Was De Montesquieu (only half) right?

**Evidence for a stronger work ethic in cold climates**

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**Abstract**

Although we know that geographical climate is associated with economic development, there have only been a few studies yet that try to explain the exact mechanisms through which climate and development are related. In this paper, we assess a cultural channel, most famously suggested by de Montesquieu, linking cooler climates to economic development through a stronger work ethic. On the basis of a novel approach exploiting individual-level happiness data in 98 countries to estimate the value attached to work, we show that people who live in a cold climate value working significantly more than people who live in a warm climate do. However, subsequent analysis at the national level suggests that the national average work ethic that we estimate from individual level data translates only marginally into a better economic performance at national level. Our results support de Montesquieu’s hypothesis that a cold climate creates informal norms encouraging people to value work more, but, in contrast to his suggestion, the impact of this channel on economic development appears very limited. We conclude that de Montesquieu was only half right when he stated that differences in economic development can be traced back to differences in climate-induced work attitudes.

**Keywords:**cold climate; geography; informal institution; unemployment; work ethics

**JEL classification***:* E02; E03; E24; J02; J06; J60; R01

1. **Introduction**

One of the most widely accepted stylized facts in development economics is that closer one gets to the equator, the lower income per capita levels are (Sala-i-Martin 1996; Nordhaus 2006). Explanations for this fact fall in two broad categories. Some authors stress mechanisms directly related to climate, such as the effects of frosts and average temperature on pathogen prevalence (Masters and McMillan 2001; McCord and Sachs 2014; Sachs 2001), the availability of domesticable plants and animals (Diamond 1997; Olsson and Hibs 2005), or the frequency of weather-related natural disasters (Hsiang and Jina 2014; Hsiang and Meng 2015). Another set of explanations links climate to economic development through effects on historical institutions (Acemoglu, Johnson and Robinson 2001; Easterly and Levine 2003; Rodrik Subramanian and Trebbi 2004; Acemoglu and Robinson 2012).

In addition to these two accepted channels, a third possible channel has most famously been suggested by Ibn Khaldun (1377) and, perhaps most famously, by Baron de Montesquieu (1748), echoed in more recent times by historians (Huntington 1915, Toynbee 1959) and political leaders such as Mahathir (1970) and Lee Kuan Yew (Barr 1999). The argument holds that colder climates, with their clearly demarcated seasons, create the necessity for people to work hard and save in order to survive. Through socialization processes (cf. Algan and Cahuc 2010; Bisin and Verdier 2001), these behavioral adaptations are subsequently transmitted between generations, over time creating cultures with a strict work ethic that will experience stronger long-run economic growth. While this environmental-cultural channel has deep roots in the literature, its discussion has in recent decades focused on its potentially racist overtones (e.g. Barr 1999; Easterly and Levine 2003). Empirical tests of the climate-culture mechanism are lacking.

In this paper, we provide a novel empirical assessment of the climate-culture hypothesis. We do so in two steps. First, we investigate the relation between climate and work ethic, following the methodology developed in van Hoorn and Maseland (2013), to trace differences in the subjective wellbeing effects of unemployment between individuals across climates. In a second step, we relate the estimated differences in this measure of work ethic to differences in economic development, assessing the extent to which the relationship between climate and development runs through this channel. While we find a clear impact of climate on attitudes to work in the first step, our second-step results indicate that only a very small part of the relation between climate and development is mediated through this cultural channel. Interestingly enough, we show that formal institutions do slightly better but still only mediate about 1% of the total climate effect as well. We conclude that climate affects culture, but that any relation with economic development through this channel is tenuous at best, thereby suggesting that Montesquieu was only half-right.

