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A Genetic Basis of Economic Egalitarianism

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Abstract Studies of political attitudes and ideologies have sought to explain their origin. They have been assumed to be a result of political values ingrained during the process of socialization until early adulthood, as well as personal political experience, party affiliation, social strata, etc. As a consequence of these environment-dominated explanations, most biology-based accounts of political preference have never been considered. However, in the light of evidence accumulated in recent years, the view that political attitudes are detached from any physical properties became unsustainable. In this paper, we investigate the origins of social justice attitudes, with special focus on economic egalitarianism and its potential genetic basis. We use Minnesota Twin Study data from 2008, collected from samples of monozygotic and dizygotic twin pairs ($n = 573$) in order to estimate the additive genetic, shared environmental, and unique environmental components of social justice attitudes. Our results show that the large portion of the variance in a four-item economic egalitarianism scale can be attributed to genetic factor. At the same time, shared environment, as a socializing factor, has no significant effect. The effect of environment seems to be fully reserved for unique personal experience. Our findings further problematize a long-standing view that social justice attitudes are dominantly determined by socialization.

Keywords Social justice · Equality · Egalitarianism · Genes · Genetics · Twin studies

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The Origin of Political Attitudes

The question of why people think and act as they do has fascinated social scientists for centuries. Since the middle of the twentieth century, social scientists studying political ideologies actively contributed to the effort to understand why people want what they want (e.g., Berelson, 1954; Downs, 1957; Converse, 1962; Lazarsfeld, Berelson, & Gaudet, 1948; Katz & Lazarsfeld, 1966; Campbell, 1980). The reason why scholarly attention is so strongly captivated by this question comes from the overarching consequences political attitudes have on the nature of the society in which we live. While every person has his or her own values and beliefs, once aggregated, they impact the social structure, institutions, and rules of society in general (Page & Shapiro, 1983). These rules may include policies on equality of resource distribution, which is the focus of this paper, as well as on how the most vulnerable among us ought to be treated; should we, if at all, punish discrimination? How extensive should government control questions of sex, marriage, and reproduction? Under what conditions should we wage war or forge peace? (Hatemi & McDermott, 2012). The range of political phenomena over which people can hold political preferences is principally unlimited. These preferences are essentially rankings derived from comparative evaluations (attitudes), and they can be held over any classes of objects (external or internal) (Druckman & Lupia, 2000). Most of the objects relevant for social science are, however, multidimensional. For instance, evaluation of a political candidate might come from various dimensions—ideology, competence, group membership, etc.—and each of these attributes can be assessed according to different belief system. What immediately becomes a matter of crucial importance is the origins of these complex belief systems.

Traditionally, the discussion on the origin of political attitudes and behaviors starts with environmental theories which pose that human behavior is largely (if not fully) determined by socialization processes. The literature on the importance of socialization is so extensive that it would be almost impossible to discuss any feature of human psychology and behavior without making a direct reference to socialized experience and institutions as one of the main driving forces (Hatemi & McDermott, 2016). It is, therefore, widely accepted that most preferences emerge from interactions between individuals and their immediate surroundings, rather than suddenly appearing (Druckman & Lupia, 2000). While most of the authors recognize the relative significance of other social agents, almost without exception, they stress the dominant role of the family. According to Jennings and Niemi (1968:169), preoccupation with the family impact comes from its ability to, directly and indirectly, shape the basic orientation of offspring. Broadly speaking, there are two ways in which parents can mold child's political belief system. First, they may do so through indoctrination, overt and concealed role-modeling, so that children can pick up values and loyalties. Another, more indirect effect, comes from social context—ethnicity, class position, community—in which the parent places the child (Lane, 1959). With regard to political attitudes, this view was traditionally supported by high inter-generational agreement in party identification and electoral behavior (Jennings & Niemi, 1968). Lane (1959) nicely summarizes the supposed

prominence of family for the political development of a child: "The history of a nation may, in considerable measure, reflect the changes in the way children and parents, sons and fathers, struggle to get along with one another. Some of the characteristics of a nation's politics may rest on the resolution of these struggles."

The view that political preferences are almost exclusively socially determined remained dominant until recent years. Despite the fact that beginning in the 1970s scholars identified genetic influences on political orientation (e.g., Eaves & Eysenck, 1974), deeper research on a genetic basis for political attitudes was essentially missing (Hatemi & McDermott, 2012). Social science research on development of political values was entirely on the nurture side of the nurture versus nature debate. While this was one of the most persistent scientific debates in history, today it is considered, by all credible science, as outdated and "absurd on its face" (Hatemi & McDermott, 2011). Nevertheless, the idea that a model incorporating both genetic and environmental factors can be superior in determining complex attitudes or belief systems was not received with ease in the social sciences. It seems that those who still believe in the ancient dichotomy between culture and nature, despite cumulated empirical evidence, are maintaining that any significant effect of genes on beliefs and behaviors is not only impossible, but also normatively undesirable (e.g., Charney, 2008).

In the last several years, however, we have seen an intense rise in approaches based on human biology, genetics in particular. Social sciences, including even sociology, have finally acknowledged that, with regard to human behavior, there is no either/or between environment and biology. Manifestation of complex biological predispositions is triggered by environmental cues, just as environmental triggers are necessarily displayed through a physical and biological action (Hatemi & McDermott, 2011). All human psychology and behavior are necessarily a result of interaction between environment and genes (Eaves & Eysenck, 1974; Boardman, 2011; Saudino et al., 1997). Humans are, thus, no longer considered to be a tabula rasa whose "content" is acquired purely from the processes of social learning during adolescence and early adulthood.

The claim that environment and socialization are not all that matters becomes immediately evident as one surveys the literature on biological foundations of political behavior. The article that received visibility both in academic and in the wider public sphere by Alford, Funk, and Hibbing (2005:164) has demonstrated that "political attitudes are influenced much more heavily by genetics than by parental socialization." They find that, for instance, half of the variance in political conservatism can be attributed to genetic factors, while parental influence accounts for merely 11%. Same as Martin et al. (1986) many years before them, Alford, Funk, and Hibbing (2005) and Hatemi (2013), came close to studying the central topic of this paper—economic egalitarianism—by thoroughly examining economic measures related to it (e.g., *socialism, unions*, and *property tax*). Despite not being the main focus of their studies, their work on ideology provides a great prelude to the argument that individual beliefs in various types of economic equality also come from something much deeper, and not simply indoctrination. However, many studies that provided evidence for genetic influence in political ideologies in general have provoked questions concerning generalizability of their results, due to either

narrow geographical or temporal scope. With regard to this, Hatemi et al. (2014) meta-analysis offers extraordinarily comprehensive supportive evidence. Using nine samples from five countries, over four decades, and employing a wide-ranging variety of ideological measures, they found consistently significant genetic influence across all samples and practically all ideological measures.[1]

Over the past fifteen years, multiple studies have provided evidence of significant genetic influence on a wide range of political attitudes and behaviors, beyond ideology (Fowler, Baker, and Dawes, 2008; Fowler & Dawes, 2008, Hatemi, Medland & Eaves, 2009c; Hatemi et al., 2009a, Fazekas & Littvay, 2012). Naturally, the amount of the effect genes have on attitudes varies greatly. In this regard, Hatemi & McDermott (2012) offer a far-reaching overview of relative genetic and environmental influences in all studies conducted from 1974 to 2012. They show that among all politically relevant domains, political knowledge, authoritarianism, and social trust are all found to be above 50% heritable. The majority of other domains—e.g., sex attitudes, religious, and out-group attitudes—fall between 30 and 45%. In contrast, ethnocentric attitudes and sense of civic duty are found to be significantly less dependent on genes, around 20%. In most of them, however, environmental effect is dominated by unique personal experiences, rather than socializing factors. At the very end of this spectrum stands party identification. This domain of political life represents essentially the only point of convergence between two blocs. Both the environment-driven socialization literature (e.g., Jennings & Niemi, 1968) and literature in behavioral genetics (e.g., Alford, Funk, Hibbing, 2005; Hatemi et al., 2009a; Martin et al., 1986; Eaves, Eysenck, and Martin, 1989; Eaves et al., 1999; Fowler & Dawes, 2008; Olson, Vernon, and Jang, 2001; Bouchard and McGue, 2003; Bouchard et al., 2003; Hatemi et al., 2009b) find party identification to be predominantly determined by shared familial environment, but even these findings are questioned in more recent inquiry (Fazekas & Littvay, 2015).

