantaged groups. This behavior raises questions on the potential interactions between individual opportunities and the difference of opportunities in a society. In fact, a similar effect has been described by [Piff et al. \(2010\)](#) where a simple manipulation of social status induces pro-social behavior in those relatively disadvantaged, while decreasing pro-sociality in the advantaged.

Following the analysis by [Ray-Biel et al. \(2012\)](#), one reason why we observe such insensitivity towards opportunities may come from individual beliefs regarding the factors that determine success and income outside the lab. Specifically, individuals from North-American societies tend to believe that luck plays a relatively small role in determining success ([Alesina and Angeletos, 2005](#)) while they also tend to attribute low income to other factors such as race (e.g. [Lee and Roe-](#)

mer, 2006). If this is true, the results found raise questions about the potential effect of raising awareness about inequalities of opportunities in redistribution decisions and ultimately policy. Moreover, one could only expect an effect from providing information regarding inequalities of opportunities as long as beliefs are changed by the information provided.

However, it can also be that participants were not significantly concerned about opportunities in this experiment—and similar experiments—as receivers were affected by opportunities once. In a true IofOs setting, an individual would be consistently disadvantaged, potentially engaging in repeated interactions in which they experience low opportunities for success. Thus, individual effort and redistribution decisions may be different in a repeated interactions environment. Moreover, participants in the experiment may be unfamiliar with high levels of inequalities in opportunities outside the lab introducing a potential role for learning. Therefore, suggestions for future research include the exploration of cases when there are multiple periods of interaction.

Annex A Solution to the problem of an informed individual concerned about relative effort and IofOs

In this problem, an individual i has a payoff ω_i earned given a probability which depends on her effort $e_i \in \{e^H, e^L\}$ and her opportunities (determined by the group in this experiment) $g_i \in (p, q)$. She is then asked to decide how much to send (x_j) to an individual j who has no payoff but exerted effort e_j and was in group g_j . Further assumptions are $\bar{\beta}_i \leq \bar{\alpha}_i$ and $0 < \bar{\beta}_i < 1$. Also $v', w' > 0$ and $v'', w'' > 0$ where $v(\cdot) = 0$ if $2x_j - \omega_i \leq 0$ and $w(\cdot) = 0$ if $\omega_i - 2x_j \leq 0$. As a simplification I will consider the case when $u(\cdot)$ is linear. The problem is then

$$\begin{aligned} \max_{x_j \in (0, \omega_i)} U_i(\omega_i, x_j) = & \left(\frac{\omega_i - x_j}{\omega_i} \right) - \alpha_i(\bar{\alpha}_i, e_i, g_i, e_j, g_j) v \left(\frac{2x_j - \omega_i}{\omega_i} \right) \\ & - \beta_i(\bar{\beta}_i, e_j, g_j, e_i, g_i) w \left(\frac{\omega_i - 2x_j}{\omega_i} \right) \end{aligned} \quad (5)$$

Given the nature of $v(\cdot)$ and $w(\cdot)$, in order to solve this problem, it has to be broken into cases of possible solutions. Below are the solutions for the possible interior solutions found using the method of Lagrange. The other possible solution is splitting the endowment by half, which utility is compared with the following two cases:

A.1 Assume an amount sent lower than half the endowment

If $\omega_i > 2x_j$ then $v(\cdot) = 0$ and the First Order Condition (F.O.C.) is:

$$\begin{aligned} 0 = & -\frac{1}{\omega_i} + \frac{2}{\omega_i} \beta_i(\bar{\beta}_i, e_j, g_j, e_i, g_i) w' \left(\frac{\omega_i - 2x_j}{\omega_i} \right) \\ w' \left(\frac{\omega_i - 2x_j^*}{\omega_i} \right) = & \frac{1}{2\beta_i(\bar{\beta}_i, e_j, g_j, e_i, g_i)} \end{aligned} \quad (6)$$

if we further assume $w(\cdot) = \frac{(\cdot)^2}{2}$ then

$$\begin{aligned}\frac{\omega_i - 2x_j}{\omega_i} &= \frac{1}{2\beta_i(\bar{\beta}_i, e_j, g_j, e_i, g_i)} \\ 2x_j &= \omega_i \left(1 - \frac{1}{2\beta_i(\bar{\beta}_i, e_j, g_j, e_i, g_i)} \right) \\ x_j^* &= \omega_i \left(\frac{1}{2} - \frac{1}{4\beta_i(\bar{\beta}_i, e_j, g_j, e_i, g_i)} \right)\end{aligned}\tag{7}$$

