

Group-Size and Inequality-Aversion

Randy Limberg

University of Michigan

Abstract

This thesis describes the relationship between group-size and inequality-aversion. Study 1 reveals a positive correlation between income inequality at the state level and the state population, suggesting that inequality becomes more tolerable as the number of people in a state increases. Study 2 demonstrates the presence of this positive relationship between number of people in an academic department and inequality in salaries within that department by examining the salaries of faculty in the University of Texas higher educational system. Study 3 articulates this effect by showing that experimental subjects create more inequality through hypothetical salary offers in groups that they perceive to be larger. Limitations and future directions as well as theoretical and practical implications are then discussed.

Introduction

I remember being intimidated by upper-level classes my freshman year at the University of Michigan. Anything that had a "300", or even worse a "400", in front of its description or that had a name like "Topics in Macroeconomics and Macroeconomic Policy: Law and Economics" was a class I was assuredly going to avoid. However, in the latter half of my sophomore year, when I began taking such classes, I noticed that I was receiving my highest grades in higher-level courses.

I was not alone in this observation. I have heard countless other undergraduate students comment on the irony of the inverse relationship between class number and class difficulty. I have often heard students describe "Principles of Economics I" or "Calculus II" as the hardest class offered at the University of Michigan. Personally, the lowest grades that I have ever received were in introductory courses in psychology and political science.

After dismissing a variety of theories for the class-level paradox, I took note of the curves offered by professors of different classes. I noticed that professors of large, lecture hall-filled classes generally offered the widest, most difficult curves and were almost always introductory courses. In contrast, the easiest curves were almost always offered in classes of fewer than twenty people, which were generally the high-level, specialized courses. These classes offered very narrow curves, and because the professors felt that they needed to give out at least one "A," these narrow curves were always at the top of the grading scale. I concluded that the levels of class difficulty had little to do with the content of the class but were instead linked to class enrollment because students of the same relative class ranks received higher grades in the smaller classes as a result of the differences in the range of the curves.

Garcia and Tor (2009) have established that increasing group-size has significantly deleterious effects on motivation because social comparison concerns decrease with group-size, In my thesis, I build on this finding that social comparison concerns decrease with increasing group-size and suggest that this decrease not only affects motivation, but also inequality-aversion as is seen in my experience with class sizes and difficulty levels. In this thesis, I test the hypothesis that people in large-group environments will be more tolerant of inequality than those in small groups. In the course of this thesis, I will first review the literatures on inequality-aversion, the relationship between social comparison and inequality-aversion, and the relationship between group-size and social comparison and then present empirical evidence and conclude with practical implications.

Literature Review

Inequality Aversion

People dislike inequality. Research has shown that, all other things equal, people will choose an outcome in which others are made better off even at the expense of their own, individual payoffs (Bolton & Ockenfels, 2000; Fehr & Schmidt, 1999). Though human rationality has been questioned in recent years (Ariely, 2008), inequality-aversion persists as a fundamental assumption in modern economic and psychological models. Of course, few if any of the decisions people make are purely without distributive consequences, and it is this fact that leads to the often-necessary procedure of choosing among a series of trade-offs between equality and profit-maximization. For example, a country's tax policy is often a reflection of its voters' preferences for this tradeoff (Ackert, Martinez-Vazquez, & Rider, 2007). A highly progressive tax reflects a choice to stifle the economy in favor of equality while a flatter tax reflects a choice

to exacerbate financial discrepancies in favor of encouraging economic growth. In this thesis we attempt to further understand the unconscious algorithms people use to make these types of decisions by isolating one variable: group-size. We then attempt to uncover the mechanism by which this variable affects inequality-aversion and test our effect outside of experimental conditions.

Inequality aversion, as presented here, is the preference of people to make decisions that increase equality within the general society or more specific groups. Though inequality-averse people often make decisions resulting in unequal allocations, they always prefer allocations that are more equal if other factors, such as social standing and total group profit, are not relevant. To demonstrate, consider a simplified version of the taxation game (Engelmann & Strobel, 2004). In this study participants were assigned a "middle income" and were asked to allocate money to two other participants, one of whom received a "high income" and the other of whom received a "low income." Regardless of the initial subject's decisions, the allocations always ranked as: high income > middle income > low income. In this case, since all other factors are held constant, an inequality-averse person would choose to minimize the range between high and low income.

Much of the inequity-aversion¹ literature is focused on two classic economic games: the dictator game and the ultimatum game. In the dictator game, subjects have no monetary incentive to transfer any money, and similarly, in the ultimatum game, they have no incentive to reject any amount of money. However, they often send nontrivial amounts to the other player or reject

¹ Inequality-aversion is a more specific version of the more often-studied inequity version. Inequity-aversion refers to a preference for fair allocations, including those allocations which reward merit with unequally high incomes. Inequity-aversion also includes the preference for equal distributions where the merit of potential recipients of rewards is indistinguishable. Here, there is no opportunity to distinguish merit, so we use the more specific term, "inequality-aversion," while recognizing our work's broader implications for inequity-aversion.

similarly nontrivial amounts of money received from the other player. This behavior clashed with all classical models of rationality (Simon, 1955).

There are several theories that explain the inequity-aversion present in these games. The first prominent theory, as proposed by Forsythe, Horowitz, Savin, and Sefton argued that people care more than marginally about fairness, although factors such as spitefulness and gamesmanship are also likely to be present (Forsythe et al., 1994). Following Forsythe *et al.*, Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) developed the two fundamental theories of modern inequity-aversion research. The Fehr-Schmidt model is an individual-centric understanding of inequity-aversion that is dependent on the economic environment. They posit that certain scenarios, most notably those that allow players to punish other members of a group, allow for a minority of "fair" players to influence others to create a "fair" outcome (1999). The Bolton-Ockenfels model focuses on a tension between narrow self-interest (profit maximization) and salient relative payoff standings (social comparison). In this way, the relative magnitude of the coefficients of those effects determines the intensity of inequity-aversion (2000). More recently, Charness and Rabin have suggested a two-person model with three weighted coefficients that acts as a combination of the Fehr-Schmidt and Bolton-Ockenfels models (2002).

Social Comparison and Inequality-Aversion

Outside of these fundamental economic models, various factors have been studied in their relation to inequality-aversion, including social comparison. The Fehr-Schmidt model is the first place where social comparison is mentioned in the economic inequity-aversion literature (1999). Fehr and Schmidt discuss the consistency of their research with the contemporary work on social

comparison, and they suggest that social comparison should apply not only to the dictator and ultimatum game, but also to every other instance of inequality-aversion.

