ABSTRACT

Title of Dissertation: BIOPHYSIOLOGICAL PREDICTORS OF POLITICAL ATTITUDES, AGGRESSION, AND VIOLENCE

Katherine Michelle Sawyer, Doctor of Philosophy, 2017

Dissertation directed by: Professor, William Reed, Department of Government and Politics

This dissertation consists of three essays examining the development of aggressive and violent political attitudes and actions. The first paper examines the relationship between genetic variation, volumetric changes in the ventral diencephalon, and aggressive attitudes towards outgroup members. Results from a mediation analysis demonstrate the role of brain development in the formation of hostile political attitudes. The second paper uses a formal model to explore the matching of potentially politically violent persons with organizations engaged in ongoing armed conflict. The final paper presents and tests a biological model of political violence. Results from a Candidate Gene Analysis demonstrate the inciting role of political repression in persons with proclivities towards aggression and violence.

BIOPHYSIOLOGICAL PREDICTORS OF POLITICAL ATTITUDES, AGGRESSION, AND VIOLENCE

by

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Dedication

To Olga, my grandmother and a kindred spirit, who met each morning with joy.

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No one completes a dissertation, let alone fieldwork, without substantial help, guidance and support. I have been extremely fortunate to have many mentors in my life and throughout this project.

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Chapter 1: Introduction

1.1 Outline

Why do individuals participate in violent politics? What would prompt individuals to sacrifice their own lives - and the lives of others - in support of a political cause? In this dissertation, I present three discrete articles all related to the development of an interactive model of individual political behavior, which examines the full profile of an individual's biological and environmental motivation for the development of political attitudes and actions. These three essays seek to answer the question of what prompts violent political engagement by examining factors at the individual, group, and state levels that motivate the development of hostile political attitudes and actions. How do these factors coalesce to predict individual engagement in political violence?

The outline of the introduction is as follows. First, I motivate the research agenda and present the empirical puzzle that underlies each of the three essays, namely why individuals within the same political, economic, and social constraints differently develop aggressive political attitudes, with some choosing to pursue violent political action. Next, I justify the focus on civil violence and the use of the Basque case. Following this discussion, I summarize the key themes of each essay and their contribution to the literature in political science. In the first essay, *The Heritability of Prejudice: Genetic Variation and Anti-Immigration Attitudes*, I develop and test a biological model of the development of hostile political attitudes

towards outgroups. In the second essay, *Rebel Recruitment in Civil Conflict*, I present a formal theory of political recruitment. In the final essay, *Biophysiological Risk-factors for Political Violence*, I use originally collected genetic, survey, and experimental data to test the interaction between environmental and biological motivations for engagement in violent political action. Together, these essays further our understanding of how individual differences interact with the environment, including group- and state-level structures, to predict a particular form of political participation, political violence. I conclude with the contributions of this research

1.2 Research Question and Empirical Puzzle

How are hostile political attitudes formed? And do the precipitants underlying the formation of these aggressive attitudes cause individuals to commit acts of political violence? Traditional explanations relying on grievance or greed explanations fail to explain individual-level variation in the development of aggressive political attitudes and acts. Some individuals within the same political, economic, and social environments develop aggressive outgroup attitudes, even to the point of violence, while their peers do not. In this dissertation, I examine individual-level differences in the formation of hostile attitudes and violent acts in two distinct political contexts, one of recent relative domestic peace, Australia, and the other with a long history of civil violence, the Basque region of Spain. This dissertation proposes that underlying both the development of hostile political attitudes and actions is a biological profile differentially responsive to social, economic, and

political grievances. For some individuals, exogenous environmental stressors incite proclivities towards aggressive and hostile behaviors.

In the context of Australia, this research demonstrates that genetic variation can lead to developmental differences that explain part of the variance in hostile and prejudicial attitudes towards others, in this particular case, immigrants. For the Basques, the history of Spanish repression provides the environmental stressor to increase the likelihood of engagement in political violence for some persons. In both contexts, environmental conditions, such as education in the Australian case, or repression, in the Basque case, serve to diminish or provoke increased hostility. Through examining the biological factors influencing aggressive political attitudes and actions, and contextualizing them within the larger political and social environment, this research provides a more comprehensive explanation for political violence, and may be useful in identifying political conditions that incite at-risk populations to support and participate in violent rebellion.

1.3 Civil Violence and Justification of the Basque Case

Civil violence has been directly responsible for over 16.2 million deaths in the last fifty years (Lai and Thyne 2007). Exposure to political violence in the form of civil conflict and terrorism has significant negative public health effects – increased rates of trauma induced PTSD, alcoholism, and suicidality – disproportionately affecting women and children (Miller and Rasmussen 2010). In order to address this political and public health crisis, it is important to first understand why individuals participate in violent conflict against the state.

The population of the Basque region presents a unique opportunity to assess the effect of both institutional and genetic factors related to civil violence while allaying one of the primary criticisms of Candidate Gene Association (CGA) studies, population stratification. The Basque region contains Euskadi Ta Askatasuna (ETA), one of the oldest and more violent of the rebel groups in Europe, attributed with close to 850 deaths. The National Consortium for the Study of Terrorism and Reponses to Terrorism (START) ranks ETA as the fourth most active terrorist group in the world, responsible for more than 2,000 attacks between the years 1970 and 2010.[1] While ETA has committed numerous violent attacks, the group has not perpetrated indiscriminate mass violence; the conflict has largely been localized and with distinct political goals, namely the independence of the Basque region from Spain.

Population stratification refers to differences in the baseline frequency of particular genetic variants across sub-populations. Pooling analyses across groups can be problematic and lead to erroneous findings if the groups have different baseline allelic frequencies. Previous candidate gene association research has been discredited on the basis of population stratification (Charney and English 2013); a commonly cited example is the work documenting an association between the dopamine receptor gene DRD2 and alcoholism. Follow-up studies, employing more stringent controls for population stratification, found no association as DRD2 alleles vary widely by race and ethnic groups (Thomas and Witte 2002). Controlling for broad genetic differences such as race/ethnicity is insufficient, as past research

[1] Accessed online: June 1, 2017. http://www.start.umd.edu/search/content/ETA. See also: https://theblue review.org/rise-fall-eta/

demonstrates differences in allele frequencies occur even within races (Helgason et al. 2005).

The Basques present an ideal case for the study of the association between genetic variation and political violence (moderated by environmental conditions) in that several critical features coalesce: the presence of a combatant (and non-combatant) population in ETA, their experience with systematic government repression, and the Basque's *relative* genetic homogeneity. Complementing linguistic evidence which has been suggestive of the Basque people's uniqueness from other European groups (Basques are speakers of the only non-Indo European language in Western Europe), research in population genetics analyzing over 60,000 single nucleotide polymorphisms has concluded that the Basque people are genetically homogenous and are identifiably distinct from other European populations (Rodríguez-Ezpeleta and Najala 2010). Prior research differentiated the Basque people from other ethnic groups according to classical genetic markers (Calafell 1994), mitochondrial DNA sequences (Achilli et al. 2004), and Y-chromosome polymorphisms (Alonso et al. 2005).

The Basque dataset collected for this research can be used in a variety of applications to answer critical research questions that have previously been unanswerable due to a lack of original data. These include: the heritability of political violence, if rebel organizations recruit on biological characteristics, if and how biological factors might impact the retention of individual members in violent rebel groups, and how environmental and biological influences interact to affect the nature and success of tactics employed against the state.

1.4 Outline of the Essays

Chapter 2: The Heritability of Prejudice: Genetic Variation and Anti-Immigration Attitudes

This manuscript seeks to model how biological factors impact political attitude formation, particularly, prejudicial attitudes towards outgroup members. I develop a biological model which connects genetic variation to the outcome, anti-immigration attitudes via an endo or proxy phenotype. The biological model is supported using genetic, structural Magnetic Resonance Imaging (MRI), and survey data from The Genetic and Environmental Foundations of Political and Economic Behaviors: A Panel Study of Twins and Families (Hatemi et al. 2015). The results demonstrate that variation in the gene 5-HTT impacts attitude formation towards outgroups through developmental differences in the ventral diencephalon. This effect can be mediated by education as the results of a gene-by-environment analysis demonstrate. By examining how biology impacts the formation of hostile attitudes, this essay makes the first theoretical step in connecting biology to aggressive political acts, developed more fully in Chapter 4.

Chapter 3: Rebel Recruitment in Civil Conflict

In this essay, I develop a formal model of rebel recruitment drawing on matching models in contract theory, which studies the issues that arise from workers' inabilities to credibly commit to long term contracts (Sattinger 1993). While it is applied specifically to the case of rebel recruitment in civil conflict, the model can be

applied to any political organization to explain the matching between organizations and individuals in the political sphere.

In particular, this model assesses how a fundamental first choice, whether to accept voluntary recruits to the organization, or to forcibly recruit fighters, impacts conflict dynamics. Empirical implications of the model are assessed with cross-national data on recruitment in conflict from Cohen (2013). As this dissertation seeks to understand how individuals interact with their environment to predict politically violent behavior, this model provides a demand side, meso-level, organizational theory of mobilization against which individuals in the following chapter, *Chapter 4: Biophysiological Risk-factors for Political Violence*, differentially choose to participate. From the perspective of the rebel group, the model demonstrates how groups choose between potential recruits, and how group characteristics motivate, through selective positive or negative incentives, potential recruits for the political cause. Individuals are modeled as having a particular level of exogenous preference and talent for violence; this can be thought of in part, as the genetic profile specified in the following chapter.

Chapter 4: Biophysiological Risk-factors for Political Violence

In this essay, I investigate the biological and environmental determinants of individual-level participation in political violence through the use of a Candidate Gene Association (CGA), gene-by-environment (GXE) interaction study. This study applies insights from the fields of behavioral genetics, economics, and psychology to differences in individual-level participation in political violence. Extant research has

demonstrated that variation in the gene MAO-A is associated with physical aggression, particularly in response to environmental stressors (McDermott et al. 2009, McDermott et al. 2013). Through original genetic data collection of both participants and non-participants of political violence in the Basque region of Spain, coupled with a survey instrument designed to measure the extent of non-genetic, individual-level motives for participation in violent rebellion, this study demonstrates how genetic variation impacts participation in political violence. Additionally, the results of field experiments are used to identify the biological mechanism through which low MAO-A impacts engagement in political violence, increased impulsivity and aggression.

Although the conflict literature in political science has carefully examined institutional and societal explanations of intrastate political violence, research on individual-level motives for rebellion is underdeveloped and existing theories are underspecified as they largely ignore the biological contribution to participation in political violence. By measuring the biological (genetic) contribution, this research provides a more comprehensive explanation of why individuals choose to engage in political violence and stands to make three central contributions to research: first, by identifying the specific risk-factors – environmental and biological – that influence persons to participate in violent rebellion movements; second, by demonstrating how these factors influence the scope of participation (violent/non-violent); and third, by investigating the biological mechanism linking genetic variation to aggressive political attitudes and violent political acts.

Chapter 2: The Heritability of Prejudice:
Genetic Variation and Anti-Immigration Attitudes

Abstract: The resurgence of populism in the United States and Western Europe puzzles many policy analysts. Extant research on attitudes towards immigrants traditionally has focused on labor market competition as an explanation for anti-immigration preferences, largely ignoring biological explanations, even though we know that these attitudes can be quite sticky, passed down through generations. Using genetic, structural Magnetic Resonance Imaging (MRI), and survey data from The Genetic and Environmental Foundations of Political and Economic Behaviors: A Panel Study of Twins and Families (Hatemi et al. 2015), I present and test a novel theory tracing genetic variation to developmental differences in the ventral diencephalon, demonstrating how heritable genetic variation affects attitudes towards immigration. Critically, this analysis delineates the role of both biology and the environment in conditioning attitudes towards immigration, demonstrating the moderating effect of education on the development of prejudicial attitudes.

2.1 Introduction

The recent prominence of anti-immigration attitudes and legislation amongst political elites in western democracies – The United States and Western Europe – has been the source of much contention. After Britain voted to exit the European Union, Donald Trump was voted into the Presidential office, and with him, the initiation of several anti-immigration legislative measures. Following an impassioned plea for the opening of Germany's borders to refugees from North Africa and the Syrian civil war, for the first time in the post-World War II history, Chancellor Angela Merkel's party lost to a populist challenger, who ran a strong anti-immigration platform. Underlying this democratic leader's support for anti-immigration policies is a seeming growing base of supporters for protectionist politics. Political analysts debate whether these recent political developments demonstrate a rise in xenophobia or if these developments, including the last presidential election in the United States, have lain open, if not made permissible, a long latent prejudice in the public.

While the apparent resurgence of these biases have shaped recent legislation,[2] and citizen reaction, both in support for and against these anti-immigration policies,

[2] In fact, in a recent Pew Research Center poll, 59% of United States citizens said that immigrants strengthen the country, 33% describe them as a burden. This is in contrast to the same poll from 1994, where 63% of U.S. citizens described immigrants as a burden and 31% responded that they strengthen the country. Jones, Bradley. (April 2016). "Americans' views of immigrants marked by widening partisan, generational divides." http://www.pewresearch.org/fact-

individual prejudicial attitudes that underlie anti-immigration rhetoric and legislation have existed across history. This study examines how individual differences in attitudes toward outsiders develop. In this manuscript, I present and test a theoretical framework for how brain development shapes attitude formation to outgroups such as immigrants by examining the role of heritable prejudice on explicit aggression and hostility to immigrants. The results of mediation analyses of genetic and structural Magnetic Resonance Imaging (MRI) demonstrate that genetic polymorphisms operate through changes in brain development to influence individual differences in opinions on immigration. In so doing, this is the first study to date to demonstrate the specific biological pathway through which heritable genetic differences shape an important form of outgroup prejudice – opposition to immigration.

Political attitude formation has been traditionally conceptualized as a deliberative process, the reflection of early life experience, or environment (Campbell et al. 1960), and conscious choice (Fitzsimons et al. 2002). Recent research in neuroscience and political psychology, however, challenges this framework, demonstrating that the development of political attitudes may be reflective of an unconscious process (Oxley et al. 2008), and that political orientations are, in part, heritable from one's parents (Alford, Funk, and Hibbing 2005, Fowler and Dawes 2008, Hatemi, Medland, Morley, Heath and Martin 2007, Settle, Dawes, Christakis and Fowler 2008, Suhay, Kalmoe, and McDermott, 2007). This body of research both challenges the idea that political opinions are consciously held, crystalized objects

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tank/2016/04/15/americans-views-of-immigrants-marked-by-widening-partisan-generational-divides/

stored in our working memory for retrieval in survey questionnaires, and illustrates that part of the unconscious process generating individual differences in political attitudes is heritable genetic variation. Critically, this research does not conclude a biological determinism, but rather demonstrates that political attitudes and beliefs can be transmitted across familial generations both through our inherited genes, as well as environmental conditions, i.e., the household we share with our parents and siblings.

I use hereditary, genetic, and brain imaging data from The Genetic and Environmental Foundations of Political and Economic Behaviors: A Panel Study of Twins and Families (Hatemi et al. 2015) to uncover the mechanism through which heritable biological differences impact individual differences in attitudes towards immigration, contributing to our understanding of the development of prejudicial attitudes in four significant ways. First, I examine the ongoing debate on the source of variation in political attitudes and present a biological pathway model of how variation in the gene 5-HTT leads to differences in attitudes on immigration. Second, I empirically investigate the relationship between variation in specific genes and brain development in the ventral diencephalon; and in turn, how developmental differences in the ventral diencephalon influence attitudes towards outgroups, particularly immigrants. Finally, I conclude with evidence how environmental factors, that likewise shape development, mediate the effect of biology to explain individual differences in attitudes towards immigration.

2.2 Political Attitude Formation: Is Prejudice Heritable?

Until the mid-2000s, research on political attitude formation centered on a debate between early environmental experiences creating lasting political preferences and beliefs, and more proximate circumstances, including media framing, priming, current events and even recent personal conversations generating "on the go" or spontaneous, political attitude formations (Feldman 1995, Wilson and Hodges 1992, Zaller 1992). The traditional theory suggests that political attitudes are the expression of conscious reflection, the synthesis of long-held beliefs and dispositions (Converse 1964, Zaller 1992). If correct, why do some attitudes, such as hostility to outsiders, persist despite efforts to educate and reform? What role – if any – does biology play in the formation of these hostile, prejudicial political attitudes?

The idea that differences in political opinions might have a biological basis has been widely ignored.[3] Alford, Funk, and Hibbing's (2005) work was the first to hypothesize - and provide evidence - that political attitudes formed on the basis of both environmental and biological factors. This research drew on the classic twin study design which compares correlations in outcomes such as attitudes, personality, and behaviors, between monozygotic (what are popularly referred to as "identical" twins, sharing roughly the same genetic makeup, although recent research suggests that during early fetal development they undergo approximately 300 genetic mutations on average) and dizygotic twins (which share 50% of their genes). This ratio, 2:1, and the assumed average equivalence in environments shared across monozygotic and dizygotic twins (on average the environment of monozygotic twins

[3] An important exception is the work of Eaves, Eysenck and Martin (1989).

should be no more/less similar than that of dizygotic twins), is the foundation against which the variation in outcomes attributable to heritable genetic differences is measured.[4]

Using twin data from the United States and Australia, Alford, Funk, and Hibbing (2005) compared correlations between the political attitudes of monozygotic and dizygotic twins, estimating the proportion of variation attributable to heritability,[5] the shared environment,[6] and the unshared environment.[7] Results demonstrated that these attitudes were modestly heritable (correlations in attitudes on political preferences ranging from approximately r = 0.20 to r = 0.40)[8] with the authors concluding that, "genetics plays an important role in shaping political attitudes and ideologies (p. 153)." Since that time, research on heritability of political attitudes and behaviors has grown to include research on ideology, voting behaviors, and political violence (Alford, Funk, & Hibbing, 2008a, 2008b; Bell, Shermer, & Vernon, 2009; Fowler, Baker, & Dawes, 2008; Fowler & Dawes, 2008; Hatemi, Alford, Hibbing,

[4] Other, somewhat anecdotal evidence, this line of research relies on is the empirical finding that monozygotic twins raised together are less similar in attitudes and behaviors than those reared apart presumably because of the extra effort of monozygotic twins, raised in the same environment, to differentiate themselves (Bouchard and McGue 2003).

[5] Measured as 2*(MZ-DZ).

[6] Also known as the common environment (c). (2*DZ) – MZ.

[7] Also known the unique environment (e). 1- MZ

[8] Opinions on federal housing, r = 0.20. School prayer, r =0.41.

Martin, & Eaves, 2009; Hatemi, Medland, & Eaves, 2009; Hatemi, Medland, Morely, Heath, & Martin, 2007; Hatemi et al., 2010, McDermott et al. 2013; Medland & Hatemi, 2009). With this burgeoning research has come criticism, in part on the validity of twin research (for example see Beckwith and Morris 2008, Charney 2008a, 2008b; for responses to these criticisms see Alford et al., 2008a, 2008b; Hannagan & Hatemi, 2008), in particular the equal environment assumption, namely that childhood and adult environments of monozygotic and dizygotic twins are comparable,[9] and the overly deterministic role of biology.

Despite criticisms, this line of research has continued, advancing our understanding of biological mechanisms on political behaviors, in addition to attitudes (Alford, Funk, and Hibbing 2005, 2008a, 2008 b, Fowler and Dawes 2008, 2013, Hatemi and Verhulst 2015, McDermott et al. 2009, 2013). In parallel with advancing technologies in behavioral genetics, research into the biology of political attributes and behaviors began uncovering particular genetic variants in candidate gene, and differences in single nucleotide polymorphisms through genome wide association studies, revealing the role of genetics, in particular, in politically relevant behaviors such as aggression (McDermott et al. 2009, McDermott et al. 2013), religiosity (Fowler and Dawes 2013, Ksiazkiewicz and Friesen 2017), and voting (Fowler and Dawes 2008, Fowler and Dawes 2013). Genetic research thus far has demonstrated potential for uncovering new insights into models of political attitude

[9] For more on this point, see Hatemi et al. (2010) and Joseph (2010). The equal environment assumption is considered the most critical assumption in the twin design methodology.

formation in addition to politically relevant behaviors (Hatemi et al. 2011, Hatemi and Verhulst 2015), providing the foundation for the next round of research to uncover the mechanisms connecting biology to (political) behavior.

2.3 Genes, Brain and Opposition to Outgroups

Thus, while research in candidate gene and genome-wide association studies have shown correlations between genetic variants and political outcomes, the pathways linking these variants to attitude formation and behaviors are still largely untested. In particular, not until very recently (Jaworska et al. 2016) have scientists postulated a relationship between genetic variation and brain development, and to date there has not been research systemically demonstrating the path from genes to the brain to behavior. In this section, I discuss the relationship between genetic variation, brain development, and behavior, developing a theory for how heritable genetic variation leads to variation in political attitudes and behavior.

Candidate gene research has demonstrated that certain genetic polymorphisms are related to aggressive and anti-social behaviors (McDermott et al. 2009, McDermott et al. 2013, Stuart et al. 2014). Neurotransmittors monamines including serotonin, dopamine, adrenaline, norephinephron, noradrenaline, and histamine, are associated with aggressive and hostile attitudes and behavior. In particular, extant research has shown that specific genetic polymorphisms in the gene 5-HTT[10] are

[10] 5-HT, 5-hydroxytryptamine, also known as Serotonin, is a monoamine neurotransmitter. The gene 5-HTT, or 5-hydroxytrptamine transporter, is also commonly referred to as: SLC6A4, and SERT. 5-HTTLPR (serotonin-transporter-

significantly related to these negative, anti-social behaviors (Aslund et al. 2003, Stuart et al. 2014, Vaughn et al. 2009). The mechanism through which 5-HTT is hypothesized to affect hostile, aggressive behaviors is through is transcriptional efficiency (Fowler and Dawes 2013). There is thought to be less transcriptional efficiency, thereby diminishing the level of serotonin uptake in the *short* 5-HTT allele relative to the *long* 5-HTT polymorphism, specifically a 44 base pair deletion in the short allelic version (Lesch et al. 1996; Little et al. 1998). The low activity variant is carried by approximately twenty percent of the population (Nilsson et al. 2014). By diminishing the transcriptional efficiency, these alleles alter serotonergic functioning in ways that are believed to lead to increased rates of "negative"/anti-social behaviors including aggression, anger, and depression (McDermott et al. 2009; Stuart et al. 2014).

However, criticisms of these studies argue that these association studies are merely correlations that may have benefited statistically from false positives. Moreover, the process by which genetic variation leads to differences in human behaviors is complex. Transcription, the process through which a segment of DNA is copied to produce mRNA, which is then used in the construction of a particular protein, is known as translation (Schwanhäusser et al. 2011). In association studies, it is not clear to what extent genetic polymorphisms impact the translational efficiency of protein levels, which downstream effects are more causally proximate to differences in human behavior. In particular, 5-HTT, exists in hair and eye cells in

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linked polymorphic region) is a degenerate repeat polymorphic region in SLC6A4, the gene that codes for the serotonin transporter.

addition to brain cells, but is epigenetically silenced (Charney and English 2013). Thus, it is vitally important to elucidate the biological mechanism through which specific genetic polymorphisms lead to variation in human behavior.

Concordantly, researchers in neuroscience have shown an association between brain size and anti-social behaviors in both humans and other mammals. In early childhood development studies, children with enlarged amygdala, as well as increased glucocorticoid levels in it, the hippocampus, and prefrontal cortex, displayed poorer levels of emotion regulation, anxiety, and hostility (Tottenham et al. 2010). Similar analyses have been replicated in series of mammals and other animals as far removed as clonal trout (Campbell et al. 2015).[11] Recent research by psychologists have unified these findings under a common hypothesis: human brains are smaller than other mammals due to increased sociality (Hood 2014). Studies on the process of animal domestication have shown that as the animal brain becomes smaller, rates of aggression and other negative social behaviors also on average, decrease (Hood 2014).

Experimental studies in laboratory rats show the lingering effects of changes in brain volume on behavior. A stressor is introduced in rat pups during the first week of nursing; brain volume is measured before and after exposure and compared to control pups who do not receive the stressor. In the second stage of the experiment, the rats treated with the stressor are placed with either a nurturing mother rat or an anti-social mother rat (measured by willingness to nurse). Compared to

[11] Although research has shown genetic analogues between humans and trout to be around 70% (Hardie, Chappell and Secombe 1994).

other treated pups, those whose brain volume on average grew with exposure to the stressor are unlikely to cleave to a nurturing mother rat, while those who did not undergo same brain volumetric changes, are able to re-socialize, suggesting a lingering effect of developmental changes in the brain on aversion to others despite environmental changes that would encourage re-socialization (Weaver et al. 2004). An early experimental study on male mice was designed to test if and how much behavioral development could be modified by environmental and social conditioning (Hood and Cairns 1989). These mice were selectively bred according to displays of antisocial, aggressive behavior. After four generations, modifications in social conditions were introduced to encourage social behaviors. The modifications diminished tendencies towards aggressive outgroup behavior in most of the mice except for those bred with other highly aggressive mice; these mice proceeded to attack despite early socialization interventions, suggesting some independent effect of biology on aggressive outgroup behaviors.

Similar associations have been demonstrated in humans. In a study of seventy-eight foster children, a third of who met the criteria for an antisocial disorder, biological markers such as larger amygdala volumes, were correlated with negative social outcomes despite changes in home environment (Tottenham et al. 2010). Other studies have shown structural impairment in MR imaging of antisocial persons that could not be accounted for by confounding environmental factors such as physical, or drug or alcohol abuse, or history of head injury (Raine et al. 2008). Coupling twin design with MRI scans, Thompson et al. demonstrate that 90 percent of variation in volume of the gray frontal matter in the brain is heritable (2000). Although these

studies in humans do not have the experimental control utilized to causally demonstrate the separate effects of heredity and socialization found in the other mammalian studies, together this body of research hypothesizes a significant effect of genetics. It is for this reason: because these negative outcomes cannot be completely attributed to social and environmental conditions, and evidence is suggestive that they may persist despite environmental modifications, it is crucial to disentangle the effect of biology from environmental conditioning on aggressive outgroup behaviors, as well as other negative behavioral outcomes.