A.2 Assume an amount sent higher than half the endowment

If $\omega_i < 2x_j$ then $w(\cdot) = 0$ the F.O.C. is:

$$0 = -\frac{1}{\omega_i} - \frac{2}{\omega_i} \alpha_i(\bar{\alpha}_i, e_j, g_j, e_i, g_i) v' \left(\frac{\omega_i - 2x_j}{\omega_i} \right)\tag{8}$$

which never holds in equality unless the function $\alpha_i(\cdot)$ is able to change sign, i.e. that for a combination of effort and opportunities an individual receives positive utility for being below. Still, even if that is the case it may be possible that sending more than half is not optimal, that is if the gains increase so slowly that giving half provides a higher utility.

From this analysis it is derived that the most possible cases solutions observed would include giving half or a positive portion, lower than half, of the endowment.

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Online Annex A Experiment Protocol

As we already discussed, this is an experiment in economic decision-making. During the experiment you will be asked to make a number of decisions. Your payment for today's session is both compensation for your time as well as for the effort you put into making your decisions. In any case, just for coming you will receive a show-up fee of 5 dollars which is yours to keep. If you have any questions, please raise your hand and an experimenter will help you.

Today's experiment will proceed as follows:

You will be randomly assigned into one of two groups: group P and group Q. Membership in these groups will change your chances of earning each 20 dollars or zero depending on your performance at manually solving multiplication questions of three digits numbers. You will be given 25 minutes to answer as many questions as possible. No calculator or cellphones will be allowed when answering. Please note that you may use this time to do something else as long as you do not use your cell-phone, a calculator or the web browser. The only tools available are the paper and the pencil that you have in front of your computer. If you need additional sheets of paper you can raise you hand. Additionally we are providing a multiplications table for 1 digits.

If you are assigned to group P you will face a 90% chance of receiving \$20 if you correctly answer at least 12 questions. If you answer fewer than 12 questions correctly you will face a <40%/60%> chance of receiving \$20. If you're assigned to group Q, you will face a <60%/40%> chance of receiving \$20 if you correctly answer at least 12 questions. If you answer fewer than 12 questions correctly, you will face a 10% chance of receiving \$20. Note that the differences between groups P and Q are therefore the likelihood of members receiving \$20 for the same level of performance.

You will be presented 50 multiplication questions. To answer them, enter

your answer in the boxes provided on the computer screen. You may change your answers during that time. To save the answers press the save button, you can press this as many times as desired but remember that only the last set of answers will be recorded. You must press it at least once to save your answers before the time is up. Then all your answers will be verified and you will be informed in the screen how many questions were answered correctly.

Based on your performance and your group, we then proceed to determine who gets the \$20. After that we will randomly make pairs between those who won the \$20 and those who did not. If you have the \$20 then you will be given the option to send any portion of that money to the other person. <You will know in which group the other person was and whether they solved the 12 questions when deciding / You will not know anything more about the other participant except the fact that they got zero>. You may choose anything between 0 and 20. In order to do this just type the amount you wish to send in the screen and then press confirm.

Once all participants have made their decisions your individual pay off from the experiment will be shown in the screen. Then a short survey will start and you will be paid individually.

As a reminder we will go over one multiplication in the board.

Go over the multiplication 123×401 on the board.

Any questions?

