ESSAYS IN POLITICAL ECONOMY

by

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A Dissertation Submitted in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy
in the Department of Economics at Brown University

Providence, Rhode Island

May 2010

This dissertation by Ruben Durante is accepted in its present form
by the Department of Economics as satisfying the
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Ruben Durante was born on April 27th 1978 in Messina, Sicily, Italy. In 2001 he received a bachelor's degree with high honors in Economics from the University of Messina. He continued his studies in France where he received an M.A. in Political Economy from Sorbonne University in 2002. In 2004 he started his doctoral studies in Economics at Brown University where he received an M.A. in course in 2005 and a Ph.D. in 2010. While at Brown, Ruben was also a trainee of the Graduate Program in Development and a fellow of the Initiative in Spatial Structures in the Social Sciences (S4) and of the Center for Latin American Studies.

ACKNOWLEDGEMENTS

It is an honor and pleasure to take this opportunity to thank those who have, in different ways, contributed to this dissertation. Their help and support have made my years at Brown an unforgettable experience of great personal and intellectual growth.

A heartfelt thanks goes to my advisors, Oded Galor, Brian Knight, Pedro Dal Bo, Luis Putterman, and David Weil, for having patiently provided direction through their teaching, constant encouragement, and guidance. Oded's vision and enthusiasm have nourished my curiosity and have shown me the importance of exploring the broad, fundamental questions which characterize humanity's past and present. Brian's inquisitive nature and ready willingness to join me in exploring the nature of the Italian media have produced a fruitful and collaborative rapport for which I am deeply grateful. Pedro has always found the time to sit and talk with me; I deeply admire his intellectual rigor and keen ability to ask pertinent and probing questions, all while maintaining a vibrant sense of humor. Louis has, from the very beginning of my time at Brown, been a constant source of advice and support; working with him has not only been stimulating, but a privilege. Finally, I am grateful to David for his insightful critique, constant questioning, and the generous amount of time he has dedicated to providing invaluable comments and suggestions.

This dissertation is also dedicated to the memory of Herschel Grossman without whom my journey at Brown would have probably never started. I would also like to devote this work to an early influence, my high school teacher Rosario Fiore, who not only inspired me, but also gave me the precious gift of seeing the world through curious and analytical eyes. He will never know the profound impact his teachings have had on the very ways I reason.

Navigating the challenges of graduate school would not have been possible without the constant companionship, scholarly exchange, and friendlybanter with my fellow econ graduate students. For this and and much more I am tremendously grateful to Jim Campbell, Martin Goetz, Juan Carlos Gozzi, Emilio Gutierrez, Toru Kitagawa, Alex Levkov, Omer Ozak, Stelios Michalopoulos, Petros Milionis, Dimitra Politi, Nathan Schiff, and Pablo Suarez.

A very very special acknowledgement goes to my wonderful family, my parents, Matteo and Maria, and my sister Erica. Without the loving care and unselfish support they have provided over the years, none of what I have achieved would have been possible.

Last, but certainly not least, my infinite gratitude goes to my lovely wife, Maya Judd, who accompanied and supported me throughout the writing of this dissertation. All I can say is that would take another thesis to express my deepest love for you. Ti amo.

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Chapter 1

Risk, Cooperation and the Economic Origins of Social Trust: an Empirical Investigation[1]

1.1 Introduction

There is a widespread consensus among social scientists that social trust is important for economic and institutional development because it facilitates cooperation and collective action among the members of a community.[2] Despite the multitude of intriguing results on

[1]I am grateful to Oded Galor for his advice and mentorship, and to Pedro Dal Bo, Brian Knight, Louis Putterman, and David Weil for their help and support. I thank Sam Bowles, Jim Campbell, Martin Goetz, Juan Carlos Gozzi, Emilio Gutierrez, Toru Kitagawa, Blaise Melly, Ross Levine, Alex Levkov, Petros Milionis, Kaivan Munshi, Sriniketh Nagavarapu, Omer Ozak, Eleonora Patacchini, Ariell Reshef, Yona Rubinstein, Nathan Schiff, and Ivo Welch for their valuable comments. I thank seminar participants at Brown, Copenhagen, Bologna, IMT Lucca, IADB, Stockholm School of Economics, Bocconi, Sciences Po, Essex, Université du Québec à Montréal, University of Colorado at Boulder, University of Alicante, Universidad Carlos III Madrid, UC Louvain and participants in the Second Conference on Early Economic Developments at SFU, the Workshop on Political Economy and the Environment at UC Louvain, the 2009 NEUDC Conference, and the Conference on Economics of Culture, Institutions, and Crime at FEEM for helpful comments. I am grateful to Vero Testa for his help in organizing the data and to Lynn Carlsson for her invaluable assistance with ArcGis.

[2]This argument was put forth long ago by Kenneth Arrow (1972) who argued that "virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence." Other influential contributions on the role of social capital and social trust are Coleman (1988), Putnam et al. (1993) and Fukuyama (1996). Social capital and trust have been associ-

the role of trust, only recently economists have begun to investigate the historical origins of trust and to explain the large differences in trust across and within countries (Tabellini, 2005; Guiso et al., 2008; Nunn and Wantchekon, 2009). These studies have documented how historical circumstances, particularly experiences of cooperation or conflict like the free-city state experience in medieval Italy and the slave trade in Africa, can have long lasting effects on the level of trust of a community.

This paper investigates whether other more primitive and universal factors may explain differential historical patterns in the emergence of cooperative behavior and differences in current levels of trust. In particular I examine the historical relationship between environmental risk - captured by variability in climatic conditions - and the evolution of cooperation and trust.

I propose a simple explanation of the emergence of trust based on the need of subsistence farmers to cope with weather fluctuations which, in the context of a pre-industrial rural economy, represented one of the main sources of risk. In the absence of well-functioning credit and insurance markets, farmers had to rely on a variety of strategies to shield consumption from weather-related shocks. While some of these strategies could be efficiently implemented by a single household, others involved some degree of interaction with members of the broader community. On the one hand, collective action among members of the local community was needed for large-scale investments such as the construction of collective storage and irrigation facilities. On the other hand, insurance capacity against climate-related risk could be improved by expanding economic relations to individuals living in neighboring areas, who were likely to be affected by weather fluctuations in less correlated ways. For example, cases of inter-community exchange, and geographically diversified mutual insurance arrangements are well-documented in the historical, anthropological and economic literature (Kirkby, 1974; Dean et al., 1985; Halstead and O'Shea,

ated with well-functioning institutions (Knack, 2002), economic growth (Helliwell and Putnam, 1995; Knack and Keefer, 1997; Zak and Knack, 2001), low corruption and crime (Uslaner, 2002; Buonanno et al., 2009), financial development (Guiso et al., 2004) and trade (Guiso et al., 2009).

1989; Platteau, 2000). However, the creation and maintenance of socio-economic connections over larger areas would have entailed higher costs since incentive and information problems would be more severe among geographically distant individuals. The degree of intra- and inter-community cooperation would depend on: a) the relative magnitude of the weather-related risk (measured by the variability of weather over time at a given location); b) the potential insurance benefit from risk-pooling (measured by the variability of weather fluctuations across neighboring locations). To the extent to which experiences of cooperation favored the emergence of a culture of trust that continues to persist today, one would expect differences in historical climate variability to explain in part differences in current levels of trust.

I test this prediction in the context of Europe, combining high-resolution climate data for the period 1500-2000 with contemporary survey data on self-reported level of trust available from the European Social Survey for a sample of 251 regions in 24 countries. I first investigate the relationship between current trust and variability using climate data for the last century, because the finer resolution of this data allow the study of both the temporal and spatial dimensions of variability. The analysis confirms that regions with greater inter-annual fluctuations in temperature and precipitation have higher levels of interpersonal trust. This result is primarily driven by weather variability in the growing-season months, consistent with the effect of climatic risk operating primarily through agriculture. Furthermore, for a given level of temporal variability, regions with a higher degree of within-region spatial correlation in precipitation fluctuations display lower trust, a result consistent with an explanation involving insurance through geographic differentiation. These findings are robust to the inclusion of a variety of geographic controls and of country-fixed effects which capture the political and historical background common to regions of the same country.

I then replicate the analysis using climate data for the period 1500-1750. The relationship between historical climatic variability and trust is positive and significant, even after controlling for climate variability between 1900-2000, which does not appear to have an

independent effect on trust. These findings support an explanation based on the historical formation and long-term persistence of trust attitudes over possible alternative arguments stressing the effect of contemporary climate variability on trust.

To further test the long-term effect of climatic risk on the emergence of cultural norms**,** I also look at the relationship between climate variability and the role of the family. Previous research has documented the existence of a negative relationship between social trust and the strength of family ties: the greater the importance of the family to the individual, the less their sense of community and civic engagement (Banfield, 1958; Ermisch and Gambetta, 2008; Alesina and Giuliano, 2009). According to the argument sketched above, a more variable environment should increase an individual's propensity to interact with non-family members and reduce her dependency on the family for insurance purposes. If trust outside and within the family are substitutes, then higher climate variability should be associated with weaker family ties. I test this hypothesis using individual data on the importance of the family available from the European Value Survey**.** The results are the mirror image of those found for trust: a) weaker family ties in regions with more temporal variability in precipitation and temperature (particularly in the growing season), b) weaker family ties in regions in which precipitation fluctuations are less spatially correlated, and c) a negative relationship between historical climate variability and the strength of family ties even after controlling for contemporary variability.

After establishing the relationship between historical climate variability and social trust, I explore the robustness of this result by controlling for regional measures of early political and economic development such as urbanization, political institutions and literacy. My results confirm the importance of early political institutions and literacy for the emergence of social trust as previously documented by Tabellini (2005). At the same time I find that historical climate variability continues to have a positive and sizeable effect on current trust. One interpretation of this result is that the demand for insurance against climatic risk may have also fostered the emergence of trust by favoring the adoption of informal collective

arrangements whose long-lasting effect on trust is not captured by historical differences in formal political institutions.

The results of this research complement the literature on the long-term persistence of cultural norms (Bisin and Verdier, 2001; Guiso et al., 2007; Tabellini, 2008) by documenting that historical patterns of cooperation in response to risk continue to influence how individuals relate to each other today, both within and outside the family. The evidence presented here also dovetails nicely with the few existing studies on the historical determinants of differences in social capital and trust (Tabellini, 2005; Guiso et al., 2008; Nunn and Wantchekon, 2009), and with previous research on the relationship between trust and the importance of the family (Banfield, 1958; Ermisch and Gambetta, 2008; Alesina and Giuliano, 2009).

My findings can also be interpreted in the context of the debate on the effects of geography on economic development. Previous research has documented that the environment can influence economic performance directly, through its effect on health and agricultural productivity (Landes, 1998; Sachs and Malaney, 2002), and indirectly, by setting the conditions in which sociopolitical institutions have formed (Sokoloff and Engerman, 2000; Acemoglu et al., 2001; Easterly and Levine, 2003) or by defining environmental constraints to population growth (Galor and Weil, 2000).[3] The evidence presented here suggests that geography may also have influenced the emergence of particular cultural traits which, in turn, continue to have an effect on economic outcomes.

The rest of the paper is organized as follows. Section 2 discusses evidence on the relationship between climatic risk and cooperation, describes the conceptual framework and illustrates its predictions. Section 3 describes the data. Section 4 illustrates the empirical strategy and presents the results obtained using both contemporary and historical climate data. Finally, section 5 summarizes the key findings and concludes.

[3]Other examples of how biogeographic factors can have long-lasting effects on different aspects of human development are discussed in Diamond (1997); Michalopoulos (2008); Nunn et al. (2009); Ashraf et al. (2009)

1.2 Background and conceptual framework

1.2.1 On climate, risk and cooperation

An extensive literature has investigated the impact of climate on various aspects of human activity including agricultural productivity (Adams et al., 1990; Mendelsohn et al., 1994; Schlenker et al., 2005), health (Curriero et al., 2002; Deschenes and Moretti, 2007; Gallup and Sachs, 2001) and conflict (Miguel et al., 2004).[4] Most contributions have looked at the effect of mean climatic conditions, seasonality, or extreme events. However, other dimensions of climate are also relevant. In particular, year-to-year variability in climatic conditions has traditionally represented an important source of risk for agriculture and other natural resource-dependent activities.[5] Even today, interannual fluctuations in precipitation and temperature account for a large fraction of the year-to-year variations in crop yields (Lobell and Field, 2007) and crop failure rates (Mendelsohn, 2007); this despite the widespread availability of irrigation, chemical fertilizers, and new crop varieties which reduce yield sensitivity to weather conditions. Rural populations were even more vulnerable to erratic weather in past centuries when the availability of these instruments was limited, and there was a greater dependence on natural resources for survival (Solomou and Wu, 1999; Le Roy Ladurie, 2004; Brunt, 2004).

In the absence of well-functioning credit and insurance markets, subsistence farmers in pre-industrial societies adopted a variety of strategies to cope with climate-related risk, as documented by historical evidence and corroborated by findings from today's developing countries.[6] Some of these strategies could be efficiently implemented at the household

[4] For a comprehensive survey of the literature on the effect of climate on human activity see the Intergovernmental Panel on Climate Change 4th Assessment Report (IPCC 2007)

[5] Variability is the product of both low and high-frequency climatic processes. While low-frequency processes have long cycles (longer than a human generation) and are responsible for major phenomena such as fluctuations in groundwater levels, erosion, etc., high frequency processes exhibit shorter cycles and are responsible for seasonal and year-to-year fluctuations. While low-frequency variability is usually not apparent to humans, high-frequency and particularly year-to-year variability represents a major determinant of fluctuations in natural resource productivity and an important source of risk for economic activity.

[6] The issue of adaptation to climate variability has attracted the interest of different disciplines, particularly

level. For example, farmers could have mitigated the economic impact of climate fluctuations by extending the set of livelihood activities to include foraging and fishing (Kates et al., 1985), by diversifying crops (Halstead and O'Shea, 1989), by selecting crops varieties that were less sensitive to weather realizations (Morduch, 1995), or by scattering their plots over larger and varied areas in order to reduce the risk of crop failure due to highly localized weather events (McCloskey, 1976).

Another range of risk-coping strategies involved interaction and collective action with members of the broader rural community. Farmers could self-insure against adverse climatic events by storing grains or other assets in good years for bad years. Although storage could be carried out by single households in isolation, since storage technologies are characterized by significant economies of scale, collective action among members of the local community to build communal storage facilities entailed large efficiency gains and was often practiced.(Stead, 2004) An example of the role of collective storage facilities in coping with weather and price volatility is analyzed by Berg (2007) in his recent work on the grain banks (*magasins*) in 18^{th} and 19^{th} century Swedish parishes. Intra-community collective action was crucial for the realization of other large-scale investments aimed at reducing vulnerability to weather shocks. For example, village-level irrigation and water management systems (e.g. wells, tanks, dikes) could increase the stability of the farming system in the face of erratic rainfall, particularly in drought-prone zones. Examples of farmer-managed irrigation systems are discussed by Bardhan (2000) and Meinzen-Dick et al. (2002) for contemporary India, and by Lam (1998) and Ostrom (2000) for Nepal. Finally, in his work on adaptation to environmental risks in Vietnam, Adger (2000) emphasizes the importance of collective action for the management of local-level coastal defense against hazards associated with flooding and typhoons.

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in the context of the effect of anthropogenic climate change on socio-economic development. Many definitions of adaptation and different categorization of adaptive strategies have been proposed in the literature (see among others Smithers and Smit (1997)). Rennie and Singh (1996) for example, define adaptive strategies as "those ways in which local individuals, households and communities change their mix of productive activities, and modified their community rules and institutions in response to vulnerabilities, in order to meet their livelihood needs".

Other risk-coping strategies were based on the possibility of pooling risk with other individuals, through exchange or mutual insurance relations. A rich literature in economics, anthropology and history has documented the importance of risk-sharing mechanisms to cope with idiosyncratic agricultural risks (see among others Townsend, 1994).[7] Research on the use of these mechanism to buffer covariant (weather-related) risk is more sparse (Scott, 1976; Kimball, 1988; Platteau, 1991). Family- and kin-related connections are generally particularly effective in providing partial insurance against idiosyncratic shocks due to the lower cost of enforcing promises and monitoring deviance among family members. However, these networks are generally too small and spatially concentrated to provide insurance against weather-related risks. Insurance capacity against weather shocks can be improved by expanding the radius of socio-economic relations to individuals living in distinct locations who are likely to be affected by shocks in less correlated ways. However, the creation and maintenance of geographically dispersed socio-economic connections would have entailed higher communication and monitoring costs. Platteau (1991) describes this "insurance dilemma" in the following terms: "the larger and geographically less concentrated the social group concerned in the insurance scheme, the lower the covariance of their income and contingencies is likely to be, but the more serious the moral hazard problem".

Examples of spatially diversified risk-pooling arrangements and of their usefulness in mitigating the effects of covariant shocks have been discussed by scholars from various disciplines working on very different geographical and historical contexts. Some of these arrangements involved exchange and trade relations. For example, in their study on the behavioral and cultural responses to environmental variability of the Anasazi civilization in the American Southwest, Dean et al. (1985) emphasize the importance of trade alliances among communities located in environmentally heterogeneous zones to cope with the frequent local subsistence shocks. Similarly, King (1976) emphasizes the importance of the

[7] Solidarity mechanisms are generally organized around delayed reciprocity contingent upon need and affordability, with contingent transfers taking the form of gifts, food, labor assistance, or loans. For a comprehensive discussion of the role and functioning of solidarity networks in pre-industrial societies see Fafchamps (1992).

elaborate inter-village exchange system used by the native population of the Chumash in coping with the considerable temporal and spatial variability of the Southern Californian environment. Other accounts refer to informal mutual assistance arrangements. In his study of the Kwakiutl native population of the Northwestern coast of America, Piddocke (1965) analyzes the *pot-latch*, a system based on delayed gift exchange among different groups (*numaym*) and used to "counter the effect of varying resources productivity by promoting exchanges of food from groups enjoying a temporary surplus to groups suffering a temporary deficit". Another example is the *hxaro* system used by the Kung San hunter-gatherers in contemporary Botswana and described by Cashdan (1985) as a system of mutual reciprocity based on delayed gift exchange connecting members of different bands living in distinct locations over distances of up to 400 km. Analogous evidence is available for subsistence farmers in contemporary developing countries. In his investigation on the Ivory Coast, Grimard (1997) finds evidence of partial insurance against locally covariant risk taking place within spatially differentiated networks formed around ethnic bonds. Similarly, in his study on the effect of risk and social connections on livestock asset dynamic in northern Ethiopia, Mogues (2006) finds that being part of a geographically dispersed network reduces the degree to which an household's livestock wealth is eroded following an adverse climatic shocks. Finally, in the context of pre-industrial Europe, Richardson (2005) emphasizes the role of rural fraternities as risk pooling institutions and their importance in coping with both weather- and non-weather related agricultural risk in medieval England. Similar evidence is available from Baker (1999) who investigates the role of regional voluntary associations as collective means used by XVIII century french peasants to defend themselves against climatic shocks.

These examples illustrate the extent to which the ability of a society to adapt to climate variability depends on the capacity of its members to act collectively. Furthermore, the above discussion suggests the importance of both the temporal and spatial dimension of climate variability for the emergence of intra- and inter-community cooperation. On the one

hand, cooperation would be more valuable in areas characterized by more erratic weather (higher *temporal* variability), since exposure to greater climatic risk would result in greater demand for insurance and would increase the incentive to forge social connections within both the local and neighboring communities. On the other hand, cooperation would be more beneficial in areas in which weather fluctuations are more unsynchronized across neighbors (higher *spatial* variability) since this would increase the potential insurance benefit from pooling risk with neighbors.[8]

1.2.2 Emergence and persistence of trust

Previous research in evolutionary anthropology on social learning (Boyd and Richerson, 1985, 1995) provides a good theoretical framework to study the emergence of mutual trust. In this literature, cultural norms are modeled as behavioral heuristics that simplify decision-making. In a context in which acquiring and processing information necessary to behaving optimally is costly, using general "rules-of-thumb" about the right thing to do can be optimal. Since different behavioral norms are available *a priori*, which norms are adopted is determined through an evolutionary process based on which ones yield the highest payoff in terms of survival probabilities. This, in turn depends on the external constraints faced by each society. Over time, through a process of social learning, rules-of-thumb that favor adaptability to the external environment will become more prevalent in the population. For example, in situations in which large-scale cooperation increase fitness, norms that facilitate fruitful interaction (such as norms of mutual trust) will be particularly valuable and will become prevalent.[9]

[8] An illuminating discussion of this aspect is offered by Dean et al. (1985) who argument that "spatial variability in climate facilitates or inhibits certain responses to local subsistence stresses. During periods of high spatial variability, interaction and exchange with other populations are viable means of offsetting local production inadequacies because different groups are likely to be experiencing different degrees and kinds of subsistence stress. Conversely, when similar conditions prevail across the region, all areas are affected uniformly, and interaction and exchange become far less useful ways of alleviating local population-resource imbalances."

[9] In the context of a large cross-cultural study, Henrich et al. (2001) conducted ultimatum, public good, and dictator game experiments with subjects from fifteen small-scale societies exhibiting a wide variety of

Based on this conceptual framework, the hypothesis advanced in this paper is that norms of trust developed because they facilitated collective action and risk-sharing among subsistence farmers exposed to weather-related risk in pre-industrial times. In particular, a culture of greater trust should have emerged in areas characterized by more variable and spatially heterogeneous weather patterns, in which extra-familial cooperation would have been particularly beneficial to coping with risk. This paper investigates the empirical validity of this argument by testing whether higher trust is observed today in regions historically characterized by: *i*) higher inter annual weather variability, and *ii*) lower spatial correlation in weather fluctuations.

These predictions are based on the assumption that differences in trust have persisted over time, even after weather patterns became less important for economic activity. Growing evidence suggest that in fact trust attitudes, like other cultural traits, can persist for surprisingly long periods of time. At the national and sub-national levels, for example, trust scores are remarkably stable over several decades (Bjørnskov, 2007). At the individual level, this persistence is generally attributed to intergenerational transmission operating through genetics, imitation, or deliberate inculcation by parents. This view is consistent with recent empirical findings documenting the existence of a strong correlation in the propensity to trust between parents and children (Katz and Rotter, 1969; Dohmen et al., 2008) and between second-generation immigrants and current inhabitants of the country of origin (Uslaner, 2002; Guiso et al., 2006; Algan and Cahuc, 2007).

Additional insights into the persistence of cultural norms are offered by recent empirical contributions on the historical determinants of trust. In a recent study on the effect of culture on economic development across European regions Tabellini (2005) finds that early political institutions have a significant impact on current trust attitudes: regions that

economic and cultural conditions. They find that, in societies where payoff from extra-familial cooperation in economic activity is higher, subjects display significantly higher levels of cooperation in the experimental games. The authors argue that one interpretation of this result is that subjects' behavior in the experiments reflect different norms of conduct with regard to sharing and cooperation, which, in turn, are shaped by the structures of social interaction and modes of livelihood of the community daily life.

centuries ago had more checks and balances on the executive are characterized by higher levels of trust. Guiso et al. (2008) trace current differences in social capital between the North and South of Italy to the culture of independence fostered by the experience of the free city-states in the Middle Ages, and conclude that "at least 50% of the North-South gap in social capital is due to the lack of a free city state experience in the South"[10]. Finally, Nunn and Wantchekon (2009) investigate the impact of the transatlantic slave trade on mistrust in contemporary Africa, finding robust evidence that "individuals whose ancestors were heavily raided during the slave trade today exhibit less trust in neighbors, relatives, and their local government".

Another stream of literature relevant to this research concerns the relationship between social trust and family values. The trust literature typically distinguishes between "generalized" trust and "particularized" trust. Particularized trust refers to those cases in which individuals trust members of a narrow circle of family members or close friends, but do not trust (and do not expect to be trusted by) people outside of it. Generalized trust applies instead to everyone, including agents for whom the agent has no direct information[11]. Empirical evidence suggest that these two objects are negatively correlated. Using survey data from multiple sources Alesina and Giuliano (2009) find that individuals with strong family ties display lower levels of generalized trust, civic engagement and political participation. According to their argument, "the more people rely on the family as a provider of services, insurance, transfer of resources, the lower is civic engagement and political participation. The more the family is all that matters for an individual the less she will care about the rest of society" (p.3). Similar results are found by Ermisch and Gambetta (2008) who combine experimental and survey data drawn from Great Britain. At the heart of their analysis lies the concept of "outward exposure" and the idea that trust attitudes are affected by "any factor which either constrains people within the family circle or that gives them an opportunity

[10]This findings support the conjecture originally formulated by Putnam et al. (1993)

[11]This distinction reflects the distinction between "generalized" and "limited" morality stressed by (Platteau, 2000)

and a motive to interact with others, whether neighbors or strangers". If, as these findings suggest, trust and family values operate as cultural substitutes, then climate variability - by increasing the payoff to extra-familial cooperation and decreasing the dependency on the family for insurance purposes - would have favored the development of norms consistent with higher trust and weaker family values. As a way of further testing my theoretical argument in what follows I also explore the empirical relationship between climate variability and family ties.

1.3 Data and variable description

To test the main predictions of my theoretical argument, I look at differences across and within European countries.[12] I employ several types of data in different parts of the empirical analysis: survey data on social trust and strength of family ties; contemporary and historical climatic data on precipitation and temperature; data on a variety of regional geographical controls; historical data on political institutions, education and urbanization. In what follows I first describe the data sources and then discuss how the variables used in the empirical analysis are constructed.

[12]There are a number of reasons why Europe can be considered a good context to test the validity of my hypothesis. First, up until the onset of the industrial revolution, the vast majority of the European continent was rural, most of the population depended predominantly on agriculture for subsistence, and the economy was characterized by relatively low spatial mobility and considerable intergenerational persistence in occupation.Le Roy Ladurie (2004) Second, an advantage of working with European data, particularly at the sub-national level, is given by the relatively small size of European regions. Since the proposed relationship between climatic volatility and emergence of trust operates at a relatively local scale, the availability of trust data for fairly small administrative divisions is particularly valuable.

My theoretical argument is based on the hypothesis that cultural norms developed at a given location are passed on to subsequent generations, which, to a large extent, continue to live in the same area. To this regard Europe represents an appropriate context because - despite significant cross- and within-country migration - it has not experienced the massive migration movements that took place for example in North and South America over the last five centuries, and, in general, a substantial portion of individuals living in a given region had ancestors that lived in the same region. Last but not least, Europe is also the continent for which better historical climate data are readily available.

1.3.1 Data

1.3.1.1 Social Trust

Measuring interpersonal trust is a problematic task. Several variables have been proposed in the literature as proxies for social trust. Some have used aggregate indicators such as the number of civic and non-profit organizations/associations, turnout in elections or referenda, and blood and organ donations (Guiso et al., 2004, 2008; Buonanno et al., 2009; Putnam et al., 1993). Most contributions, however, employ measures of self-reported trust based on individual responses to survey questions (Alesina and La Ferrara, 2002; Tabellini, 2005). I follow the latter approach, using data on self-reported trust in others from the three rounds of the European Social Survey (ESS), a biennial cross-sectional survey designed to monitor attitudes and behaviors across (mostly) European countries[13], similar in many aspects to the American General Social Survey (GSS). The three rounds of the survey were conducted in 2002-03, 2004-05, and 2006-07. Overall, the ESS data cover 31 countries: the large majority of the European Union members plus Iceland, Israel, Russia, Switzerland, and Turkey. Most countries were surveyed in all three ESS rounds, some, instead, only in one or two of the rounds.

In addition to providing information on the respondent's country, the ESS surveys report the region in which the interviewee resides. This feature makes it possible to study differences in trust attitudes at the sub-national level, an approach that is consistent with my theoretical argument which links the evolution of trust to social responses to climate variability on a local scale. The ESS regions are generally defined in accordance with the administrative divisions used in each country. These, in turn, often coincide with one of the three levels of the European NUTS classification[14]. The number and size of the ESS re-

[13]The core module of the ESS questionnaire questions aimed to monitor change and continuity in a wide range of social variables, including media use, social and public trust, political interest and participation; socio-political orientations, governance and efficacy; moral, political and social values; social exclusion, national, ethnic and religious allegiances; well-being, health and security; demographics and socio-economics. The ESS data have been extensively used in previous studies on culture and social capital, by Luttmer and Singhal (2008); Alesina and Giuliano (2009); Butler et al. (2009) among others.

[14]The Nomenclature of Territorial Units for Statistics (NUTS) is a three-level hierarchical classification

gions vary considerably from country to country. For example, France is divided into nine large regions roughly corresponding to NUTS level 1, Italy into 20 regions corresponding to NUTS level 2, and Bulgaria into 28 regions corresponding to NUTS level 3.

Seven of the thirty-one original ESS countries were excluded from the analysis because they lie partially or totally outside the area covered by the climate data used. Overall my sample includes 251 regions in 24 countries, comprising approximately 107,000 individuals[15]. On average, 427 individuals were interviewed in each region, the median number of respondents being about 306. Table 1.1 reports the number of respondents in each round for the countries in the sample.

The ESS questionnaire includes a version of the standard trust question used in most surveys, commonly known as Rosenberg's question. The exact wording of the question is as follows: "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people? Please tell me on a score of 0 to 10, where 0 means you can't be too careful and 10 means that most people can be trusted"[16]. Doubts have been raised about the ability of this kind of question to capture individual trust attitudes. For example, some have argued that this question is a relatively ambiguous in that it does not explicitly specify the object of the respondent's trust. However, the impersonal framing of the question ("people") may be valuable in encouraging respondents to think about the general context in which they live rather than specific groups such as friends or relatives. Trust surveys do not display the large and random fluctuations in responses that one would expect of question of dubious reliability and meaning. On the contrary, average trust scores - both at the national and sub-national level - show a surprising deal of stability

established by EUROSTAT in order to provide a single uniform breakdown of territorial units for the production of regional statistics for the European Union. Depending on their size countries can have only one or two levels of divisions. In the case of Luxembourg, for example, each of the three NUTS level corresponds to the entire country.

[15]The decision of pooling together responses from the three rounds of the ESS is aimed at maximizing the number of available observations, and is justified by the great stability of both national and regional trust scores over the relative short length of time between different rounds (2 years).

[16]Unlike other similar surveys (like the World Value Survey) the ESS trust question does not offer a 0-1 choice, but rather allows respondents to choose a value on a 1-10 scale, thus allowing for a more precise assessment of the the intensity of trust.

over time Uslaner (2002); Delhey and Newton (2005). Another element of reassurance is given by the fact that survey-based measures tend to be correlated with behavioral indicators of trust. For example, Knack (2000) reports the results of an experiment in which a certain number of wallets containing $50 worth of cash and the addresses and phone numbers of their putative owners were "accidentally" dropped in each of 20 cities in 14 different western European countries and 12 U.S. cities. He finds that the number of wallets returned with their contents intact - both at the national and regional level - is highly correlated with the average score in the standard trust question from the World Value Survey. Similarly, at the individual level, responses to survey-based trust questions have been shown to be good predictors of actual behavior in trust experiment (Glaeser et al., 2000; Fehr et al., 2003; Sapienza et al., 2007).[17]

1.3.1.2 Family Ties

Measuring cultural differences on the relative importance of the family and the strength of family ties is often problematic, especially since many surveys do not include questions designed to capture these aspects. This is the unfortunately the case for the European Social Survey data used to derive my trust measure. Some relevant questions are however available from another similar survey, the European Value Study (EVS). In particular, I use data from three waves of the EVS carried out respectively in the years 1989-1993, 1994-1999, and 1999-2004. Overall, the three waves of the EVS cover 39 European countries. However, for consistency with the analysis of the trust data, and due to limitations in the climate data, I restrict my attention to the same 24 countries for which data on both trust

[17] These contributions, however, have provided contrasting evidence with regard to whether responses to the trust question reflect an individual's own trustworthiness rather than his tendency to trust others. In an attempt to reconcile these apparently contrasting results, Sapienza et al. (2007) argue that the different findings might be due to differences in the composition and homogeneity of the two populations showing that an individual's trust attitude is heavily influenced by his own trustworthiness in the context of a homogeneous population (such as the Harvard undergraduates participating in Glaeser's experiment), but not in a more heterogeneous population, (such as the cross-section of the German population in Fehr's sample). Since the ESS surveys a random sample of the adult population of each country, the sample is extremely heterogeneous with respect to different individual characteristics. In light of the debate discussed above, it seems plausible that responses to the ESS trust question reflect respondents' trust attitude towards others rather than their own trustworthiness.

and climate are available. As with the ESS, the EVS data generally include information on the respondent's region of residence, allowing for the study of differences at the sub-national level. Overall the EVS sample for the 24 countries of interest includes almost 82,000 individuals. For some countries in certain years, however, no information on the respondent's region is available (see 1.2). Excluding these observations, the usable sample includes over 69,000 individuals in over 220 regions. [18]

Following Alesina and Giuliano (2007; 2009), I employ three of the EVS questions covering different aspects of the centrality of family relationships in a person's life, as well as individual beliefs about the role and obligations of parents and children. The first question (labeled as *Family important*) asks the respondent how important is family in his/her life, the possible answers ranging from "not very important" (score of 1), to very important (4). The second question (*Respect parents*) assesses the respondent's opinion on whether "children have to respect and love parents only when these have earned it by their behavior and attitudes" (1), or whether they always have this duty, regardless of parents' qualities and faults (2). Finally, the third question (*Parents responsibilities*) aims at evaluating respondents' view about parents' responsibilities to their children, particularly on whether "parents have a life of their own and should not be asked to sacrifice their own well being for the sake of their children" (1), or whether "it's parents' duty to do their best for their children even at the expense of their own well-being" (2).

1.3.1.3 Climate

With regard to climatic variables, I restrict my attention to temperature and precipitation. These two variables have a considerable impact on agriculture and other natural resource-dependent activities, are highly correlated with other important factors such as relative humidity, cloud cover, and solar radiation. I employ two kinds of climatic data covering

[18] The difference between the number of regions in the ESS sample (251) and the number of regions in the EVS sample is due to the fact that, in some cases, especially for the early waves, the EVS regions coincide with larger administrative divisions than those used for the ESS.

different time periods. In the first part of my analysis I use gridded data derived from actual weather station records covering the period 1900-2000. These are high-quality data, both in terms of temporal frequency and spatial resolution, but since they only cover the last century they can only be used as a proxy for historical climate. I then extend the analysis to look directly at historical climate variability using reconstructed paleoclimatic data for the period 1500-1900. The obvious benefit of these data is that they cover a much longer period, however, their temporal and spatial resolution is much more coarse. On the one hand, the high resolution of the 20th century data allows us to analyze both temporal and spatial dimensions of climate variability. On the other, the use of the historical data in combination with the 20th century data further allows us to confirm that historical variability, rather than current variability, is correlated with trust.

1900-2000 Climate data for the last century come from the TS 1.2 data set constructed by the Climatic Research Unit (CRU) of the University of East Anglia (Mitchell and Jones, 2005). The CRU TS 1.2 data are in grid format and cover most of the European surface at a 10-minute spatial resolution Mitchell and Jones (2005). The grid includes 258 columns and 228 rows. Only data for land grid cells (overall 31,143) are available. For each cell the data set provides monthly observations on air temperature and precipitation for the period 1901-2000 (1200 data points per cell). The data are constructed from actual climatic records collected at a number of weather stations throughout Europe, and generalized at the grid cell level using a particular interpolation technique [19]. The cells in the CRU grid have width of 10 minutes, approximately 10 miles. Each region in my sample comprises a number of grid cells, which varies considerably depending on the region's size. To give a sense of the size of the cells, Figure a1 shows the example of Sicily, a mid-size region in southern Italy, the surface of which is divided into 85 cells.

[19] Further information on the characteristics of the CRU data sets is available at `http://www.cru.uea.ac.uk/~timm/grid/CRU_TS_1_2.html`. For a detailed description of the primary data sources and of the methods employed in the construction of the TS 1.2 data set see `www.tyndall.ac.uk/publications/working_papers/wp55.pdf`.

1500-1900 Climatic data for past centuries are available from paleoclimatic studies. These kind of data are not based on actual weather station records, but are rather derived, through a sophisticated process of "reconstruction", from a multiplicity of indirect proxies such as tree rings, ice cores, corals, ocean and lake sediments, and documental evidence. One of the most recent and advanced reconstructions of European climate over the last 500 years is the European Seasonal Temperature and Precipitation Reconstruction (ESTPR henceforth), a product of the work of a group of paleoclimatologists at the University of Berne, Switzerland (Luterbacher et al., 2004; Pauling et al., 2006) [20].

The ESTPR data are in grid format and cover roughly the same area as the CRU data described above, although at a much lower spatial resolution. The cells in the ESTPR grid have width of 0.5º, approximately 35 miles. Using the example of Sicily, Figure 2 provides a visual sense of the difference in cell size between the CRU and the ESTPR. Overall, the ESTPR grid for the precipitation data includes 72 rows and 132 columns for a total of 5117 land cells. The temperature data set covers a slightly smaller area including 70 rows and 130 columns, for a total of 4961 land cells. For each cell the data include seasonal observations for the period 1500-2000 (2000 data points per cell)[21]. Measurement error is likely to be more severe in the case of the ESTPR data than for the CRU data for two orders of reasons: 1) climatic records are derived not from observed data but from proxy variables through an indirect process of reconstruction; 2) they are interpolated over larger areas. Despite these limitations, these data, which have not been previously used by social scientists, are among the best data available on European climate for past centuries.