Given the heated scientific debate over the idea that ideologies are, to any extent, determined by genes, we make additional effort for this special issue to clarify the basic claim on which this paper rests. Namely, to say that identification with political ideologies is genetically influenced is not to say that there are corresponding genes to every ideology or set of social values. Fortunately, humans are far more complex. The fact that we are portioning the origin of certain human psychological traits does not imply that these components work separately, in isolation. Even in the case of highly heritable psychological traits, transmission is not carried out by a single gene. Instead, in the case of such complex attitudinal characteristics, there are likely to involve the interplay of thousands, if not more, genes. This means that the same set of genes can influence one's opinion differently depending on the mode of interaction with other genes, as well as the order in which they express themselves (Alford, Funk, & Hibbing, 2005). While we stress the complexity of these processes, as well as the human ability to behave against their

[1] The sole exception to their findings is left–right identification, which was found to be highly susceptible to different local and cultural interpretations, and may suggest group identification more than ideological position (Hatemi et al., 2014:10).

genetic predisposition, we move forward under the assumption that human psychology and behavior are influenced by forces of which we are often unaware. Thus, while genetic effect can (and should) be seen as a stabilizing factor, mechanisms of such influence are not isolated and therefore remain essentially amendable.

The goal of this paper is to explore the structure of determinants of a certain set of political attitudes, economic egalitarian attitudes. In the next section, we explore how scholars think about and measure social justice attitudes; then, we move on to an empirical test exploring the structure of genetic and socialized foundations of social justice attitudes.

Social Justice Attitudes

Social justice attitudes are defined as beliefs and judgements about an equal society in which all groups have full and equal participation, where resources are equally distributed, and everyone is physically and psychologically safe[2] (Grayman & Godfrey, 2013; Broido & Reason, 2005). They represent a specific kind of political attitudes that focus on belief in equal society and government's intervention in reducing socio-economic inequalities by securing fair distribution of resources and goods. In 1964, T.H Marshall hypothesized that ideological justification for such a modern welfare state emerged through the inclusion of social rights, which would secure an acceptable level of economic welfare and the life of a civilized human being (Hasenfeld & Rafferty 1989). Overall support for government's intervention in distribution of resources is found to be influenced by two social ideologies: economic individualism and social equality (collective responsibility) (Feldman, 1983; Feagin, 1975; Furniss & Tilton, 1977; McClosky & Zaller, 1984).

Economic individualism essentially assumes that each individual is responsible for her/his own welfare and economic success. As economic success is determined by one's work ethic (Sniderman & Brody, 1977), poverty is seen as a result of personal deficiencies, biological, or cultural (Hasenfeld & Rafferty, 1989). For this reason, any purposeful engineering of social equality through governmental intervention is seen to foster dependency and moral corruption (Verba & Orren, 1985; Lipset, 1963). On the other hand, the principles of social equality and collective responsibility imply that government should play a major role in providing equal economic opportunities to all citizens, as a part of an obligation to ensure minimal standards of living (Hasenfeld & Rafferty, 1989). The intervention, from this perspective, is morally justifiable and especially welcomed when it benefits the most vulnerable social groups.

Institutional explanations for public adoption of such positions start with the type of welfare regime—*liberal, conservative,* and *social democratic*—which profoundly

[2] In this paper, we focus on more traditional social justice concerns associated with economic equality (distributive justice). Therefore, throughout the paper we use the terms "economic egalitarianism" and "social justice" interchangeably. However, we do recognize that different concepts of social justice are becoming increasingly relevant, such as group recognition (cultural justice), which brings greater focus on, for example, equal treatment of ethnic or gender identities (Fraser, 1999).

affects the social structure and "produces its own unique fabric of social solidarity" (Esping-Andersen, 1990). In this classification, the USA is an ideal case of a liberal welfare regime in which the state is "forbidden" from interfering with the "clearing mechanisms" and efficiency of the market. This should, theoretically, result in wide support for pursuing minimalist social policies (1990:62). Indeed, multiple studies showed that Americans, by large, subscribe to ideas of economic individualism and principally reject any idea of economic collectivism and interventionism. For instance, Kluegel & Smith (1986) report that only 10% of Americans in 1980 believed that groups usually perceived as vulnerable—poor, blacks, women, etc.—had less opportunity than did others. Consequently, they only minimally support direct redistributive politics to achieve equality through taxes (Jacobs & Skocpol, 2005). Seemingly, the belief in meritocracy and equal opportunity is so strongly rooted in minds of Americans that it is considered to be the "dominant American ideology" (Kluegel & Smith, 1986).

While the effect of these ideologies on specific welfare policies—guaranteed jobs, medical insurance, affirmative action—is well documented (e.g., Feldman & Zaller, 1992; Jacoby, 1994; e.g., Feldman, 1983; Kluegel and Smith, 1983, Feldman & Steenbergen, 2001), in this paper we are interested in the origins of economic egalitarianism attitudes in general. We cover a wide range of attitudinal dimensions such as—equality of chances, wealth, income, as well as general levels of concern people in society should have regarding economic equality.

Self-Interest Hypothesis

To this point, research on economic egalitarianism has based its foundation on individual characteristics, shaped by broader environmental forces (Blekesaune & Quadagno, 2003). The existing literature identifies personal *self-interest* as the main determinant of attitudes toward redistribution[3] (Downs, 1957; Kinder & Kiewiet, 1981; Feldman, 1982). Under this view, individuals seek to maximize their own private financial self-interest, which is largely determined by which social groups they belong to. Here, the assumption is that different social/demographic groups are likely to have distinct cultures, norms, and socialization practices that greatly impact individual attitudes (Sears & Funk, 1991; Grayman & Godfrey, 2013).

The support for the self-interest hypothesis comes from studies showing that the strongest support for welfare programs is among vulnerable, low-income, young

[3] In addition to self-interest, value-based approaches are recognized as very important. They posit that individual's normative orientations are likely to profoundly affect his/her attitudes toward justice and equality (Roller, 1995; Sachweh, 2016, in Sabbagh & Schmitt). One of the widely explored value systems in any study of redistributive politics is *humanitarianism*—the belief that people have responsibilities for their fellow human beings. In general, humanitarianism and egalitarianism affect support for welfare policies differently. While the latter is associated with support for extensive governmental intervention, the former is associated with support for modest policies focused on those in need (e.g., poverty relief) (Feldman & Steenbergen, 2001). Despite the fact that the two are considered to be distinct belief systems, some of our measures of egalitarianism make direct reference to income and basic needs of poor people. Thus, we believe that the two would be, in this case, highly correlated and likely to originate from the same social and biological processes.

adults (Robinson & Bell, 1978; Hesenfeld & Raferty, 1989; Kluegel & Smith, 1983; Groskind, 1994). Socio-economic strata in which one is socialized are found to be related to greater or lesser support for welfare state policies (Gelissen, 2000; Kulin & Svallfors, 2011; Svallfors, 1997). Andersen & Yaish (2012) find that not only respondent's own social class, but also their father's social class, is significantly related to the direction of redistribution attitudes, with working class respondents leaning toward more egalitarian views. Alesina and La Ferrara (2005) and Yaish and Andersen (2012) expand this argument by adding social mobility to the picture. Going beyond mere economic power of one's social strata, they claim those living in more socially mobile communities will be less supportive of redistributive policies.