While economics-focused scholarship of inequity-aversion has only recently suggested the impact of social comparison on inequality-aversion, psychologists have explored that possibility more thoroughly. Bazerman, Loewenstein, and White (1992). analyze the decision between profit-maximization and relative rank. They arrange subjects into pairs and ask each member of the pair to rate allocation options. They show that subjects rate unequal allocations of a large sum of money between themselves and their paired subject well when that allocation is presented in isolation, but when subjects can compare that allocation to an equal allocation of less money, their rankings of the unequal distribution decrease. These scholars' work suggests that people are more sensitive to inequality-aversion when they are able to compare allocations of varying degrees of equality.

Garcia, Gonzalez, and Tor (2006) build on the work of Bazerman, Loewenstein, and White (1992). They argue that social comparison pressures are stronger when potential changes in rank are more salient and that those pressures manifest themselves in increased aversion to unequal joint profit. That is to say, the difference between being 2nd and 3rd is substantially more important than the difference between being 102nd and 103rd, and subjects in the former situation are less likely than those in the latter to accept a personally beneficial scenario that benefits the other party more than themselves. In this way they suggest that people in salient ranks will care more about relative payoffs than total payoffs, and people in less salient ranks will care more about total payoffs.

Garcia, Tor, Bazerman, and Miller take a slightly different approach to the inequality-aversion and social comparison question; they examine the impact of social category lines (2005). Their research shows that social category lines such as race, gender, class, or even school affiliation increase the magnitude of inequality-aversion. For example, University of Michigan (UM) participants were asked to make a hypothetical decision in a hotel vacancy dilemma between two student groups traveling together. One solution was to put everyone in a 1-star motel while another solution was to put one student group in a 3-star hotel and the other in the 4-star hotel. In this control condition, most people chose to maximize hotel quality and thus, chose the second solution. However, in the social categories condition, the 2 student groups traveling together were from UM and Harvard, respectively. And in this case, most participants chose the first solution – the low quality but equal 1-star motel. Thus, when inequality cleaves along social category lines, social comparison concerns become so strong that equality is preferred to quality maximization. Later research suggests that this effect persists even when a fair mechanism, such as a coin toss, is used to determine which social group is favored (Garcia & Miller, 2007). And, in this case social category lines amplify social comparison, and this amplification is demonstrated by an increase in the magnitude of inequality-aversion.

Group-Size and Social Comparison

Social comparison, an aforementioned determinant of inequality-aversion, is influenced by perceived differences in group-size. Garcia and Tor demonstrate this relationship by examining motivation of competitors in different sized groups (Garcia & Tor, 2009). That research shows that the increasing number of competitors in a group has negative effects on

individual motivation beyond the limit, and that those negative effects are the consequence of decreased saliency of social comparison pressures.

Garcia and Tor provide significant evidence for a causal relationship between group-size and social comparison in their study two (2009). They create a competitive environment by providing subjects with a task, and the subjects are incentivized with a higher payoff for finishing in the top 20% of their respective group with regards to the speed with which they complete their task. Subjects are then told that they are competing against either 10 or 100 other subjects. As predicted, subjects told that they are in the 10-person groups finish significantly faster than those told that they are in the 100-person groups.

Garcia and Tor's work was influenced by other psychological principles relating motivation to group-size. For example, by increasing group-size in an experiment, subjects experience large increases in motivation as they begin to see the other subjects as competitors, a process known as social facilitation (Zajonc, 1965). Garcia and Tor argue that adding subjects initially provides this social facilitation, but eventually, the number of subjects becomes too great for the perception of social comparison. When subjects feel that the number of competitors is stifling their opportunity to separate themselves from others, motivation decreases.

We focus here on studies three and five of Garcia and Tor's work (2009). In study three, they test whether a decrease in social comparison concerns is one of the mechanisms through which decreasing group-size decreases motivation. Using the Gibbons-Buunk social comparison scale (1999), Garcia and Tor found that increasing group-size not only decreases motivation, but also decreases social comparison scale scores (2009). In study five, Garcia and Tor replicated the finding that social comparison concerns decrease as the number of competitors is increasing.

Group Size and Inequality-Aversion

We have thoroughly discussed the relationship between inequality-aversion and social comparison, and we have shown that social comparison correlates positively with inequality-aversion. We have also discussed the relationship between social comparison and group-size, and we have similarly shown that group-size correlates positively with social comparison. In this thesis, we examine the interplay between these two relationships, and we make the formally logical step to examine the relationship between group-size and inequality-aversion. We hypothesize here that (1) in the United States, states' population and relative inequality will correlate positively; (2) salary variances in the University of Texas system will vary with department-size, with larger departments having more salary variance; and (3) under experimental conditions, subjects will be increasingly inequality-averse as group-sizes increase.

Study 1*Income Inequality in States of Varying Populations*

Study 1 tests the presence of our effect in very large group scenarios. Here, we show that states with larger populations experience more inequality than smaller states. We understand this correlation by suggesting that the politically powerful in those states both recognize their states' population sizes and are less inequality-averse if they are in a state with a larger population.

Data Set

In this section we use state population estimates from both 1990² and 2006³. We also use income data distinguishing average incomes within income-earning quintiles for corresponding time periods⁴.

Key Variables

The unit of analysis for Study 3 was the ratio between the average income of the top quintile of income earners in each respective state and the corresponding bottom quintile in 2006. This ratio is defined as:

$$\text{AVG}(Q_1^5)/\text{AVG}(Q_5)$$

In essence, this ratio basically measures income inequality at the state-level, and we focus on the inequality between the highest and lowest income earners.

These ratios were then relabeled as BT2006⁶. Our parameter of interest was the correlation between state population and the BT2006 ratio. Our null hypothesis was that the BT2006 ratio would be consistent across varying population sizes. Our alternative hypothesis predicted that larger states would experience larger ratios of income disparity, which we interpret as inequality.

² Retrieved from <http://www.census.gov/population/www/cen2000/briefs/phc-t2/index.html>

³ Retrieved from <http://www.census.gov/popest/intercensal/state/state2010.html>

⁴ Retrieved from <http://www.cbpp.org/archiveSite/4-9-08sfp.pdf>

⁵ Q_1 is here defined as the basket of incomes within each state falling in the top 20% of all earners. Q_2 , Q_3 , Q_4 , and Q_5 are defined as the corresponding baskets of income for the other four quintiles.

⁶ We run an identical analysis using the ratio between average income in the middle quintile (Q_3) and highest quintile (MT2006).