2.4 A Model: Genetic Variation, Brain Development and Opposition to Immigration

What underlies these differences in the structural development of the brain? And how does this in turn effect aggressive outgroup behavior, such as opposition to immigration? The hypothesized connection between both brain size and aggressive, anti-social behaviors, is monamine neurotransmission regulated, for example, by the gene 5-HTT. Only very recently (2016) have neuroscientists been able to identify specific genetic variants related to differences in brain volume in a way that portends differences in human attitudes and behaviors (Jaworksa et al. 2016). However, the nature of the association between genetic variation and brain volume and density in animals – and in particular humans – is still a matter of debate.[12] A case control study

[12] In fact, some paleontologists evince that as our brains shrank, the wiring became more efficient; thus, not only did we not lose intelligence, we became smarter.

using structural MRI to compare the cortical thickness and volume of brain matter in forty-three adults with Major Depressive Disorder and fifteen healthy controls (Jaworksa et al. 2016). The researchers found that the short allelic variant of the genetic polymorphism region 5-HTTLPR impacted both the cortical thickness in the frontal, cingulate and temporal regions of the brain, as well as volume in the thalamus, caudate, putamen, pallidum, hippocampus and amygdala, confirming prior association studies which found brain volume to be associated with more anti-social and aggressive behaviors (Jaworksa et al. 2016).

Building on this recent research demonstrating the connection between genetic variants, particularly in the gene 5-HTT, cortical thickness, and brain volume, I develop a biological pathway model depicting how genetic variation ultimately leads to variation in attitudes towards immigrants (Figure 2.1 below) by way of an intermediate or endo phenotype, brain development.

Others cite our reduction in gray matter as proof that we are as a species becoming dumber. http://discovermagazine.com/2010/sep/25-modern-humans-smart-why-brain-shrinking

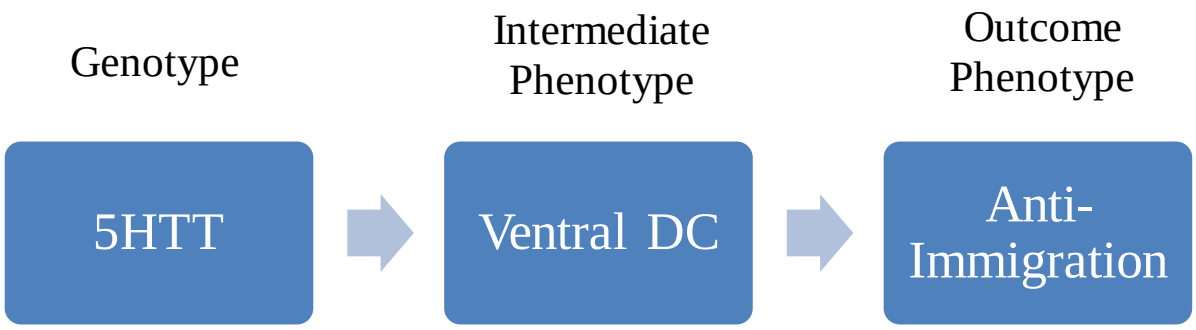

Figure 2.1. Biological Pathway from Genotypic to Phenotypic Variation

The first step in this process is the effect of the *genotype*, in this case allelic variation in 5-HTT, on the *intermediate phenotype*, volume in the ventral diencephalon (ventral DC). *Genotypes* are a person's heritable genetic identity, or the makeup of a person's specific genes as passed on from one's ancestors. The term genotype can be used to refer a person's complete heritable genetic identity, or the term can be used to refer to a specific set of gene(s), as in this case, where we use the term to refer to whether the persons has the long or short version of the 5-HTT gene. In contrast, the term *phenotype* describes the person's physical or behavioral trait. This is the (hypothesized) observable outcome of the person's particular *genotype*.

It is important to note, as suggested in the literature review above, that by investigating the role of a particular genotype on the phenotypic outcome, we are not

implying that only one genetic variant explains differences in the phenotype.[13] The focus on this particular, or candidate gene, and its relationship to both brain development and attitudes towards immigration, is theoretically motivated and based on existing research on the relationship between genes, the brain, and attitude formation. Several other genes, including COMT, BDNF, 5-HTT, NRG1 and DTNBP1, have been shown to be associated with anti-social outcomes (Burdick et al. 2007, Egan et al. 2001, Chen et al. 2004, Craddock et al. 2006, Georgieva et al. 2008, Joo et al. 2007, Li et al. 2006, Neves-Pereira et al. 2005, Riley and Kendler, 2006, Rosa et al. 2006, Sklar et al. 2002, Stefansson et al. 2002, Tunbridge et al. 2006). However, there is no evidence to date that these genes are related to volumetric changes in the brain that in turn affect anti-social attitudes and behaviors (Dutt et al. 2009), and other genes that have been shown to affect volumetric changes in the brain, such as VAL66MET (Jaworska et al. 2016), have not been shown to be related to our behavioral outcome of interest.[14] The candidate gene 5-HTT was chosen because of its specific relationship both to development differences in brain volume

[13] Most human complex traits are likely polygenic. See Yang et al. 2013 for a discussion of polygenicity. Moreover, a single genetic variant can be associated with many different, and even seemingly unrelated, phenotypic outcomes. This is known as pleiotropy.

[14] MAO-A, for example, is a candidate due to its known association with anti-social and aggressive outcomes (McDermott et al. 2013, McDermott et al. 2009). However, it has not been shown to be related to volumetric changes in the diencephalon (Raine 2008, Jaworska et al. 2016).

and because extant studies have shown the short allele to be related to aggressive, antisocial outcomes (Stuart et al. 2014, Sysoeva et al. 2009). Tracing a particular genetic variant's effect on a phenotypic outcome allows us to quantify relationships in a way that then may be usefully applied to other biological mechanisms and furthers our understanding of causal processes relating biology to differences in behavior in a way that genome wide association analyses alone cannot (Lee et al. 2011).

Intermediate phenotypes, also known as endophenotypes, are the more immediate, proximate biological result of differences in individual genetic architecture. Their role is to connect the genotypic variation to the downstream behavioral, or outcome phenotype. One of the four major regions of the brain, the diencephalon is situated between the cerebral hemispheres, superior to the midbrain and includes the thalmus, hypothalamus, epithalamus, and subthalamus, forming part of the "roof" of the third ventricle (see Figure 2.2 below). The ventral diencephalon connects structures of the endocrine system with the nervous system and works in conjunction with limbic system structures to generate and manage emotions and memories, in addition to controlling autonomic functions, such as body temperature and sleep. This area is also involved in sensory perception, which is the conscious mental capacity to register, process, and act upon sensory input. Directing impulses to the appropriate location in the brain, the diencephalon is similar to a "switchboard," responsible for activating responses to environmental stressors and threats. It is through these connections with the limbic system, that the diencephalon generates behaviors involved in rage, aggression, escape.

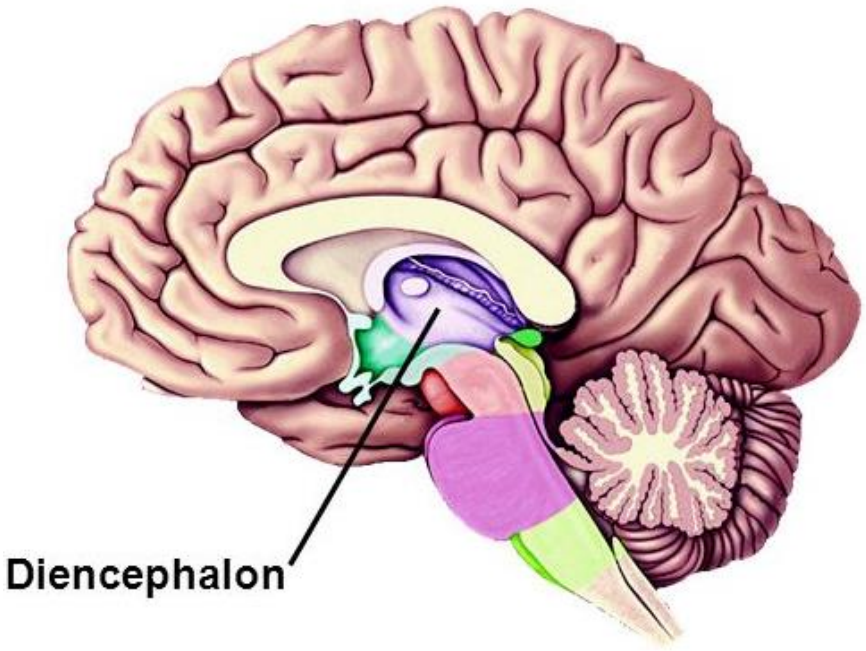

Figure 2.2. Location of the Diencephalon

Early research into threat perception often targeted the amygdala as the area responsible for perceptions of threat. However, recent research has shown that response to *internalized* threats occurs outside the amygdala, in the diencephalon (Feinstein et al. 2013). In experimental research, the diencephalon is particularly activated in instances where personal security is threatened (Feinstein et al. 2013, Spence 2014). Thus, the diencephalon seems to play a role in the extent to which external stimuli are internalized or perceived as threatening.

Outcome Phenotype

Extant research on attitudes towards immigration suggest that preferences for anti-immigration policies are predicated upon citizen's perceptions of immigrants as threats, whether through economic competition and job security, cultural

differences, or personal security (Borjas, Freeman, and Katz 1996 and 1997; and Borjas 1999). The traditional economic explanation for citizen hostility towards open immigration policy reasons that increasing the labor supply with presumably low-skilled laborers increases competition for those jobs and allows the owners/bosses to decrease wages to any particular worker.[15] Depending on the model, this can also increase local unemployment rates (Razin and Sadka 1995, and Angrist and Kugler 2003). Social psychologists present a similar argument as a reframing of relative deprivation (Gurr 1970, Walker and Pettigrew 1984) where relative deprivation and the perception of threat are subjective assessments of the labor market.

Non-economic explanations argue that individual and group racism and prejudice underlie support for stricter immigration regulation. Immigrants may represent a threat to the values of the home or receiving society; the simple perception of differences regarding customs and values raises fear. Stephan and Stephan (2000) attribute a critical role of this symbolic threat perception in the generation of prejudice. A particular strand of research post September 11, 2001 has adopted this theory to explain outgroup prejudice towards those of the Islamic religion as not only inducing a physical, security threat, but a cultural threat to the values of "western civilization." Huntington himself exhibits this fear that immigration will have deleterious effects: "a multicultural America will inevitably end up becoming an

[15] This is known as the factor-proportions model and assumes fixed amounts of land and capital. Whether this economic model is an accurate representation of a particular economy is a matter of debate; what matters for attitude formation is that individuals within that economy perceive the economy to be working in that manner.

America of several credos, constituted by different cultural groups, each one following different political values and principles rooted in different cultures (2004, p. 333)."

The connection between all these explanations is the perception of immigrants as threats to one's security, whether physical, cultural, or economic. What has been largely overlooked in the literature to date is the role of biology in the formation of anti-immigration attitudes. The diencephalon, as the region of brain responsible for registering internalized threats, should regulate the extent to which persons internalize outgroup members, such as immigrants, as a personal threat. Developmental differences that lead to the heightened registration of threat, i.e., an enlarged diencephalon, likely impact the extent to which individuals perceive immigrants as threats and in turn, report anti-immigration attitudes.

Hypotheses

This discussion leads to the following hypotheses:

Hypothesis 1: Individuals with the short 5-HTT allele are more likely to express opposition to immigration than those with the long 5-HTT allele.

Hypothesis 2: Individuals with the short 5-HTT allele are more likely to have greater volume in the ventral diencephalon than individuals with the long 5-HTT allele.

Hypothesis 3: Individuals with greater volume in the ventral diencephalon are more likely to express opposition to immigration. Differences in volume in the ventral diencephalon should act to mediate the effect of genetic variation in 5-HTT on attitudes toward immigration.

2.5 Data and Empirical Analysis

I test these hypotheses using data from the Genetic and Environmental Foundations of Political and Economic Behaviors, a panel dataset collected by the Queensland Institute of Medical Research, in Queensland, Australia. The data was collected in two waves: wave one, between July 2008 and December 2009, wave two, between July 2010 and November 2011 (Hatemi et al. 2015). The sample consists of twins aged 19 to 30 years (who were participants in ongoing research at the medical center).[16] The data includes political, social, and economic attitudes and preferences, as well as structural MRI, genotypic, and demographic data. The empirical analyses trace the biological pathway model. First, we establish the association between genetic variation and opposition to immigration. Then, I proceed to test each intermediate step in the biological model; we model the relationship between genetic variation and brain volume in the ventral dc, showing that persons with short 5-HTT allele have on average larger brain volume in the ventral dc. I follow this by demonstrating the relationship between the intermediate phenotype, brain volume, and the outcome phenotype, opposition to immigration. In the final set

[16] During the second wave, parents of the twins were invited to participate as well.

of analyses, I use a causal mediation model to measure the extent of variation in outcome owing to genes versus brain development.

Opposition to Immigration

Anti-immigration attitudes were assessed using a survey instrument administered to all subject participants in wave 2 of the Queensland study. Respondents were asked if they supported stricter immigration laws in Australia as part of a battery of items assessing the respondent's agreement with the position. The respondents were given three response options: yes, unsure, no. The responses are coded analogously to a three point likert scale with yes coded as a three, unsure two, and no as one.[17] Approximately 25 percent of respondents stated support for stricter immigration, 32.60 percent of respondents reported being unsure about this issue, and 42.41 percent disagreed.[18]

Genotype

5-HTT alleles vary according to their transcription efficiency, with the short 484 base pair hypothesized as being both less transcriptionally efficient (and more associated with anti-immigration attitudes), coded as a one in these analyses, and the

[17] Collapsing the variable to yes/no does not change the results. See Appendix Table 2.2 and Appendix Table 2.3.

[18] Respondents were also asked a reverse item, whether they agreed with the use of foreign trained doctors. Again, respondents could answer yes, unsure, or no. The results are substantively similar. See Appendix Figure 2.1 for the full list of items.

long 528 base pair allele classified as more transcriptionally efficient (hypothesized to be less likely associated with anti-immigration attitudes), and coded as zero.[19] Approximately 18.51 percent of the sample carries the short 5-HTT allele. This is comparable to that of caucasian populations overall; the low (short) activity variant (allele) has been found to be carried by approximately twenty percent of caucasians (Nilsson et al. 2014).

Intermediate/Endophenotype

Brain volume was measured using structural Magnetic Resonance Imaging (MRI). Brain volume was measured in the right and left ventral diencephalon in cubic centimeters (log transformed for the analyses). The mean volume for the right ventral diencephalon was 3991.67 cubic millimeters (s.d. = 399.10) and 4067.24 cubic millimeters (s.d. = 429.26) for the left ventral diencephalon.

[19] I follow a functional coding of 5-HTT collapsing the heterozygous long/short as short; others operationalize the functioning to be triallelic, citing that the functioning of the long/short acts midway between homozygous long or short (Luddington et al. 2009). In addition to the short allele, a variant of the long allele in which an adenine has been replaced with a guanine (designated $long_G$) is also associated with reduced 5-HTT expression to a level comparable to the short allele. In examining effect of genotypes on the course and outcome of depression, the $long_G$ allele is frequently grouped with the short allele (Parsey et al. 2006).

Alternative Explanations

Competing explanations in the immigration literature argue that individual's preferences for immigration policy are based on their own financial security and competiveness within the labor market (Kessler 2001, Mayda 2006, Scheve and Slaughter 2001a and 2001b). In as much as individuals see immigrants as a threat to their income and livelihood, we should expect support for liberal immigration policies to decrease. I include a measure of income to assess whether support changes with financial wellbeing.

In contrast with this economic explanation, Hainmueller and Hiscox (2007) argue that life experiences that expand an individual's world view, i.e., furthering one's education, should reduce individual bias towards outgroups such as immigrants. Additionally, increasing levels of education should make an individual more competitive in the labor market and diminish job insecurity resulting from an increased labor supply. I include an ordinal measure of education to assess this possibility.

Finally, as some research demonstrates that age tends to be negatively correlated with support for immigration, and males are on average less in favor of open immigration policies than women, I include these in our models (Citrin et al. 1997, Dustmann and Preston 2001, Gang, Rivera-Batiz, and Yun 2002).

Results

In Table 2.1, I report the results on an empirical test of association between genetic variation in the gene 5-HTT and individual attitudes towards immigration. I find strong support for hypothesis 1: having the short 5-HTT allele as opposed to the long variant increases opposition to immigration, while accounting for alternative hypotheses regarding preferences for immigration including age, gender (Models 1 and 2), education, and income (Model 2). I also find some evidence that with age, anti-immigration attitudes increase (Model 1, $p<0.05$; Model 2, $p<0.10$). Contrary to other findings in the immigration literature, education, after controlling for differences in age and sex, and income, as well as genetic variation in 5-HTT, shows a modest increase in support for anti-immigration attitudes (Model 2, $p<0.05$). Substantively, having the short 5-HTT allele on average increases the probability of opposition to immigration by approximately 13 percentage points.[20]

[20] Calculated by regressing opposition to immigration on set of explanatory variables from Table 2.1, Model 2. All other variables to their observed values.

Table 2.1. Regression Model - Association between 5-HTT and Opposition to Immigration

VARIABLES	(1) Anti-Immigration	(2) Anti-Immigration
Short 5-HTT	0.144**	0.131**
	(0.070)	(0.070)
Age	0.023**	0.016*
	(0.009)	(0.010)
Sex	0.047	0.060
	(0.056)	(0.058)
Education		0.051**
		(0.021)
Income		0.022
		(0.020)
Constant	-0.232	-0.333
	(0.265)	(0.270)
Observations	302	301
R-squared	0.035	0.058

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

While the association between the low 5-HTT variant and opposition to immigration is statistically significant, it says little about the mechanisms by which genetic variation leads to the distant expression of preferences for or against immigration. To further probe the process, I explore the link between genetic variation in the gene 5-HTT and brain volume in the ventral diencephalon.

In support of hypothesis two, results of the structural magnetic resonance imaging depict significant volumetric differences in the ventral diencephalon between persons with the short 5-HTT allele and the long 5-HTT variant. This result is in keeping with findings in the neuroscience literature (Jaworska et al. 2016, see Figure 2.3 below). Specifically, bivariate regression results indicate that the total volume of the ventral diencephalon in persons with the short 5-HTT allele is on average 325.67

cubic milliliters greater than those with the long 5-HTT allele ($p<0.001$; Table 2.2 below). Moreover, as we would expect if these increases were due to genetic variation that would affect development in the entire ventral diencephalon, and not due some other trauma or abnormality, they are approximately evenly dispersed between the left and right ventricles.

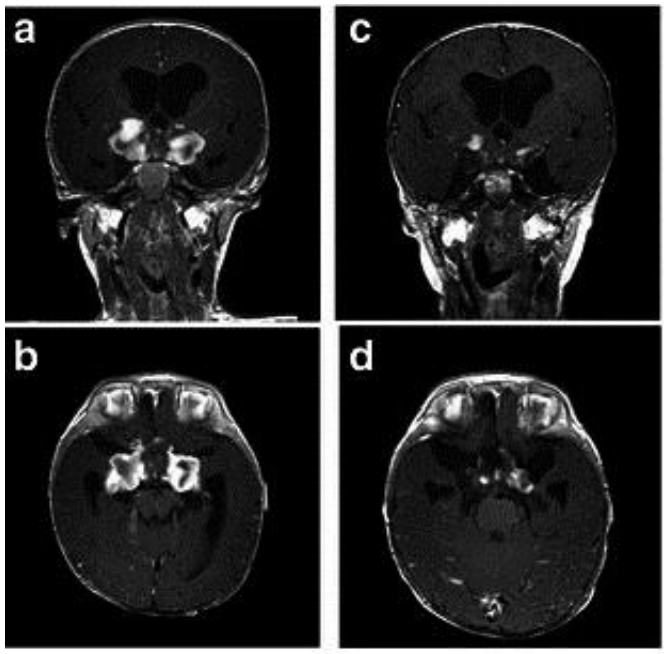

Figure 2.3. MRI depicting volumetric differences in ventral diencephalon (Kim et al. 2007). Person with enlarged ventral diencephalon (white mass above brain stem, panels a and b) and recessed, average ventral diencephalon volume (panels c and d).

Table 2.2. Volumetric Differences in Ventral Diencephalon according to 5-HTT Allele

	Ventral Diencephalon		
	Right Ventral	Left Ventral	Total Ventral
short 5-HTT	162.365***	163.307***	325.672***
	(45.888)	(49.829)	(92.151)
Constant	3788.078	3853.400	7641.478
	(65.087)	(70.677)	(130.707)
Observations	338	338	338
R^2	0.036	0.031	0.036

*** p<0.01, two tailed test, standard errors in parentheses

In following our biological pathway model, next I empirically test for whether greater brain volume (here log transformed for ease of substantive interpretation) in the ventral diencephalon is associated with stronger opposition to immigration (Table 2.3). Critically, the relationship between genetic variation and opposition to immigration should be mediated by differences in brain development (i.e., volumetric differences in ventral diencephalon, Table 2.4). I estimate the intermediate effect of volumetric differences using a causal mediation model. The results illustrate several important consequences of differences in biological development on individual attitude formation with respect to immigration.

In Table 2.3, Models 1 – 3 display the coefficients for right ventral diencephalon, the left ventral diencephalon, and the total ventral diencephalon volume, respectively, while controlling for differences in age, gender, education, and income. These models show that volumetric increases in any (or all) region(s) of the ventral diencephalon have a statistically significant and robust effect on attitudes against immigration.

Table 2.3. Regression Model - Association between Ventral DC and Opposition to Immigration

VARIABLES	(1) Anti-Immigration	(2) Anti-Immigration	(3) Anti-Immigration
log(Right Ventral DC)	0.922**		
	(0.359)		
log(Left Ventral DC)		0.735**	
		(0.335)	
log(Total Ventral DC)			0.886**
			(0.360)
Age	0.016	0.015	0.015
	(0.014)	(0.014)	(0.013)
Sex	-0.103	-0.080	-0.097
	(0.081)	(0.079)	(0.081)
Education	0.013	0.015	0.014
	(0.027)	(0.027)	(0.027)
Income	0.043	0.043	0.043
	(0.026)	(0.026)	(0.026)
Constant	-7.595**	-6.050**	-7.920**
	(3.020)	(2.823)	(3.277)
Observations	203	203	203
R-squared	0.064	0.056	0.062

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In Table 2.4, I use the approach first described by Zellner (1962) and later adopted by Preacher and Hayes (2008) for modeling mediator variables through a system of seemingly unrelated regressions. In this approach, the mediating effect of volumetric difference in the ventral diencephalon is modeled using two equations, model 1, where allelic variation in 5-HTT predictors the volume of the ventral diencephalon, and model 2, where the volume of the ventral diencephalon in turn predicts differences in anti-immigration attitudes (along with variation in 5-HTT and other control variables). The benefit of this approach is twofold: first, while each

equation could be estimated separately (as above), since the error terms are expected to be correlated, there are efficiency gains for estimating them together;[21] second, this approach allows us to estimate both the direct effect of genetic variation in 5-HTT on anti-immigration attitudes and the indirect effect of variation in 5-HTT through changes in the ventral diencephalon.

Table 2.4. Mediation Analysis - Effect of 5-HTT on Opposition to Immigration via Ventral DC

VARIABLES	(1) log(Ventral DC)	(2) Anti-Immigration
Short 5-HTT	0.057***	0.118**
	(0.017)	(0.092)
log(Ventral DC)		0.762**
		(0.385)
Age		<-0.001
		(0.014)
Sex		-0.039
		(0.086)
Education		0.006
		(0.030)
Income		0.070**
		(0.028)
Constant	8.212***	-6.327**
	(0.024)	(3.227)
Observations	168	168
R-squared	0.062	0.089

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[21] It does this by weighting the estimates by the covariance of the residuals from the individual regressions. If the set of independent variables is identical across the equations, the results will be identical to those obtained by OLS (Greene 2005).

The results of the fitted seemingly unrelated regression model demonstrate that variation in the gene 5-HTT is significantly affecting differences in attitudes on immigration through volumetric developmental differences in the region of the brain, the ventral diencephalon (Model 1; $p<0.05$). Moreover, the results reported in Model 2 show that the ventral diencephalon itself has a direct effect on differences in attitudes on immigration, even after correcting for correlated errors between the two models, as well as accounting for differences in age, sex, education, and income. Finally, although not as substantively important as changes in the ventral diencephalon, the results in Model 2 suggest that variation in the gene 5-HTT also has a direct effect on immigration attitudes, apart from the indirect effect through developmental differences in the ventral diencephalon ($p<0.05$).

2.6 Prologue: Bringing the Environment Back In

What – if anything – can mitigate the development of threat perceptions towards outgroups such as immigrants? Although the extant literature on the genetics of anti-social behaviors demonstrate the significant effects of structural biology on emotional and behavioral expression, several studies demonstrate the moderating effect of environmental conditions on predispositions towards aggression and negative behaviors in both nonhuman and human mammals (McDermott et al. 2013, McDermott et al. 2009, Tottenham et al. 2010). For example, experimental studies in rats showed that while enlarged regions of the brain, including the ventral diencephalon, were associated with larger amygdala volumes, environmental changes precipitated further brain changes that lead to substantive difference in anti-social

outcomes (Zhu et al. 2006). Moreover, as Hainmueller and Hiscox argue, differences in education impact the development of prejudicial attitudes towards outgroups (2007). While we do not find direct support for the effect of education on anti-immigration attitudes, we might expect that education can condition the relationship between genetic variation and opposition to immigration, particularly given that we find developmental differences, such as changes in brain volume, can mediate the effect of genetic variation on attitude formation towards immigrants.

I evaluate whether differences in educational attainment moderate differences in genetic variation towards anti-immigration attitudes. Results of the predicted effects of the long versus short 5-HTT when interacted with educational attainment are plotted in Figure 2.4 below. As illustrated, the effect of genetic propensities towards anti-immigration attitudes is greatest when not moderated by outside educational influences. In fact, we see that the effect of genetic proclivities on hostility towards outgroups such as immigrants is significantly attenuated with increased education: having the short allele no longer shows a greater substantive association with anti-immigration attitudes when the person has achieve at least a technical, or community college level of education. After achieving a college education or greater, there is no substantively significant difference in the predicted level of support for anti-immigration policies for persons with the short versus long 5-HTT allele.