In the USA, besides class membership and employment status, gender (Svallfors, 1997; Beutel & Marini, 1995), age (Blekesaune & Quadagno, 2003), and race are discussed as important determinants of one's egalitarian attitudes. For example, women are thought to be more supportive of social justice for two reasons. First, they are less likely to believe in meritocracy and that Americans experience equal opportunity (e.g., Flanagan & Tucker, 1999; Baldi, 2001). Second, women are likely to be socialized into roles that are more empathic than males (Eagly, 1987, in Grayman & Godfrey, 2013). With regard to age, older people tend to favor substantial handovers toward elderly, while younger respondents tend to favor child care support. In case the person is of African- or Asian-American origin, belief in government's responsibility to assist is found to be intensified even further (Flanagan et al., 2009).

In short, the main conclusion to be drawn from the existing literature on the origin of social justice attitudes is that people tend to adopt social ideologies that are the most congruent with their immediate surrounding or personal characteristics (Hesenfeld & Raferty 1989). However, this approach undoubtedly suffers from overly "mechanical" understanding of people's attitudes. It assumes that attitudes on economic equality can be directly deduced from long-term class interests, short-term self-interests, group membership, or internalized values and norms (Larsen, 2008). For the most part, however, findings are inconclusive. Besides the literature on unemployment (e.g., Svallfors, 1997; Gelissen, 2000) and, to an extent, on class effect, the self-interest hypothesis was hard to support once a wider range of variables is included (Larsen, 2008). Sears & Funk (1991) report that support for busing and affirmative action policies is much better explained by symbolic attitudes (conservatism, nationalism, symbolic racism, etc.) than by a set of self-interest variables. Merill & Grofman (1999), among others, also confirm that voter's stand on concrete policy issues cannot be straightforwardly inferred from personal/group interests. Similarly, in a recent study investigating social justice attitudes among adolescents in the USA, in which both individual and contextual demographic variables (e.g., types of schools, geographical region, type of settlement), authors find rather weak evidence (Grayman & Godfrey, 2013). A model containing dozens of demographic variables accounted for no more than 10% (depending on abstractness of attitude under consideration) of variance in individuals' willingness to endorse governmental responsibility for individuals' economic conditions. While these numbers vary across studies, they hardly appear

to be strong enough to carry heavy theoretical expectations put forth by the prevailing literature (2013:433).

Beyond Environment?

Clearly, it would be false to assume that any unexplained variance implies a biological (genetic) link. Environmental and social forces are not easily observed, and thus, a failure to pinpoint a situational factor does not mean biology is at work (Hatemi & McDermott, 2011). However, inconclusive evidence (often paired with poor model fit) in studies focused exclusively on environmental factors and suggests that investigating other potential origins of social justice attitudes is likely to be beneficial. Hence, we are not arguing that societal factors are unimportant sources of economic egalitarianism attitudes, but instead we try to provide additional explanation which could complement existing knowledge in places where purely environmental approaches fall short.

With this in mind, we depart from the position that social justice research has been particularly untouched by bio-politics. To corroborate such a claim, we point to obvious and systematic lack of awareness of the relevant literature in the field of behavioral genetics. This journal, since its inception in 1987, published less than 30 articles mentioning such terms as: *genes*, *genetics*, *twins/twin studies*, or *heritability*. The vast majority of these papers made only a subtle reference to genetic foundations when discussing potential sources of moral virtue and norms related to social/distributive justice, without properly stressing the remarkable progress that has been made in the field. For instance, out of all articles surveyed, only four have any of the terms broadly related to genetics in their abstracts, or among their keywords. To the best of our knowledge, outside of this special issue, barely a handful of articles cited in any of the most influential and mainstream works on the genetic basis of ideology or attitudes related to social justice (e.g., Alford, Funk & Hibbing, 2005). It is hardly an overstatement to say that four decades since breakthrough studies on genetic influence on political attitudes (Eaves & Eysenck, 1974; Martin et al., 1986), and at least a decade since they became widely discussed in mainstream social science journals, these topics are still underrepresented in social justice literature. Thus, we see the initial contribution of our paper in nurturing interaction between divided, and yet related, fields.

In the light of evidence collected in behavioral genetics literature on various types of political attitudes, we believe there is no reason to expect social justice attitudes to be exempted from genetic influence. Indeed, the contribution of genes in explaining various economy-related attitudes and behaviors has been already documented. Although Martin et al. (1986) did not directly study attitudes toward economic equality, but rather wider support for socialism, they found evidence of both genetic and social components of twin resemblance. Decades later, Funk et al. (2013) conducted a univariate analysis of economic equality attitudes to confirm initial findings that egalitarianism is likely to be strongly influenced by genetics. They report that almost half of the variance in individual differences can be attributed to biology. Hatemi et al. (2014), using three economic individualism–

collectivism items, detect roughly 40% of variance in individual differences among Americans that can be attributed to genetic influence. In a noteworthy recent study, Ksiazkiewicz & Krueger *(in this special issue)* find that 48.5% of variation in six-item (Wilson–Patterson) economic ideology scales is heritable. Furthermore, they effectively demonstrate that genetic variance of direction and strength of economic ideology is shared with the individual's need to evaluate. Moving beyond typical classical twin design, Hatemi (2013) incorporates person-specific experiences—e.g., losing a job or great financial loss—and finds that both genetic and environmental variances are moderated by financial risk. He also finds that changes in magnitude of genetic influences, as a result of personal experience, were only temporary. This indicates that the effect of genes adds stability to one's opinions regarding economy-related issues. Despite smaller differences in the size of the effect, all of the above-mentioned studies suggest a significant influence of genes, and only modest, or non-existing role of shared environment. Another regularity is the strong effect of the unique environment on these attitudes.

Outside of fostering better communication between the fields, our study contributes to the existing literature in two ways. First, although related, a majority of above-mentioned studies did not look specifically at economic equality as the core concept of social justice. Second, for the most part, existing evidence was collected as a part of much wider studies on ideological positioning, which looked into a number of different types of political attitudes. Consequently, they mostly represent univariate analyses of individual attitude items. In this paper, however, we conduct in-depth multivariate analysis of attitudes toward economic equality exploring both the attitude structure and the underlying genetic and environmental mechanisms. Testing numerous multivariate genetic models allows us not only to test whether or not there is genetic influence at play, but also to better understand the structural relationship between various dimensions of economic equality—i.e., *equality of chances, income, wealth*, etc. Instead of studying them in isolation, we are interested in whether these dimensions of equality are underscored by a common latent factor, to what extent they have shared genetic foundation, and how (relative) environmental influences differ across its different dimensions.

Method and Design

Data and Measures

We ran our analysis using the 2008 Minnesota Twins Political Survey Data (MTPS). The sample includes 573 complete twin pairs, out of which 346 are monozygotic and 227 are dizygotic. There are 353 female and 220 male pairs, aged 51–63 (mean $\sim$ 56, SD $\sim$ 2.50).

In the MTPS, economic egalitarian attitude is measured using 5 items. All items are measured on a five-point scale, ranging from "strongly agree" to "strongly disagree." The differently worded items 3 and 5 were reverse coded prior to analysis to match the rest of the items:

Item 1: One of the biggest problems is that we don't give everyone an equal chance.
Item 2: If wealth were more equal in this country, we would have many fewer problems.
Item 3: We have gone too far with pushing equality (R).
Item 4: Income should be equal because every family's basic needs are the same.
Item 5: We would be better off if we worried less about how equal people are (R).

Before moving to multivariate analysis, we first display descriptive statistics for all items across zygosity groups (Table 1). Subsequently, we present a univariate breakdown for each item separately, together alternative sub-models and model fit comparison (Table 2).

In Table 1, we show means and standard deviations, together with correlation matrix between all available indicators. A majority of correlations appear to be of moderate strength. Correlation within DZ twins is, in most cases, just under half of those observed in MZ twins. This indicates that additive genetic effect assumption is met. If common environment was the decisive factor in developing attitudes toward economic egalitarianism, then correlations among MZ and DZ twins would be closer to each other. Also, based on within twin correlations (significantly below 1.00) we foresee that unique environment is the dominant environmental factor in this case.