Control Variables

While this ratio is already a suitable unit of analysis because of the proper surveying techniques and large sample of the data from which it is derived, we nevertheless attempt to minimize the effect of possible confounds. We control for relevant variables: geographic region, race, and recent change in population. To control for geographic region, we use the United States Census Bureau-defined geographic region coding system⁷. To control for race, we use the percentage of whites compared to the total population, and we use data from the 2012 Census Statistical Abstract defining the percentage of whites in each state. To control for recent change in population, we create a variable for percentage change in population since 1990⁸.

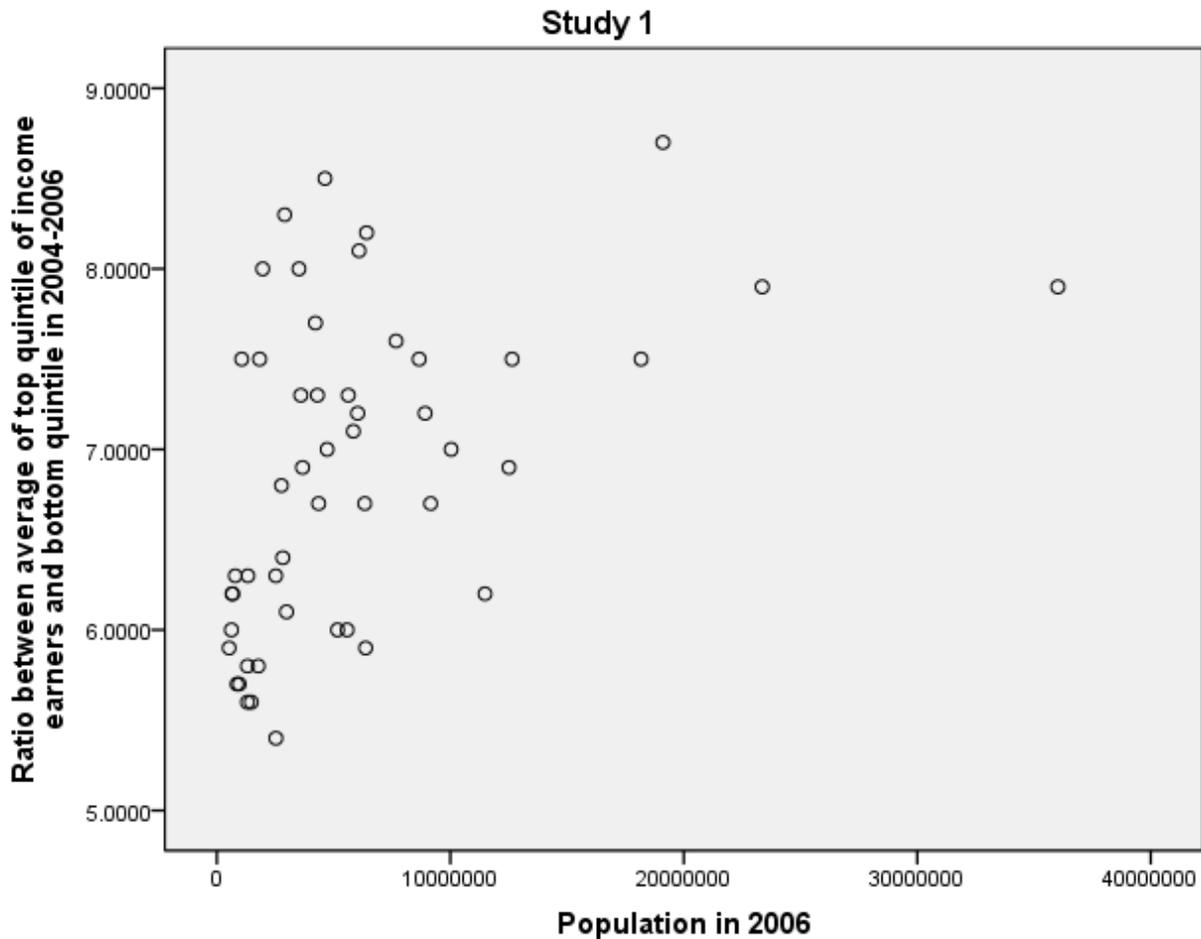
Results and Discussion

Consistent with our alternative hypothesis, we found a significant positive correlation between population-size and income inequality (N=50, $r=.458$, $p=.001$)⁹. Including our controls in the analysis, the correlation is essentially the same (N=50, $r=.446$, $p=.002$). Larger states, in terms of population, experience larger gaps in income, and thus more income inequality as demonstrated below.

⁷ U.S. Census Bureau, U.S. Department of Commerce Economics and Statistics Administration. Census regions and divisions in the united states. Retrieved from http://www.census.gov/geo/www/us_regdiv.pdf

⁸ $\Delta\text{Pop}=(\text{Pop}_{2006}/\text{Pop}_{1990})-1$

⁹ We find similarly robust results for our analysis of incomes between MT2006 and population (N=50, $r=.514$, $p=.000$; N=50, $r=.501$, $p=.000$)



While the level of significance is irrefutable, there are a variety of confounds for which we were unable to control. Among these, variance of population density and variance in industry are notable. Since urban areas earn higher incomes on average and have lower levels of poverty than rural areas (Miller & Rowley, 2002), those states that experience significant proportions of both extremes in population-density in their population composition should be expected to have larger gaps between the rich and the poor. Similarly, those states that experience large variations in industry type should also experience larger variances in income inequality if we make the safe assumption that different industries offer significantly different earning potentials. However, while there is the possibility that these types of variances do vary across states and that they have

a significant impact that is not uncovered through controls for region, change in population, and racial proportions, we feel comfortable dismissing such criticisms.

Besides these potential confounds, our data here is subject to a line of criticism suggesting either that representatives do not have the power to control inequality within their states or that even if they do, representatives may not pay attention to the relative sizes of their constituencies. In the first case, anecdotal evidence suggests that representatives have enough power to actively control income-equality. With direct control of state budgets, social welfare programs, and the tax code, there is little reason to believe that income inequality is not at least partly a function of representative-action. In the second case, we would suggest that the nature of being a politician makes the possibility that representatives pay little attention to the sizes of their respective constituencies unlikely. Receiving demographical information throughout campaigns, politicians are likely to be especially attentive to their individual constituency's size.

A third potential criticism is the variation in measurement times. Due to limitations in available data, measurement times did not correspond perfectly. For example, data on income inequality was measured as an average across three years of time in two separate periods (1987-1989 & 2004-2006). We could not access intercensal data for the years 1987-1989, so we instead used populations from the 1990 census. To be consistent, we used intercensal data from only the 2006 census to correspond to the latter group. While these inconsistencies are unfortunate, the relatively slow change in intrastate demographic statistics due to very large numbers suggests that one-year differences in measurements are inconsequential.

