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Are individualistic societies less equal? Evidence from the parasite stress theory of values

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ABSTRACT

It is widely believed that individualistic societies, which emphasize personal freedom, award social status for accomplishment, and favor minimal government intervention, are more prone to higher levels of income inequality compared to more collectivist societies, which value conformity, loyalty, and tradition and favor more interventionist policies. The results in this paper, however, challenge this conventional view. Drawing on a rich literature in biology and evolutionary psychology, we test the provocative Parasite Stress Theory of Values, which suggests a possible link between the historical prevalence of infectious diseases, the cultural dimension of individualism–collectivism and differences in income inequality across countries. Specifically, in a two-stage least squares analysis, we use the historical prevalence of infectious diseases as an instrument for individualistic values, which, in the next stage, predict the level of income inequality, measured by the net GINI coefficient from the Standardized World Income Inequality Database (SWIID). Our findings suggest that societies with more individualistic values have significantly lower net income inequality. The results are robust even after controlling for a number of confounding factors such as economic development, legal origins, religion, human capital, other cultural values, economic institutions, and geographical controls.

1. Introduction

A rich literature in social psychology, and more recently economics, has identified the value dimension individualism–collectivism (IC) as one of the most important cultural determinants of economic growth and prosperity (Oyserman et al., 2002; Gorodnichenko and Roland, 2012). Broadly defined, the IC dimension is the degree to which people are embedded within groups in society. In individualistic societies the ties between individuals are loose and everyone is expected to look after themselves and their immediate family (Hofstede et al., 1991). Such societies place value on personal freedom, self-reliance, creative expression, intellectual and affective autonomy, minimal government intervention, and reward individual accomplishments with higher social status. Higher rewards generate productivity that makes societies richer by channeling entrepreneurial talent into experimentation and innovation (Gorodnichenko and Roland, 2012), but

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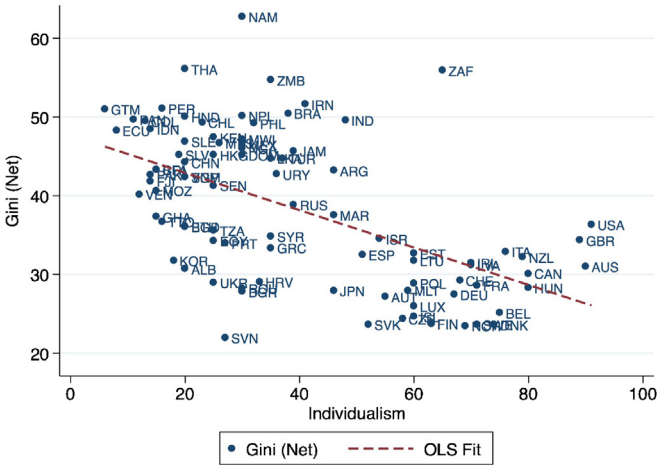

Fig. 1. Individualism and Income Inequality. Source: Data on inequality came from Solt (2016). Data on individualism were collected from https://geert-hofstede.com/.

the newly created wealth is inevitably distributed unevenly as entrepreneurs enter new markets and generate extraordinary wealth for themselves.[1]

Collectivist societies, on the other hand, are the ones where individuals are born into strong, cohesive in-groups and receive protection from their extended family in return for unquestioning loyalty (Hofstede et al., 1991). Collectivism encourages conformity and discourages individuals from standing out from the group through variety of restrictive social norms that undermine individual achievement in favor of group solidarity, the status quo, and traditional order (Gorodnichenko and Roland, 2012). Indeed, as Pitlik and Rode (2016, p. 10) show, people in more collectivist societies are far more likely to support interventionist attitudes such as the belief that "government should take responsibility to ensure that everyone is provided for." Such cultural attitudes play an important role in influencing redistributive policy, which can influence the net distribution of income.

In this paper, we examine the relationship between the cultural dimension individualism–collectivism and net income inequality. All else equal, are individualist societies more likely to have higher levels of income inequality compared to collectivist ones after taxes have been redistributed? On the one hand, as it is commonly believed, we would expect to see higher level of net income inequality in more individualistic societies, which tolerate greater individual differences, favor less redistributive policies, and have social and market institutions that promote higher economic inequality. On the other hand, collectivist societies, should have much lower net income inequality since individual preferences favor more redistributive policies and encourage conformity and the status quo. Yet, as Fig. 1 shows, the correlation between individualism and net income inequality across countries seems to go in the opposite direction – with more individualist cultures having lower levels of net income inequality. This empirical observation is quite puzzling in the face of an established literature, which shows that at the individual level there is a strong link between individualism and preferences for redistribution (Lansley, 1994; Alesina and Glaeser, 2004; Alesina and La Ferrara, 2005; Castell and Thompson, 2007; Quattrociocchi, 2014). It is possible, of course, that the negative relationship in Fig. 1 is spurious capturing some third variable such as economic development that is unobserved. The graph is also merely correlational and does not imply causality. Thus, the starting point of our analysis are the issues of reverse causality and omitted variable bias.

To deal with these issues, we propose a potential instrument, the historical prevalence of infectious diseases, as a source of exogenous variation for individualistic values. There is by now substantial evidence in support of the so called Parasite-Stress Theory of Values (PSTV), according to which regional variation in infectious diseases influenced cultural traits such as xenophobia, openness, and ethnocentrism that led to the formation of social values associated with collectivism-individualism (Fincher et al., 2008), which, in the next stage, shaped economic outcomes at the regional level. Our analysis, then, is based on a rich literature in evolutionary psychology and biology that has identified the instrument *a priori* (Thornhill and Fincher, 2014). Thus, our paper contributes to the literature on the causes of economic inequality by suggesting that cross country differences in income inequality today have their deep origins in the historical prevalence of infectious diseases, which determined cultural values at the regional level.

Our results challenge the conventional view that individualistic societies are more prone to higher levels of income inequality. On the contrary, we find that even if people in more individualistic cultures are more likely to accept and encourage greater individual differences, they end up living in far more equal societies at the end of the day. In our 2SLS analysis, we find that the historical prevalence of infectious diseases is strongly and negatively correlated with individualistic values, which

[1] In economics, the trade-off between efficiency and equality is well-established theoretically, e.g., see Okun (2015).

then, in the next stage, are a strong (negative) determinant of economic inequality, measured by the net GINI coefficient from the Standardized World Income Inequality Database (SWIID). These results hold even when we control for a number of confounding factors including the level of economic development, formal institutions, local factor endowments, geographic dummies, and other cultural values. The results are furthermore robust to different sub-samples of countries and alternative measures of income inequality and individualism.

One possible explanation for these findings is that citizens in individualistic cultures favor more inclusive institutions that are characterized by respect for the rights, liberties, and well-being of all members of society, not just their immediate circle. This is consistent with recent empirical findings which show that more individualistic societies are far more likely to develop high quality political and economic institutions including respect for the rule of law, protection of private property and strong democratic institutions (Greif, 1994; Nikolaev and Salahodjaev, 2017, 2016; Kyriacou, 2016; Gorodnichenko and Roland, 2015; Licht et al., 2007; Inglehart and Oyserman, 2004). People in more individualistic cultures are also more likely to tolerate minorities and have higher levels of interpersonal trust and lower levels of corruption (Thornhill and Fincher, 2014; Allik and Realo, 2004), which can further reduce transaction costs and facilitate market exchange leading to higher rates of human and physical capital investment, technological innovation and long-run economic growth (Oyserman et al., 2002; Gorodnichenko and Roland, 2012) and encouraging people to put more effort and get a fairer share of the economic pie (Alesina and Angeletos, 2005). When citizens perceive state institutions to be fair, less corrupt, and more efficient, they are far more likely to tolerate higher taxes and government spending on welfare programs (Dimitrova-Grajzl et al., 2012; Svallfors, 2013; Pitlik and Kouba, 2015; Daniele and Geys, 2015; Pitlik and Rode, 2016). When they trust and care about the well-being of their fellow citizens, they will be more inclined to support welfare programs that benefit others. Finally, when people earn higher incomes, they are more likely to be able to bear the burden of higher taxation while still maximizing their own talents through their free choices.

Understanding the relationship between income inequality and cultural values such as individualism–collectivism is important for several reasons. First, income inequality is strongly correlated with many negative social outcomes such as the concentration of political power and rent-seeking in a society (Stiglitz, 2012; Bartels, 2009). More unequal societies are also more likely to experience higher crime rates, diverging educational outcomes, and lower levels of psychological well-being (Pickett and Wilkinson, 2010) as well as lower levels of socio-economic mobility (OECD, 2011; Krueger, 2012; Dabla-Norris et al., 2015). This is particularly troubling since the gap between the rich and the poor in both developed and developing countries has been growing in recent decades (Bordia Das, 2013; Dabla-Norris et al., 2015). By some measures, the 85 richest people in the world today own as many assets as the poorest 3.5 billion people (Oxfam, 2014) and, according to the World Economic Forum, the widening gap between the rich and the poor is now the most significant challenge facing the world (World Economic Forum, 2015).