Clearly, there is variation in how items are correlated with each other (Table 1), as well as with regard to relative share of genetic influence in their variance (Table 2). For this reason, we proceed with a more detailed analysis of structure among them. We are particularly interested in whether they represent different dimensions of the same psychological construct or not. This will also give as an initial hunch about which genetic model, discussed in greater detail in the next section, is likely to be a better fit for our data. To answer this question, we first conducted a confirmatory factor analysis (CFA).

Initial results showed that the five items cannot be considered together as a part of the same latent factor. The CFA model shows an unsatisfactory model fit on all measures (CFI = 0.83, RMSEA = 0.20, SRMR = 0.10), meaning that items do not represent the same underlying psychological construct. After further inspection, it became clear the third item is substantively different from the other four. Its factor loading is lower (0.34–11% of variance explained) compared to other indicators. Clearly, this indicator differs from items 1, 2, and 4. While they seem to measure specific dimensions of equality—*chance*, *wealth*, and *income*—item 3 is more about general concern over equality in a society. However, the same can be said for item 5. Thus, while it remains in a domain of speculation why these two items interact differently with other items, we consider removing the item 3. Once excluded, repeated CFA yielded a single-factor solution with satisfactory model fit (CFI = 0.99; RMSEA = 0.017, SRMR = 0.009). Hence, we decide to proceed to the multivariate analysis with four items that represent the common latent factor of economic egalitarianism.

Table 1 Correlations, means, and standard deviations of the economic egalitarianism in monozygotic twins (MZ) (n of pairs = 346) presented above the diagonal, and dizygotic twins (DZ) presented below the diagonal (n of pairs = 227)

	Twin 1					Twin 2					
	Chance	Wealth	Push	Income	Worry	Chance	Wealth	Push	Income	Worry	
Twin 1											
Chance		0.53	0.20	0.49	0.22	**0.33**	0.26	0.12	0.21	0.10	3.23
		(0.45–0.60)	(0.09–0.20)	(0.40–0.56)	(0.11–0.31)	(**0.23–0.42**)	(0.15–0.35)	(0.01–0.23)	(0.10–0.30)	(0.00–0.20)	(1.15)
Wealth	0.58		0.27	0.69	0.33	0.26	**0.34**	0.08	0.32	0.15	3.17
	(0.48–0.66)		(0.16–0.36)	(0.63–0.74)	(0.23–0.42)	(0.15–0.35)	(**0.24–0.42**)	(–0.03–0.18)	(0.22–0.40)	(0.04–0.25)	(1.23)
Push	0.26	0.27		0.17	0.46	0.20	0.13	**0.26**	0.02	0.17	3.28
	(0.13–0.37)	(0.15–0.39)		(0.07–0.27)	(0.37–0.54)	(0.09–0.29)	(0.02–0.23)	(**0.16–0.35**)	(**–0.08–0.13**)	(0.07–0.13)	(1.04)
Income	0.46	0.62	0.26		0.22	0.31	0.26	0.05	**0.31**	0.11	3.49
	(0.35–0.55)	(0.53–0.69)	(0.13–0.38)		(0.12–0.32)	(0.21–0.40)	(0.16–0.35)	(− 0.05 to 0.15)	(**0.21–0.40**)	(0.01–0.21)	(1.12)
Worry	0.32	0.40	0.46	0.34		0.11	0.11	0.19	0.07	**0.15**	3.06
	(0.20–0.43)	(0.29–0.51)	(0.35–0.56)	(0.23–0.45)		(0.00–0.21)	(0.00–0.21)	(0.09–0.29)	(− 0.03 to 0.17)	(**0.03–0.175**)	(1.09)
Twin 2											
Chance	**0.11**	0.11	0.05	0.05	0.002		0.48	0.26	0.43	0.18	3.23
	(− **0.02** to **0.23**)	(− 0.02 to 0.24)	(− 0.07 to 0.18)	(− 0.08 to 0.17)	(− 0.13 to 0.13)		(0.39–0.56)	(0.15–0.35)	(0.34–0.50)	(0.07–0.28)	(1.15)
Wealth	0.11	**0.19**	0.05	0.15	0.06	0.54		0.19	0.60	0.27	3.14
	(− 0.02 to 0.23)	(**0.06–0.31**)	(− 0.08 to 0.17)	(0.02–0.27)	(− 0.07 to 0.18)	(0.44–0.62)		(0.08–0.29)	(0.52–0.66)	(0.17–0.36)	(1.24)
Push	0.02	0.13	**0.09**	0.15	0.06	0.20	0.30		0.12	0.48	3.30
	(− 0.11 to 0.14)	(0.004–0.26)	(− **0.03** to **0.22**)	(0.02–0.27)	(− 0.07 to 0.19)	(0.07–0.32)	(0.18–0.41)		(0.01–0.22)	(0.39–0.56)	(1.02)

Table 1 continued

	Twin 1					Twin 2					
	Chance	Wealth	Push	Income	Worry	Chance	Wealth	Push	Income	Worry	
Income	0.11	0.12	0.02	**0.10**	0.03	0.41	0.56	0.14		0.22	3.29
	(− 0.02 to 0.23)	(− 0.01 to 0.24)	(− 0.11 to 0.15)	(− **0.03** to **0.227**)	(− 0.10 to 0.16)	(0.30–0.51)	(0.46–0.64)	(0.01–0.26)		(0.12–0.32)	(1.12)
Worry	0.05	0.04	0.03	0.11	**0.10**	0.28	0.33	0.59	0.16		3.01
	(− 0.08 to 0.17)	(− 0.09 to 0.17)	(− 0.10 to 0.16)	(− 0.02 to 0.23)	(− **0.02** to **0.23**)	(0.16–0.40)	(0.20–0.44)	(0.50–0.67)	(0.03–0.28)		(1.07)
DZ mean	3.07	2.94	3.43	3.30	3.15	3.24	3.17	3.28	3.49	3.06	
(SD)	(1.23)	(1.18)	(1.00)	(1.14)	(1.03)	(1.16)	(1.23)	(1.04)	(1.12)	(1.09)	

The intraclass correlations for the same item are in bold

Chance: one of the highest problems is that we don't give everyone an equal chance, *Wealth:* If wealth were more equal, we would have many fewer problems, *Push:* we have gone too far in pushing equality in this country, *Income:* income should be equal because every family's basic needs are the same, *Worry:* we would be better off if we worried less, about how equal people are

Table 2 Univariate ACE models comparison (95% CI)

Model	*A*	*C*	*E*	*N* par	− 2LL	*df*	AIC	diffLL (*df*)	*p* values	Model comp.
Chance										
ACE	0.57 (0.46–0.67)	0.00 (− 0.57 to 0.57)	0.82 (0.76–0.89)	4	3570	1142	1286	–	–	–
AE	0.57 (0.46–0.67)	–	0.82 (0.76–0.89)	3	3570	1143	1284	− 1.19 (1)	1	ACE versus AE
CE	–	0.49 (0.38–0.58)	0.87 (0.81–0.93)	3	3578	1143	1292	8.46 (1)	0.004	ACE versus CE
E	–	–	1	2	3611	1144	1323	41.63 (2)	0.000	ACE versus E
Wealth										
ACE	0.52 (0.16–0.89)	0.24 (− 0.45 to 0.93)	0.82 (0.75–0.89)	4	3643	1142	1359	–	–	–
AE	0.58 (0.48–0.68)	–	0.82 (0.75–0.88)	3	3643	1143	1357	0.17 (1)	0.68	ACE versus AE
CE	–	0.53 (0.43–0.63)	0.85 (0.79–0.90)	3	3646	1143	1360	3.03 (1)	0.08	ACE versus CE
E	–	–	1	2	3693	1144	1406	50.12 (2)	0.000	ACE versus E
Push										
ACE	0.55 (0.40–0.60)	0.00 (− 0.68 to 0.68)	0.86 (0.80–0.92)	4	3296	1142	1012	–	–	–
AE	0.55 (0.40–0.60)	–	0.86 (0.80–0.92)	3	3296	1143	1010	− 8.25 (1)	1	ACE versus AE
CE	–	0.44 (0.34–0.53)	0.9 (0.84–0.94)	3	3300	1143	1014	4.26 (1)	0.039	ACE versus CE
E	–	–	1	2	3323	1144	1035	2.64 (2)	0.000	ACE versus E