[20] Extensive information on these data, as well as on other climate reconstructions data sets, is available on the website of the National Oceanic and Atmospheric Administration's National Climatic Data Center at `http://www.ncdc.noaa.gov/paleo/recons.html`.

[21] While the data for the period 1500-1900 are reconstructed, those for the years 1900-2000 are derived from the CRU data set described above.

1.3.1.4 Regional environmental controls

Other bio-geographic conditions may have influenced the evolution of cooperation and the emergence of trust over the course of history. At the same time, some of these factors may be correlated with climate variability. To test whether climate variability has an independent effect on trust and is not merely proxying for other geographical characteristics, in addition to the region's area, I control for a range of variables that the literature has traditionally identified as important determinants of socio-economic development.

Average climatic conditions are likely to have had considerable impact on livelihood strategies and patterns of cooperative behavior. To account for the effect of average climate in estimating my regressions I control for the average level of temperature and precipitation at the regional level. These measures are constructed from the same data described above (CRU data for the period 1900-2000, and ESTPR data for the period 1500-2000), taking the average over the entire period of interest.

Both average land quality in a region and differences in land quality *within* a region can have important implications for productivity, mobility, and exchange at the local level.[22] To account for this aspect, measures of both average land quality and variability in land quality at the regional level are included in all the regressions. High-resolution data on soil suitability are available from the Food and Agriculture Organization Global Agro-Ecological Zones project (FAO-GAEZ).[23,24] The FAO-GAEZ data are constructed to measure soil suitability for rain-fed crops assuming the absence of irrigation. This feature make these sort of data particularly suited for the historical analysis of pre-industrial societies. The FAO-GAEZ database include a variety of measures of soil suitability. Since I separately control for mean climatic conditions in the regressions, I employ a measure that captures

[22] In his recent study on the environmental origins of ethnolinguistic diversity, Michalopoulos (2008) argues that, by favoring the accumulation of region-specific human capital, differences in land endowments limited population mobility and lead to the formation of localized ethnolinguistic groups.

[23] More information on the FAO-GAEZ project can be found at `http://www.fao.org/ag/agl/agll/gaez/index.htm`

[24] Data from FAO-GAEZ were used by Michalopoulos (2008), and by Nunn and Qian (2008) who investigate the effect of the introduction of potato on modern European economic and demographic growth.

all those soil characteristics that affect land suitability for rain-fed crops, abstracting from average local climate.[25] The data are in grid format, have very high resolution (1'), and assign to each grid cell a score from 0 (totally unsuitable), to 7 (very suitable). As regional measures of average land quality and variability in land quality I use the mean and the standard deviation of the suitability index over all cells in a region.

Terrain ruggedness can have both direct and indirect effects on patterns of human interaction and on economic outcomes (Nunn et al., 2009). To some extent, ruggedness and elevation can also be expected to be correlated with climate variability, especially with regard to its spatial dimension. The presence of a mountain can cause very different microecosystems to manifest over relatively small distances; as a consequence, climatic realization on the one side of the mountain can be very different from those of the other side. To control for the relationship between climate variability and topography, I include a regional measure of terrain ruggedness in my regressions constructed from the Global Land One-km Base Elevation Project (GLOBE), a global gridded digital elevation data set covering the Earth's surface at a 10-minute spatial resolution (approximately 1km).[26,27]

Access to waterways may potentially be correlated with both climate variability and the historical emergence of interpersonal trust. On the one hand, in coastal areas, climate fluctuations can be less extreme than in interior areas, due to the mitigating influence of the sea. On the other hand, one could expect individuals living in regions with no access to the sea to have been historically less exposed to other populations, and as a consequence, to be less inclined to relate to, interact with, and trust strangers. A similar argument can be made

[25]The FAO-GAEZ measure of combined soil constraints considers the following factors: slope constraints, terrain fertility constraints, drainage constraints, texture constraints, and chemical constraints. A more detail and comprehensive description of the criteria is available at: `http://www.fao.org/ag/agl/agll/gaez/index.htm`

[26]The GLOBE data set has superseded the GTOP30 which, before the introduction of GLOBE, was considered the most accurate digital elevation data set and had been used, among others, by Nunn et al. (2009) in the above mentioned contribution.

[27]For every cell i and neighboring cell j I calculate the absolute value of the difference in elevation between i's center and j's center, and then divide it by the sea level distance between the two points to obtain the uphill slope ($h_{i,j}$). I repeat the same calculation for each of i's neighbors (at most eight), and then average these slopes to calculate cell i's mean uphill slope (h_i). Finally, to obtain the average uphill slope of the region's land area (h_r), I average h_i across all cells in region r.

for access to rivers which have historically represented important ways of communication particularly in areas with limited access to the sea. To control for proximity to the sea in my cross-regional regressions I include two variables: a dummy for the region being landlocked, and the distance of the region's centroid from the coast line. To account for access to rivers I control for the number of large rivers - longer than 200 km - passing through each region. Data on the geographic distribution of major European rivers are available from the Water Information System for Europe (WISE) project of the European Environment Agency.[28]

Finally, in all regression I control for the latitude of the region's centroid, which, to some extent, should capture differences in geographic conditions other than those discussed above.

1.3.1.5 Historical background

Historical data on political and economic development at the sub-national level are not available for all regions in my original sample. However, reliable measures are available from Tabellini (2005) for a sample of 69 regions in eight western European countries including Belgium, France, Italy, Netherlands, Portugal, Spain, Germany, and the United Kingdom. Tabellini's data include historical regional measures of political institutions, urbanization and educational attainment.[29] With regard to early political institutions the data include a measure of constraints on the executive between 1600 and 1850. This variable, analogous to the one included in the POLITY IV dataset (Eckstein and Gurr, 1975), is designed to capture "institutionalized constraints on the decision making powers of chief executives". According to this criterion, a region had better political institutions if the executive branch was accountable to assemblies of elected representatives, and if the power of the executive was constrained by the existence of checks and balances and by

[28] More information about the WISE project are available at http://water.europa.eu/

[29] A detailed description of the procedure and sources used in the construction of this variable is provided in the Appendix of Tabellini's paper (2005).

the rule of law. The measure of constraints on the executive was coded for different 40-year windows around the years 1600, 1700, 1750, 1800, and 1850, and takes values from 1 (unconstrained authority) to 7 (maximum accountability and constraints). With regard to education, Tabellini's data include regional measures of literacy around the year 1880, the earliest date for which systematic information on education could be found. Finally, the data include a measure of urbanization around 1850, measured as the share of regional population living in cities of population 30,000 or more.

1.3.2 Variable description

1.3.2.1 Social trust

As basic measure of social trust at the regional level I use the average individual score on the trust question for all individuals interviewed in a region over the three ESS rounds (*trust*). The regional average conceals very large variation among individuals within a region and is hence likely to be an imperfect measure of regional trust attitudes. Besides measurement error, another concern is that, given the relatively small number of respondents in some of the regions, the ESS samples may not be fully representative of the regional population, and that differences in the average trust score might be due to differences in the composition of the regional sample with regard to certain individual characteristics that might be correlated with trust. To address this concern, in addition to the unconditional average, I compute a conditional regional measure of social trust that accounts for differences in some observable features of the individual respondents (*trust_cond*). Following Tabellini's approach (2005), in the comprehensive dataset of individual responses, I regress individual trust score on a vector of regional dummy variables, three ESS round dummies, and a set of individual controls including a dummy for the respondent gender, the respondent's age and age squared, marital status, and educational attainment. Education in particular, is intended to serve as proxy measures for individual income, which has been shown to be highly correlated with trust attitudes. The regional measure of conditional trust is taken to

be the estimated coefficient on the regional dummy variables.[30] The conditional and unconditional regional measure of trust are very highly correlated (0.992); this suggests that regional differences in average trust score are not driven by differences in the composition of the respective samples, but are rather related to more fundamental cultural differences. In what follows I will report the results obtained using the unconditional means. The conditional trust measure is used for robustness checks. Figure 1.1 represents the distribution of the unconditional regional trust measure, while the map in Figure A.1 displays its geographic distribution across the regions in the sample, with darker values corresponding to higher levels of trust.[31] It is immediately apparent that there is general pattern of higher trust in the north and less in the south of Europe, and also that there are important within-differences.

1.3.2.2 Family ties

To construct a compound measure of the strength of family ties I combine the three EVS questions described above in two ways. First, in the whole data set of individual responses I extract the first principal component of the three variables and use its regional average as a summary measure of family ties at the regional level (*family_pc*). The principal component only captures the variation that is common to the three variables. However, these attributes may have more than one relevant dimension of variation. To address this concern, I also compute the algebraic sum of the three variables (*family_sum*). Given the way the three variables were recoded, for both the sum and the principal component, a higher number reflects stronger family ties. Table 1.3 displays the correlation between the three original cultural attributes and the summary measures of culture for the whole sample of over 68,000 individuals. The correlation of three variables with each other is positive though not very

[30] The coefficients on the individual controls in the first stage regression are consistent with findings from previous studies: younger, more educated and female respondents tend to reports higher level of trust in others. When regional dummies are included in the regression almost all of them display highly significant coefficients.

[31] Data are displayed in equal intervals, but the continuous measures are used in the econometric analysis.

high. However, all of them are highly correlated with the principal component and the sum. Also, the principal component is very highly correlated with the sum of the three variables which indicates that the principal component assigns very similar weights to the three variables. Figure 1.2 represents the distribution of the regional measure of family ties (principal component), and the map in Figure A.2 displays its geographic distribution across the regions in the EVS sample, with darker values corresponding to stronger family ties. As with social trust, there is a significant difference between north and south of Europe - with family ties stronger in the south (with the partial and surprising exception of Greece) and weaker in the north - as well as important within differences.

1.3.2.3 Measuring climate variability

As discussed above, both the temporal and the spatial dimension of climate variability are relevant to my theoretical argument. However, while measures of interannual climate variability can be derived from both the contemporary and historical climate data, only the higher resolution of the CRU data allows to measure spatial variability. In, fact using the ESTPR data to study the spatial variability in climate is not worthwhile since the grid-cells are much larger and hence communication across cells would have been very implausible given the transportation technology available in pre-industrial times.

Temporal variability In what follows I describe the procedure used to construct measures of interannual climate variability from the raw CRU monthly data for the period 1900-2000. Each measure of variability is computed at at the cell level first, and then aggregated at the regional level. Year-to-year climatic fluctuations coexist with both within-year fluctuations - particularly seasonal variations - and long-run trends. A good measure of interannual variability should address this and isolate interannual variation from seasonality and long-term trends. One way to control for seasonal variation is by looking at how climatic conditions in a given month vary over the years. Starting from monthly data

has the added benefit of allowing us to aggregate over specific relevant periods, such as the growing season, as well as over the whole year. For each climatic variable x 1,200 observations are available for each cell (12 months $\times$ 100 years). Consider climatic variable x, cell i (part of region r), month m and year y, and define x_{imy} as the value of x in cell i in month m in year y. For each month m, I compute the standard deviation of x_{imy} over all years (denoted σ_{im}), which measures the month-specific variability of variable x in cell i.[32] To obtain a compound measure of year-to-year variability for cell i I average σ_{im} over the twelve months (or over other specific periods of interest). Finally, I average σ_i over all cells in region r to obtain a regional measure of variability σ_r. The regional measures of temporal variability for precipitation and temperature are labeled as *pr_var* and *tm_var* respectively. To address the concern that these measure of variability may capture long-run trends in climatic conditions in addition to interannual fluctuations, I construct complementary measures of variability following the same procedure described above but using first differences instead of the actual observations. The detrended variability measures (*pr_var_det* and *tm_var_det*) are highly correlated with the standard measures, and will be used to check the robustness of the results.

The same procedure described above is used for the ESTPR data covering the period 1500-2000. The only difference is that, in the case of the ESTPR data, seasonal and not monthly observations are available. Hence, given x_{isy}, the value of climatic variable x in cell i in season s in year y, I first compute σ_{is}, the standard deviation of x_{isy} over all years, then average it over the four seasons to obtain σ_i, and finally over all cells in region r to obtain σ_r. Following this procedure I can also construct measures of variability for the entire 500-year period, but also focus on specific sub-periods, as I will do in my empirical analysis.

[32]The use of the standard deviation (or variance) as a measure of climatic variability is common in climatology. This measure was also used by economists to measure variability in climatic conditions (see among others Paxson, 1992).

Spatial variability To quantify how climate fluctuations are correlated across neighboring locations, I first need to define what I mean by neighborhood. For each cell i in the data, I identify a set J of neighbors j to cell i, composed of those cells that share with i a border or a vertex, such that each cell can have at most eight neighbors. The value of x_{imy} in a given year y, can be higher or lower than $\bar{x_{im}}$, the mean x for month m in cell i over the entire 100-year period. $x\_imy - \bar{x}\_my$ represents the deviation in year y from the 100-year month m mean in cell i. For each pair i, j I compute the correlation between monthly deviations in i and j over all months and years ($\rho_{i,j}$) which measures how climate variations in cell i are correlated with variations in cell j. Finally, in order to obtain a unique measure of spatial correlation for cell i, one needs to aggregate $\rho_{i,j}$ across all neighbors j. This can be done in different ways: I can calculate the average of the mean, the median or the minimum of all ρ_i, j. Of these, the minimum best captures the local potential for insurance, since an agent willingness to cooperate depends on the benefit of cooperating with my most complementary neighbor. The mean and median may fail to fully capture this potential since the dissimilarity of my best neighbor may be diluted by other neighbors' similarity to my location. The regional measures of spatial correlation in precipitation and temperature are labeled as *pr_spcorr* and *tm_spcorr* respectively.

1.4 Empirical strategy and results

1.4.1 Empirical strategy

To test the empirical relationship between cultural variables and climate variability I exploit differences across European regions. Using data at the sub-national level allows to control for all those country-specific factors that may potentially have an impact on citizens' trust attitudes - such as, for example, government regulation (Aghion et al., 2009) - as well as the common historical background shared by regions belonging to the same country(Tabellini, 2007). The cross-regional approach alleviates the concerns related to border and country

formation inherent to cross-country analysis allowing for a more compelling test of the validity of the theory.

I first investigate the relationship between climate variability and trust using both contemporary and historical climate data. I then replicate the analysis using family ties as dependent variable. To further test the robustness of the relationship between trust and historical climate variability, I finally extend the analysis to account for differential patterns of early economic and institutional development at the regional level.

My empirical strategy can be summarized by the following estimating equation:

$$Trust_{r,c} = \beta x\_var_r + \gamma x\_spcorr_r + \alpha_c + \mathbf{X_r'}\delta + \varepsilon_{r,c}$$

The subscripts r and c index regions and countries respectively. The $Trust_{r,c}$ variable denotes one of my two measures of trust (unconditional and conditional), which vary across regions. $x\_var_{r,c}$ and $x\_spcorr_{r,c}$ denote respectively the degree of temporal variability and spatial correlation for climatic variable x (temperature or precipitation) in region r; the last term is only included when using contemporary climate data. α_c denotes the country fixed effects. The vector $X_r^{'}$ denotes a set of regional controls which can include both the geographical and historical factors discussed in the previous section.

The coefficients of interest are β, the estimated relationship between temporal variability and the regional measure of current trust, and and γ the estimated relationship between spatial correlation in climatic fluctuations and trust. In particular, the theory predicts a positive sign for β and a negative sign for γ.

An analogous equation is estimated for family ties. To allow for arbitrary patterns of correlation within countries, in all regressions robust standard errors are clustered at the country level.

1.4.2 Climate variability and social trust

1.4.2.1 Contemporary variability and social trust

I start by investigating the relationship between the level of trust in the ESS regions and climate variability measured using the climatic data for the period 1900-2000, which allow me to analyze both the temporal and spatial dimension of variability.

The underlying assumption for using contemporary data as an informative proxy for past climate is that the geographic distribution of climatic conditions in the twentieth century is similar to that in past centuries. This assumption seems reasonable in light of the fact that the spatial distribution of climatic conditions - both their average and variability - is in large part determined by differences in geographic factors which tend to remain fairly stable over long periods of time.

A partial test can be performed by looking at the relationship between climatic conditions for the periods 1900-2000 and 1500-1900. Figure A.4 provides a graphical representation of this relationship separately for average precipitation, average temperature, precipitation variability and temperature variability. The correlation between average temperature at the regional level in the last century and in the previous four is 0.999, while it is 0.987 for average precipitation; the correlation for the variability measures in different periods is lower but still large: 0.902 for precipitation, and 0.871 for temperature. These findings confirm that region characterized by more variable climate in contemporary times tended to have more volatile climate also in the past, and provide reassurance that the assumption is realistic.

Table 1.4 display the summary statistics for all the variables used in the trust analysis. Table 1.8 reports the results using the unconditional regional measure of trust, separately for precipitation and temperature. In column 1 I regress the trust variable on the annualized measure of precipitation variability. The estimated coefficient for precipitation variability is positive, and statistically significant (at the 5% level), which is consistent with climate vari-

ability positively affecting average trust score at the regional level. In column 2 I include the vector of geographic controls described above, which includes average temperature, average precipitation, terrain ruggedness, average soil quality, standard deviation in soil quality, area of the region, a dummy for the region being landlocked, the distance of the region's centroid from the coast, the number of major rivers passing through the region, and the latitude of the region's centroid. When the controls are included the point estimate of the coefficient of interest increases slightly and remains highly statistically significant (at 1% level). With regard the magnitude of the coefficient, one standard deviation increase in precipitation variability corresponds to a .17 standard deviation increase in trust. Of the other regressors, only average precipitation, latitude and number of rivers display significant coefficients, negative for the first one and positive for the other two.

The availability of monthly climatic data allow us to go a step further, and to investigate whether variability in weather conditions over different parts of the year affects trust in different ways. If patterns of mutual cooperation arose as a response to economic risk in times in which agriculture was the dominant economic activity, I would expect variability during the growing season months to have a relatively larger effect on trust than variability during other months. The term of the growing season depends on the geographic location and crops of interest. In the case of Europe, cereals like wheat, barley and rye have historically been the most important and widespread crops, representing the base of the European peasants' diet (Le Roy Ladurie, 1971), followed by sugar beet, rapeseed, sunflower seeds, and, in the South, olives and grapes. Even after the diffusion of potatoes and corn - which became widespread in Europe only from the late 18th century - cereals continued to remain preeminent.[33] In general, the growing season for these crops coincides with the spring and summer months.[34] For example, in their study on the relationship between climate and crop yield at the global level, Lobell and Field (2007)define the growing season for

[33]Even in current times, cereals continue to have a prominent role in European agriculture. According to the FAO-Agromaps statistics, over the period 1975-2000, barley rye and wheat together account for approximately —% of the European total agricultural production .

[34]This is also the case for winter grain varieties, which are usually harvested at the end of the summer.

wheat as the months between May and October, and for barley the months between May and August. Similarly, the USDA publication "Major Crop Areas and Climatic Profiles" reports the growing season for spring and summer grains for European countries to be from March-April to October-November, with the exact length depending on the specific location (longer in the South and shorter in the North). In what follows I define the growing season as the months between April and October; however, as discussed below, all the results shown are robust to alternative choices of growing season.

In column 3, I include separately variability in precipitation for growing season months (GSM henceforth) and non growing season months (NGSM). When doing so, only the coefficient on precipitation variability for the GSM is positive and highly significant, and the point estimate somewhat larger than the one found in column 2 for variability over the whole year. This result suggests that the variability in precipitation during the growing season months is accounting for most of the effect found in column 2, consistent with the effect of climatic risk operating mainly through agriculture. Since variability in the NGSM does not seem to add much to the picture, in what follows I will use variability in the GSM as the regressor of interest.

As argued in section 2, if cooperative relations are aimed at providing mutual insurance from weather related risk, I would expect the capacity to share and differentiate risk to be larger where climatic shock are less correlated across neighboring locations, since this would facilitate differentiation and increase the scope for insurance. Column 4 tests this hypothesis by including, together with precipitation variability in the GSM, a measure of spatial correlation in precipitation anomalies. The result of the regression supports an explanation involving risk sharing and mutual insurance: while the coefficient on temporal variability continues to be positive and significant, the coefficient on spatial correlation is negative and highly significant.

I find similar results when looking at temperature (columns 5-7). The relative magnitude of the coefficient on temporal variability in temperature is similar to that on precip-

itation: one standard deviation increase in annualized temperature variability (column 6) corresponds to a 0.15 standard deviation increase in trust. However, I do not find the same result for spatial correlation in temperature. The coefficient is negative but the standard error is very large. This difference can be attributed to the fact that the spatial correlation in temperature across neighboring locations is, on average, much larger than that for precipitation, and does not offer enough variation to identify an effect. This result is consistent with previous findings in climatology - and particularly with regard to the CRU data on Europe - according to which the pattern in temperature appears to be much more spatially homogeneous than in precipitation. Figure 1.3 plots the estimated residuals of trust (on the vertical axis) and variability (on the horizontal axis), estimated from a regression against the remaining regressors (regional controls and country fixed effects), respectively for precipitation and temperature.

To verify the robustness of these results I perform a series of checks. The results are presented in Table A.1. First, I re-estimate the main specification (with growing season variability and spatial correlation) using the conditional measure of trust which accounts for differences in individual characteristics of respondents in each region (column 1). The results obtained using the conditional and unconditional measure of trust are qualitatively very similar, suggesting that the relationship between variability and trust are not explained by regional differences in the composition of the respondents' sample. I then replicate the analysis using the detrended measure of variability, to make sure the results are not influenced by long-term trends in climatic conditions (column 2). Once again, the results are very similar. To make sure the results are not driven by the relationship between variability and trust in some particular countries, I re-estimate the main regression excluding Scandinavian countries, usually characterized by extremely high levels of trust (column 3), and former communist countries, which generally display low trust scores (column 4). In both cases, the results remain similar. Finally, Appendix Table A.2 display the results obtained using alternative terms of the growing season which are very similar to those obtained with

the base specification.

1.4.2.2 Historical variability and social trust

Overall, the results described so far, obtained using climatic data for the twentieth century, suggest the existence of a robust correlation between patterns of temporal and spatial variability in climatic conditions and social trust at the regional level. Insofar as the cross-region distribution of climatic variability in the twentieth century is a good approximation for climatic variability in previous centuries, this evidence supports the thesis of an historical impact of environmental volatility on the emergence of norms of generalized trust. However, the same findings are also consistent with alternative explanations emphasizing the effect of *contemporary* variability on trust. To test whether differences in current levels of trust are related to historical rather than to contemporary climate variability, I replicate the analysis using reconstructed climatic data for the period 1500-2000. Due to their lower spatial resolution (0.5º), the reconstructed data are too coarse to construct an accurate measure of spatial correlation within reasonable distances. Therefore, these data are only used to analyze the relationship between temporal variability in climate and trust.

In the first column of Table 1.6 I regress trust on precipitation variability for the growing season over the period 1900-2000. Since for this period the ESTPR data are derived from the same CRU data used above (although interpolated over larger areas), not surprisingly the coefficient on precipitation variability is positive and statistically significant (at the 10% level). In column 2 I regress trust on precipitation variability in the growing season calculated over the period 1500-1750. The choice of this particular period is motivated by the desire to capture historical variability over a period characterized by the prevalence of agriculture and natural resource-dependent activities, prior to the onset of the industrial revolution which determined profound changes in the traditional forms of economic and social organization throughout Europe.[35] The coefficient on precipitation variability between

[35] Alternative choices of the reference period (e.g. 1500-1700 or 1500-1800) lead to very similar results

1500 and 1750 is also positive and significant (5% level), and larger than the coefficient on variability between 1900 and 2000. Interestingly, when both variables are included in the regression (column 3), the coefficient on historical variability continues to be positive and significant, while the coefficient on precipitation variability over the last century becomes statistically insignificant. With regard to the magnitude of the effect, a one standard deviation increase in growing season precipitation variability corresponds to an increase of 0.10 standard deviation in trust. Analogous results are found for temperature (columns 3-5): temperature variability between 1500 and 1750 tends to have a positive effect on trust even after controlling for variability between 1900 and 2000, which does not appear to have an independent effect. In the case of temperature the effect is larger: a one standard deviation increase in growing season variability implies a 0.20 standard deviation increase in trust.

Taken together, these results support an explanation emphasizing the historical influence of climatic volatility on the emergence of norms of mutual trust, as opposed to alternative arguments stressing the effect of contemporary climate variability on current trust attitudes.

1.4.3 Climate variability and family ties

1.4.3.1 Contemporary variability and family ties

To further test the empirical validity of my theoretical argument I now look at the relationship between climate volatility and the importance of the family, replicating the analysis performed in the previous section.

To do so I combine the climate data with survey data from the European Value Survey. Table 1.7 display the summary statistics for all the variables used in the family ties analysis. As before, I start by presenting the result of the analysis using climate data for the period 1900-2000. To measure the strength of family ties I use both the sum and the first principal component of the three relevant questions, as described in the data section. Table 1.8 present the results separately for precipitation (columns 1-6) and temperature (7-12). All

regressions include both country fixed effects and regional geographical controls.

In column 1 I start by regressing the first principal component of family ties on annualized variability in precipitation between 1900-2000. The coefficient on precipitation variability is positive and statistically significant (5%). The result is consistent with that found for social trust and confirm the theoretical predictions: in regions characterized by a more variable climate people tend to attach less importance to the family. Once again, this result is primarily driven by variability in precipitation during the growing season months, while variability during the other months displays no significant effect (column 2). As for the case of trust, the spatial dimension of precipitation variability appears to have a significant effect on the strength of family ties. In this case the coefficient on spatial correlation is positive: more spatially correlated climatic shocks decrease the gain from cooperation with outsiders, and increase the importance of within-family relations. Both effects are fairly large: one standard deviation in precipitation variability in the growing season corresponds to a 0.26 decrease in the strength of family ties, while one standard deviation in spatial correlation corresponds to a 0.11 standard deviation increase in family ties. Very similar results are obtained when using the sum of the three cultural attributes as dependent variable: both the point estimates and significance levels remain mostly unchanged.

Once again, the qualitative results for temperature are analogous: higher inter-annual variability, particularly during the growing season, corresponds to weaker family ties. Furthermore, as with trust, the coefficient on spatial correlation in temperature has the expected sign but is not statistically significant. As with precipitation, the results are very similar when both measures of the strength of family ties are used as dependent variable.

1.4.3.2 Historical variability and family ties

Using climate data for the previous centuries I then test whether differences in the strength of family ties are related to historical rather than contemporary variability (Table 1.9). Once again, the results are consistent with those found for trust: historical variability in the grow-

ing season's precipitation and temperature appear to have a negative, large and significant effect on the strength of family ties. This effect remains, and becomes even larger, when controlling for climate variability over the last century, which appears to have no significant effect on the dependent variable, or, in the case of precipitation an inverse - though marginally significant - effect. The magnitude of the coefficients on historical variability is considerable and comparable to what found for trust: a one standard deviation in growing season variability corresponds to a 0.40 standard deviation decrease in the strength of family ties, for precipitation, and a 0.38 standard deviation decrease for temperature.

1.4.4 Trust, climate variability and historical background

The evidence presented above confirms the existence of a robust relationship between historical climate variability and current differences in trust. As a further robustness check, I then explore the relationship between this result and findings from a previous study by Tabellini (2005) which emphasize the impact of early political institutions on differences in trust across European regions. Doest the effect of historical variability on trust persist when controlling for early political institutions? Finding that this is the case would suggests that the demand for insurance against erratic weather may have fostered the emergence of trust by favoring the adoption of other, more informal collective arrangements whose long-lasting effect of trust is not captured by historical differences in institutions.

To explore this issue I extend my empirical analysis to include a regional measure of early political institutions: constraints on the executive between 1600-1850, available from Tabellini (2005) for 69 European regions. This variable was coded for different 40-year windows around the years 1600, 1700, 1750, 1800, and 1850, and takes values from 1 (unconstrained authority) to 7 (maximum accountability and constraints). To be consistent with the time frame used in the construction of the historical variability measure described above, I consider constraints on the executive in 1600, 1700 and 1750. Following Tabellini (2005), I use the first principal component of the three variables as my main measure of

early political institutions. However, all the results described below are remain mostly unchanged when using each of the three variables separately or their arithmetic average (Tables A.3 and A.4). Tabellini's data also include regional measures of urbanization (around 1850) and literacy (around 1880), which I include as additional regressors in my analysis to explore the relative importance of patterns of early economic development and human capital accumulation on trust attitudes. Summary statistics for all the variables used in this section are shown in Table 1.10.

Table 1.11 reports the results of the regressions, all of which include country fixed effects and the set of standard regional controls used before. In column 1 I regress the unconditional trust measure on precipitation variability in the growing season alone. The results for the smaller sample (66 regions) confirm those found for larger sample: the coefficient on precipitation variability (in the growing season months) is positive, large, and statistically significant.[36] Again, when historical and contemporary variability are included in the regression (column 2), only the first one displays a positive and significant coefficient (10% level). Column 3 displays the result of the regression of trust on early institutions, literacy rate in 1880, and urbanization rate around 1850. The results are consistent with Tabellini's findings: past level of education and, particularly, early political institutions, display a positive and significant effect on current levels of trust (significant at the 10% and 1% level respectively). Finally, the regression in column 4 includes precipitation variability along with the three historical variables. When doing so, the coefficient on precipitation variability continues to be positive and statistically significant (5% level), while those on constraints on the executive and literacy rate remain practically unchanged. With regard to the magnitude of the coefficients, the effect of historical precipitation variability and early institutions on trust are comparable: while one standard deviation increase in historical precipitation variability corresponds to a 0.33 standard deviation increase in trust,

[36]Three of the 69 regions included in Tabellini's original sample, are not covered by the climatic data I use and are hence excluded from the current analysis. These regions are: Madeira and Azores Islands (Portugal) and Canaries Island (Spain).

one standard deviation increase in the principal component of constraints on the executive between 1600 and 1750 corresponds to a 0.45 standard deviation increase in trust. Similar results hold for historical temperature variability (columns 5-8), which display a positive and significant coefficient even when controlling for contemporary variability. Unlike for precipitation, however, when historical temperature variability is included in the regression along with early institutions, literacy rate and urbanization (column 8), the point estimate on variability drops significantly - from 2.343 to 1.962 - as well as does the coefficient on early institutions, from 0.146, when variability is not included, to 0.091, which suggest that the two variables are correlated. Based on the point estimates in column 8, historical temperature variability appears to have a relatively larger impact on trust than early institutions: one standard deviation increase in historical temperature variability increases trust by 0.56 standard deviation, compared to a 0.26 standard deviation increase for early political institutions.

1.5 Conclusion

Social trust has become the object of extensive research in economics as part of a broader agenda on the impact of culture on economic performance. Nevertheless, the economic origins of trust remain relatively unexplored, limiting our understanding of the phenomenon and its implications for economic development. Recent theoretical and empirical findings indicate that historical circumstances - in particular historical experiences of cooperation - can have considerable and long-lasting effects on the level of trust of a community, providing a coherent framework for further research on the historical determinants of trust.

This paper contributes to this growing literature by examining the historical relationship between risk and the emergence of mutual cooperation and trust. In doing so, it focuses on a primitive and universal source of environmental risk: climate volatility. The hypothesis advanced and tested in this paper is that norms of generalized trust developed

in pre-industrial times as a result of experiences of cooperation triggered by the need for subsistence farmers to cope with climatic risk. Since cooperation was particularly valuable in riskier environments, norms of trust became more prevalent in areas exposed to more erratic weather. These norms were then transmitted from generation to generation and managed to persist even after climate patterns had become less crucial for economic activity. Insofar as these norms continue to influence the trust attitudes of the descendants, one should expect to observe higher levels of trust in regions historically characterized by higher climatic variability.

My empirical results provide support for this prediction in the context of Europe. Combining detailed climate data for the period 1500-2000 and contemporary survey data from the European Social Survey I find that interannual variability in both temperature and precipitation has a significant positive effect on current levels of trust at the regional level. This effect is mainly driven by climatic variability in the growing season months. Furthermore, trust is higher in regions with more spatially heterogeneous precipitation, in which risk-sharing through geographic differentiation would have been more effective. Finally, trust is related to historical climate variability (between the 16th and the 18th century) but not to contemporary variability (over the 20th century), a result which contrasts with alternative explanations on the impact of contemporary variability on current trust.

These findings are further corroborated by evidence on the relationship between climatic variability and individuals' beliefs on the importance of the family in their life. In line with recent studies documenting the existence of a negative empirical relationship between trust within and outside the family, I find that in regions with higher temporal and spatial variability in climate, people have weaker family ties. As in the case of trust, the strength of family ties is related to historical variability, but not to contemporary variability, which appears to have no independent explanatory power.

The last part of the paper attempts to shed some light on the relationship between trust, climate variability and early political institutions. To do so I extend my empirical analysis

to control for measures of historical political and economic development at the regional level available from Tabellini (2005). The results confirm the importance of early political institutions (and, to a lesser extent, early literacy) for the emergence and diffusion of mutual trust (Tabellini, 2005). On the other hand, historical climate variability continues to have a considerable impact on trust, which suggests that the demand for insurance that aroused from exposure to erratic weather may have favored the adoption of other more informal collective arrangements.

This research provides a new point of investigation into the emergence of social norms as a product of collective responses to risk. However, the present study can provide only suggestive evidence on the specific channel(s) through which exposure to climate variability may have favored the development of a culture of trust. As the availability and quality of historical data improve, future research should aim at sheding further ligth on this crucial question.