Study 2

Salary Variances Explained by Department-Size

Study 2 tests the effect of group-size on inequality-aversion outside of experimental conditions. Using salary variances within departments of varying size, we predicted that salaries would vary less in smaller departments than larger departments because of greater inequality-aversion felt by those in charge of salary structures in smaller departments.

Data Set

Salary data was analyzed from 5,327 tenure-track or tenured faculty members of the University of Texas system including the branches at Austin, Brownsville, Dallas, El Paso, Pan American, Permian Basin, San Antonio, and Tyler¹⁰.

Methods - Statistical Analysis

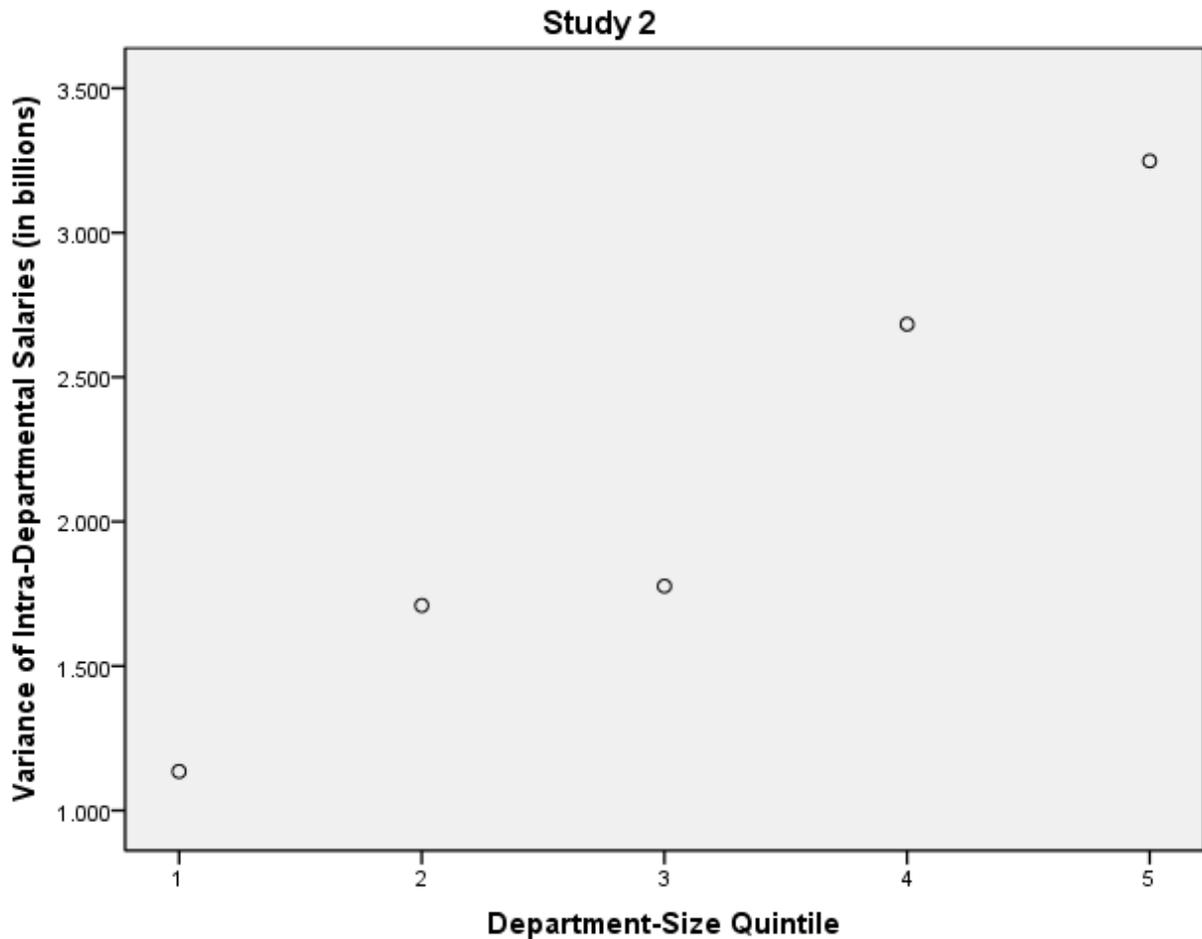
The unit of analysis for Study 2 was the individual faculty member, and we computed the number of faculty in each department across the University of Texas system. Once we established the number of faculty for each department, the faculty members were coded for quintiles describing the group-size of their respective departments in terms of number of faculty members. Those quintiles were obtained using a department-level analysis of the same data set and comparing number of faculty members across those departments. The quintiles were defined in five equal parts (Q₁: ≤12.9, Q₂: 13-19.9, Q₃: 20-28.9, Q₄: 29-53.9, Q₅: ≥54).

¹⁰ Retrieved from http://chronicle.com/article/Release-of/127439/?sid=pm&utm_source=pm&utm_medium=en%29

Our parameters of interest were the unexplained error variances (residual variances) within each group-size quintile after accounting for the variance explained by faculty rank and quintile. Our null hypothesis was that all five group-size quintiles had the same unexplained error variance. Our alternative hypothesis was that at least one of the five group-size quintiles had a different error variance, specifically that the largest quintile had one of the largest variances. We tested the null hypothesis by first fitting a model with equal error variance in each quintile, and then fitting a model with unequal variance across the five quintiles. These models were fitted using SAS PROC MIXED (SAS Institute Inc., 2008). A likelihood ratio test (LRT) was used to test the null hypothesis, with the initial LRT statistic being (asymptotically) a chi-square with four degrees of freedom (given that the larger model had five variance parameters and the smaller model had only one variance parameter). We concluded that the larger model provided a better fit if the LRT statistic had $p < 0.05$.

Results and Discussion

Our results suggested that the alternate hypothesis, that salary variance varied across the five quintiles, was significantly more likely than the null hypothesis (LRT chi-square(4)=327.31, $p < .001$). Further, estimated variances within quintiles varied in an expected upward trend as demonstrated by the graph on the next page ($Q_1=1.135E9$, $Q_2=1.7096E9$, $Q_3=1.7765E9$, $Q_4=2.683E9$, $Q_5=3.2483E9$).



Our finding in this section is consistent with the basic proposition of our argument; larger groups experience more inequality than smaller groups. Here, not only do we show that variation within departments, our proxy for inequality, is largest in the largest quintile of department-size, but also that variance increases in a predictably linear pattern as group-size increases.