Table 2 continued

Model	*A*	*C*	*E*	*N* par	− 2LL	*df*	AIC	diffLL (*df*)	*p* values	Model comp.
Income										
ACE	0.54 (0.43–0.64)	0.00 (− 0.61 to 0.61)	0.84 (0.78–0.90)	4	3514	1142	1230	–	–	–
AE	0.54 (0.44–0.65)	–	0.84 (0.77–0.90)	3	3514	1143	1228	− 1.02 (1)	1	ACE versus AE
CE	–	0.47 (− 0.57 to 0.54)	0.88 (0.82–0.94)	3	3520	1143	1234	6.52 (1)	0.011	ACE versus CE
E	–	–	1	2	3548	1144	1260	3.46 (2)	0.00	ACE versus E
Worry										
ACE	0.31 (− 0.27 to 0.88)	0.24 (− 0.37 to 0.86)	0.92 (0.85–0.98)	4	3399	1142	1115	–	–	–
AE	0.4 (0.27–0.53)	–	0.92 (0.85–0.98)	3	3399	1143	1113	0.17 (1)	0.68	ACE versus AE
CE	–	0.37 (0.24–0.49)	0.93 (0.87–0.98)	3	3399	1143	1113	0.31 (1)	0.58	ACE versus CE
E	–	–	1	2	3549	1144	1261	150.29 (2)	0.005	ACE versus E

Standardized coefficients are presented

Chance: one of the biggest problems is that we don't give everyone an equal chance, *Wealth:* if wealth were more equal, we would have many fewer problems. *Push:* we have gone too far in pushing equality in this country. *Income:* income should be equal because every family's basic needs are the same. *Worry:* we would be better off if we worried less about how equal people are

Variance Decomposition

The most commonly used approach for estimating the relative share of genetic influences on individual attitudes and behaviors, and the most powerful one, is comparison between monozygotic (MZ) and dizygotic (DZ) twins. In this paper, we employ the most prevalent design for such comparison—*classical twin design* (CTD). Typically, in twin study designs environment and genes are not directly measured, but rather researchers draw conclusions from the patterns of covariance on the phenotype across sibling pairs (Neale & Cardon, 1992). The strength of twin designs comes from biometric genetic theory and the fact that while both groups share an environment to the same extent, MZ twins are genetically identical while DZ twins share, on average, 50% of genetic material. Because of this, using the difference between MZ and DZ twin pairs, we are able to decompose variability in traits of interest into genetic and environmental components.

While this is true in general, unbiased decomposition of variance depends on the number of assumptions that cannot be taken for granted in social sciences. The most crucial one is the equal environmental assumption, which posits that, on average, the magnitude and distribution of shared environmental influences do not vary across the zygosity groups with regard to their impact on the phenotype of interest (Medland & Hatemi, 2009). Second, there should be no assortative mating between parents. Here, this means that choice of partner is independent from the egalitarianism attitudes of the members of the mate pair, though the violation of this only produces type II error with regard to heritability as it biases its estimates downward. Third, the effect of genes on economic egalitarianism is additive. Included in this assumption is the elimination of the possibility of multiplicative or interactive source of variance, such as dominance, epistasis, or, the most commonly cited example of non-additive effect as far as the social sciences are concerned, gene by environmental (or G x E) interaction. G x E interaction arises when individuals with different genotypes differ in their response or sensitivity to the environment. In other words, genetic and environmental effects within the sample can differ as a result of environmental stimuli. If these stimuli are not shared between co-twins, the estimated effect of unique environment will be inflated. Similarly, if they are shared, estimates of additive genetic influences will be inflated (Medland & Hatemi, 2009). Later, in "Discussion and Limitations" section, we dedicate a great deal of attention to why these assumptions do not represent grave concerns in our paper and are unable to undermine the crucial rationale behind our study.

In a classic behavioral genetics models, the total variance—(V) t—of trait of interest is decomposed into genetic and environmental components. Genetic influence is most commonly specified as additive effect (A). This class of gene action assumes that cumulative gene effect is equal to a sum of independent effects of all genes involved (Falconer, 1960). Environmental effect can come in two forms: shared (common) (C) and unique (non-shared) environment (E). The common environmental effect is essentially the influence of all environmental factors and experiences that are shared within the twin pair. These include most of the factors perceived as important for the socialization process, such as parent's income, class membership, family size, parent's educational history, or value

structure. On the other hand, unique environment (E) represents differences in trait values between family members that are derived from their personal experience. Most commonly these include, spousal influences, employment history, and peers not shared with siblings (Medland & Hatemi, 2009). In a typical ACE model, the effect of non-shared environment is treated as measurement error, and thus, it should never be constrained in the specification stage (Bouchard and Loehlin, 2001). Accordingly, the equation for decomposition of total variance is:

$$(V)t = a^2 + c^2 + e^2$$

Individual twins share, by default, all of their shared environment and none of the unique environment, as well as all genes being shared in the case of MZ and 50% of genetic material among DZ. Thus, covariance can be specified using equations:

$$(COV)\,mz = a^2 + c^2 \quad (COV)\,dz = 1/2\,a^2 + c^2$$

The result of twin design is relative to the portion of variance that can be attributed to each of the components (A, C, E) in the model. While there are a number of statistical methods that can be used to carry out this kind of analysis, the most common approach to analyzing twin data is structural equation modeling (SEM) within a maximum likelihood framework (Posthuma et al., 2003). SEM allows the researcher to combine factor analysis (latent part) and path modeling (structural part), and to apply restrictions on the variance–covariance matrix in order to find a mathematical solution and estimate the ACE components. To conduct our analysis, we use OpenMx package (Boker et al., 2012) from R statistical software. Full information maximum likelihood estimation was fitted to the raw data matrix when fitting models to the data (Neale & Cardon, 1992). Working with twin pairs as observations means that genetic data will be exactly twice as "long" as typical individual level data. Once sorted as pairs, each observation will keep a separate record for phenotypical measures for each individual twin. However, due to equal constraints on variances and factor loadings of the latent factor within twin pairs, model produces a single estimate of the ACE components (Falconer & Mackay, 1996).

Multivariate Approach

In the case of multiple indicator constructs, one can partition ACE components into one which is common to all indicators and one which is specific to each indicator. In such situations, it is possible to estimate the effect of unique environment on economic egalitarianism, net of errors of measurement in each of four indicators (Sturgis et al., 2010). Two prevalent multivariate models in twin studies are the *independent pathway model* (IPM in Fig. 1) and the *common pathway model* (CPM in Fig. 2). In both cases, the model is comprised of three common latent variables for additive genetic (Ac), shared environmental (Cc), and unique environmental (Ec) effect, and three specific latent variables (As, Cs, and Es) for each of the four indicators in our model. In our case, that makes a total of 12 specific latent variables.

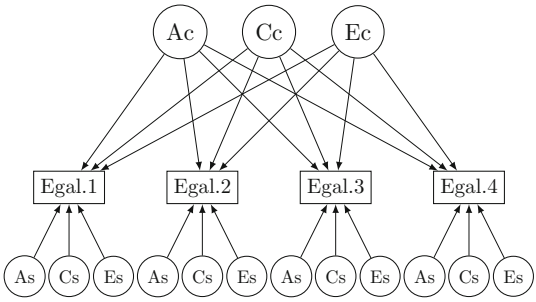

Fig. 1 Independent pathway SEM model

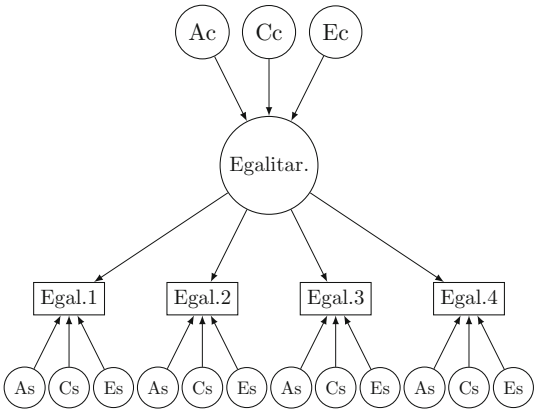

Fig. 2 Common pathway SEM model

The crucial difference between two models is in the number of direct paths from common ACE factor loadings to observed indicators. While within an IPM each common latent factor has direct effect on each observed item, in a CPM direct paths are specified between ACE latent factors and single latent traits, without direct paths between ACE common factors and observed variables (Neale & Cardon, 1992). In other words, the latter hypothesizes that the covariation between variables is due to a single underlying "phenotypic" latent variable (Medland & Hatemi, 2009).