Second, individualism is one of the hallmarks of market capitalism and the values associated with it provide the necessary incentives that drive competition, encourage innovation and ultimately lead to economic growth and prosperity. Individual freedom is also the foundation of liberal democracy and is in the core of the narrative that fuels the "American dream." Yet, individualistic values have also received a great deal of scrutiny (Schwartz, 2004).

Finally, while the developmental economics literature has identified a number of determinants of income inequality such as human capital, legal origins, ethnolinguistic fractionalization, technology, factor endowments, globalization, economic growth, and neo-liberal policies, far less is understood about the deep origins of economic inequality. In this paper, we suggest one possible explanation that relies on the provocative PSTV hypothesis, which has recently received significant support in the fields of biology and evolutionary psychology (Thornhill and Fincher, 2014).[2]

2. The parasite stress theory of values

There is by now a sizable literature in biology and evolutionary psychology that supports the theory that cross-country differences in cultural traits associated with the value dimension individualism–collectivism have their origins in the historical prevalence of infectious diseases. Below, we briefly summarize the evidence for the so called Parasite Stress Theory of Values (PSTV), which provides a strong foundation for the 2SLS analysis in this paper. Thornhill and Fincher (2014) provide a comprehensive overview of this literature while Nikolaev and Salahodjaev (2017) discuss the PSTV in the context of economic institutions.

Parasitic (infectious = pathogenic) stress accounts for more evolutionary action across the human genome than any other environmental factor including climate, geography, diet or subsistence strategies (Fumagalli et al., 2011). This is because in human evolutionary history pathogens were a major source of morbidity and consequently of natural selection (Wolfe et al., 2007; Volk and Atkinson, 2013).

[2] Our paper is closely related to a line of research originating from the seminal work of Acemoglu and Robinson (2001) who use settler mortality to explain the deep origins of economic institutions. In this paper, we add an additional layer of explanation of their hypothesis by linking the historical prevalence of infectious diseases to cultural values associated with individualism. We also use a different instrument, which while closely related to settler mortality is based on a rich literature in biology and evolutionary psychology. Finally, we are more interested in the effect of cultural institutions and show that even when we control for economic institutions, cultural values are strongly and significantly correlated with economic outcomes.

There are two main ways in which humans adapted to parasitic stress: (1) adaptation of the physiological immune system at the cellular level, and (2) adaptation of the behavioral (psychological) immune system. This latter type of evolutionary adaptation allowed people to avoid infectious diseases and manage their contagion (Schaller and Duncan, 2007; Fincher and Thornhill, 2008). Examples of psychological adaptations include adaptive feelings (e.g., disgust), cognition (e.g., worry about contagion), and, more importantly, changes in attitudes towards out-group and in-group members. Interpersonal forms of prejudice such as xenophobia, ethnocentrism, or, more generally, prejudice against people who are perceived unfamiliar, unclean, or unhealthy, are at least partially a result from this form of pathogen-avoidance adaptations of the behavioral immune system (Thornhill and Fincher, 2014). A series of experimental studies, for instance, show that when people perceive to be exposed to infectious diseases, they are far more likely to display traits associated with ethnocentrism (Navarrete and Fessler, 2006), the avoidance of outsiders such as immigrants (Faulkner et al., 2004) and even people who are obese (Park et al., 2007). A large body of literature also shows that parasitic stress is strongly correlated to changes in the psychology and social behavior of many other species, including primates (e.g., see Loehle (1995)).

Since host–parasite arm races were geographically localized (Fincher et al., 2008), these two types of evolutionary strategies of the host defense were most effective against local parasite genotypes and less so against pathogens that evolved in out-group hosts. The Parasite Stress Theory of Values, which was first introduced by Thornhill and Fincher (2014), proposes that regions with high levels of parasitic stress were more likely to naturally select personality traits such as xenophobia, neophobia, ethnocentrism, and, more generally, values that disregard the well-being of out-group members, including those at the lower end of the economic ladder. Traits like xenophobia and neophobia, for instance, not only reduce economic transactions between groups and across-regions, but also reward conformity and obedience toward traditional order and discourage novelty. As a result, societies with high degree of pathogenic stress were more likely to develop cultural traits associated with collectivist values (Fincher et al., 2008) that view negatively ideas that can potentially threaten the established social norms. Consequently, corruption, in-group favoritism, and even authoritarianism were more likely social outcomes (Thornhill et al., 2009). From an evolutionary standpoint, these behavioral strategies were mechanisms to stop the spread of infectious diseases.

Societies with low pathogenic stress, on the other hand, developed value systems associated with social tolerance and trust of out-groups (Fincher et al., 2008). Such societies were far more likely to favor inclusiveness and respect for the rights, liberties and well-being of people from differences socio-economic classes, religion, or ethnicity. Cultural values favored openness to new ideas, even if these ideas came from out-groups. From an evolutionary standpoint, this was a successful strategy because it provided social and economic benefits by stimulating the free exchange of goods and services, promoting specialization of labor, lowering transaction costs, and increasing cooperation with out-groups that further encouraged the diffusion of new knowledge. Fig. 2 shows the strong correlation between the historical prevalence of infectious diseases and individualistic values ($r = -.63$; $p = 0.000$).

A number of studies provide empirical support for the PSTV. For instance, Cashdan and Steele (2013) show that people in societies with high degree of infectious diseases are more likely to raise children with collectivism values. van Leeuwen et al. (2012) show that high prevalence of parasitic stress robustly predicts variety of cultural practices associated with in-group favoritism. Similarly, Fincher et al. (2008) find a strong link between the historical prevalence of infectious diseases and the value dimension individualism–collectivism, with societies that were exposed to less pathogenic stress developing strong individualistic values. Furthermore, Murray et al. (2011) provide four separate tests that the origins of cultural conformity are strongly correlated with the historical distribution infectious diseases across countries. Studies also find a strong link between parasitic stress and authoritarian regimes (Murray et al., 2013; Thornhill et al., 2009). Finally, a more indirect test for

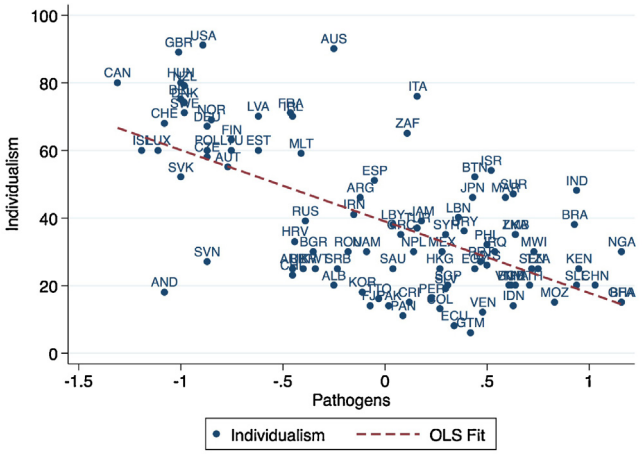

Fig. 2. Historical prevalence of infectious diseases and individualism. Source: Data on individualism were collected from https://geert-hofstede.com/. Data on the historical prevalence of pathogens came from Murray et al. (2011).

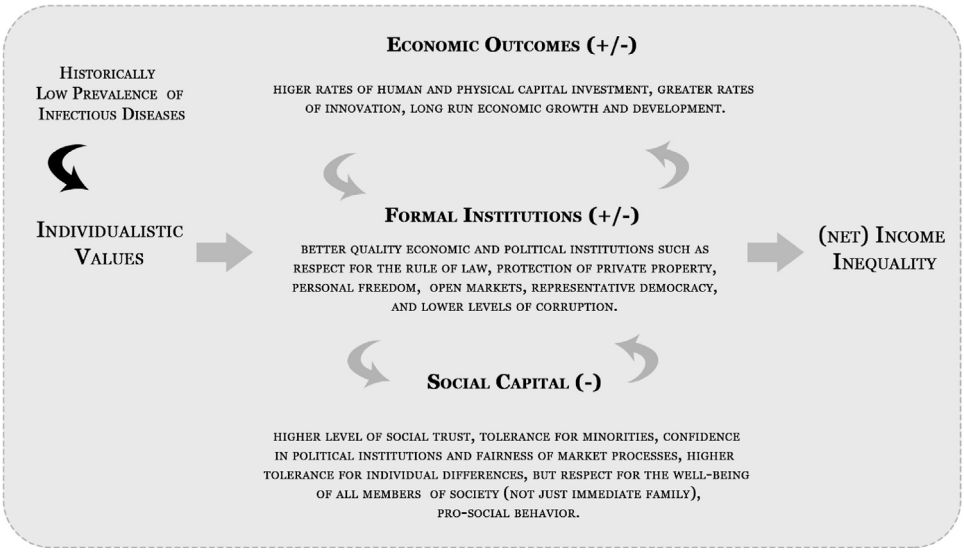

Fig. 3. Pathogens, individualism and income inequality.

the PSTV hypothesis comes from the observation that regions located near the equator, which have high degree of infectious diseases, are more likely to have collectivist values compared to societies at higher latitudes (Hall and Jones, 1999).