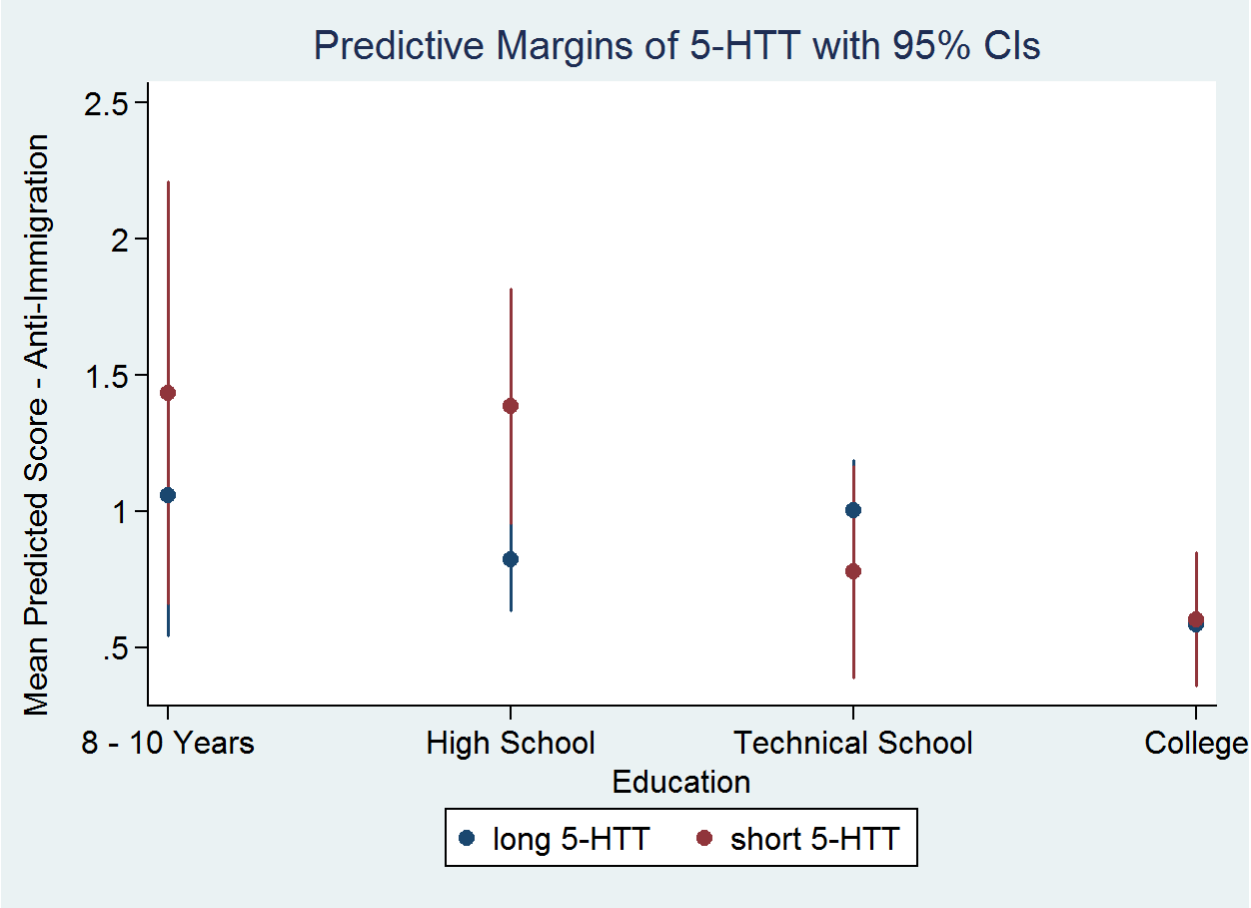

Figure 2.4. Predicted Support for Anti-Immigration Attitudes – 5-HTT and Education

2.7 Discussion and Conclusion

This is the first study to demonstrate how genetic variation is moderated by brain development – as well as education – to explain differences in attitudes towards immigration. Not only is a study of support for anti-immigration policy timely given the seemingly increasing support for prejudicial policy, this explanation stands in stark contrast to the existing economic literature that suggests job insecurity is the source of differences in attitudes toward immigration policy. Currently, much of the literature within American politics emphasizes the growing divide between rural, middle American conservatives and the liberal, urban elite. Part of the explanation

for conservative politics, including anti-immigration legislation, has been perceived job insecurity; others suggest that the growing support amongst conservatives for this type of legislation is a latent prejudice. If, as this research demonstrates, anti-immigration attitudes are in part heritable, this may explain, in part, the growing divide between conservatives and liberals as assortative mating further entrenches existing prejudicial attitudes towards outgroup members. This research provides new insight into the motivation for anti-immigration attitudes by developing and testing a novel biophysiological explanation for internalized security threats theorized in the literature on outgroup prejudice.

Moreover, this research has implications for motivations for ethnic conflict. If individuals with developmental differences in the ventral diencephalon not only internalize threat perceptions differentially, but also respond with increased rates of physical aggression towards the object of their perceived threat, this may provide an explanation for individual differences in engagement in political, ethnic violence. Extant candidate gene research already demonstrates that individuals with different genetic profiles are more likely to report higher rates of aggression. The connection between these genetic variants and developmental changes in the brain may be the missing link in explaining why persons experiencing the same forms of political repression respond differentially.

In closing, a word of optimism. The growing literature on the genetic and biological influences of political behavior has been critiqued for only illustrating associations between structural variation in genetics and far downstream effects, such as support for anti-immigration policy, leading some to ignore any relationship

between biology and political behavior. By demonstrating the relationship between genetic variation and developmental differences in the brain, this research comes closer to explaining intermediate steps relating genetic variation to politically relevant behavior. In addition, demonstrating the attenuating effect of education on biological proclivities towards anti-immigrant attitudes, this research provides both a more nuanced explanation by explicitly modeling environmental influences, and also speaks to policy recommendations. This research concludes that genetic influences are not deterministic, and that access to higher education, a noninvasive intervention, has the potential to significantly temper proclivities towards outgroup prejudice.

Acknowledgements

The data for this analysis was provided by Peter K. Hatemi; The Genetic and Environmental Foundations of Political and Economic Behaviors: A Panel Study of Twins and Families (John R. Alford, Peter K. Hatemi, John R. Hibbing, Nicholas Martin, and Kevin Smith 2015).

Chapter 3: Rebel Recruitment and Retention in Civil Conflict

Abstract: While the conflict literature has examined the use of forced recruitment and child soldering, the question remains why groups chose to forcibly recruit and train personnel when faced with the threat of defection. In this paper, I develop a formal model for rebel recruitment that matches the individual's talent and utility for rebellion to that of the rebel group's. The equilibrium depicts the individual recruit's "transfer fee" or the cost to the organization for defection. At the group-level, the formal model is supported with a novel cross-national dataset on rebel recruitment practices from Cohen (2013). The results speak to the growing literature emphasizing the importance of the meso-level both theoretically and empirically.

3.1 Introduction

Murad, a Hazara Afghani immigrant, and a mercenary employed to fight for Iran's revolutionary forces, was threatened with execution, if he did not continue to fight in the Iranian war. After emigrating to Afghanistan, he was falsely accused of drug smuggling and agreed to fight for the rebels in exchange for money and a commuted prison sentence. Murad's story, at face value, exemplifies the Hazara refugee experience in Iran. Since the Afghan wars, one ethnic minority group in particular, the Hazara, was chosen as the scapegoat by the Taliban, blamed for the Taliban's own wartime atrocities. Mass killings and other forms of violence against the Hazara resulted in upwards of two million emigrating to Iran, many illegally, seeking asylum from the discrimination in Afghanistan. The Pasdars, Iran's Revolutionary Guard, have employed thousands of Hazara to fight its war in the last year.[22]

Who are these fighters? They are called "the reservoir of the desperate" as the impoverished refugees to Afghanistan are seen as an inexhaustible supply of soldiers to fight Iran's war. Are they voluntary mercenaries as Pasdar generals would suggest? Or, have the refugees been forced to fight, either through the subtle coercion of economic desperation or through explicit threats of physical violence? For Murad, the answer is perhaps both; after a bombing which killed almost his entire

[22] Reuter, Christoph. May 11, 2015. "The Afghan's Fighting Assad's War." Spiegel Online International. Accessed online: May 30, 2017. http://www.spiegel.de/international/world/afghan-mercenaries-fighting-for-assad-and-stuck-in-syria-a-1032869.html

unit including the general that threatened his death if he deserted, he, alongside the one other surviving solder, continued, perhaps inexplicably, to fight.

Forced recruitment occurs in approximately 30 percent of all armed conflicts (Eck 2014). Forced recruitment often involves children – an estimated 250,000 to 300,000 children are currently employed in conflicts across the globe with pernicious effects on society, the psychological well-being of the children abducted, and survived, apart from the death toll. The Lord's Resistance Army, in Uganda, who predominantly used forced recruitment in their conflict against the Uganda government amongst other groups, abducted over 60,000 child soldiers to be used in conflict alone with the United Nations declaring the LRA crisis to be "the most forgotten, neglected humanitarian crisis in the world." Moreover, we know that patterns in the use of violence at the recruitment stage often go hand in hand with a culture of group violence, including civilian targeting, gang rape, and other forms of sexual violence (Cohen 2013).

This paper examines two fundamental questions of violent political conflict. How do groups select fighters to take up arms on behalf of their cause, and perhaps more critically, why do these persons fight? These processes are key as the quality of recruits is paramount to the success of the rebellion. In fact, given the technical requirements, some groups have been known to screen for recruit capacity (De Mesquita 2005). Research has shown that some recruitment methods, particularly coercion and forced recruitment, lead to protracted conflicts fought by unmotivated, less skilled combatants who are more likely to desert (Beber and Blattman 2013, Eck 2014, Haer and Böhmelt 2017), and yet, as the case of Murad illustrates, many

continue to fight on behalf of an organization that threatened them into fighting. An ancillary question, driven in part by the prevalence of the use of forced recruitment, and the seemingly inexplicable commitment to fighting from some coerced recruits, for those forced to fight, can groups incentivize – or threaten– in a way that creates highly talented and committed fighters?

These questions have been the basis of the agenda in political violence research to date and many important insights into individual motivation for rebellion have been uncovered, particularly within the microfoundational literature on conflict and recruitment. However, there are still some crucial questions that have remained unanswered. In particular, the extant literature has yet to solve the forced recruitment puzzle, if highly committed fighters are critical to winning wars, particularly rebellion that tends to favor the government with respect to balance of power, why do rebel groups use forced recruits?

Moreover, while the microfoundational literature has made important strides in identifying factors predictive of individual violence, one issue with this work has been the predominant concentration on "nonstate actors in the periphery (Roessle 2016, p. 42)." Without contextualizing the individual's contribution within larger group or state processes, we are unable to fully answer questions such as those posed above. Drawing on basic contract theory, I develop a formal model that examines the interrelation between group level practices, such as forced recruitment, monitoring, and punishment for defection, with the individual recruit's proclivity and talent for violence. The model holds consequences for two critical facets of rebellion: first, the model explains variation in rebel recruitment practices, and second, how variation in

these recruitment practices inform individual motivation for fighting, as well as desertion.

The paper proceeds as follows. I begin by reviewing the literature on motivations for fighting and methods of recruitment. Next, drawing on insights in contract theory, which predominantly studies the issues that arise from workers' inabilities to credibly commit to long term contracts, I introduce a unified model of recruitment that matches the individual's talent and utility for fighting with that of the group's. Why would groups use forced recruitment when threat of defection is high? Perhaps counterintuitively, the model shows this occurs because the skill/talent of soldier is unknown. This uncertainty is mitigated by transfer fees or punishment inflicted by the organization on a soldier for desertion. This paper demonstrates that costs for defection are highest – and penalties for defection most useful – when there is large uncertainty about the talent/skill of the fighter such as in cases of conflict where rebels employ forced recruitment (i.e., scenarios of forced recruitment). Implications of this model are then empirically tested using data on forced recruitment in conflict from Cohen (2013). I conclude with a discussion of the substantive and theoretical contributions of the model, as well as possible extensions. By integrating group-level processes and preferences with the individual recruit's talent and utility for fighting, this piece contributes to meso-level theorizing, a growing research focus in conflict (Roessler 2016, p. 42).

3.2 Why Fight? Motivating Individual Participation in Conflict

What motivates men and women to take up arms, risking their very lives for a political pursuit, is one of the most fundamental and extensively examined questions in conflict research, not only because it necessarily impacts both prospects for war and peace, but because the mobilization of individuals to fight in rebellion is a collective action problem. Three waves of research have examined this question, the first identified grievances, namely peasant grievances as the basis of rebellion, and moreover, modernity (Moore 1966, p. 1).[23] Rebellions were seen as violent reactions to the growing economic instability of peasants following the commercialization of agriculture, threatening the peasant's financial wellbeing, and the foundation of rural, peasant communities (Hobsbawm 1959, Moore 1966, Scott 1976, Jenkins 1982, Skocpol 1979, Skocpol et al. 1982, Lichbach 1994). Peasant rebelled because they were aggrieved.

Grievances, however, are neither necessary nor sufficient to incite rebellion (Olson 1965). Individuals face the same economic and social grievances and some choose to rebel while others do not. Olson's collective action reframed rebellion as a public good (nonrival, nonexcludable). Why would individuals participate in rebellion, when they could realize the benefits without paying any costs? Thus, the collective action framework produced an empirical puzzle, no rational individual should participate in rebellion when they could realize the benefits without paying

[23] "[The] process of modernization begins with peasant resolutions that fail (Moore 1966, p. 1)."

any of the costs, and yet, revolutions throughout history suggest the potential of presumably rational people to mobilize on behalf of a public good.

A third wave of research on the motivations for participation in rebellion focused on what Olson suggested as a solution to the collective action problem, selective incentives (1965, p. 72). This focus was driven in part by empirical finds that found a positive association between countries with natural, typically lootable, resources and civil war (Collier and Hoeffler 2002, Hegre and Sambanis 2006, Lujala et al. 2005, Ross 2004), argued to be indicative of a greed based motivation for rebellion. On a more micro-level, the selective incentive solution to the collective action problem avers that rebels are able to use these natural resources not only to finance rebellion but to reward the participants of rebellion. Yet, the selective incentives solution is problematic for several reasons; first, many civil conflicts occur in either resource-poor countries, where resource rewards are not possible nor the primary pursuit of rebels; second, even in resource-rich countries, natural resource extraction may not be possible (not lootable) making resource payments impossible; finally, for the selective incentive explanation to effectively overcome the free-rider issue, group leaders must be able to discern the level of commitment, skill, and participation of each individual recruit (Weinstein 2005). Weinstein, drawing on signaling theory, developed a revised selective incentive explanation for engagement in rebellion: potential recruits must signal their commitment by foregoing immediate material rewards in order for group leaders to distinguish between recruits driven by greed and those committed to the cause (2005). Yet, as Weinstein notes, commitment

to rebellion is private information, which until revealed during the course of fighting, may be unknown even to the combatant.

In one of the first microfoundational studies to directly assess individual explanations for participation in rebellion, Humphreys and Weinstein found that for members of the Revolutionary United Front (RUF), who were predominantly forcibly recruited into participation, selective incentives, as well as other commonly cited motivators for conflict such as social sanctioning, and grievances, did not motivate their ongoing participation in fighting (2008). This is problematic for theories of individual participation in conflict that aver selective rewards as a solution to the collective action problem while presuming engagement to be largely voluntary. Theories of participation in conflict focusing exclusively on ascertaining individual motivation for fighting are thus incomplete. In building a theory of individual motives for engagement in rebellion, we must first consider the recruitment method employed at the group-level.

3.3 Recruitment Practices in Conflict

In fact, coercion is an alternative proposed by Olson to overcome issues of free-riding in rebellion: "Selective incentives can be either negative or positive, in that they can either coerce by punishing those who fail to bear an allocated share of the costs of the group action, or they can be positive inducements offered to those who act in the group interest (1965, p. 72)." Yet, surprisingly little theoretical attention has been paid to incorporating the possibility of coercion into models of individual participation in conflict. Eck (2014) and Herbst (2000) suggest that this

may be due to the use of labor market theories where employment is voluntary. There is, however, a fairly extensive, predominantly policy-oriented literature on the use of child soldiers (Achvarina and Reich 2006, Andvig and Gates 2007, Beber and Blattman 2013), consequences (Blattman and Annan 2010), their skill in battle (Blattman and Annan 2010, Haer and Böhmelt 2016, 2017), their long term potential (Beber and Blattman 2013, Haer and Böhmelt 2016), as well as characteristics of groups that use them, including their lack of popular legitimacy (Achvarina and Reich 2011). Part of the theoretical issue with this literature, as Eck (2014) observes, is that, while egregious, most studies presume children, including adolescents, are unable to voluntarily commit to fighting.

Notable exceptions in the literature on recruitment more generally, not specifically children, include Gates (2002), Gates and Nordås (2014), and Eck (2014). In his earlier work, Gates develops a formal model of enforcement; given the incentives for free-riding and defection, groups must be able to credibly coerce recruits into participation in conflict (2002). Gates demonstrates that geography has a critical role to play in the recruitment and particularly retention of fighters: the more spatially proximate the group leaders are to their fighters, the more credible the threats to defection (2002). In their 2014 research, Gates and Nordås develop a model of rebel recruitment and retention in civil conflict, examining a range of group types and individual utilities for fighting, illustrating differences in recruitment practices between groups that rely on material rewards and those that offer ideological or religious benefits to individual participants.

While this literature has examined variation in rebel recruitment, and ways to enforce coerced individuals into fighting, the extant research does not resolve the dilemma of why groups, knowing the likelihood of desertion, force recruitment in the first place. Eck (2014) comes closest, arguing, counter to the conventional wisdom on the use of forced recruitment, that it is a costly method, employed in conflicts when the balance of power greatly favors the state. However, as Gates (2002) concludes, decisions regarding recruitment are made in light of the possibility of defection. Empirically, there is substantial variation in the use of forced recruitment with respect to balance of power vis-à-vis the state. For example, many rebel groups, such as the CNDD-FDD in Burundi, the MNLF in the Philippines, and the RCD in the Democratic Republic of the Congo, employ coercion, and yet, were not weak relative to the government. In fact, each of these groups were near (or greater than) parity in terms of troop strength vis-à-vis the state, and each of these rebels ultimately gained concessions from the state.[24]

Theoretically, if as Eck (2014) and others have noted (Beber and Blattman 2013, Haer and Böhmelt 2017), that forced recruitment leads to unmotivated fighters who are more likely to defect than voluntary combatants, it is precisely when the balance of power so greatly favors the state, that groups, if rational, should employ their most committed and talented fighters. Forced

[24] Using data on rebel and state troop size from the Uppsala Conflict Data Program (Date of retrieval: 14/07/01) UCDP Conflict Encyclopedia: www.ucdp.uu.se/database, Uppsala University, and concessions from Cunningham (2014).

recruitment not only has the possibility of leading to desertion, defection can precipitate further imbalances as defecting soldiers switch sides, encourage splits, and may lead to the collapse of the rebel group (Lyall 2014). Why then would rebel groups use forced fighters when the threat of defection is (presumably) high and the consequences for the success of the rebellion significant?

I argue that forced recruitment is not primarily a tactic of the weak (although it can be used by such). Under certain conditions, outlined more fully below, forced recruitment can be beneficial to rebels. First, to answer the question of why rebels would use forced recruitment, I lay out a simple model where rebel groups choose between forced and voluntary recruits. The equilibrium condition of this model demonstrates why forced recruits, all else equal, are more profitable for rebels than employing voluntary recruits. Second, I explore the effects of coercion on continued fighting by forced recruits by defining a system where fighters can leave at will without penalty for defection. This depicts the benefits of the "transfer fees" or payments leveled by the group to the fighter for defection. Third, I add the possibility of employing "transfer fees" back into the model and solve for the equilibrium forced recruits under the condition of unrestricted punishments for defection.

3.4 A Formal Model of Rebel Recruitment

The model describes the process by which rebel groups and potential recruits coalesce to take up arms against the state or one or more competing nonstate entities. In this, rebel group leaders face a basic choice: to forcibly recruit fighters or to enlist

non-coerced recruits, each with different benefits for the organization. Below I outline the assumptions made.

Assumption 1: There exists one (or more) group(s), fighting against the state. Groups are assumed to be risk-neutral; they seek to maximize the payoffs they receive from fighting. Fighters seek to maximize their utility for fighting. They will not fight for less than their reservation point, which is normalized to zero.[25]

Assumption 2: The revenue, or benefits to the group generated by a fighter, i, of given talent, m, in a rebel group with size n, is given by $y_i = \text{mn}$. The profit to the group for recruiting a particular fighter, i, to its cause is defined by $y_i = \text{mn}$ minus the price of talent for fighter i, or $p[i]$.

The size of the rebel group, n, is analogous to the total number of recruits (here I assume to be fighters), e.g., total troop strength. Prices to talent can be thought of as the wage paid to the fighter for her services. For voluntary recruits, these are the positive 'selective incentives,' such as loot/resources from war, or even monetary payments. For persons forcibly recruited into fighting, however, no wage or payment need be offered for their services.

Assumption 3: Rebel group leaders would (strictly) prefer more talented recruits, m', to less talented recruits m'', m' $\succ$ m", where talent is defined by the individual

[25] A new recruit is assumed to produce enough benefits to the group to cover his/her outside opportunity for fighting, defined as $n[0]\int_0^1 \theta\ [j]\,d_j\ \geq 0$.

recruit's capacity to carry out the activities of rebellion, including, but not limited to, in battle fighting.[26]

Assumption 4: Recruits' careers are simplified to last two periods. In the first period, the forced recruit's talent for fighting is unknown, but is learned through the first period of fighting.

Rebel leaders, all else equal, would prefer a recruit that is more capable of fighting (and is more committed to the cause) than a less capable fighter (with less allegiance to the group). As Weinstein (2005) notes, there are ways groups can mitigate these information asymmetries. One of these is through observing fighting. For persons forcibly abducted or consigned into rebel service, there is likely less known about their capacity to wage war than for voluntary recruits. This is in part due to the different composition of forced recruits vs. voluntary recruits. Forced recruits tend to be younger on average than voluntary recruits (child soldiers compose up to 40% of fighters in ongoing conflicts, an estimated 300,000 children);[27] their "talent" for fighting is still unknown and must be trained. Learning through observed fighting reveals the recruit's latent talent for conflict.

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[26] There are many other activities critical to successfully carrying out rebellion including commitment to the group's goals and ideals, capacity for strategy and espionage, etc. The model is not limited to actual in battle fighting capacity. Talent for fighting is used as shorthand throughout to represent the recruit's capacity to carry out all of these activities.

[27] Council on Foreign Affairs. https://www.cfr.org/backgrounder/child-soldiers-around-world

Assumption 5: The process of recruitment occurs in each period: the distribution of talent, θ, is continuous and (strictly) increasing, $\theta[i],\ i \in [0,1]$. The rebel group's size distribution is described by a strictly increasing and continuous profile, $n[i],\ i \in [0,1]$.

Critically, however, this does not assume that recruits cannot defect. They can do so after the first period, after their "talent" for fighting is revealed (particularly in the case of forced recruits). The recruit can abandon fighting altogether, or defect, if desired, to another group. In fact, it is this revealed capacity for fighting observed in the first period of play that informs the group's punishment for defection to the particular recruit.

While simplifying, these assumptions are not unrealistic; they provide an authentic starting point to build a model of the recruitment matching process. I use a simplified assignment model from basic contract theory (Sattinger 1993), and use it to determine the equilibrium "price" for talent under complete information. Next, I use this price to derive the equilibrium in absence of "transfer fees," the case where groups do not punish recruits for defection. Finally, I bring these "fees" back into the model, and derive the stationary equilibrium proportion of forced to voluntary recruits.

Demand for Recruits

Rebels must choose between a particular recruit, i, and an alternative fighter, j. In meeting their demand for fighters, rebels will forcibly recruit some proportion of their fighters, z, and the rest, 1-z, will be filled by voluntary recruits. The proportion of rebel group(s) using forced recruits is defined by the profile $i \in [z, 1]$. Talent and rebel group size are notated by $m[i]$ and $n[i]$, respectively. The equilibrium price for an individual recruit, i, is notated as $p[i]$. The equilibrium "price" for any particular rebel recruit is such that the group does not strictly prefer drafting any other recruit, j. The profit should be at least equal to, if not greater, than the profit accrued to the same group for hiring fighter, j, at price, $p[j]$:

$$m[i]n[i] - p[i] \geq m[j]n[i] - p[j] \quad \forall i, j \in [z, 1] \qquad (1)$$

The "price" of any particular recruit can be thought of as a wage to the conscripted soldier, lootable goods or other selective incentives to reward commitment. Rebels abducting or otherwise forcibly recruiting soldiers need not pay any explicit price to a particular recruit. To derive the equilibrium price for talent, I use a constraint reduction method from nonlinear pricing problems.[28] This simply constrains the function in such a way that rebels would not want to recruit the next lowest talented fighter. The price profile is defined by the (derivative) with respect to talent multiplied by the size of the group, or the derivative with respect to individual i of the benefits fighter i brings to the group:

[28] See Wilson (1993) for a complete coverage of nonlinear pricing problems.

$$p'[i] = m'[i]n[i] \quad (2)$$

Next, I integrate the price profile to get the equilibrium price for fighter i.

$$p[i] = \int_z^i m'[j]n[j]dj, \; i \in [z, 1] \quad (3)$$

If both fighters *i* and *j* are forcibly recruited, with no prior knowledge of their skill or commitment as soldiers, the group will be clearly indifferent to choosing fighter *i* or *j*.

Supply of Recruits

The supply of recruits is dependent in part upon the fighter's talent, which is assumed to be unknown in the case of forced recruits in period one. Thereafter, recruits must be above a certain talent threshold, m*, to make it into the second period of play (which can be thought of as not getting killed in the first battle; recruits may also choose to defect from the group). Fighters above this threshold, m*, compose the 1-z top quantile of recruit in terms of talent, and 1-z/z proportion of talent.[29] Forced recruits are expected to be, on average, less talented fighters than voluntary recruits, with a mean distribution of talent, $\bar{\theta}$. Thus, the complete supply of expected talent for fighting is defined as:

[29] This means the threshold relationships is: $m^*(z) = \theta\left[2 - \frac{1}{z}\right]$ which is strictly increasing in z.

$$m[i|z] = \begin{cases} \bar{\theta} & i \in [0, z] \\ \theta\left[1 - \frac{1-i}{z}\right] & i \in (z, 1] \end{cases} \quad (4)$$

which combines the distribution of talent of forced recruits, $\bar{\theta}$, with the distribution of talent, $\theta\left[1 - \frac{1-i}{z}\right]$, for voluntary recruits.