Figure 1.1: Distributions of Trust score in ESS regions

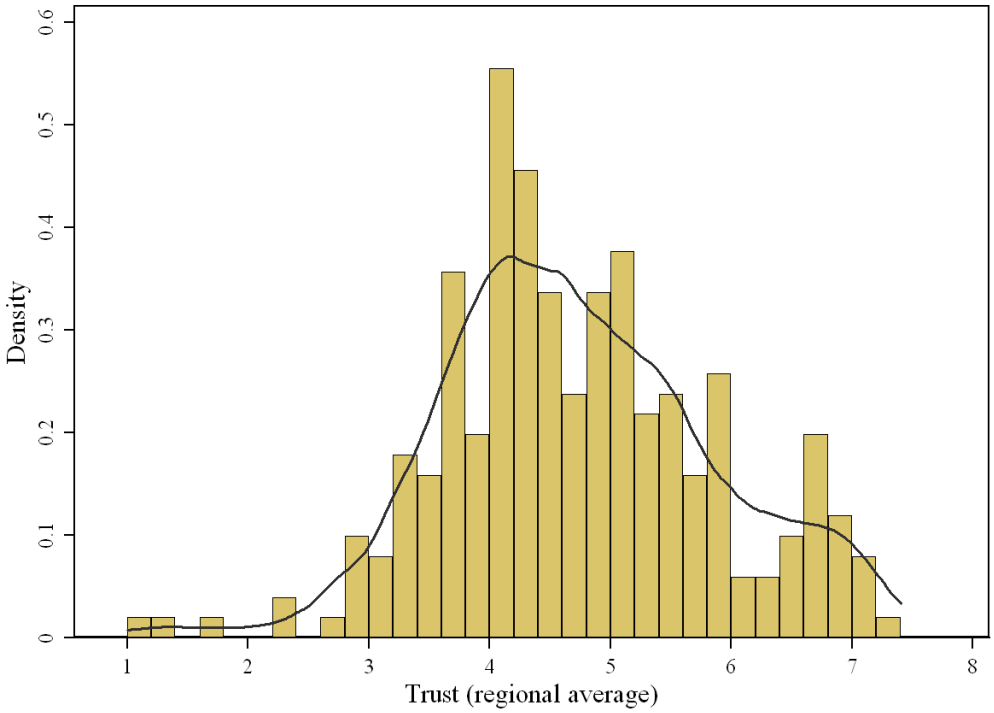
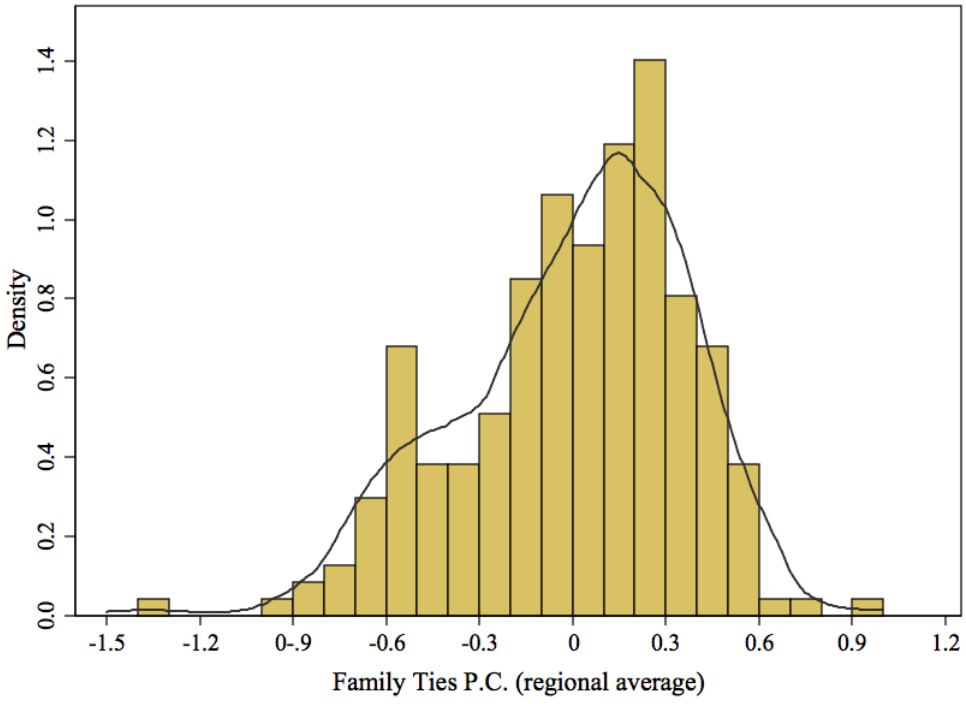


Figure 1.2: Distribution of Family Ties (P.C) by EVS regions



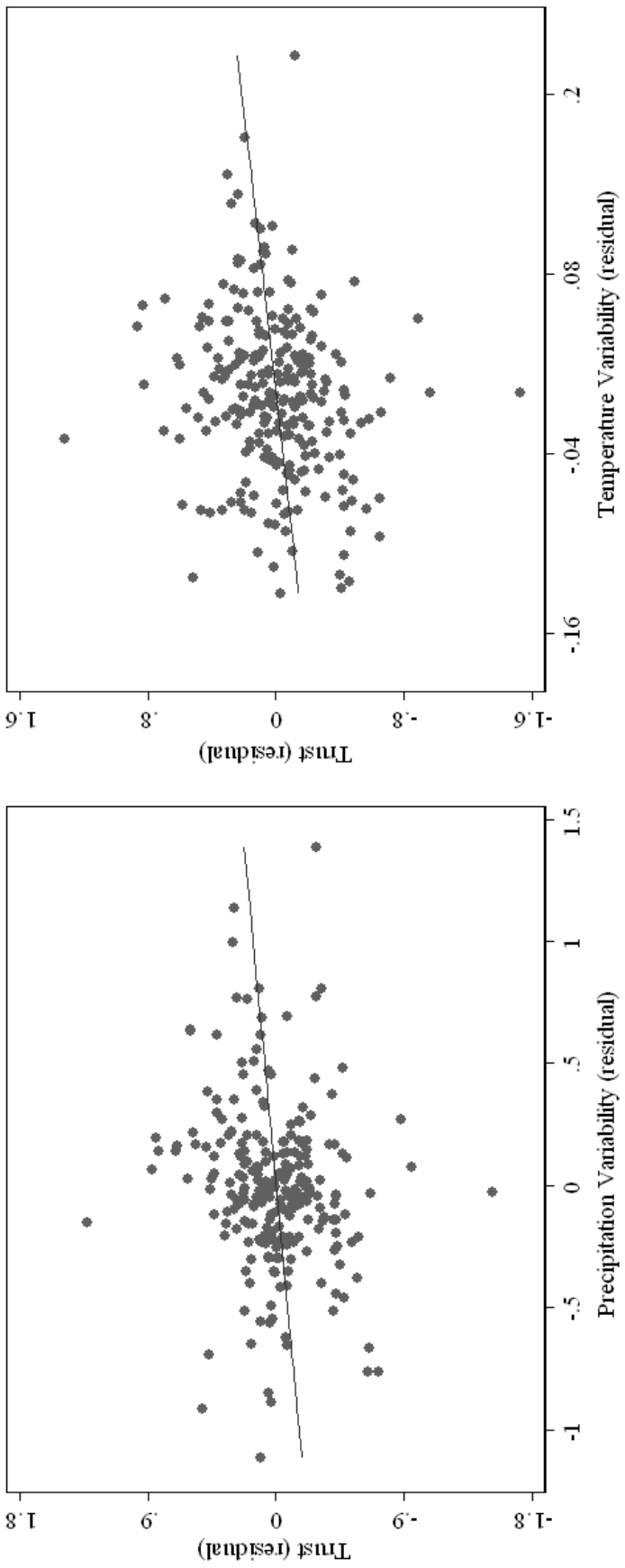


Figure 1.3: Climate Variability and Trust - OLS residuals (after controlling for country f.e. and regional controls)

Table 1.1: European Social Survey: Number of respondents by country/round

Country	*Round 1*	*Round 2*	*Round 3*	*Mean trust score*
Austria	2,257	2,256	2,405	4.9
Belgium	1,899	1,778	1,798	4.9
Bulgaria	-	-	1,400	2.2
Czech Republic	1,360	3,026	-	3.3
Denmark	1,506	1,487	1,505	6.3
Estonia	-	1,989	1,517	4.6
Finland	2,000	2,022	1,896	6.0
France	1,503	1,806	1,986	4.3
Germany	2,919	2,870	2,916	4.2
Greece	2,566	2,406	-	4.8
Hungary	1,685	1,498	1,518	4.1
Ireland	2,046	2,286	1,800	4.6
Italy	1,207	1,529	-	4.6
Luxembourg	1,552	1,635	-	5.7
Netherlands	2,364	1,881	1,889	4.9
Norway	2,036	1,760	1,750	5.6
Poland	2,110	1,716	1,721	2.9
Portugal	1,511	2,052	2,222	3.9
Slovakia	-	1,512	1,766	4.2
Slovenia	1,519	1,442	1,476	4.1
Spain	1,729	1,663	1,876	5.0
Sweden	1,999	1,948	1,927	5.6
Switzerland	2,040	2,141	1,804	5.6
United Kingdom	2,052	1,897	2,394	4.3
Total	**39,860**	**44,600**	**37,566**	

Table 1.2: European Value Study - Number of Respondents by Country/Wave

Country	*Round 1 (1989-1993)*	*Round 2 (1994-1999)*	*Round 3 (1999-2004)*	*Family important (1-4)*	*Respect parents (1-2)*	*Parents' responsibility (1-2)*	*Family Ties (P.C.)*	*Family Ties (sum)*
Austria	1,460	-	1,522	3.854	1.695	1.690	-0.110	7.250
Belgium	2,792		1,912	3.820	1.725	1.777	0.040	7.344
Bulgaria	1,034	1,072	1,000	3.798	1.842	1.711	0.081	7.371
Czech Republic	3,033*	1,147	1,908	3.842	1.726	1.631	-0.137	7.230
Denmark	1,030	-	1,023	3.856	1.429	1.612	-0.610	6.900
Estonia	1,008†	1,021	1,005	3.697	1.775	1.710	-0.113	7.207
Finland	588†	987	1,038	3.771	1.674	1.682	-0.244	7.129
France	1,002	-	1,615	3.836	1.759	1.819	0.160	7.431
Germany	3,437	2,026	2,036	3.717	1.629	1.629	-0.409	7.006
Greece	-	-	1,139	3.799	1.692	1.679	-0.136	7.225
Hungary	999†	650	1,000	3.871	1.822	1.767	0.201	7.472
Ireland	1,000	1,012†	-	3.894	1.776	1.802	0.236	7.502
Italy	2,018	-	2,000	3.868	1.811	1.875	0.385	7.600
Luxembourg	-	-	1,211	3.857	1.592	1.784	-0.072	7.277
Netherlands	1,017		1,003	3.725	1.366	1.806	-0.491	6.939
Norway	1,239	1,127†	-	3.862	1.453	1.875	-0.146	7.222
Poland	1,920	1,153†	1,095	3.898	1.884	1.800	0.370	7.598
Portugal	1,185	-	1,000	3.705	1.811	1.867	0.177	7.404
Slovakia	1,602‡	1,095	1,331	3.868	1.762	1.734	0.100	7.404
Slovenia	1,035	1,007†	1,006	3.783	1.802	1.847	0.221	7.457
Spain	4,147	1,211	2,409	3.821	1.825	1.847	0.297	7.524
Sweden	1,047	1,009†	1,015	3.852	1.469	1.783	-0.276	7.131
Switzerland	-	1,212	-	3.792	1.714	1.692	-0.139	7.209
United Kingdom	1,788	1,093	1,959	3.865	1.709	1.831	0.129	7.417
Total	34,381	16,882	29,227					

** Of these, for 2,109 individuals intreviewed in 2001 no information on the region of residence was available.*
† No information on the respondent's region of residence available.
‡ Of these, for 1,136 individuals intreviewed in 1999 no information on the region of residence was available.

Table 1.3: Family Ties (EVS) - Correlation among variables

	Family important	*Respect parents*	*Parents' responsibility*	*Family Ties (P.C.)*
Family important				
Respect parents	0.087			
Parents' responsibility	0.088	0.169		
Family Ties (P.C.)	0.512	0.695	0.698	
Family Ties (sum)	0.627	0.652	0.638	0.990

Observations: 55754

Table 1.4: Summary statistics for the trust-climate analysis

Variable	Obs.	Mean	Std. Dev.	Min	Max
Trust:					
Trust unconditional (0-10)	251	4.72	1.12	1.11	7.31
Climate 1900-2000:					
Precipitation variability 12 months (mm)	251	34.15	12.21	17.43	76.17
Precipitation variability GSM (mm)	251	33.98	10.99	15.04	77.68
Precipitation variability NGSM (mm)	251	34.38	16.23	12.27	87.62
Precipitation spatial correlation	251	0.93	0.04	0.89	0.98
Temperature variability 12 months (°C)	251	1.64	0.29	1.03	2.43
Temperature variability GSM (°C)	251	1.35	0.16	0.90	1.71
Temperature variability NGSM (°C)	251	2.04	0.51	1.11	3.45
Temperature spatial correlation	251	0.98	0.00	0.96	0.99
Precipitation Average 12 months (mm)	251	66.64	22.40	32.32	148.98
Temperature Average 12 months (°C)	251	9.12	3.22	-1.47	17.63
Climate 1500-2000:					
Precipitation variability GSM 1500-1750 (mm)	248	15.31	7.38	6.92	49.10
Precipitation variability GSM 1900-2000 (mm)	248	16.78	6.39	7.85	51.45
Temperature variability GSM 1500-1750 (°C)	248	0.78	0.17	0.30	1.14
Temperature variability GSM 1900-2000 (°C)	248	1.01	0.20	0.64	1.57
Precipitation average 1500-2000 (mm)	248	67.28	26.06	28.40	166.40
Temperature average 1500-2000 (°C)	248	8.76	3.34	-1.59	17.56
Controls:					
Terrain Ruggedness	251	1.43	1.50	0.01	7.99
Soil Suitability average (0-6)	251	2.28	0.86	0	4.90
Soil Suitability st.dev.	251	1.03	0.41	0	2.02
Area (km^2)	251	17,077	23,954	96	168,466
Landlocked	251	0.55	0.50	0	1
Distance to the coast (km)	251	149.93	147.22	0	588.47
Number of major rivers	251	1.18	1.58	0	11
Latitude (°)	251	48.70	6.41	35.23	68.85

Table 1.5: Social Trust and Climate Variability - Climate Data: 1900-2000

	Dependent variable: Trust in others (unconditional regional average)							
	Precipitation				Temperature			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variability (12 Months)	0.133**	0.155***			1.060**	1.028***		
	(0.058)	(0.042)			(0.490)	(0.304)		
Variability (growing season months)			0.193***	0.168***			0.958**	1.019***
			(0.068)	(0.044)			(0.390)	(0.293)
Variability (non-growing season months)			-0.012				0.255	
			(0.031)				(0.283)	
Spatial Correlation				-5.747***				-2.918
				(1.988)				(13.680)
Average Temperature		0.007	0.025	0.040*		0.035	0.036	0.036
		(0.035)	(0.038)	(0.023)		(0.033)	(0.033)	(0.033)
Average Precipitation		-0.051*	-0.046*	-0.044**		0.028	0.026	0.027
		(0.026)	(0.024)	(0.016)		(0.017)	(0.018)	(0.017)
Average Terrain Ruggedness		0.030	0.043	0.037		0.074	0.064	0.072
		(0.061)	(0.067)	(0.043)		(0.054)	(0.059)	(0.057)
Soil Quality (Average)		-0.003	-0.008	0.008		-0.000	-0.001	-0.000
		(0.036)	(0.034)	(0.024)		(0.034)	(0.036)	(0.035)
Soil Quality (St. Dev.)		0.031	0.028	0.047		0.030	0.023	0.029
		(0.064)	(0.068)	(0.055)		(0.057)	(0.063)	(0.059)
Area		-0.323	-0.211	-0.054		-0.197	-0.205	-0.197
		(0.215)	(0.228)	(0.130)		(0.206)	(0.204)	(0.206)
Landlocked		0.008	0.007	0.057		-0.006	-0.013	-0.005
		(0.098)	(0.101)	(0.075)		(0.109)	(0.105)	(0.108)
Distance to the Coast		0.060	0.052	0.025		0.027	0.025	0.027
		(0.048)	(0.048)	(0.030)		(0.043)	(0.041)	(0.043)
Access to Rivers		0.071**	0.062**	0.040*		0.055*	0.054*	0.055*
		(0.029)	(0.029)	(0.023)		(0.030)	(0.030)	(0.031)
Latitude		0.058**	0.057**	0.054***		0.038	0.042	0.039
		(0.028)	(0.024)	(0.019)		(0.029)	(0.030)	(0.029)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	251	251	251	251	251	251	251	251
Number of clusters	24	24	24	24	24	24	24	24
R-square	0.881	0.888	0.889	0.945	0.883	0.889	0.889	0.889

*OLS regressions. Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Table 1.6: Social Trust and Climate Variability - Climate Data: 1500-2000

	Dependent variable: Trust in others (unconditional regional average)					
	Precipitation			Temperature		
	(1)	(2)	(3)	(4)	(5)	(6)
Variability GSM (1500-1750)		0.132**	0.141**		1.303***	1.311***
		(0.050)	(0.059)		(0.248)	(0.369)
Variability GSM (1900-2000)	0.109*		-0.026	1.040**		-0.019
	(0.057)		(0.043)	(0.455)		(0.580)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	248	248	248	248	248	248
Number of clusters	24	24	24	24	24	24
R-square	0.894	0.895	0.895	0.890	0.890	0.890

*OLS regressions. Regional controls: mean temperature, mean precipitation, average ruggedness index, soil suitability (average and standard deviation), area, dummy for landlocked, distance from of the region's centroid from the coast, number of major rivers passing through the region, latitude of the region's centroid. Robust standard errors clustered at the country level in parenthesis. ***,** and * indicates significance at the 1, 5 and 10% level.*

Table 1.7: Summary statistics for the Family Ties-climate analysis

Variable	Obs.	Mean	Std. Dev.	Min	Max
Family ties:					
Family ties first principal component	220	0.02	0.35	-1.01	0.91
Family ties sum (0-8)	220	7.31	0.26	6.62	7.92
Climate 1900-2000:					
Precipitation variability 12 months (mm)	220	34.38	12.31	17.43	76.17
Precipitation variability GSM (mm)	220	34.13	11.00	15.04	77.68
Precipitation variability NGSM (mm)	220	34.72	16.36	12.27	91.60
Precipitation spatial correlation	220	0.93	0.04	0.90	0.98
Temperature variability 12 months (°C)	220	1.64	0.30	1.03	2.43
Temperature variability GSM (°C)	220	1.35	0.17	0.90	1.71
Temperature variability NGSM (°C)	220	2.04	0.53	1.11	3.45
Temperature spatial correlation	220	0.98	0.00	0.96	0.99
Precipitation Average 12 months (mm)	220	66.80	22.00	39.28	148.06
Temperature Average 12 months (°C)	220	9.06	3.28	-1.47	17.63
Climate 1500-2000:					
Precipitation variability GSM 1500-1750 (mm)	217	16.30264	6.65	6.84	39.73
Precipitation variability GSM 1900-2000 (mm)	217	19.96012	7.11	10.56	52.41
Temperature variability GSM 1500-1750 (°C)	217	0.718353	0.17	0.30	1.02
Temperature variability GSM 1900-2000 (°C)	217	0.928003	0.14	0.64	1.33
Precipitation average 1500-2000 (mm)	217	67.78502	26.59	34.96	166.40
Temperature average 1500-2000 (°C)	217	8.70063	3.40	-1.59	17.56
Controls:					
Terrain Ruggedness	220	1.43	1.50	0.01	7.99
Soil Suitability average (0-6)	220	2.26	0.89	0.002544	4.90
Soil Suitability st.dev.	220	1.05	0.41	0	1.973814
Area (km^2)	220	20,124	8,209	96	102,466
Landlocked	220	0.51	0.50	0	1
Distance to the coast (km)	220	142.73	139.76	0.2751	585.74
Number of major rivers	220	1.22	1.75	0	15
Latitude (°)	220	49.06	6.52	36.74	68.85

Table 1.8: Family Ties and Climate Variability - Climate Data: 1900-2000

	Family Ties (Principal Component)						Family Ties (Sum)					
	Precipitation			Temperature			Precipitation			Temperature		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variability (12 Months)	-0.072**			-0.392*			-0.069**			-0.416*		
	(0.033)			(0.214)			(0.031)			(0.227)		
Variability (growing season months)		-0.081***	-0.086***		-0.692***	-0.592***		-0.079**	-0.083***		-0.692***	-0.576***
		(0.029)	(0.023)		(0.219)	(0.188)		(0.028)	(0.021)		(0.220)	(0.196)
Variability (non-growing season months)		-0.004			0.063			-0.003			0.046	
		(0.024)			(0.130)			(0.023)			(0.137)	
Spatial Correlation			4.567**			7.592			5.158**			10.925
			(1.825)			(8.782)			(1.903)			(8.286)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	220	220	220	220	220	220	220	220	220	220	220	220
Number of clusters	24	24	24	24	24	24	24	24	24	24	24	24
R-square	0.826	0.828	0.832	0.826	0.832	0.832	0.782	0.783	0.789	0.783	0.789	0.791

*OLS regressions. Regional controls: mean temperature, mean precipitation, average ruggedness index, soil suitability (average and standard deviation), area, dummy for landlocked, distance from of the region's centroid from the coast, number of major rivers passing through the region, latitude of the region's centroid. Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Table 1.9: Family Ties and Climate Variability - Climate Data: 1500-2000

	Family Ties (Principal Component)				Family Ties (Sum)			
	Precipitation		Temperature		Precipitation		Temperature	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variability GSM (1500-1750)	-0.205**	-0.300**	-0.205**	-0.306***	-0.769***	-0.876***	-0.781***	-0.880***
	(0.085)	(0.112)	(0.081)	(0.100)	(0.211)	(0.228)	(0.205)	(0.209)
Variability GSM (1900-2000)		0.129*		0.138		0.362		0.334
		(0.074)		(0.081)		(0.344)		(0.327)
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	218	218	218	218	218	218	218	218
Number of clusters	24	24	24	24	24	24	24	24
R-square	0.830	0.833	0.785	0.789	0.836	0.837	0.792	0.793

*OLS regressions. Regional controls: mean temperature, mean precipitation, average ruggedness index, soil suitability (average and standard deviation), area, dummy for landlocked, distance from of the region's centroid from the coast, number of major rivers passing through the region, latitude of the region's centroid. Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Table 1.10: Summary statistics for the trust-climate-Institutions analysis

Variable	Obs.	Mean	Std. Dev.	Min	Max
Trust:					
Trust unconditional (0-10)	66	4.77	0.57	2.70	5.84
Climate 1500-2000:					
Precipitation variability GSM 1500-1750 (mm)	66	16.24	4.46	8.16	31.12
Precipitation variability GSM 1900-2000 (mm)	66	17.94	4.30	10.22	36.03
Temperature variability GSM 1500-1750 (°C)	66	0.74	0.17	0.39	1.01
Temperature variability GSM 1900-2000 (°C)	66	0.84	0.08	0.64	0.99
Precipitation average 1500-2000 (mm)	66	58.12	20.85	22.55	115.07
Temperature average 1500-2000 (°C)	66	13.84	2.54	8.93	18.64
Historical background:					
Institutions 1600-1750 (first principal component)	66	0.00	1.65	-1.34	3.06
Institutions 1600-1750 (average)	66	2.24	1.55	1	5
Urbanization rate (1880)	66	11.61	13.35	0	57.43
Literacy rate (1880)	64	55.40	25.73	14.60	96.50
Controls:					
Terrain Ruggedness	66	1.26	1.03	0.02	4.10
Soil Suitability average (0-6)	66	2.24	0.57	0.99	3.79
Soil Suitability st.dev.	66	1.21	0.37	0.37	1.95
Area (km^2)	66	30,137	28,676	161	145,130
Landlocked	66	0.35	0.48	0	1
Distance to the coast (km)	66	97.66	99.19	0.31	417.20
Number of major rivers	66	2.06	2.59	0	15
Latitude (°)	66	46.11	5.52	37.22	56.19

Table 1.11: Trust, Climate Variability and Institutions - Climate Data: 1500-2000

	Dependent variable: Trust in others (unconditional regional average)							
	Precipitation				Temperature			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variability GSM (1500-1750)	0.404**	0.620*		0.476**	2.364**	2.123**		1.962*
	(0.144)	(0.271)		(0.166)	(0.935)	(0.849)		(1.003)
Variability GSM (1900-2000)		-0.308				0.702		
		(0.214)				(0.951)		
Contraints on Executive P.C. (1600-1750)			0.148***	0.155**			0.148***	0.091**
			(0.036)	(0.045)			(0.036)	(0.031)
Literacy (1880)			0.010*	0.009**			0.010*	0.005
			(0.004)	(0.004)			(0.004)	(0.004)
Urbanization (1850)			-0.003	-0.002			-0.003	-0.002
			(0.003)	(0.004)			(0.003)	(0.003)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	66	66	64	64	66	66	64	64
Number of clusters	8	8	8	8	8	8	8	8
R-square	0.724	0.727	0.753	0.767	0.769	0.770	0.753	0.781

*OLS regressions. Regional controls: mean temperature, mean precipitation, average ruggedness index, soil suitability (average and standard deviation), area, dummy for landlocked, number of major rivers passing through the region, distance from of the region's centroid from the coast, latitude of the region's centroid. Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Chapter 2

Partisan Control, Media Bias, and Viewer Responses: Evidence from Berlusconi's Italy[1]

2.1 Introduction

Since the introduction of newspapers, there has been substantial concern over partisan control of the media. Some observers worry that impressionable voters may be influenced by an ideological media and that this may result in an electoral advantage for the favored party. According to this view, an overtly partisan media may lead to the election of low quality candidates and to the enactment of poor policies.

This argument rests upon three key assumptions. First, it assumes that ideological control of the media will lead to biased news content. The opposing view is that, under private ownership of the media, market forces, and viewers' ideology in particular, are sufficiently strong such that the profit motive will dominate any influence motive. If the media is publicly owned, by contrast, then the profit motive may be less of a driving force.

[1]This chapter is the product of a joint collaboration with Brian Knight. We thank Constanca Esteves-Sorenson, Andrew Foster, Matt Gentzkow, Ethan Kaplan, Riccardo Puglisi, Jesse Shapiro and three anonymous referees for helpful comments. We also thank seminar participants at Brown University and participants to the 6th Workshop on Media Economics, the 10th Meeting of the LACEA Political Economy Group, and the 2010 Annual Meeting of the Midwest Economic Association for helpful discussion. We are grateful to the Italian Nation Election Studies group, to the Osservatorio dei Media di Pavia, and to GECA Italia for providing part of the data used in this study.

The second key assumption is that consumers will not respond to ideological control of the media by shifting to outlets more in line with their own ideology, a behavioral response that will only be possible with a sufficiently pluralistic media sector. Third, voters must respond to media content when choosing between candidates.

In this paper, we investigate these issues in the context of the television industry in Italy, where a single politician with easily identified ideology, Silvio Berlusconi, owns the main private television network, and where the public television corporation is traditionally controlled by the ruling political coalition. In particular, we examine news content and viewership of the six top national television channels before and after the 2001 change in government, which shifted control of the public television corporation from the center-left coalition to the Berlusconi-led center-right coalition.

We first investigate whether or not partisan control of the media affects news content. To address this question, we first develop an absolute, but time invariant, measure of station ideology. We find that Berlusconi's private network provided more speaking time to the right during the period in which the right was in power than to the left during the period in which the left was in power. Based upon this finding of an asymmetry, we conclude that Berlusconi's private network is biased towards the right. We then develop a relative, but time varying, measure of station ideology. Based upon this measure, we find that the public network shifted to the right, relative to the private network, following the change in control of the public network from the left to the right.

We then investigate whether and how viewers responded to these changes in media control. Given our finding that the public network shifted to the right on the ideological spectrum following the change in its control from the left to the right party, did viewers respond to the change in content by switching to a channel with an ideological leaning closer to their own? To answer this question, we develop an econometric model of viewer's choice of media outlets. In the model, viewers have incomplete information and thus potentially benefit from media reports. This benefit, however, is larger when the ideology of the station

is closer to that of the voter. We then estimate this model using panel data on viewership and ideology before and after the shift in control. Our primary finding is that, after the change in control of the public network from the left to the right, right-leaning viewers become much more likely to watch news on public television channels. Conversely, we find that some left-wing viewers reacted to this change in control by switching from the main public channel to another public channel that was controlled by the left even after the change in government.

Given that: 1) the ideological content of public channels moved to the right but remained to the left of the private channels, and 2) that viewers responded to this change by switching to more like-minded channels, we next examine the net change in the ideological exposure of viewers with differing political ideologies. We find that, while those viewers who continued to watch public channels were eventually exposed to a more right-leaning news coverage, this effect is offset in part by an opposite effect on those viewers who switched channels and ended up being exposed to a more left-leaning coverage. In fact, for one group of viewers we find that, on average, overall ideological exposure was largely unchanged following the shift in control and content to the right.

Finally, we provide five additional pieces evidence on viewer responses. First, we show that results are similar when using a measure of frequency of watching each channel. Second, we investigate second choices by consumers. Third, we show that the relationship between viewer trust in the public network and ideology changed in an analogous manner following the change in government. Fourth, we investigate measures using aggregate ratings of news programs. Finally, we investigate possible substitution between viewership of television news and newspaper readership.

2.2 Literature review

Our paper is related to a literature on the relationship between ideological control of the media and media content. In terms of private media ownership, Besley and Prat (2006) theoretically examine the case for government capture of the media sector in the context of a political agency model. They find that capture is less likely when voters have access to a wide variety of outlets and when ownership is independent in the sense that it is costly for the government to provide transfers to the media. They also find that media capture affects political outcomes. Snyder and Strömberg (2008) empirically examine this relationship between media coverage and political accountability based upon a measure of the geographic congruence between media markets and Congressional districts. Supply-driven media bias can come from factors other than political capture. In a theoretical contribution Baron (2006) studies how media bias can originate from the incentive of career-oriented reporters to write sensationalized stories. In Baron's model profit-maximizing news organizations may tolerate bias if this allow them to hire journalists at lower wages; as a consequence, media bias can persist even in competitive market environments, and, in some case, an increase in the number of independent media outlets can actually increase, rather than reduce, the level of bias.

Several empirical studies provide support for the notion that control of the media matters for media content as well as other outcomes. Djankov et al. (2003) examine control of the media in a variety of countries and find that government control of the broadcast media is pervasive and that this public control is associated with poor government outcomes. Gentzkow et al. (2006) document the movement from a partisan to an informative press in the United States between 1880 and 1920. They argue that this shift is largely driven by reductions in marginal costs of production and the associated increases in readership along with heightened competition in the marketplace. In a case study of coverage of Gary Hart's 1988 Presidential campaign by the newspaper chain Glasser et al. (1989) demonstrate that private group ownership of newspapers led to more uniform coverage across newspapers in

this instance. Pritchard (2002) examines the role of private group ownership of newspapers in the United States on coverage of the 2000 Presidential campaign. Finally, Puglisi and Snyder (2008) find that bias in news coverage of political scandals is related to a newspapers' ideological leaning as measured by editorial endorsements.[2]

An alternative view is that reader preferences are the dominant factor in driving news coverage. Mullainathan and Shleifer (2005) and Gentzkow and Shapiro (2006) formalize this argument and demonstrate that viewers choose media outlets with content conforming to their own ideology. Gentzkow and Shapiro (2010) empirically examine this issue in the U.S. newspaper industry and show that newspaper content is closely related to the prevailing ideology of readers in the marketplace. They argue that reader ideology, rather than private owner ideology, is the key driver of newspaper slant.

2.3 Background on Italian television

The Italian broadcast television industry is composed of two main national networks - one public and one private.[3] The Italian public service broadcaster (RAI) operates three national terrestrial channels: RAI 1, RAI 2 and RAI 3 (labeled respectively P1, P2, and P3 henceforth, where P refers to public). RAI's main competitor is Mediaset, the main Italian commercial television network, founded and controlled by Silvio Berlusconi through his family's holding Fininvest, which also broadcast three national channels: Canale 5, Italia 1, and Rete 4 (respectively B1, B2 and B3 henceforth, where B refers to Berlusconi). Taken together RAI and Mediaset account for approximately 85-90% of the average TV viewership.[4] This high degree of concentration and corresponding lack of pluralism in this

[2]There is also a larger literature on media bias and its effects on voters' behavior. See Groseclose and Milyo (2005), DellaVigna and Kaplan (2007), George and Waldfogel (2006), and Gerber et al. (2009).

[3]Along with a multitude of regional and local channels, there is a smaller national network (La7), which is currently owned by Telecom Italia Media. La7 is fairly small relative to the two other networks and only represents about 3% of the market.

[4]The average daily audience share of RAI and Mediaset combined was 90.4% in 2001, 89.6% in 2002, 89.0% in 2003, 87.5% in 2004, 85.5% in 2005, 83.9% in 2006, and 82.7% in 2007. The data come from Auditel, the research company responsible for television audience measurement in Italy.

market is particularly salient given that television represents the main source of political information for the vast majority of the Italian population.[5]

For several reasons, the relationship between the political system and the media in Italy is particularly close. First, the leader of one of the two main political coalitions is the owner of the top private media conglomerate. This issue has generated debate about both Berlusconi's potential use of the private media for political gain and potential regulation of this conflict of interest. Second, the political majority has substantial influence over public television. During our sample period, the news director of P1 - the most viewed and influential public channel - was replaced following changes in the majority coalition (Table 1).[6] These two issues were particularly salient between 2001 and 2006, when Silvio Berlusconi was also the head of the ruling coalition and hence in a position to exert influence on both private and public television. Despite the undeniable influence of the majority, the opposition is generally granted control of one of the three public channels. During our entire sample period, P3 news remained within the sphere of influence of the left-wing coalition, whereas P2 news directors were closer to the center-right parties.

[5]According to a recent survey by Diamanti et al. (2007), for example, broadcast television represents one of the principle sources of information for 94% of the population. Other surveys present similar results (ISTAT, 2008; CENSIS, 2008). Furthermore, for a significant segment of the population, broadcast television represents the only source of news.

[6]Traditionally, the executive body of the Italian public broadcasting corporation has been representative of the ruling political coalition. RAI is governed by a nine-member administrative council. Seven members are elected by a parliamentary committee while the remaining two, including the president, are nominated by the largest shareholder - the Ministry of Economy and Finance. The council appoints the director-general, the channels' directors, and the directors of each channel news service. The latter are very influential figures since they are responsible for setting the news program editorial line and agenda, therefore influencing which issues or events are covered. These appointments are made according to a long-standing system of political quotas (*lottizzazione*). In fact, most of the time those appointed to these positions can be linked to one political coalition or even to a specific political party according to previous political or professional experience.

2.4 Content analysis

We next investigate the evolution of news coverage of the two major coalitions, the center-right and the center-left.[7] Monthly data on content for the top six national channels are available from the Italian Communications Regulatory Authority (AGCOM) and cover the period between January 2001 and September 2007. These data include measures of both speaking time **-** defined as airtime in which each political actor speaks directly to the public (statements, interviews, etc.) - and news time - defined as airtime devoted to the coverage of issues and/or events related to a political actor.[8]

In constructing our measure of station ideology, we choose to focus on speaking time rather than news time. Unlike news time, which may include both positive and negative reports, speaking time measures the opportunity for a political actor to communicate its views directly to the audience, and can hence be considered a better measure of favorable coverage.[9] To compute the speaking time of a coalition, we aggregate the speaking time devoted to the affiliate parties, and, for the coalition in power, we also include the time assigned to the government (Prime Minister and other members of government) and to the Speakers of the two Houses.[10]

Note that our speaking time measure may still include unfavorable coverage if, for example, Berlusconi's network provides airtime to extreme left parties that are critical of

[7] Over the course of the last decade the Italian political system has been characterized by the presence of these two main political coalitions. Despite considerable within-coalition ideological differences and attrition, these alliances have not experienced major transformations over the period under examination (2001-2007). It seems therefore appropriate for the period under examination to treat these coalitions as the key players in the Italian political arena.

[8] We also developed measures based upon coverage of different issues by channels. This analysis documents that Berlusconi's private channels, relative to the public channels, tended to devote more coverage to issues, such as crime and security, that are commonly considered to be more salient to right-leaning voters. See Durante and Knight (2009) for further details.

[9] Gentzkow and Shapiro (2010) circumvent this problem of negative coverage by measuring ideology via the printing of political phrases in newspapers in the United States. Unfortunately, such a measure is infeasible in the Italian context, since, to the best of our knowledge, there is no systematic database of television news transcripts.

[10] We do not consider the time devoted to the President of the Republic since this figure cannot be associated with any of the coalitions. We also disregard the time devoted to the European Union, and to those parties that are not affiliated with any of the two major coalitions.

the center-left coalition. For this reason, we also present results focusing on the distribution of speaking time among the different members, such as the Prime Minister, within the majority coalition. More generally, the presence of negative coverage should only bias our analysis against the key hypotheses since right-leaning channels may tend to air positive coverage of the center-right coalition but negative coverage of the center-left coalition and likewise for left-leaning channels.

We begin by developing an absolute, but time-invariant, measure of station ideology. In particular, we examine how speaking time on each station is distributed between the majority and the opposition over this period. This measure of station ideology is based upon a test for symmetry. If a channel provides equal coverage of the right when the right is in power and the left when the left is in power, we conclude that this channel is unbiased, and deviations from symmetry provide evidence of bias.

As shown in Figure 2.1a, the right receives more extensive coverage on Berlusconi's channels than does the left, even when the latter is in power. Thus, we find evidence that Berlusconi's network is biased to the right. The same pattern does not apply to public channels (Figure 2.1b) which, on aggregate, devote a fairly stable fraction of time to the majority, regardless of who is in power. With regard to differences between Mediaset channels (Figure 2.2), while news coverage on B2 and B3 is more favorable to the right throughout the entire period, B1 covers the two coalitions in a rather more balanced way, devoting more time to the left when this is in power. Nevertheless, on B1, the gap between the majority and the opposition is also much larger when Berlusconi is in power. Turning to public television (Figure 2.3), all three channels devote on average a larger fraction of time to the ruling coalition. However, on P2 the gap between majority and opposition is larger during Berlusconi's government, while the opposite is true for P3, which provides particularly favorable coverage of the left-wing coalition when it is in the opposition. P1 is characterized by the most regular pattern. Over the period analyzed, in fact, time is distributed in a fairly stable fashion between majority and opposition.

To further test these patterns we regress the share of total speaking time devoted to the majority on group dummies and interaction terms with a dummy for Berlusconi being in power.[11] The coefficient on this interaction term provides a summary measure of the degree of bias to the right. As shown in column 1 of Table 2.2, the coefficient on the interaction term for Berlusconi's channels is large, positive and statistically significant, confirming a much more favorable coverage of the majority when the right is in power.[12] As depicted in column 2, this result is more pronounced for B2 and B3, but the difference is also large and significant for B1. Turning to public channels, the coefficient on the interaction term for P2 is positive and significant, confirming a clear bias in favor of the right-wing coalition. In contrast, coverage on P3 is more favorable to the left-wing majority than to the right-wing majority. Finally, P1 slightly favors the right coalition.

This measure of station ideology is based upon the assumption that an unbiased station provides equal coverage to the majority regardless of which coalition is in power. Even without this assumption, however, one can compare coverage across stations in order to measure the relative positions of the stations on the ideological spectrum. According to this comparison, which is based upon the coefficients on the interactions terms in column 2 of Table 2.2, we can order the stations from left to right as follows: P3, P1, P2, B1, B2, and B3. Thus, the public stations all lie to the left of the private stations, and the public station controlled by the left throughout the sample (P3) is the furthest to the left of the three.

One limitation of these measures of station ideology is that they do not account for changes over time in the party controlling the main public channel (P1), which will be the key source of variation in the behavioral responses section to follow. To examine the role of changes in control, we next develop a time-varying, but relative, measure of station

[11] Some members of the majority coalition may be particularly exposed to the media during certain periods of the year (e.g. the Ministry of Economy during the discussion of the budget law). To control for possible seasonal variations in the coverage of the majority, regressions in Tables 2.2 and 2.3 include calendar month fixed effects.

[12] Standard errors are corrected for possible correlation over time via GLS estimation assuming autocorrelation (AR1) within channel*time period (before, during, and after Berlusconi's government) groups. Note that this procedure is related to, but different from, clustering based upon these groups; this clustering procedure tended to generate uniformly lower standard errors.

ideology. This measure gauges the change in content on the public network following changes in ideological control, relative to the change in content on the private network, which was controlled by Berlusconi for the entire sample.