Thus, the PSTV provides the critical link for our econometric estimations which are based on the hypothesis that societies with low pathogenic stress were more likely to develop cultural values that favor inclusive economic and political institutions (e.g., respect for the rule of law, representative democracy, etc.), higher levels of social tolerance and trust, which can then lead not only to higher investment in human and physical capital, and long-run growth, but also to the natural selection of personality traits that favor respect for the rights, liberties, and well-being of all members of society, not just members of the family or the clan.

Theoretically, then, the effect of individualistic values on income inequality is ambiguous. On the one hand, tolerance for individual differences and pro-market economic institutions that encourage people to innovate and be rewarded with extraordinary wealth as well as anti-interventionist attitudes can lead to higher income inequality. On the other hand, more inclusive economic and political institutions, lower levels of corruption, higher investment in human capital, tolerance for minorities, greater levels of social trust, and less in-group favoritism can lead to lower levels of income inequality. Fig. 3 shows this mechanism.

To test this hypothesis, we use a two stage least squares (2SLS) model in which we use the historical prevalence of infectious diseases as a source of regional exogenous variation for cultural values, which we proxy with the multifaceted value system of individualism–collectivism. As Oishi et al. (1998) define it, collectivism is characterized by strong values placed on tradition and conformity while individualism is defined by greater tolerance for deviations from the status quo. IC values, then, in the next stage, explain differences in income inequality across countries.

3. Data

Below we provide a brief overview of the main variables used in this study.

3.1. Income inequality

Measures of income inequality vary tremendously within and across countries. Deininger and Squire (1996), for instance, identify more than 2600 calculations of Gini coefficients that have been made across countries and over time. Some of these calculations use national samples, others rely on rural or urban samples; some are at the household level, others at the individual level; some are based on expenditures while others use income. Thus, one of the biggest challenges in cross-country studies on income inequality has been the lack of comparable data.

In this study, we use the net Gini coefficient from the Standardized World Income Inequality Database v.4 (SWIID) as a measure of net income inequality (Solt, 2016). The SWIID dataset incorporates and standardizes data from a large number of sources such as the United Nations University's World Income Inequality Database, the OECD Income Distribution Database, the Socio-Economic Database for Latin America and the Caribbean generated by CEDLAS and the World Bank, Eurostat, the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Caribbean, national statistical offices around the world, and academic studies while minimizing reliance on problematic assumptions by using as much information as possible from proximate years within the same country. The data collected by the Luxembourg Income Study is employed as

the standard. Thus, the SWIID dataset maximizes the comparability of income inequality data while maintaining the widest possible coverage across countries and over time. In our dataset income inequality ranges from 18.47 in Mauritius to 62.77 in Namibia. The mean global net GINI coefficient is 39 (median level is 40).

3.2. Historical prevalence of infectious diseases

The measure of historical prevalence of infectious diseases is based on the index developed by Murray and Schaller (2010), which shows the magnitude to which nine infectious diseases (leishmanias, schistosomes, trypanosomes, leprosy, malaria, typhus, filariae, dengue, and tuberculosis) have been historically prevalent within countries. This index is estimated based on the regional pathogen prevalence data derived from old epidemiological maps provided in Rodenwaldt and Bader (1952–1961) and summarized by Simmons et al. (1944).

To ensure the comparability across different diseases, the pathogens prevalence data was brought down to a common unit of measurement. To do so, Murray and Schaller (2010) first standardize pathogen prevalence ratings by converting them to z scores. In the next stage, the overall pathogen prevalence index is estimated as the simple average of z scores of the nine diseases. Thus, the mean of the overall index is close to 0, with positive values suggesting that the historical prevalence of pathogens is higher than the mean, and negative scores indicating disease prevalence that is lower than the mean.

To establish validity, Murray and Schaller (2010) show that their index is strongly correlated ($r = 0.90$) with the disease prevalence index by Gangestad and Buss (1993) and with the contemporary parasite prevalence index ($r = 0.84$) by Fincher et al. (2008). In this study, we prefer the index by Murray and Schaller (2010) because it is available for almost 100 nations and geopolitical regions.

3.3. individualism–collectivism

The best known international measure of individualism and collectivism is the one originally developed by Hofstede (1980) who initially focused on how values in the workplace are shaped by culture. As suggested by Hofstede et al. (1991) "individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after himself or herself and his or her immediate family." In contrast, collectivism "pertains to societies in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty."

To collect these data, Hofstede and co-authors originally disseminated questionnaires among 100,000 IBM employees worldwide. Based on answers to fourteen "work goal" questions, the authors obtained IC scores for 40 countries. To avoid cultural bias, the translation of the questions was done by a team of English and local language speakers. While the original survey was based on IBM employees, subsequent waves of the survey and replication studies included a variety of sub-groups such as airline pilots, students, civil service managers, and "up-market" consumers and elites (Hofstede, 2010). The most current version of the international values survey module (2013) includes 24 values questions that respondents rate on a scale from 1 = most important to 5 = least important.[3] Using factor analysis, Hofstede finds that the index of individualism is the first factor (Cronbach's alpha = 0.770) that emerges in questions about the value of personal time, freedom, achievement, interesting and fulfilling work, etc. Thus, Hofstede et al. (1991) suggest that there are a number of key differences between collectivist and individualist societies that they summarize in two categories: (1) general norms, family, school, and workplace, and (2) politics and ideas. Table A1 in the supplementary Appendix provides a summary of these differences.

Although Hofstede's data were originally collected to study differences in IBM's corporate culture, the main advantage of using this measure of individualism–collectivism is that it has been replicated in a number of other studies – e.g., by Hoppe (1990) on parliaments, labor and employer leaders, academics and artists in 18 countries, by Shane (1995) across 28 countries for international companies other than IBM, by Merritt (2000) on commercial airline pilots in 19 countries, by van Nimwegen (2002) among employees of an international bank in 19 countries, by Wu (2006) on employees from US and Taiwanese universities, by Mouritzen and Svara (2002) among municipal public servants in 14 countries, and by De Mooij (2010) among consumers in 15 European countries.

Hofstede's scores have been also used extensively in the cross-country empirical literature. His theory has become the paradigm for research in several fields including cross-cultural psychology, international management, entrepreneurship, etc. and his cultural dimensions have been used in over 2000 studies. Recently, research in economics (Gorodnichenko and Roland, 2011) has also focused and used extensively the Hofstede's measure of individualism–collectivism.

Since the individualism–collectivism component loads positively on values such as individual freedom, opportunity, achievement, advancement, recognition, and loads negatively on values such as harmony, cooperation, and relations with supervisors, Gorodnichenko and Roland (2012) note that, broadly defined, individualism emphasizes the values of personal freedom, affective autonomy, and achievement. In that sense, individualistic cultures award social status to personal achievements such as innovation, discoveries, or artistic achievements with high social status (Gorodnichenko and Roland, 2012).

[3] These questionnaire can be found at http://www.geerthofstede.nl/.

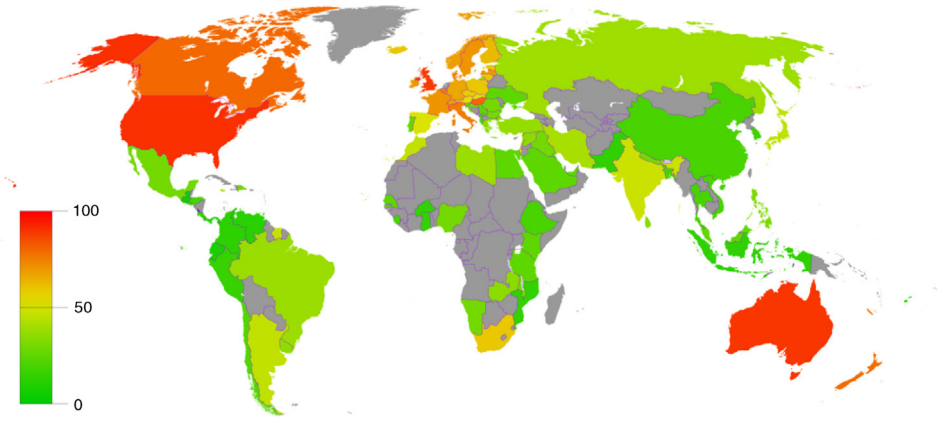

Fig. 4. Individualism across countries.