Rebel "buyer"profits

The profit to the rebel group for recruiting a fighter, i, consists of the revenue the fighter brings to the group, $m[i|z]n[i]$, minus the price of the fighter, $p[i|z]$. Note that the profile of talent $m[i|z]$ is now endogenous to the proportion of forced recruits, *z*.

$$\pi^B[i|z] = m[i|z]n[i] - p[i|z], \; i \in (z, 1] \quad (5)$$

Where the price, $p[i|z]$, for a particular recruit is defined by:

$$p[i|z] = \int_z^i m'[j|z]n[j]dj, \quad i \in (z, 1] \quad (6)$$

Here, we can easily see the marginal profitability of employing forced recruitment. When groups chose to force individuals into fighting, the price of the forced recruit, $p[i|z]$, is zero.

Fighter "supplier" profits

In the long run, the profit to recruits, or "suppliers," for fighting is defined as a function of the price or wage they receive from fighting, if any, and their individual talent, as well as the talent, of the other recruits. Why is this the case? As Weinstein notes, any rewards, lootable or otherwise, depend on the ability of the group to successfully wage rebellion, making any individual's outcome inextricably linked to the talent and success of the other recruits (2005).

Long run average profits are thus:

$$\pi^S[i|z] = \bar{\theta} n[i] + \frac{1}{z} P(z) \qquad (7)$$

Where $P(z)$ is defined as:

$$P(z) = \int_z^1 p[i|z]di = \int_z^1 \int_z^i m'[j|z]n[j]djdi = \int_z^1 (1-i)m'[i|z]n[i]di \qquad (8)$$

Equilibrium Condition

The solution must make the (threshold) rebel group indifferent between choosing a voluntary recruit and forcibly recruiting a person to fight. Mathematically, this means that the equilibrium condition is defined by: $\pi^B[z|z] = \pi^S[z|z]$. Substituting in the rebel buyer and supplier profit functions yields:

$$m[z|z]n[z] - p[z|z] = \bar{\theta}m[z] + \frac{1}{z}P(z) \qquad (9)$$

This can be simplified as $m[z|z] = m^*(z)$, $p[z|z] = 0$ and equilibrium threshold, z*. This yields the equilibrium recruitment threshold:

$$(m^*(z) - \bar{\theta})\, n[z^*]) = \frac{1}{z^*}P(z^*) \qquad (10)$$

What are the consequences of this model? This simple model illustrates the relative profitability of using forced to voluntary recruits, and answers the question of why rebels might be tempted to use forced recruits in the first place, when the threat of defection looms large. However, as demonstrated in the next section, the consequences of using forced recruits differ depending on the characteristics of the group itself. I will use the equilibrium condition above (10) to derive the conditions under which groups are more, or less, likely to use forced recruitment.

3.5 No Penalty for Defection

What happens when groups cannot credibly threaten costs for defection? This is mathematically analogous to replacing the right side of equation (10) with zero:

$$(m^*(z) - \bar{\theta})\, n[z^*]) = 0$$

Solving for m* yields:

$$m^*(z) = \bar{\theta} \qquad (11)$$

This defines the new equilibrium for recruitment, generating several significant results outlined below.

Proposition 1: The proportion of forced recruits decreases in the absence of punishment for defectors; simultaneously, the level of talent decreases in rebel groups.

Proof. Recall that the threshold of talent, defined by $m^*(z) = \theta\left[2 - \frac{1}{z}\right]$ is increasing in z. Thus, $m^*(z^*) > m^*(z^0)$ as $z^0 < z^*$. If groups cannot credibly commit to punishing defectors, they will cease using coercion as a recruitment tool. Moreover, the profile of fighter talent, $m[i|z] = \theta\left[1 - \frac{1-i}{z}\right]$ $i \in (z, 1]$, is also increasing in z, so that $m[i|z^*] > m[i|z^0]$ for all $i \in (z^*, 1)$. Thus, the level of talented fighters decreases without credible punishments to defection.

Proposition 2: Total surplus to rebellion is decreased.

Proof. The equilibrium (10) is the first-order condition for maximizing total surplus, $Y(z) = \int_0^1 m[i|z]n[i]di$. Thus, the reduction in efficiency is essentially due to a price ceiling at zero.

3.6 Penalty for Defection

Next, I add in penalties to fighters for defection to examine how credible threats to defection affect recruitment patterns. Payments or penalties to defection are now dependent and continuously increasing in the penalty for defection, $\hat{p}$.

Thus:

$$(m^*(z) - \bar{\theta})\, n[z^*]) = \frac{1}{z^*} \hat{P}(z^*|\hat{p}) \qquad (12)$$

Note that when $\hat{p} = 0$, the equilibrium condition simplifies to the case without penalties for defection (see above).

Proposition 3: The proportion of forced recruits increases (and benefits to fighting) as groups are more able to credibly threaten increasingly harsh punishments to defection.

Proof. In order to do so, we need to show that the proportion of forced recruits increases in the cost or penalty to defection, $\hat{p}$. First, the left hand side of (12) is increasing in z, while decreasing in the right hand side. Moreover, m* and Y increase for all $\hat{p} \in (0, p[1|z^*])$. This means that the total differential $dz/d\hat{p}$ is positive. We will define a function, $\hat{m}(m^*|\hat{p})$ and substitute this into the right hand side of (12) to become:

$$\hat{P}^E(m^*|\hat{p}) = \int_{m^*}^{\hat{m}(m^*|\hat{p})} p(m|m^*) f(m) dm + (1 - F(\hat{m}(m^*|\hat{p})))\hat{p} \qquad (13)$$

Taking the derivative of $\hat{P}^E(m^*|\hat{p})$ with respect to m^*, or the equilibrium talent for individual recruit *i*, will yield the following negative expression:

$$\frac{\partial}{\partial m^*}\hat{P}^E(m^*|\hat{p}) = 0 - \int_{m^*}^{\hat{m}(m^*|\hat{p})} n[1 - \frac{1-F(m^*)}{2-F(m^*)}\, f(m)dm \qquad (14)$$

$$- \int_{m^*}^{\hat{m}(m^*|\hat{p})} b'\left[1 - \frac{1-F(m^*)}{2-F(m^*)}\right] * \left[1 - \frac{1-F(\theta)}{(2-F(m^*))^2}\right] f(m^*)d\theta\, f(m)dm$$

This expression is clearly negative: $\frac{\partial}{\partial m^*}\hat{P}^E(m^*|\hat{p}) < 0$ and $\frac{\partial}{\partial m^*}\hat{P}^E(m^*|\hat{p})$. Thus, the proportion of forced recruits is positive and increasing in the penalty for defection, $\hat{p}$. As $\hat{p}$ increases, the proportion of forced recruits, z, becomes closer to the unrestricted equilibrium at which point rebel surplus to rebellion becomes maximized.

Proposition 4: Large rebel groups (in terms of troop size) will have a greater proportion of forced recruits than small rebel groups.

Proof. In other words, $z_L^* > z_S^*$. To prove this, first, we define the equilibrium condition, z_L^*, for the large rebel group, using (10) and the average punishment for defection, (8),

$\int_z^1 (1-i)m'[i|z]n[i]di$, to be:

$$(m^*(z) - \bar{\theta})\, n[z^*])p(z) = \frac{1}{z}\int_z^1 (1-i)m'[i|z]n[i]p(i)di \qquad (15)$$

Next, we divide both sides by $p(z)$ and evaluate at z_S^*. This by definition yields z_S^* for the left hand side, but includes $p(i)/p(z)$ on the left hand side. Evaluating the expression, the left hand side will be increasing in z, yet the right hand side, decreasing (because the integrand on the right hand size is multiplied by 1/z). In order, then, for the left hand side to equal the right hand side, which must be true

according to the proof demonstrating the uniqueness of the equilibrium (10), the proportion of forced recruitment in large groups must be greater than that of small groups, $z_L^* > z_S^*$. In part, this is because larger, more powerful rebels are better able to credibly threaten severe enough punishments to defer defection and encourage continued fighting than are less powerful groups. This allows more powerful rebels to employ a greater proportion of forced recruits and retain more of the profits from fighting as illustrated above (5).

3.7 Data and Empirical Analysis

One critical implication from this model is that forced recruitment is not a tactic of last resort employed by weak rebels at risk of losing the conflict. Rather, strong rebel groups, those that can more credibly threaten punishment for defection, should be more likely to use forced recruitment practices than weak rebel groups.

Hypothesis: Strong(er) rebels should be more likely to use forced recruitment than weak(er) rebels.

I evaluate this hypothesis using data from Cohen (2013) on rebel recruitment practices and from the Uppsala Conflict Database on conflict characteristics.[30] The dataset covers 133 civil conflicts occurring between 1989 and 2009[31] and observes

[30] As employed by Sawyer, Cunningham and Reed (2015).

[31] The last year for which Cohen (2013) codes data on rebel recruitment practices.

UCDP's criteria for inclusion as an armed conflict.[32] The unit of analysis is the dyad-year. Results from logistic regression coupled with causal inference models demonstrate that stronger rebels are significantly more likely to use forced recruitment than weaker rebels.

Forced Recruitment

Forced recruitment is dichotomous measure of the use of violent/physical force by the insurgent group to coerce or threaten individuals into fighting on the group's behalf. This measure is coded by Cohen (2013) using State Department reports.

Rebel Strength

Rebel strength is measured as the yearly count of rebel troops, log transformed, from the Uppsala Conflict Database.[33] As fighting capacity is dependent on the strength of the opponent, state strength, measured as the yearly count of state troops, log transformed, is included in all models. As a robustness check, the relative

[32] UCDP defines armed conflict as: "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a year." For further information, see http://www.pcr.uu.se/research/ucdp/definitions/.

[33] Uppsala Conflict Data Program (Date of retrieval: 14/07/01) UCDP Conflict Encyclopedia: www.ucdp.uu.se/database, Uppsala University.

balance of rebel to state troops (ratio, log transformed) is reported in the Appendix, Table 3.1. All results are statistically and substantively similar.

Alternative Explanations

Counter to the coercion mechanism, the positive selective incentives literature suggests that groups motivate individuals to fight through material rewards from the "spoils" of war. Contraband, from illegal activities, as well as natural resources, can be converted into payments to fighters. In Model 1, I test for these motivating alternatives to coercion by including data on contraband, specifically, whether groups fund conflict through drugs, and whether or not the state is an oil producer (Fearon and Laitin 2003, updated by Cohen 2013).

The growing literature on rebel governance and legitimacy demonstrates that rebel group characteristics greatly influence the tactics they employ in conflict (Cohen and Nordås 2014, Cunningham and Sawyer 2017, Mampilly 2011, Staniland 2012). Rebel groups seeking legitimacy, either locally or internationally, are less likely to engage in combatant or civilian abuse (Sawyer, Cunningham and Bond 2017). These groups are more likely engaged in the politics of their cause, with democratically elected leaders and legal political wings. Dichotomous measures of legitimacy are added in Model 2: whether the group has a history of elected leadership (Cunningham and Sawyer 2017) and whether the rebels have a legal political wing (Cunningham, Gleditsch, and Salehyan 2009).[34] Conversely, the literature on rebel group atrocities demonstrates that groups with relatively strong

[34] Data from Expanded Armed Conflict Data (EACD) v2.3, updated 2013.

rebels are more likely to engage in other forms of brutality, such as sexual violence (Pickering 2010). I include a dichotomous measure of rebel group sexual violence from Cohen (2013).

In Model 3, I include several state level controls correlated with the relative power of the rebel group and likely impact the choice of rebels to use forced recruitment: a dummy variable indicating whether or not the state is democratic,[35] the size of the population (log transformed),[36] and the per capita GDP.[37]

Results

The results in Table 3.1 show strong support for the argument that relatively strong rebel groups are more likely to engage in forced recruitment practices. Consistent across all three models, controlling for the strength of the state, as well as competing explanations for recruitment, group and state characteristics, stronger rebel groups are significantly more likely to use forced recruitment than weaker rebels.[38]

[35] Gleditsch, Kristian Skrede (2013). Modified Polity P4 and P4D Data, Version 4.0.

[36] Data from World Bank. World Development Indicators. 2016.

[37] World Bank. World Development Indicators. 2016.

[38] In additional models reported in the Appendix, conflict dynamics, including battle deaths and length of conflict following Carter and Signorino (2013), t, t^2, and t^3, are added. See Appendix Table 3.2 and Appendix Table 3.3, respectively. The results with respect to rebel strength do not change across model specification.

Table 3.1. Logistic Regression – Determinants of Forced Recruitment

VARIABLES	(1) Forced Recruitment	(2) Forced Recruitment	(3) Forced Recruitment
log(Troop size rebel)	0.353***	0.366***	0.237***
	(0.073)	(0.082)	(0.086)
log(Troop size state)	-0.390***	-0.326***	0.058
	(0.054)	(0.056)	(0.139)
Oil	0.134	0.130	0.326
	(0.431)	(0.388)	(0.623)
Drugs	0.398*	0.346	0.505*
	(0.229)	(0.241)	(0.274)
Election tenure		0.347	0.469
		(0.336)	(0.405)
Legal political wing		-0.178	-0.265
		(0.476)	(0.562)
Sexual violence		1.369***	1.422***
		(0.295)	(0.312)
Democracy			-0.080
			(0.470)
log(Population)			-0.430***
			(0.136)
log(GDP per capita)			-0.340*
			(0.199)
Constant	0.055	-1.024	2.596
	(0.861)	(0.932)	(1.801)
Observations	525	525	513

Reporting logistic coefficients with robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Rebel group strength is significantly associated with the use of rebel recruitment. Increasing rebel group strength from the first to the third quartile is associated with on average a 7.75 percent point increase in the probability the group will use force as a recruitment tactic in a given year, from approximately 18.77

percent to 26.52.[39] Figure 1 below displays the predictive margins for forced recruitment over the full range of observed rebel troop strength (logged). At every point, as rebel force size increases, coercion of recruits becomes increasingly likely.

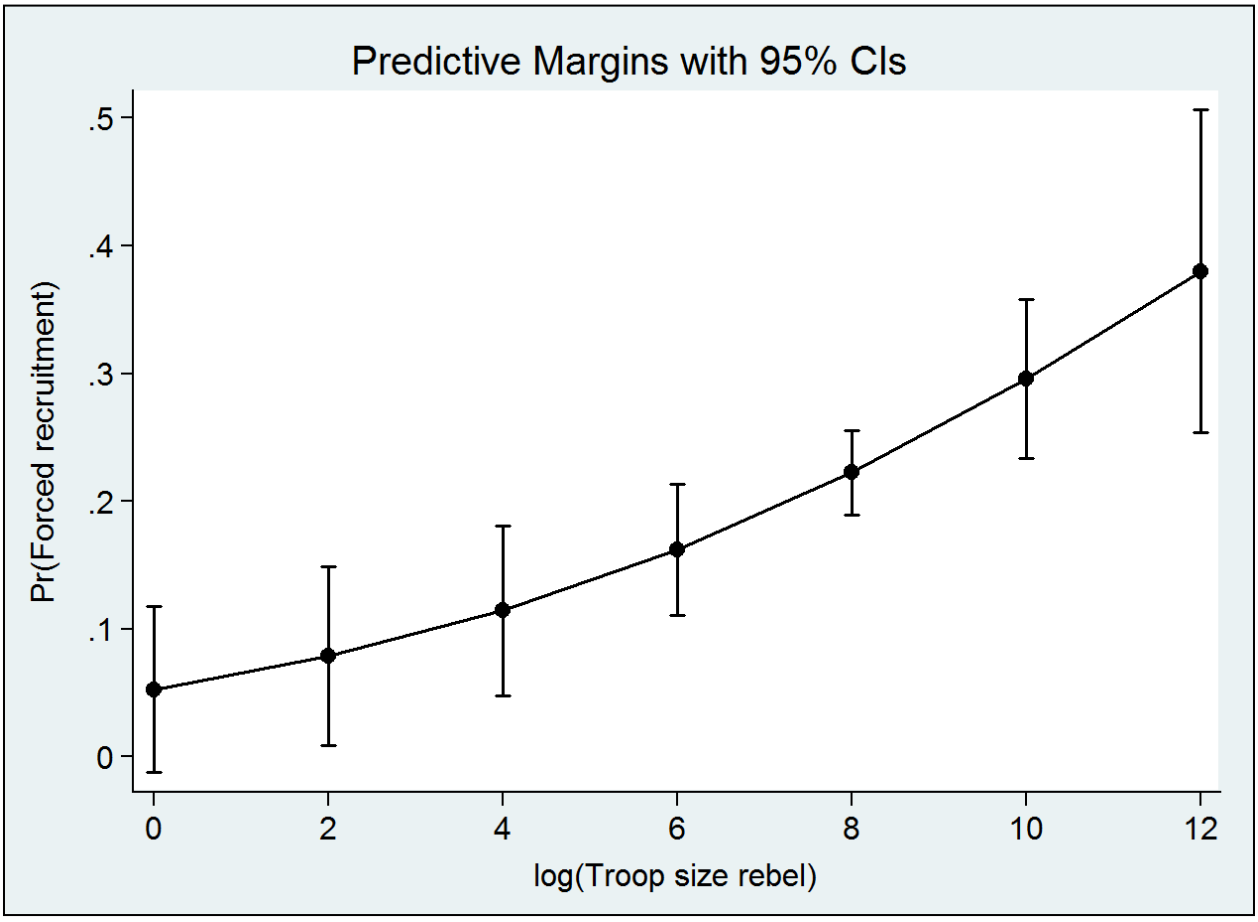

Figure 3.1. Predicted Probability of Forced Recruitment by Rebel Group Strength

[39] This is a change from approximately 6.908 (first quartile) to 9.210 (third quartile). The predicted probabilities are calculated following the observed values approach described by Hanmer and Kalkan (2013). Predicted probabilities are calculated by regressing forced recruitment on the set of explanatory variables in Table 3.1, Model 3 and are significant at the 95 percent confidence level.

Moreover, the results show strong support for rebels engaging in a package of abusive tactics. Rebel groups that commit acts of sexual violence are associated with, on average, a 24.70 percentage point increase in the probability of the use of forced recruitment.[40] In terms of state characteristics, surprisingly, more populous states are associated with a lower probability of forced recruitment. In particular, increasing the population from the first to the third quartile is associated with, on average, a 12.04 percentage point decrease in the predicted probability a group will use forced recruitment.

3.8 Causal Inference Model

The models above demonstrate strong evidence of the positive association between rebel troop strength and the use of forced recruitment. However, rebel strength likely does not vary independently of the recruitment strategy employed, and may, in fact, be endogenous to the recruitment strategy, particularly if it is expected to impact rebel strength through desertion. I employ a causal inference model, developed by Woodridge (2014, 2010, 2007), to parse out the specific effect of rebel strength on employing forced recruitment.

Specifically, I use a treatment effects estimator, designed to simulate experimental outcomes by estimating the unconditional means of outcomes by treatment levels (Sloczynski and Wooldridge 2017), in order to account for the possible endogeneity of troop size to recruitment tactics. I report the Average Treatment Effect (ATE), the mean difference in the use of forced recruitment

[40] Statistically significant at the 95 percent confidence level.

between relatively stronger rebels (1), those at parity or greater than state troop forces, and those that are weaker than state troops (0).[41] The results reveal that relatively stronger rebel groups are significantly more likely to coerce fighters using force than relatively weaker groups.[42]

Table 3.2. Treatment Effects Estimator – Average Treatment Effect of Relatively Strong Rebels

Rebel Sexual Violence	Coefficient	Robust Std. Errors	Z	P>|z|	[95% Conf. Interval]	
Relative Rebel Strength (1 vs. 0)	0.194	0.051	3.78	0.000	0.093	0.295
Potential Outcome Means	0.296	0.012	25.53	0.00	0.273	0.319

In Table 3.3, I report the regression adjusted coefficients on the covariates used in Model 3 of Table 3.1 to examine differences in the effects of the covariates on the use of forced recruitment across treatment conditions. Specifically, I use an Augmented Inverse Probability Weighted (AIPW) estimator which combines the

[41] Based on the ratio of rebel to state troop size from the UCDP conflict encyclopedia.

[42] The results above use a Regression Adjustment (RA) estimator specifically to model the nonrandom treatment assignment; the results are robust, however, across several causal model specifications including the inverse probability weighting (IPW) estimator, the IPW with regression adjustment estimator, and the augmented IPW (AIPW) estimator, which adds a bias-correction term to the IPW estimator to account for misspecification in the treatment model (reported in Table 3.3).

"double-robust" properties of the IPW estimator, meaning the estimates of the effects should be consistent if either the treatment or outcome models are misspecified (Wooldridge 2010). In addition, the form of this model includes a bias-correction term that adjusts for issues in the specification of the treatment model, which is critical as this is the process by which we statistically account for the nonrandom assignment of rebel group leaders – either electorally or otherwise. Model 1 displays the regression adjusted coefficients for the case where the rebel group is relatively weak vis-à-vis the government, the untreated condition; Model 2, the adjusted coefficients for the case where the rebels are stronger (or at least at parity) with the government, the treated condition.

Table 3.3. Augmented Inverse Probability Estimator of Forced Recruitment by Rebel Strength

VARIABLES	(1) Rebels Weaker	(2) Rebels Stronger
Oil	-0.028	-0.059
	(0.060)	(0.093)
Drugs	0.111***	0.472***
	(0.037)	(0.122)
Election tenure	0.033	0.252
	(0.046)	(0.148)
Legal political wing	-0.006	0.241**
	(0.050)	(0.094)
Sexual violence	0.274**	0.277*
	(0.060)	(0.142)
Democracy	-0.012	-0.069
	(0.053)	(0.188)
log(Population)	-0.060**	-0.112*
	(0.010)	(0.066)
log(GDP per capita)	-0.045*	-0.017
	(0.024)	(0.122)
Constant	1.123	1.075
	0.218	1.257
Observations	525	525

Reporting logistic coefficients and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

In comparing the two conditions – (1) relatively weak and (2) relatively strong rebels – we observe several significant differences in the effect of the covariates on the use of forced recruitment. Sexual violence is more strongly associated with the use of forced recruitment when rebels are relatively weak. This is in keeping with Cohen's (2013) theory on sexual violence as a cohesion building tactic. Relatively weak rebels, which likely have more difficulty monitoring and enforcing fighting, ought to be more reliant on other methods, such as gang rape or other forms of sexual

violence (Cohen 2013) to foster group cohesion and commitment. State-level covariates, population size, and GDP per capita are modestly more negatively associated with the use of forced recruitment when rebels are relatively weak. A wealthier population may provide a check on relatively weak rebels who might otherwise forcibly recruit soldiers. For relatively stronger rebels, having a legal political wing is positively associated with the use of forced recruitment. These rebels, who are quite militarily strong, at least at parity with the state, and have also achieved a degree of political legitimacy, are in a fairly strong position of power. It is possible that rebels in such a position of power, both militarily and politically, use it to exploit the cheap labor of forced recruits, while maintaining power through coercion, and their ability to credibly carry out threats.

On the other hand, access to contraband (i.e., drugs) is statistically significantly associated with the use of forced recruitment, regardless of rebel strength. This association suggests a more nuanced story than the typical greed argument, where drugs are used as a selective incentive to pay or reward fighters. Here, the strong association with forced recruitment regardless of rebel strength suggests that rebel groups are not using drugs to pay voluntary soldiers. This result is more in line with accounts of child soldiering, where drugs are provided to encourage risk-taking, aggression, and brutality (Human Rights Watch, 2000).[43]

[43] "Sierra Leone Rebels Forcefully Recruit Child Soldiers." Humans Rights Watch. 2000. Accessed online: May 30, 2017. https://www.hrw.org/news/2000/05/31/sierra-leone-rebels-forcefully-recruit-child-soldiers

3.9 Conclusion

Forced recruitment is a pernicious, and widespread, human rights violation that holds significant costs to the individual, the community, and to the larger society. Understanding the conditions under which groups forcibly recruit fighters is a critical security concern. This research offers an answer to the puzzle of why groups use force to recruit fighters when defection poses a significant threat to the viability of the organization and the success of the rebellion. Previous scholarship suggests that forced recruitment, similar to other unethical treatment of civilians during wartime, is a tactic of last resort, utilized by rebels without other resources (Eck 2014). Yet, anecdotal evidence points to its use by some of the more powerful rebels fighting against the state. The results of a formal model of recruitment and empirical analysis of rebel recruitment practices provide strong evidence for a counter argument: rebel recruitment is a profitable tactic used by the strong.

Several interesting findings emerge from the causal inference model which addresses the endogeneity of group strength to recruitment practices, resolving the tension between the use of forced recruitment and the potential for desertion. The results of the causal inference model demonstrate that the more static, conflict- and state-level measures that have been theorized to account for differences in the use of combat tactics are not capturing the true variation in rebels' use of coercion in armed conflict. Rather, group-level features drive the decision of rebel groups to engage in civilian violence, such as forced recruitment, and become increasingly important as the group becomes more powerful vis-à-vis the state. Moreover, when coupled with political legitimacy, the results suggest that rebels may become tempted to exploit

their power to coerce allegiance to their cause. This research adds nuance to the growing literature on differences in rebel type: groups whose goal is to gain a monopoly on political power versus those who use rebellion in tandem with other more peaceful legitimacy building practices. Seeking political legitimacy alone is not enough to signal type; rebels may strategically engage in these practices to gain power and support while committing atrocities.

This research holds implications for understanding how groups might shape environmental conditions to train or modify an individual recruit's talent or skill at engaging in rebellion. As rebels strategically choose between recruitment tactics, these differences have potential effects, both for training talented fighters and for counterinsurgency and counterterrorism operations. Moreover, the reintegration of forced and abducted recruits is also significantly more challenging than that of voluntary recruits. Differentiating between coerced and voluntary fighters can be difficult, and the rehabilitation (or punishment) of participants to rebellion should differ. Practically, however, this may be hard to identify and implement. Rebels who engage in civilian brutality, including forced recruitment, pose a unique challenge for post war peace. Scholarship on positive peace consistently demonstrates that power sharing agreements make peace more durable (Hartzell and Hoddie 2007, Hartzell and Hoddie 2003, Roeder and Rothchild 2005, Werner and Yuen 2005); yet, creating a position of power for leaders and groups that abuse the civilian population creates an ethical dilemma and potential threats to continued peace. In this way, the choice rebels make in recruiting fighters is not trivial; it does not simply impact the lives of

the abducted or threatened but holds lasting consequences for society. Future research is needed to understand the complete consequences of forced recruitment.