Online Annex B Participants beliefs compared to the rest of Canada

This annex presents the distribution of beliefs with regard to the sources of inequality, social mobility, taxation and the role of the government in decreasing inequality for the group of participants (in the left) and for the sample available for Canada from the ISSP 2009 (in the right).²⁷

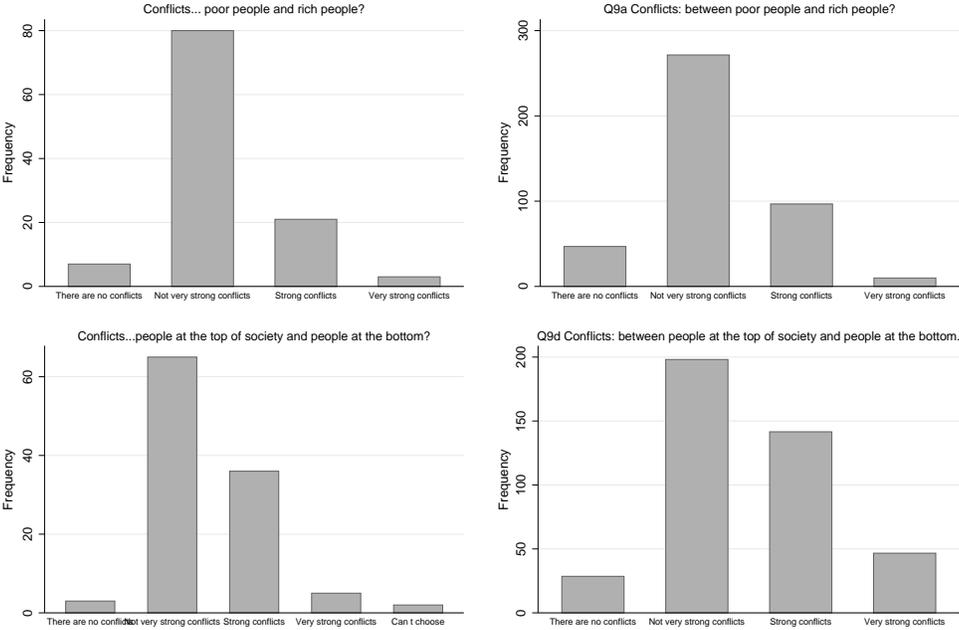


Figure B.1: Beliefs regarding social conflict.

²⁷I should note though, that because the sample procured for Canada was insufficient the ISSP decided to withdraw Canada from their multi-country sample. Nevertheless, the distribution of beliefs in the experiment’s sample and in the 5th wave of the World Values Survey (last available for Canada) is quite similar to the sample available from the ISSP.