Our finding is potentially limited by a variety of confounds. Among these, perhaps it is the case that larger departments can hire more sub-areas that may have significantly different average salaries than the department in general. This difference would present itself in our data as increased intra-departmental variance. Nonetheless, it is also possible that those large

departments specialize in sub-areas, and that this specialization decreases inequality in large departments. For example, the Department of Economics at the University of Michigan focuses on the sub-area of labor economics, and this focus would suggest that salary within that department would vary by a small amount around the average salary for such labor economics faculty members. This example contradicts the supposition that all departments that utilize sub-area faculty would hire faculty from a variety of sub-areas. If this second possibility is occurring with similar or greater frequency than the first, it is likely that aggregating across departments is mitigating any explanatory impact sub-areas could have.

Assuming the presence of sub-areas does increase intra-departmental inequality, our finding is still sound because this potential criticism is actually consistent with our finding. If inequality-aversion did not vary by group-size, there would be no reason to suggest that large groups would be willing to use their greater resources to attract faculty working in the higher-salaried sub-departments. We focus here on the act of an individual in power choosing more inequality rather than focusing on the opportunities available to that individual through which that inequality-inducing choice could be realized. Though it is true that having sub-departments may offer an extra avenue for inequality to large departments, the heads of those large departments still make the choice of whether or not to engage in this potentially inequality-inducing practice, which is a choice highly dependent upon the inequality-aversion that we suggest is lessened in those larger groups.

Study 3

Perceptual Group-Size and Inequality-Introducing Salary Offers

Study 3 tested the effect of group-size on inequality-aversion in a controlled experimental condition. Participants were asked to offer a salary to a potential new hire in a new department¹¹, and we predicted that participants who imagined this department as being larger would offer higher salaries as a result of decreased inequality-aversion.

Participants

Participants were solicited to participate in an online survey using Amazon Mechanical Turk. To avoid language and cultural confounds, only subjects from the United States were allowed to participate. Thirty people (14 male, 16 female) completed the survey.

Procedure

Participants read in the survey that they had created a new department in their business, and that they needed to hire one final candidate to complete their team whose credentials were "much better than anyone already on your team". They were then given the maximum and minimum salaries already offered to a new hire (\$120,000, \$80,000) as well as the average salary within their new department (\$100,000). Participants were asked to respond with the highest salary they would be willing to offer the new candidate.

¹¹ Research suggests that third-party inequality-aversion paradigms have similar results to results expected in first and second-person paradigms (Garcia & Tor, 2008; Fehr & Fishbacher, 2004; Garcia & Miller 2007).

On a new page, participants were asked to respond with the number of candidates they imagined that the group had already hired. To ensure a variety of perceptual group sizes, participants had been randomly prompted with size-related adjectives describing the new department (small, mid-sized, large, very large). In this section, participants were finally asked to self-report how important they felt group-size was in determining their salary offers.

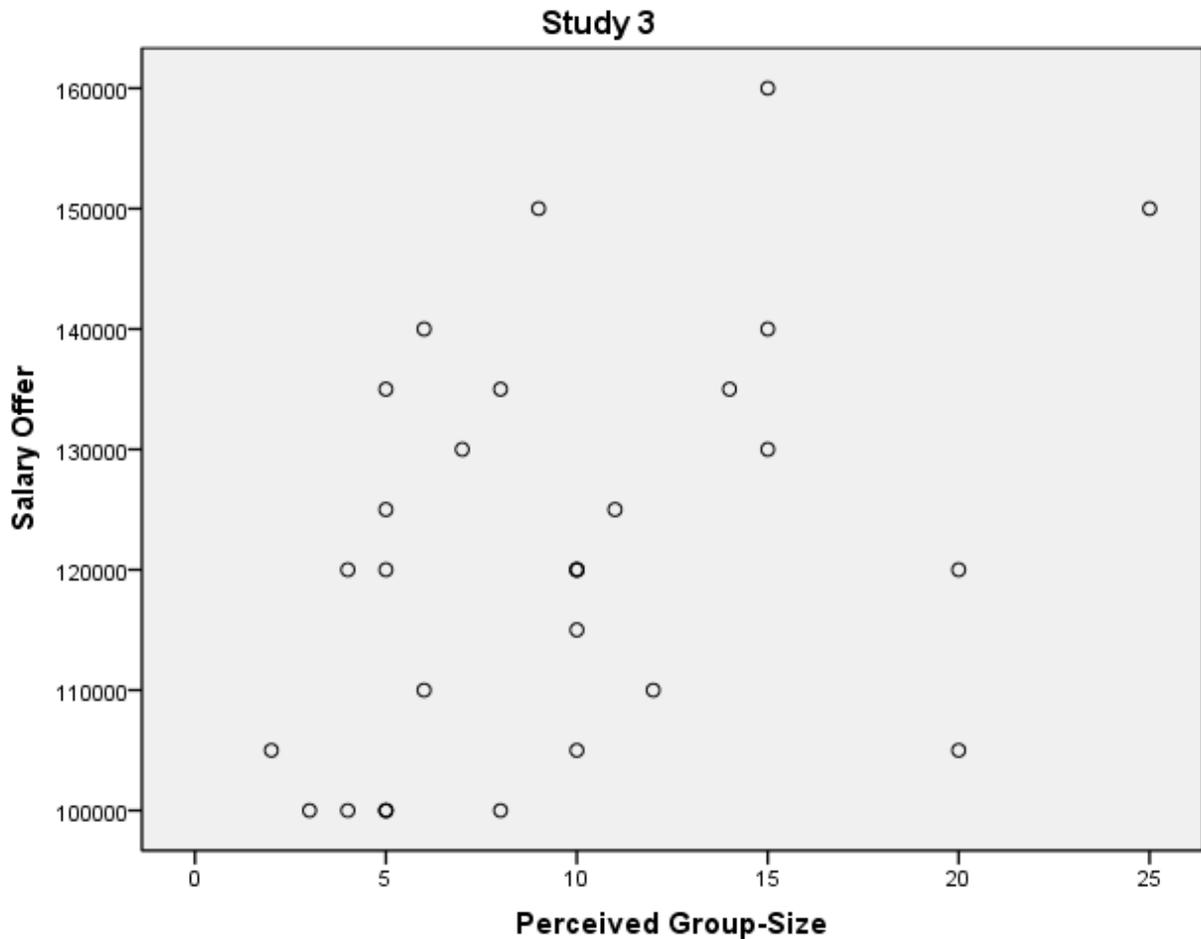
Following these portions of the experiment, participants responded to a questionnaire about social comparison¹² and they responded to manipulation checks and demographic questions.