A stylized empirical fact that emerged from a series of follow-up studies is that developed and industrialized nations are more likely to be associated with greater prevalence of individualism whereas less developed, traditional and agricultural societies are more likely to preserve collectivistic values (Hofstede et al., 1991). The empirical literature since then has successfully linked individualistic cultural traits to better quality political and economic institutions, long-run economic growth, and higher levels of social capital (Gorodnichenko and Roland, 2011; Ball, 2001; Mazar and Aggarwal, 2011; Van Hoorn, 2014; Allik and Realo, 2004; Nikolaev and Salahodjaev, 2017; Thornhill and Fincher, 2014).

In this study, we use the most recently updated dataset from Hofstede et al. (1991) which covers close to 100 countries.[4] The IC scores are standardized and rescaled from 0 (most collectivistic) and 100 (most individualistic). Fig. 4 presents a heat map for the worldwide distribution of IC scores.

3.4. Control variables

To reduce potential omitted variable bias we also incorporate a vector of antecedents of income inequality that have been drawn from the extant literature. This set of control variables includes legal origins, GDP per capita, latitude, local factor endowments, economic institutions, human capital, ethnic diversity, ethnolinguistic fractionalization, and religious denominations (La Porta et al., 2000, 1999; Acemoglu and Robinson, 2001; Sturm, 2015; Gallup et al., 1999; Engerman and Sokoloff, 2012). Because the variables for the main analytical part of this study – individualism and the historical prevalence of pathogens – are available for less than 100 countries, once we merge our dataset and eliminate missing observations, we are left with up to 88 observations. Adding additional variables such as local factor endowments furthermore decreases our dataset to 71 countries. Descriptive statistics are presented in Table 1.

4. Empirical estimates

In this section, we report the results from our empirical estimations. First, we present some descriptive evidence that individualism is strongly and significantly correlated with income inequality using a standard least squares estimator. In the next stage, we re-estimate the association between income inequality and cultural values using a two stage least square (2SLS) estimator in which we use the historical prevalence of infectious diseases as an instrument for IC values.

4.1. IC values and income inequality: OLS estimates

We start the analysis by estimating a conventional cross-country regression model where net income inequality ($Inequality_c$) is a function of IC values ($Individualism_c$) and a vector of control variables ($Controls_c$) as discussed above. The econometric model can be expressed as:

$$Inequality_c = \mu + \alpha Individualism_c + Controls_c + \epsilon_c \quad (1)$$

where α is the main coefficient of interest which shows the association between individualism and net income inequality, and ϵ_c is a random error term satisfying normality assumptions.

The results are displayed in Table 2. Column (1) reports a simple bivariate regression model where the net Gini coefficient is regressed only on the IC index and suggests a significant negative association between the two. The results imply that

[4] The most recent dataset can be found at https://geert-hofstede.com/.

Table 1
Summary statistics.

Variable	Description	Source/Year	Mean	Std. Dev.	Min	Max
Gini (net)	Net Gini coefficient measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.	Standardized World Income Inequality Database v.4 (SWIID)/Solt (2016)	39.261	9.404	18.473	62.774
Individualism	Index that measures the degree to which a society accepts and reinforces individualist or collectivist values. The index ranges from 0 (most collectivistic) and 100 (most individualistic)	Hofstede et al. (1991)/2010	39.170	22.075	6	91
Pathogens	Index measuring the historical prevalence of infectious diseases in a particular country. When available the pathogen index is derived from epidemiological maps of infectious diseases before the introduction of modern medicine. Therefore, Murray and Schaller (2010) dataset provides a robust deep-rooted measure of the historical prevalence of infectious diseases. These epidemiological maps and summaries presented in Simmons et al. (1944).	Murray and Schaller (2010)	0.15	0.66	−1.31	1.17
Legal Origins	Legal origins dummies for UK, France, Socialist, German, and Scandinavian = 1 if legal origin; 0 otherwise	La Porta et al. (2000)	0.174	0.380	0	1
Latitude	Value of the latitude of a country's approximate geodesic centroid	La Porta et al. (2000)	19.062	24.215	−41.806	74.728
Log GDP per capita	The logged value of GDP per capita, PPP	World Bank/2013	9.193	1.219	6.340	11.807
Percent Muslim	Share of population Muslim	La Porta et al. (2000)	21.725	35.050	0	99.9
Percent Catholic	Share of population Catholic	La Porta et al. (2000)	31.493	35.502	0	99.1
Percent Protestant	Share of population protestant	La Porta et al. (2000)	15.151	23.730	0	99.8
Ethnolinguistic Fractionalization	Index that captures the probability that two individuals, selected at random from a country's population, will belong to different ethnic groups	Alesina et al. (2003)	0.439	0.258	0	0.930
Economic Freedom	Index of economic freedom evaluates countries on broad dimensions of economic environment over which governments typically exercise policy control. Values range from 0 (least free) to 100 (most free).	Heritage Foundation / 2014	60.696	10.343	29.6	89.6
Human Capital	Average years of schooling	Barro and Lee (2013)/ 2013	6.524	2.933	0.864	12.686
Power Distance	This index measures the degree to which the less powerful members of a society accept and expect that power is distributed unequally.	Hofstede et al. (2010) / 2010	64.240	21.011	11	100
Property Rights	Sub index of economic freedom which measures the degree to which a country's laws protect private property rights and the extent to which those laws are respected.	Heritage foundation / 2014	42.235	24.866	5	95
Corruption Index	Sub index of economic freedom which measures the extent to which corruption prevails in a country.	Heritage Foundation / 2014	42.021	19.639	6.7	91
Global Innovation Index	The Global innovation index ranks the innovation performance of countries and economies	Cornell University, INSEAD and WIPO (2015) / 2015	37.133	11.647	15	68.3
Life Expectancy	Average life expectancy	World Bank, 2013	71.147	8.569	48.938	83.831
Tropics	Share of population living in the tropics	Ashraf and Galor (2013)	0.471	0.477	0	1
Wheat-Sugar	Suitability of climate and land endowments for growth wheat relative to sugar. Measured as: log[(1 +share of arable land suitable for wheat)/(1 +share of arable land suitable for sugarcane)].	Easterly (2007)	0.172	0.16	0	0.58
UTIP	Gross household income Gini coefficient. Predicted from econometric relationship between manufacturing pay inequality, Gini coefficients from the World Income Inequality Database, and other independent variables.	Galbraith and Kum (2005)	42.90	6.69	25.99	64.25
90/10	The ratio of the average income of the richest 10% to the poorest 10%	Human Development Report (2009)	20.121	16.87	4.08	86.01
80/20	The ratio of the average income of the richest 20% to the poorest 20%	Human Development Report (2007/2008)	10.138	6.589	3.09	37.32
Embeddedness (vs Autonomy)	Index that reflects the extent to which people are in a collectivity and find meaning through identifying with the group, participating in a shared way of life, and striving towards shared goals. In embedded societies high value is placed on the status quo and avoiding individual actions that might undermine traditional order. Values range from 0 (not at all important) to 6 (very important).	Schwartz (2008)	3.80	0.39	3.01	4.63
Affective Autonomy	Index of affective autonomy that reflects the extent to which people are encouraged to pursue pleasure, seek enjoyment by any means. Values range from 0 (not at all important) to 6 (very important).	Schwartz (2008)	3.42	0.51	2.13	4.39
Intellectual Autonomy	Index of affective autonomy that reflects the extent to which people are encouraged to pursue independent ideas and thoughts, whether theoretical or political. Values range from 0 (not at all important) to 6 (very important).	Schwartz (2008)	4.31	0.38	3.58	5.13

Table 2
OLS results, individualism and income inequality (Net GINI).

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Income Inequality (Net GINI)						
Individualism	−0.238***	−0.184***	−0.141***	−0.144***	−0.114**	−0.029
	(0.032)	(0.031)	(0.040)	(0.048)	(0.061)	(0.050)
Legal origins: Socialist		0.611	1.332	0.908	0.567	0.639
		(1.897)	(1.853)	(2.025)	(2.280)	(2.760)
Legal origins: French		9.210***	6.756***	8.606***	6.620**	4.204
		(1.719)	(1.755)	(2.216)	(2.649)	(2.642)
Legal origins: UK		12.315***	8.881***	8.060***	6.176**	5.479***
		(1.844)	(1.717)	(1.984)	(2.506)	(1.965)
Legal origins: Scandinavian		−1.842	−0.409	−5.986	−5.409	−1.338
		(1.268)	(1.213)	(3.737)	(4.098)	(4.301)
Latitude			−0.115***	−0.087*	−0.076	−0.109***
			(0.042)	(0.044)	(0.047)	(0.039)
Log GDP per capita				−0.307	−0.496	4.272**
				(1.064)	(1.626)	(2.090)
Percent Muslim				−0.028	−0.061	−0.089**
				(0.039)	(0.042)	(0.039)
Percent Catholic				−0.022	−0.008	−0.018
				(0.027)	(0.029)	(0.025)
Percent Protestant				0.069	0.029	0.033
				(0.058)	(0.053)	(0.051)
Ethno Fractionalization				4.517	4.674	2.942
				(3.567)	(3.387)	(2.929)
Economic Freedom					−0.025	0.339**
					(0.132)	(0.160)
What-Sugar					−8.991*	−4.152
					(5.285)	(4.200)
Human Capital						−2.021***
						(0.536)
Global Innovation						0.010
						(0.149)
Corruption Index						−0.210**
						(0.095)
Trade Freedom						0.015
						(0.172)
Property Rights						−0.077
						(0.092)
Observations	88	88	88	85	71	70
R-squared	0.305	0.547	0.602	0.609	0.622	0.725

Note: All models are estimated with OLS with robust standard errors reported in parentheses. See Table 1 for descriptive statistics and sources of all variables. Legal origins "German" is used as a reference group.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

one standard deviation increase in the IC index is associated with more than a half standard deviation decrease in income inequality. The R-squared furthermore indicates that the IC index alone explains nearly 30 percent of global variations in income inequality. This negative effect remains strong and significant when we control for legal origins (column 2), latitude (column 3), as well as economic development, ethnolinguistic fractionalization, and the share of population that belongs to different religious denomination (column 4), variables that have been previously found to be correlated with economic inequality in the extant literature (La Porta et al., 2000, 1999; Acemoglu and Robinson, 2001; Sturm, 2015; Gallup et al., 1999).