This paper connects with several strands in the literature. It contributes to the growing literature on culture and economics that seeks to identify the effects of cultural norms, values and beliefs on economic outcomes (Beugelsdijk and Maseland 2012; Gorodnichenko and Roland 2016; Greif 1994; Tabellini 2010). It also connects to the wider growth literature, which increasingly has moved away from proximate causes towards the deep determinants of development (Spolaore and Wacziarg 2013; Nunn 2014). Finally, it contributes to the literature in economic geography (Bosker and Garretsen 2009) by presenting novel channels through which geographical conditions affect economic behaviour.

The remainder of the paper is organized as follows. In section 2, we develop the theoretical framework linking climate, institutions, culture and economic development. Sections 3 and 4 outline the data and the methodology. Section 5 presents the results, first for the step from climate to culture using individual data, and subsequently for the step from culture to national economic development. Section 6 concludes.

1. **Theoretical framework**

Studies discussing the relationship between geographical climate and economic development often focus on factors such as the prevalence of human, animal, and crop diseases, agricultural suitability, or the incidence of natural disasters (Hsiang and Jina 2014; Masters and McMillan 2001; Nordhaus, 2006; Sachs 2001). Frequent periods of frost act as natural brake on pathogens and create superior soil, boosting human capital and agricultural productivity. Temperate climate zones’ lower exposition to extreme weather events such as droughts or cyclones also contributes to stability and long-run development. Similarly, crops that typically grow well in climates with moderate rainfall are relatively easily storable and hence foster the accumulation of physical and indirectly human capital (Haber and Menaldo 2010). Altogether, climatically more beneficial environments directly enhance productivity levels and growth.

However, geography does not just drive productivity differences directly. An area’s habitability also contributes to the development of its’ inhabitants settlement patterns and lifestyles (e.g. Kuper and Kropelin, 2006) including the formal and informal institutions of the societies occupying the area. It has been argued that regions more favorable to agricultural production typically went through the Neolithic revolution at an earlier date. This process stimulated changes in social organization, most notably the formation of territorial states, giving such regions a head start in institutional development (Diamond 1997; Putterman 2008). Agricultural suitability has also been linked to democracy, through an effect on human capital accumulation (Haber and Menaldo 2010). In more recent times, an area’s relative suitability for plantation production has been shown to contribute to the formation of structural inequality and exploitative institutions (Sokoloff and Engerman 2001). Pathogen prevalence has, through its impact on colonial settlement, been similarly linked to the development of an extractive institutional framework (Acemoglu etal 2001; Acemoglu and Robinson 2012).

Beyond formal institutions, a long tradition of authors, including reputable names such as thus De Montesquieu, but also Alexander von Humboldt, Friedrich List, and J.S. Mill, have theorized about a link between climate, cultural attitudes about work effort (Boianovski 2013a; Boianovski 2013b). The argument typically runs like as follows. Tropical areas provide an abundance of resources, allowing people to survive with relatively little effort. The main threats come from predatory animals and diseases which are equally abundant. The cost of food gathering remains fairly the same throughout the year. Such conditions induce communal lives in which people hunt or protect themselves and their livestock. This leads to the formation of (informal) institutions that promote cooperation but discourage competition among the people. The challenge that people face in cold climate regions is different. The challenge of surviving in a cold climate does not come from predatory animals, but from winter seasons during which it is difficult to produce or collect food. This requires a longer time horizon and periods of long and intensive activity concentrated in the agricultural season. Lack of year round food availability in cold climates, induces the formation of norms and attitudes that promote individual production as well as adjustments to the changing seasons, and, thus, saving and innovation. Such cultural adaptation has boosted long run economic performance.

While the literature about cultural effects of climate has become discredited in the mid-twentieth century due to its suggestions of cultural superiority of the peoples inhabiting temperate zones, interest in the relation between natural environment, culture and politico-economic outcomes has recently revived. A literature focusing on pathogen prevalence has linked this to the formation of collectivist attitudes and values (Fincher et al 2008), openness to experience and extraversion (Schaller and Murray 2008) and the prevalence of democracy and social stability ( ). The logic is that in climatic conditions that are favorable to parasites and contagious diseases, outsiders pose an immediate threat to the community, inducing people to be more hostile towards outside groups. Other examples include Alesina, Giuliano and Nunn (2013), who show that geo-climatic characteristics favoring plough agriculture over shifting cultivation have made a long lasting imprint on gender roles in societies. In light of these recent results, an investigation into the supposed climatic effects on work attitudes is overdue.