Results and Discussion

After removing participants who we labeled as outliers and those with failed manipulation checks¹³, analyses revealed that the correlation between perceptual group-size and salary offer was significant ($N=30$, $r=.436$, $p=.016$). Controlling for race, educational background, gender, and age reinforced the effect ($N=30$, $r=.504$, $p=.009$). Since we interpret higher salary offers as increased inequality-aversion, we perceive this finding as evidence of a relationship between group-size and inequality-aversion. The chart on the next page demonstrates the correlation between perceived group-size and salary offer.

¹² We use the social comparison scale developed by Gibbons and Buunk (1999).

¹³ One participant was removed for reporting a perceived group-size that was an outlier ($M=9.47$, $SD=5.563$, $Response=50$). Other participants were removed for failing to accurately recall the average salary of the previous hires and for self-reporting an understanding of "I didn't understand." Before this selection, there were 38 participants.



We also find that scores on the Gibbons-Buunk social comparison scale (1999) correlate indirectly with group-size as expected ($N=30$, $r=-.206$, $p=.276$). While this finding is not significant at the $p<.05$ level, prior work examining this relationship suggests that our lack of significance is most likely an issue of power (Garcia & Tor, 2009).

There are several potential confounds for which we were unable to control, most notably, perceived candidate characteristics and perceived departmental industry. In the first case, we acknowledge the criticism that participants may have perceived the phrase "much better credentials than anyone already on your team" differently. We also acknowledge that participants

may have perceived this potential hire with different sets of relevant characteristics such as race, age, experience, etc. However, we see no reason to believe that these confounds would be affected by group-size, so we expect that they are mitigated through the aggregation of participants. In the second case, we again acknowledge the potential for participants to imagine industries with different salary norms and that these norms may have impacted the responses of our participants. However, we again see no reason to believe that these confounds could vary with group-size, and we expect that they are also mitigated through aggregation of the participants.

Beyond potential confounds, we recognize the problems presented with using random prompts for department-size. These prompts were included to ensure a variety of perceived group-sizes among the participants. While it is unlikely that these effects change our results in a significant way since the only logical effect would be reinforcement of the salience of perceptual group-size, we recognize the problems with correlating across groups in what are technically separate experimental conditions. However, we note that within the prompt groups, two groups with sufficiently large numbers of participants to expect significant results, small and large, both individually present significant and near-significant correlations between perceived group size and salary offer (N=11, $r=.598$, $p=.052$; N=7, $r=.895$, $p=.006$)

General Discussion

Summary of Results

Our research suggests that general inequality-aversion is more intense in small-group scenarios than large-group scenarios. In Study 1, we found that the size of a state in terms of population correlates significantly with income-inequality in that state. In Study 2, we found that faculty salary variance within departments varied more in large departments than in small departments within the University of Texas system. Finally, in Study 3, we found that, under experimental conditions, subjects offered higher, inequality-inducing salary offers in our department salary paradigm when they imagined their departments as being larger.

That said, we do not mean to suggest that group-size is the cause of inequality-aversion or that it is the primary variable determining the scale of inequality-aversion. However, with the results from Study 3, we can confidently proclaim that group-size has a significant effect on the intensity of inequality-aversion, and that there is an inverse relationship between the two such that larger group-sizes lead to less inequality-aversion.

Also in Study 3, we show that social comparison pressures may help mechanize this finding. Since social comparison pressures are lessened in larger group sizes (Garcia & Tor, 2009), our finding is consistent with current psychological research. Again, we do not mean to suggest that group-size is the cause of social comparison or that it is the primary variable in determining its scale. However, we do argue that group-size has a significant effect on social comparison pressures in the inequality-aversion scenario presented in our studies.

We check for the presence of this effect outside of experimental conditions in Study 1 and Study 2. Our intention in Study 2 is to demonstrate that the effect of group-size on inequality-aversion exists outside of hypothetical situations and among non-strangers. We find that the effect is significant in real-world workplaces with non-trivial amounts of money by examining the salaries of University of Texas faculty. Our intent in Study 1 is to test the effect in very large groups, and examine one of the primary implications of our work. We find that the effect is as strong in this analysis as it is in the others.

Limitations and Future Directions

Although previous findings have explored the relationship between group-size, competitive motivation, and social comparison (Garcia & Tor, 2009; Tor & Garcia, 2010), this thesis extends these findings for the first empirical test of the relationship between group-size and equality. For this reason, there is enormous potential for future research in a variety of areas, including psychology, economics, political science, and even biology.

There are various unanswered questions about the psychology of the effect presented in this work. For example, we have shown that salient changes in group-size can affect inequality-aversion. However, we tested only for the presence of this effect. An interesting direction for future research would be to determine the bounds of the effect and the particular saliency of specific changes in group-sizes. For example, is the impact on inequality aversion of a change from a 5-person group to a 15-person group as large as a change from a 50-person group to a 150-person group? Study 2 informs this research direction, but does not thoroughly address it. And, at what point is a group's size saturated as either very small or very large? A 5-person group may be considered equally small as a 3-person group for the purposes of this decision

mechanism. Similarly, a 5,000-person group may be considered equally large as a 50,000-person group, though our results from Study 1 would suggest that the upper bound is significantly larger than this.

Along with undefined boundary conditions, we were also unable to check for directionality in this thesis, and so we propose a topic for an economics-focused study of our effect. More specifically, in what way is the relationship between group-size and inequality-aversion different in the context of loss-aversion? It is possible, and in many ways intuitive, that the direction of the effect may be reversed in the case of loss-aversion. However, research on the effects of changing the directionality of a paradigm to frame it in a loss-aversion context has shown amplification rather than a change in direction (Prelec & Loewenstein, 1991). For example, Tversky and Kahneman suggest that the value ratio within marginal bounds between losses and gains is about 2:1, but that the value direction is the same (1991). That is to say, a loss of some value is perceived as twice as large as the gain of the same value. In this way, it is possible, and in many ways expected, that the change in magnitude of inequality-aversion due to group-size, using the same numbers as presented in our Study 3, in a loss-aversion context would be twice as prominent since the perceived value of those salaries is doubled.

A final area of interest to be checked in our original paradigm is the interpretation of the effect by from various perspectives. We justified our use of a quasi-third-party perspective by referencing work by various works that suggest that third parties experience inequality in the same way as those directly involved in equality-salient situations (Garcia & Tor, 2008; Fehr & Fishbacher, 2004; Garcia & Miller 2007). However, with the introduction of a new paradigm and effect, a logical tangential project would be to examine the effect from all of the perspectives

present in the paradigm. In this way we would suggest a study on the perception of equal and unequal allocations by subjects in the role of a true third party¹⁴, members of the department who had already been hired, and the new candidate.