An important theory that explains the persistence of income inequality over time comes from the work of economic historians Engerman and Sokoloff (2012) who hypothesize that contemporary inequality has its deep origins in local factor endowments such as climate, geography and natural resources. More specifically, when factor endowments were favorable for the establishment of large slave plantations and/or mines, the economic and political elite established rules and policies intended to promote their own economic interests. This, in turn, created inequality before the law characterized by unfavorable and biased access to private property rights, contract enforcement, and corrupt judicial system. Inequality before the law, then, stifled economic mobility by hindering access to economic opportunities for the masses creating a culture characterized by persistently high levels of economic inequality for subsequent generations.[5] On the

[5] Easterly (2007) calls this type of persistent inequality, structural inequality. This hypothesis has recently received support in the empirical literature (Bennett and Nikolaev, 2016).

other hand, when factor endowments were more favorable for small scale farming that could efficiently grow grains such as wheat and corn, then property rights we more evenly distributed across all income classes. A related story is the settlement conditions hypothesis by Acemoglu and Robinson (2001), who argue that the settlement conditions faced by European colonists ultimately affected the development of economic institutions such as the protection of property rights. When settlement conditions were favorable, European colonists had a much greater incentives to settle permanently and to develop more inclusive economic institutions which respected the rights and liberties of all income classes.

Thus, in column 5, we furthermore control for economic institutions and local factor endowments. As a measure of economic institutions, we use the index of Economic Freedom published by the Heritage Foundation, which is a complex composite indicator that assesses the quality of the institutional environment based four basic pillars – rule of law, regulatory efficiency, government size, and open markets. As a measure of local factor endowments we use a measure for the suitability of land and climate for growing wheat relative to sugarcane (wheat-sugar), a variable that was originally developed by Easterly (2007).[6] Even after controlling for the quality of economic institutions and local factor endowments, we find that individualism is negatively and significantly correlated (at the 5 percent level) with net income inequality.

Finally, we control for a number of possible channels through which individualism can possibly affect income inequality such as human capital, innovation, trade freedom, corruption, and property rights. Once we do this, our individualism index loses its significance and the magnitude of the effect become negligible, suggesting that many of the benefits of individualism possible work through these channels. This result, however, is expected since these are major channels through which individualism might affect income inequality as we suggest in our theoretical section. We provide further tests for these channels in Section 4.7 where we show that our individualism measure is strongly and significantly correlated with these channels.

The estimates reported in Table 2 provide strong support for a significant association between cultural values, measured by our IC index, and income inequality, measured by the net GINI coefficient. Of course, these results are merely correlational and do not imply causality. It could be argued, for instance, that countries with a more equal distribution of income foster social institutions which nurture collectivist values. In this case, however, the relationship should go in the opposite direction. Yet, it is possible that in more equal societies, individuals may have more opportunities to succeed on their own and it might be more natural for individualistic values to develop. Moreover, mean regression estimators ignore potentially unobserved variables that can be correlated with both individualism and income inequality simultaneously causing omitted variable bias.

One way to address this issue is to identify an external instrument for IC values that is strongly correlated with individualism/collectivism, but uncorrelated with all unobserved antecedents of income inequality. In other words, this instrument should have an effect on income inequality only through its direct effect on individualism and not through other channels that are unobserved in our regressions.

4.2. Two stage least squares estimations

In this sub-section, we use the historical prevalence of infectious diseases, proxied with the pathogen index by Murray and Schaller (2010), as an instrumental variable (IV) for IC cultural values, which then predict income inequality, measured by the net GINI coefficient, in the second stage. Section 2 provides rationale for the use of this IV based on the provocative Parasite-Stress Theory of Values, which suggests that the historical prevalence of pathogens affects the net distribution of income through the channel of cultural values. Since contemporary levels of income inequality are not likely to influence the historical variations of infectious diseases across countries, we are also less worried about reverse causality.

The exclusion restriction implied by our instrumental variable estimation is that, conditional on other controls in our model, the historical prevalence of infectious disease has no effect on income inequality today other than its effect through the individualism-collectivism dimension of cultural values. However, there are two main limitations to our analysis. First, our instrument may be correlated with the current health of nations which is related to income inequality. Second, pathogens may be linked to other cultural values that may predict income inequality. As we show later in our analysis, however, even when we control for the current level of the health of nations and additional cultural dimensions, individualism is still significantly and negatively correlated with income inequality. This seems to support the findings of a number of previous studies described in Section 2.

Equations (2) and (3) illustrate the first and second-stages of our model. In the first stage, we regress our IC index, $Individualism_c$, on the historical prevalence of infectious disease index, $Pathogens_c$ and a set of controls, $Controls_c$, similar to

[6] Wheat-sugar is measured as the log of the ratio of one plus the share of arable land suitable for the growth of wheat plus the share of arable land suitable for growing sugar.

the ones in equation (1). In the next stage, we use the predicted values of our IC index, $\widehat{Individualism}_c$, to estimate net income inequality, $Inequality_c$ while controlling for a set of confounding variables.

$$Individualism_c = \beta Pathogens_c + Controls_c + \epsilon_c \quad (2)$$

$$Inequality_c = \alpha \widehat{Individualism}_c + Controls_c + \nu_c \quad (3)$$

The 2SLS estimates are presented in Table 3. Panel A of Table 3 provides the results from the second stage regression while Panel B presents the first stage results. Across all specification we document that the historical prevalence of infectious diseases is inversely related to the IC score in the first stage as predicted by the PSTV, which then is a significant predictor of income inequality in the second stage. If causal, the results from the bivariate specification in column (1), for instance, suggest that when our IC index increase by one standard deviation, income inequality declines by 9 percentage points, approximately one standard deviation. Turning to control variables, we find that compared to countries with Dutch legal origins, countries with Napoleonic and British common law are associated with higher levels of net income inequality. After controlling for religion, geography, economic development, the quality of the institutional environment, and local factor endowments, income inequality is still higher in more developed countries.

Here, it is important to note that the magnitudes suggested by our OLS estimations are smaller (on a magnitude of 4) compared to our 2SLS estimates. One possible reason for this difference has to do with the nature of the estimation procedure. OLS estimates the average treatment effect (over the entire population) while the 2SLS coefficients show estimates of the

Table 3
Two-stage least squares (2SLS) results, individualism and income inequality.

	1	2	3	4	5	6
Panel A: 2SLS results	Dependent Variable: Income Inequality (Net GINI)					
Individualism	−0.406***	−0.259***	−0.214***	−0.372***	−0.454**	−0.205
	(0.0608)	(0.0494)			(0.245)	(0.256)
			(0.0529)	(0.123)		
Legal origins: Socialist		0.00807	0.653	2.236	4.212	4.087
		(3.341)			(4.740)	(5.672)
			(3.120)	(3.701)		
Legal origins: French		7.514**	5.805*	10.79**	12.02**	7.450
		(3.245)			(5.943)	(5.691)
			(3.049)	(4.191)		
Legal origins: UK		11.55***	9.013***	11.83***	15.81*	10.93
		(3.184)			(8.091)	(8.361)
			(3.093)	(4.241)		
Legal origins: Scandinavian		−0.599	0.322	−11.42*	−4.992	−3.076
		(4.176)	(3.880)	(6.681)	(7.332)	(6.143)
Latitude			−0.0889**	−0.0185	−0.000926	−0.0830
			(0.0358)	(0.0554)	(0.0722)	(0.0510)
Log GDP per capita				1.801	2.865	5.098***
				(1.386)	(2.645)	(1.726)
Percent Muslim				−0.0230	−0.0721	−0.0888***
				(0.0392)	(0.0477)	(0.0337)
Percent Catholic				−0.0180	−0.0241	−0.0225
				(0.0310)	(0.0359)	(0.0249)
Percent Protestant				0.183**	0.114	0.0769
				(0.0852)	(0.0976)	(0.0898)
Ethno Fractionalization				2.793	4.018	3.633
				(4.339)	(4.939)	(3.334)
Economic Freedom					0.154	0.213
					(0.190)	(0.264)
What-Sugar					0.339	−1.207
					(9.871)	(6.338)
Human Capital						−2.103***
						(0.493)
Global Innovation						0.0692
						(0.191)
Corruption Index						−0.117
						(0.151)
Trade Freedom						0.0563
						(0.185)
Property Rights						−0.0328
						(0.115)
Observations	86	86	86	83	69	68
R-squared	0.138	0.542	0.605	0.524	0.446	0.750
IV F-stat	78.37	66.80	51.99	12.08	3.690	1.886