In order to implement this relative measure, we use the fraction of speaking time devoted to the right party rather than the fraction of speaking time devoted to the majority. We again regress speaking time on group dummies and on interaction terms with a dummy for Berlusconi being in power. The coefficient on this interaction term provides a measure of how each channel shifted their coverage of the right after Berlusconi's party is in control. We omit the key coefficients for one channel, and all results should be interpreted as relative to this omitted category. Thus, this measure captures changes in the relative positions of stations on the ideological spectrum but cannot measure whether a particular station or the sector as a whole is biased to the left or to the right.

As shown in column 3, we find that the private network devoted less coverage to the right, relative to the public network, during the period in which Berlusconi was in government and hence controlled the public network. This finding is consistent with the idea that the public network shifted to the right when Berlusconi was in power. This effect, however, is small and statistically insignificant, perhaps reflecting the fact that the news director changes with the government in only one of three public channels (P1). We next examine more fully this heterogeneity in coverage within the public and private networks. As shown in column 4 of Table 2.2, where channel P1 is the omitted category, we find that, relative to each of the five other channels, the main public network (P1) moved to the right during the period in which the center-right was in control. These results are statistically significant for channel P1 relative to channels B3 and P3. In terms of comparing P1 and the Mediaset channels (B1, B2, and B3), we can say that P1 remained to the left of the Mediaset channels in all periods but that these ideological differences between the two were smaller when the right was in power.[13] In terms of comparing P3 and P1, we conclude that

[13] In fact, some commentators suggested that news content on P1 might have become even more pro-Berlusconi than on B1. This impression, however, was not based on a systematic comparison of political

P1 was to the right of P3 in all periods and that these ideological differences between the two were larger when the right was in power. Taken together, these results document that P1 was a less extreme version of P3 when the left was in power and a less extreme version of the Mediaset channels when the right was in power.

While our interpretation is that these changes in content were due to changes in control of the public channel, there are other possible explanations for this result. If media outlets favor the party that is more popular among voters, as documented by Gentzkow and Shapiro (2010), then coverage of the majority may be higher than the minority for this reason since majority status necessarily reflects the preferences of voters for this party. If this demand-side view applies to both the public and private networks, however, it would not explain why content on the public shifts to the right relative to the private. On the other hand, it is possible that Berlusconi's private network was already so biased to the right that there was little capacity for increased coverage of the right when Berlusconi was in power. This capacity issue would not explain, however, the variation within the public channels and why, in particular, P1 shifts to the right, relative to P3, which was always controlled by the center-left and had plenty of capacity for additional coverage of the right. Of course, we cannot rule out an alternative explanation in which P1 is simply more responsive to viewer preferences than other channels. This duly noted, we see no reason why P1 would differentially respond in this manner, and thus view changes in partisan control of media as the most likely explanation for changes in the pattern of coverage.

Returning to our measure based upon speaking time devoted to the majority, another question of interest is how this time is distributed among different members of the ruling coalition and whether the distribution changes depending on who is in power. As shown in Table 2.3, when Berlusconi is in power his channels tend to cover the government dis-

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coverage on the two news channels, but rather on anecdotal evidence of P1's patently unbalanced coverage of particular political events. One notable example was P1's decision of not broadcasting the EU Parliament session in which prime minister Berlusconi replied to Mr. Martin Schulz - a German MEP who had criticized Berlusconi's domestic policy - by comparing him to a Nazi concentration camp guard, an episode which was instead broadcast on B1's news programs.

proportionately more. Interestingly, this result is mostly driven by a steady increase in the coverage of the Prime Minister himself, rather than coverage of others in governments, majority parties, and MPs, and Speakers. For the public channels, by contrast, we find little increase in coverage of the Prime Minister when right is in power.

In summary, we have found that the Italian television market for news appears to be segmented along different lines. Overall, Berlusconi's channels provide a more favorable coverage of the right-wing coalition relative to public channels. We also find evidence of substantial heterogeneity within Berlusconi's channels with B2 and B3 offering a more unbalanced coverage than B1. We find significant heterogeneity within the public channels with P2 leaning towards the right and P3 toward the left. P1, by contrast, is not characterized by a particular left-right bias and generally favors the ruling coalition over the opposition, regardless of the color of the majority.

2.5 Theoretical framework

In this section, we examine how viewers altered their viewing habits in response to the changes in media ownership and content documented above. We begin by deriving a theoretical model of consumer choice of media outlets. The model is based upon a media sector that provides potentially valuable information to imperfectly informed consumers. We then use the theoretical model to generate an empirical specification of the choice of media outlet by viewers of differing ideologies.

2.5.1 Preliminaries

Society must choose between two policy alternatives ($p \in \{L, R\}$). These options could be interpreted in a variety of ways, including an election featuring two parties, a decision over whether to go to war, or proposed changes to immigration policy. There is a set of individual voters, indexed by v, and a set of news stations, indexed by s. Voter's payoffs

from each policy option depend upon two factors. First, each voter's judgment of the policy options is affected by a certain ideological position. Thus, left-leaning voters are predisposed to the left-wing option and likewise for right-wing voters. In addition to this ideological dimension, we assume that there is a payoff that is common to all voters. We refer to this payoff as the quality of the policy option, and the options thus can be interpreted as 'good policy' or 'bad policy'. In the electoral context, this quality dimension can be interpreted as the experience or integrity of the candidates. In the conflict context, the common payoff would depend upon the degree of the threat posed by the hostile nation.

More formally, we assume that voter v receives the following payoff from policy option p:

$$U_{vp} = q_p - \tau(i_v - i_p)^2 \tag{2.1}$$

where q_p represents the quality of p, i_v represents voter ideology, i_p represents the policy's position in the ideological spectrum, and τ represents the relative importance of the ideological dimension. We assume that $i_L < i_R$ so that increases in ideology are associated with movements to the right. Defining relative utility as $\Delta_v = U_{vL} - U_{vR}$, we have that:

$$\Delta_v = q + \alpha - \beta i_v \tag{2.2}$$

where $q = q_L - q_R$ represents relative quality, $\alpha = \tau(i_R^2 - i_L^2)$ is a constant, and $\beta = 2\tau(i_R - i_L)$ represents the coefficient on voter ideology.

We assume that voters know the ideological positions of the policy options (i_L, i_R) but are uncertain over quality. Priors over relative quality $(q = q_L - q_R)$ are unbiased and normally distributed with variance σ_q^2. Voters potentially observe a news report (n_s) from station s. Before observing any news, voter v supports L if his ideology is below a threshold:

$$E(\Delta_v) > 0 \Leftrightarrow i_v < \frac{\alpha}{\beta} \tag{2.3}$$

After observing a report, voter v supports L if his ideology is below a quality-adjusted threshold:

$$E(\Delta_v|n_s) > 0 \Leftrightarrow i_v < \frac{\alpha + E(q|n_s)}{\beta} \tag{2.4}$$

Thus, if voters update favorably with respect to L upon observing report n_s, then $E(q|n_s) > 0$, and the threshold thus shifts to the right. This convinces some voters who supported R ex-ante to now support L. Similarly, if voters update favorably with respect to R, then $E(q|n_s) < 0$, and the threshold thus shifts to the left. In order to understand how voters update their beliefs following news reports, we next present a framework for news station coverage choices.

Similarly to voters, stations can be characterized by their ideology (i_s). We take station ideology as exogenous and assume that it reflects the political preferences of the owner.[14] News stations are assumed to have better information than voters about the quality of the policy options and may provide valuable guidance. In particular, we assume that station s receives an unbiased signal over the relative quality of the two options:

$$\theta_s = q + \varepsilon_s \tag{2.5}$$

where ε_s is the noise in the signal and is assumed to be normally distributed with mean zero and variance σ_ε^2. Given this information, stations update over quality as follows:

$$E(q|\theta_s) = \omega\theta_s \tag{2.6}$$

where the weight on the signal is given by $\omega = \sigma_q^2/(\sigma_q^2 + \sigma_\varepsilon^2)$.

[14]For several reasons, we have abstracted from endogenous station ideology. First, in a model with endogenous ideology, one would have to make assumptions regarding the objectives of the different stations. In our context, with a private media owned by a political leader and the public media controlled by the majority party but financed heavily through advertising revenues, objectives may involve a mix of ideological and profit motives and also differ across channels. In addition, our context involves 6 channels, whereas most tractable models with an endogenous supply of slant, such as Mullainathan and Shleifer (2005), focus on the case of monopoly or duopoly. Gentzkow and Shapiro (2006) allow for more than two firms but assume that, from the perspective of consumers, newspapers are ex-ante identical.

Following the literature, we assume that news reports are 'coarse' in the sense that news organizations cannot feasibly provide all of their information gathered during their investigations in a single news report.[15] As a simplification of this idea that news reports are coarse, we assume that news stations provide binary reports, which are favorable to one of the two policy options. That is, voters observe a news report from station n favoring either the left policy option ($n_s = L$) or favoring the right option ($n_s = R$).

Given these assumptions, station s thus provides a report supportive of L if the signal exceeds a station-specific threshold:

$$n_s = L \text{ if } \theta_s \geq \frac{\beta i_s - \alpha}{\omega} \tag{2.7}$$

where the threshold is increasing in the ideology of the owner. If the signal does not exceed this threshold, the station provides a report supportive of R.

2.5.2 Value of an informative media

Readers attempt to learn about quality from these news reports but this inference is potentially complicated by the ideological position of stations. The value of information from station s thus depends upon the preferences of the voter. For a left-leaning voter $[\alpha - \beta i_v > 0]$, the value of information (W) is the possibility of a report favoring R:

$$W = \Pr(R)E(-\Delta_v | n_s = R) \tag{2.8}$$

Using the properties of the censored normal distribution, this value can be re-written as follows:

$$W = \Phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right)(\beta i_v - \alpha) + \sqrt{\omega}\sigma_q \phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right) \tag{2.9}$$

[15] See, for example, Suen (2004) and Baron (2006).

The first term is negative and represents the cost of voting against one's prior. The second term is positive and represents the value of information. This second term is maximized at $i_s = \alpha/\beta$, which can be interpreted as the ideology of an unbiased station, and is thus declining in the degree of bias. For a right-leaning voter [$\alpha - \beta i_v < 0$], the value of information is the possibility of a report favoring L:

$$\begin{aligned} W &= \Pr(L)E(\Delta_v|n_s = L) \\ &= \left[1 - \Phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right)\right](\alpha - \beta i_v) + \sqrt{\omega}\sigma_q \phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right) \end{aligned} \tag{2.10}$$

Combining these two measures into a single expression for the value of news to consumers, we have that:

$$W = \min(\alpha - \beta i_v, 0) + \Phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right)(\beta i_v - \alpha) + \sqrt{\omega}\sigma_q \phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right) \tag{2.11}$$

The first and second terms combined are negative for both left-leaning and right-leaning voters and again represent the cost associated with voting against one's prior. The final term, by contrast, is positive and represents the value of information to the voter. We next use this derived value of an informative media in order to understand the choice of news stations by viewers of differing ideologies.

2.5.3 Analysis of choice of outlet

As a benchmark, consider the case in which voters with differing ideologies can directly choose the ideology of the station (i_s^*). Using the fact that $\phi'(z) = -z\,\phi(z)$, we can show that the relevant first-order condition is given by:

$$\frac{\partial W}{\partial i_s} = \phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right)\left(\frac{i_v - i_s}{\sqrt{\omega}\sigma_q}\right) = 0 \tag{2.12}$$

Thus, readers prefer a station with ideology equal to their own ($i_s^* = i_v$). This result is similar to Suen (2004), who examined a similar model but with binary signals and binary payoffs.

As a first step towards generating an empirical specification of the choice of media outlets, suppose next that voters cannot choose station ideology directly. Instead, each chooses to watch one station from a limited menu of $S+1$ outlets, which are indexed by $s = \{0,1,2,...,S\}$. In order to make this choice probabilistic, we next assume that, in addition to the deterministic payoff in equation 11, voter v receives an idiosyncratic payoff from station s equal to ε_{vs}. We can then write the payoff to voter v from watching station s as follows:

$$W_{vs} = \theta_v + \theta_s + \lambda_s i_v + \varepsilon_{vs} \tag{2.13}$$

where $\theta_v = \min(\alpha - \beta i_v, 0)$, $\theta_s = \sqrt{\omega}\sigma_q \phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right) - \alpha\Phi\left(\frac{\beta i_s - \alpha}{\sqrt{\omega}\sigma_q}\right)$, and $\lambda_s = \beta\Phi\left(\frac{i_s - \mu}{\sqrt{\alpha}\sigma_q}\right)$. Thus, the station-specific coefficient on voter ideology (λ_s) is related to the ideological leanings of the network. Assuming that ε_{vs} is distributed type-I extreme value and normalizing the payoff from station 0 to equal zero, viewership probabilities are given by:

$$\Pr(v \text{ chooses } s) = \frac{\exp(\theta_s + \lambda_s i_v)}{1 + \sum_{t=1}^{S} \exp(\theta_t + \lambda_t i_v)} \tag{2.14}$$

Thus, a multinomial logit model of the choice of station by viewers of differing ideology allows for identification of the channel-specific parameters (λ_s), which, as shown above, are closely related to the ideology of the station owner.

2.6 Empirical analysis

In this section, we estimate a model of the individual choice of channel before and after the 2001 change in government. This model suggests that viewers may migrate to like-minded

outlets following a change in control of the government from center-left to center-right. Given the findings of the content analysis, we hypothesize that left-leaning voters may switch from channel $P1$ to channel $P3$. Correspondingly, we hypothesize that right-leaning voters may move from the private network to channel $P1$.

2.6.1 Primary switching measures

To test these hypotheses, we use survey data on political attitudes and electoral behavior from the Italian National Election Study series (ITANES), which includes a set of novel questions on individual media and news consumption.[16] A complete description of the questions used is provided in Appendix B. Following the national elections on May 13, 2001, the first wave was conducted between May 18 and June 15 and involved 3209 individuals. 1882 of these (58.6% of the original sample) were re-interviewed in the second wave, which was conducted between April and June of 2004. Note that the first wave was conducted right after the election but that almost all of the interviews were completed before the change in government, which occurred on June 11, 2001. Thus, the first and second waves can be interpreted as periods in which the left and right, respectively, controlled the main public channel $P1$.

Before turning to the econometric results, we first present trends in viewership between 2001 and 2004 for viewers of differing ideologies. As shown in Figure 2.4, there was no reduction among left-leaning viewers, defined as those with self-reported political ideology equal to 1 or 2 on a 5-point scale in 2001, in the propensity to view news on channel B1, which remained low in both periods. There is a noticeable increase, however, in viewership of channel P3, which was controlled by the center-left coalition both before and after the

[16]The Italian National Election Study (ITANES) is a long-term research project on electoral behavior established in the early nineties by the Istituto Carlo Cattaneo Research Foundation (www.cattaneo.org). Several pre- and post-electoral survey studies have been conducted in the context of the ITANES project over the course of the last fourteen years (1994, 1996, 2001, and 2006). In many aspects the questions included in the ITANES surveys are analogous to those used in the surveys of the American National Election Study (ANES).

elections. This increase was associated primarily with a reduction in viewership of channel P1. This switch from P1 to P3 is striking given that these two news programs are broadcast at different times, and these viewers must thus alter their viewing schedule in order to accommodate this change.[17] Among centrists, defined as those with political ideology equal to 3 on a 5-point scale, there was a small increase in viewership of channel P3 news. The more prevalent factor, however, is a significant shift in viewership away from channel B1, the most popular channel of the private network, to channel P1, the most popular channel of the public network. As shown in the bottom panel, the shift from channel B1 to channel P1 is even stronger among right-wing voters, defined as those with a self-reported political ideology equal to 4 or 5 on a 5-point scale. Taken together, these results suggest that right-leaning viewers responded to the shift in control and content of channel P1 to the right by increasing their consumption of this channel, while left-leaning viewers responded by increasing their propensity to consume news from the left-leaning channel P3.

We investigate these patterns more completely by estimating an econometric model of viewer choice of news channel. We start with a simple analysis of the choice between public and private channels in which public is the omitted category. As shown in the first column of Table 2.4, as voter ideology moves to the right, viewers are more likely to watch private channels, relative to public channels, prior to Berlusconi coming to power. More interestingly, however, is the coefficient on the interaction between voter ideology and 2004, during which Berlusconi controls the public network. As shown, right-wing viewers, relative to left-wing viewers, are more likely to watch public channels, relative to private channels, after Berlusconi assumes power.

We next extend the analysis to investigate potential heterogeneity within the public and private networks. In particular, the final five columns of Table 2.4 presents results from a multinomial logit choice model in which channel P1, which has the largest viewership of

[17]The following are the broadcasting time for the main news programs on the six national channels. P1 (TG1): 1:30 pm and 8 pm; P2 (TG2) 1:30 pm and 8:30 pm; P3 (TG3) 2:20 pm and 7 pm; B1 (TG5) 1 pm and 8 pm; B2 (Studio Aperto) 12.25 pm and 6:30 pm; B3 (TG4) 1:30 pm and 6:55 pm.

the public channels in both periods and whose control shifted from the center-left to the center-right, is the omitted category. Thus, these results can be interpreted as relative to P1. As shown, right-wing voters were much more likely to watch any of the private channels relative to channel P1 prior to Berlusconi taking control of the public channels. Within the public channels, left-wing voters were more likely to watch P3 than P1 even prior to Berlusconi taking control. Most interestingly, however, is the interaction between viewer ideology and Berlusconi controlling the public channels. As shown, the ideological gap between B1 and P1 shrinks, but remains positive, after Berlusconi takes control of P1. The ideological gap between P1 and P3, however, increases as P1 becomes less of a substitute for P3 among left-leaning viewers. Taken together, these results are consistent with the content analysis, which demonstrated that channel P1 was a less-extreme version of P3 when under center-left control but was a less-extreme version of the Mediaset channels when under center-right control.

2.6.2 Offset measures

Taken together, the above results provide significant evidence that viewers responded to the changes in content by shifting to channels with ideological content similar to their own ideology. Importantly, however, both the content analysis and this revealed preference analysis suggest that the ideology of channel P1, the public channel controlled by the center-right in 2004, remained to the left of the private channels even after the change in control. These results, combined with the shifting of right-wing viewers to channel P1 and the shifting of left-wing viewers to P3, suggests that the ideological exposure of some viewers actually moved to the *left* following the shift in public control and content to the *right*. This behavioral response and the associated unanticipated effect of exposure moving to the left may offset, partially or even fully, the direct effect of moving ideological content to the right following the change in partisan control of the public media.

To explore this issue more formally, we define expected ideological consumption for

voter v at time t as follows:

$$E(C_{v,t}) = \sum_{s=0}^{S} \Pr(v \text{ chooses } s \text{ at time } t) \times \Pr(s \text{ reports } R \text{ at time } t) \tag{2.15}$$

Thus, holding viewership probabilities fixed, increases in right-leaning content are associated with increases in expected ideological consumption. In order to motivate our offset measure, we next define the actual change in ideological consumption (δ) and the change in ideological consumption had viewers not switched ($\delta_{\text{no switch}}$) as follows:

$$\delta = E(C_{v,2004}) - E(C_{v,2001}) \tag{2.16}$$

$$\delta_{\text{no switch}} = E(C_{v,2004}^{\text{no switch}}) - E(C_{v,2001}) \tag{2.17}$$

where $\text{E}(C_{v,2004}^{\text{no switch}})$ uses 2004 station ideology but 2001 choice probabilities. That is,

$$E(C_{v,2004}^{\text{no switch}}) = \sum_{s=0}^{S} \Pr(v \text{ chooses } s \text{ at time } t = 2001) \times \Pr(s \text{ reports } R \text{ at time } t = 2004) \tag{2.18}$$

Finally, percent offset, which is defined by the fraction of the potential change in ideological consumption that is offset by consumer behavioral responses, is given as follows:

$$O_v = \frac{\delta_{\text{no switch}} - \delta}{\delta_{\text{no switch}}} \tag{2.19}$$

To interpret this percent offset measure, consider two extreme cases. First, if there is no behavioral response to changes in station ideology, then $E(C_{v,2004}) = E(C_{v,2004}^{\text{no switch}})$ and therefore $\delta_{\text{no switch}} = \delta$. Thus, in this case with no behavioral response we have that $O_v = 0$. On the other hand, if the behavioral response is complete in the sense that ideological exposure does not change, then $E(C_{v,2004}) = E(C_{v,2001})$ and therefore $\delta = 0$. Thus, in this case we have that $O_v = 1$.

In terms of measuring $E(C_{v,t})$, we use 2001 and 2004 predicted probabilities from the

multinomial logit in order to estimate viewership probabilities for each channel for voters of differing ideologies. Also, using the fact that $\Pr(s \text{ reports } R) = \Phi\left(\frac{i_s-\mu}{\sqrt{\alpha}\sigma_q}\right) = \lambda_s/\beta$ in the theoretical model above, we can estimate reporting probabilities up to a scale by the channel-specific coefficients from the multinomial logit.[18]

Figure 2.5 provides the results from this analysis separately by viewer ideology. As shown, the offset is sizable for left-wing viewers, reflecting the shift from P1 to P3 for many of these viewers. While significant, the offset is incomplete since many left-wing viewers continued to watch P1 in 2004 and were hence exposed to a more right-leaning coverage. The percent offset, by contrast, is small for center-left voters. This reflects the fact that fewer of these viewers shifted from P1 to P3. Comparing center-left to center, however, the percent offset increases, reflecting the fact that more of these viewers were watching B1 prior to Berlusconi taking power and switched to P1 in 2004, when Berlusconi was in power. For center-right and right-wing voters, the effects associated with the shift from B1 to P1 are very significant. For the extreme right, this shift almost completely offset the change in content on channel P1. In addition to the shifting from B1 to P1, this large offset also reflects the fact that relatively few of these viewers were watching P1 prior to Berlusconi coming to power and thus the direct effect of moving content to the right was relatively small.

2.6.3 Additional evidence on switching

We next provide five additional pieces of evidence on patterns of news consumption and their relation to political ideology. The first analysis uses information from additional survey questions regarding how often viewers watch each of the six channels. For each channel, possible responses include never or almost never, rarely, fairly often, and very often. We did not focus on this measure in our baseline analysis since the question is not focused on news programming specifically and thus incorporates both news and non-news

[18]This scaling parameter β disappears when computing our percentage offset measures given by O_v.

consumption. Under the assumption that non-news consumption is unaffected by changes in the political majority, however, we would expect to see patterns using these measures that are similar to those in our baseline analysis of favorite news program. As shown in Table 2.5, the results from an ordered Probit model demonstrate that movements to the right in viewer ideology are associated with a statistically significant increase in viewership of P1 when Berlusconi was in power in 2004, relative to 2001. For the other channels, by contrast, we find no statistically significant differences in consumption between 2001 and 2004 for viewers of differing political ideologies. Taken together, these results using overall consumption of channels is consistent with the baseline analysis of favorite news program, which demonstrated that right-leaning viewers substituted towards P1 and left-leaning viewers substituted away from P1 following the shift in majority from the left to the right.

Second, we investigate measures of second choices in news programming. While our baseline analysis focused on favorites, or first choices, the survey also included responses on second choices for 2,660 out of the 2,756 observations. Using both pieces of information, we consider first and second choices as a bundle of information consumed by viewers and conduct of multinomial logit analysis of the choice of this bundle. Since some combinations of first and second choices, especially those involving the smaller Mediaset channels B2 and B3, were quite rare, we combine the three Mediaset channels into one (B) for the purposes of this analysis. For consistency with our baseline analysis, we choose P1 as the first choice in the omitted category. For the second choice, we choose private channels (B) since this was the most popular among the possible second choices to P1. As shown in Table 2.6, relative to this (P1, B) bundle, we find that right-leaning viewers were less likely to consume the bundles (B, P1) and (B, P2) when Berlusconi was in power in 2004. Thus, while many right-leaning viewers reduced their consumption of Mediaset channels as a first choice after Berlusconi came to power, many of these switched to Mediaset in terms of their second choice. We also find that right-leaning viewers were more likely to

consume the bundle (P1, B) than to watch two Mediaset channels (B, B) in 2004. Finally, the negative coefficient on the key measure 2004*Political Ideology for the bundle (P3, B) is consistent with left-leaning viewers switching to this bundle, relative to the bundle (P1, B), after Berlusconi came to power. These viewers may prefer to have access to a variety of views across the political spectrum and to also have a mix of both public and private news.

Third, we analyze questions in the survey regarding media credibility and trust in the media. In particular, we investigate the relationship between political ideology in 2001 and trust in public and private television in both 2001 and 2004. As shown in the top panel of Figure 2.6, trust in public television is higher prior to Berlusconi coming to power than in 2004 among left-of-center voters. For centrist viewers, trust is public television is similar under both governments. For right-of-center voters, by contrast, trust in public television is higher when Berlusconi is in power in 2004. These patterns are consistent with the content analysis, which documented a shift to the right in public news content under Berlusconi, and with the analysis of favorite news program, which documented an increase in public viewership among right-leaning viewers following the change in government. As shown in the bottom panel, overall trust in Berlusconi's channels fell after Berlusconi took power. The relationship between ideology and trust in Berlusconi's channels, however, was relatively stable during these two periods, with trust increasing as ideology moves to the right. If anything, the documented decline in trust was strongest among right-leaning voters.

To test for the statistical significance of these results, Table 2.7 provides results from a regression of trust on political ideology in which the coefficient is allowed to vary between 2001 and 2004. As shown in the first column, trust in the public channels is decreasing in ideology prior to Berlusconi coming to power but this effect disappears in 2004, a period in which there was little or no relationship between trust in the media and political ideology. As shown in the second column, the interaction between political ideology and trust in the private channels is positive under both center-left and center-right governments. Finally, the

third column demonstrates that trust in public, relative to private, increased significantly for right-leaning viewers, relative to left-leaning viewers. Taken together, these results on trust help to explain why viewers of differing ideology switched their choice of favorite channel after Berlusconi won the election and hence provide evidence on a potential mechanism underlying the baseline results.

Fourth, we use data on aggregate viewership. These are available from AUDITEL, the research company responsible for television audience measurement in Italy, on a monthly basis between 2001 and 2007 and report the average daily number of viewers for each national news program.[19] For the purposes of our analysis, we compute the news market shares by dividing the average number of viewers of each news program in a given month by the average number of viewers across all news programs in that month.[20] Our baseline analysis of favorite news program suggests that viewership of the left-leaning public channel (P3) should increase when Berlusconi is in power and that viewership of Mediaset channels should decrease. We have no clear prediction with respect to the main public channel (P1) since left-leaning viewers are less likely to watch and right-leaning viewers are more likely to watch when Berlusconi is in power. As shown in Table 2.8, we do find support for the first prediction as viewership of P3 increases in a statistically significant manner when Berlusconi is in power. We do not find support, however, for the second prediction since viewership of the Mediaset channels B1-B3 does not decrease when Berlusconi is in power. There are several possible interpretations for this discrepancy between these results and our baseline analysis of favorite news program. First, as documented in Table 2.6, many right-leaning viewers may have continued to watch Mediaset as a second choice when Berlusconi was in power in 2004 even though they switched to P1 in terms of a favorite, or first choice. In this case, overall viewership of Berlusconi's channel may not

[19]Esteves-Sorenson (2009) uses micro-level AUDITEL data to document significant inertia in television viewing in Italy.

[20]The original data also included market shares but calculated over the total number of TV viewers (of both news and non-news programs). These do not correspond to shares of news viewers since news programs are broadcast at different times. Since changes in the non-news offerings on other stations may affect these shares, we create our own shares based upon the total number of viewers of news programs.

decline. Second, it could be that there were other changes when Berlusconi was in power. Given the use of individual-level panel data, our baseline analysis of first choices allows us to hold everything other than station ideology, such as viewer ideology, constant. This test based upon aggregate data, by contrast, is valid only if nothing other than station ideology changed during this period. If viewers tended to become more conservative, for example, when Berlusconi was in power, this could explain why we do not detect a decrease in Mediaset viewership in the aggregate data.

Finally, we investigate a variety of issues involving readership of newspapers, a key alternative source of information for voters. The first issue relates to substitution between television and newspapers. In particular, if these media sources are substitutes, then left-leaning voters may be more likely to access the newspaper for information after the movement of the main public channel (P1) to the right. To investigate this hypothesis, we use responses to a binary survey question on whether or not individuals report that they usually read the newspaper. As shown in Table 2.9, we find no evidence of such substitution as the coefficient on the interaction between 2001 ideology and the year 2004 dummy, which indicates the Berlusconi-led government, is statistically insignificant. We also investigate readership of *La Repubblica*, a key critic of Berlusconi, based upon whether respondents list this paper as their favorite among newspapers. Again, if television and newspapers are substitutes, then we would expect readership of *La Repubblica* to increase among left-leaning individuals when the main public channel (P1) is controlled by the right. While we do find that left-leaning voters are more likely to read this paper in general, we find no evidence of any change in this relationship between these two time periods. Finally, we examine a more comprehensive set of newspapers, which we code according to the ideology of their political leanings (left, center-left, center, center-right, and right).[21] As shown, we

[21]To define the political leaning of a newspaper we looked at whether: a) it is or has been formally affiliated with one political party; or, b) it is controlled by Berlusconi or by his family members. For those newspapers not affiliated with a party or controlled by Berlusconi, we base our categorization on how critically (or favorably) they have covered the Berlusconi government over the years. Based on these criteria, we coded the newspapers as follows: *Liberazione* (left), *Il Manifesto* (left), *L'Unità* (left), *La Repubblica* (center-left), *Il Corriere della Sera* (center), *La Stampa* (center), *Il Messaggero* (center), *Il Sole 24 Ore* (center), *La Padania*

again find a strong correlation between newspaper ideology and reader ideology but, unlike our analyses of television consumption, no change in this relationship between these two time periods. Taken together, this analysis of newspaper consumption provides no evidence of substitution between the newspaper and television markets.

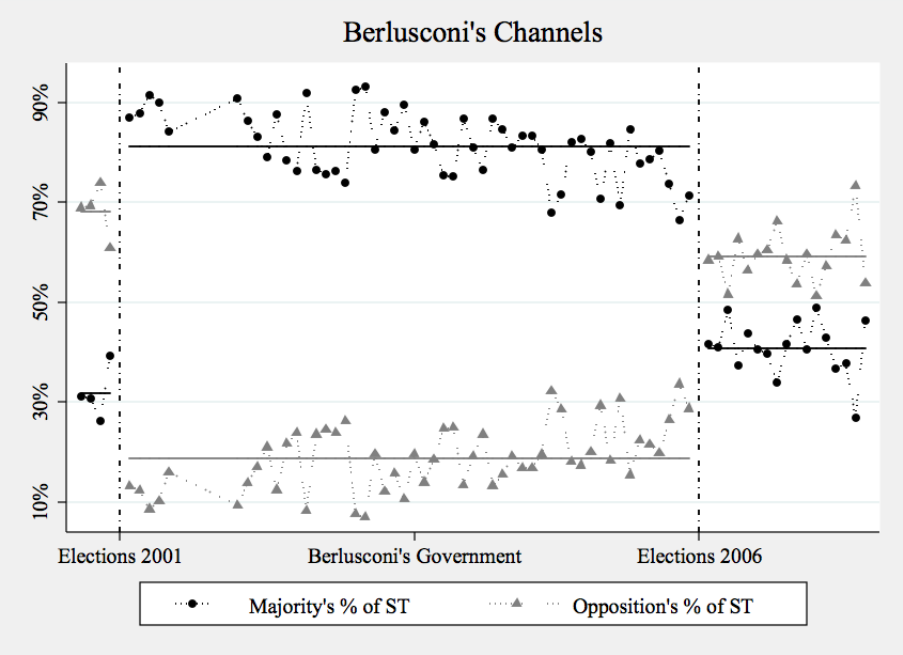
2.7 Conclusion

This paper investigates partisan control of the media in the context of Berlusconi's Italy. We find that a shift in control of the public media from the center-left coalition to the center-right coalition led to a shift in ideological content, as expressed in speaking time devoted to politicians from different parties, from the left to the right. We also find that viewers responded to these changes. Most importantly, many viewers changed their choice of favorite news program in response. Right-wing viewers switched to public television, which moved to the right despite remaining to the left of private television in terms of ideological content. Some left-wing viewers, by contrast, abandoned the majority-controlled channel P1 and switched to the left-leaning channel P3. This switching partially offset the change in ideology of the public stations, and the ideological consumption of news thus did not move as far to the right as it would have in the absence of these viewer responses. Taken together, these results demonstrate that partisan control of the media does lead to biased coverage but that viewers are sufficiently sophisticated that they respond to these changes and thereby offset, at least in part, the direct effect of the manipulation of the news by the majority party. Furthermore, since viewers' capacity to respond to media bias is limited by the number of independent outlets in the market, our results suggest another way through which increased competition in the media industry can enhance welfare and make media capture less effective.

(center-right), *Libero* (center-right), *Il Foglio* (center-right), *Il Secolo d'Italia* (right). As a further check, we replicated our analysis coding the newspapers in three ideological categories (left, center, right); when doing so we obtain very similar results.

Given our focus on the Italian media, a key question involves the generalizability of our results. Our finding that consumers switch to like-minded outlets in the face of changes in control of the media will only apply to situations in which consumers have access to a variety of outlets. In U.S. newspaper markets, for example, consumers often have no alternatives to the local monopoly newspaper. With the advent of the internet, however, consumers have access to much greater choice of media outlets across the ideological spectrum. A related issue involves the structure of Italian television, in which public television is controlled by the majority party and private television is controlled by the leader of the center-right coalition. While seemingly unique, this situation is in fact quite common across countries, with the rule, rather than the exception, being government control and private ownership by families closely linked to politics (Djankov et al., 2003). Thus, while our empirical results are derived specifically from Italian data, the lessons to be learned from these findings are more general.