Since so much of the inequality-aversion literature is focused on the dictator and ultimatum game, it would be reasonable to apply our findings to that classic work. For example, while the dictator game has been studied using teams as the sender (Cason & Mui, 1997), there is no research on the variability of group-size for receivers. Our research would suggest that that the increasing number of recipients would increase the level of inequality-aversion of the sender, and that the increase in inequality-aversion would be manifested in a mean transfer closer to fifty percent of the original allocation. Similarly, the ultimatum game can be examined under variable receiver group sizes. Here, we would expect mean proposals closer to fifty percent of the original allocation and also higher rates of rejection for unfair¹⁵ proposals by the senders.

In political science literature, our finding should also lead to new research in the inequality-aversion and welfare research line. For example, Moene and Wallerstein (2001) argue that more inequality in tax policy leads to greater support for welfare programs, and they describe various mechanisms for why this occurs with special attention to risk of job loss. Our research would suggest that their analysis is incomplete. The size of the constituency would have significant effects on the perceptual acceptance of welfare programs. We would expect that the variable "constituency-size" would alter the attractiveness of equality-increasing welfare plans. We offer some macro-level evidence for this in Study 1.

¹⁴ We define a true third party here as a subject with no control over any dynamic within the paradigm and no stake in any of the dynamics in the paradigm.

¹⁵ We define unfair here as any proposal perceived as deviating too far from an even split of the original allocation.

This thesis also provides direction for collective action research within the area of political science. Esteban and Ray (2001) extend the current reasoning that large groups struggle more than small groups in collective action dilemmas, and they note a few of their own exceptions. Our work would suggest that the effect of increasing group-size for public good collective-action problems would not only be affected by individual-centric payoff schedules but also by a decreased concern for equality. Members in a group experiencing a collective action problem would be inclined to act more selfishly as their perceptual importance of equality decreases, and they would subsequently harm the collective by defecting for higher personal gains at the expense of total group profit and equality. Thus, the overall effect of group-size on collective-action problems of public goods may be dependent on classical variables such as individual payoff, but also by inequality-aversion, and we suggest a subsequent research design as a future direction for this line of research.

From a biological point of view, the use of fMRI machines has allowed for the discovery of the area of the brain responsible for decisions on equality versus profit-maximization questions (Ming, Anen, & Quartz, 2007). Since we have shown that those decisions are linked with group-size, the same technology should be able to demonstrate a relationship between areas of the brain responsible for such decisions and areas of the brain responsible for interpreting group-sizes. In terms of evolutionary advantage, Fehr and Fischbacher describe the theories that analyze the evolution of altruism among humans (2005). In their discussion of reciprocal altruism, they note the inability of large groups to maintain altruistic norms in experimental settings. We would argue here that there is a possibility that the relationship presented in this

thesis between group-size and inequality-aversion may be the result of millennia of altruistic individuals receiving the suckers' payoff¹⁶ in large cooperative settings.

Theoretical and Practical Implications

Because of the far-reaching nature of human decision-making, our research has implications in a variety of settings, including academic, professional, legal, and political spheres. In the area of scholarly research, our work has several consequences for the current landscape of inequality-aversion literature. In the major debate between the Fehr-Schmidt model and Bolton-Ockenfels model, our research strongly supports the environmental impact described by Fehr and Schmidt (2000, 1999). Among the situations described by Fehr and Schmidt as allowing "fair" players to influence groups into "fair" outcomes, small-group situations can be added.

Within the business world, our research would suggest that companies seeking more equality within their departments would be wise to decrease the number of employees in those departments. Study 3 uses an experimental procedure very relevant for the effect of group-size on the inequality-aversion of business managers. The desire to avoid inequality by our subjects in their salary offers would be similar to the desire to avoid inequality by managers in the hiring process and while evaluating employees for raises. In this way, we would expect the same types of changes in group-sizes to influence managers in a professional context, and we see this effect in the management of faculty at the University of Texas system in Study 2. Since we can intuit no reason why salary norms of a university faculty system would differ from other organizations, we would expect this effect to apply to all sorts of organizations' pay structures.

¹⁶ The suckers' payoff differs here from its traditional use in prisoners' dilemma games. Our intent is to describe the payoff received by a member of a collective action dilemma who behaves cooperatively, but suffers the defection of another member of the group.

There is also an important interaction between our finding and the practice of pay secrecy. Research has shown that, despite intuitive and anecdotal evidence, wage compression under open-pay systems does not increase firm profitability, and thus pay secrecy theoretically has little effect (Charness & Kuhn, 2005). This finding is surprising because worker jealousy would seem to decrease the effort of employees at the lower end of the salary spectrum, especially when salary variance is high. However, though we did not test the presence of the group-size and inequality-aversion effect on recipients, if it is present in the same direction, Charness and Kuhn's finding may be less relevant in small-group settings. We would predict that workers with low-end wages in those small-group settings would put forth less effort because their distaste for the present inequality would be heightened by increased social comparison concerns resulting from the smaller number of people.

From the perspective of the employee, this research suggests that the size of a department should be an important factor in choosing among a variety of jobs. Those competitive individuals who expect to be at the top of their respective departments in performance, and salary as a result, would be wise to join larger teams since the higher variance in salary would allow them to earn higher salaries. Jobs in departments with fewer people whose salary variance we would predict to be lower would have lower maximum salaries as a result. For those less competitive individuals who expect to earn the lowest salaries among their peers, smaller departments would offer a safer maximized minimum option because of the high degree of equality.

There are also legal implications. First, class action law suits' equity of damages is likely to be indirectly proportional to the number of filers in that law suit. We would argue that courts are more likely to award damages with high variance in large class action suits. Second, if the

group-size effect is not specific to allocation recipients, but instead appears in any situation where the general number of people increases, large audiences in courtrooms may decrease inequality-aversion. This decrease in inequality aversion would skew the interpretations of judges handing down sentences. Presumably, judges would be less inclined to offer life-altering sentences because when inequality-aversion is high because it would substantially disadvantage the defendant and thus raise levels of inequality.

Finally, there are political implications of our findings. Regarding the ever-increasing wage-gap, the continuing increase in the number of constituents per representative could be decreasing inequality-aversion (U.S. Census Bureau, 1990). That decrease may be responsible for the continual increase in the difference between the top 5% of owners and everyone else (U.S. Census Bureau, 2010). Assuming fiscal policy within the control of representatives is powerful enough to impact inequality at both district and national levels, our work would suggest that the growing number of constituents per representative may be at least partially responsible for this growing wealth gap. Our work would also suggest that reducing the number of constituents per representative would at least increase that representative's value of equality and could lead to policy decisions to reverse this trend.