Table 3 (*Continued*)

	1	2	3	4	5	6
Panel B: First stage	Dependent Variable: Individualism Index					
Pathogens	−23.68***	−25.46***	−23.41***	−16.68***	−10.21*	−7.071
	(2.675)	(3.115)	(3.247)	(4.800)	(5.314)	(5.149)
Legal origins: Socialist		−6.920	−7.531	−0.705	6.466	16.73*
		(8.216)	(8.089)	(8.675)	(8.694)	(9.147)
Legal origins: French		−0.879	2.291	13.31	16.77*	19.15**
		(8.008)	(8.050)	(9.278)	(9.237)	(9.168)
Legal origins: UK		7.540	11.53	17.98**	26.93***	30.47***
		(8.084)	(8.221)	(8.541)	(8.641)	(8.175)
Legal origins: Scandinavian		4.634	2.589	−18.88	−2.333	−12.42
		(10.25)	(10.14)	(14.01)	(15.64)	(14.98)
Latitude			0.161*	0.222**	0.191*	0.114
			(0.0843)	(0.0962)	(0.0968)	(0.101)
Log GDP per capita				2.573	5.955	0.914
				(2.765)	(3.632)	(4.812)
Percent Muslim				−0.0449	−0.0763	−0.0243
				(0.0927)	(0.100)	(0.0983)
Percent Catholic				−0.0438	−0.0671	−0.0310
				(0.0755)	(0.0776)	(0.0734)
Percent Protestant				0.302**	0.202	0.254*
				(0.147)	(0.157)	(0.145)
Ethno Fractionalization				−13.28	−7.239	−4.075
				(9.561)	(10.24)	(9.488)
Economic Freedom					0.403	−0.799*
					(0.303)	(0.452)
What-Sugar					16.89	9.317
					(16.45)	(15.34)
Human Capital						−0.706
						(1.453)
Global Innovation						0.467
						(0.463)
Corruption Index						0.364
						(0.297)
Trade Freedom						0.312
						(0.450)
Property Rights						0.305
						(0.233)
Observations	86	86	86	83	69	68
R-squared	0.483	0.534	0.555	0.605	0.697	0.778

Note: Panel A reports the 2SLS estimates with the net Gini coefficient. Panel B reports the corresponding first stage. See Table 1 for summary statistics and description of all variables. "Legal Origins: German" is used as a reference group. Robust standard errors are reported in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

local average treatment effect, which could be larger for a sub-sample of countries (i.e., the local treatment effect is larger because the IV may affect only certain countries within our sample for which the effect of becoming more individualistic is much higher than the average effect over the entire population). In fact, additional tests based on a procedure outlined by Huang et al. (in press) allowed us to calculate that the proportion of "compliers" is 42.3 percent.[7]

The F-test statistic presented at the bottom of Table 3 assesses the credibility of our instrument. In the case of a single instrument and a single endogenous regressor, the t-value of the instrument should be greater than 3.2, i.e., the rule of thumb is that the F-statistic of the joint test whether all excluded instruments are significant should be greater than 10 (Staiger and Stock, 1994). This is the case in all five models, which provides further confidence for the choice of instrument in our study.

4.3. Robustness with additional controls

There are two main challenges to the empirical estimations so far. First, while it is highly unlikely that regional variation in the historical prevalence of infectious diseases directly influenced differences in income inequality today, it is possible that the current health of nations, which might influence income inequality today, is strongly correlated with the historical prevalence of infectious diseases. Second, it is also likely that the historical prevalence of infectious diseases influenced other cultural values which then influenced the net distribution of income. In both cases, our IV variable, the historical prevalence of parasitic stress, will be correlated with the error term in the second stage of our 2SLS model and our results will be biased.

[7] This analysis is available upon request.

Table 4
Robustness, additional controls.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: 2SLS results	Dependent variable: income inequality (net Gini)						
Individualism	−0.233***	−0.270**	−0.243***	−0.233***	−0.223***	−0.274***	−0.301**
	(0.0819)	(0.120)	(0.0858)	(0.0813)	(0.0851)	(0.0894)	(0.119)
Life expectancy	−0.359**						−0.540**
	(0.167)						(0.221)
Tropics		−2.175					−5.062
		(3.536)					(4.425)
Masculinity			0.00668				0.0253
			(0.0466)				(0.0553)
Uncertainty				−0.0891**			−0.130**
				(0.0409)			(0.0552)
Long term orientation					0.0423		−0.000273
					(0.0491)		(0.0559)
Indulgence						−0.00479	−0.00717
						(0.0440)	(0.0495)
Observations	84	83	84	84	73	69	68
R-squared	0.615	0.571	0.586	0.616	0.579	0.508	0.578
IV F-stat	21.33	12.93	21.78	21.93	21.68	20.63	12.25
Durbin pval	0.113	0.111	0.0755	0.126	0.0883	0.0116	0.0384
Panel B: First Stage	Dependent variable: Individualism index						
Pathogens	−19.44***	−14.76***	−19.21***	−19.56***	−20.69***	−21.79***	−16.93***
	(4.209)	(4.103)	(4.117)	(4.177)	(4.443)	(4.799)	(4.838)
Observations	84	83	84	84	73	69	68
R-squared	0.574	0.635	0.591	0.580	0.578	0.580	0.686

Note: Panel A reports the 2SLS estimates with the net Gini coefficient. Panel B reports the corresponding first stage. See Table 1 for summary statistics and description of all variables. All models include legal origins, latitude, and logged GDP as additional controls. "Legal Origins: German" is used as a reference group. Robust standard errors are reported in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

To address these issues, in Table 4 we re-estimate our main model from Table 2 by including a number of variables that proxy other cultural dimensions and the current health of nations. Model 1, for instance, controls for life expectancy as a measure of the current health of nations. Model 2 controls for the share of the population living in the tropics. Societies located around the tropics are subject to a larger number of infectious diseases compared to societies at higher latitudes (Thornhill and Fincher, 2014) and this variable has previously been linked to income inequality (Easterly and Levine, 2003). In models 3 to 6 we control for other cultural dimensions such as masculinity, uncertainty, long term orientation and indulgence (Hofstede and Hofstede, 2001). We do not include the cultural dimension Power Distance, which represents the degree to which the less powerful members of a society accept and expect that power is distributed unequally, because in our sample individualism and power distance are highly correlated ($r = -0.79$, $p = 0.000$) likely capturing similar cultural values. Finally, in column 7 we include all of these additional controls in one specification and close the channels through which pathogens can affect income inequality. In all instances, the coefficient on our individualism-collectivism index remains negative and statistically significant at conventional levels. These findings are consistent with previous research which finds that the IC dimension of culture is the most robust determinant of different economic outcomes including long-run growth (Gorodnichenko and Roland, 2011) and the quality of economic and political institutions (Nikolaev and Salahodjaev, 2017). It is possible, of course, that other omitted cultural variables are correlated with both the historical prevalence of infectious diseases and income inequality, which would violate the exclusion restriction. As most studies in cultural psychology and more recently economics, however, we believe that the IC dimension is the most important one in the context of the PSTV theory (Thornhill and Fincher, 2014).

4.4. Robustness with sub-samples

Up to this point, we have ignored potential heterogeneity across countries in our sample. It is possible of course that individualism may exert different impact on income inequality across different regions. Therefore, we replicate our 2SLS estimations by taking into account the role of geography. The results are reported in Table 5. The effect of instrumented individualism on net GINI remains negative and significant when we include regional dummies (column 1), exclude Africa (column 2), North America (column 4), South America (column 5) and finally potential influential observations (column 7).[8]

[8] Fig. A1 in the Appendix shows a plot of the normalized residuals and their leverage, which helps us identify influential observations.