We propose the following framework, see Figure 1. We start out from findings by Rodrik et al. (2004) that the effect of geography on income runs through institutions (Channels 4 and 5). We add to this the thesis that geography affects economic outcomes not only through formal, but also through informal institutions, (Channels 1 and 2). More specifically, we theorize that different geographical climates lead to the formation of different types of cultural norms, which develop in tandem with the formal institutional framework (Channel 3). For example, a winter season that makes growing or collecting food difficult induces people to develop norms encouraging people to work harder during warm seasons, and save for the cold season. Such a propensity to work hard and save may also in turn influence formal institutions such as individual property rights and credit, which are required for safely storing food for winter and in absence of which working hard and saving is discouraged. These informal and formal institutions may in turn translate into economic prosperity in the long run.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Income level  Now | (5)  (2) |  |
|  | Formal  Institution  [100  Geographical Climate  (1)  Time | (3)  Informal Institution (Work Ethic)  (4) |  |
|  | Past |  |  |

**Figure: 1: Geographical climate, work ethics and development**

We aim to assess the empirical relevance of Channels 1-2 in the relation between climate, work ethic, and economic development, while also checking for the relevance of channel 3. The literature shows that there is positive correlation between motivation to work and productivity (e.g. Kruse, 1992; Belorgey, et al., 2006; Grant, 2008 and Herzberg et al., 2011) as well as between productivity and macroeconomic performance (e.g. Verdoorn, 1949; Kaldor, 1957; Jorgenson et al., 1987; Fase and Van Den Heuvel, 1988; Barro, 1989 and Hall and Jones, 1999). We also know from the literature that informal institutions affect formal institutions and development (e.g. Raiser, 2001 and Williamson, 2009). In this paper we connect these dots and analyze the evidence for a climate induced work ethic that has repercussions for economic outcomes.

1. **Methodology**

As mentioned in the introductory section, our empirical investigation will proceed in two main steps: (i) investigating the relation between climate and work attitudes using individual data, and (ii) analysing the relation between such work ethic and national economic development.

**3.1 Climate and Work ethic**

This sub-section deals with Channel 1 from Figure 1. In order to estimate the effects of climate on work ethic, we follow the approach pioneered in van Hoorn and Maseland (2013). This ‘experienced preferences’ method revolves around the idea that an individual’s preferences for a certain experience, such as having a job, are reflected in the relative impact this experience has on subjective wellbeing. Individuals attaching low weight to work suffer only small drops in wellbeing when unemployed, whereas individuals for whom work is very important experience a large decline in wellbeing. This principle means that when we seek to assess differences in work ethic between groups, such as people from warmer and colder climates, we can do so by comparing the impact of unemployment on wellbeing between people from various climatic zones. If people from colder climates care more about work, the wellbeing impact of unemployment should be larger for them.

We use an ordered logit approach to estimate the effect of unemployment on subjective well-being (SWB) of individual respondents in different geographical climate zones. To single out the effect of climate on the SWB of an unemployed person, we use the interaction between unemployment indicator variable and different measures of climate. The interaction terms are the focus of the analysis as they measure the effect of certain climate type or its intensity on SWB of an unemployed person relative to the rest of the group.. Thus, we will estimate regression models of the following general form for the ordered logit estimations:

(1)

where stands for ‘’ or ‘’; and are matrices of individual i level and country j level addition controls during survey year t, respectively, are parameters, are vectors of parameters, and is the residual term.