We test alternative models by comparing log-likelihoods of more restricted, CPMs, and the more general IPM. This yields a statistic that is distributed as Chi-square, with degrees of freedom equal to the difference in the number of free parameters in the two models. Once we decide between two general models, we proceed with testing a number of sub-models in order to find the best fitting final model. We use p-values of Chi-square to look for the most restrictive model that does not have a significantly worse fit (Bollen, 1989). Additionally, AIC (Akaike information criterion) (Akaike, 1987) was used to evaluate the fit of alternative models, with lower values of AIC being indicative of a superior fit.

Table 3 Comparison of common pathway models for variance decomposition

Model	Common factors	Specific factors	− 2LL	*N* par	AIC	diffLL (*df*)	Model comp.
1. Full independent pathway	ACE	ACE	13,042	36	3946	–	–
2. Full common pathway	ACE	ACE	13,048	31	3940	**5.42** (6)ns	2 versus 1
2.1 Ac = 0	CE	ACE	13,056	30	3946	8 (1)**	2.1 versus 2
2.2 Cc = 0	AE	ACE	13,048	30	3938	**0** (1)ns	2.2 versus 2
2.3 Ac = 0 and Cc = 0	E	ACE	13,104	29	3993	57.17 (2)***	2.3 versus 2
2.4 Cc = 0 and Cs = 0	AE	AE	13,048	26	3930	**0.42** (4)ns	2.4 versus 2.2
2.5 Cc = 0 and As = 0	AE	CE	13,050	26	3932	**2.70** (4)ns	2.5 versus 2.2
2.6 Cc = 0 and Cs = 0 and As = 0	AE	E	13,067	22	3942	20.17 (8)**	2.6 versus 2.2
2.7 Model 2.2 + (As2-4, Cs1-4 = 0)	AE	ACE	13,056	23	3932	**8.99** (7)ns	2.7 versus 2.2

Models under considerations are bolded

Significance levels: ns * 0.05 ** 0.001 *** 0.0001

The Model and Results

In Table 3, we present the alternative structural equation models with corresponding model fits. We start with a comparison of two general models: the IPM and the CPM. In this situation, we use AIC to evaluate which one has a better model fit. CPM, as the more restrictive one, has a lower AIC and therefore is preferred on the grounds of parsimony. Moreover, we also have a strong inclination toward common pathway solution due to a theoretical expectation that four items represent a single latent construct of economic egalitarianism.

Once we established that CPM is our selected specification, on both statistical and theoretical grounds, we moved into testing alternative sub-models, with the purpose of finding a simpler model that does not have a statistically worse fit than the general model (insignificant p-values). We do so by constraining causal paths from A and C factors to a common latent factor or directly to observed variables. In essence, this allows us to test the possibility that the two factors potentially have no influence on economic egalitarianism attitudes in the population. In our first sub-model (2.1), we fix the common additive genetic factor (Ac) to 0, in order to see whether a model without genetic effect fits equally well as the overall model. Clearly, results indicate that the effect of additive genetic factors on the latent economic egalitarianism variable is different from zero. Then we restrict the common shared environmental (Cc) factor (Model 2.2). Model which assumes a non-existing shared environment effect shows a similar model fit as the model with all paths freely estimated. In other words, we can proceed further with model selection assuming that the common shared environment (socializing factor) does not contribute to individual variation in economic egalitarianism attitudes. Last, we restrict both Ac and Cc. This model clearly yields an unsatisfactory model fit.

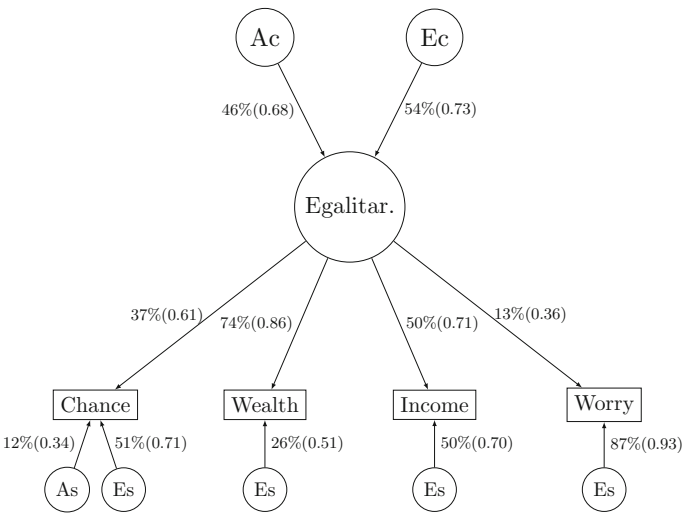

Fig. 3 Final model (2.7)

Once we established that only unique environmental and additive genetic factor have significant effect on the economic egalitarianism latent factor, we proceed toward testing the effects specific to each item. Here, we first constrain all specific shared environmental factors (Cs) to 0 (Model 2.4). This model, as well as a model restricting specific additive genetic factors (As) (Model 2.5), is found to improve model fit. However, once all As and Cs factors are fixed simultaneously, the model fit deteriorates significantly (Model 2.6). For this reason, we create an additional step toward restricting only previously insignificant specific factors in Model 2.2, which are all common environment-specific factors and all genetics-specific factors other than As1 (Model 2.7). This model did not fit significantly worse in comparison with Model 2.2. At this point, we have three models that are more parsimonious and do not have a worse fit than Model 2.2 (Models 2.4, 2.5, and 2.7). Although all three of these models offer viable solutions, as we have no clear theoretical guidance and preference on which to base our decision, we choose Model 2.7 as our final model since there are three parameters less to be estimated without impairing overall fit.

Figure 3 shows coefficient estimates for the CPM of our choice. In parentheses, we present standardized regression coefficients. Once squared, these coefficients provide a percentage of variance explained by a given factor. The total variance of each observed indicator is calculated by calculating the sum of the percentage of variance attributed to the common factor and item-specific factors. For example, total variance (100%) of the wealth equality indicator is comprised of 74 percent that can be attributed to the common economic egalitarianism factor and 26 percent explained by item-specific unique environmental factors. Only significant and unconstrained parameters are displayed (full model specification available in Appendix section). With regard to the latent economic egalitarianism variable, almost half of its variance (46.25%) can be attributed to the additive genetic factor, the shared environment has no effect at all, and the rest of the variance (53.75%) is due to unique environment. Besides the proportion of variation on the common latent variable, we also explain the leftover variances in each of the items separately (specific factors). This portion of variance is sometimes considered as just measurement error, or item-specific variation that remains after the latent economic egalitarianism factor takes its own share (Neale & Cardon, 1992; Bollen, 1989). We

Table 4 Cumulative genetic and environmental effects

Factor	Chance	Wealth	Income	Worry
Ac	17% (11–21%)	36% (23–47%)	23% (14–38%)	6% (3–10%)
Cc	0%	0%	0%	0%
Ec	20% (13–29%)	38% (28–51%)	27% (18–43%)	7% (4–12%)
As	12% (8–19%)	0%	0%	0%
Cs	0%	0%	0%	0%
Es	51% (41–64%)	26% (21–34%)	50% (41–61%)	87% (76–98%)

Final model estimator with 95% CI

see that the dominance here of unique environment is consistent across all four items. This is especially true for the item measuring general concern with equality in society, where 87% of the remaining variance can be attributed to the item-specific unique environmental factor. Again, shared environment does not contribute to the variance previously unaccounted for by the latent factor. Additive genetic factor, on the other hand, explains approximately 12% of the variance on the item measuring attitude on equality of chance. Together, this strongly suggests that major part of the variance in individual propensity to support economic equality, beyond what is captured by the common factor, is influenced by personal experiences and not by socializing factors.