Table 5
Robustness, sub-samples.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: 2SLS							
Individualism	−0.249**	−0.322***	−0.236*	−0.283***	−0.265***	−0.182	−0.249**
	(0.122)	(0.0890)	(0.122)	(0.0921)	(0.0820)	(0.133)	(0.113)
Controls	√	√	√	√	√	√	√
Continental Dummies	√	×	×	×	×	×	×
Excluded	Whole Sample	No Africa	No Asia	No North America	No South America	No Europe	No Influential Observations
Observations	84	69	66	75	77	52	78
R-squared	0.605	0.577	0.640	0.582	0.559	0.311	0.642
IV F-stat	11.91	19.27	9.183	19.91	24.29	7.210	17.340
Panel B: First Stage							
Pathogens	−16.09***	−20.06***	−18.35***	−19.21***	−21.87***	−15.84**	−15.67***
	(4.663)	(4.568)	(6.056)	(4.305)	(4.437)	(5.900)	(5.016)
Controls	√	√	√	√	√	√	√
Continental Dummies	√	×	×	×	×	×	×
Excluded	Whole Sample	No Africa	No Asia	No North America	No South America	No Europe	No Influential Observations
Observations	84	69	66	75	77	52	78
R-squared	0.671	0.624	0.638	0.564	0.584	0.388	0.580

Note: Panel A reports the 2SLS estimates with the net Gini coefficient. Panel B reports the corresponding first stage. See Table 1 for summary statistics and description of all variables. "Legal Origins: German" is used as a reference group. Robust standard errors are reported in parentheses. All models include legal origins, latitude, and logged GDP, religion, and ethnolinguistic fractionalization as additional controls.

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

However, this effect is only marginally significant when we exclude Asia (column 3) and is insignificant when we exclude Europe (column 6). One possible explanation for the result in column 6 is that majority of the individualistic countries in our sample are located in Europe. Removing these observations leaves us with very little variation in the individualism variable, which explains the insignificant results.

4.5. Alternative measures of inequality

Even though the Gini coefficient has been the most popular measure of the distribution of income, there are a number of limitations to using it as a measure of income inequality. For example, because the Gini coefficient is a relative measure, it is possible that inequality in a country increases while at the same time the absolute level of living standards improves, including those at the bottom of the income distribution. Similarly, growing income inequality can be due to structural changes in society related to population growth or immigration. De Maio (2007) provides an excellent review of the limitations of the Gini coefficient and suggests a number of alternative measures including the Atkinson index of inequality, the generalized entropy index, and others. Unfortunately, none of these alternative measures are available for a large cross-section of countries.

A more general concern is whether our results will replicate with alternative measures of income inequality for different years. Therefore, in Table 6 we provide several additional tests using alternative measures of income inequality for different years. In column 1, we present our baseline results with the net Gini coefficient. Next, in column 2, we use a Gini measure of gross household income inequality from the University of Texas Inequality project (Galbraith and Kum, 2005). In column 3, we use the ratio of the average income or share of expenditures of the richest 10 percent to the poorest 10 percent of income earners, the so called 90/10 ratio, from the 2009 Human Development Report. Finally, in column 4, we use the 80-20 ratio, the ratio of the average income of the richest 20 percent to the poorest 20 percent, from the 2007 Human Development Report. In all models, the coefficient on income inequality is negative and statistically significant and, overall, the results are consistent with our previous findings, which provides further confidence in the findings so far.[9]

[9] In additional tests, not reported here, we used as an alternative measure of income inequality the long-run average for net Gini coefficient from SWIID. The results remained virtually the same likely because the correlation between our preferred measure of income inequality and its long-run average is close to perfect, $r = 0.86$. In other words, even if income inequality has changed over time, the SWIID data suggests that income inequality has likely changed in the same direction and magnitude over time, keeping cross-country differences very similar to what we find today.

Table 6
Alternative inequality measures.

	Gini (Net)	UTIP (Gross)	90/10	80/20
Panel A: 2SLS				
Individualism	−0.359***	−0.522**	−0.213**	−0.129*
	(0.126)	(0.227)	(0.0910)	(0.0701)
Controls	√	√	√	√
Observations	83	81	81	81
R-squared	0.542	0.471	0.464	0.697
IV F-stat	21.13	20.59	20.18	20.59
Panel B: First Stage				
Pathogens	−16.20***	−16.36***	−16.36***	−15.96***
	(4.878)	(4.932)	(4.932)	(5.183)
Controls	√	√	√	√
Observations	83	81	81	81
R-squared	0.607	0.606	0.606	0.582

Note: Panel A reports the 2SLS estimates with the net Gini coefficient. Panel B reports the corresponding first stage. See Table 1 for summary statistics and description of all variables. "Legal Origins: German" is used as a reference group. Robust standard errors are reported in parentheses. All models include legal origins, latitude, logged GDP, religion, ethnolinguistic fractionalization, and economic freedom as additional controls.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

4.6. Alternative measures of individualism

Despite widely used in the literature, Hofstede's cultural dimensions model has also received criticism (Schwartz, 1994). Therefore, in this section, we provide additional robustness tests using three alternative measures of individualism–collectivism. These measures are based on Schwartz's cultural orientation scale, which was derived from an extensive list of 56–57 single value items that ask respondents to indicate the importance of each values as "a guiding principle in my life." (Schwartz, 1994). Schwartz and collaborators conducted surveys with K-12 schoolteachers and college students between 1998 and 2000 that covered more than 75,000 respondents from 78 countries and 70 cultural groups representing close to 80 percent of the world population.

Similar to the individualism–collectivism dimension from Hofstede et al. (1991), Schwartz differentiates cultures according to an autonomy-embeddedness dimension. Autonomous (individualistic) cultures are ones where people are seen as autonomous and independent entities. In such cultures, people are encouraged to cultivate and express their own preferences, feelings, ideas, and abilities, and derive meaning from their own uniqueness. Embedded (collectivist) cultures, on the other hand, are ones where people find meaning by identifying with the group, participating in a shared way of life, and striving towards shared goals. In embedded societies high value is placed on the status quo and avoiding individual actions that might undermine traditional order. The autonomy index consists of two sub-indexes – one on affective autonomy and another one on intellectual autonomy. Affective autonomy measures the extent to which people are encouraged to seek enjoyment and pleasure for themselves by any means while the intellectual autonomy index measures the extent to which people are encouraged to pursue independent ideas and thoughts, whether theoretical or political. Countries that score high on autonomy also score low on intellectual and affective autonomy. Thus, as an alternative measure of individualism–collectivism, we use the index of autonomy-embeddedness and its two sub-indexes on affective and intellectual autonomy. These additional tests are reported in Table 7. In all three cases, we find that more culturally autonomous (embedded) countries are far more likely to have lower (higher) levels of income inequality, which is consistent with our previous findings.

4.7. Robustness, possible channels

In Section 2, we suggested several possible channels through which IC values can affect income inequality, specifically, the quality of social and economic institutions, human capital, and economic growth. In Table 8 we test the association between IC values and several of these channels. We first show that more individualistic societies are less likely to have cultural values associated with the cultural dimension power distance, which represents the degree to which less powerful members of society accept that power is distributed unequally in a society. The results imply that people in more individualistic countries are less likely to accept a higher degree of unequally distributed power such as political power than do people in collectivist cultures. We then show that more individualistic societies are more likely to have greater protection of property rights, a measure often used to evaluate the quality of economic institutions, experience lower levels of corruption, are more open to trade internationally, are more likely to invest in human capital, and experience higher level of innovation. These results are consistent with our theoretical discussion in Section 2 and previous empirical studies. We provide these additional estimations with the caveat that our IV may not be appropriate for picking up a causal association between individualism and these possible channels.

Table 7
Alternative measures of individualism.

	(1)	(2)	(3)	(4)
Panel A: 2SLS	Dependent Variable: Gini (Net)			
Individualism	−0.359***			
	(0.126)			
Embeddedness		30.14**		
		(14.10)		
Affective Autonomy			−14.07**	
			(6.488)	
Intellectual Autonomy				−31.96**
				(15.09)
Controls	√	√	√	√
Observations	83	71	71	71
R-squared	0.542	0.447	0.463	0.437
IV F-stat	21.13	8.289	11.66	5.507
Panel B: First Stage				
Pathogens	−16.20***	0.163***	−0.349***	−0.153**
	(4.878)	(0.0565)	(0.102)	(0.0654)
Controls	√	√	√	√
Observations	83	71	71	71
R-squared	0.607	0.817	0.665	0.745

Note: Panel A reports the 2SLS estimates with the net Gini coefficient. Panel B reports the corresponding first stage. See Table 1 for summary statistics and description of all variables. "Legal Origins: German" is used as a reference group. Robust standard errors are reported in parentheses. All models include legal origins, latitude, logged GDP, religion, ethnolinguistic fractionalization, and economic freedom as additional controls.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 8
Two-stage least squares results, individualism and alternative outcomes.