Figure 2.1: Majority vs. Opposition Share of Total Speaking Time by Group



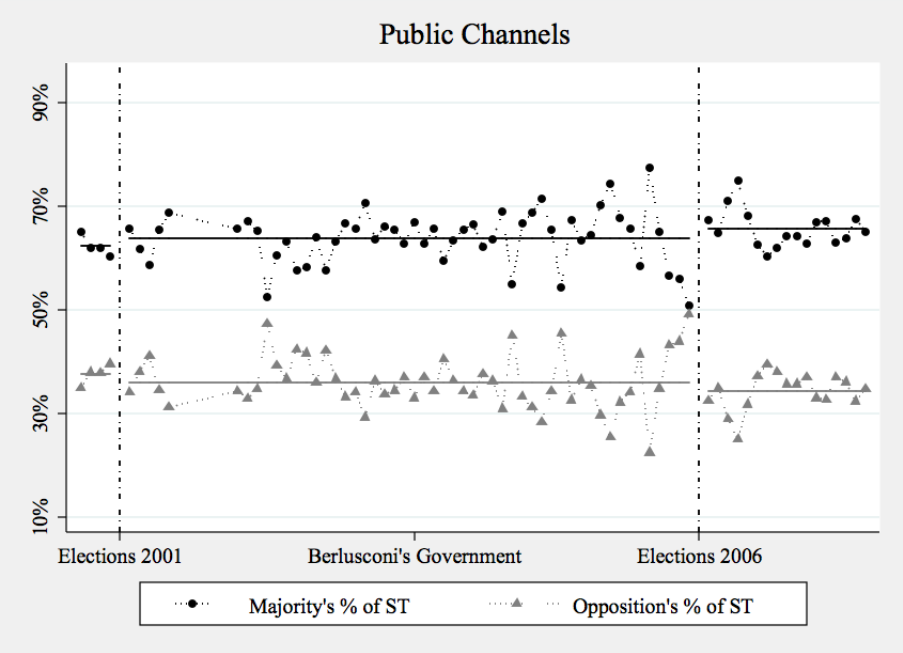


Figure 2.2: Majority vs. Opposition Share of Total ST by Channel (Mediaset)

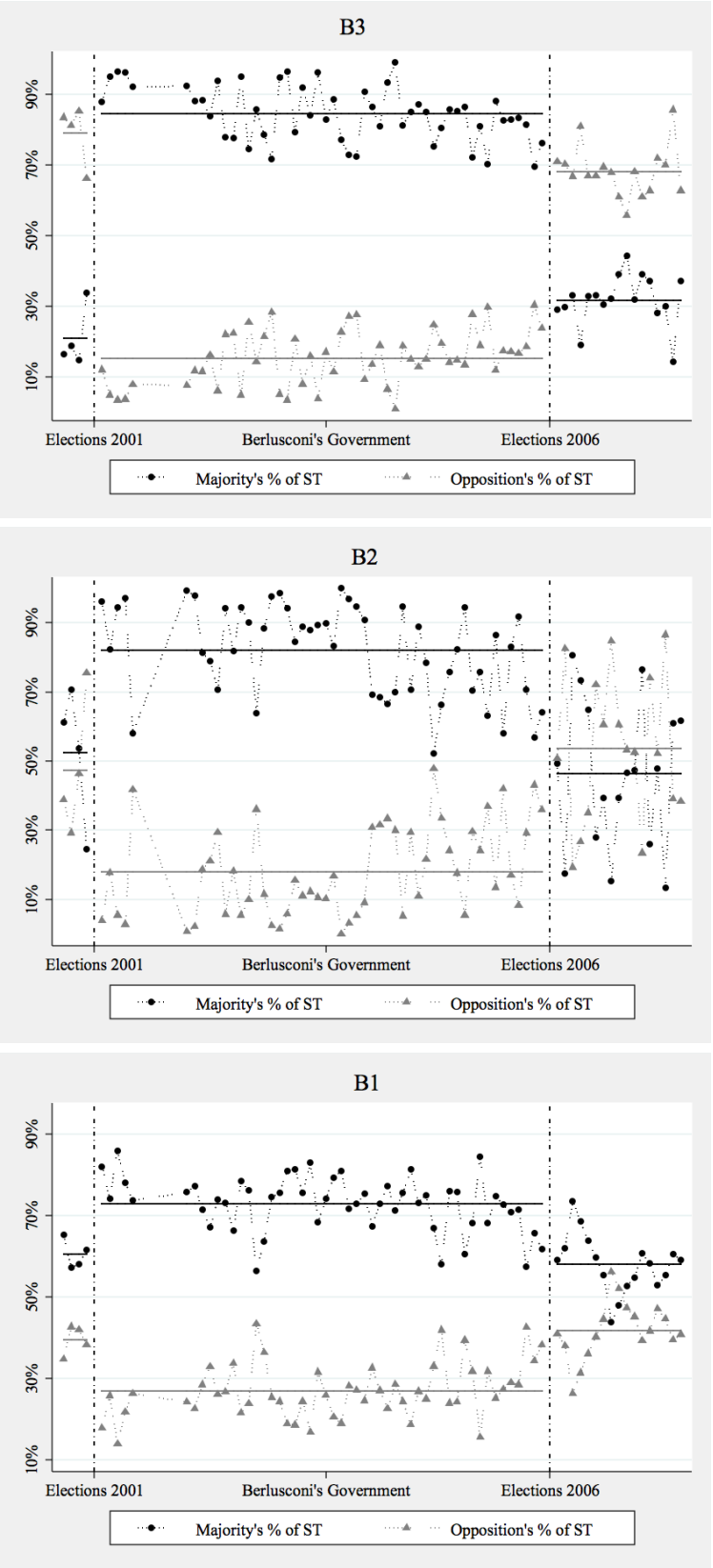


Figure 2.3: Majority vs. Opposition Share of Total ST by Channel (RAI)

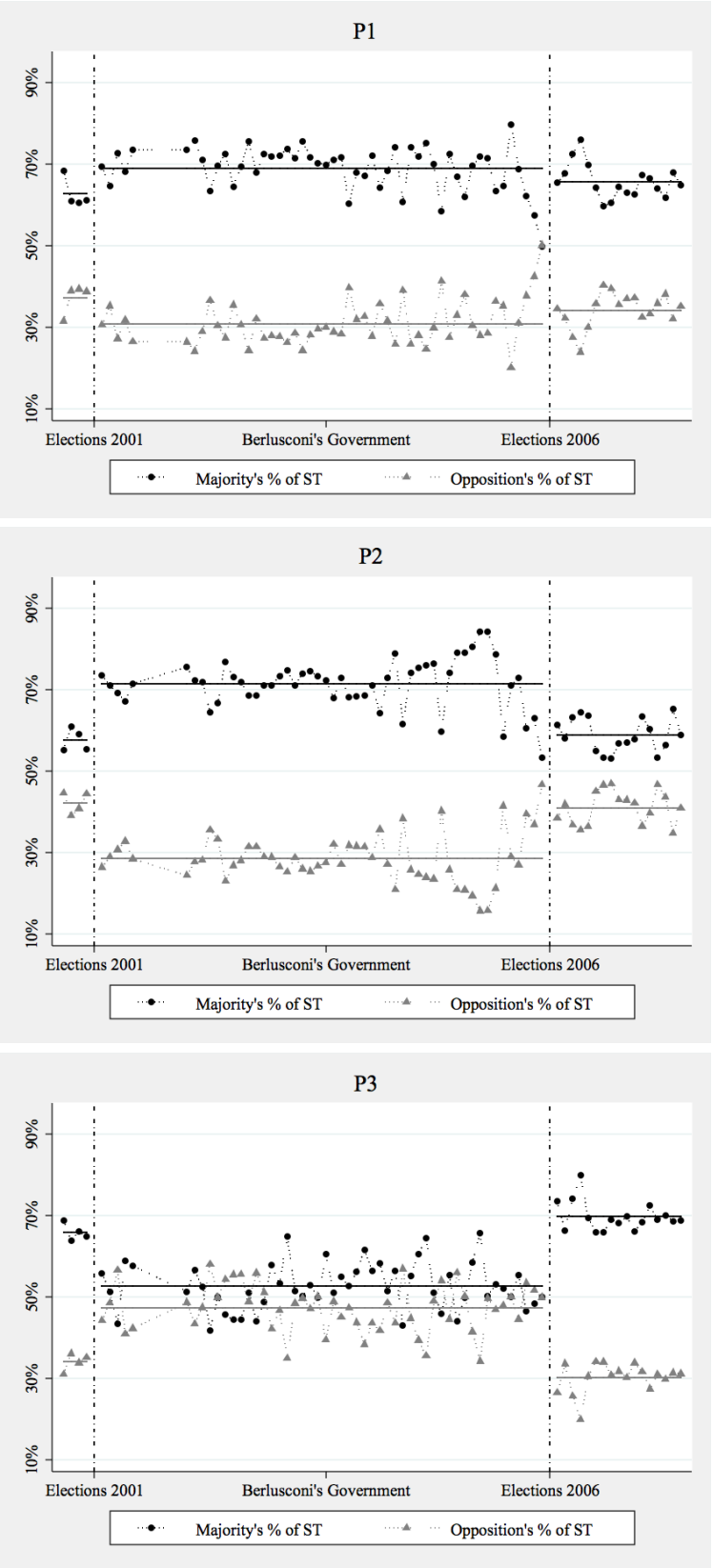
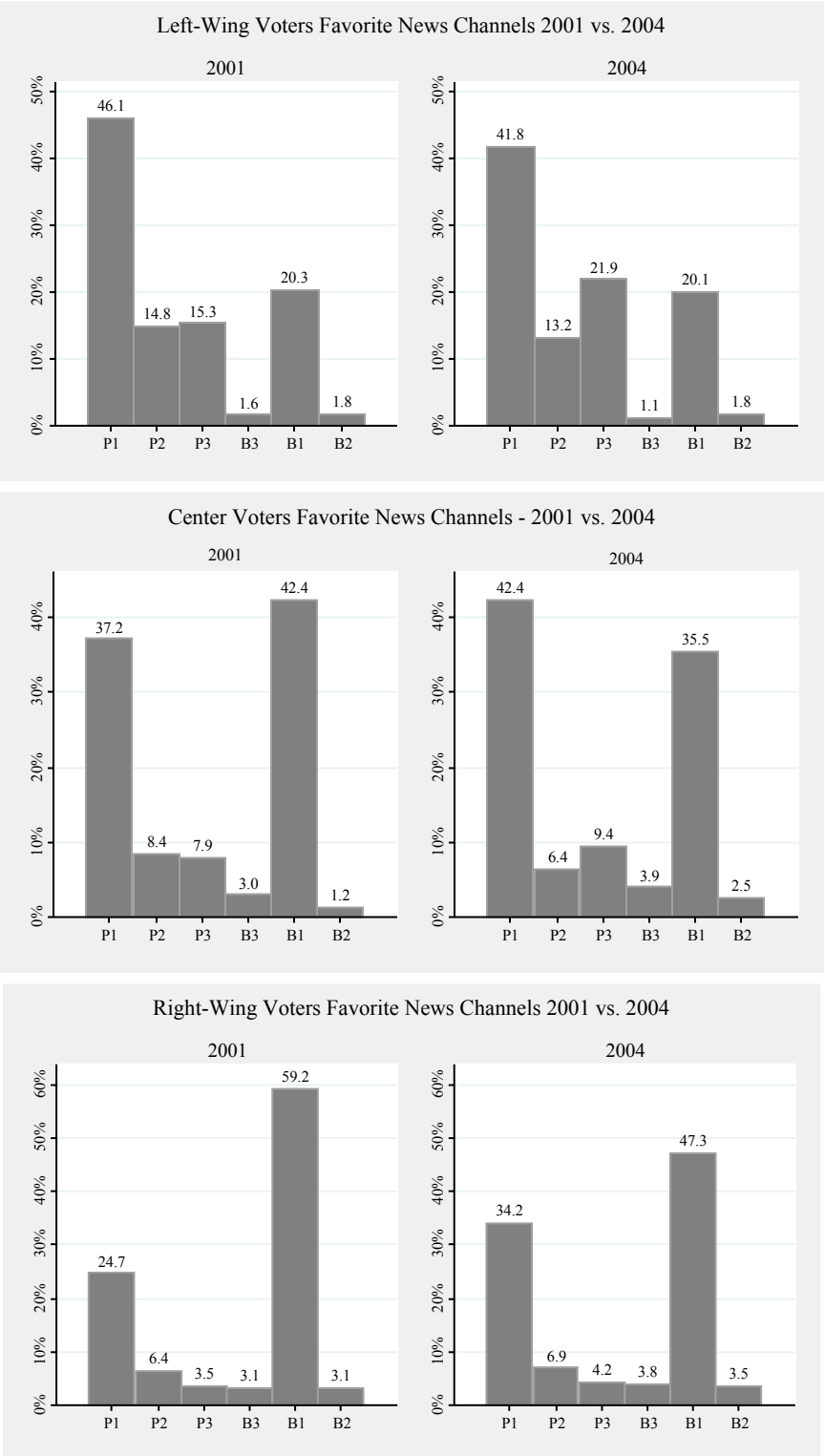


Figure 2.4: Favorite News Channel by Political ID (2001-2004)



Note: The 2001 data refer to interviews conducted between May 18th and June 15th 2001, right after the May 13th national elections, and mostly before the Berlusconi's government assumed power. The 2004 interviews were conducted between April 3rd and June 30th 2004, several years into the Berlusconi's government term.

Figure 2.5: Percentage Offset by Political Ideology

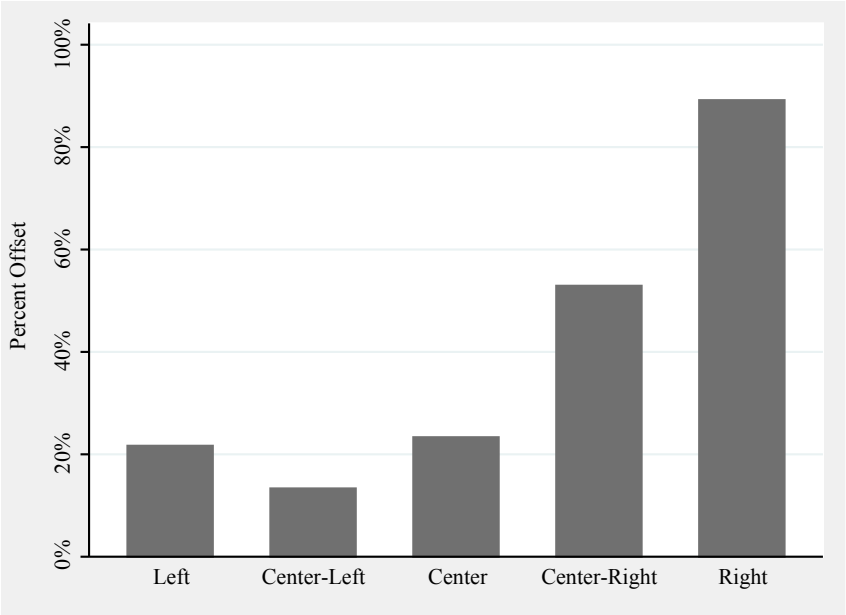
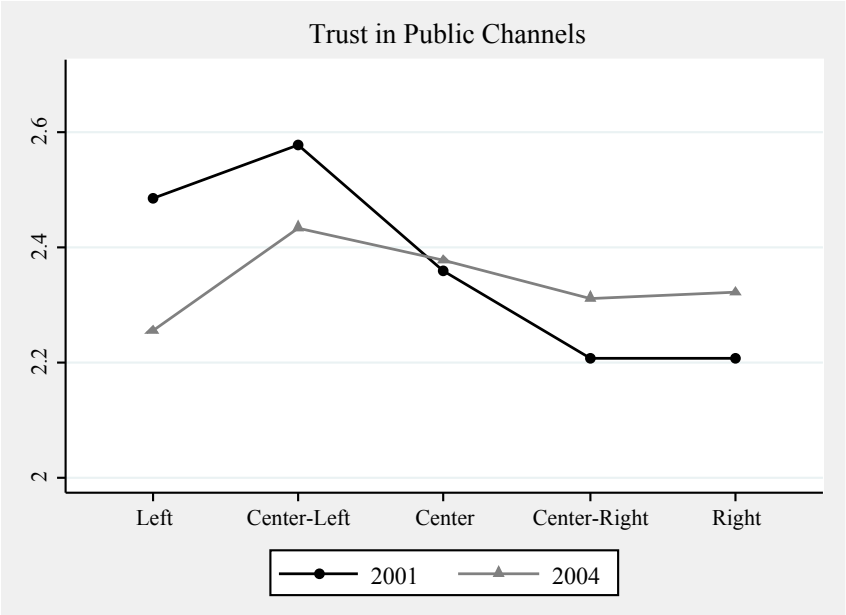


Figure 2.6: Trust in Public and Berlusconi's Channels by Political ID (2001-2004)



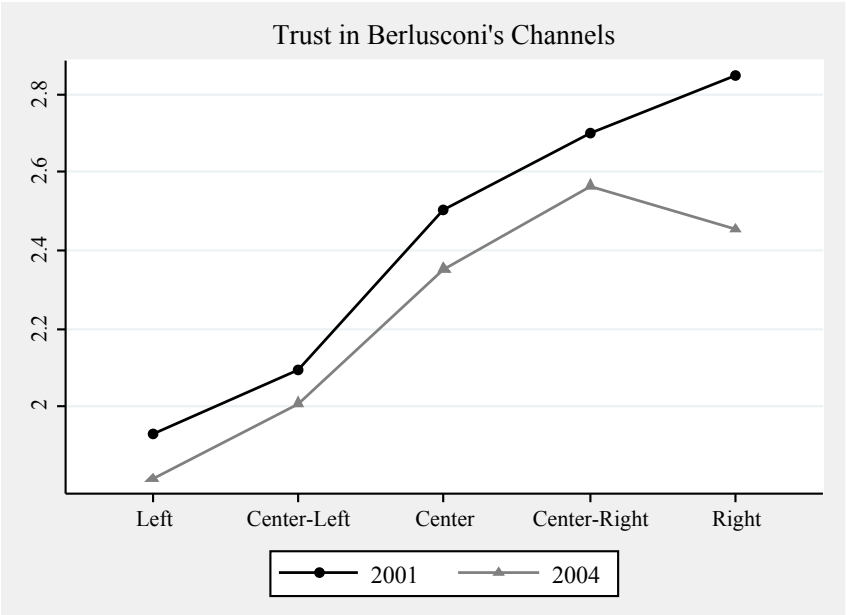


Table 2.1: Public TV - News Directors (2000-2007)

P1 (Channel 1)	
June 2000	G. Lerner (Center-Left)
October 2000	A. Longhi (Center-Left)
2001 Elections	
April 2002	C.Mimum (Center-Right)*
2006 Elections	
September 2006	G. Riotta (Center)
P2 (Channel 2)	
1994-2002	C.Mimum (Center-Right)*
April 2002	M. Mazza (Center-Right)
P3 (Channel 3)	
1998-2000	E. Chiodi (Center-Left)
June 2000	A. Rizzo Nervo (Center-Left)
July 2001	A. Di Bella (Center-Left)

** From 1991 to 1994 and after July 2007 served respectively as deputy director and director of Berlusconi's Channel 5 News.*

Table 2.2: Distribution of Total Speaking Time by Group and Channel

	Dependent variable: Share of Total Monthly Speaking Time			
	Majority		Right	
	(1)	(2)	(3)	(4)
Berlusconi_Gov			0.281***	0.339***
			[0.030]	[0.026]
Berlusconi's Channels	0.471***		0.187***	
	[0.029]		[0.035]	
Berlusconi_Gov * B.'s Channels	0.345***		-0.030	
	[0.030]		[0.043]	
Public Channels	0.658***			
	[0.029]			
Berlusconi_Gov * P. Channels	0.000			
	[0.030]			
B1		0.603***		0.065**
		[0.025]		[0.031]
Berlusconi_Gov * B1		0.143***		-0.024
		[0.025]		[0.037]
B2		0.492***		0.176***
		[0.025]		[0.031]
Berlusconi_Gov * B2		0.344***		-0.046
		[0.025]		[0.037]
B3		0.313***		0.355***
		[0.025]		[0.031]
Berlusconi_Gov * B3		0.550***		-0.198***
		[0.025]		[0.037]
P1		0.669***		
		[0.025]		
Berlusconi_Gov * P1		0.037		
		[0.025]		
P2		0.603***		0.066**
		[0.025]		[0.031]
Berlusconi_Gov * P2		0.127***		-0.042
		[0.025]		[0.037]
P3		0.707***		-0.038
		[0.025]		[0.031]
Berlusconi_Gov * P3		-0.164***		-0.125***
		[0.025]		[0.037]
Constant			0.356***	0.350***
			[0.029]	[0.026]
Observations	438	438	438	438

*Calendar month fixed effects included in all regressions. Public Channels is the base outcome in Column 3; P1 (Channel 1) is the base outcome in column 4. GLS estimates assuming autocorrelation (AR1) within channel*time period (before, during and after Berlusconi's government) group. Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1.*

Table 2.3: Distribution of Majority Speaking Time across Different Members of the Ruling Coalition

	Dependent Variable: Share of Majority Speaking Time				
	Government	Prime Minister	Others in Government	Majority Parties MPs	Speakers
	(1)	(2)	(3)	(4)	(5)
B1	0.490***	0.112***	0.389***	0.484***	0.036***
	[0.051]	[0.037]	[0.041]	[0.054]	[0.010]
Berlusconi_Gov * B1	0.094*	0.108***	-0.006	-0.096	-0.008
	[0.056]	[0.036]	[0.042]	[0.060]	[0.010]
B2	0.462***	0.165***	0.313***	0.499***	0.050***
	[0.051]	[0.037]	[0.041]	[0.054]	[0.010]
Berlusconi_Gov * B2	0.104*	0.169***	-0.063	-0.066	-0.049***
	[0.056]	[0.036]	[0.042]	[0.060]	[0.010]
B3	0.145***	0.008	0.167***	0.853***	0.005
	[0.051]	[0.037]	[0.041]	[0.054]	[0.010]
Berlusconi_Gov * B3	0.498***	0.400***	0.084**	-0.487***	-0.014
	[0.056]	[0.036]	[0.042]	[0.060]	[0.010]
P1	0.432***	0.135***	0.319***	0.530***	0.047***
	[0.051]	[0.037]	[0.041]	[0.054]	[0.010]
Berlusconi_Gov * P1	0.070	-0.025	0.089**	-0.105*	0.027***
	[0.056]	[0.036]	[0.042]	[0.060]	[0.010]
P2	0.359***	0.125***	0.264***	0.614***	0.036***
	[0.051]	[0.037]	[0.041]	[0.054]	[0.010]
Berlusconi_Gov * P2	0.127**	-0.027	0.137***	-0.156***	0.022**
	[0.056]	[0.036]	[0.042]	[0.060]	[0.010]
P3	0.408***	0.124***	0.322***	0.557***	0.046***
	[0.051]	[0.037]	[0.041]	[0.054]	[0.010]
Berlusconi_Gov * P3	0.030	-0.022	0.028	-0.060	0.020**
	[0.056]	[0.036]	[0.042]	[0.060]	[0.010]
Observations	438	414	414	438	426

*Calendar month fixed effects included in all regressions. Public Channels is the base outcome in Column 3; P1 (Channel 1) is the base outcome in column 4. GLS estimates assuming autocorrelation (AR1) within channel*time period (before, during and after Berlusconi's government) group. Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1.*

Table 2.4: Favorite News Channel by Political Ideology (2001 vs. 2004)

	Dependent Variable: Favorite News Channel					
	Private Channels	B1	B2	B3	P2	P3
	(1)	(2)	(3)	(4)	(5)	(6)
Political Ideology (right leaning)	0.708***	0.641***	0.529**	0.537***	-0.100	-0.347***
	[0.059]	[0.064]	[0.207]	[0.184]	[0.098]	[0.105]
2004*Political Ideology	-0.173***	-0.223***	-0.135	-0.070	-0.060	-0.223*
	[0.061]	[0.071]	[0.231]	[0.201]	[0.116]	[0.123]
Observations	2756	2756	2756	2756	2756	2756

*Multinomial logit regressions. Column 1 base outcome: Public channels. Other coulmns base outcome: P1 (Channel 1). The following controls and their respective interaction with the 2004 dummy are included: gender, education, age, occupational status, social class, church attendance, index of political knowledge, TV exposure, regional fixed effects. Robust standard errors clustered by individuals in brackets. *** p<0.01, ** p<0.05, * p<0.1.*

Table 2.5: Channel Consumption by Political Ideology (2001 vs. 2004)

	Dependent Variable: Frequency of Watching each Channel					
	B1	B2	B3	P1	P2	P3
	(1)	(2)	(3)	(4)	(5)	(6)
Political Ideology (right leaning)	0.323***	0.208***	0.266***	-0.195***	-0.203***	-0.272***
	[0.027]	[0.026]	[0.026]	[0.027]	[0.026]	[0.026]
2004*Political Ideology	-0.026	0.035	0.010	0.096***	0.053	0.006
	[0.030]	[0.030]	[0.030]	[0.032]	[0.033]	[0.030]
Observations	2750	2755	2751	2748	2751	2753

*Ordered probit regressions based upon reported frequency of watching each Channel (never of almost never, rarely, fairly often, or very often). The following controls and their respective interaction with the 2004 dummy are included: gender, education, age, occupational status, social class, church attendance, index of political knowledge, TV exposure, regional fixed effects. Robust standard errors clustered by individuals in brackets. *** p<0.01, ** p<0.05, * p<0.1.*

Table 2.6: Favorite Bundle of News Channels by Political Ideology (2001 vs. 2004)

	Dependent Variable: Favorite Bundle of News Channels											
	P1, P2	P1, P3	P2, P1	P2, P3	P2, B	P3, P1	P3, P2	P3, B	B, P1	B, P2	B, P3	B, B
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Political Ideology (right leaning)	-0.318***	-0.680***	-0.603***	-0.892***	-0.001	-0.840***	-0.980***	-0.082	0.379***	0.291***	0.147	0.545***
	[0.102]	[0.134]	[0.158]	[0.234]	[0.148]	[0.151]	[0.219]	[0.203]	[0.087]	[0.101]	[0.142]	[0.106]
2004*Political Ideology	-0.150	-0.039	0.009	-0.178	-0.107	0.045	-0.341	-0.781***	-0.327**	-0.376***	-0.110	-0.253**
	[0.131]	[0.178]	[0.225]	[0.349]	[0.198]	[0.202]	[0.313]	[0.253]	[0.129]	[0.143]	[0.192]	[0.121]
Observations	2480	2480	2480	2480	2480	2480	2480	2480	2480	2480	2480	2480

*Multinomial logit analysis of first and second choice bundles. Base outcome is the bundle (P1,B), where B refers to a Berlusconi channel. The following controls and their respective interaction with the 2004 dummy are included: gender, education, age, occupational status, social class, church attendance, index of political knowledge, TV exposure. Robust standard errors clustered by individuals in brackets. *** p<0.01, ** p<0.05, * p<0.1.*

Table 2.7: Trust in Public and Berlusconi's TV (2001 vs. 2004)

	Dependent variable: Self-Reported Level of Trust (1-4)		
	Trust Public	Trust Berlusconi	Trust Public - Trust Berlusconi
	(1)	(2)	(3)
Political Ideology (right leaning)	-0.125***	0.229***	-0.355***
	[0.016]	[0.017]	[0.021]
2004*Political Ideology	0.102***	-0.032	0.135***
	[0.021]	[0.021]	[0.026]
Observations	2721	2701	2701
R-squared	0.069	0.183	0.177

*OLS regressions. The following controls and their respective interaction with the 2004 dummy are included: gender, education, age, occupational status, social class, church attendance, index of political knowledge, TV exposure, regional fixed effects. Robust standard errors clustered by individuals in brackets. *** p<0.01, ** p<0.05, * p<0.1.*

Table 2.8: Aggregate Ratings of News Programs by Channel

Dependent Variable: Ratings for Prime-Time News Programs	
B1	0.295***
	[0.005]
B2	0.077***
	[0.005]
B3	0.057***
	[0.005]
P1	0.341***
	[0.005]
P2	0.113***
	[0.005]
P3	0.117***
	[0.005]
B1*Berlusconi_Gov	0.005
	[0.005]
B2*Berlusconi_Gov	-0.007
	[0.005]
B3*Berlusconi_Gov	0.006
	[0.005]
P1*Berlusconi_Gov	-0.019***
	[0.005]
P2*Berlusconi_Gov	0.005
	[0.005]
P3*Berlusconi_Gov	0.010**
	[0.005]
Observations	492

*Auditel monthly market shares over 2001-2007. GLS estimates assuming autocorrelation (AR1) within channel*time period (before, during and after Berlusconi's government) group. Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1.*

Table 2.9: Consumption of Newspapers by Political Ideology (2001 vs. 2004)

	Dependent Variable:		
	Overall consumption	*La Repubblica*	Newspaper ideology (right leaning)
	(1)	(2)	(3)
Political Ideology (right leaning)	-0.063	-0.740***	0.305***
	[0.061]	[0.105]	[0.036]
2004*Political Ideology	0.06	0.111	-0.022
	[0.062]	[0.118]	[0.035]
Observations	2754	1909	760

*Columns 1 and 2 represents coefficients from logit regressions. Column 3 represents an OLS regression in which newspaper ideology is the dependent variable. The following controls and their respective interaction with the 2004 dummy are included: gender, education, age, occupational status, social class, church attendance, index of political knowledge, TV exposure, regional fixed effects. Robust standard errors clustered by individuals in brackets. *** p<0.01, ** p<0.05, * p<0.1.*

Chapter 3

Preferences for Redistribution and Perception of Fairness: an Experimental Study[1]

3.1 Introduction

Redistribution of income through government taxes and transfers has long been normal practice in industrial democracies. Using data from the Luxembourg Income Study, Branko Milanovic (2000) estimated that the income share of the bottom two quintiles of households in 14 OECD countries in the early 1990s was on average 14.7% higher when measured on a post-tax-and-transfer than on a pre-tax-and-transfer basis. Even in the U.S., the least redistributive of the wealthy industrialized countries, Milanovic found a difference of almost 8% between the income share of the bottom 40% of households after versus before taxes and transfers.

The question of how much redistribution there ought to be is one that in the end must

[1]This chapter is the product of a joint collaboration with Louis Putterman. We are grateful to Roland Benabou, Claudia Biancotti, Samuel Bowles, Jeremy Clark, Pedro Dal Bo, Kfir Eliaz, and Jean-Robert Tyran for very helpful comments. We would also like to thank seminar participants at Brown University, Princeton University, the University of Massachusetts at Amherst, the University of Padua, the University of Trento and the University of Copenhagen, as well as participants at the ESA 2007 Conference and, the 2007 meeting of the Society for the Study of Economic Inequality (ECINEQ) and the 2008 La Pietra-Mondragone Workshop for helpful discussion. We thank Adam Rachlis for his help in initiating the set of experiments that led to this paper, and Gregory Wyckoff for rapid and efficient programming of the software used. Funding for this study was provided by the Alex C. Walker Foundation, the Steven Rattner and P. Maureen White Foundation and the Department of Economics, Brown University.

cross the boundary between positive and normative discussion. But there are many points on which positive economic analysis can be helpful. Studies that attempt to estimate the magnitude of the trade-off between equality and efficiency are one example. An understanding of why income is redistributed can also be pursued as a matter of positive analysis.

Among the possible explanations of why redistribution occurs in democracies is that there is a social consensus behind it, that is, a large majority of citizens feel better off living in a society with less inequality because it reflects their ethical values, increases their perceived personal and property security (Thurow, 1971), or some combination of these or other reasons. In the limit, redistribution could be Pareto improving, i.e. even those with high incomes could prefer some degree of redistribution to occur despite the material cost to them. If redistribution were universally preferred, then an efficient amount of redistribution could in principle be found, whether using the Pareto criterion or by a Benthamite social welfare function.

At the other end of the spectrum of explanations is the possibility that redistribution results from the combination of majority rule and self-interest, as emphasized in traditional political-economic models of redistribution (Meltzer and Richard, 1981; Alesina and Rodrik, 1994; Sinn, 1995, among others). The distribution of incomes in most societies is right-skewed, with the income of the median individual or household being far below the arithmetic mean. Thus, assuming that a given amount of revenue has to be raised by either a head tax (taking a fixed amount per person), a flat tax (taking an equal proportion of income from each person), or a progressive tax (taking a proportion of income that is higher the greater the individual's income), a self-interested median voter will always prefer the flat over the head tax and the progressive over the flat tax, assuming absence of incentive considerations. If government expenditure benefits all more or less equally, political economy models that assume equal participation in elections always predict that progressive taxes will be adopted in market democracies. The same logic can be extended from funding of public goods to provision of health and other services to providing transfer payments. In

the absence of incentive and other dynamic considerations, however, such models predict the complete leveling of incomes, something not observed in practice.

The above discussion leaves out one more important reason why self-interest might lead to redistribution: in the absence of adequate means of insuring themselves against negative shocks, individuals with average or above-average incomes may favor redistributive taxation as a form of social insurance (Benabou and Ok, 2001; Alesina and La Ferrara, 2005). For this to happen, tax regimes must be relatively persistent over time, and voters must have some degree of uncertainty about how they will fare in the future. Both these assumptions are reasonable in real contexts.

Our remarks about social or ethical preferences for redistribution are also incomplete insofar as they fail to consider that the value judgments in question may depend on the nature and causes of pre-tax inequality, and on how these are perceived by the voters. Some authors have suggested that differences in voter preferences may depend, at least in part, on their perceptions of whether the distributive outcomes of the market economy are perceived as fair or not (Piketty, 1995; Ravallion and Lokshin, 2000; Graham and Pettinato, 2002; Alesina et al., 2004; Alesina and Angeletos, 2005; Benabou and Tirole, 2006). Using survey data from several sources, Fong (2001, 2003) finds supporting evidence for the United States that such fairness considerations matter to people.

An extensive experimental literature has investigated how agents' choices in various economic interactions and games of division may be dictated by forces other than self-interest, such as aversion to inequality (Charness and Rabin, 2002; Fehr and Schmidt, 2003; Camerer, 2003) and how the origin of initial entitlements affects the extent of non-self-interested behavior (Hoffman and Spitzer, 1985; Burrows and Loomes, 1994). However, most of these studies have focused on small group interactions, and it is unclear how these findings can be generalized to explain attitudes toward equality and redistribution at the societal level. Our experiment joins a relatively small existing set of studies of preferences on redistribution that are designed with a macro-political economy application in mind

and involve choices that are potentially costly in real money terms to the decision-maker (Krawczyk, 2010; Ackert et al., 2007; Beckman et al., 2004; Beck, 1994). Studies in which respondents' statements of preference among distributions have no payoff consequences for them include Amiel and Cowell (2002), Amiel et al. (1999), and Johansson-Stenman et al. (2002).

To investigate the extent of social preferences for redistribution, their sensitivity to the determinants of inequality and to perceptions of fairness, and the more general role that self-interest plays in voting for redistributive taxes, we conducted a series of laboratory decision experiments involving a large number of subjects. One goal was to shed light on the degree to which observed redistributive outcomes in democracies are explained by self-interest versus social preferences for equality. Thus, each subject in our experiments was asked to express a preference for redistribution among the micro community of participants both under the condition of being an outside observer of a distribution of income among others, and in the situation of being an affected party with a specific interest stemming from the expectation or knowledge of having a higher or lower pre-tax income. To investigate subjects' willingness to pay for income equalization and their concern over the possibly "leaky" nature of taxation and redistribution, we varied across treatments both a direct cost to the decision-maker and an administrative or efficiency loss to recipients. We also had subjects make decisions both under uncertainty about their relative position in the pre-tax distribution and when uncertainty had been resolved. We used mainly student subjects but also a non-student adult comparison group. Our design contains several new elements, including large group size, explicit replication of an actual country's income distribution, and multiple income determination methods in combination with multiple decision contexts.

We find most subjects willing to pay to increase equality of earnings among others whom they do not know. This willingness varies in predictable ways with the direct cost to the decision-maker, and with their political views and (real world) incomes. It varies in an intuitive way with whether subjects "earn" their unequal laboratory incomes, although

this difference itself is sensitive to gender in an interesting manner echoing the political "gender gap" (females are more reluctant to accept even "earned" inequality). Subjects value efficiency, redistributing less when more income is thereby lost. Despite the clear evidence of "social preferences" most subjects' choices regarding redistribution reflect their personal interest when this is also at stake. We also find a link between risk aversion and desire for redistribution. Finally, we show how subjects' decisions can be used to fit utility functions which are clearly concave in the degree of social equality and with which both the median-preferred and the (additive) social welfare maximizing level of redistribution can be calculated. Using these estimates, we compare the redistribution desired by our subjects to the levels of redistribution delivered by real-world democracies.

The remainder of the paper is organized as follows. Section 2 describes the design and rationale of our experiments. Section 3 provides a theoretical framework for predicting and interpreting the results. In section 4 we illustrate and discuss our main results. Section 5 concludes.

3.2 Experiment design

We designed our experiment to elicit choices with respect to redistribution of income from twenty-one participants in each of sixteen sessions. In outline, each subject first chose her preferred level of a linear tax to redistribute earnings among twenty subjects with pre-tax incomes mirroring the U.S. pre-tax income distribution. Her choice was implemented if he or she became the randomly selected dictator who earned an amount unaffected by it (or largely so) - a "disinterested observer" condition. Then each subject chose a level of redistributive tax for the alternative situation in which the choosers income was one of the affected twenty. Each choice was in fact a quadruple, with a separate redistributive tax level possible for each of four different determinants of initial incomes, two amenable to interpretation as "earned," two not. In about half of the sessions, the second set of choices could

be remade after the resolution of uncertainty about own income. Randomizations determined whether the disinterested or interested decision-maker condition held and which of the four methods determined pre-tax income rankings. Although only the eight (or twelve) choices just described are of focal concern to us, subjects required more than 90 minutes to learn the nature of their choices, make the decisions, engage in the tasks potentially determinative of own pre-tax income, make a final set of decisions providing a measure of risk aversion, and complete a background survey. A potential direct cost of redistribution to the decisive individual, and a possible efficiency loss to others, varied among sessions. We now describe the experiment in greater detail.

The sessions began with a set of instructions that appeared on the subjects' computer screens and were simultaneously read aloud by the experimenter so that all subjects were aware of facing identical rules and procedures. At the end of this first instruction stage, subjects were invited to ask questions and then answered five questions to test their comprehension of the procedures. Subjects were informed that there would be two additional parts to the experiment and that further instructions would follow.

As part of the on-screen instructions, we presented a table describing the set of provisional experimental payoffs to be assigned to each of the participants (Appendix Table C.1). The distribution of the payoffs, ranging from \$0.11 to \$100.00, reproduced the distribution of the average pre-tax incomes of the lowest to highest earning twentieths of the US population, which was also included in the table.[2] Participants were informed that the provisional earnings might be altered by a tax and transfer process.

In the disinterested observer condition of Part I, each subject was asked to choose a proportional tax rate (0%, 10%, 20%, ... , 100%) to be applied to the pre-tax payoff distribution among the other twenty participants with the proceeds being distributed equally

[2]Appendix Table C.1's reference to the distribution of income in the United States was partly intended as a framing device, to give decisions a real world macro-economic reference. However, we attempted to steer a middle course, never telling subjects, for example, that "this is an experiment to study your views about the distribution of income," never using words like "just" or "fair," etc. Compare, for example, Frolich and Oppenheimer (1992) or Johansson-Stenman et al. (2002).

among all subjects. Participants were informed that, at the end of the session, one person would be randomly selected as the "decisive individual," and his preferred tax rate would be applied to the pre-tax earnings distribution of the other twenty participants to determine their final payoff. The decisive individual himself, however, would be affected neither by the pre-tax income profile nor by the tax and transfer to be implemented. By requiring all subjects to indicate their tax preferences at the outset, we aimed at eliciting "outside observer" preferences from the entire subject pool. We used a dictator rather than a median voter design so that subjects would have no reason to vote strategically.

Two additional dimensions of treatment variation were included in order to study agents' willingness to pay for a more equal earnings distribution and their concern for aggregate efficiency. The first parameter (which we will refer to as 'tax cost') measures the cost of each additional 10% tax in terms of a direct reduction in the decisive individual's payoff (compare to Andreoni and Miller 2008). The tax cost parameter could take four alternative values: \$0, \$0.25, \$0.5, or \$1. For example, in a session with tax cost equal to \$0.5, the decisive individual was charged 50 cents for imposing a tax of 10%, \$1 for a tax of 20%, continuing up to \$5 for a tax of 100%. The second parameter measures 'efficiency loss', or the loss in the aggregate payoff of the other participants associated with each additional 10% tax, in line with Okun's (1975) "leaky bucket" argument.[3] This could take three alternative values: 0%, 12.5%, or 25%. For instance, in a session with efficiency loss of 25%, for each \$10 collected as tax, \$2.50 is lost and \$7.50 is divided equally among the twenty affected subjects.