Chapter 4: Biophysiological Risk-factors for Political Violence

Abstract: Why do individuals engage in violence against the state? This research investigates the biological and environmental determinants of individual-level participation in political violence through the use of a Candidate Gene Association (CGA), gene-by-environment interaction study. This study applies insights from the fields of behavioral genetics, economics and psychology to differences in individual-level participation in political violence. Extant research has demonstrated that variation in the gene MAO-A is associated with physical aggression, particularly in response to environmental stressors (McDermott et al. 2009, McDermott et al. 2013). This study argues that individuals with the low MAO-A variant, when exposed to conditions of political repression, are more likely to commit acts of political violence. Through original genetic data collection of both participants and non-participants of political violence, coupled with a survey instrument designed to measure the extent of non-genetic, individual-level motives for participation in violent rebellion, this study investigates how genetic variation affects participation in political violence.

4.1 Introduction

Recent footage issued from the rebel group the Islamic State in Iraq and Syria (ISIS) depicts members warning the United States: "We will drown you all in blood."[44] Theirs are not just remote, foreign threats, however. With FBI discoveries of individual terrorist sympathizers from Minneapolis to Chicago, where a local young man was arrested before boarding a plane to allegedly join the rebel group ISIS,[45] these "homegrown" terrorists seeking to join and/or act on behalf of violent political groups, have threatened U.S. security interests. For many in the security community, these individual cases are mystifying; however, they underscore a general lack of understanding as to why persons choose to become involved in violent rebellion. While the conflict literature in political science has carefully examined institutional and societal explanations of intrastate political violence, research on individual-level motives for rebellion is underdeveloped. Relatively few conflict studies have been conducted on the individual-level, even though guerrilla warfare, terrorism, and coups d'état require few persons to exact large-scale damage.[46] In the

[44] Time.com. "ISIS to U.S.: 'We Will Drown All of You in Blood'." August 19, 2014. Accessed online: October 7, 2014.

[45] New York Times. "For Jihad Recruits, a Pipeline from Minnesota to Militancy." September 6, 2014. Accessed online: October 7, 2014.

[46] Notable exceptions include: Gates (2002) and Gates and Nordås (2010) which develop formal individual-level theories of civil war recruitment. Humphreys and Weinstein (2008) test individual-level theories of recruitment using survey data.

face of such national security threats, it is imperative that researchers develop theoretical explanations for individual participation in political violence that can guide the identification of potential risk-factors and the creation of effective intervention strategies.

Extant explanations for civil rebellion fail to explain individual-level variation in participation in political violence. Since Gurr's (1970) model of the individual determinants of political violence, political science traditionally has promoted the theory that relative deprivation incites violence. More recent research by Humphreys and Weinstein (2008) on participation by insurgents in the Sierra Leone war finds support for several competing theories for engagement in rebellion including grievance, greed/incentives, and societal pressure. Humphreys and Weinstein conclude, however, that Gurr's (1970) theory of relative deprivation may be a proxy for defenselessness to elites in power, as they find that grievance predicts both participation in rebellion and counterrebellion.

Humphreys and Weinstein's (2008) seemingly contrary finding is the result of an underspecified causal mechanism. Individuals experience similar grievances – poverty, political repression, lack of education – and some choose to rebel while others do not. The discrepancies in the literature are likely due to the omission of a critical explanatory factor. This proposed research offers an improvement on the existing literature by considering an important, individual-level, omitted variable: genetic variation. Recent research in American politics has found that genetic

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Thyne and Schroeder (2012) test individual-level characteristics such as marriage, unemployment, and military service, but on a macro-level outcome, civil war onset.

variation in the gene MAO-A affects non-violent political participation under certain environmental conditions (Fowler and Dawes 2008; 2013).[47] Similarly, McDermott et al. (2013) have demonstrated a link between early childhood trauma, the low MAO-A variant, and adult aggression. By examining the biological factors influencing rebellion, we can better understand why individuals faced with the same grievances, incentives, and societal pressures, differentially choose to become involved in political violence and rebellion, and what environmental conditions are likely to mediate proclivities to become involved in violence.

4.2 Theory: Genes, Environment and Political Violence

How do genes influence an individual's participation in acts of political violence? Genes transcribe proteins which serve to regulate bodily functions such as neurological processes. The relationship between the genotype -- or the inherited "blueprint" found within each cell responsible for maintaining the body -- and the phenotype, which is the observable, behavioral manifestation of the genetic coding, is complex. Candidate gene association studies (CGA) are a first step in identifying the relationship between specific genotypes and their associated phenotypes, or observable characteristics, traits, or behaviors. The goal of CGA studies is to identify a particular gene(s) that is causally related to a particular phenotype. As monoamine oxidase A (MAO-A) transcribes neurochemicals that strongly impact the serotonin system in parts of the brain that regulate fear, trust, and social interaction, variation in this gene is particularly likely to affect social behaviors (Fowler and Dawes 2008).

[47] As well as the gene, 5-HTT or SERT.

There is less transcriptional efficiency in the *low* activity variant, or allele, of MAO-A[48] relative to the *high* version of the MAO-A polymorphism[49]. By diminishing the transcriptional efficiency, these alleles alter serotonergic functioning in ways that are believed to lead to increased rates of "negative"/anti-social behaviors including aggression, anger, and depression (McDermott et al. 2009; Stuart et al. 2014).

I selected the low MAO-A variant as a possible predictor of political violence as prior research has shown variation in this gene to be separately associated with *violent* and *political* behavior. Research in American politics indicates that these genes are related to political participation, specifically, low MAO-A is associated with decreased voter turnout (Fowler and Dawes 2008; 2013). Extant research in behavior genetics has shown that variation in the gene MAO-A is related to

[48] The 2-repeat and 3-repeat alleles are commonly classified as low MAO-A, and the 3.5-repeat and 4-repeat alleles are classified as high (as established in Caspi et al. 2002, see also Fergusson et al. 2011); there is some debate regarding the classification of the 5-repeat allele; although, molecular genetics research has shown it to be less transcriptionally efficient than the 3.5- or 4-repeat alleles (Sabol, Hu, and Hamer 1998). Some recent research has found the rarer 2-repeat allele to be more strongly associated with violence and aggression, in some cases irrespective of the environment (Beaver et al. 2013).

[49] As MAO-A is located on the X variant of chromosome 23 (Shih 1999); females have the potential for two different MAO-A alleles, whereas males can only have one variant. A control for gender is also included in all analyses to separate out differences by sex.

differences in the rates of expressions of aggression, anger, and engagement in risky-behaviors (Bertolini et al. 2005; McDermott et al. 2009; Stuart et al. 2014; Sysoeva et al. 2009). A recent study on intimate partner violence demonstrated that low MAO-A is associated with increased rates of spousal abuse (Stuart et al. 2014). In 2009, an experiment by McDermott et al. demonstrated that individuals with low MAO-A are more likely to pay to punish others whom they suspect to have stolen money from them. In a related observational study, McDermott et al. 2013 combined existing data from the National Longitudinal Study of Adolescent Health (Add Health) survey and the Virginia Twin Study of Adolescent and Behavioral Development (VTSABD) in order to show the relationship between MAO-A low, traumatic life events, and aggression in adulthood. Crucially, McDermott et al. (2013) found that low MAO-A itself is not associated with aggressive acts; however, when interacted with exposure to traumatic events in childhood, the probability of aggressive acts increases (gene-by-environment). By examining the interaction between biological and environmental predictors, this study offered an important improvement over studies that examined either genetic or environmental precipitants in isolation.

Gene-by-environment (G X E) Interaction

In fact, recent research has established that whether genes are active as well as the nature of their impact depends on environmental conditions and the plasticity of the candidate genes (Baum 2013; Belsky et al. 2014). Gene-by-environment studies have demonstrated that under *certain conditions*, individuals with low MAO-A display greater levels of aggression, fear, hostility, and negativity (Bertolini et al.

2005; McDermott et al. 2009; Sysoeva et al. 2009). Studies that have ignored the impact of the environment on outcomes have produced contradictory results. For example, although McDermott et al. (2009) found that low MAO-A is associated with aggressive retribution, others have shown low MAO-A to be correlated with diminished rates of anger and aggressive behaviors. Both Manuck et al. (2000) and Caspi et al. (2002) found low MAO-A to be predictive of lower rates of aggression. DeWall and Way (2014) explicate that the failure to replicate findings is in large part due to researchers ignoring the importance of environmental factors. A recent review (DeWall and Way 2014) of a study on intimate partner aggression (Stuart et al. 2014) went so far as to state that the scientific and policy communities cannot begin to design interventions to reduce aggression because we do not understand the mechanism linking genetic variation to the outcomes of interest. Environmental conditions (E) must be explicitly measured and included in models of behavioral outcomes if progress is to be made.

Similarly, studies of the effects of political repression on rebellion potentially suffer from the omission of the genetic (G) component. In the field of political science, longstanding research on repression has generated several consistent insights into the *causes* of state repression: dissent, past repression, and a powerful, dominant military (Danneman and Ritter 2014; Davenport 1995; Hibbs 1973; Poe and Tate 1994); as well as *pacifiers* of state repression: democracy and economic development (Davenport and Armstrong 2004; Hibbs 1973; Poe and Tate 1994; Keith 2002; Krain 1997; Zanger 2000); but, the causal relationship between repression and future civil violence is still unsettled (Davenport 2007; Earl 2011). Although some scholars

demonstrate that state repression can lead to increased rebellion (Lawrence 2013), others postulate a curvilinear relationship between repression and civil unrest (Della Porta 1995, p. 6; Gupta, Singh, and Sprague 1993; Muller and Weede 1990), and still others find no impact (De Mesquita and Smith 2010). Davenport (2007) states that whether or not repression "works", i.e., is able to squash dissent behavior, or if it simply serves to encourage future civil unrest is unknown:

> "Whether repression is more or less likely to reduce proto-insurgency or any other form of dissident activity, and if so under what conditions, are open empirical questions. Explicit consideration of the punishment puzzle and its integration into studies of civil war would thus go a long way in advancing our understanding of political processes (Davenport 2007, p. 10)."

Lawrence (2013) observes that one of the issues with the literature linking repression to uprisings has been its focus on macro-level outcomes such as civil war, democratization, and revolution, while the effects of repression on individuals, those ultimately choosing to rebel or not, within oppressive states have been overlooked. This is problematic as focusing on macro-level outcomes such as civil war victory can obscure the causal effects of repression. A state may appear to be successfully repressing civilian dissent due to external factors (such as third-party intervention), when in fact increasing repressive control did incite civil unrest. Although useful in evaluating large-scale patterns, large-N work focusing on country-level comparisons is not useful for elucidating the causal mechanism by which individuals are more/less

likely to engage in civil violence, and the conditions under which individuals do so. This research proposes that the differential response to political repression observed at the aggregate level is partially due to individual-level differences in response to politically repressive environments. By modeling both the effects of the political environment and individual-level factors contributing to violence, including the role of genetic variation, we can more fully explain differences in participation in political violence.

I build upon the diathesis-stress model from behavioral genetics which theorizes that a diathesis, or a genetic vulnerability, such as the inefficiency in serotonin transportation caused by the low MAO-A allele, when combined with an environmental stressor, will increase the rate of the negative/disordered behavior (McGrath et al. 2007; Rende and Plomin 1992; Zuckerman 1999). Critically, the diathesis-stress model predicts that the combination of genetic vulnerability and environmental stress significantly increases the rate of the negative/disordered behavior beyond what either would produce in isolation (McGrath et al. 2007).

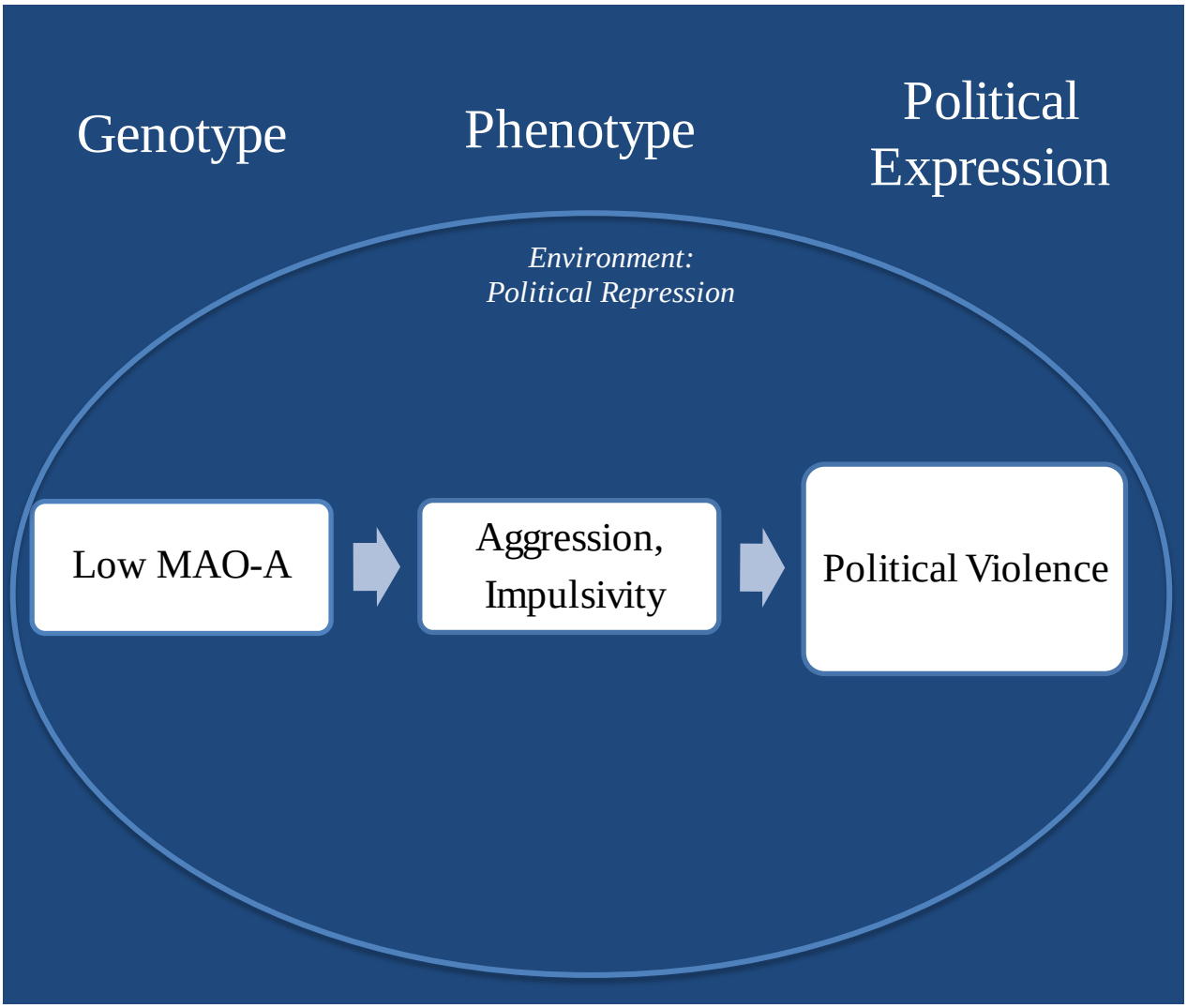


Figure 4.1. Biophysiology of Political Violence

Figure 4.1 displays the causal path from genetic variation to engagement in political violence. Political science has traditionally focused on the right-hand side of the diagram, or the relationship between individual-level traits and outcomes such as engagement in political violence.[50] I propose that the missing piece that explains

[50] Notable exceptions include Fowler and Dawes (2008), Fowler and Dawes (2013), McDermott et al. 2013.

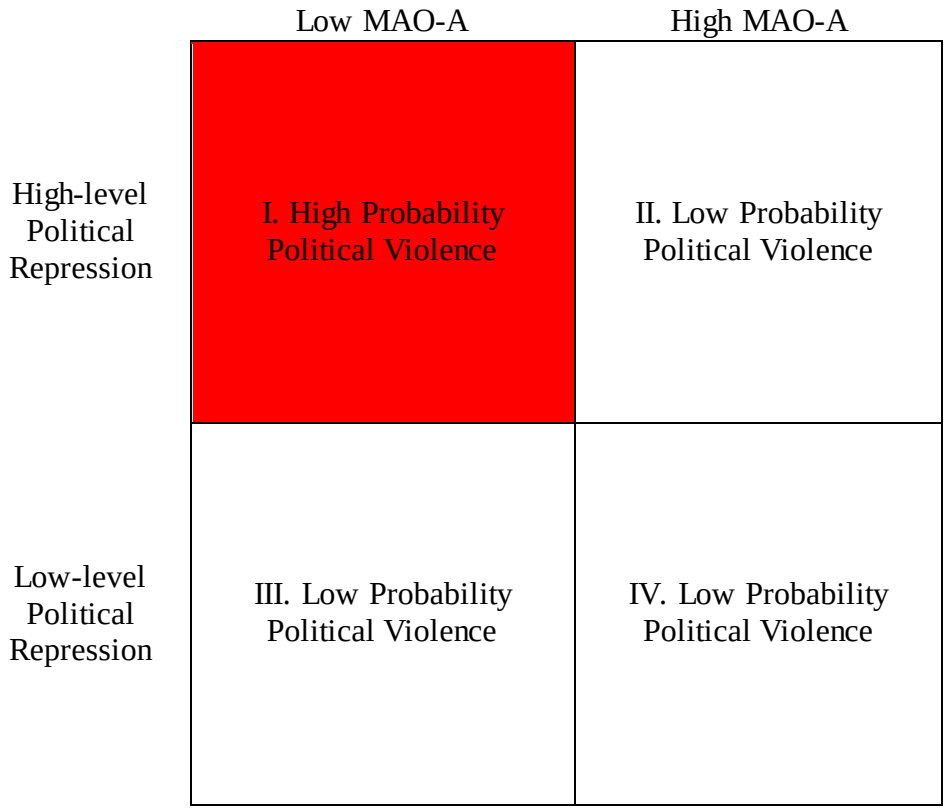
individual-level variation in engagement in acts of political violence is genetic variation. Specifically, for persons with the low variant MAO-A, the accompanying inefficiency in serotonin transportation increases the risk of violent behavior in stressful environments more than for persons with the high or long variants. It is important to stress that this research does not propose that individuals with certain genetic polymorphisms will necessarily participate in political violence. Environmental conditions play a critical role in inciting rebellion. In particular, political repression[51] – where persons living within a country are restricted from taking part in the political process, denied political rights, or receive active/passive abuse from the government – will be more likely to provoke politically violent responses in persons with deficiencies in the genes which regulate serotonin metabolism. Individual differences in rates of political violence within similarly high conditions of political repression can be attributed in part to differences in rates of genetic risk.

Figure 4.2 depicts the interaction between environmental and genetic precipitants of political violence. Under conditions of very low-levels of political

[51] Davenport (2007, p. 2), reflecting on Goldstein's definition of repression (1978, p. xxxi) describes state repression as the violation of "First Amendment-type rights" including freedom of speech, association, and assembly (right to peacefully protest) as well as due process. In keeping with this definition, we do not consider the threat of physical violence essential for an act to be labeled as repressive; further, repression does not necessarily entail violation of the law.

repression (Quadrants III and IV), the probability of engaging in acts of political violence is equally low for both individuals with low MAO-A or high MAO-A. I theorize that genetic risk alone is not enough to significantly increase the probability of political violence; a repressive political environment is an essential condition to inciting violence.

Figure 4.2. Gene-by-environment (GXE) Interaction: Individual Probability of Engaging in Political Violence



Genetic variation, however, predicts the differential response to politically repressive environments. Under higher-levels of political repression (Quadrants I and

II), individuals with low MAO-A (Quadrant I) are more likely to engage in political violence than persons with the high MAO-A variant (Quadrant II). For persons with high MAO-A, political repression is likely to cause anger, but the probability of engaging in acts of political violence is still low relative to persons with low MAO-A. Persons with high MAO-A, have more efficient transcription of serotonin; healthy serotonin regulation serves to provides a physiological buffer during periods of stress. Moreover, as previous research suggests that serotonin metabolism affects individuals' social interactions (Beaver et al. 2013), these persons are also more likely to have established, healthy social networks which can provide outlets to their anger through means other than state directed violence.

However, for persons with low MAO-A, who are more predisposed to anti-social behaviors (Fergusson et al. 2011), political repression is more threatening both to their identity and to their existence. Moreover, the deficiency in the genes which regulate the metabolism of serotonin negatively impacts their ability to process and respond to social stress. Prior research on suicide bombers concludes that terrorists have the tendency to express their anger in a political context in an attempt to provide meaning to their pain (Ross 1996). Persons with low MAO-A are therefore more likely than persons with the high/long variants to engage in political violence in an attempt to specifically redress their grievance.

Hypothesis: Under conditions of political repression, persons with low MAO-A are more likely to commit violent political acts than persons with high MAO-A.

4.3 Research Design

I use a mixed-methods design to evaluate the connection between genetic variation in MAO-A, environmental conditions, and participation in political violence. Specifically, I empirically test the hypothesis that persons with low MAO-A, under conditions of political repression, are more likely to engage in acts of political violence than persons with high MAO-A, by collecting individual-level surveys and genetic data from a sample of non-combatants and combatants from the rebel group Euskadi Ta Eskatasuna (ETA) in the Basque region of Spain. My expectation, based on the extant literature cited above, is that the Basque subjects, who have experience with system-wide political repression, and low MAO-A, will be more likely to participate in political violence (i.e., ETA membership as well higher comparative rates of violence within the group) than persons with high MAO-A under the same environmental conditions. In addition, I administered a series of experiments to parse-out the mechanism through which genetic variation impacts engagement in acts of political violence.

The three main components of the study are outlined below:

1. Candidate Gene Association Study. I conducted a Candidate Gene Association (CGA) study to examine the association between variation in the gene MAO-A and individual-level participation in violence against the government. DNA data was collected via buccal swabs, an inexpensive, non-invasive method to extract genetic material, from current and former members of the rebel group ETA, whom have been

implicated in violent attacks against the Spanish government, in addition to a non-combatant Basque sample matched on age, gender, and ethnicity, as well as controlling to the extent possible for other forms of past violence that are likely associated with similar variation in the gene MAO-A.

Candidate gene studies have been critical in the identification of risk variations that are associated with specific outcomes (e.g., disease, behavior, or trait). With the advance of new technologies, there has been some movement away from CGA studies to Genome-Wide Association Studies (GWAS); recent research, however, has affirmed CGAs use in drawing inferences concerning relations between genes and traits, particularly when experimental data support the role of specific biochemical pathways. CGA studies, especially relative to GWAS, are inexpensive and quick to perform, and are particularly useful in cases where expected effect sizes may be small and the population of interest is low-N (Jorgensen et al. 2009; Patnala, Clements and Batra 2013). As reported above, MAO-A is associated with differences in rates of aggression and violence making MAO-A an ideal candidate for a gene association study. In genetic association studies, the relationship between the phenotype, or behavioral outcome of interest, and the genotype is tested quantitatively by regressing the phenotype, participation in political violence, on the respective allele.

2. Survey Instrument and Semi-Structured Interviews. I administered a survey instrument and conducted semi-structured interviews with members of ETA as well as non-combatants with three broad goals: 1) to assess the extent of members participation in politically violent acts; 2) to assess the environmental risk-factors for

participation in acts of political violence; and 3) to assess the support for competing political explanations for participation in violent rebellion common in the literature (e.g., relative deprivation). The Basque sample, which has experienced wide-spread, institutionalized political repression, is useful for measuring the relative contribution of grievance explanations for engagement in political violence. The results of the surveys were used to construct a measure of the individual's perceived experience of political repression. In addition, the survey results were used to construct measures of other factors likely related to genetic variation in MAO-A and participation in political violence such as experiences with trauma, police violence, and drug and alcohol use.

3. *Experimental Studies of Impulsivity and Aggression.* A series of experiments were administered to explore the mechanism through which genetic variation may lead to differences in rates of participation in political violence under specific environmental conditions. As low MAO-A has been associated with increased impulsive behaviors in addition to aggression (Nilsson et al. 2011), subjects participated in experimental tests of impulsivity (i.e., Cued Go No-Go, Fillmore, Rush and Hayes 2006 and Delayed Discounting, Richards, Zhang, Mitchell, and De Wit 1999) and aggression (Aggression Implicit Association Test as developed by Adnan Niazi and Sabine Strofer 2016). This is critical as differences in the mechanism, increased impulsivity or aggression, can affect the success of intervention strategies in moderating individual propensities to engage in violence.

Case Selection and History of the Conflict

The population of the Basque country presents an ideal opportunity to assess the effect of both institutional and genetic factors related to civil violence while allaying one of the primary criticisms of CGA studies, population stratification. The Basque country contains ETA, one of the oldest and more violent of the rebel groups in Europe, attributed with nearly 850 deaths. Previous CGA research has been discredited on the basis of population stratification (see Charney and English 2013 for a critique). Population stratification refers to differences in the baseline frequency of particular genetic variants across sub-populations. A commonly cited example is the work documenting an association between the dopamine receptor gene DRD2 and alcoholism (Gelernter, Goldman, and Risch 1993). Follow-up studies, employing more stringent controls for population stratification, found no association between variation in DRD2 and alcoholism as DRD2 alleles vary widely by race and ethnic groups (Thomas and Witte 2002).

Controlling for broad genetic differences such as race/ethnicity is insufficient, as past research demonstrates differences in allele frequencies occurs even within races (Helgason et al. 2005). Complementing linguistic evidence which has been suggestive of the Basque people's uniqueness from other European groups (Basques are speakers of the only non-Indo European language in Western Europe), research in population genetics analyzing over 60,000 single nucleotide polymorphisms has concluded that the Basque people are genetically homogenous and are identifiably distinct from other European populations (Rodríguez-Ezpeleta et al. 2010). Prior research differentiated the Basque people from other ethnic groups according to

classical genetic markers (Calafell 1994), mitochondrial DNA sequences (Achilli et al. 2004), and Y-chromosome polymorphisms (Alonso et al. 2005).

The Basque people, owing in part to their unique language and culture, have throughout their history to some degree maintained their independence from their Spanish neighbors. From the confirmation of the Basque fueros, or traditional rights, in 1476 at Gernika, the Basque regions were autonomous, with their own political apparatus and judicial sovereignty from Castile. Its coastal geography and natural resources - Bilbao holds some of the world's most significant iron deposits - made the Basque region one of the wealthiest regions in all of 19th century Europe. So as Basque wealth, and with it the desire for self-governance, increased, Spain became more intent on holding its resource. Amidst this backdrop, Sabino Arana, the father of Basque nationalism, founded the Basque Nationalist Party (PNV), and with it the narrative that the preservation of a pure Basque identity could only be maintained through strict independence. The rise of the self-determination movement coincided with civil war in Spain, and in exchange for promised independence, the Basques fought alongside the Republic against the Franco led Nationalist rebellion.