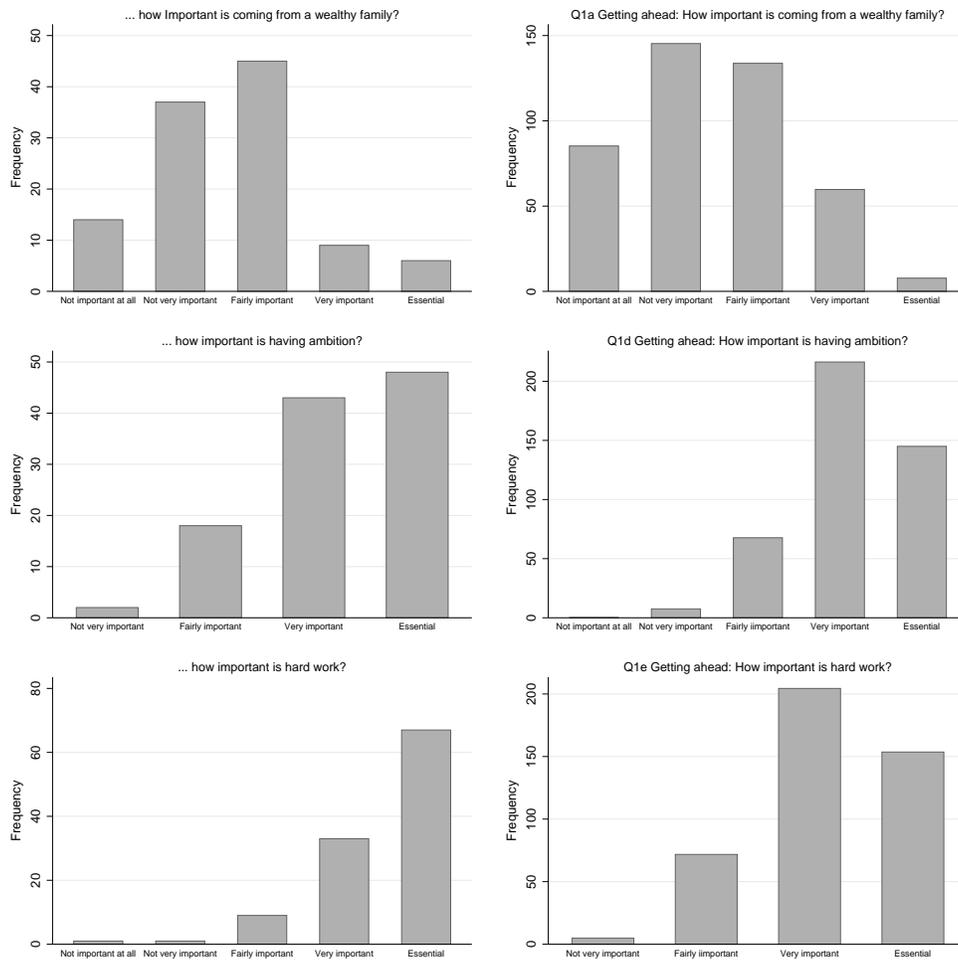


Figure B.2: Beliefs on determinants for getting ahead.