Formally, the post-tax earnings of the twenty affected subjects are given by:

$$\tilde{y}_i = (1-t)y_i + t(1-e)\frac{1}{20}\sum_{j=1}^{20} y_j \tag{1}$$

with y_i being individual i's pre-tax earnings, t being the tax rate chosen by the decisive

[3]The efficiency loss parameter could be interpreted as a measure of the dead weight loss associated with distortionary taxation, or alternatively, as the cost of administering the tax. The latter interpretation was offered to the subjects.

individual, and e the dead weight loss associated with the tax. The (expected) payoff of the outsider or decisive individual is given by:

$$\tilde{y}_d = y_d - c(10 \cdot t) \tag{2}$$

with y_d being his or her base-payoff, t his preferred tax rate, and c the cost of each 10% tax. Participants were informed that the base payoff of the decisive individual would be randomly drawn from the interval between \$19.80 (the mean pre-tax payoff of the other 20 subjects) and \$21.80.[4] Therefore, the final payoff of the decisive individual was either entirely unaffected by taxes and transfers (when $c = \$0$, our pure "disinterested observer" benchmark), or else was affected only by the cost of the tax he would choose to impose ("modified disinterested observer" scenario).

Both the tax cost and the efficiency loss parameters were held constant during a given session, allowing their effects to be measured only by between-subject comparisons.[5] The effects of taxation were explained to subjects verbally, graphically, using a table (Table 3.1), and by means of an equation resembling (1), so that both more and less mathematically inclined subjects could understand them. Subjects were required to pass a comprehension test before making any decision.

Prior to making their Part I choice, participants were also informed that the pre-tax

[4]Although it was impossible to totally eliminate comparisons between his own income and that of the other twenty subjects, we chose a base income at least equal to the group average for the decisive individual with the aim of moderating the salience of such concerns. A higher base income would reduce the likelihood of invidious comparisons with higher earners, but increase the likelihood of guilty comparisons with low earners. The impact of the choice of base income can be explored in future experiments. Subjects were told that the identity of the decisive individual would never be revealed, a measure we adopted to eliminate worry over the social tension that he might feel from anyone unhappy with the chosen t. The decisive individual's base income had a random element to make it difficult even for that individual to be sure he had been chosen, again to reduce worries about feelings of tension at the end of the session (this is also the reason why a revision stage was not added in cases in which Part I was randomly selected.). We wanted each subject to focus as much as possible, when choosing tax rates, on the consequences for her and others' earnings, and not on any consequences for their own social interactions with the others at the close of the experiment.

[5]Because each subject already made either eight or twelve tax choices in the session under varied sources of inequality, outsider versus insider conditions, and uncertainty versus certainty of own income, while also performing a number of other tasks, varying tax cost or efficiency within sessions seemed inadvisable.

earnings distribution would be determined by one of four possible methods: a) randomly ("Random"); b) based on the average income of their place of origin ("Where From," derived from their home ZIP code, or, for subjects from countries other than the US, from their home country);[6] c) according to their performance on a general SAT-like knowledge quiz ("Quiz"); d) according to their score on a computer-based game of skill ("Tetris").[7] The actual method to be employed would be randomly selected at the end of the experiment. Each subject was asked to choose a tax rate for each of the methods. The four methods were designed to mimic different determinants of economic success in real life (luck, initial conditions, effort and/or ability, respectively) and were used to assess differences in agents' attitude toward redistribution relative to their perception of fairness.

After each subject chose four preferred tax rates for Part I, the nature of Part II was explained, questions were invited, and subjects again took a comprehension test.

Part II was an "involved participant" condition in which each subject was again asked to choose a tax rate for each of the four methods, this time on the understanding that if selected to be the decisive individual, his base payoff would be one of the twenty earnings levels described in Table 3.1 and his preferred tax rate would be applied to the pre-tax earning distribution among twenty participants, including himself. In this case, another subject was randomly selected to receive \$19.80 to \$20.80 and be unaffected by either the redistribution or the tax cost. This section was designed to analyze the effect of involvement on subjects' choices. The tax cost and efficiency loss parameters varied across sessions but did not vary between Part I and II.

Before choosing Part II tax rates, subjects had to pass another comprehension test. They were then asked to report how they expected to rank under the three non-random earnings determination methods, and how confident they were about their guesses. They then chose the tax rates, took the 20 question Quiz, practiced the Tetris game for two minutes, and

[6]This information was collected during the log-in procedure, before subjects knew how it would be used

[7]Subjects were told that the version of Tetris to be played was specially modified to put more and less experienced players on a more equal footing.

played the Tetris game for five minutes. After this, a coin was tossed to determine whether payments would be based on Part I or II. If Part II was selected, participants were informed of their actual ranking in each of the four methods and were offered the possibility of revising their tax choice (we will refer to this stage as 'Part III'). This condition removed subjects' uncertainty about their relative position in the pre-tax distribution allowing us to study the effects of self-interest under certainty and with a wider range of costs than in Part I.[8] Then the earnings-determination method was selected (by the roll of two dice), the decisive individual was chosen (by drawing a code number from a hat),[9] and the final payoffs were announced.

Before exiting the session, subjects were asked to make a series of choices between earning a dollar with certainty and participating in a lottery with a 50% probability of earning nothing and a 50% probability of earning a positive amount which increased from one question to the next ($1.80 in the first choice, $2.00 in the second, $2.33 in the third, $2.67 in the fourth, and $3.00 in the last). This is a simple example of the "multiple price list" method of eliciting risk attitudes; see Andersen et al. (2008). This section, which was not pre-announced to the subjects, contributed on average an extra $1.50 (about 6%) to total earnings, and was included in order to generate an indicator of subjects' risk aversion. After completing it, subjects answered a series of background questions regarding their gender, area of study, socioeconomic background, political inclination, and views on inequality and taxation, while cash payments were counted out and brought to them in closed envelopes. The timing of the experimental session is summarized in Figure 3.1. All the instructions are available at: www.brown.edu/Research/IDE/walkthrough.

Overall, sixteen experimental sessions were held, involving a total of 336 Brown University undergraduate students from a wide range of disciplines. Table 3.2 summarizes the

[8] Whereas the net cost of taxation to the decisive individual ranges from 0 to $1 in Part I, it ranges from + $9.3 per 10% tax for the top earner to -$2.0 per 10% tax for the lowest earner in the revised decision stage. As mentioned in note 3, there was no revision of tax choices if Part I was chosen.

[9] Although subjects themselves had no way to identify code numbers with individuals, this method was used to help convince subjects that the identity of a decisive individual was indeed being determined randomly.

number of sessions and subjects organized by the exogenous parameters tax cost and efficiency loss. To check the sensitivity of the results to the subject pool, additional sessions were conducted involving a total of 55 adult non-student subjects recruited from the surrounding community. Results of the analysis of these additional sessions are not reported here, but in general they are not qualitatively different than those with students.

3.3 Hypotheses and predictions

In order to predict how subjects will behave in the experiment we need to make some assumptions about their utility functions. A general form for subject i's utility function is:

$$U_i = f(\tilde{y}_1, \tilde{y}_2, \ldots, \tilde{y}_i, \ldots, \tilde{y}_{21}) \tag{3}$$

where $\tilde{y}_{j \neq i}$ represent the post-tax earnings of each of the twenty other participants potentially affected by agent i's decision., and $\tilde{y}_i$ represents i's payoff if he/she is selected as the decisive individual, given by (2).

If individual i is purely self-interested, arguments other than $\tilde{y}_i$ can be ignored without loss of predictive power. Under this assumption, we can predict:

H_{0a}: In the "disinterested observer" scenario (Part I) a purely self-interested individual will never select $t > 0$ if the tax cost is strictly positive ($c > 0$). When $c = 0$ a purely self-interested agent will be equally likely to select any of the possible tax rates $(0, 0.1, \ldots 1)$.

In the "veil of ignorance" condition (Part II under random assignment), agent i's choice will depend on the values of c (tax cost), and e (efficiency loss), as well as on his degree of risk aversion. The following hypothesis can be formulated:

H_{1a}: In Part II under random income determination, a purely self-interested agent will never select $t > 0$ if he is risk neutral or risk loving, and if $c > 0$ and/or $e > 0$. Among

risk-averse agents who are purely self-interested, the utility-maximizing t is increasing in the degree of risk-aversion and decreasing in c and e. For the other three methods in Part II, we predict for purely self-interested subjects:

H_{2a}: *In Part II under the Where From, Tetris, and Quiz methods, subjects confident of their predictions about their relative standing will choose 0% or 100% taxation, depending on which maximizes their own expected income. In order to maximize their expected utilities, risk averse subjects lacking confidence in their predictions may select positive tax rates which will be higher the lower the tax cost or efficiency loss, the greater is their degree of risk aversion, the lower is their predicted rank for the method in question, and the lower is their confidence (ability to predict their standing).*

Consider now an individual who, due to social preferences, attaches a positive weight to the earnings of other subjects. We are interested in two types of preferences: preferences regarding equality and preferences regarding efficiency.

Assuming that agents' utility increases with equality in the distribution of incomes ($\mathbf{e}$), we can write $h(\mathbf{e})$ as a general function linking utility and equality, with $h' > 0$ if the subject prefers greater equality.[10]

Abstracting from agents' concern for their own income, preference for aggregate efficiency can be formalized in relation to the average of others' aggregate payoffs. Intuitively, the more efficient redistribution is, the larger will be the total pie to be divided among the remaining N_j subjects, *ceteris paribus*. Thus, the utility individual i gets from aggregate efficiency can be written as: $g(\frac{1}{N_j}\sum_{j\neq i}\tilde{y}_j)$, with $g\prime \geq 0$.[11]

Formally:

$$U_i = f_i(\tilde{y}_i, x_i) + h_{m,i}(\mathbf{e}, x_i) + g_i\left(\frac{1}{N_j}\sum_{j\neq i}\tilde{y}_j, x_i\right) \tag{4}$$

[10]The possibility that a subject prefers less equality, especially in cases in which he believes that unequal incomes have been justly earned, will also be considered.

[11]Here, too, $g\prime < 0$ is a possibility, for instance a subject may feel better off the less others earn in comparison to her. We let our data tell us whether subjects value the aggregate earnings of others positively, negatively, or neither.

Function $f_i(\cdot)$ can have varying degrees of concavity, thus incorporating risk aversion, and functions $h_i(\cdot)$, and $g_i(\cdot)$ can vary across individuals both randomly and in relation to a vector of measurable characteristics x_i such as gender, ethnicity, political inclination, and socioeconomic background.

The subscript m in $h_{m,i}$ indicates that i's desire for equality may depend on what method is used to determine pre-tax earnings. For example i may have a strong desire for income equalization under the Where From method if basing earnings on socioeconomic background is perceived by her as unfair, but a much weaker or possibly no desire to redistribute if pre-tax income has been determined by performing a task.

We propose the following compound hypothesis:

H_{0b}. Both in Part I and Part II (under random income assignment), a subject displaying some level of social preferences may select $t > 0$ even if $c > 0$.

Several sub-hypotheses can be spelled out:

1. The larger c (tax cost) and e (efficiency loss), the smaller the value of t that will be selected, *ceteris paribus*.

2. The greater i's preference for equality under the pre-tax income determination method in question, the larger the value of t the agent will select at every stage, *ceteris paribus*

3. Agents with similar characteristics x will tend to select similar values of t, *ceteris paribus*.

Concern for equality or efficiency does not imply the absence of simultaneously operating self-interest. For example, in both Part II (for any methods other than Random) and Part III, an agent's tax choice will be affected by his expected rank in the pre-tax income distribution via the $f_i(\cdot)$ function. Individuals with higher (lower) expected pre-tax incomes will have a stronger bias toward a low (high) tax. However, concerns for equality and efficiency may have effects countervailing those of self-interest, which will be stronger the closer i's (expected) rank is to the point at which $\partial y_i/\partial t = 0$ (e.g. between ranks 7 and 8, when there

is no efficiency loss). Also, since Part II decisions are taken prior to learning one's rank according to the various methods, subjects are expected to prefer higher taxes the greater their lack of confidence in their estimate of their relative performance and the greater their degree of risk aversion. Subjects with (almost) any degree of risk aversion have a self-interested reason to choose a high tax under the Random method, in Part II, if tax cost and efficiency loss are zero (low).

3.4 Results

The following analysis is based on the results of the sixteen experimental sessions in which all participants were undergraduate students. Students from a wide range of disciplines participated in the experiment. Subjects were not drawn from particular courses; hence they were not likely to know each other before the sessions.[12] The large majority of participants appeared to have no difficulty understanding the instructions and answering the control questions. Accordingly, all subjects took full part, making tax choices for each of the four methods - both in Part I and II, and in Part III when this occurred (7 out of 16 sessions). All but one subject also completed the debriefing questions as well as the test for the assessment of risk aversion.

The background questions allowed us to collect information about a number of personal characteristics of the participants. These variables, as well as the risk aversion indicator,[13] are used in the econometric analysis. The distribution of participants by personal characteristics is presented in Appendix Table 3.2. The questions used to construct the indicators are also reported in the Appendix.

[12]The 336 subjects were drawn from an undergraduate population numbering about 5700 students at the time of these experiments.

[13]Of the 335 subjects completing these parts, 308 answered the risk-aversion questions consistently and 27 in an inconsistent fashion, that is they rejected a gamble with high expected value but accepted one with lower expected value. To keep the sample as large as possible, we defined a second measure of risk aversion which could be calculated for both consistent and inconsistent responders. To check robustness, we carried out each piece of analysis also for the restricted sample composed by those who replied consistently. Since the results turn out to be quite similar, we present in what follows, the analysis for the larger sample.

We next illustrate our key findings by presenting the main descriptive statistics. We then discuss the results of a a set of multiple regressions estimated using data from all experimental sessions.[14] The dependent variable - the tax rate selected by each subject - is regressed on a set of explanatory variables which includes: tax cost, efficiency loss,[15] method dummies, risk aversion, a gender dummy variable, ethnic dummy variables, political philosophy, home area income, socioeconomic status, and number of economics courses taken.

Considering the significant share of 0% and 100% tax choices[16], in order to address the concern that, if allowed, some subjects may have chosen a tax rate less than 0% (regressive) or more than 100%, we estimate the regressions using a Tobit model, censored at 0 and 1. We also estimated the same set of regressions using ordinary least squares (OLS) obtaining very similar results. In what follows, we report the results of the Tobit regressions.

3.4.1 The "disinterested observer" scenario: part I

Do agents' tax choices suggest the existence of a demand for redistribution among the micro-community of the twenty other participants? The large majority of subjects display such a demand in the sense that, all things being equal, they prefer earnings to be distributed more equally than the *status quo*, no matter which method is used to determine pre-tax income distribution.Considering all the experimental sessions taken together, in 76.4% of the cases subjects favored some equalization of earnings ($t > 0$), in 44.2% of the cases a tax rate of 50% or higher was chosen, and 14% of the time subjects decided to fully equalize earnings among other participants. The mean tax rate is 42.4%. In principle this

[14] In some cases, we restrict our attention to the sample of tax choices for one of the four methods of pre-tax determination (335 observations). Most of the time, however, we use the larger sample obtained by pooling together all of the 1340 observations (335 subjects by four choices)

[15] Since subjects's choices were very similar for levels of tax cost other than \$1 per 10% (see Figure 3.2a), in order to simplify the interpretation of the coefficient we use a dummy variable which equals 1 for sessions with tax cost = \$1, and 0 for the others. Similarly for the efficiency loss parameter, we use a dummy which equals 1 for sessions with efficiency loss = 25%, and 0 for the others (see Figure 3.2b).

[16] A comprehensive description of the distribution of participants' tax choices in Parts I, II and III is reported in Appendix Table 3.3.

result could be due to the choices of those individuals participating in sessions in which redistribution was free or very cheap. However, when only those sessions with a positive tax cost are considered (12 sessions, 251 participants, 1004 tax choices) we observe a very similar pattern. Furthermore, even restricting the analysis to those sessions in which redistribution was more expensive (tax cost = \$1 per 10%) the qualitative result remains the same. A large majority (69.9%) of the participants still opted for a positive level of taxation, more than a third (34.8%) for a tax rate of 50% or higher, and 7.7% were willing to pay a full \$10.00 (approximately half of their expected payoff [17]) to equalize earnings among the other participants. This evidence supports hypothesis H_{0b} against the alternative hypothesis H_{0a}.

Does the existence of widespread support for redistribution imply that agents are not responsive to the cost of taxation? The answer suggested by our Part I data is no. As shown in Figure 3.2a, participants in sessions characterized by high values of tax cost chose lower levels of taxation than participants in sessions with zero tax cost. The difference is negligible for low levels of tax cost but significant when taxation becomes relatively expensive.[18] This pattern is consistent with the view that redistribution is a conventional good with demand being downward sloping with respect to the price of taxation.

As for concern with aggregate inefficiency, we find that subjects in the disinterested and modified disinterested observer portion of our experiment chose lower levels of redistribution when taxation involved a higher cost in terms of aggregate payoffs, even when this has no impact on their own expected pay-off. As suggested by Figure 3.2b and confirmed in Mann-Whitney tests, the effect is significant only when the share of tax revenue lost reaches 25%, the highest value included in our design.[19]

[17] Excluding the show-up fee of \$5.

[18] A series of Mann-Whitney tests find no significant difference in the preferred tax between subjects facing \$0 up to \$0.5 cost per 10% tax, but do find tax choices to be significantly lower at \$1 tax cost than at lower levels (significant at the 5% level in two-tailed tests).

[19] Recall that in the case of complete equalization, a 25% efficiency loss means that a fourth of the total pie is foregone. Two-tailed Mann-Whitney tests show no significant difference in preferred tax between the 0% and 12.5% efficiency loss sessions, but a lower preferred tax at 25% efficiency loss than at 12.5%, significant

The first column of Table 3.3 confirms the significant negative impact of tax cost and efficiency loss on Experiment I tax choices using a Tobit regression. Both coefficients have the expected sign, and they remain large and highly statistically significant (1% level) as additional controls are added in columns (2) through (7). According to these estimates, when tax cost rises to $1 per each additional 10% tax, the preferred tax rate falls by somewhere between 10 and 12 percentage points. This is in line with the average tax falling from 45%, in sessions with 0 tax cost, to 34%, in sessions with tax cost of $1. Similarly, when the leakage associated with redistribution rises to 25%, the preferred tax rate falls by between 7 and 9 percentage points, in line with the 8.4% drop in Figure 3.2b.

Individual demand for redistribution may also be influenced by beliefs about the determinants of inequality. The set-up of Part I, which lets subjects choose different tax rates for each of the four methods, allows us to study how perception of fairness informs redistributive decisions. If agents are indifferent about how initial income is determined, we should observe no systematic differences in tax choices across different methods. However, we do, in fact, observe such differences. In particular, as depicted in Figure 3.3 subjects tend to express a greater desire for redistribution when pre-tax earnings are determined according to the Random and the Where From methods (mean tax rates of 49.3% and 45.1%, respectively) than when relative performances in the Tetris and Quiz games are used (37.7% and 37.3 respectively).[20]. These differences are confirmed in the regressions of columns (2) through (6) of Table 3.3, in which we include dummy variables for the Where From, Tetris, and Quiz methods of determining pre-tax earnings. Although preferred tax under the Where From method is never significantly different from that in the default method, Random, the estimates consistently show differences of about 11%, significant at the 1%

at the 10% level, and at 25% versus 0% efficiency loss, significant at the 5% level.

[20]To make sure these differences are not driven by a relatively small number of extreme observations, we perform a series of Wilcoxon matched pair tests for within-subject comparisons. The tests confirm our main finding, showing that subjects were somewhat more likely to choose a higher tax for the Random than for the Where From method (p-value: .021), and much more likely to choose a higher tax for both the Random or Where From methods than for the Quiz or Tetris ones (p-values below 0.001 in all four comparisons). Finally, we find no evidence of significant differences in preferences between the Tetris and Quiz methods (p-value: .276).

level, for the preferred redistributive tax when earnings are determined by performance in a quiz or computer game. These results are in line with others suggesting that aversion to inequality and demand for redistribution may crucially depend on agents' beliefs about what causes one to be rich or poor, and, in general, about how fair the process is that generates the pre-tax income distribution.

In columns (3) - (5) of Table 3.3 we test for possible influences of sets of personal characteristics. Column (3)'s regression suggests that female subjects wanted as much as 13% more of others' incomes to be redistributed than did male subjects, whereas there are no significant differences in demand for redistribution based on ethnicity. Column (4)'s estimate suggests that the average income of the subjects' home area is negatively correlated with the demand for reducing inequality among others, while more risk averse subjects preferred more equality among others' incomes. Column (5)'s estimate indicates that subjects self-reporting more politically liberal views preferred more redistributive taxation, while those who took more economics courses preferred less. Column (6) shows that each of these results is robust to the inclusion of all of the variables in the previous columns' specifications, and column (7)'s regression shows that this remains the case if the pre-tax income determination method is controlled for by only the combined dummy variable Tetris-Quiz.

In sum, in the disinterested and modified disinterested observer decisions (Part I), subjects wanted less redistribution when the direct cost to them or the losses to others through tax leakage were higher and when pre-tax incomes were performance-based, and subjects from higher-income areas and those taking more economics courses also preferred significantly less redistribution. Subjects who were female, more risk averse, and more politically liberal preferred significantly more redistribution.

Some of these results are relatively familiar and increase confidence in the "normalcy" of the subject pool and the possible external validity of the experiment. For example, responsiveness to Tax Cost suggests that there is a downward sloping demand for redistribution, while the significant correlation of demanded redistribution and self-reported lib-

eralism helps us to argue against the notion that choices in our experiment may have no relation to the kinds of preferences expressed in the political sphere. The higher preference for redistribution among women than among men may be related to previous experimental evidence that women tend to be more altruistic than men (Eckel and Grossman, 1998), and it also accords with evidence of the gender gap in voting on social issues in the United States (Kaufmann and Petrocik, 1999; Norrander and Wilcox, 2008). The desire of many subjects to tamper less with incomes that have in some sense been ”earned” resembles results found elsewhere (e.g. Hoffman and Spitzer, 1985).

Some of the findings deserve additional comment in view of the fact that the decision-maker in Part I is (for the most part) an outsider given the opportunity to alter income distribution among others, not an involved participant. First, the preference for about 8% less taxation when a quarter of tax proceeds would be lost on administrative leakage indicates that on average subjects do care about efficiency (Charness and Rabin, 2002) and not only about equalizing incomes or raising up those of the lowest earners. Second, the impact of home area income on preferred tax cannot be understood in terms of pure self-interest but must rather be seen as suggesting a taste, possibly sprouted in the soil of self-interest but carried over to a domain in which self-interest has no direct application (high income individuals simply view redistribution less favorably). Similarly, the impact of risk aversion on a decision that has no bearing on the protection of own earnings suggests a perhaps durable correlation of tastes. In particular, whereas the more risk-averse are expected to prefer more redistribution to protect their own earnings, in Part II, the Part I result suggests that those who prefer to bear less risk, personally, also happen to like equality of earnings among others, even if one preference in no way logically entails the other.[21]

The strong effect of gender also calls for further unpacking. Upon further examination,

[21]The possibility that more risk-averse subjects may have chosen higher taxes in Part I because they did not understand their own earnings to be unaffected–in other words, that they confused Part I with Part II - is ruled out by the fact that subjects did not know the Part II task when making their Part I tax choices, and that all subjects correctly answered questions showing their comprehension of Part I prior to entering their tax decisions.

one of the most interesting features of our data turns out to be that virtually all of the difference between male and female preferences for redistribution found in Table 3.3 can be attributed to the different ways in which male and female subjects react to the source of income, the direct cost of redistribution, and redistribution's efficiency cost. The first of these effects is the strongest and is displayed graphically in Figure 3.4, which shows that whereas males tended to have a substantially lower demand for redistribution when the inequalities derive from performance, this was much less true of females. Differences in the effects of tax cost and efficiency loss can be similarly illustrated but are not shown due to space limitation.

We study further how gender affected tax choice through its interactions with the factors just mentioned using the series of regressions in Table 3.4, which also control for the the other individual characteristics included in Table 3.3's main specification. Column (1) provides a basic specification with only Tax Cost, Efficiency Loss, the Tetris-Quiz methods dummy and the female gender dummy, all showing much the same significant coefficient values as in Table 3.3. In column (2), inclusion of an interaction term between the female and Tetris-Quiz dummy variables causes the female dummy's value to decline by roughly a half and its significance level to fall to only 10%. In column (3), we include instead an interaction term between the female and Tax Cost variables, and in column (4), an interaction between female and Efficiency Loss. Inclusion of these interaction terms reduces the estimated coefficients on the stand-alone female dummy variable and their significance levels more modestly, and the interaction terms themselves obtain positive coefficients significant at the 10% (column (3)) and 5% (column (4)) levels. Finally, in the specification of column (5), all three interaction terms are included and each obtains the same significance level as in its respective column (2), (3) or (4) specification. Now, however, the coefficient on the stand-alone female dummy variable is less than a tenth of its original magnitude and its estimate is not remotely significant. Together, these results suggest that the effect of gender on desired redistribution is accounted for by the fact that female subjects are considerably

less deterred from redistributing by incomes being earned in a quiz or Tetris game, the fact that female subjects reduce their redistributive choice less than males as the direct cost to them rises, and by the fact that female subjects are much less deterred from redistributing by the presence of substantial transfer inefficiency than males.[22]

3.4.2 The "involved observer" under uncertainty: part II

In Part II of the experiment respondents were invited to select a tax rate for each of the four earnings assignment methods, knowing that if selected, their preferred tax would be applied to the earning distribution among twenty participants, this time including themselves. When making their choice, individuals were uncertain about which position they would eventually occupy in the distribution of payoffs.

When directly affected by redistribution, agents' choices can be expected to be influenced by self-interest considerations, in addition to any fairness concerns evident in their Part I decisions. Under the Where From, Tetris and Quiz methods, subjects could form expectations of their possible pre-tax earnings rank and take these into account when deciding how much to redistribute. If confident enough about their guess, subjects with relatively low expected rank (that is, high predicted pre-tax earnings) would have an interest in choosing a low tax rate, and conversely for those anticipating a high rank. However, uncertainty about earnings rank, including the radical uncertainty under the Random condition, provides a motive for favoring redistribution if the individual is risk averse. Finally, individual tax choice could also reflect agents' social preferences and aversion to inequality (if any).

The regressions in Table 3.5 explore similarities and differences in tax choices under the Random method in Part I and II, pooling together the 335 observations for this condition in each Part. As before. we control for Tax Cost and Efficiency Loss (which vary

[22]The coefficients in column (5) indicate that the average female subject reduced preferred tax by only 4% versus 14% for male subjects, in response to a shift to Quiz or Tetris income determination, that such a subject reduced redistribution by only about 5% versus a male subject's 14% reduction when Tax Cost rose to $1 per 10% redistributed, and that she would reduce redistribution by only a little over 1% versus a male subject's reduction by over 11% in response to Efficiency Loss rising from 0 to 25%.

across sessions) and for our risk aversion measure, gender, home area income, political philosophy response, and number of economics courses. Each variable obtains a significant coefficient of the same sign and similar magnitude to Table 3.3, except that the coefficient on the Female dummy variable is quite insignificant. In column (2), we add a dummy variable to identify the observations from Part II, and this obtains a positive and significant coefficient indicating that on average subjects' tax choices were about 6% higher in this part, a change in the predicted direction given that there is now an added motivation to redistribute assuming self-interest coupled with risk aversion.

One way to check whether the preference for more redistribution under the Random method in Part II is due to risk aversion, as is predicted by theory, is to interact the Part II dummy with our risk aversion measure (Table 3.5, column 3). If the measure performs well and if risk aversion is a driver of the desire to redistribute, the coefficient on the interaction term should be positive and significant. Surprisingly, it is neither. This finding, is not necessarily devastating to the theory, since risk aversion is notoriously difficult to measure. Other coefficients, including the significant positive coefficient on the risk aversion level term, remain unaffected.

We now turn to the issue of whether, and to what extent, demand for redistribution is influenced by the expectation about what position one will occupy in society in the future. We can address this question by looking at the difference between choices in Part I and Part II for methods other than the Random one.

Overall average tax rates for the three other methods appear to be very similar between Part I and Part II. For the Where From method the average tax in Part I and II are essentially the same (45.1%); for the Tetris method the difference is less than 1 percentage point (37.7% in Part I, and 36.8% in Part II), and for the Quiz method about 2.6% (37.3% in Part I against 39.9% in Part II).

However, this result hides important variations at the individual level. In fact, almost half of the subjects change their preferred tax choice in Part II relative to Part I, although

these changes are generally small (around 20%). This pattern holds for all methods, with a slight tendency for larger changes in the Where From method. The proportion of participants who choose a higher tax is similar to the share of those choosing a lower tax, both ranging around 20%.

In Table 3.6, we report a series of Tobit regressions on only the Part II tax choices under Where From, Quiz, and Tetris-based determination of pre-tax incomes. As depicted in column 1, most of the results that hold for Part I decisions continue to hold for those of Part II. In particular, average tax rates decrease with tax cost and efficiency loss; female, liberal, and more risk averse individuals tend to support more redistribution than male, conservative and less risk averse subjects; preferred tax continues to be negatively correlated with the level of home area income.[23] Only the coefficient on the number of economics courses taken, which is still negative, loses the significance displayed in Table 3.3.

That the same factors which predict voting for redistribution in Part I operate in the same manner and explain a similar proportion of the variance in votes for redistribution in Part II suggests that preferences for greater equality operated in a similar fashion whether the decision-maker was an interested party or not. [24] The regression in column 2 allows us to explore how important these factors are in comparison with the immediate self-interest of the decision-maker. This regression adds the subject's self-reported expected rank to the set of independent variables. Subjects with a high expected rank (low expected pre-tax earnings) could increase their expected earnings by voting for a high level of redistributive taxation, while those with low expected rank expected to earn more with no taxation. This expectation is strongly born out by the distribution of tax choices in Figure 3.5 which displays a gradual shift towards more redistribution going from high to low expected rankings. The estimate in column (2) of Table 3.6 confirms that self-interest played this role:

[23] As in Part I, also in Part II the result on the income variable is driven by the tax choices for the Where From method. When the other two methods are considered the income variable has essentially no predictive power.

[24] Another way of demonstrating this is to regress the subject's tax choice in Part II for a given method on their tax choice in Part I for the same method. When this is done, the coefficient on Part I tax choice is positive and statistically significant at the 1% level.

the coefficient on expected rank is positive and significant at the 1% level. The explanatory power of the regression also rises dramatically, more than doubling according to the Psuedo R-square. By this measure, self-interest is at least somewhat more important than pure preferences about equality when subjects chose taxes in our experiment from behind a partial veil of ignorance.

The remaining specifications shown in Table 3.6 take into account variation in a subject's confidence regarding her prediction of pre-tax earnings rank. In column 3, we add a dummy variable, Confidence, set to 1 for subjects who reported being very confident about their prediction of rank and 0 for those who reported being "somewhat" or "not at all confident." [25] We also add an interaction term between Confidence and Expected Rank. As expected, Confidence has a negative effect on the chosen tax: the less confident is the subject in his or her prediction, the more does the situation resemble the Random case, in which a risk-averse individual will prefer more redistributive taxation, ceteris paribus. The interaction term is significant and positive in line with the prediction that a subject more confident of having a high pre-tax rank number (low pre-tax earnings) will want greater redistribution. Appendix Figure C.1 provides a graphical representation of these result based on the regression coefficients.

In columns (4) and (5) we introduce an interaction with an indicator for the methods Tetris and Quiz. In Part II as in Part I, subjects chose less redistribution under these methods, but perhaps this is partly due to greater confidence in their predictions of their earnings rank in the Where From than in the Tetris and Quiz cases. [26] The significant negative coefficient on the interaction between the Tetris-Quiz dummy and Expected Rank, in columns (4) and (5), is consistent with this idea: under these two methods, there is less demand for

[25] With regard to the expected rank participants could select one of the following options: "Positions 1-2" (where 1 is the highest income); "Positions 3-5"; "Positions 6-8" ; "Positions 9-11"; "Positions 12-14"; "Positions 15-17"; "Positions 18-20". With regard to the level of confidence, three options were available: "Very confident"; "Somewhat confident" ; "Not at all confident".

[26] Subjects can form good estimates of the relative level of their home area income, but had less basis for guessing their relative performance on tasks they had not yet performed. The data show their guesses of earnings rank to be substantially more accurate for the Where From than for the other two methods; their self-reported confidence in their guesses was also higher.

redistribution by those whose guesses about their own rank, held less confidently, would otherwise tend to make redistribution desirable. The negative coefficients on the Tetris-Quiz dummy itself are also replaced by positive ones, apparently because these pre-tax earnings determination methods mainly proxy for uncertainty once their interaction with expected rank has been controlled for. The effects found in column (4) remain when the Confidence*Expected Rank interaction is once again included, in column (5).

3.4.3 The "involved observer" under perfect information: part III

The revised decisions in Part III, made after the revelation of exact rank under each of the four methods, provide evidence on subjects' distributive preferences and on the weight they place on them relative to own earnings in the absence of uncertainty and over a substantially wider range of private costs than in Part I. Risk aversion has no direct relevance in this case, and in principle, a purely self-interested subject should choose either a 100% tax or a 0% tax, depending on his revealed rank under each particular method.[27] A deviation toward redistribution by those whose earnings would be maximized by a 0% tax must reflect concern for lower earners or a preference for equality. By contrast, downward deviations by subjects whose self-interest favors a 100% tax could be motivated by a belief that the higher incomes are rightfully earned or deserved or by some other source of reluctance to alter the unequal earnings pattern.

Overall, 147 subjects in 7 experimental sessions were offered the opportunity to revise their initial tax choice in each of the four methods (for a total of 588 observations). In addition to the usual tax cost, when revising their preferred tax, individuals took into account their potential additional payoff from redistribution. This was positive if their ranking was such that they would benefit from taxation, or negative, otherwise.[28]

[27]Unlike some previous studies (e.g. Herne and Suojanen, 2004) in our experiment participants are not allowed to communicate after having learned their actual position in the distribution. Furthermore, when making his/her revised tax choices each subject had in hand a printed copy of Table 3.2, or of the variant appropriate to the relevant efficiency loss.

[28]In sessions with no efficiency loss, for example, redistribution harms the decisive individual if he is

Altogether, 53.7% of the observations are of subjects facing methods in which their own earnings would be maximized with a tax of 100%, while for the remaining 46.3% of observations own income would be maximized by a tax of 0%.

Although agents had no difficulty in recognizing and pursuing what was in their interest, about one third of choices (34.2%) were for a tax rate that did not maximize the chooser's earnings, and 61.2% of subjects selected such a tax rate in at least one of their choices. [29]

The numbers and sizes of deviations from an income-maximizing tax of 0% and those from an income maximizing tax of 100% are similar with the average deviation being about 18% and with slightly more and larger deviations in the upward (pro-equality) than in the downward direction.

It is worth noting that among subjects with the same income-maximizing tax, the cost of taxation varied significantly depending on the exact rank. Intuitively, the cost of redistribution in terms of foregone earnings for someone at the top of the ranking is higher than for someone ranked 2nd, and so on. Similarly, the net benefit from redistribution for someone ranked 20th is higher than for someone ranked 19th and so on. To account for this, we calculated the net cost of a 10% increase in tax for each income rank, tax cost, and efficiency loss. For example, someone ranked 1st in a session with zero efficiency loss and $1 tax cost, would sacrifice about $9 of his potential payoff per each additional 10% tax he would impose if selected to be decisive. By contrast, in the same session, someone ranked 9th would still have a positive incentive to choose a zero tax, but deviation would only cost him about 65 cents per 10% tax. Similarly, for subjects who would potentially benefit from redistribution, low ranked participants had a much greater incentive to choose a 100% tax than subject ranked toward the middle. Due to this, the cost of redistribution to the decisive

ranked between the 1st and the 7th position when tax cost is zero, between the 1st and the 8th position, when tax cost is $0.25, between the 1st and 12th position when tax cost is $1. The cut-off point is between the 14th and the 15th position when efficiency loss is 12.5% and tax cost is $1, between the 9th and the 10th position when efficiency loss is 25% and tax cost is $0 and between the 11th and the 12th position when efficiency loss is 25% and tax cost is $0.25

[29]This proportion is high compared with the findings of previous experiments involving no income uncertainty and no strategic considerations, such as Rutstrom and Williams (2000). This might be explained in part by subjects' desires for self-consistency and by the fact that Part III came after parts I and II.

individual covers a much larger range in Part III than in Part I, allowing observations on willingness to pay for redistribution at costs both well above the Part I maximum tax cost of \$1 per 10% and well below the Part I minimum tax cost of \$0 per 10% tax.