Table 4 shows cumulative genetic and environmental effects in percentages, together with confidence intervals. Once we consider the effect of both common factors and specific factors, we see that the strongest influence of genetics is on attitudes regarding equality of wealth (36%), followed by equality of chance (29%), and income (23%). General concern with how equal people are, on the other hand, is almost entirely rooted in a person's unique life experience. (6% of variance has genetic basis.) The disproportional effect of genetic influence across the different dimensions of economic equality is important, as it provides practical knowledge on which dimension is more likely to be influenced by external, societal influence. But overall, the existence of significant genetic influence, together with the dominance of personal experience over shared environment, seems to be very damaging to the environment-driven self-interest hypothesis. Although somewhat underestimated in the literature on social justice, there are sound theoretical reasons to expect a strong effect on unique experience (Sears & Funk, 1991). Such direct personal experience provides more information about attitude object (in this case people in need, for example) and makes the attitude more salient and more accessible (Fazio & Zanna, 1981). Also, indirect effects (and family/group experience can be considered as one) are significantly less vivid, emotionally less provoking, distant in a sensory and temporal way, and therefore conceivably weaker (Nisbett & Ross, 1980).

Discussion and Limitations

The two most important conclusions of our paper will not be surprising for those who are, to any extent, familiar with recent research in bio-politics. However, our results may still be striking to the vast majority of social scientists who belong to the traditional scholarship of social justice attitudes, welfare states, or economic equality in general. First, we find that economic egalitarianism has important genetic component. Second, contrary to the deeply entrenched view that the social situation in which an individual is brought up is the most prevalent factor, we find that when it comes to environmental factors, the effect is solely reserved for unique experiences. In short, results show that the effect of parent–child interaction, through role-modeling or placement within a certain social context, is greatly overestimated, at least concerning attitudes on economic equality. Individual differences, therefore, seem to be based on a mixture of personal experience and

genetic influence, a combination largely disregarded in the traditional literature on social justice attitudes.

When it comes to variance that goes beyond the common factor, results provide an additional support for these conclusions. This residual variance seems to be mostly determined by the unique environment, with a small contribution of the genetic influence in case of attitude toward equality of chances. While the effect of shared environment is consistently non-existing, there is variation across different dimensions of equality with regard to the influence of the unique environment. While the vast proportion (87%) of the item-specific variance in worry about equality (item 4) is explained by the unique environment, attitudes toward equality of wealth are considerably less determined by it (26%). For equality of income and chances, the unique environmental factor contributes around half of the item-specific variance. At the very least, these differences in item-specific structure mean that attitudes toward different dimensions of equality are not equally amendable. For instance, due to the lower contribution of environmental influence, attitudes on equality of wealth appear significantly more stable. The same holds, to a certain extent, for equality of chances due to the active contribution of genes. On the other hand, the level of support for equality of income and general worry are susceptible to greater alterations through personal experience. These underlying differences between item-specific factors should remind researchers and policy-makers of the need for a nuanced approach to the study of economic equality. At the same time, the variance in the magnitude of the unique environmental effects specific to the individual items and going beyond the common factor could also be a function of the measurement error associated with each item. Random error, by definition, is uncorrelated with anything, and therefore, its variation will be part of unique environmental effects.

Now, we would like to come back to the assumptions behind our design and discuss other potentially limiting features of our study. First, we would like to stress that these results should not be interpreted outside of particular operationalization and survey items we used. With regard to sample characteristics, two things are worth keeping in mind. First, respondents in our sample are born in a rather narrow period of time (53–65 years old). Nonetheless, we do control for the effect of age and sex. Second, our sample consisted only of Americans, and one can argue that if the study was replicated in a different geographical location the result might be different. However, we believe this is not a very plausible expectation. After all, our results are in line with other studies of political attitudes (see meta-analysis done by Hatemi et al., 2014).

Another sample-related limitation might come from its size. Namely, we work with 537 twin pairs. While this might be common within social sciences, behavioral genetics researchers agree that higher sample sizes are needed to make sure separation of genetic and environmental effects in the same model is not biased. The main danger comes from potential underestimation of shared environmental factor. However, in the case of our study this seems not to be a problem given that freely estimated Cc factor was extremely close to zero. Slight underestimation would not, therefore, in any way change substantive results and our conclusions.

The equal environmental assumption (EEA) remains to be at the core of all significant criticism of the application of genetic models in social sciences (e.g., Beckwith & Morris, 2008; Charney, 2008; Horwitz et al., 2003) and therefore deserves special attention. Namely, if the environment of MZ twins is more similar than those of DZ twins, the proportion of variance attributed to environmental influences would be biased in favor of the genetic effects (Medland & Hatemi, 2009). This can easily happen if parents intentionally create a more similar environment for MZ twins. For instance, they are more likely to have the same playmates, share the same room, dress alike, as well as have higher rates of interaction rates compared to DZ twin pairs (Charney, 2008). While failing to meet this assumption represents a legitimate concern, existing critiques failed, almost without exception, in recognizing a vast literature in behavioral genetics dealing with this issue. Moreover, they failed to provide empirical support for theoretical discussion on how potential violation actually leads to overestimation of genetic factors at the expense of common environment. In this regard, Littvay (2012) offers solid empirical ground for dismissing concern in case of economic egalitarian attitudes. Namely, this study explicitly tested the effect of the most cited EEA violations: (1) shared bedroom; (2) shared friends; (3) dressed alike; and (4) had the same classes as their co-twin. The results undoubtedly show that a violation of this assumption does not occur with regard to any set of attitudes related to economic egalitarianism: socialism, welfare spending, lower taxes, and small government (Littvay, 2012:9). Also, as pointed out by (Alford & Hibbing, 2008), if the reason that the MZ environment is more similar than the DZ environment comes from the fact that parents and peers perceive them as more similar, due to initially larger similarity in genetic predisposition (e.g., physical appearance), then one can argue the biased portioning toward genetic influence is not an unfair one.

An additional assumption of the twin design we have used in this paper is that there is no assortative mating. Assortative mating occurs if individuals choose one another based on a given trait (Medland & Hatemi, 2009). It is indeed plausible to imagine that individuals might select their partners on the basis of how compassionate they are toward other people, and economic egalitarianism can be understood as one dimension of it. However, because our study was conducted on individuals of older age, who are likely to have been married decades ago, our guess would be that the effect of assortative mating is less troubling. Additionally, potential assortative mating would lead to inflation in the estimation of the common environment and underestimating of genetic influence (Medland & Hatemi, 2009, Falconer & Mackay, 1996), which represent no danger, given that the common factor is estimated to be not different from zero.

With regard to the assumption of potential genotype by environmental interaction (GxE), the ACE model, like all predictive statistical models, makes the assumption of full model specification. This includes potential omissions of interactions. If such exists, it is possible that the heritability estimates could be a function of the interacting factor. Current results omit such nuances from the analysis and present the ACE results, on average, with regard to any and all potential interaction effects. This is common practice for initial ACE analyses of any phenomenon; in fact, any meta-analysis of published statistical models will show that any discussion of

potential interactions is certainly the exception and not the rule. Our goal was to present a primary assessment of social justice attitudes, but future analyses certainly could nuance these findings accordingly.