Conclusion

The increasing number of people in a group has a negative effect on inequality-aversion. In this thesis, we demonstrate that effect, show its viability outside of experimental conditions, and test for the presence of a mechanistic variable. Later, we consider its impact both on future research and domains outside of academia. More importantly, our research provides both descriptive and

prescriptive information for those seeking to lesson inequality in every facet of human interaction.

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References

- Ackert, L., Martinez-Vazquez, J., & Rider, M. (2007). Social preferences and tax policy design: some experimental evidence. *Economic Inquiry*, 45(3), 487-501.
- Ariely, D. (2008). *Predictably irrational*. (1 ed.). New York, NY: HarperCollins.
- Bazerman, M. H., Loewenstein, G. F., & White, S. B. (1992). Reversals of preference in allocation decisions: Judging an alternative versus choosing among alternatives. *Administrative Science Quarterly*, 37(2), 220-240.
- Bernstein, J., McNichol, E. & Nicholas, A., Center on Budget and Policy Priorities & Economic Policy Institute. (2008) *Pulling apart: A state-by-state analysis of trends* Retrieved from <http://www.cbpp.org/archiveSite/4-9-08sfp.pdf>
- Bolton, G. E., & Ockenfels, A. (2000). Erc: a theory of equity, reciprocity, and competition. *The American Economic Review*, 90(1), 166-193.
- Cason, T. N., & Mui, V. L. (1997). A laboratory study in group polarisation in the team dictator game. *The Economic Journal*, 107(444), 1465-1483.
- Charness, G., & Kuhn, P. (2005). *Pay inequality, pay secrecy, and effort: Theory and evidence* (NBER Working Paper 11786). Cambridge, MA: National Bureau of Economic Research. Retrieved November 2, 2011, from <http://www.nber.org/papers/w11786>
- Charness, G., & Rabin, M. (2002). Understanding social preferences with simple tests. *Quarterly Journal of Economics*, 117(3), 817-869.
- Engelmann, D., & Strobel, M. (2004). Inequality aversion, efficiency, and maximin preferences in simple distributive experiments. *American Economic Review*, 94(4), 857-869.
- Esteban, J., & Ray, D. (2001). American political science review. *Collective action and the group size paradox*, 95(3), 663-672.
- Fehr, E., & Fischbacher, U. (1994). Third-party punishment and social norms. *Evolution and Human Behavior*, 25(2), 63-87.
- Fehr, E., & Fischbacher, U. (2005). Human altruism—proximate patterns and evolutionary origins. *Analyse & Kritik*, 27, 6-47.
- Fehr, E., & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *The Quarterly Journal of Economics*, 114(3), 817-868.
- Forsythe, R., Horowitz, J. L., Savin, N. E., & Sefton, M. (1994). Fairness in simple bargaining experiments. *Games and Economic Behavior*, 6, 347-369.

- Garcia, S. M., Gonzalez, R., & Tor, A. (2007). Rankings, standards, and competition: Task v. scale comparisons. *Organization Behavior and Human Decision Processes*, *102*, 95-108.
- Garcia, S. M., & Miller, D. T. (2007). Social categories and group preference disputes: the aversion to winner-take-all solutions. *Group Processes & Intergroup Relations*, *10*(4), 581-593.
- Garcia, S. M., & Tor, A. (2009). The n effect: More competitors, less competition. *Psychological Science*, *20*, 871-877.
- Garcia, S. M., Tor, A., Bazerman, M. H., & Miller, D. T. (2005). Profit maximization versus disadvantageous inequality: The impact of self-categorization. *Journal of Behavioral Decision Making*, *18*, 187-198.
- Gibbons, F. X., & Buunk, B. P. (1999). Individual differences in social comparison: development of a scale of social comparison orientation. *Journal of Personality and Social Psychology*, *76*(1), 129-142.
- June, A. W. (2011, May 06). Release of faculty-productive roils u. of texas. *The Chronicle of Higher Education*, Retrieved from http://chronicle.com/article/Release-of/127439/?sid=pm&utm_source=pm&utm_medium=en
- Miller, K. K., and Rowley, T.D. *Rural poverty and rural urban income gaps: A troubling snapshot of the "prosperous" 1990s*. Columbia, Mo.: Rural Policy Research Institute, 2002.
- Ming, H., Anen, C., & Quartz, S. R. (2008). The right and the good: distributive justice and neural encoding of equity and efficiency. *Science*, *320*, 1092-1095.
- Moene, K. O., & M., W. (2001). Inequality, social insurance, and redistribution. *American Political Science Review*, *95*(4), 859-874.
- Prelec, D., & Lowenstein, G. (1991). Decision making over time and uncertainty: A common approach. *Management Science*, *37*(7), 770-786.
- SAS Institute Inc. 2008. SAS/STAT ® 9.2 User's Guide. Cary, NC: SAS Institute Inc
- Simon, H. A. (1955). A behavioral model of rational choice. *The Quarterly Journal of Economics*, *69*(1), 99-118.
- Tversky, A., & Kahneman, D. (1991). Loss aversion in riskless choices: A reference dependent model. *Quarterly Journal of Economics*, *106*(4), 1039-1061.
- U.S. Census Bureau. (2011). 2012 Statistical abstract: State rankings. (2011). Retrieved from <http://www.census.gov/compendia/statab/rankings.html>

- U.S. Census Bureau, U.S. Department of Commerce Economics and Statistics Administration. Census regions and divisions in the united states. Retrieved from http://www.census.gov/geo/www/us_regdiv.pdf
- U.S. Census Bureau, Income Division. (2010). *Income limits for each fifth and top 5% of all households: 1967-2010* (HO1AR2010). Retrieved from <http://www.census.gov/hhes/www/income/data/historical/inequality/index.html>
- U.S. Census Bureau, Population Division. (1990). *1990 census of population housing* (CPH-2). Retrieved from <http://www.census.gov/population/www/censusdata/files/table-2.pdf>
- U.S. Census Bureau, Population Division. (2010). Intercensal estimates of the resident population for the united states, regions, states, and puerto rico: April 1, 2000 to july 1, 2010 (ST-EST00INT-01). Retrieved from <http://www.census.gov/popest/intercensal/state/state2010.html>
- U.S. Census Bureau, Population Division. (2001). Ranking Tables for States: Population in 2000 and Population Change from 1990 to 2000 (PHC-T-2). Retrieved from <http://www.census.gov/population/www/cen2000/briefs/phc-t2/index.html>
- Zajonc, R. B. (1965). Social facilitation. *Science*, 149(3681), 269-274.