This alliance led to one of the great massacres initiating the start of World War II, as the Nazi support of the Franco regime prompted the bombing of Gernika, the Basque capital, which a Nazi war general later confessed to as practice in Nazi aerial bombing. With nearly 2,000 civilians killed in the bombing, and close to 800 wounded, the newly formed state surrendered to Franco, which he repaid with repression and attempts at the complete annihilation of Basque identity. Basque customs were outlawed. The Basque language was prohibited in all public places –

speakers were not simply fined, they were given jail sentences – Basque names were prohibited from any legal documents and were removed from all historical birth, marriage and death certificates. Combined with Franco's aggressive redistributive tax policies, which placed the burden of the war and crumbling infrastructure on the relatively wealthy Basques, ETA, Euskadi Ta Askatasuna, Basque Homeland and Liberty, was founded initially by students of the group Ekin, in response to a growing frustration with the PNV's moderate stance against the Spanish government.

ETA evolved from a student led political organization, to an armed, radicalized movement following the death of ETA member Txabi Etxebarrieta in June of 1968 during a routine road check by the Guardia Civil, the Spanish police. Txabi's death led to the retaliation and planned assassination of Melitón Manzanas, the chief of the secret police in San Sebastián. Thereafter, the Spanish state - through both the Guardia Civil and Grupos Antiterroristas de Liberación, GAL - fought ETA as they became a paramilitary organization with the goal of achieving Basque independence through armed violence.

4.4 Data and Empirical Results

Survey interview and genetic data were collected on 671 persons in the Basque region of Spain over the period of two years (September – December 2015, September – December 2016). Experiments were also conducted on the second cohort (575 persons, September – December 2016).

Respondents were recruited to the study using Respondent Driven Sampling (RDS) techniques. Respondent Driven Sampling (RDS) techniques are designed to recruit peers from within the group when the group of interest is either "hidden" or public acknowledgement of membership, particularly to an outsider, is seen as being potentially harmful or damaging (Heckathorn 2002, 1997). RDS peer-to-peer recruitment allows for a more extensive penetration of the organizational network, which is crucial as ETA has a diffuse network of cells. A matched, non-combatant population was recruited specifically to mirror the demographic characteristics of the combatants to diminish differences between the groups apart from the proposed underlying genetic variation. A full report of the demographic characteristics of the sample separated by participation in political violence is detailed in the Appendix. The two samples do not vary substantively with respect to several demographic characteristics: gender, education, age, trauma, and alcoholism.[52]

As subjects were asked sensitive questions, including participation in illegal activities, several measures were undertaken to ensure subject anonymity, privacy, and confidentiality. All respondents were immediately de-identified and provided with a randomly generated numeric identifier linking the genetic sample, survey data, and experimental data (as provided: the respondent was given the option to participate in any or none of the components of the study). All data was stored with only the randomly generated identifier on an encrypted external hard drive, accessible

[52] The two samples do diverge with respect to two characteristics which are significant in the analyses below: experience with police violence and drug use. See Appendix Table 4.8 and 4.9.

only to the study's Principal Investigator. At no time were names, addresses, or any other uniquely identifying data recorded or kept.[53] Ethics board approval was obtained both in the United States under the University of Maryland IRB and in Spain under the Universidad del País Vasco (University of the Basque Country). Under both U.S. IRB and Spanish Ethics Board approval, no recrimination was ensured for admission of illegal acts.[54] The PI personally administered all surveys, experiments, and DNA collection.

Political Violence

The dependent variable in the following analyses is a dichotomous indicator of engagement in political violence, in particular a form of organized street violence committed by members of the group ETA, *kale borroka*. *Kale borroka* is a form of violent political protest consisting of aggressive attacks on the police, the sabotage and destruction of offices of members of political parties on the right, and the

[53] Only consent forms asked respondents to provide their signature and name. The consent forms are kept under lock and key by the Principal Investigator separate from any survey, experiment, or genetic data. At no time were respondent addresses or phone numbers requested or recorded (including consent forms).

[54] University of Maryland IRB reference number 597668. Due to the sensitive nature of the questioning, the PI was also prepared with references to accessible mental health professionals if so needed/requested by the subject. Respondents had the right to exit participation at any juncture and withdraw from participation at any future date, if so desired.

destruction of their private property (e.g., burning homes, cars). It is one of the few remaining forms of organized violence ongoing in the Basque conflict since the 2007 ceasefire (Ridley 2011).[55] Respondents were asked if they ever participated in this form of political violence (yes/no); 28.79 percent of respondents reported participation.[56]

Low MAO-A

The MAO-A polymorphism of interest in this research consists of a 30 base-pair variable number tandem repeat (VNTR) that is located in the promoter region of the gene. Allelic variants consist of 2-, 3-, 3.5-, 4-, and 5-base pair repeats. Alleles with the 3.5- and 4- repeats have been found to be between 2-10 times more productive than the 2-, 3-, or 5-repeat alleles.[57] MAO-A was coded into a

[55] It was originally designed as a sort of test of commitment to identify future ETA commandos. See Ridley 2011.

[56] As an additional control, respondents were also asked if they had participated in other forms of non-violent political action; inclusion of non-violent protest does not affect the results of the analyses below. See Appendix Table 4.10. The extent of participation was also measured by asking respondents what services they provided to the organization. For participants, low MAO-A is also statistically significantly associated with providing non-violent services to the organization (logistic help, information support). See Appendix Table 4.11.

[57] Sabol, Hu, and Hamer 2008. Although there is some debate on the classification of the 5-repeat allele (see Deckert et al. 1999). Changing the coding of the 5-repeat allele does not have a significant impact on the results of this analysis.

dichotomous variable based on these functional differences: the low activity allele was coded as one, and the high activity allele, zero.[58] Approximately 23 percent of the sample has the low MAO-A variant, similar but slightly under the average for Caucasians in general, with estimates between 30 to 33 percent (Fallon 2013).[59]

Female

A dichotomous variable for the respondent's sex is included in all analyses. This is critical for two reasons. First, there is debate in the extant research as to whether females are less prone to acts of (political) violence and aggression than males, for reasons not related to biology per se, but due to social conditioning.[60] Some studies argue that women are less aggressive overall due to cultural/environmental factors that discourage displays of hostility (Buss 1961,

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[58] To date, 496 subjects have been genotyped for MAO-A. The Candidate Gene Analysis was performed by the author under the supervision of Chamindi Seneviratne, Assistant Professor, Institute for Genome Science, University of Maryland Baltimore Medical School.

[59] Although, this has been found to vary within race. See also: https://news.brown.edu/articles/2009/01/hotsauce

[60] The partitioning of sex and gender has been recently debated both in terms of practical utility and as a reflection of distinct processes, particularly as the biological manifestations of sex are largely confounded with psychosocial covariates; however, this debate is beyond the scope of this research. See Halpern 2012 and Francis and Kaufer 2011 for a more complete discussion.

Olweus 1978). Others suggest women are not less aggressive per se, but express aggression in different ways than men (Bjorkqvist and Niemelä 1992, Olweus 1986). Whether or not women are less aggressive and violent than men, the motivation and role of women in conflict is likely different; extant research suggests that women may participate in rebellion in particular to redress grievances and trauma experienced in their life under the current regime (Alison 2009, Bloom 2005, Thomas and Bond 2015).

Second, the MAO-A gene is linked to the X chromosome; meaning that while males are homozygous for MAO-A, males only inherit one and so will either be strictly low or high, females have the potential to be heterozygous. Biologically speaking, it has been suggested that this heterozygosity acts as protector for females against predispositions to aggression and violence, as women who carry the low variant, are rarely homozygous low. As previous research has shown that being homozygous (low) makes a person more vulnerable to negative environmental stimuli compared to being either homozygous (high) or heterozygous, functionally heterozygous females were coded as zero for MAO-A (Caspi et al. 2003).[61] There is some debate, however, on how to classify heterozygous females, and as a result, males and females are either separated in the analyses or females are dropped from the sample altogether, which is suboptimal considering the debated role of gender in conflict research. Females are included in all analyses, with a dichotomous variable distinguishing females (1) from males (0). Approximately 41 percent of the

[61] Females could be heterozygous but functionally homozygous, i.e., 2- and 3- repeat.

respondents were female, 59 percent reported being male. This is similar to the distribution of males and females in the Basque population of Spain overall.[62]

Age and Education

Extant research suggests that there is a negative relationship between age and engagement in violent political activity, as opportunity costs to participation increase with age (Melo and Stockemer 2014). The relationship between education and individual-level motivation for participation in political violence, however, is more complex. Some scholarship suggests that increasing education diminishes individual likelihood for engaging in violence (Butcher and Piehl 1998, Ehrlich 1973, Freeman 1996), other scholarship suggests that persons who commit acts of political violence/terrorism are on average more educated (although the relationship is not causal; see Berrebi 2007), others find no relationship at all (Krueger and Malečková 2003). The Basque population is largely uniformly educated; most (approximately 98 percent) have completed high school, and the distribution of education does not differ substantively across groups (see Appendix Table 4.5).

Trauma and Police Violence

Caspi et al. (2002) were the first to report the aggravating effect of early childhood abuse/trauma on the likelihood of developing anti-social behaviors. In particular, persons with low MAO-A who were abused in childhood, were

[62] 48 percent male and 52 percent female. Eustat, Statistics of the Basque Country. http://en.eustat.eus/indice.html#axzz4izdWUozN

significantly more likely to develop anti-social behaviors than those with high MAO-A or those with low MAO-A but no exposure to trauma. Subsequent research has largely corroborated this finding (Ducci et al. 2008, Foley et al. 2004, Huizinga et al. 2006) in the gene-by-environment literature. Environmental conditions, including abuse or trauma, can aggravate or moderate underlying biological proclivities.

However, some debate surrounds this research, particularly concerning whether or not the environment is exogenous to any genetic correlates, as individuals with certain genetic variants may be more likely to seek out environments that exacerbate underlying genetic predispositions, and in the case of early childhood trauma, the parent's own heritable characteristics, which are then passed on to the children, are likely a factor in the home they create (the gene-by-environment interaction will be examined more closely in the following section). Respondents were asked if they had experienced a traumatic experience (yes/no), and the date, and description, if willing, of the incident. The dichotomous measure (1 – yes, 0 – no) is included in Model 2 and Model 3. Approximately 31 percent of respondents reported having had a traumatic experience.

In addition, experience with authority violence, such as police attacks, can impact whether or not an individual chooses to engage in political violence. While there is some debate as to whether past experiences with violence from authority increases fear and diminishes engagement (Davenport 1995, 2007), or whether it incites some to action, it may be correlated with underlying biological proclivities towards violence. Respondents were asked if they had experienced violence from the Guardia Civil, a *Spanish* police and military unit, yes (1) or no (0), the date, and

description of event, if willing. The dichotomous measure is included in Model 2 and Model 3. Approximately 22 percent of respondents reported having experienced police violence.

Alcoholism and Drug Use

Alcohol and drug use has been shown to be comorbid with committing acts of violence, including political violence (Cairns and Wilson 1993, Fortuna, Porche, and Alegria 2008); moreover, low MAO-A has been correlated with alcoholism, domestic and other forms of violence, and drug use (DeWall and Way 2004). Alcohol and drug use have been demonstrated to be related to variation in MAO-A. Model 3 includes two measures of alcohol and drug abuse included in the National Institute on Alcohol Abuse and Alcoholism and the National Survey on Drug Use and Health that assess both how much and how often the respondent engages in alcohol and drug consumption.[63] According to this classification system, approximately 58.92 percent of the respondents were coded as having alcohol abuse issues. Approximately 66.87 percent of respondents reported engaging in illicit drug use.

[63] See Codebook for a description of each question. Based on the definition for abuse, a dichotomous variable (1) abuse (0) no abuse was coded. For women, this included drinking more than 4 beverages in 2 hours and for men, 5 beverages in 2 hours. See: https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking for definitions.

Results

Table 4.1 below reports the results of three logistic model specifications examining the association between MAO-A and engagement in acts of political violence. Across all three models, having the low MAO-A allele is statistically significantly associated with political violence, controlling for differences in age, gender, education (Models 1, 2, and 3), past experiences with trauma and police violence (Models 2 and 3), and alcohol and drug use (Model 3). Substantively, the average predicted probability of committing acts of political violence for persons with the low MAO-A allele is approximately 40.28 percent, as opposed to persons with the high MAO-A allele, 29.49 percent, controlling for differences in age, sex, education, experiences with trauma and police violence, and drug and alcohol abuse. The first difference is statistically significant at greater than a 95 percent confidence level. ($p<0.039$).[64]

[64] Predicted probabilities calculated using the observed values approach specified by Hanmer and Kalkan (2013).

Table 4.1. Logistic Regression – Determinants of Political Violence

VARIABLES	(1) Political Violence	(2) Political Violence	(3) Political Violence
Low MAO-A	0.480**	0.639**	0.631**
	(0.240)	(0.287)	(0.297)
Female	-0.930***	-0.494*	-0.404
	(0.220)	(0.286)	(0.306)
Education	0.127***	0.122**	0.124*
	(0.047)	(0.062)	(0.065)
Age	-0.073**	-0.074	-0.069
	(0.035)	(0.046)	(0.045)
Trauma		-0.298	-0.353
		(0.305)	(0.311)
Police Violence		2.248***	2.245***
		(0.316)	(0.325)
Alcoholism			-0.265
			(0.288)
Drugs			0.688**
			(0.319)
Constant	-1.274*	-1.884	-2.349*
	(0.747)	(1.192)	(1.317)
Pseudo R^2	0.05	0.18	0.20
Observations	440	329	323

Reporting logistic coefficients and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The models above also suggest that drug use is modestly correlated with engagement in political violence (Model 3). Persons who have reported using illegal drugs are approximately 11 percentage points more likely to commit political violence (p<0.05). Model 1 shows some support for age and sex having a diminutive

impact on the probability of engaging in political violence (although they are not statistically significant at conventional levels in Models 2 and 3). Models 1 and 2 suggest education may be positively associated with acts of political violence. Police violence has a strong positive association with engagement in political violence. Experiencing police brutality increases the probability of engaging in acts of political violence, on average, by approximately 47 percent points ($p<0.05$). Trauma, in general, however, was not significantly associated with an increased probability of committing acts of political violence, suggesting that life experiences with repressive violence substantially predict both the form and expression of reaction. Any form of traumatic experience does not precipitate political violence.

4.5 Perceptions of Repression

Underlying each of the models above is the assumption of an exogenous, state-wide form of political repression against the Basque people. However, as Model 3 above demonstrates, personal experience with repressive state authorities varies and can have significant consequences with respect to variation in engagement in political violence. Next, I include a measure of political repression constructed from four feeling thermometer survey items assessing the individual's perception of repression by the Spanish government. The respondents were asked on a scale of 1-10 (10 being the highest), how much they agree with the following statements: In Spain, I have freedom of speech/protest/religion/petition. The items were reverse coded (0 – 9) and scaled to form a perception of political repression index. The average score was 4.49 (out of 9 possible).

Figure 4.3 below reports the results of a logistic regression predicting engagement in political violence controlling for differences in perceptions of political repression as well as the list of covariations in Table 4.1, Model 3. The results illustrate two important points. First, persons with low MAO-A are more likely to commit acts of political violence, across all level of repression, than persons with high MAO-A. At the lowest end of the repression scale, when respondents report full freedom to speak, practice any religion, petition the government without redress, and to protest, the mean probability of engaging in political violence for persons with low MAO-A is approximately 20.73 percent ($p<0.001$) as compared to individuals with high MAO-A, 12.33 percent ($p<0.01$).

Second, even for individuals with the high MAO-A genotype, a highly repressive environment, as perceived by the individual, will significantly increase his/her likelihood of engaging in political violence (although at lower probabilities than persons with high MAO-A at the same level of repression). At the highest end of the repression scale, the mean probability of engaging in political violence for persons with low MAO-A is approximately 65.08 percent ($p<0.001$), as compared to persons with high MAO-A, 49.93 percent ($p<0.001$). While the mean probability of engaging in political violence is always greater across the repression scale for persons with low MAO-A versus high MAO-A, under high levels of repression, the probability of engaging in political violence is nearly fifty percent for those with the "non-risk" genetic profile, demonstrating that state conditions matter greatly in terms of inciting violence. Political violence seems to be a response to repressive political conditions that states can control.

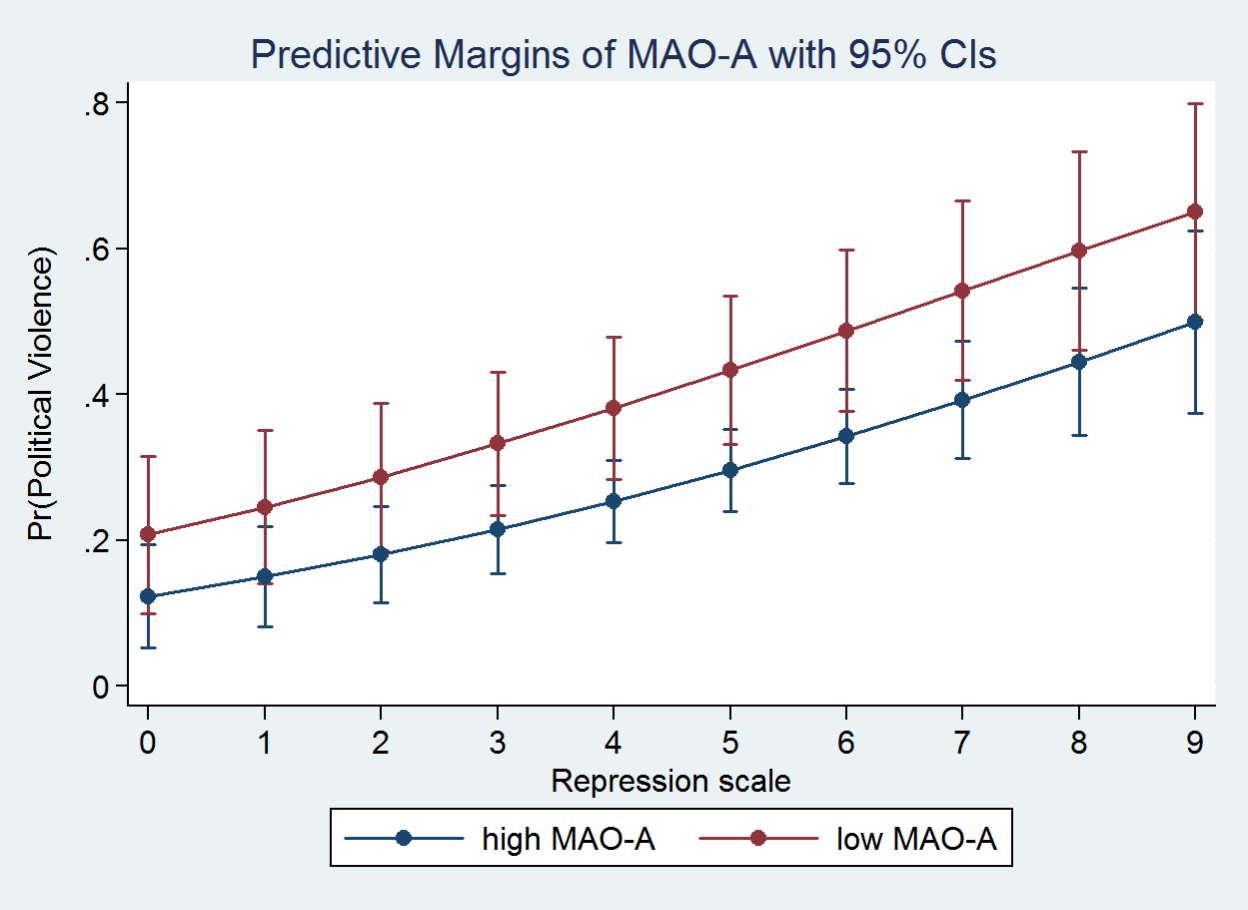

Figure 4.3. Predicted Marginal Effect on Political Violence – Low MAO-A and Repression

4.6 Experiments: Impulsivity and Aggression

Although the results above demonstrate a strong correlation between genetic variation in MAO-A and committing acts of political violence, the mechanism is unknown. Experiments were conducted with participants to probe how genetic

variation translates into behavior. Biologically, variation in MAO-A may be expressed as differences in impulsive or aggressive behaviors, that have components in the form of political violence analyzed here. In particular, two experiments were played to assess the subject's level of impulsivity and *implicit* aggressiveness, the Cued Go No-Go game (Fillmore, Rush, and Hayes 2006) and the Aggression Implicit Association Test (Niazi and Strofer 2016), respectively.[65]

The Cued Go No-Go game presents a continuous stream of stimuli where respondents are required to make a binary decision (go, no-go) on the basis of each stimulus (Fillmore, Rush, and Hayes 2006). At the beginning of the game, respondents are told to make a specified motor response, (or go), when presented with one form of stimulus, and to withhold from making the same response (or no-go), when presented with the second form of stimulus. The game is designed to assess the subject's degree of action impulsivity. The cue is manipulated so that valid cues are designed to increase response inhibition, and shorter response times, and invalid cues act to increase response times, by confusing response inhibition. The critical condition used to assess impulsivity occurs when the no-go cue appears, and the subject may fail to inhibit response. The game consists of 250 trials and is approximately 10-15 minutes long. The average response time was approximately 324 milliseconds (minimum: 116, maximum: 808).

[65] These were also complemented by a battery of survey items directly assessing *explicit* aggressive and impulsive behaviors, the full 29-item Buss and Perry aggression questionnaire (1992) and the Barratt Impulsiveness Scale (1995).

The second game, or task, the Aggression Implicit Association Test (Aggression IAT) was used to assess the respondent's *implicit* aggressiveness. Designed to overcome respondent issues with social desirability, The Aggression IAT is one of several IATs designed to assess automatic affective, cognitive, and behavioral tendencies through latency measures in a sorting task (Bluemke and Zumbach 2007, Greenwald, McGhee, and Schwartz 1998). Respondents are required to sort words (e.g., "peaceful", "hateful") into response categories denoting whether the words are more descriptive of oneself or of others. A positive score demonstrates that the respondent perceives him/herself to be less aggressive relative to others, whereas a negative score demonstrates that the respondent perceives him/herself to be more aggressive than others. The average score was 0.40 (minimum: -0.893, maximum: 1.439).

Results

Figures 4.4 and 4.5 below show the change in the predicted probability of political violence for persons with the low MAO-A allele versus the high MAO-A allele over changes in the impulsivity and aggression IAT scores, respectively, and controlling for the list of covariates reported in Table 4.1, Model 3. The impulsivitiy score below is measured in milliseconds with higher scores indicating less impulsivity (more time delay in the no-go cue). The results depicted in Figure 4.4 suggest that one mechanism through which differences in participation in political violence occur is through impulsivity. Consistent with the previous findings, across all levels of impulsivity, persons with low MAO-A are more likely to engage in acts

of political violence than persons with high MAO-A. However, now persons with low MAO-A and higher baseline levels of impulsivity (lower scores) are more likely to engage in acts of political violence than persons with high MAO-A or lower levels of impulsivity.

Similarly, the results in Figure 4.5 suggest that genetic variation in MAO-A is conditioned by aggression. Persons with low MAO-A who are more aggressive relative to others (lower Aggression IAT scores), are on average more likely to engage in acts of political violence than persons with high MAO-A or lower levels of baseline aggression. Together, these results suggest that the pathway through which genetic variation in MAO-A leads to differences in politically violent behavior is through both impulsivity and aggression. There is, however, still an additive effect of low MAO-A on the increased probability of engagement in political violence not explained through either mechanism, necessitating future research.