Conclusion

The aim of this paper was to examine the origin of economic egalitarianism attitudes, as the central concept within social justice. More precisely, we explore the possibility that the assumed effect of socialization on egalitarian views is overestimated at the expense of biology. Using classical twin study design, we test, within the same model, the contribution of social learning relative to personal experiences and genetic influence. Thus, this paper can be, in a way, seen as a critique of countless publications on social justice, economic equality, and welfare policies, which directly or indirectly reject the potential role of genes. We do not, however, see our results as a definitive answer to the question we sought to answer. Instead, we remain careful in our conclusions and consider our findings to be simply an additional contribution to the already existing body of research trying to address an issue of origin of social justice attitudes. While by no means do we try to present social factors as obsolete, we argue that the amount evidence gathered in the last decade is simply overwhelming and asks for a serious revision of the way in which social scientists understand the origin of social justice attitudes. We used the design which is the most common and understandable to the wider social science community, which paves the way to more complex and comprehensive analyses that would investigate not only the possibility of gene by environmental ($G \times E$) interaction, but also analysis of extended family (Hatemi et al., 2010). Also, it is important to point out that such results can vary heavily across the social and political contexts of the populations studied (Fazekas & Littvay, 2015). Countering criticisms of determinism inherent in genetic findings, the reality is that social traits function differently in different social contexts. Like most social science studies, our findings come from one such context, so we caution generalizations beyond just because genetic processes are often (incorrectly) assumed to be universal.

Principally, two main conclusions can be drawn from our results. First, evidence undoubtedly shows that genetics contribute to individual differences with regard to attitudes on economic equality. Genetic influence is estimated to account for around half (46%) of variation. Second, environmental effect seems to be exclusively reserved for unique personal experience. The unique environment accounts for 54% of variation and clearly overrides the effect of social learning. This should come as no surprise to anyone who follows the developments in the literature in ideology, a construct practically inseparable from the attitudes under inspection here. Our results are very much in line with existing behavioral genetics literature on political attitudes in general and on economic equality in particular. Both the magnitude of genetic effect and the dominance of unique environment over shared were reported in existing studies (e.g., Hatemi et al., 2014; Hatemi, 2013; Alford, Funk & Hibbing, 2005; Ksiazkiewicz & Krueger, 2017). When it comes to item-specific factors, results are much more unidimensional. Namely, once variance explained by

common economic egalitarianism factor is accounted for, the rest of the variation in the items mostly comes from the unique personal, and not socialized experience. In short, although we gladly admit the possibility of socialization expressing its effect through certain G x E interactions, it is clear that the neglect of genetic influence when studying social justice attitudes is no longer defensible.

Our results, paired with evidence brought by other studies on similar equality-related topics, have multiple implications for social justice literature. First, by neglecting biology as an obviously integral part of the origin of social justice attitudes, the vast majority of existing theoretical and empirical accounts are inherently mis-specified (Alford & Hibbing, 2008; Sturgis et al., 2010). Second, social justice attitudes, even more than other political attitudes, are assumed to be determined by environment. However, the significant influence of genes acts as a stabilizing factor, which means what there should be a new understanding of beliefs in social justice which is less flexible and less open to direct environmental and policy changes.

But how did we get it so wrong for almost a century assuming that socialization played the important part in the parent–offspring similarity of social justice attitudes? When first presented with such evidence, social scientists often respond with disbelief looking for the flaw in the model. But the flaw is not in the model; it is in the thinking that assumes genes exert some kind of direct and deterministic effect on social outcomes. The pathway for genes to express themselves is long, complicated filled with both physiological and social phenomena. Once someone comes to terms with the heritability of political attitudes, in general, the question naturally emerges: How much of the heritability of economic egalitarianism is simply a function of the heritability of political attitudes. Similar questions were asked by people who grappled with the heritability of ideology who were ready to accept that openness to experience, one of the big 5 personality traits, is, in fact, heritable and also related to ideology (Mondak et al., 2010). Working through these pathways can certainly mitigate the shock of the initially counterintuitive results. It even has the potential of turning a seemingly impossible result into an obvious and self-evident finding. The exploration of the numerous potential pathways offers future generations of research material to study for decades to come. The answer is certainly that they are interrelated with ideology, but I would caution against wholesale application of correlational models as, in understanding the pathways, a causal approach should be applied. Is ideology causing social justice attitudes, or vice versa? Is there a bidirectional causal relationship or is the relationship completely spurious? Can these things be separated conceptually even or do they tap the same sub-construct? Answering these questions is a tedious endeavor in having to test multiple competing causal mechanisms. But approaches generally available in the methodological toolkits of behavior geneticists (Neale & Cardon, 1992, Duffy and Martin 1994) with a promise of disentangling complex causal relationships the social sciences have a difficulty dealing with.

In light of this, it should be clear that finding effects of genes brings biological (instead of environmental) determinism, quite the opposite. In addition to knowing more about the nature of biological influences, we believe that studies of this kind give us valuable information about environmental influences. A novel stream of

research now starts to examine how social structures and political institutions affect the environment in ways that trigger or suppress the expression of particular genetic factors, as well as how genetic information might shape and develop policy intervention (Hatemi & McDermott, 2012). Such a comprehensive approach is simply not an option as long as we remain within the realm of purely environmental explanations. For instance, genetically informative studies can bring more insight into which dimensions of social justice attitudes are more influenced, or resistant, to a common environment compared to external influences. Such information can be valuable to policy-makers when making informed decisions about where to concentrate efforts and financial support in order to maximize the desired effect (Hatemi & McDermott, 2011).

In conclusion, we hope that our effort to approach this topic from the perspective of biology will help to foster interest of scholars of social justice in developing more comprehensive models by expanding traditional approaches. We strongly believe that pursuit of novel questions in the field of social justice research, as well as studying previously untouched topics, should be free from fear that application of new methods and techniques will annihilate the importance of environmental and social factors. The study presented here is a result from one context, from one population, for attitudes where attitudes were studied from multiple populations, and the variation in the impact of both genetics and the environment is certainly apparent (Hatemi et al., 2014, Fazekas & Littvay, 2015), but few studies of attitudes had the luxury to be studied in more than one context. Paradoxically, working at the intersection between traditional social and biological sciences might be the most reasonable way to bring the impact of the environment back to the center of modern social inquiry.

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Compliance with Ethical Standards

Conflict of interest Nemanja Batrićević declares that he has no conflict of interest. Levente Littvay declares that he has no conflict of interest.

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

Appendix

See Fig. 4.

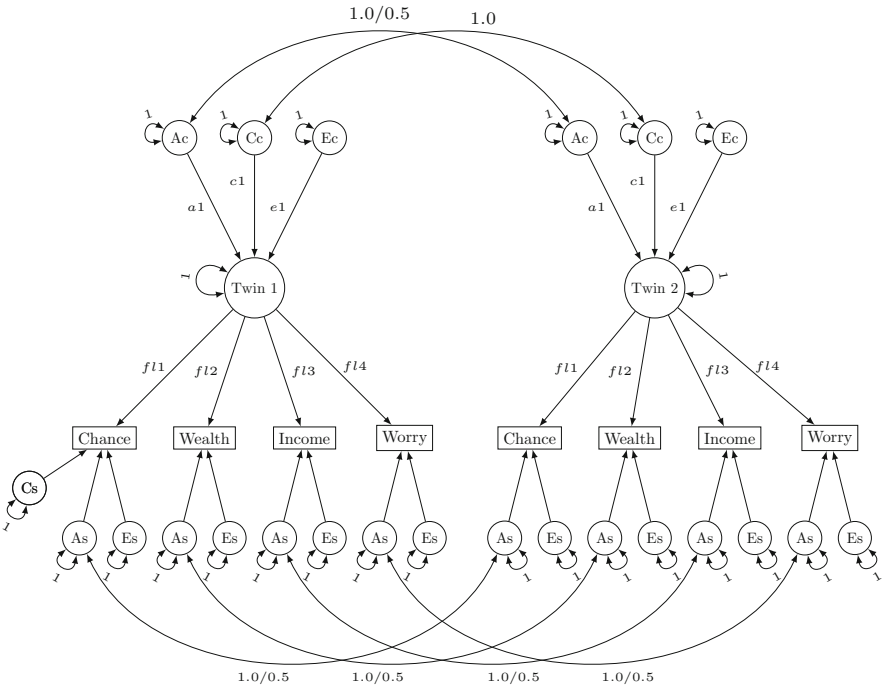

Fig. 4 Fully specified CPM model

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