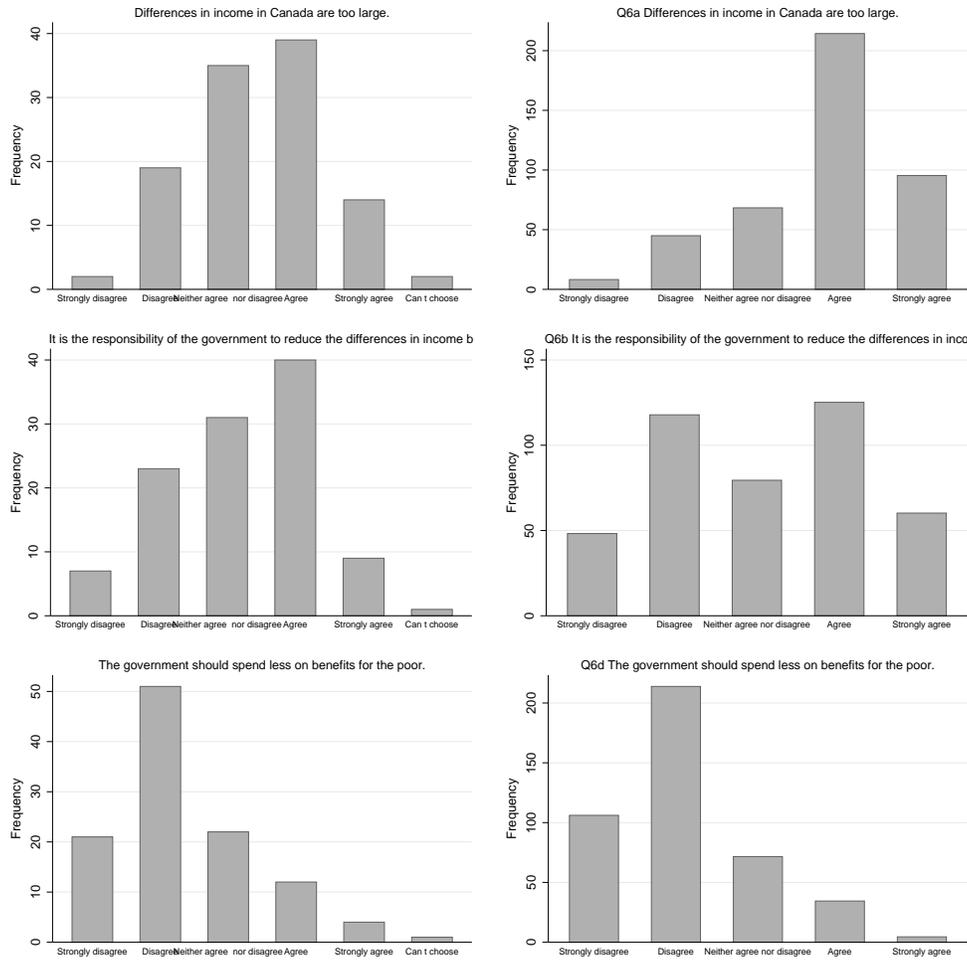


Figure B.3: Beliefs on inequality and the role of government.

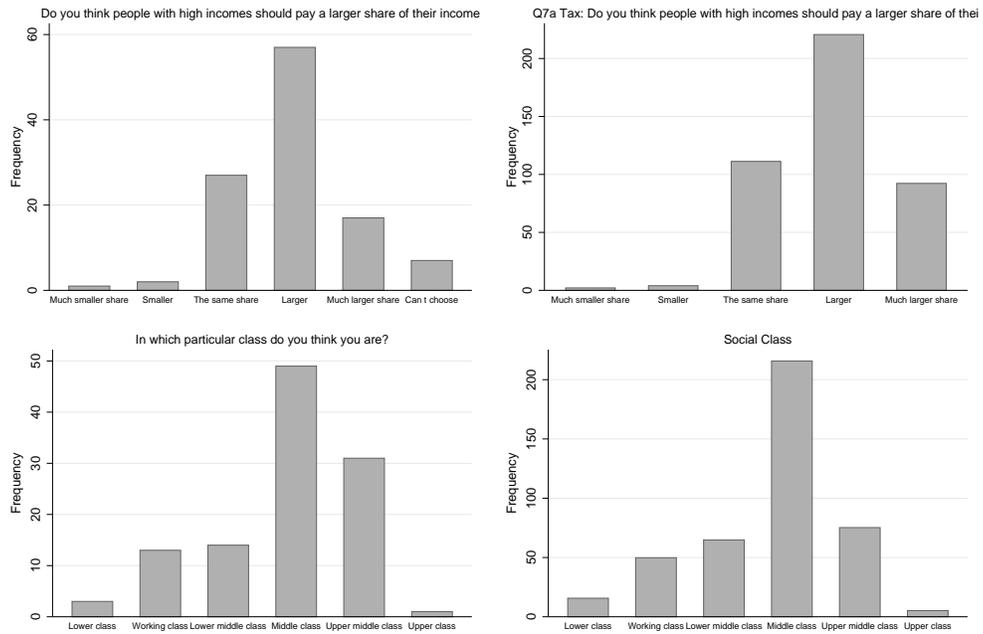


Figure B.4: Beliefs on taxes and social position.

Online Annex C Summary tables of pairwise comparisons

Table C.1: Non parametric tests summary by level of effort of the receiver.

	Low IofO		-	High IofO	
	R more 12	R no info	R less 12	R more 12	R no info
Low IofO					
-R less 12	.013	.193	.383	.063	.447
-R more 12	.	.919	.495	.703	.704
-R no info	.	.	.412	.734	.598
High IofO					
-R less 12005	.761
-R more 12365

Wilcoxon p-Values.

Note: signed-rank tests were performed when the data was matched.

Table C.2: Non parametric tests summary by group of the receiver.

	Low IofO		-	High IofO	
	R group Q	R no info	R group P	R group Q	R no info
Low IofO					
-R group P	.944	.446	.52	.525	.818
-R group Q	.	.527	.583	.556	.887
-R no info	.	.	.825	.798	.598
High IofO					
-R group P977	.77
-R group Q755

Wilcoxon p-Values.

Note: signed-rank tests were performed when the data was matched.