Figure 3.6 reports for each positive or negative total cost per 10% tax increase the average tax selected by subjects in Part III. [30] As expected, those individuals who, given their revealed ranking, should choose a zero tax rate (net losers) generally support low levels of redistribution. Furthermore, pro-redistribution deviations from self-interest are decreasing in the cost of taxation. In other words, when their position in the pre-tax earnings distribution is high and deviating is very costly in terms of foregone earnings, subjects choose a tax rate very close to 0. However, when deviating from the purely selfish option becomes sufficiently cheap, individuals tend to support higher levels of redistribution and their choices are fairly responsive to variations in the cost of taxation.[31] This pattern is intuitive and certainly reassuring of the fact that subjects had a good understanding of the experiment and a relatively clear perception of the incentives they faced.

Turning to the left part of the Figure 3.6, to those subjects who, based on their rank, would benefit from redistribution (net winners) and should hence choose complete equalization, we can see that the large majority of these selected a very high tax rate (70% or higher), and about two thirds chose to fully equalize earnings (average tax rate 82.5%, standard deviation 0.30). The scatter of points suggests some modest responsiveness to the size of the loss suffered by not selecting full redistribution, but we will see shortly that the relationship is much flatter than that for costs in the positive range. Nonetheless, enough subjects resist full redistribution, when in their own interest, to suggest that it's not the case that subjects are either strictly self-interested or else egalitarian. Some subjects, in some circumstances, are willing to sacrifice personal earnings to maintain some inequalities (and, when $e > 0$, to avoid shrinking the pie by redistribution).

[30] Costs on the tails of the distribution are not shown to permit closer inspection of the main part of the data. 4.7% of the observations lie in the ranges thus excluded.

[31] When the net cost of taxation is between \$0 and \$1 per 10%, the average tax rate is 37%, similar to the average tax choice in Part I (42.3%).

In Table 3.7 we estimate a regression model for Part III tax choices as a function of the total cost of taxation to the decision-maker (per 10% tax), the square of that cost, a dummy variable "earnings maximizing tax rate" (EMTR) which is either 1 (100%) or 0, and the interaction between EMTR and total cost of taxation.

As expected, tax choices appear to be very sensitive to the net cost of taxation faced by each subject (both the coefficients on cost of taxation and its square term have the expected sign and are statistically significant). However, the fact of having a net gain from redistribution has an independent, strong and positive impact on preferred tax rate.

Indeed, the coefficient on the interaction term between EMTR and the cost of taxation suggests that a change in the total cost (benefit) of taxation has a significant impact only on those subjects with an earnings-maximizing tax of 0, but has essentially no effect on the choices of net winners.

How do preferences for equality affect individuals' redistributive choices when uncertainty is resolved? In principle we would expect individuals with more egalitarian views to be, on the one hand, more inclined to deviate from the purely self-interested zero tax choice, and, on the other, less likely to deviate from 100% tax choice when this is in their interest.

One way to test this prediction is by using the tax rate chosen by the same individual for the same method under the "disinterested observer" condition (Part I) as an indicator of the subject's genuine "disinterested" attitude toward equality. To do so in column 2 we include in the initial specification the variable "Part I Tax" corresponding to the tax rate chosen by the same subject for the same method in Part I. In line with our prediction, the coefficient on the Part I tax choice is positive and statistically significant.

This result confirms that participants who selected higher taxes in Part I tend to support more redistribution than others in Part III, and this regardless of their actual ranking and of the cost they face.

Figure 3.7 shows the relationship between selected tax rate and total cost of taxation,

according to the coefficients in column 1 of Table 3.7. Figure 3.8 plots the relationships separately for subjects choosing high and low tax rates in Part I (higher or equal, and lower than 50% respectively)[32] It is worth noting again that the predicted tax choice in Part III when the cost is zero is quite close to that in Part I, suggesting that Part III choices indeed help us to extend Part I conclusions to a broader set of both positive and negative costs of taxation to the decisive individual.[33] Also worth noting are the sharp discontinuity between the positive and negative cost sides of the figures, and the considerably gentler slope of the curves to the left, indicating lesser sensitivity to cost. Finally, the fact that the average tax remains below 100% even when in the self-interest of the decision-maker suggests that some inequalities had legitimacy.

3.5 What level of redistribution maximizes social welfare?

To what extent should fiscal redistribution in a politically democratic industrial market economy be understood as increasing welfare quite generally, due to a desire for income insurance or a social preference for greater equality, versus representing the self-interested expropriation of a richer minority by the poor and middle income majority?

If there is unanimous agreement (even among those with higher pre-tax incomes) that income should be distributed more equally, then taxing and redistributing income can be Pareto-improving. But if a majority favors some redistribution and a minority prefers that there be none, as in our results, then to say whether "society" is better off redistributing, and how much redistribution is best, requires some way of aggregating the well-being of different individuals.

To illustrate, we conduct an exercise which posits a specific cardinal form of utility

[32]These estimates are based on the coefficient of a separate regression, analogous to the one in Table 3.7 column (2), in which, instead of the actual Part I tax rate, we include a dummy variable which equals one for those subjects who chose a tax rate of 50% or higher for the same method in Part I, and 0 otherwise.

[33]The fact that for very high tax costs, the estimated curves imply a preference for negative rates of taxation is an artifact of the specification of Table 3.7's regressions, which do not explicitly impose the lower limit actually faced by our subjects.

function that can be calibrated from our data to determine what level of redistribution maximizes additive (Benthamite) social welfare. In our exercises, we assume that each individual's utility is a function of:

1. her expected post-tax earnings;
2. the (expected) variance of her earnings (a measure of the income uncertainty to which she is exposed);
3. the degree of income inequality in the overall population;
4. the aggregate earnings of the population.

For simplicity, we suppress consideration of the individual characteristics x_i that were included in equation (4), and we decompose function f_i of that equation into additively separable functions of i's income and its variance. Factors (3) and (4) are assumed to be only functions of the vector of income for the twenty individuals whose earnings are determined by the tax rate chosen by the decisive individual. We use a simple statistic, one minus the Gini coefficient, to capture the degree of equality in the income distribution, and we assume that the function $g_i\left(\sum \tilde{y}_j\right)$ of equation (4) takes the multiplicative form $\delta_i \bar{y}$, where δ is a scalar and $\bar{y}$ the average income. Then the utility function can be written as:

$$U_i = E(y_i) + \beta_i(\sigma_{y_i}) + \psi_i h(1 - Gini) + \delta_i \bar{y} \tag{5}$$

To facilitate the recovery of the parameters of function U, we assume function h to have a quadratic form: $h(1 - Gini) = a + b(1 - Gini) + c(1 - Gini)^2$

After multiplying and renaming the coefficients and dropping the constant, we can rewrite the utility function as follows:

$$U_i = E(y_i) + \beta_i(\sigma_{y_i}) + \gamma_i(1 - Gini) + \eta_i(1 - Gini)^2 + \delta_i \bar{y} \tag{6}$$

Under the assumption that subjects choose the tax rate that maximizes their utility under each experimental condition, we can use our experimental data to estimate the parameters of the utility function. While the form of the utility function is assumed to be common across all subjects, the parameters of (5) are allowed to vary with specific individual characteristics such as risk aversion, political ideology, and concern for efficiency.[34]

The estimation model differs somewhat when analyzing tax choices performed in part I, in part II (under random and non-random methods respectively), and part III. For example, since the decisive individual faces no income uncertainty in both part I and III, β - the coefficient on income variance -cannot be estimated from tax choices made under those conditions. Similarly, the estimating equations for parts II and III take into account the fact that the payoff of the decisive individual depends on her expected or actual rank, whereas rank is irrelevant to her payoff in Part I.

Finally, while in principle we view each subject as having a unitary utility function that responds differently to different conditions, it is convenient to capture differences in response to inequalities having different origins by estimating utility function parameters separately based on the tax choices made under each method. We also carry out estimates with the combined data of Part I, for reference purposes.

Leaving the details of the derivation for the Appendix, in Table 3.8 we show the implied signs of parameters β , γ , η and δ for each of the four subsets of our data, as well as the significance levels of the coefficients on which each parameter estimate is based.[35]

The results support the idea that most subjects are concerned with inequality, and that their utilities display some level of concavity in our Gini-based equality measure: all coefficients on which the estimates of γ and η are based, are statistically significant at the

[34] More precisely we allow income variance to matter more for subjects with higher measured risk-aversion, concern for equality to be greater for subjects with more liberal political ideology, and finally concern for redistributive efficiency to be larger for participants having taken more economics courses, but we allow the degree of influence of these concerns, if any, to be established by the data.

[35] As shown in the Appendix, the imputed value of η is based on the estimate of one coefficient only, while the values of β , γ and δ are based on the joint estimation of that and another coefficient. Since the coefficient from which we recover the value of η turns out to be highly significant in all cases, we report in the columns for β , γ and δ only the significance levels for the other relevant coefficient in each case.

1% level and have signs and numerical values consistent with substantial concavity in the relevant range. Results for δ, the coefficient on aggregate income, are supportive of the expectation that efficiency matters in Part I and Part II Random choices, but have a sign opposite than expected and are statistically insignificant in the other two estimates. The key coefficient for estimating β, the coefficient on own income uncertainty, is insignificant for both Part II estimates.

The concavity of the utility functions with respect to equality implies that for most subjects utility reaches a maximum at an interior value of t. The four panels of Figure 3.9 illustrate the relationship between utility and t for different population subsets and income determination methods based on Part I tax choices. Panel (a) shows the average relationship between utility and t for those subjects who self-reported to be very conservative (response 1 on the 1-7 political ideology scale), while panel (b) shows the corresponding relationship for very liberal ones (response 7).[36]. We also estimated the utility function parameters separately for each income determination method. In panel (c) we show the relationship between utility and tax rate for a subject with average ideology under the Random method, and in panel (d), the corresponding relationship under the Quiz method. For an individual with average political ideology the optimal tax rate is 30% when the pre-tax income is determined randomly, and 40% when it is determined according to the performance in the quiz.

With the utility function estimates in hand, we can now calculate the value of t that maximizes the sum of subjects' utilities under various conditions. For example, basing the utility function estimate on all tax choices in Part I - without regard to determinant of initial income - the tax rate that maximizes the sum of utilities is 43.0%. If we only use the tax choices under the Random income determination method, the tax maximizing the sum of utilities is 52.3%, versus a rate of only 37.7% based on tax choices for the Tetris method.

[36]The utility levels displayed in Figure 3.9 are calculated assuming c = 1 and e = .25, and for an average number of economics courses taken (approximately 1.3). The exercise abstracts from the disutility due to risk born by the decisive individual but unrelated to the chosen t.

Using tax choices by involved observers in the Random income condition of Part II, the tax rate maximizing the sum of utilities is 55.5%.[37] Thus, even when not personally affected by the outcome, our subjects' summed welfare appears higher when substantial redistribution occurs, especially when income differences don't seem to be earned. The additional effect of self-involvement (the shift to Part II) is not large.

How do our subjects' tastes for redistribution compare to the amount of redistribution delivered by the real-world political process? Actual redistribution of income through the U.S. fiscal system does not conform to potential outcomes in the experiment, because federal income taxes have a progressive rather than proportionate structure, much revenue is generated by other federal, state and local taxes, only a fraction of the revenue collected goes into transfer payments, some progressivity-imparting transfers are income-tested, various exemptions apply, and so forth. Nevertheless, we can get an impression of how the apparent preferences of our subjects relate to the degree of redistribution observed in the U.S. and other industrialized countries by comparing before- and after-tax-and-transfer (for convenience, we'll say more simply "pre- and post-tax") inequality in the experiment to that observed at the macro level. Our experiment imposes the same pre-tax inequality on subjects as was actually observed in the U.S. The associated Gini coefficient is 0.51. The median preferred taxes in experiments I, II and III - 40%, 40% and 60%, respectively - would bring the Gini coefficient down to 0.306, 0.306 and 0.204.[38] These outcomes can be compared to the actual post-tax Gini coefficient for U.S. individuals in 2000, 0.401.

Comparison with the degrees of redistribution inferred from the experiment data suggest that our subjects may be somewhat unrepresentative of the overall U.S. population, that choices made in the context of our laboratory experiment are not perfect proxies for the preferences voters have in mind when they go to the polls, or that the political process does not generate outcomes that perfectly match median preferences. One reason may be

[37]The sum of utilities based on the Where From condition and the Quiz condition choices achieve their maximum with t = 45.9% and t = 38.1%, respectively.

[38]The tax levels that would maximize the social welfare function as discussed above, 37.7% for the Tetris method and 52.3% for the Random method, correspond to Gini coefficients of 0.318, and 0.243 respectively.

that the high level of redistribution preferred in Part III, especially, reflects mainly the self-interest of most individuals in redistribution given the right skewed distribution of pre-tax incomes, but may exaggerate interest in redistribution in a more realistic setting because real world voters may take into consideration dynamic (incentive) effects of taxation that are lacking in our experiment. Nevertheless, our subjects' preferences do not seem to be completely "off the map" for voters in industrial democracies, since their desired post-tax Gini coefficients are for most conditions slightly larger than those in very egalitarian countries such as Denmark (Gini=0.220) or Sweden (0.261).[39]

3.6 Conclusion

What is the relative importance of social preferences for equality as opposed to other forces such as self-interest and risk aversion in determining support for redistribution at the societal level? Does demand for redistribution vary with the perception of whether earnings are 'deserved' or not?

To address these questions, we conducted sixteen experimental sessions in each of which each of twenty-one subjects could potentially determine the degree, if any, to which an array of earnings mirroring U.S. pre-tax income distribution would be modified by a linear tax-and-transfer scheme under 'earned' and 'unearned' income conditions as well as in both the situation of a disinterested observer and that of an involved observer, the latter both under uncertainty about own position and after resolution of uncertainty. Our experiment is distinctive in its combination of large groups, large subject pool, macro framing, decision-making under multiple conditions, and variation of both direct cost to decision-maker and efficiency cost of redistribution. While participants were mainly undergraduates at Brown University, a smaller set of parallel sessions obtained similar results for non-student adult subjects.

[39]Gini coefficients for disposable income in 2001, from the United Nations World Income Inequality Database

Both the median selected tax rates and the tax rates maximizing the sum of calibrated utility functions (aggregate social welfare) call for the elimination of about half of pre-tax income inequality when the efficiency loss is low or zero. Self-interest stands out as a dominant concern in the interested decision-maker conditions, with most choices converging toward the degree of redistribution maximizing own income when uncertainty of position is resolved and with high redistribution levels being a natural outcome of the right-skewed nature of the pre-tax distribution. Yet preferred redistribution levels were only a few percent lower in the disinterested observer condition. Because the situation in which voters find themselves when voting on candidates who will determine tax and transfer levels resembles more that of our involved observer conditions, with some degree of uncertainty but also some knowledge of position, our findings suggest that self-interest, including risk-aversion, suffices in practice to explain most of the observed preference for reducing inequalities by state action. But our data also suggest that disinterested social preferences for equality would lead to only slightly lower levels of redistribution, were concerns about the impact on own earnings not present.

Turning to the second question with which we began this section, our subjects' choices suggested a considerable impact of whether relative pre-tax earnings were or were not determined by knowledge or skill, with the average preferred level of taxation and redistribution being about 27% greater in "earned" than in "unearned" income conditions.[40] Our findings are consistent with the suggestions of authors like Benabou and Tirole (2006) that differences in demand for redistribution across countries may be explained, at least in part, by different beliefs about the extent to which pre-tax inequalities are earned. The lion's share of the sensitivity of preferred redistribution to source of inequality is attributable to male subjects (the average difference between "earned" and "unearned" methods being 14.5%), with female subjects typically preferring more redistribution in all conditions and showing an average difference of only 4% between preferred redistribution in "earned" vs.

[40] An average tax rate of 47% and 37% respectively.

"unearned" inequality conditions. We thus illuminate the sources of differences in voting by gender while also confirming a gender gap that is large and consistent with female voters' observed differential inclination to vote for candidates and parties associated with greater tax progressivity and more social spending.

How valid, if at all, is extrapolating from these findings to the political economy of taxation and redistribution? Clearly, our findings can be no more than suggestive, among other reasons because stakes averaging $25 are small compared to U.S. annual incomes and because our experiment abstracts from production, investment, and the incentive issues attaching to them. But we can allay some other common concerns. For instance, experimentalists speak of an "experimenter demand effect" in which subjects do what they guess the experimenter wants them to do, and they worry about the possibility that subjects will take actions that appear economically irrational simply to avoid boredom if these are the only action opportunities offered them. Might our subjects have chosen to redistribute earnings simply to have something to do or because opportunities to dis-equalize were not on offer? Although our disinterested observer condition (Part I) could potentially suffer from such problems, several factors suggest to us that they are not major concerns.

First, Forsythe et al. (1994) find that first-mover sending is greatly reduced in dictator games when double-blindness is assured, as is the case in our design. Second, in our interested observer conditions, and especially after the resolution of uncertainty (Part III), most subjects had opportunities to choose distributions that were more unequal than the one maximizing their own earnings, and more did so when pre-tax incomes were 'earned,' suggesting fairness concerns other than preferences for equality. That tax choices tended to vary systematically with self-interest, that they were responsive to direct and efficiency costs, and that they varied significantly with pre-tax income determination method, gender, and self-reported political philosophy, all suggest that perceived experimenter demand, or 'doing something rather than nothing,' were not the main factors behind subjects' decisions in our experiment. In sum, our data appear to provide real insights into the demands for

redistribution that play an important role in modern economies and polities. Use of experimental methods like ours with more diverse subject pools, including subjects in countries exhibiting different tax and transfer preferences than the United States, could further expand our understanding of why states redistribute.

Figure 3.1: Sequence of the Experimental Session

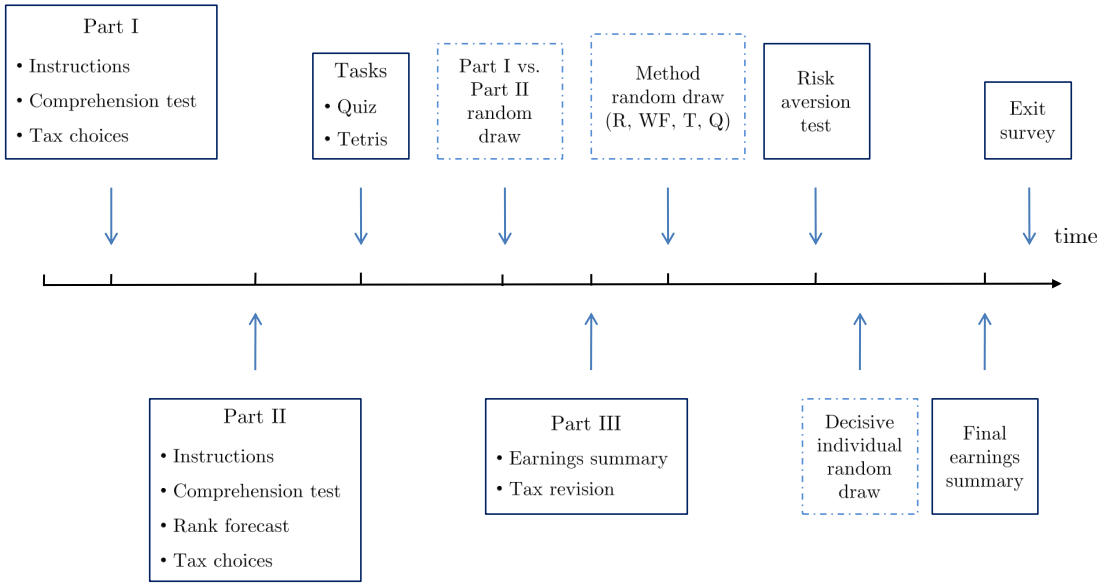


Figure 3.2: Part I Average Tax Rate by Tax Cost and Efficiency Loss

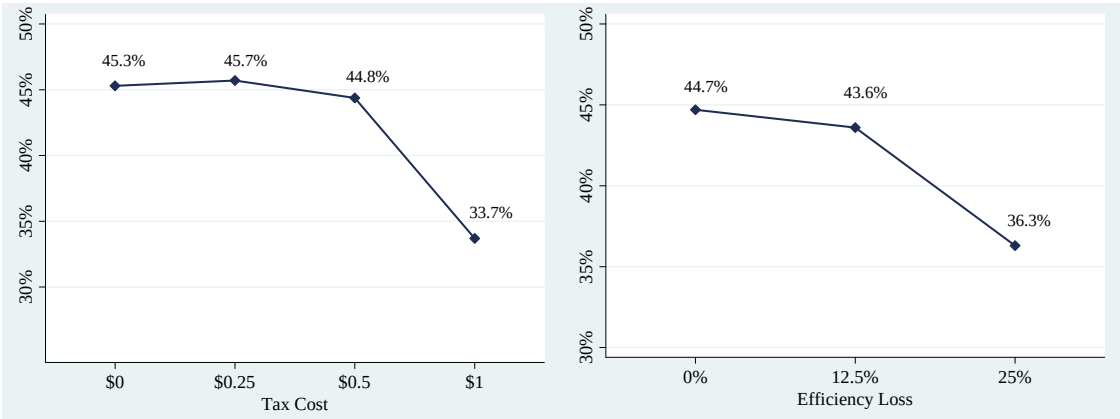


Figure 3.3: Part I Average Tax Choice by Method

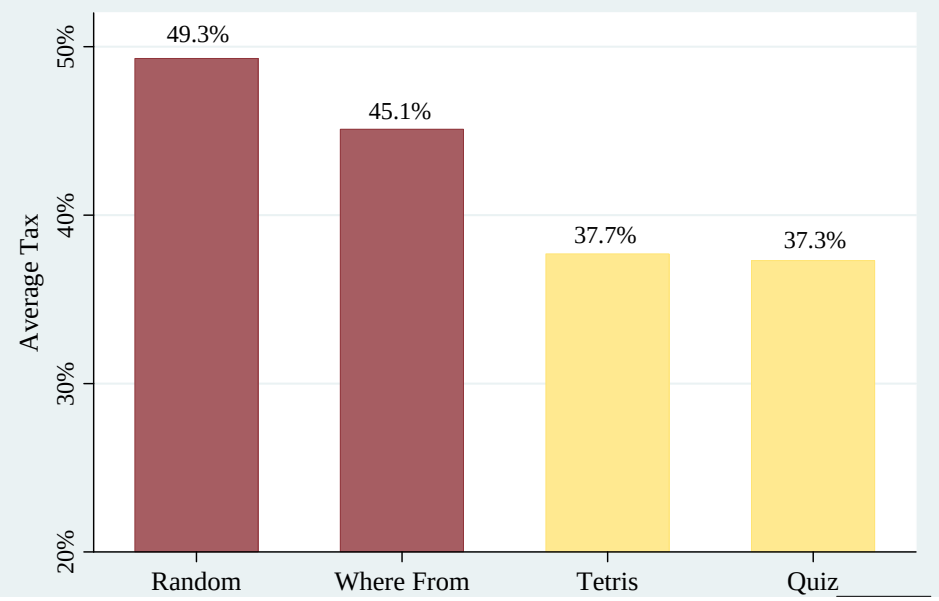


Figure 3.4: Part I Average Tax Choice by Method and Gender

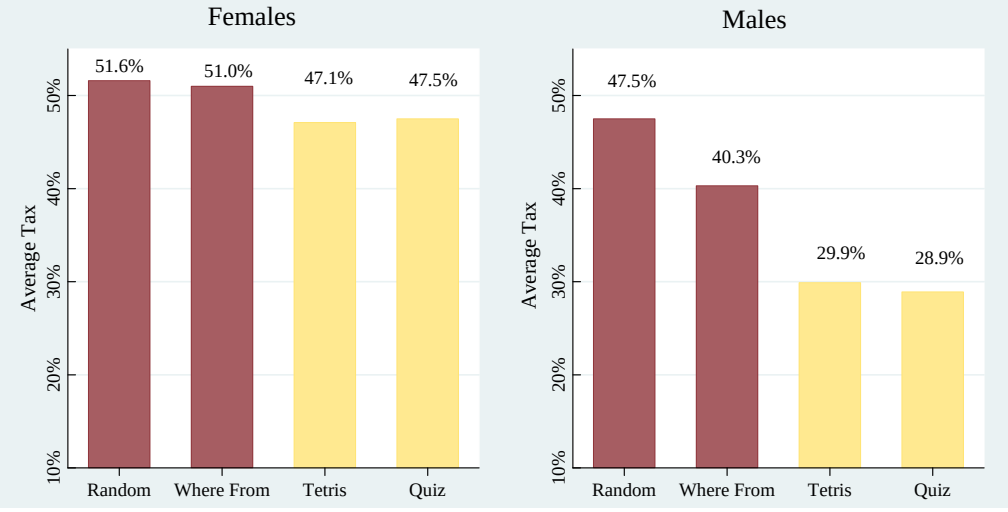


Figure 3.5: Part II Tax Choices Distribution by Expected Rank

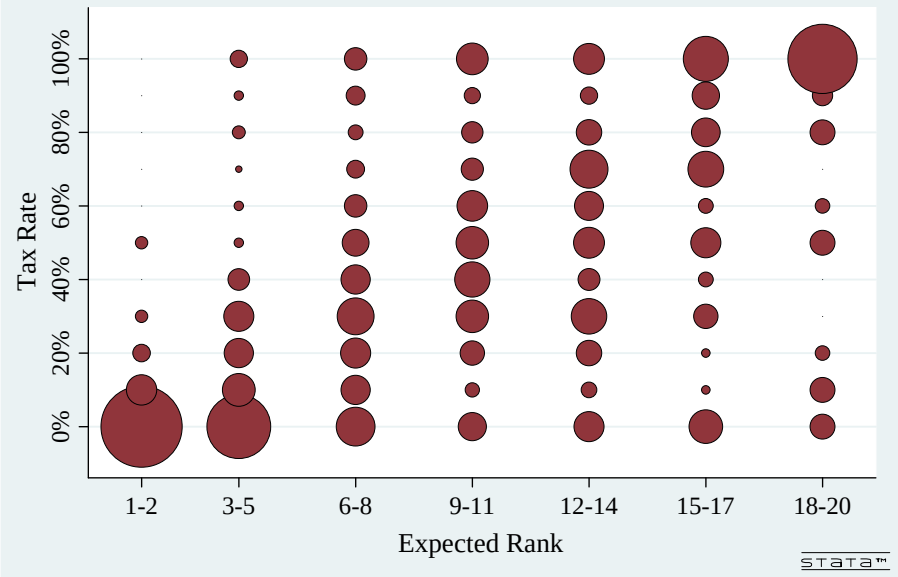
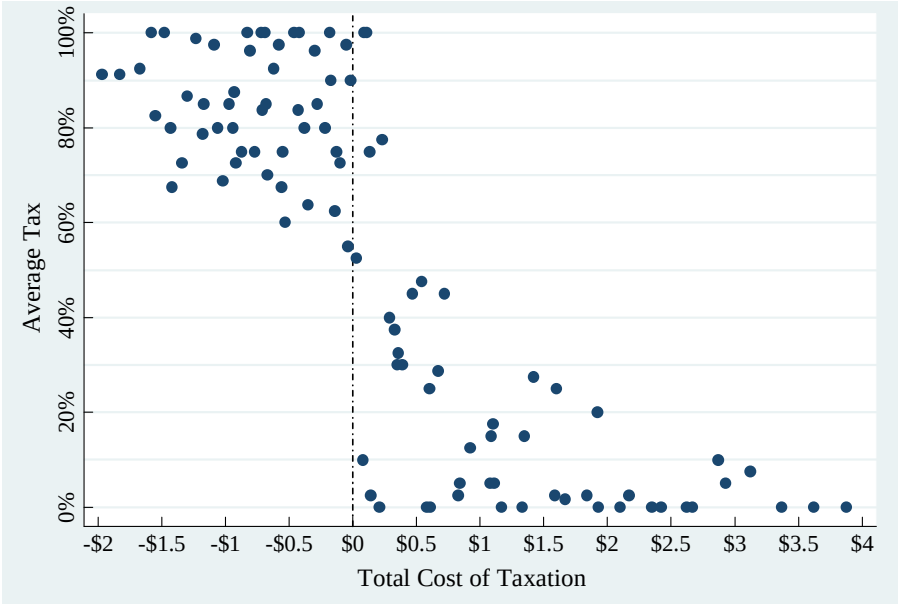


Figure 3.6: Part III Average Tax Choice by Total Cost of Taxation



Note: the "Total Cost of Taxation" includes the regular tax cost parameter used in the experimental session as well as the additionall cost of redistribution which depends on each individual's revealed rank.

Figure 3.7: Part III Tax Choice by Total Cost of Taxation

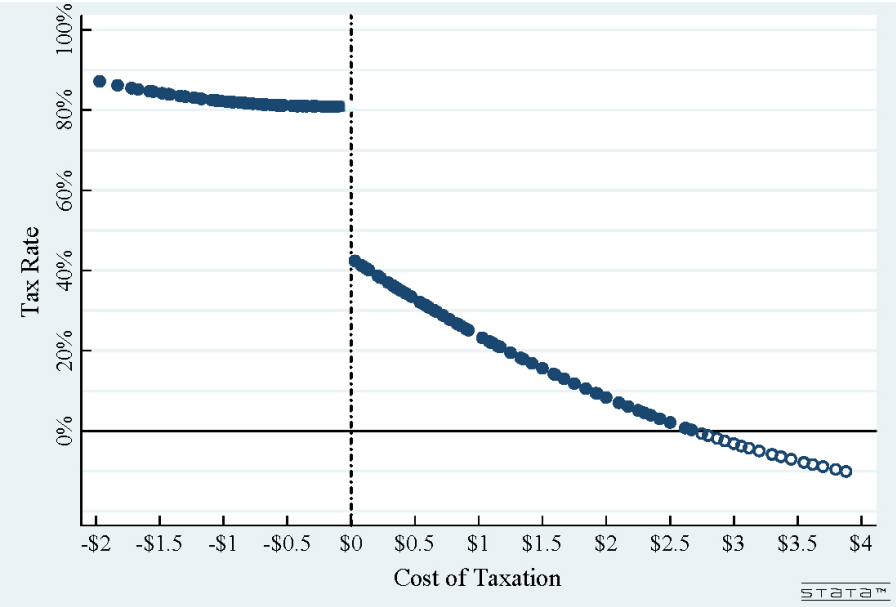


Figure 3.8: Part III Tax Choice by Total Cost of Taxation and Part I Tax Choice

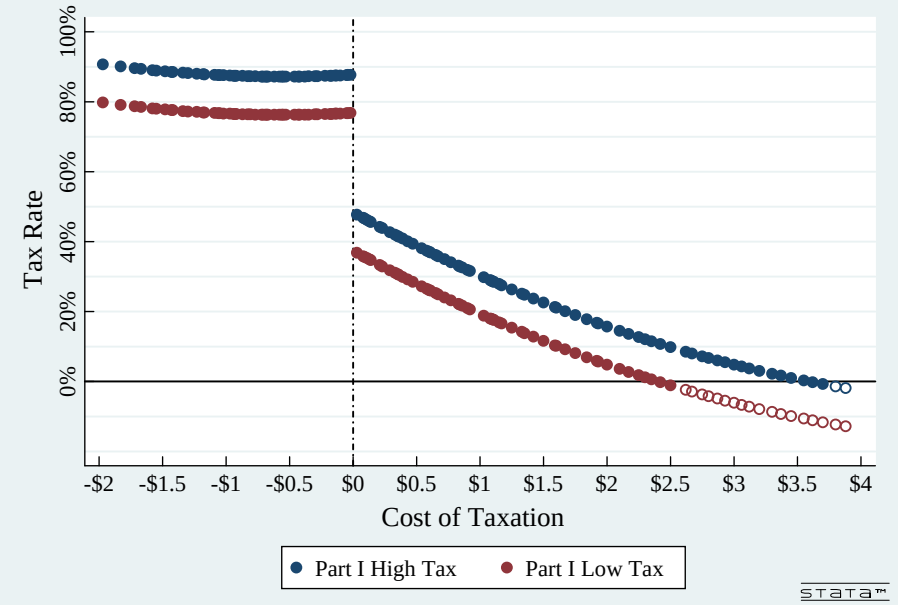


Figure 3.9: Part I Optimal Tax

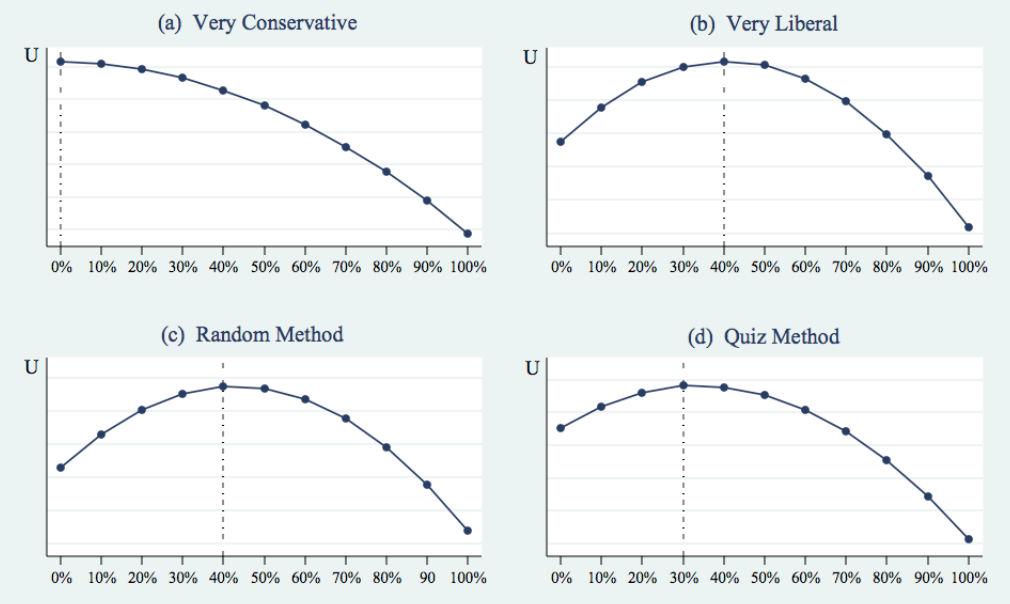


Table 3.1: Part I Participants' Earnings Distribution under Different Tax Rates

Rank	*t = 0%*	*t = 10%*	*t = 20%*	*t = 30%*	*t = 40%*	*t = 50%*	*t = 60%*	*t = 70%*	*t = 80%*	*t = 90%*	*t = 100%*
1	100.0	92.0	84.0	75.9	67.9	59.9	51.9	43.9	35.8	27.8	19.8
2	46.1	43.4	40.8	38.2	35.6	32.9	30.3	27.7	25.1	22.4	19.8
3	36.6	34.9	33.2	31.5	29.9	28.2	26.5	24.8	23.2	21.5	19.8
4	30.8	29.7	28.6	27.5	26.4	25.3	24.2	23.1	22.0	20.9	19.8
5	26.5	25.9	25.2	24.5	23.8	23.2	22.5	21.8	21.2	20.5	19.8
6	23.3	23.0	22.6	22.3	21.9	21.6	21.2	20.9	20.5	20.2	19.8
7	20.6	20.5	20.5	20.4	20.3	20.2	20.1	20.1	20.0	19.9	19.8
8	18.4	18.6	18.7	18.8	19.0	19.1	19.3	19.4	19.5	19.7	19.8
9	16.3	16.6	17.0	17.3	17.7	18.0	18.4	18.8	19.1	19.5	19.8
10	14.5	15.0	15.5	16.1	16.6	17.1	17.7	18.2	18.7	19.3	19.8
11	12.7	13.4	14.1	14.9	15.6	16.3	17.0	17.7	18.4	19.1	19.8
12	11.1	12.0	12.9	13.7	14.6	15.5	16.3	17.2	18.1	18.9	19.8
13	9.6	10.6	11.6	12.6	13.7	14.7	15.7	16.7	17.8	18.8	19.8
14	8.1	9.3	10.5	11.6	12.8	14.0	15.1	16.3	17.5	18.6	19.8
15	6.8	8.1	9.4	10.7	12.0	13.3	14.6	15.9	17.2	18.5	19.8
16	5.5	7.0	8.4	9.8	11.2	12.7	14.1	15.5	17.0	18.4	19.8
17	4.3	5.9	7.4	9.0	10.5	12.1	13.6	15.2	16.7	18.3	19.8
18	3.1	4.8	6.4	8.1	9.8	11.5	13.1	14.8	16.5	18.1	19.8
19	1.5	3.3	5.2	7.0	8.8	10.7	12.5	14.3	16.1	18.0	19.8
20	0.1	2.1	4.0	6.0	8.0	10.0	11.9	13.9	15.9	17.8	19.8

Table 3.2: Experimental Sessions and Subjects by Tax Cost and Dead Weight Loss

		Tax Cost				
		$0	$0.25	$0.50	$1	Total
Dead Weight Loss	0%	2 (42)	2 (42)	2 (42)	2 (42)	8 (168)
	12.5%	1 (21)	1 (21)	1 (20)	1 (21)	4 (83)
	25%	1 (21)	1 (21)	1 (21)	1 (21)	4 (84)
	Total	4(84)	4(84)	4(83)	4(84)	**16 (336)**

Note: numbers in parenthesis indicate the total number of subjects participating in the experimental sessions.