	Gini (Net)	Power Distance	Property Rights	Corruption	Trade Freedom	Human Capital	Global Innovation Index
Panel A: 2SLS							
Individualism	−0.243***	−0.810***	0.698***	−0.559***	0.227**	0.0704***	0.136*
	(0.0855)	(0.206)	(0.202)	(0.156)	(0.103)	(0.0199)	(0.0758)
Controls	√	√	√	√	√	√	√
Observations	84	93	92	93	92	87	89
R-squared	0.586	0.491	0.670	0.670	0.418	0.712	0.767
IV F-stat	21.13	20.59	20.18	20.59	20.18	21.60	21.26
Panel B: First Stage							
Pathogens	−19.27***	−19.10***	−19.13***	−19.10***	−19.13***	−20.12***	−19.84***
	(4.192)	(4.210)	(4.258)	(4.210)	(4.258)	(4.329)	(4.304)
Controls	√	√	√	√	√	√	√
Observations	84	93	92	93	92	87	89
R-squared	0.570	0.507	0.506	0.507	0.506	0.525	0.515

Note: Panel A reports the 2SLS estimates with the net Gini coefficient. Panel B reports the corresponding first stage. See Table 1 for summary statistics and description of all variables. "Legal Origins: German" is used as a reference group. Robust standard errors are reported in parentheses. All models include legal origins, latitude, and logged GDP, religion, and ethnolinguistic fractionalization as additional controls.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

5. Concluding remarks

The idea that culture plays an important role for economic development has its origins in the works of Adam Smith, David Hume, Karl Marx, Max Weber,[10] Thorstein Veblen, Friedrich Hayek, and many other early economists and social psychologists from different schools of thought. Cultural values, just like economic, political and legal institutions, as defined by North (1990), impose norms on individual behavior and structure incentives in human interaction and exchange. In that sense,

[10] As Gorodnichenko and Roland (2012) point out, the importance of culture has been recognized at least since the seminal work of Max Weber, who argued that the protestant ethic of Calvinism was a powerful force behind the development of capitalism in its early stages. But even Adam Smith discussed the importance of culture to generate language, moral norms, and an individual's very capacity for self-awareness and self-efficacy.

cultural values can influence human behavior and thus the distribution of entrepreneurial talent to different productive and unproductive activities (Baumol, 1996), affecting how society invests in human and physical capital as well as technology.

It is widely believed that individualistic cultures, which emphasize personal freedom, award social status for accomplishment, and favor minimal government intervention, are more prone to higher levels of income inequality compared to more collectivist societies, which value conformity, loyalty, and tradition and favor interventionist policies. Yet, as we show in this paper, simple bi-variate correlations suggest that more individualistic societies have much more equitable distribution of income than collectivist ones. In this paper, we examine this empirical puzzle within the context of the provocative Parasite Stress Theory of Values (Thornhill and Fincher, 2014), which suggests that the historical prevalence of infectious diseases influenced the natural selection of cultural traits associated with individualistic and collectivistic values, which, then, in the next stage, explained cross-country differences in income inequality.

Our analysis suggests that societies with more individualistic values have significantly lower level of net income inequality. The results are robust even after controlling for a number of confounding factors such as economic development, legal origins, religion, economic institutions, local factor endowments, and geographical controls as well as a number of alternative estimations that account for influential observations. They are also consistent when we use alternative measures of income inequality and individualism. It is important to note that these results do not suggest that cultural values alone explain today's differences in income inequality across countries. Our results, however, imply that variation in income inequality across countries has its origins in the historical prevalence of infectious diseases and the cultural values that emerged through the evolutionary process of natural selection which made some countries develop more individualistic values and ideologies while others became more collectivistic.

One implication of our study is that preferences for a more equal society do not directly translate into a more equal society. For instance, preferences for redistribution in many formal communist societies such as Bulgaria and Romania remain relatively high, yet income inequality in many of these countries is relatively high. The Public Choice literature provides a possible explanation–using government as a mechanism to redistribute wealth may not necessarily create a more equal society beyond some optimal point, despite the fact that one of the most salient features of modern governments is redistributing income and promoting equality of opportunity (Mueller Dennis, 2003). As public choice scholars note, beyond some optimal level, larger government may be welfare reducing[11] and create even larger disparities in equality of opportunity because most political actors have a vested interest in larger government, not optimal government. Politicians and bureaucrats, for instance, are largely motivated by their own self-interest and are prone to political capture by special interest groups that look for regulations and policies that provide them with an economic advantage over other groups and competitors in society (Mueller Dennis, 2003; Niskanen, 1971; Olson, 1971; Tullock, 1998; Downs, 1962) potentially generating higher levels of income inequality. Recent studies have also emphasized that much of the growth in income inequality has political origins (Stiglitz, 2012). In other words, only because people want a more equal society does not necessarily mean that they will get one. Instead, the quality of formal institutions can mediate this relationship and recent studies suggest that in countries where people have trust in the public sector, they are far more likely to be willing to pay higher taxes and trust government officials to do the right thing (Dimitrova-Grajzl et al., 2012; Svallfors, 2013; Pitlik and Kouba, 2015; Daniele and Geys, 2015; Pitlik and Rode, 2016).

As Alesina and Angeletos (2005) point out "if a society believes that individual effort determines income, and that all have a right to enjoy the fruits of their effort, [which are major features of individualism], it will choose low redistribution and low taxes. In equilibrium, effort will be high, the role of luck limited, market outcomes will be quite fair, and social beliefs will be self-fulfilled. If instead a society believes that luck, birth, connections and/or corruption determine wealth, it will tax a lot, thus distorting allocations and making these beliefs self-sustained as well." In other words, the quality of formal and informal institutions, which a large literature argues have historical origins, can influence people's beliefs about the type of society they live in. When people believe that societal institutions are fair, they will be far more likely to learn new skills, innovate, develop their talents, and put the necessary effort required to capture a more fair share of the economic pie.

As we suggest in this paper, the PTSD hypothesis suggests one potential and plausible mechanism that is based on a very rich literature in biology and evolutionary psychology. That is, people in more individualistic societies are less likely to share cultural values such as xenophobia, ethnocentrism, and more generally disregard for the well-being of out-group minorities. There is a long history of discrimination of minorities in collectivist societies (e.g., gypsies in Eastern Europe, Tibetans and Uyghur minorities in China, and great many ethnic and racial conflicts in Africa, which happens to be the place with the greatest history of pathogenic stress). At the same time, some of the most individualist societies in our sample (e.g., Sweden or UK) have relatively lower levels of inequality (and this relationship holds even after we control for economic development, institutions, legal origins, geography.)

One possible explanation for these findings is that individualistic cultures are more likely to develop inclusive economic, social, and political institutions, which respect the rights, liberties, and well-being of all members of society, not just of those in their immediate family or clan. This is consistent with recent findings which show that more individualistic societies are far more likely to have high quality political and economic institutions including respect for the rule of law, lower levels of corruption, and strong democratic institutions (Greif, 1994; Nikolaev and Salahodjaev, 2017, 2016; Kyriacou, 2016;

[11] Bjørnskov et al. (2007), for example, find that government consumption is negatively associated with life satisfaction.

Gorodnichenko and Roland, 2015; Licht et al., 2007; Inglehart and Oyserman, 2004). People in more individualistic cultures are also more likely to tolerate minorities and have higher levels of interpersonal trust (Thornhill and Fincher, 2014; Allik and Realo, 2004), which can reduce transaction costs and further facilitate market transactions leading to higher rates of innovation and economic growth (Oyserman et al., 2002; Gorodnichenko and Roland, 2012). When citizens perceive state institutions to be fair, less corrupt, and more efficient, they are far more likely to favor higher taxes and government spending on welfare programs (Dimitrova-Grajzl et al., 2012; Svallfors, 2013; Pitlik and Kouba, 2015; Daniele and Geys, 2015; Pitlik and Rode, 2016). When they trust and care about the well-being of their fellow citizens, they will be more inclined to support welfare programs that benefit others. When they earn higher incomes, they are also more likely to be able to bear the burden of higher taxation.

Appendix A. Appendix A

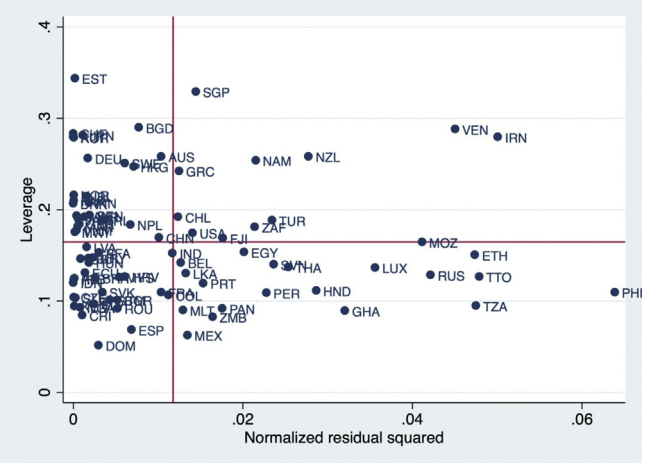

Fig. A1. Influential observations.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jebo.2017.04.001.

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