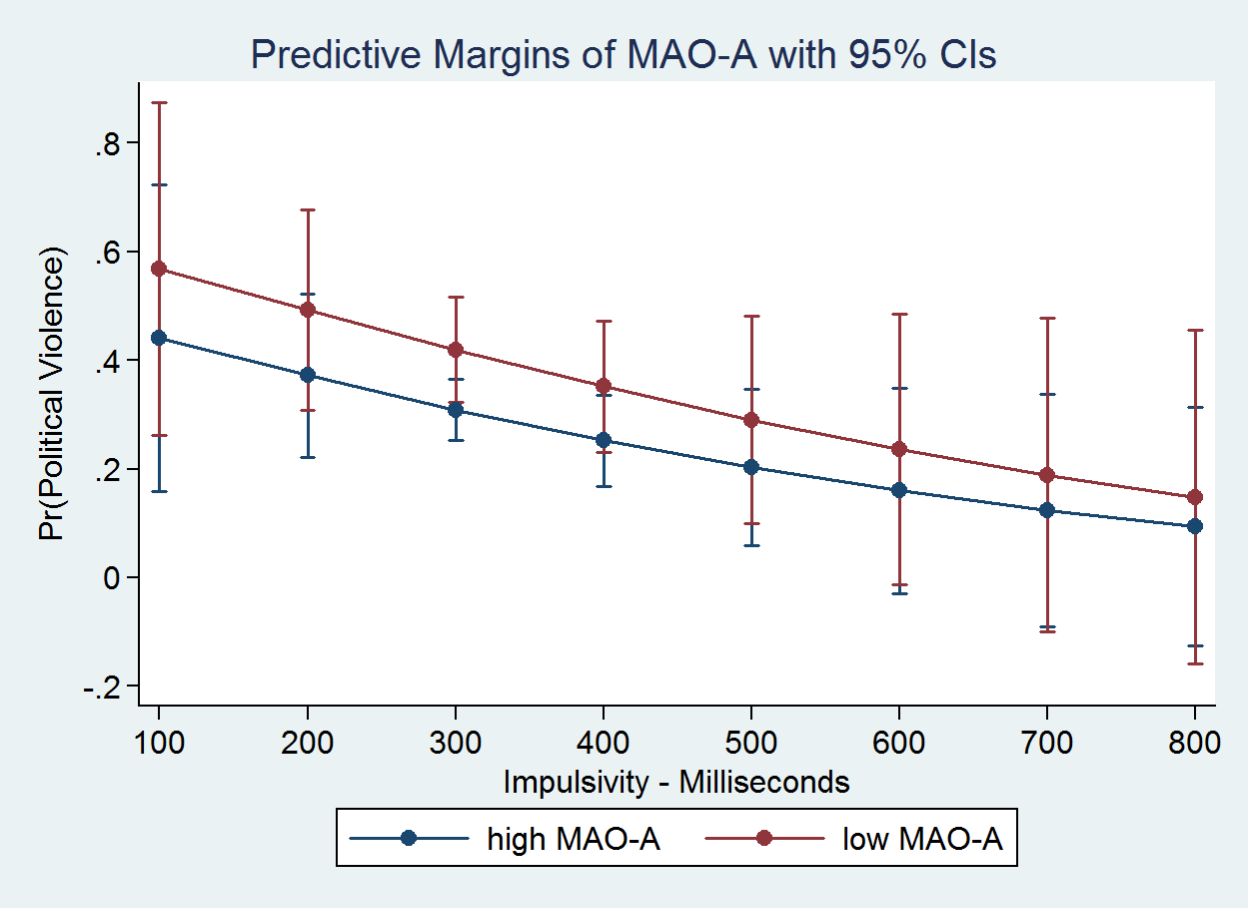

Figure 4.4. Predicted Marginal Effect on Political Violence – Low MAO-A and Impulsivity

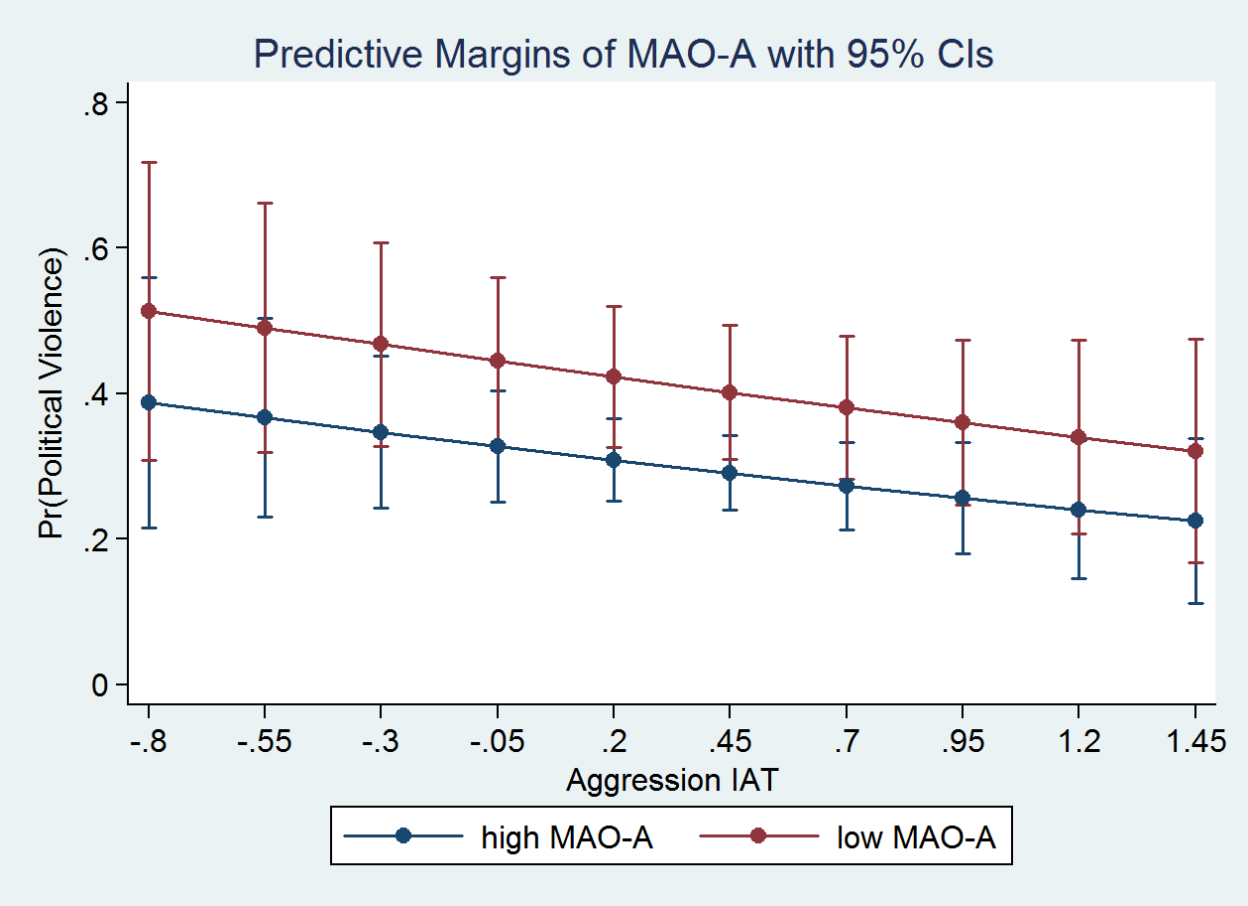

Figure 4.5. Predicted Marginal Effect on Political Violence – Low MAO-A and Aggression IAT

4.7 Limitations and Future Research Directions

This is the one the first studies to directly examine the relationship between genetic variation and participation in acts of political violence through the collection of original genetic, survey, and experimental data. The results of these analyses demonstrate a robust positive association between low MAO-A and engagement in political violence. However, the results should be interpreted with some care. First, although the relationship between low MAO-A and acts of political violence is

robust, the reader should not conclude that having this particular allele is either causal in committing acts of political violence or deterministic. As shown in the analyses, political conditions can become sufficiently repressive as to significantly increase the probability of acts of political violence in any person, with either allele. The policy implications are clear: governments can dramatically decrease the likelihood of domestic political violence by establishing a rule of law that protects civil liberties.

Second, from a statistical standpoint, the genetic results should be interpreted with some caution until further replication. Given reasonable expectations concerning genetic effect sizes, Benjamin et al. (2012) demonstrate that discovery samples with a few hundred individuals are not well-powered to detect a "true" effect. In a sample size of 400, approximately similar to the sample sizes reported here, genetic effect sizes would have to be in the range of $R^2 = .06$ to be 100 percent powered to detect a "true" effect at an alpha = 0.05.[66] Although the Pseudo R^2 from the analyses presented here ranged from 0.05 to 0.20, until corroborated in an independent sample, the association found in this sample may be an example of winner's curse, compounded in part by multiple hypothesis testing implicit in modeling gene-by-environment interactions. Unless truly exogenous, what we are detecting with the environmental measure may well be a product of gene-by-gene interaction. To address this potential environmental confounding, I treat the environment as an exogenous pre-condition constant across all individuals in the first set of analyses, and do not include the measure of perceived political repression,

[66] Power calculated as $1 - \Phi[\Phi\text{-}1(1 - \alpha/2) - (NR2)½]$.

which may be correlated with the genotype, or downstream results of low MAO-A. In both sets of models, we find strong support for an association between variation in MAO-A and political violence. Future research, particularly laboratory studies that exogenously manipulate the environment, will be useful in partitioning the relative environmental and genetic effects and provide an independent sample to corroborate the genetic association presented here.

Despite the concerns addressed above, the robust association between low MAO-A and engagement in political violence demonstrates the importance of further research into the relationship between biology and political behavior. Early studies reported the heritability of political behavior to be around 40 percent (Alford, Funk, and Hibbing 2005). The results reported above suggest that biology not only impacts attitudes but political behaviors, as well. If the results of the genetic analyses reported above hold, models of political violence and terrorism that ignore baseline differences in human biology are misspecified. The genetic associations provide a starting point for the development of more complete models of political behavior and may offer significant traction in explaining individual-level differences in engagement in political violence under similar political, economic, and social conditions.

Beyond usefulness in understanding the interrelated processes of biology, environment, and politics, the incorporation of genetic measures can improve research design and statistical analyses in other substantively interesting areas. For example, some of the most interesting and puzzling areas of political research are constrained by endogeneity bias. The association between MAO-A and political

violence can be used as the basis for an instrumental variables analysis. This result can be used to untangle the complex and endogenous relationship between government repression and domestic violence, as individual genetic variation is likely exogenous to state repression but is correlated with participation in political violence. The use of genetic scores as instrumental variables, in general, is one of the useful paths forward in genomics. Additionally, adding genetic variables as covariates in other substantively interesting analyses will improve the estimates of the variables of interest, as the standard errors decrease.

At the opposite end of the spectrum, research in epigenetics and phenotypic plasticity may further explain the human biological response to repressive conditions. Aggression is a highly adaptive behavior and, as demonstrated in this research, likely a response to environmental conditions such as political repression. Phenotypic plasticity, or the change in the behavior of an organism in response to environmental conditions (Pigliucci, Murren, and Schlichting 2006), would suggest that aggression be employed as an adaptive response under conditions in which it would be most useful to the organism. Aggression is not necessarily a useful response under all continuums of repression; tracing allelic differences to actual methylation changes in an individual can provide a more complete picture of how and when aggressive and violent responses to environmental stimuli turn on. The genetic associations reported here with respect to political violence are just the beginning of a research agenda that will transform our understanding of human social and political behavior.

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Chapter 5: Conclusion

When politics begets violence, the consequences are devastating. Political violence is one of the most destructive forms of political engagement throughout all of human history. Current estimates demonstrate that political violence is only increasing; in 2014, the Uppsala Conflict Data Program reported over 126,000 deaths due to organized political violence – the highest level of fatalities since the Cold War.[67] Similarly, the United States State Department has shown increased deaths due to terrorist attacks around the world, a reported 13,463 attacks, with total fatalities increasing by 81 percent since 2013.[68]

This dissertation is the first to provide evidence for the genetic basis of engagement in real-life acts of political violence, using originally collected genetic, survey, and experimental data on persons who have committed acts of political violence against both the government and civilians. To date, no dataset available to researchers has included as detailed or comprehensive information on the background, characteristics, or biology of persons who have committed acts of violence and terrorism.

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[67] Pettersson, Therése and Peter Wallensteen. July 2015. "Armed conflicts, 1946–2014". *Journal of Peace Research* 52: 536–550. doi:10.1177/0022343315595927.

[68] Cordesman, Anthony. June 2015. "Broad Patterns in Global Terrorism in 2014". Center for Strategic & International Studies.

In addition, the use of a controlled experimental setting allows us to isolate the mechanism through which genetic differences impact rates of participation in conflict and identify if and how environmental conditions such as political repression can exacerbate/ameliorate individual proclivities to engage in violence. By employing an experimental innovation to manipulate the subject, this is the first study to investigate the causal mechanism linking genetic variation to acts of political violence. Critically, I find that increased impulsivity and aggression are the mechanisms through which genetic variation impacts engagement in political violence. This suggests that cognitive therapies and individual interventions that increase control and diminish reactive aggression may be able to moderate underlying propensities to violence.

Moreover, this dissertation traces the impetus for political violence to the inception of aggressive and hostile opinions to outgroup members, demonstrating that the biological mechanisms that influence the development of hostile attitudes are similar to those that ultimately lead to engagement in politically violent actions. In particular, variation in genes that impact the degradation of monoamine neurotransmitters, i.e., MAO-A and 5-HTT, impact the development of aggression towards outgroups members (5-HTT, Chapter 2) as well as acts of political violence (MAO-A, Chapter 4).

Finally, this dissertation provides and tests a novel theory aligning political groups with individuals to explain recruitment, participation, and defection from violent political movements. By combining organizational level group theory with the precipitants of individual violence, this research makes a significant step forward

in explaining why persons, both individually and collectively, chose to commit political violence. In sum, this dissertation makes a substantial contribution to our understanding of the causes of one of the most critical forms of political engagement: political violence.

Appendices

Chapter 2. Appendix

Appendix Table 2.1. Descriptive Statistics

Variable	Sample Size	Mean	Std. Dev.	Min	Max
Anti-Immigration	580	1.826	0.803	1	3
Short 5-HTT	1502	0.185	0.388	0	1
log(Right Ventral Diencephalon)	405	8.287	0.099	8.066	8.600
log(Left Ventral Diencephalon)	405	8.305	0.105	8.057	8.580
Age	1793	37.906	14.094	18	73
Sex	1844	0.398	0.490	0	1
Education	577	3.835	1.400	1	6
Income	576	3.929	1.594	1	8

Appendix Table 2.2. Logit Model – Association between 5-HTT and Opposition to Immigration

VARIABLES	(1) Anti-Immigration	(2) Anti-Immigration
Short 5-HTT	0.610**	0.568*
	(0.298)	(0.302)
Age	0.0970**	0.0673
	(0.0383)	(0.0418)
Sex	0.209	0.266
	(0.246)	(0.257)
Education		0.227**
		(0.0941)
Income		0.101
		(0.0878)
Constant	-3.149***	-3.647***
	(1.159)	(1.205)
Observations	302	301

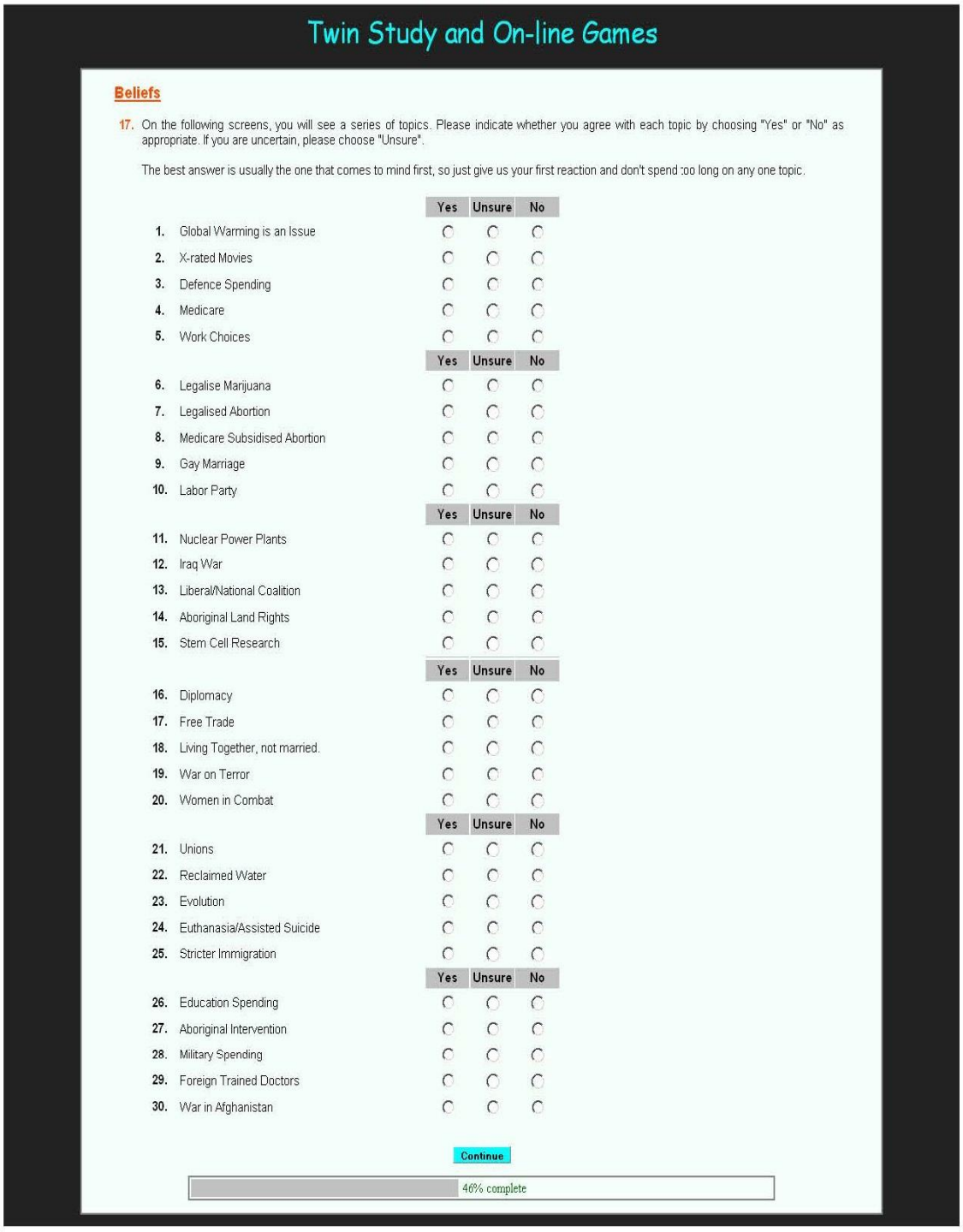
Reporting logistic coefficients. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 2.3. Association between Ventral DC and Opposition to Immigration

VARIABLES	(1) Anti-Immigration	(2) Anti-Immigration	(3) Anti-Immigration
log(Right Ventral DC)	4.194**		
	(1.691)		
log(Left Ventral DC)		4.194**	
		(1.691)	
log(Total Ventral DC)			4.016**
			(1.675)
Age	0.0670	0.066	0.0655
	(0.056)	(0.056)	(0.056)
Sex	-0.477	-0.455	-0.445
	(0.369)	(0.365)	(0.365)
Education	0.0593	0.064	0.0644
	(0.121)	(0.120)	(0.120)
Income	0.191	0.191	0.191
	(0.118)	(0.119)	(0.119)
Constant	-36.740***	-38.080***	-38.080**
	(14.230)	(15.280)	(15.280)
Observations	203	203	203

Reporting logistic coefficients. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Figure 2.1. Survey Items Assessing Political Attitudes



Twin Study and On-line Games

Beliefs

17. On the following screens, you will see a series of topics. Please indicate whether you agree with each topic by choosing "Yes" or "No" as appropriate. If you are uncertain, please choose "Unsure".

The best answer is usually the one that comes to mind first, so just give us your first reaction and don't spend :oo long on any one topic.

		Yes	Unsure	No
1.	Global Warming is an Issue	○	○	○
2.	X-rated Movies	○	○	○
3.	Defence Spending	○	○	○
4.	Medicare	○	○	○
5.	Work Choices	○	○	○
		Yes	Unsure	No
6.	Legalise Marijuana	○	○	○
7.	Legalised Abortion	○	○	○
8.	Medicare Subsidised Abortion	○	○	○
9.	Gay Marriage	○	○	○
10.	Labor Party	○	○	○
		Yes	Unsure	No
11.	Nuclear Power Plants	○	○	○
12.	Iraq War	○	○	○
13.	Liberal/National Coalition	○	○	○
14.	Aboriginal Land Rights	○	○	○
15.	Stem Cell Research	○	○	○
		Yes	Unsure	No
16.	Diplomacy	○	○	○
17.	Free Trade	○	○	○
18.	Living Together, not married.	○	○	○
19.	War on Terror	○	○	○
20.	Women in Combat	○	○	○
		Yes	Unsure	No
21.	Unions	○	○	○
22.	Reclaimed Water	○	○	○
23.	Evolution	○	○	○
24.	Euthanasia/Assisted Suicide	○	○	○
25.	Stricter Immigration	○	○	○
		Yes	Unsure	No
26.	Education Spending	○	○	○
27.	Aboriginal Intervention	○	○	○
28.	Military Spending	○	○	○
29.	Foreign Trained Doctors	○	○	○
30.	War in Afghanistan	○	○	○

Continue

46% complete

Appendix Table 3.1. Logistic Regression – log(Ratio of Rebel to State Troops)

VARIABLES	(1) Forced Recruitment	(2) Forced Recruitment	(3) Forced Recruitment
log(Rebel/State Troops)	0.372***	0.345***	0.155**
	(0.046)	(0.0490)	(0.075)
Oil	0.121	0.138	0.343
	(0.427)	(0.386)	(0.545)
Drugs	0.396*	0.353	0.456*
	(0.229)	(0.241)	(0.274)
Election tenure		0.363	0.531
		(0.329)	(0.356)
Legal political wing		-0.195	-0.354
		(0.480)	(0.593)
Sexual violence		1.349***	1.367***
		(0.292)	(0.310)
Democracy			-0.322
			(0.446)
log(Population)			-0.269***
			(0.101)
log(GDP per capita)			-0.218
			(0.196)
Constant	-0.301	-0.637***	3.187*
	(0.195)	(0.207)	(1.686)
Observations	525	525	513

Reporting logistic coefficients and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3.2. Logistic Regression – log(Battle Deaths)

VARIABLES	(1) Forced Recruitment
log(Troop size rebel)	0.195**
	(0.089)
log(Troop size state)	0.110
	(0.134)
Oil	0.300
	(0.612)
Drugs	0.487*
	(0.280)
Election tenure	0.462
	(0.387)
Legal political wing	-0.192
	(0.606)
Sexual violence	1.360***
	(0.319)
Democracy	-0.027
	(0.472)
log(Population)	-0.490***
	(0.134)
log(GDP per capita)	-0.226
	(0.205)
log(Battle deaths – best estimate)	0.168*
	(0.086)
Constant	1.198
	(1.850)
Observations	505

Reporting logistic coefficients and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3.3. Logistic Regression with Controls for Time

VARIABLES	(1) Forced Recruitment
log(Troop size rebel)	0.210**
	(0.097)
log(Troop size state)	0.131
	(0.130)
Oil	0.437
	(0.610)
Drugs	0.609*
	(0.314)
Election tenure	0.353
	(0.389)
Legal political wing	-0.363
	(0.658)
Sexual violence	1.346***
	(0.324)
Democracy	-0.127
	(0.460)
log(Population)	-0.486***
	(0.137)
log(GDP per capita)	-0.183
	(0.207)
log(Battle deaths – best estimate)	0.162*
	(0.0854)
t	0.148
	(0.107)
t^2	-0.009
	(0.006)
t^3	<0.001
	(<0.001)
Constant	0.116
	(1.919)
Observations	505

Reporting logistic coefficients and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Chapter 4. Appendix

Appendix Table 4.1. Descriptive Statistics

Variable	Sample Size	Mean	Std. Dev.	Min	Max
Political Violence	671	0.288	0.453	0	1
Low MAO-A	496	0.234	0.424	0	1
Female	609	0.411	0.492	0	1
Education	603	17.874	2.298	5	26
Age	592	20.806	3.689	18	56
Trauma	554	0.318	0.466	0	1
Police Violence	506	0.219	0.414	0	1
Alcoholism	667	0.589	0.492	0	1
Drug Use	498	0.669	0.471	0	1

Appendix Table 4.2. Participation in Political Violence (Kale Borroka) by Low MAO-A

	High MAO-A	Low MAO-A	Total
No Participation	72.89%	62.07%	70.36%
Participation	27.11%	37.93%	29.64%
Total	100.00%	100.00%	100.00%

Appendix Table 4.3. Mean Age by Participation in Political Violence

	Mean	Std. Dev.	Min	Max
No Participation	20.734	3.222	18	53
Participation	20.839	3.891	18	56

Appendix Table 4.4. Female by Participation in Political Violence

	No Participation	Participation	Total
Male	54.44%	68.75%	58.95%
Female	45.56%	31.25%	41.05%
Total	100.00%	100.00%	100.00%

Appendix Table 4.5. Education by Participation in Political Violence

	No Participation	Participation	Total
Less than high school	0.48%	<0.01%	0.33%
Some high school	0.24%	0.53%	0.33%
College graduate	65.86%	58.95%	63.68%
Graduate school	33.41%	40.53%	35.66%
Total	100.00%	100.00%	100.00%

Appendix Table 4.6. Trauma by Participation in Political Violence

	No Participation	Participation	Total
No Trauma	69.19%	66.08%	68.23%
Trauma	30.81%	33.92%	31.77%
Total	100.00%	100.00%	100.00%

Appendix Table 4.7. Alcoholism by Participation in Political Violence

	No Participation	Participation	Total
No Alcoholism	42.32%	38.02%	41.08%
Alcoholism	57.68%	61.98%	58.92%
Total	100.00%	100.00%	100.00%

Appendix Table 4.8. Police Violence by Participation in Political Violence

	No Participation	Participation	Total
No Police Violence	90.00%	53.61%	78.06%
Police Violence	10.00%	46.39%	21.94%
Total	100.00%	100.00%	100.00%

Appendix Table 4.9. Drug Use by Participation in Political Violence

	No Participation	Participation	Total
No Drug Use	40.06%	19.28%	33.13%
Drug Use	59.94%	80.72%	66.87%
Total	100.00%	100.00%	100.00%

Appendix Table 4.10. Logistic Regression – Controlling for Non-violent Protest

VARIABLES	(1) Political Violence
Low MAO-A	0.810**
	(0.350)
Female	-0.240
	(0.347)
Education	0.140**
	(0.0642)
Age	-0.0950*
	(0.0518)
Trauma	0.00427
	(0.351)
Police Violence	1.897***
	(0.371)
Alcoholism	-0.604*
	(0.336)
Drugs	0.362
	(0.356)
Non-violent Protest	2.640***
	(0.418)
Constant	-3.635***
	(1.039)
Observations	313

Reporting logistic coefficients and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4.11. Logistic Regression – Services to Organization (ETA members)

VARIABLES	(1) Services	(2) Services	(3) Services
Low MAO-A	0.988**	1.378**	1.395**
	(0.486)	(0.567)	(0.577)
Female	0.112	0.361	0.321
	(0.534)	(0.594)	(0.595)
Education	0.311	0.194	0.199
	(0.190)	(0.180)	(0.176)
Age	-0.313*	-0.189	-0.172
	(0.184)	(0.178)	(0.165)
Trauma		0.0611	-0.0318
		(0.590)	(0.605)
Police Violence		0.670	0.692
		(0.573)	(0.603)
Alcoholism			0.755
			(0.674)
Drugs			0.191
			(0.691)
Constant	-1.401	-2.383	-3.474*
	(1.129)	(1.507)	(2.055)
Observations	142	106	105

Reporting logistic coefficients and robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Political Violence in Spain
Cumulative Codebook

Codes for the Surveys

Question: How old are you?
Variable Name: Age

Response
Continuous

Question: What is your gender?
Variable Name: Female

Response	Coded
Male	0
Female	1

Question: Where were you born?
Variable Name: Birthplace

Response
Continuous

Question: Where was your mother born?
Variable Name: Birthplace_mother

Response
Open-ended

Question: Where was your father born?
Variable Name: Birthplace_father

Response
Open-ended

Question: What is your civil status?
Variable Name: Married

Response	Coded
Single	0
Married	1

Question: How many years have you lived in the Basque Country?
Variable Name: YearsLived_basque

Response
Continuous

Question: Total years of education?
Variable Name: YrsEduc

Response
Continuous

Question: Are there Basque surnames on your mother's side of the family?
Variable Name: Mother_basque

Response	Coded
No	0
Yes	1

Question: How many Basque surnames are on your mother's side of the family?
Variable Name: NumNames_mother