Table 3.3: Tobit Regressions for Part I (All Methods)

Dependent variable: Part I Tax Choice

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax Cost	-0.116***	-0.117***	-0.113***	-0.113***	-0.116***	-0.105***	-0.105***
	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.022)	(0.022)
Efficiency Loss	-0.082***	-0.082***	-0.071***	-0.087***	-0.077***	-0.073***	-0.073***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
WF		-0.040	-0.041	-0.041	-0.040	-0.042	
		(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	
Tetris		-0.113***	-0.115***	-0.114***	-0.114***	-0.116***	
		(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	
Quiz		-0.111***	-0.113***	-0.112***	-0.113***	-0.114***	
		(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	
Tetris-Quiz							-0.096***
							(0.019)
Female			0.133***			0.105***	0.104***
			(0.019)			(0.020)	(0.020)
Asian			0.002			0.006	0.006
			(0.026)			(0.026)	(0.026)
African American			-0.007			-0.052	-0.052
			(0.038)			(0.038)	(0.038)
Hispanic			0.026			-0.001	-0.001
			(0.040)			(0.040)	(0.040)
Income				-0.031*		-0.037**	-0.037**
				(0.016)		(0.016)	(0.016)
Risk Aversion				0.010***		0.007***	0.007***
				(0.002)		(0.002)	(0.002)
Political Philosophy					0.034***	0.033***	0.033***
					(0.008)	(0.008)	(0.008)
Economics Courses					-0.014***	-0.012***	-0.012***
					(0.005)	(0.005)	(0.005)
Constant	0.303***	0.374***	0.312***	0.645***	0.220***	0.519***	0.496***
	(0.012)	(0.021)	(0.024)	(0.164)	(0.047)	(0.178)	(0.177)
Observations	1340	1340	1340	1340	1340	1340	1340
Uncensored observations	837	837	837	837	837	837	837
Left-censored observations	316	316	316	316	316	316	316
Right-censored observations	187	187	187	187	187	187	187
Log Likelihood	-1155	-1142	-1118	-1131	-1125	-1098	-1099
Chi2	40.334	66.378	113.711	88.816	100.115	154.259	151.816
Pseudo-R square	0.017	0.028	0.048	0.038	0.043	0.066	0.065

*Coefficients are marginal effects. Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3.4: Tobit Regressions for Part I with Gender Interaction Terms

Dependent variable: Part I Tax Choice

	(1)	(2)	(3)	(4)	(5)
Tax Cost	-0.105***	-0.105***	-0.141***	-0.105***	-0.142***
	(0.022)	(0.022)	(0.028)	(0.022)	(0.028)
Efficiency Loss	-0.073***	-0.073***	-0.073***	-0.113***	-0.114***
	(0.022)	(0.022)	(0.022)	(0.028)	(0.028)
Female	0.104***	0.055*	0.083***	0.081***	0.009
	(0.020)	(0.028)	(0.023)	(0.023)	(0.032)
Tetris-Quiz	-0.096***	-0.142***	-0.096***	-0.096***	-0.143***
	(0.019)	(0.026)	(0.019)	(0.019)	(0.026)
Female * Tetris-Quiz		0.100***			0.101***
		(0.039)			(0.039)
Female * Tax Cost			0.086*		0.088*
			(0.046)		(0.046)
Female * Efficiency Loss				0.099**	0.100**
				(0.046)	(0.046)
Constant	0.496***	0.52***	0.426**	0.475***	0.529***
	(0.177)	(0.177)	(0.178)	(0.178)	(0.178)
Observations	1340	1340	1340	1340	1340
Uncensored observations	837	837	837	837	837
Left-censored observations	316	316	316	316	316
Right-censored observations	187	187	187	187	187
Log Likelihood	-1099	-1096	-1097	-1097	-1092
Chi2	151.816	158.535	155.380	156.396	166.914
Pseudo-R square	0.065	0.067	0.066	0.067	0.071

The following controls are included in the regression and maintain the expected sign and statistical significance: measure of risk aversion, ethnic dummies, log income, self-reported political identification, # of economics courses taken.

*Coefficients shown are marginal effects. Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3.5: Tobit Regressions for Parts I and II Pooled (Random Method)

Dependent variable: Part I and II Tax Choice

	(1)	(2)	(3)
Tax Cost	-0.145***	-0.145***	-0.145***
	(0.032)	(0.031)	(0.031)
Efficiency Loss	-0.101***	-0.101***	-0.101***
	(0.032)	(0.032)	(0.032)
Female	0.017	0.017	0.017
	(0.029)	(0.029)	(0.029)
Income	0.047**	0.047**	0.047**
	(0.024)	(0.023)	(0.023)
Risk Aversion	0.008**	0.008**	0.010**
	(0.003)	(0.003)	(0.005)
Political Philosophy	0.045***	0.045***	0.045***
	(0.011)	(0.011)	(0.011)
Economics Courses	-0.021***	-0.021***	-0.021***
	(0.007)	(0.007)	(0.007)
Part II		0.059**	0.076*
		(0.027)	(0.043)
Part II * Risk Aversion			-0.003
			(0.007)
Constant	-0.311	-0.342	-0.351
	[0.253]	[0.253]	[0.254]
Observations	670	670	670
Uncensored observations	421	421	421
Left-censored observations	111	111	111
Right-censored observations	138	138	138
Log Likelihood	-552	-550	-550
Pseudo-R square	0.068	0.072	0.072
Chi2	80.924	85.557	85.815

Ethnic dummies are included in the regression. Coefficients shown are marginal effects.
*Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%*

Table 3.6: Tobit Regressions for Part II with Expected Rank and Confidence

Dependent variable: Part II Tax Choice

	(1)	(2)	(3)	(4)	(5)
Tax Cost	-0.088***	-0.094***	-0.093***	-0.093***	-0.093***
	(0.024)	(0.023)	(0.023)	(0.023)	(0.023)
Efficiency Loss	-0.073***	-0.076***	-0.070***	-0.070***	-0.065***
	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)
Female	0.133***	0.084***	0.083***	0.096***	0.094***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Home Area Income	-0.109***	-0.040**	-0.038**	-0.029	-0.028
	(0.019)	(0.018)	(0.018)	(0.019)	(0.019)
Risk Aversion	0.008***	0.005**	0.005**	0.006**	0.005**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Political Philosophy	0.025***	0.021**	0.020**	0.022***	0.020**
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)
Economics Courses	-0.007	-0.005	-0.004	-0.004	-0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Tetris-Quiz	-0.065***	-0.044**	-0.055**	0.114**	0.097*
	(0.023)	(0.022)	(0.022)	(0.049)	(0.050)
Expected Rank		0.038***	0.034***	0.048***	0.044***
		(0.003)	(0.003)	(0.004)	(0.004)
Confidence			-0.182***		-0.168***
			(0.048)		(0.048)
Confidence*Expected Rank			0.012**		0.010*
			(0.005)		(0.005)
Tetris-Quiz * Expected Rank				-0.017***	-0.016***
				(0.005)	(0.005)
Observations	1005	1005	1005	1005	1005
Uncensored observations	651	651	651	651	651
Left-censored observations	237	237	237	237	237
Right-censored observations	117	117	117	117	117
Log Likelihood	-762	-651	-644	-645	-638
Pseudo-R square	0.091	0.225	0.233	0.232	0.240
Chi2	153.538	377.084	391.272	388.963	402.048

Ethnic dummies are included in the regression. Coefficients shown are marginal effects.
*Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%*

Table 3.7: Tobit Regressions for Part III (All Methods)

Dependent variable: Part III Tax Choice

	(1)	(2)
Tot. Cost of Taxation ($ per 10%)	-0.360***	-0.346***
	(0.053)	(0.054)
Total Cost of Taxation ^{2}	0.032***	0.030***
	(0.006)	(0.006)
Earnings-Maximising Tax Rate	0.312***	0.345***
	(0.065)	(0.064)
EMTR * Cost of Taxation	0.358***	0.365***
	(0.080)	(0.081)
Part I Tax		0.309***
		(0.059)
Observations	588	588
Uncensored observations	149	149
Left-censored observations	197	197
Right-censored observations	242	242
Log Likelihood	-443	-429
Pseudo-R square	0.302	0.324
Chi2	383.574	411.091

*Coefficients shown are marginal effects. Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3.8: Estimates of the Utility Function Parameters

Experimental Condition	β	γ	η	δ
Part I	n.a.	+ (***)	- (***)	+ (***)
Part II (Random method)	- ( )	+ (***)	- (***)	+ (*)
Part II (Non-random methods)	+ ( )	+ (***)	- (***)	+ ( )
Part III	n.a.	- (***)	- (***)	- ( )

(*) *significant at the 10% level,* (**) *5%,* (***) *1%*

Appendix A

Figure A.1: Geographic Distributions of Trust score in ESS regions

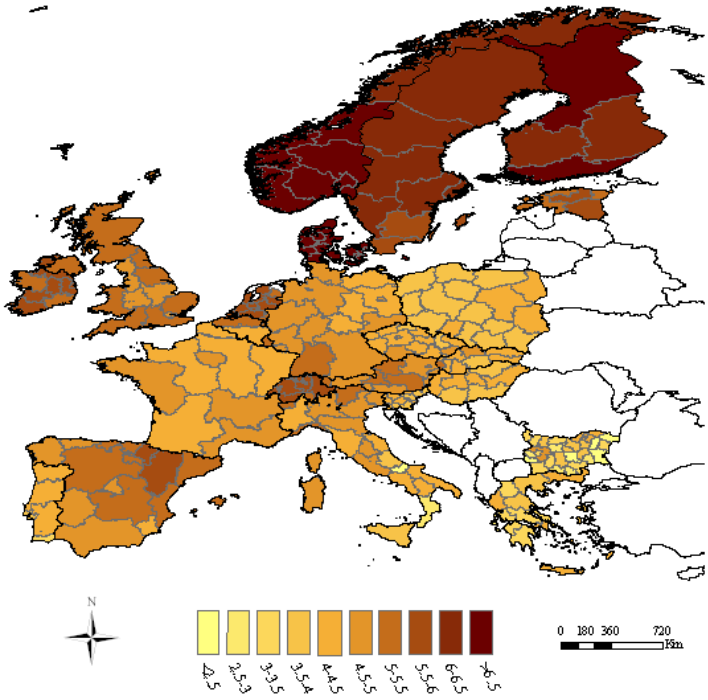


Figure A.2: Geographic Distribution of Family Ties (P.C) in EVS regions

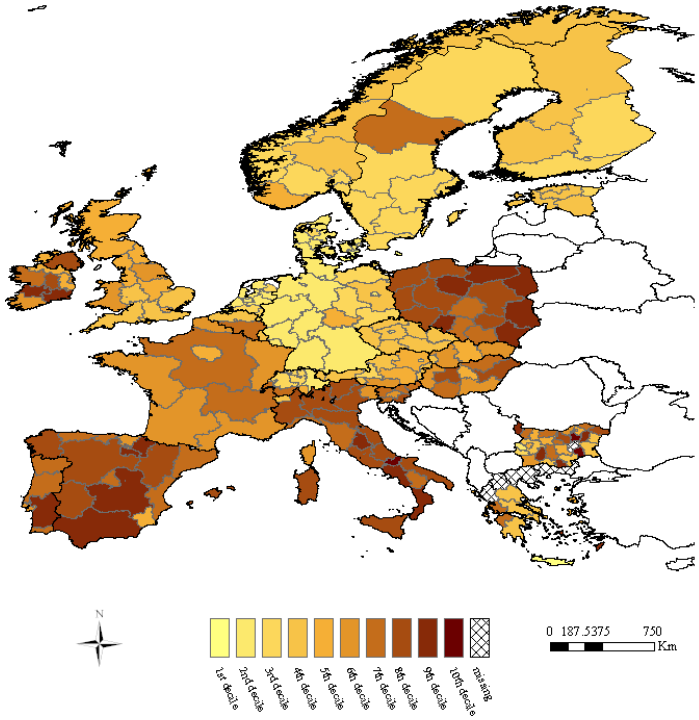


Figure A.3: Grid Cell Size for Contemporary and Historical Climate Data

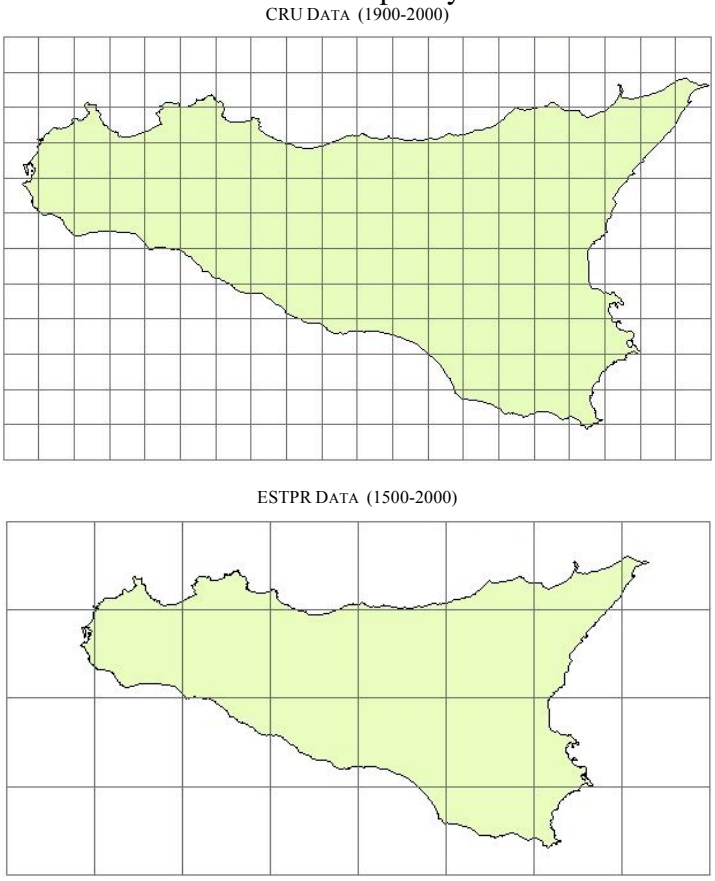


Figure A.4: Climate 1900-2000 and 1500-1900

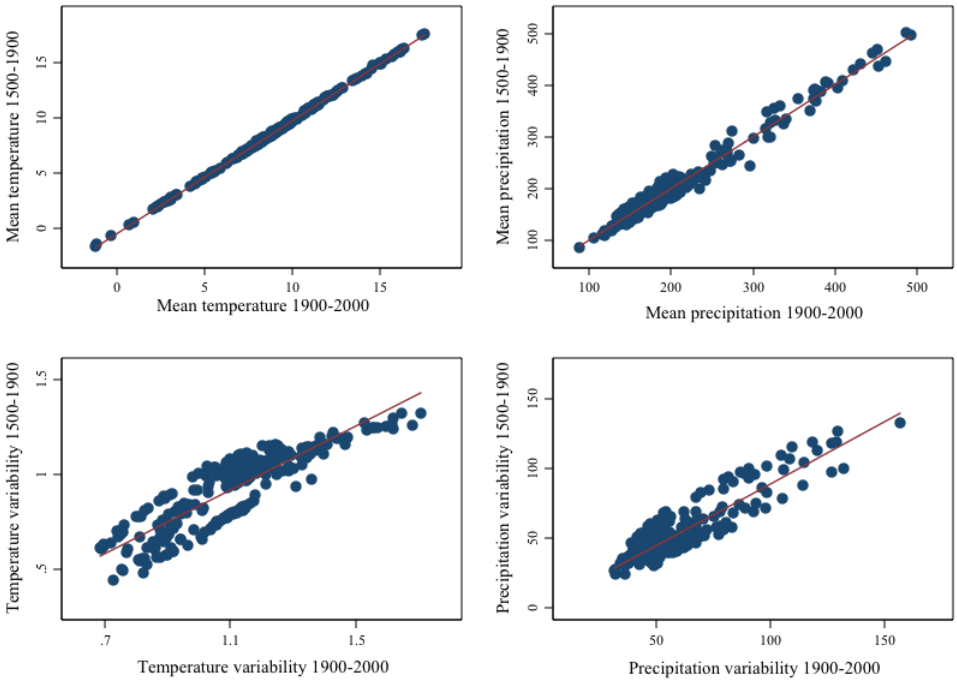


Table A.1: Social Trust and Climate Variability (1900-2000) - (robustness checks)

	Precipitation				Temperature			
	Dependent variable:				Dependent variable:			
	Trust (conditional)	Trust (uncon.)	Trust (uncon.)	Trust (uncon.)	Trust (conditional)	Trust (uncon.)	Trust (uncon.)	Trust (uncon.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variability GSM	0.132***		0.167***	0.211***	1.060***		0.977***	1.518***
	(0.041)		(0.054)	(0.049)	(0.333)		(0.328)	(0.443)
Variability GSM (detrended)		0.118***				0.635***		
		-0.03				(0.208)		
Spatial Correlation	-4.461**	-5.687***	-6.202**	-8.909***	7.999	-3.385	-0.314	-7.414
	(2.093)	(1.958)	(2.596)	(1.744)	(11.277)	(13.915)	(14.354)	(14.650)
Average Temperature	0.038*	0.040*	0.043*	0.053**	0.025	0.032	0.033	0.085***
	(0.021)	(0.023)	(0.024)	(0.023)	(0.029)	(0.033)	(0.036)	(0.027)
Average Precipitation	-0.029**	-0.042**	-0.029	-0.055**	0.023	0.023	0.021	0.020
	(0.014)	(0.015)	(0.020)	(0.020)	(0.019)	(0.018)	(0.026)	(0.015)
Average Terrain Ruggedness	0.038	0.035	0.012	0.038	0.039	0.071	0.075	0.129**
	(0.039)	(0.043)	(0.041)	(0.042)	(0.057)	(0.058)	(0.062)	(0.050)
Soil Quality (Average)	0.001	0.007	-0.009	0.036	-0.006	0.001	-0.016	0.003
	(0.022)	(0.024)	(0.030)	(0.024)	(0.035)	(0.034)	(0.045)	(0.041)
Soil Quality (St. Dev.)	0.041	0.042	0.096	0.041	0.010	0.027	0.038	0.035
	(0.047)	(0.055)	(0.060)	(0.059)	(0.059)	(0.057)	(0.090)	(0.071)
Area	0.013	-0.060	0.016	-0.021	-0.171	-0.195	-0.043	-0.055
	(0.106)	(0.132)	(0.126)	(0.139)	(0.183)	(0.212)	(0.167)	(0.213)
Landlocked	0.039	0.053	0.037	0.070	-0.023	0.003	-0.015	0.019
	(0.067)	(0.076)	(0.081)	(0.086)	(0.096)	(0.105)	(0.109)	(0.122)
Distance to the Coast	0.030	0.027	0.028	0.054	0.034	0.028	0.038	-0.007
	(0.029)	(0.030)	(0.033)	(0.051)	(0.034)	(0.044)	(0.047)	(0.066)
Access to Rivers	0.044**	0.040*	0.034*	0.038	0.056*	0.058*	0.049	0.040
	(0.017)	(0.023)	(0.018)	(0.027)	(0.027)	(0.031)	(0.031)	(0.035)
Latitude	0.046**	0.055***	0.046**	0.065***	0.045	0.042	0.052	0.053
	(0.018)	(0.019)	(0.022)	(0.020)	(0.027)	(0.030)	(0.040)	(0.032)
Scandinavian regions	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Ex-communist regions	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	251	251	217	167	251	251	217	167
Number of clusters	24	24	20	18	24	24	20	18
R-square	0.951	0.944	0.884	0.955	0.892	0.888	0.794	0.928

*OLS regressions. The dependent variable is the conditional measure of trust in columns 1 and 5, and the unconditional measure of trust in the other ones. Scandinavian regions (all regions of Denmark, Finland, Norway and Sweden) are excluded from the sample in columns 3 and 7; formerly communist regions (all regions of Bulgaria, Czech Republic, Estonia, Hungary, Poland, and Slovakia, and the eastern regions of Germany) are excluded from the sample in columns 4 and 8. Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Table A.2: Social Trust and Climate Variability (1900-2000) - (with different growing seasons)

	Dependent variable: Trust in others (unconditional regional average)							
	Precipitation				Temperature			
	Growing season months:				Growing season months:			
	March to October	April to November	March to November	April to September	March to October	April to November	March to November	April to September
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variability GSM	0.169***	0.150***	0.150***	0.175***	1.133***	1.718***	1.129***	1.060**
	(0.042)	(0.040)	(0.037)	(0.049)	(0.315)	(0.586)	(0.294)	(0.380)
Spatial Correlation	-5.652***	-5.687***	-5.601**	-5.911***	3.959	-0.946	2.686	4.122
	(1.977)	(2.024)	(2.026)	(1.989)	(13.859)	(14.845)	(13.896)	(13.873)
Average Temperature	0.034	0.035	0.031	0.044*	0.033	0.017	0.032	0.029
	(0.023)	(0.023)	(0.022)	(0.023)	(0.032)	(0.035)	(0.033)	(0.031)
Average Precipitation	-0.048***	-0.041**	-0.044**	-0.038**	0.023	-0.048	0.024	0.019
	(0.017)	(0.016)	(0.016)	(0.016)	(0.019)	(0.029)	(0.018)	(0.020)
Average Terrain Ruggedness	0.032	0.037	0.034	0.037	0.058	0.038	0.060	0.056
	(0.043)	(0.042)	(0.042)	(0.042)	(0.060)	(0.067)	(0.060)	(0.062)
Soil Quality (Average)	0.008	0.008	0.008	0.008	-0.004	-0.007	-0.004	-0.004
	(0.024)	(0.024)	(0.024)	(0.023)	(0.037)	(0.036)	(0.036)	(0.036)
Soil Quality (St. Dev.)	0.045	0.047	0.046	0.049	0.019	0.030	0.023	0.015
	(0.056)	(0.054)	(0.055)	(0.054)	(0.063)	(0.066)	(0.061)	(0.064)
Area	-0.080	-0.087	-0.105	-0.025	-0.234	-0.259	-0.244	-0.219
	(0.127)	(0.131)	(0.129)	(0.130)	(0.203)	(0.210)	(0.208)	(0.200)
Landlocked	0.052	0.054	0.050	0.059	-0.008	0.008	-0.004	-0.006
	(0.074)	(0.074)	(0.074)	(0.075)	(0.101)	(0.095)	(0.102)	(0.097)
Distance to the Coast	0.027	0.029	0.030	0.021	0.028	0.056	0.023	0.028
	(0.031)	(0.031)	(0.031)	(0.030)	(0.039)	(0.044)	(0.040)	(0.038)
Access to Rivers	0.042*	0.043*	0.044*	0.037	0.058*	0.066**	0.059*	0.056*
	(0.023)	(0.023)	(0.023)	(0.023)	(0.031)	(0.029)	(0.031)	(0.030)
Latitude	0.052**	0.054***	0.052**	0.055***	0.046	0.058**	0.044	0.052*
	(0.019)	(0.019)	(0.020)	(0.019)	(0.028)	(0.026)	(0.028)	(0.028)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	251	251	251	251	251	251	251	251
Number of clusters	24	24	24	24	24	24	24	24
R-square	0.945	0.944	0.944	0.946	0.889	0.889	0.889	0.889

*OLS regressions. "Variability GSM" is the variability in the growing season months defined as the months from March to October (columns 1 and 5), April to November (columns 2 and 6), March to November (columns 3 and 7) and April to September (columns 4 and 8). Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Table A.3: Trust, Precipitation Variability and Institutions (robustness checks)

	Dependent variable: Trust in others (unconditional regional average)							
	Constraints on the executive:							
	Average 1600-1750	Average 1600-1750	1600	1600	1700	1700	1750	1750
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Precipitation Variability GSM (1500-1750)		0.478**		0.469**		0.450**		0.502**
		(0.170)		(0.142)		(0.160)		(0.187)
Contraints on the Executive	0.163***	0.171**	0.147***	0.153**	0.152***	0.156**	0.142***	0.157**
	(0.040)	(0.050)	(0.039)	(0.045)	(0.040)	(0.053)	(0.033)	(0.052)
Literacy (1880)	0.010*	0.009**	0.011**	0.010**	0.009*	0.009*	0.009	0.009
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.006)	(0.005)
Urbanization (1850)	-0.003	-0.002	-0.003	-0.002	-0.003	-0.002	-0.003	-0.001
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	64	64	64	64	64	64	64	64
Number of clusters	8	8	8	8	8	8	8	8
R-square	0.752	0.767	0.755	0.769	0.747	0.760	0.746	0.762

*OLS regressions. "Constraints on the executive" is the average score for the years 1600, 1700, and 1750 in columns 1 and 2, the score for 1600 (columns 3 and 4), for 1700 (columns 5 and 6) and for 1750 (columns 7 and 8). Regional controls: mean temperature, mean precipitation, average ruggedness index, soil suitability (average and standard deviation), area, dummy for landlocked, number of major rivers passing through the region, distance from of the region's centroid from the coast, latitude of the region's centroid. Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Table A.4: Trust, Temperature Variability and Institutions (robustness checks)

	Dependent variable: Trust in others (unconditional regional average)							
	Constraints on the Executive:							
	Average 1600-1750	Average 1600-1750	1600	1600	1700	1700	1750	1750
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Temperature Variability GSM (1500-1750)		1.977*		1.904*		2.034*		2.133*
		(1.004)		(0.981)		(1.020)		(1.013)
Contraints on the Executive	0.163***	0.102**	0.147***	0.087**	0.152***	0.085**	0.142***	0.105***
	(0.040)	(0.033)	(0.039)	(0.033)	(0.040)	(0.035)	(0.033)	(0.025)
Literacy (1880)	0.010*	0.005	0.011**	0.006	0.009*	0.004	0.009	0.004
	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.005)
Urbanization (1850)	-0.003	-0.002	-0.003	-0.002	-0.003	-0.002	-0.003	-0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	64	64	64	64	64	64	64	64
Number of clusters	8	8	8	8	8	8	8	8
R-square	0.752	0.781	0.755	0.780	0.747	0.778	0.746	0.783

*OLS regressions. "Constraints on the executive" is the average score for the years 1600, 1700, and 1750 in columns 1 and 2, the score for 1600 (columns 3 and 4), for 1700 (columns 5 and 6) and for 1750 (columns 7 and 8). Regional controls: mean temperature, mean precipitation, average ruggedness index, soil suitability (average and standard deviation), area, dummy for landlocked, number of major rivers passing through the region, distance from of the region's centroid from the coast, latitude of the region's centroid. Robust standard errors clustered at the country level in parenthesis. ***, ** and * indicates significance at the 1, 5 and 10% level.*

Appendix B

ITANES 2001-04 Panel Survey – Relevant Questions

Political Self-Identification

Question: In political matters people talk of "the left" and "the right". In this card there is a row of cells going from the left to the right. Thinking about your political opinions, where would you place yourself?

Left									Right
A	B	C	D	E	F	G	H	I	L

Does not want to place him/herself
Don't know
No answer

Favorite TV Channel

Q.: I am going to mention some television channels. Can you please tell me how often you usually watch each of them?

	Channel	Often	Rather often	Rarely	Never or almost never	No answer
1	Rai 1	1	2	3	4	-1
2	Rai 2	1	2	3	4	-1
3	Rai 3	1	2	3	4	-1
4	Canale 5	1	2	3	4	-1
5	Italia 1	1	2	3	4	-1
6	Rete 4	1	2	3	4	-1
7	Smaller channels or local TV stations	1	2	3	4	-1

News Consumption on TV

Q.: Do you usually watch news programs? If so, how often?

No, never
Less than once a week
1 day a week
2 days a week
3 days a week
4 days a week
5 days a week
6 days a week
Every day
No answer

Favorite TV News Program (first and second)

Q.: Which news program do you usually watch most? And next?

Tg1 (RAI1)
Tg2 (RAI2)
Tg3 (RAI3)
Tg4 (Rete 4)
Tg5 (Canale 5)
Studio Aperto (Italia 1)
TMC News
Local news program
Other news program

Trust

Q.: Please tell me how much you trust each of the following institutions (i.e. very much, some what, little, not at all)

		Very much	Somewhat	A little	Not at all	Don't know	No answer
1	Parliament	1	2	3	4	9	-1
2	Political Parties	1	2	3	4	9	-1
3	President of the Republic	1	2	3	4	9	-1
4	Catholic Church	1	2	3	4	9	-1
5	Armed Forces	1	2	3	4	9	-1
6	Judiciary	1	2	3	4	9	-1
7	Press	1	2	3	4	9	-1
8	**RAI-TV**	**1**	**2**	**3**	**4**	**9**	**-1**
9	**Mediaset TV Stations (Canale5, Rete4, Italia1)**	**1**	**2**	**3**	**4**	**9**	**-1**
10	Trade Unions	1	2	3	4	9	-1
11	Police	1	2	3	4	9	-1
12	Public Administration	1	2	3	4	9	-1
13	Confindustria (Business' union)	1	2	3	4	9	-1
14	European Union	1	2	3	4	9	-1

Newspaper Consumption

Q. : Do you usually read newspapers (except of sport papers)? If so, how often?

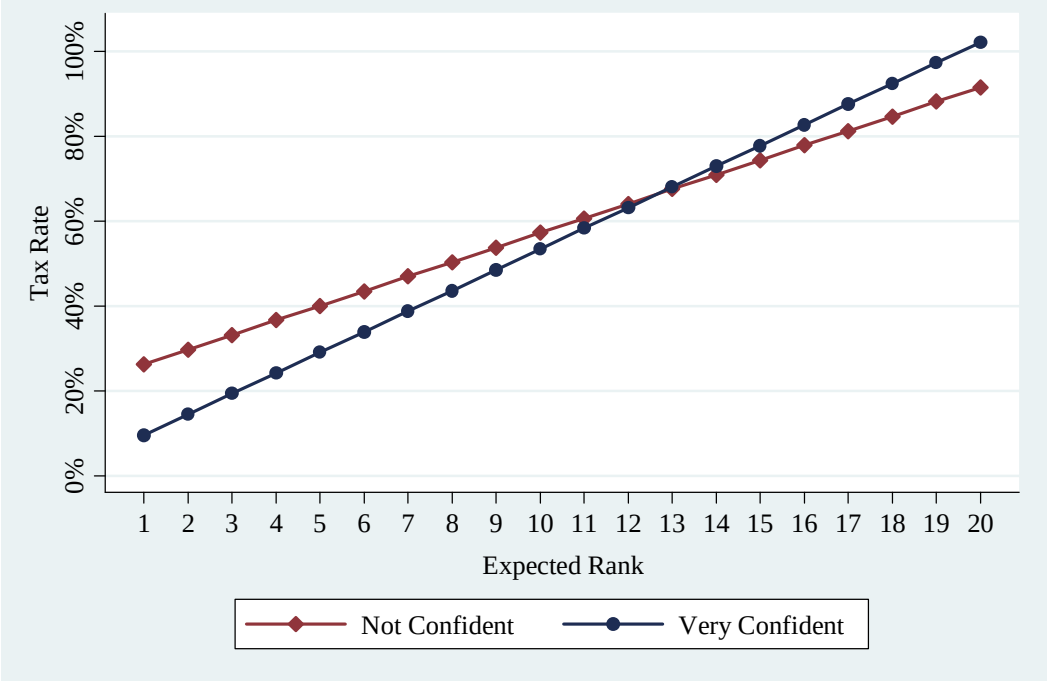
No, never
Less than once a week
1 day a week
2 days a week
3 days a week
4 days a week
5 days a week
6 days a week
Every day
No answer

Favorite Newspaper

Q. : Which newspapers do you usually read? (If more than one, indicate only the most read)

Appendix C

Figure C.1: Part II Tax Choices by Expected Rank and Confidence



Note: predicted tax choice for a subject of average characteristics, based on coefficients estimated in the Tobit regression shown in column (3) of Table 6.

Table C.1: U.S. Individual Income Distribution and Possible Experiment Earnings

Twentieth/Rank	Income	Earnings
1	$157,423	$100.00
2	$72,488	$46.05
3	$57,538	$36.55
4	$48,516	$30.82
5	$41,776	$26.54
6	$36,697	$23.31
7	$32,458	$20.62
8	$28,991	$18.42
9	$25,637	$16.29
10	$22,795	$14.48
11	$20,028	$12.72
12	$17,525	$11.13
13	$15,052	$9.56
14	$12,818	$8.14
15	$10,715	$6.81
16	$8,699	$5.53
17	$6,792	$4.31
18	$4,878	$3.10
19	$2,383	$1.51
20	$166	$0.11

Source: US Census Bureau, 2000

Table C.2: Distribution of Participants by Personal Characteristics

		Subjects	% Subjects
Gender			
	Female	151	45.1%
	Male	184	54.9%
Ethnic background			
	White	213	63.6%
	African-American	25	7.5%
	Asian	58	17.3%
	Hispanic	21	6.3%
Home Area Income			
	< $ 20,000	65	19.4%
	$ 20,000 - $ 40,000	176	52.5%
	$ 40,000 - $ 60,000	67	20.0%
	> $ 60,000	27	8.1%
Socioeconomic Status			
	Middle-low	162	48.4%
	Middle-high	173	51.6%
Political Inclination			
	Liberal	247	73.7%
	Moderate	50	14.9%
	Conservative	38	11.3%
Economics Courses			
	2 or less	283	84.5%
	More than 2	52	15.5%

Table C.3: Distribution of Tax Choices for Part I, II, and III by Method

Part I (335 subjects, 1340 choices)

	All	Random	Where From	Tetris	Quiz
t=0%	23.6%	20.0%	24.5%	25.7%	24.2%
t=10%	6.2%	3.9%	8.1%	5.7%	7.2%
t=20%	6.6%	5.1%	5.7%	8.4%	7.5%
t=30%	11.0%	8.1%	9.3%	13.4%	13.1%
t=40%	8.4%	8.1%	5.1%	9.3%	11.3%
t=50%	10.2%	14.6%	7.5%	8.4%	10.5%
t=60%	5.5%	5.4%	4.8%	6.6%	5.1%
t=70%	5.8%	5.1%	6.6%	5.7%	6.0%
t=80%	5.2%	5.7%	5.1%	5.4%	4.5%
t=90%	3.6%	5.1%	4.5%	3.3%	1.5%
t=100%	14.0%	19.1%	19.1%	8.4%	9.3%

Part II (335 subjects, 1340 choices)

	All	Random	Where From	Tetris	Quiz
t=0%	21.0%	13.1%	26.0%	25.1%	19.7%
t=10%	6.0%	3.6%	7.5%	6.3%	6.9%
t=20%	7.2%	5.4%	5.4%	9.3%	8.7%
t=30%	11.2%	8.7%	9.6%	13.1%	13.4%
t=40%	8.2%	8.1%	3.6%	10.2%	11.0%
t=50%	10.5%	16.1%	5.7%	8.7%	11.3%
t=60%	5.8%	4.8%	6.3%	5.1%	7.2%
t=70%	6.8%	7.5%	7.5%	6.9%	5.4%
t=80%	5.1%	5.7%	5.4%	5.1%	4.2%
t=90%	4.0%	5.1%	3.9%	3.9%	3.3%
t=100%	14.3%	22.1%	19.4%	6.6%	9.0%

Part III (147 subjects, 588 choices)

	All	Random	Where From	Tetris	Quiz
t=0%	33.5%	35.4%	34.7%	30.6%	33.3%
t=10%	3.9%	0.7%	5.4%	4.8%	4.8%
t=20%	1.5%	1.4%	0.7%	3.4%	0.7%
t=30%	3.1%	3.4%	3.4%	2.7%	2.7%
t=40%	3.1%	2.7%	1.4%	0.7%	7.5%
t=50%	3.7%	6.8%	3.4%	2.7%	2.0%
t=60%	2.0%	2.0%	2.0%	1.4%	2.7%
t=70%	3.2%	3.4%	2.0%	4.8%	2.7%
t=80%	2.0%	0.7%	3.4%	2.7%	1.4%
t=90%	2.7%	2.0%	2.7%	4.1%	2.0%
t=100%	41.2%	41.5%	40.8%	42.2%	40.1%

Table C.4: Questions Used to Construct the Political Philosophy and the Socioeconomic Status Indicators

	Political Phylosophy	
1.	Question: Possible answers:	Which of the following best describes your political inclination (affiliation)? Republican; Democrat; Independent; don't know; other
2.	Question: Possible answers:	Which of the following best describes your political philosophy (ideology)? On a scale of 1 (Very Conservative) to 7 (Very Liberal)
	Socioeconomic Status	
1.	Question: Possible answers:	When you were in high school, did your family live in: an apartment; a single family house; a multi-family house; other
2.	Question: Possible answers:	When your father was growing up, were his parents: working class ; middle class; upper middle class; rich
3.	Question: Possible answers:	When your mother was growing up, were her parents: working class ; middle class; upper middle class; rich
4.	Question: Possible answers:	When you were growing up, were your parents: working class ; middle class; upper middle class; rich
5.	Question: Possible answers:	How would you characterize the principal wage-earner in your family? a professional (doctor, lawyer, dentist, accountant, etc.) ; a business person, executive, or manager ; a small business owner ; an ordinary employee ; other
6.	Question: Possible answers:	Considering your family's income, what your family has to live on and the cost of living, how would you say your family is making out today? all right ; fairly well ; quite pinched ; not making ends meet

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