Response
Continuous

Question: Are there Basque surnames on your father's side of the family?
Variable Name: Father_basque

Response	Coded
No	0
Yes	1

Question: How many Basque surnames are on your mother's side of the family?
Variable Name: NumNames_father

Response
Continuous

Question: What is your father's highest level of education?
Variable Name: Educ_father

Response	Coded
No school	a
Some elementary school	b
Completed elementary school	c
Some high school	d
Completed high school	e
Some technical school	f
Completed technical school	g
Some college credit	h
Completed college	i
Other (please specify)	j

Question: What is your mother's highest level of education?
Variable Name: Educ_mother

Response	Coded
No school	a
Some elementary school	b
Completed elementary school	c
Some high school	d
Completed high school	e
Some technical school	f
Completed technical school	g
Some college credit	h
Completed college	i
Other (please specify)	j

Question: Do you work?
Variable Name: Work

Response	Coded
No	0
Yes	1

Question: What is your occupation?
Variable: Work_type

Response
Open-ended

Question: Are you religious?
Variable Name: Religious

Response	Coded
No	0
Yes	1

Question: What is your religion, if you have one?
Variable Name: Religious_type

Response	Coded
None	a
Catholic	b
Protestant	c
Evangelical Christian	d
Muslim	e
Buddhist	f
Other (please specify)	g

Question: How many languages do you speak?
Variable Name: NumLanguages

Response	Coded
One	1
Two	2
Three	3
Four	4
Five	5

Question: Do you speak Euskara?
Variable Name: Euskara

Response	Coded
No	0
Yes	1

Question: What is your primary or first language?
Variable Name: Language_primary

Response	Coded
Spanish	1
Euskara	2
Other (specify)	3

Question: What is your total monthly income?
Variable Name: Income

Response
Continuous

Question: How many people live on [the above] income?
Variable: Num_income

Response
Continuous

Question: How many people live with you at your home?
Variable: Num_house

Response
Continuous

Question: What type of home do you live in?
Variable: House_type

Response	Coded
House	a
Apartment	b
Other (please specify)	c

Question: Have you ever served in the military?
Variable Name: Military

Response	Coded
No	0
Yes	1

Question: How many years have you served in the military?
Variable Name: Military_years

Response
Continuous

Question: Do you live alone?
Variable Name: Live_alone

Response	Coded
No	0
Yes	1

Question: Who do you live with?
Variable Name: Live_with

Response	Coded
Spouse	a
Partner	b
Mother	c
Father	d
Sister	e
Brother	f
Friend	g
Children	h

Question: How many people do you live with?
Variable Name: Live_number

Response
Continuous

Question: Do you live with any children:
Variable Name: Children

Response	Coded
No	0
Yes	1

Question: How many of the following activities, if any, have you done in the past year? Options include: took on a leadership role in a club or organization, worked for a political party, participated in a social committee or local organization, attended a town hall or school issues meeting, attended a political rally or speech, gave a speech, wrote to an elected representative, signed a petition, been chosen for political office, written a letter to a newspaper, written an article for a magazine or newspaper.
Variable Name: Social_yr

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10
Eleven	11

Question: How many of the following have you done in the past week? Options include: talked about politics, ate at a restaurant, had friends over for the night, went to a friend's house, saw a movie, made a long distance call, read a book, went to church, watched sports on television, went to a sporting event, went to a club/bar or place of entertainment, spent time on a hobby, write a personal letter, received a personal letter.
Variable Name: Social_wk

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10
Eleven	11
Twelve	12

Thirteen	13
Fourteen	14

Question: How many of the following activities have you done in the past month? Options include: donated to charity, volunteer work, donated blood, went to a friend's house for dinner or the night, had friends over for dinner or the night, attended church as a social function, went to a club or civic organization meeting, ate dinner at a restaurant, went to a club or bar, went to the theater or to see an opera/concert, went to a sporting event, went to the movies.
Variable Name: Social_mth

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10
Eleven	11
Twelve	12

Question: How many of the following rural Basque games, Herri Kirolak, have you participated in? Options include: giza-abere probak, harri zulaketa, ingude altxatzea, lasto altxatzea, lasto botatzea, ontzi eramatea.
Variable Name: Basque_games

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6

Question: Which of the following do you do more frequently on weeknights after dinner and before going to bed? Options include: take a shower or bath, read the newspaper, watch the news on television, watch other programs on television, read a book or newspaper, play CDs or tapes, talk with family members, spend time with children, do housework, drink a beer, eat a snack, read an electronic newspaper, take the dog for a walk.
Variable Name: Social_daily

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10
Eleven	11
Twelve	12
Thirteen	13

Question: Which of the following activities do you do together as a family? Options include: eat lunch or dinner together, sit and talk together, watch television together, go out to eat together, go on vacation together, attend religious services together, and exercise or do sports together.
Variable Name: Together

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7

Question: How many of the following have you ever participated in? Options include: giza-abere probak, harri zulaketa, ingude altxatzea, kale borroka, lasto altxatzea, lasto botatzea, ontzi eramatea.
Variable Name: Basque_num

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7

Question: Do you support the Basque independence movement?
Variable Name: Basque_ind

Response	Coded
No	0
Yes	1

Question: Would you become a citizen of an independent Basque country?
Variable Name: Basque_citizen

Response	Coded
No	0
Yes	1

Question: Has you ever been to a Podemos, Bildu, or Movimiento 15M event?
Variable Name: PoliticalRally

Response	Coded
No	0
Yes	1

Question: Has you ever been a member of a political party?
Variable Name: PoliticalParty

Response	Coded
No	0
Yes	1

Question: Which political party do you belong to, if any?
Variable Name: PoliticalParty_name

Response
Open-ended

Question: Do you have any family members who belong to ETA?
Variable Name: ETA_family

Response	Coded
No	0
Yes	1

Question: How many family members do you have who belong to ETA?
Variable Name: NumETA_family

Response
Continuous

Question: Did you vote in the December 2015 elections?
Variable Name: Vote

Response	Coded
No	0
Yes	1

Question: Do you attend political meetings?
Variable Name: PoliticalMeetings

Response	Coded
No	0
Yes	1

Question: How often do you attend political meetings?
Variable Name: NumMeetings

Response
Open-ended

Question: Is your mother a member of a political party?
Variable Name: PolParty_mother

Response	Coded
No	0
Yes	1

Question: What is the name of your mother's political party, if any?
Variable Name: PolParty_mother_name

Response
Open-ended

Question: Is your father a member of a political party?
PolParty_father
Label: Is R's mother a member of a political party?
Question: ¿Eres tu madre un miembro de un partido político?

Question: What is the name of your mother's political party, if any?
Variable Name: PolParty_father_name

Response
Open-ended

Question: Have you ever participated in a political protest?
Variable Name: PolProtest

Response	Coded
No	0
Yes	1

Question: Have you ever participated in a political protest that turned violent?
Variable Name: PolProtest_violent

Response	Coded
No	0
Yes	1

Question: Why did you decide to participate in the heat of the moment?
Variable Name: PolProtest_motive

Response
Open-ended

Question: Have you ever joined spontaneous protests in the streets?
Variable Name: PolProtest_street

Response	Coded
No	0
Yes	1

Question: Were guns present at the protest?
Variable Name: Guns

Response	Coded
No	0
Yes	1

Question: Was anybody hurt at the protest?
Variable Name: Wounds

Response	Coded
No	0
Yes	1

Question: Was anybody hit or pushed at the protest?
Variable Name: Pushed

Response	Coded
No	0
Yes	1

Question: Was property destroyed at the protest?
Variable Name: Property

Response	Coded
No	0
Yes	1

Question: Do you donate to the political groups that you support?
Variable Name: Donate

Response	Coded
No	0
Yes	1

Question: Do you offer services (e.g. logistic services, information help) to the political groups that you support?
Variable Name: Services

Response	Coded
No	0
Yes	1

Question: How much do you trust the president?
Variable Name: President

Response	Coded
Not at all	1
A little	2
Somewhat	3
A lot	4

Question: How much do you trust the Civil Guard?
Variable: GuardiaCivil

Response	Coded
Not at all	1
A little	2
Somewhat	3
A lot	4

Question: How much do you trust the Ertzaintza?
Variable Name: Ertzaintza

Response	Coded
Not at all	1
A little	2
Somewhat	3
A lot	4

Question: How much do you trust the Municipal Police (Udaltzaingoa)?

Variable Name: Udaltzaingoa

Response	Coded
Not at all	1
A little	2
Somewhat	3
A lot	4

Question: How much do you trust Parliament?
Variable Name: Parliament

Response	Coded
Not at all	1
A little	2
Somewhat	3
A lot	4

Question: During the election campaigns in this country, have you feared being a victim of political intimidation or violence?
Variable Name: Campaign_violence

Response	Coded
Not at all	1
A little	2
Somewhat	3
A lot	4

Question: On Election Day, have you feared being a victim of political intimidation or violence?
Variable Name: ElectDay_violence

Response	Coded
Not at all	1
A little	2
Somewhat	3
A lot	4

Question: Have you ever experienced police violence?
Variable Name: PoliceViolence

Response	Coded
No	0

Yes	1

Question: If you have ever experienced police violence, could you describe the experience?
Variable Name: PolViolence_description

Response
Open-ended

Question: On what date did you experience police violence?
Variable Name: PolViolence_date

Response
Open-ended

Question: Have you ever experienced non-police violence (ETA, gangs, parents, siblings)?
Variable Name: Violence_other

Response	Coded
No	0
Yes	1

Question: If you have ever experienced non-police violence, could you describe the experience?
Variable Name: Violence_other_description

Response
Open-ended

Question: On what date did you experience non-police violence?
Variable Name: ViolOther_date

Response
Open-ended

Question: On a scale from 1-10 (10 being the highest), how much do you agree with the following statements:

In Spain, I have the freedom of religion.
Variable: Free_religion

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

In Spain, I have the freedom to write, speak, and express myself as I choose.
Variable Name: Free_speech

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

In Spain, I can peacefully protest without fear of personal or professional repercussions.
Variable Name: Free_protest

Response	Coded
Zero	0
One	1
Two	2
Three	3

Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

In Spain, I can petition the government without fear of personal or professional repercussions.
Variable Name: Free_petition

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

Immigrants to Spain don't have to speak Spanish in public places all the time.
Variable Name: Spain_speech

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

Immigrants to the Basque Country don't have to speak Euskera in public places all the time.

Variable Name: Basque_speech

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to Spain should speak to each other in Spanish, including in the intimacy of their own homes.
Variable Name: Spain_otherLanguage

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to the Basque Country should speak to each other in Spanish, including in the intimacy of their own homes.
Variable Name: Basque_otherLanguage

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6

Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to Spain take jobs from Spanish people.
Variable Name: Spain_jobs

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to the Basque Country take jobs from the Basque people.
Variable Name: Basque_jobs

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to Spain increase the level of crime in Spain.
Variable Name: Spain_delinquent

Response	Coded
Zero	0
One	1

Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to the Basque Country increase the level of crime in the Basque Country.
Variable Name: Basque_delinquent

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to Spain can treat women according to their own culture and religious beliefs.
Variable Name: Spain_women

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

The immigrants to the Basque Country can treat women according to their own culture and religious beliefs.
Variable Name: Basque_women

Response	Coded
Zero	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

Question: Please rank each of the following on a scale from 1-5 (5 being the most characteristic of you and 1 being the least characteristic of you).

Sometimes, I cannot control the impulse to hit other people.
Variable Name: Agg_physical1

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

If I am provoked enough, I could hit another person.
Variable Name: Agg_physical2

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

If someone hits me, I would return the punch.
Variable Name: Agg_physical3

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I find myself in fights a little more than the average person.
Variable Name: Agg_physical4

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

If I have to resort to violence to protect my rights, I will.
Variable Name: Agg_physical5

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

There are people who push me until we come to blows.
Variable Name: Agg_physical6

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I cannot think of any good reason to ever hit a person.
Variable Name: Agg_physical7

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I have threatened people who I know.
Variable Name: Agg_physical8

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I have gotten so crazy that I've broken things.
Variable Name: Agg_physical9

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I openly tell my friends when I don't agree with them.
Variable Name: Agg_verbal1

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Often, I find myself disagreeing with people.
Variable Name: Agg_verbal2

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

When people bother me, I can tell them what I think of them.
Variable Name: Agg_verbal3

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I can't resist entering discussions when people don't agree with me.
Variable Name: Agg_verbal4

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

My friends think that I'm a little controversial.
Variable Name: Agg_verbal5

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I get angry easily, but I overcome it quickly.
Variable Name: Agg_anger1

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

When I am frustrated, I stop or leave what is irritating me.
Variable Name: Agg_anger2

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Sometimes, I feel like a powder keg on the point of exploding.
Variable Name: Agg_anger3

Response	Coded

One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I am a calm person.
Variable Name: Agg_anger4

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Some of my friends think that I'm hot-headed.
Variable Name: Agg_anger5

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Sometimes I lose my temper for no good reason.
Variable Name: Agg_anger6

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I have problems with controlling my temperament.
Variable Name: Agg_anger7

Response	Coded
One (Very unusual of me)	1
Two	2

Three	3
Four	4
Five (Very characteristic of me)	5

Sometimes I get consumed with jealousy.
Variable Name: Agg_hostility1

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I sometimes feel like I have gotten an unfair deal from life.
Variable Name: Agg_hostility2

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Other people always seem like they have it better.
Variable Name: Agg_hostility3

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I ask myself why I sometimes feel so bitter about things.
Variable Name: Agg_hostility4

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4

Five (Very characteristic of me)	5

I know that my "friends" talk about me behind my back.
Variable Name: Agg_hostility5

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I don't trust strangers who are too friendly.
Variable Name: Agg_hostility6

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I sometimes feel like people laugh about me behind my back.
Variable Name: Agg_hostility7

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

When people are especially friendly, I ask myself what they want.
Variable Name: Agg_hostility8

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Question: Continuing with our series of personality traits that may or may not apply to you, please indicate whether you are in agreement or disagreement with the following statements. You should classify each statement by whether the pair of traits applies to you, including if one characteristic is more accurate than the other.

I see myself as outgoing, enthusiastic
Variable Name: Personality1

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as critical, argumentative
Variable Name: Personality2

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as trusting, self-disciplined
Variable Name: Personality3

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as anxious, easily upset

Variable Name: Personality4

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as open to new experiences, complicated
Variable Name: Personality5

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as reserved, quiet
Variable Name: Personality6

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as nice, warm
Variable Name: Personality7

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4

Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as disorganized, careless
Variable Name: Personality8

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as calm, emotionally stable
Variable Name: Personality9

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

I see myself as conventional, uncreative
Variable Name: Personality10

Response	Coded
Strongly disagree	1
Moderately disagree	2
Disagree a little	3
Neither agree nor disagree	4
Agree a little	5
Moderately agree	6
Strongly agree	7

Question: A car out of control is headed towards five people who will die if the car proceeds on its current course. The only way to save them is to hit a switch that will move the car to an alternative set of tracks, which would only kill one person instead of five. Would you turn the car to save five people at the expense of one?
Variable Name: Trolly1

Response	Coded
No	0
Yes	1

Question: Now consider a similar problem. Like before, a car is in danger of killing five people. You are walking next to a stranger on a path that is above the tracks, the car, and the five people. In this scenario, the only way to save the five people is to push the stranger off the bridge, onto the tracks below. The stranger will die if you do it, but his body will stop the car from hitting the rest of the people. Would you save the other five people by pushing the stranger to his death?
Variable Name: Trolly5

Response	Coded
No	0
Yes	1

Question: Suppose that you were asked to divide 10 euros between yourself and another person. The other person is selected at random, and you don't know their identity at any time (and they don't know yours). You would keep whatever amount of the 10 euros for yourself, and you would anonymously give the rest to the other person. You can save none, all, or part of the money – the decision is totally yours. Please indicate how many euros you would keep.
Variable Name: Ultimatum_offer

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

Question: Suppose now that the other person was anonymously given 10 euros, and had the opportunity to give some, all, or none of them to you. Without knowing the other person, you have the opportunity to accept or reject the proposal of division. If you reject it, neither of you will get anything, and if you accept it, the euros will be divided as the other person proposed. What is the minimum amount of euros you would accept?
Variable Name: Ultimatum_accept

Response	Coded
None	0
One	1
Two	2
Three	3
Four	4
Five	5
Six	6
Seven	7
Eight	8
Nine	9
Ten	10

Question: What distance did you travel to attend elementary school?
Variable Name: Distance_school

Response	Coded
Less than 1 km	1
1-5 km	2
5-10 km	3
10-15 km	4
More than 15 km	5

Question: Did you ever attend ikastolak?
Variable Name: Ikastolak

Response	Coded
No	0
Yes	1

Question: In which language did you receive your education?
Variable Name: School_lang

Response	Coded
Entirely in Spanish	1
In Spanish, with Euskera as a required class	2
In Spanish and Euskera	3
In Euskera, with Spanish as a required class	4

Question: Please indicate, on a scale from 1-6 (6 being the highest), your level of agreement with the following statements.

Our country needs a powerful leader, to destroy the immoral and radical trends in today's society.
Variable Name: RightWing1

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

Our country needs free thinkers, who have the courage to rise above traditional ways, although it may bother some people.
Variable Name: RightWing2

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

The "ways of the past" and the "values of the past" still demonstrate the best way to live.
Variable Name: RightWing3

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

Our society would be better off if we show tolerance and understand untraditional values and opinions.
Variable Name: RightWing4

Response	Coded

One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

God's laws about abortion, pornography, and marriage should be strictly followed, before it's too late, and people who break God's laws should be punished
Variable Name: RightWing5

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

Society needs to be open to people with different ways of thinking, instead of a strong leader, the world is not particularly bad or dangerous
Variable Name: RightWing6

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

It would be best if newspapers were censored so people couldn't get a hold of destructive and repugnant material.
Variable Name: RightWing7

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

Many good people defy the government, criticize the church, and overlook the "normal way of living".
Variable Name: RightWing8

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

Our ancestors should be honored more for the ways in which they've built our society, similarly, we should put an end to the forces that destroy them.
Variable Name: RightWing9

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

People should pay less attention to the Bible and religion, and should develop their own moral norms.
Variable Name: RightWing10

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

There are many radical immoral people, who try to ruin things; society should arrest them.
Variable Name: RightWing11

Response	Coded
One (Strongly Disagree)	1

Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

It is better to accept bad literature than to censor it.
Variable Name: RightWing12

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

The facts show that we have to be tougher against crime and sexual immorality, in order to maintain law and order.
Variable Name: RightWing13

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

The situation in today's society could improve if troublemakers were treated with reason and humanity.
Variable Name: RightWing14

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

If society wants it, it is the obligation of every true citizen to help eliminate the bad that poisons our country from the inside.
Variable Name: RightWing15

Response	Coded
One (Strongly Disagree)	1
Two	2
Three	3
Four	4
Five	5
Six (Strongly Agree)	6

Question: I can find a way of getting what I want, even if someone opposes me.
Variable Name: GSE1

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: I can resolve difficult problems if I try hard enough.
Variable Name: GSE2

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: It is easy for me to stick to what I've proposed, until I reach my goals.
Variable Name: GSE3

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: I am confident that I could effectively handle unexpected events.
Variable Name: GSE4

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: Because of my virtues and resources, I could overcome unexpected situations.
Variable Name: GSE5

Response	Coded
False	1

Somewhat true	2
Pretty true	3
True	4

Question: When I encounter difficulties I can remain calm because I have the necessariy abilities to handle tough situations.
Variable Name: GSE6

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: What comes can come, generally I am capable of handling it.
Variable Name: GSE7

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: I can resolve the majority of problems if I put in the necessary effort.
Variable Name: GSE8

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: If I find myself in a difficult situation, it generally occurs to me what I should do.
Variable Name: GSE9

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: When I have to face a problem, various ways of resolving it generally occur to me.
Variable Name: GSE10

Response	Coded
False	1
Somewhat true	2
Pretty true	3
True	4

Question: Please rank each of the following on a scale from 1-5 (5 being the most characteristic of you, 1 being the most unusual of you).

It is not advisable to tell your secrets.
Variable Name: Mach1

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

In general terms, people shouldn't work hard unless they have to.
Variable Name: Mach2

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Whatever it takes, you should keep important people by your side.
Variable Name: Mach3

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Avoid direct conflict with others, because they could be useful in the future.
Variable Name: Mach4

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

It is advisable to keep track of information that you can use against people in the future.
Variable Name: Mach5

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

You should wait until the right moment to go back to people.
Variable Name: Mach6

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

There are things that you should hide from other people that they do not need to know.
Variable Name: Mach7

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Make sure that your plans benefit yourself, not others.
Variable Name: Mach8

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

The majority of people can be manipulated.
Variable Name: Mach9

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

People see me as a natural leader.
Variable Name: Narc1

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I hate being at the center of attention.
Variable Name: Narc2

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Many group activities tend to be boring without me.
Variable Name: Narc3

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I know that I am special because everybody tells me so.

Variable Name: Narc4

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I would like to get in touch with important people.
Variable Name: Narc5

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I feel embarrassed if someone compliments me.
Variable Name: Narc6

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I have been compared with famous people.
Variable Name: Narc7

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I am an average person.

Variable Name: Narc8
Label:
Question: Soy una persona promedio.

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I insist on getting the respect that I deserve.
Variable Name: Narc9

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I would like to take revenge on the authorities.
Variable Name: Psycho1

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I avoid dangerous situations.
Variable Name: Psycho2

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

The recovery of one's investments has to be fast and unpleasant.

Variable Name: Psycho3

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

People usually say that I'm out of control.
Variable Name: Psycho4

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

It's true that I can be bad with others.
Variable Name: Psycho5

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

The people that mess with me always regret it.
Variable Name: Psycho6

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I have never had problems with the law.

Variable Name: Psycho7

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I like to pick on losers.
Variable Name: Psycho8

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

I will say anything to get what I want.
Variable Name: Psycho9

Response	Coded
One (Very unusual of me)	1
Two	2
Three	3
Four	4
Five (Very characteristic of me)	5

Question: Have you ever experienced an event in which you were scared that you could die, or that somebody else could die or be seriously injured?
Variable Name: Trauma

Response	Coded
No	0
Yes	1

Question: If so, what was the event?
Variable Name: Trauma_description

Response
Open-ended

Question: The following are symptoms that people sometimes have after they experience, witness, or are faced with a traumatic event. Please read each one carefully and rate how much each of the symptoms has bothered you since the event.

Recurring thoughts or memories of the event.
Variable Name: PTSD1

Response	Coded
Never	1
Rarely	2
Sometimes	3
Most of the time	4

Feelings like the event is happening again.
Variable Name: PTSD2

Response	Coded
Never	1
Rarely	2
Sometimes	3
Most of the time	4

Recurring nightmares about the event.

Variable Name: PTSD3

Response	Coded
Never	1
Rarely	2
Sometimes	3
Most of the time	4

Sudden emotional or physical reactions when you remember the event.
Variable Name: PTSD4

Response	Coded
Never	1
Rarely	2
Sometimes	3
Most of the time	4

Avoiding the activities that remind you of the event.
Variable Name: PTSD5

Response	Coded
Never	1
Rarely	2
Sometimes	3
Most of the time	4

Avoiding thoughts or feelings associated with the event.
Variable Name: PTSD6

Response	Coded
Never	1
Rarely	2
Sometimes	3
Most of the time	4

Feeling nervous, easily startled.
Variable Name: PTSD7

Response	Coded
Never	1
Rarely	2
Sometimes	3

Most of the time	4

Feeling on guard.
Variable Name: PTSD8

Response	Coded
Never	1
Rarely	2
Sometimes	3
Most of the time	4

Question: Thinking about your life these days, how often do you attend religious services, not including social obligations, like weddings or funerals?
Variable Name: ReligAttend

Response	Coded
Never	1
Once a year or less	2
Several times a year	3
Once or twice a month	4
Once a week	5
More than once a week	6

Question: During the past 12 months, how often have you generally consumed alcohol beverages?
Variable Name: Alcohol1

Response
I have never had alcohol in my life
Everyday
5-6 days a week
3-4 days a week
2 days a week
1 day a week
2-3 days a month
1 day a month
3-11 days in the past year
1-2 days in the past year

Question: During your life, what is the maximum number of alcoholic drinks have you had in a 24 hour period?
Variable Name: Alcohol2

Response
I have never had alcohol in my life
Everyday
5-6 days a week
3-4 days a week
2 days a week
1 day a week
2-3 days a month
1 day a month
3-11 days in the past year
1-2 days in the past year

Question: During the past 12 months, how often have you had, 5 alcoholic drinks (if you're a man) or 4 alcoholic drinks (if you're a woman), in a 2 hour period?
Variable Name: Alcohol3

Response
I have never had alcohol in my life
Everyday
5-6 days a week
3-4 days a week
2 days a week
1 day a week
2-3 days a month
1 day a month
3-11 days in the past year
1-2 days in the past year

Question: During the past 12 months, how often has *your mother* generally consumed alcoholic beverages?
Variable Name: Alcohol4

Response
I have never had alcohol in my life
Everyday
5-6 days a week
3-4 days a week
2 days a week
1 day a week
2-3 days a month
1 day a month
3-11 days in the past year
1-2 days in the past year

Question: During the past 12 months, how often has *your father* generally consumed alcoholic beverages?
Variable Name: Alcohol5

Response
I have never had alcohol in my life
Everyday
5-6 days a week
3-4 days a week
2 days a week
1 day a week

2-3 days a month
1 day a month
3-11 days in the past year
1-2 days in the past year

Question: Would you consider any family members an alcoholic?
Variable Name: FamAlcoholic

Response	Coded
No	0
Yes	1

Question: How many family members would you consider alcoholic?
Variable Name: Num_FamAlcoholic

Response
Continuous

Question: Have you ever smoked a cigarette?
Variable Name: Cig

Response	Coded
No	0
Yes	1

Question: For how many weeks in your life have you smoked cigarettes?
Variable Name: Cig_time

Response
Continuous

Question: Have you ever smoked marijuana?
Variable Name: Pot

Response	Coded
No	0
Yes	1

Question: For how many weeks in your life have you smoked marijuana?
Variable Name: Pot_time

Response
Continuous

Question: Have you ever used other drugs?
Variable Name: OtherDrugs

Response	Coded
No	0
Yes	1

Question: For how many weeks in your life have you used other drugs?
Variable Name: OtherDrugs_time

Response
Continuous

Question: How much do you weigh?
Variable Name: Weight

Response
Continuous

Question: How tall are you?
Variable Name: Height

Response
Continuous

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