To measure SWB, we will make use of the World Value Survey (WVS) data involve sampling at different levels, see section 4 for the data. A sample of countries was selected during each wave from both climate zones: cold climate and warm climate. At a lower level, a random sample of respondents was selected from each country that was also randomly selected. This means that the data involve a hierarchical or clustered structure. Estimating a pooled regression models in this case might conceal the effects at different levels. In other words, it might not be possible to separate the effects due to observed and unobserved group characteristics. To address this, we will also do a multilevel analysis (MLA) which adjusts for such possible differences due to the hierarchical nature of the data, this implies estimating a multilevel version of equation (1), including a country level error term. As opposed to treating the respondents as a sample of individuals drawn from cold and warm climates, the MLA allows us to also look at the country level average effects by the climate zones.

**3.1 Work ethic and Income**

After we will have investigated whether climate is related to differences in work ethic, we will then move on to explore whether work ethic can account for the effects of climate on economic performance. To do so, we first estimate national level work ethic from individual level data. We regress subjective well-being on individual unemployment for each country and for every year included in the survey separately. This is summarized by the following equation:

 (2)

whereis subjective wellbeing of respondent i in country j at time/year t; is a matrix of all other additional individual level controls such as income, education, health, age, and marriage status;  is residual term; and , and  are parameters to be estimated for each country j and time t.

We will store all country-level estimated coefficients , which we will then be used as an indicator for national work ethic. Subsequently, we undertake mediation analysis using the estimated work ethic indicator coefficients as a mediator variable between cold climate and per capita GDP. This allows us to test whether the effect of geographical climate on the national income level runs through a work ethic channel. The mediation analysis involves regressing the work ethic estimates on geographical climate, and then running additional regressions of income level on both climate and estimated work ethic. These are given as follows:

 (5)

 (6)

Where measures direct effect of Cold climate on per capita GDP (); the product measures the indirect effect of on  via the mediation variable; and the total effect is the sum of the direct and the indirect effects, . The validity of these effects requires that we assume the error terms (,) are uncorrelated and both normally distributed. The interpretation of the two structural equations is simultaneous.

1. **The Data**

In order to conduct our estimations and specifically to arrive at a measure of work ethic, we use two types of data: (i) individual level survey data collected by the world value survey (WVS) in six waves over the past three decades, 1981 to 2014, and (ii) national level indicators that we obtained from various sources. The WVS dataset includes data on the individual level Subjective Social Well-Being (SWB), unemployment status, location and other socio-economic characteristics of over a third of a million respondents from 100 countries (see Table 1 and for further details see Table A1 in the Appendix).

**Table 1: Sample Data**

|  |  |  |
| --- | --- | --- |
| Survey wave | Number of countries | Number of respondents |
| 1981 | 10 | 13,586 |
| 1990 | 18 | 24,558 |
| 1995 | 54 | 77,129 |
| 2000 | 41 | 60,045 |
| 2005 | 58 | 83,975 |
| 2010 | 60 | 86,272 |
| **Total** | **100** | **345,565** |

After cleaning up and excluding observations with missing values or errors, there are 98 countries and 266,817 observations remaining for the analysis. The data on temperature are obtained from the UK Met Office (2014). The data on the welfare state and other national level institutional quality indicators that we use as controls and in robustness analysis are obtained from the ILO (2016) and the World Bank (2015), respectively.

Our dependent variable at individual level in this 1st step of our empirical analysis is an ordinal variable of a self-reported measure of subjective social wellbeing (SWB) measured by happiness on a scale of 1 to 4, where “1” represents “totally unhappy” and “4” stands for “very happy”. The main explanatory variables are thus, see equation (1), the unemployment indicator, the climate variables, and their interaction. The unemployment indicator (UNEMP) is a dummy variable which takes the value of 1 if the respondent is unemployed at the time of the interview and 0 otherwise. We measured the climate variable in two different ways which also help us to check robustness of the results: (i) a cold climate dummy (COLD) which takes value of 1 if the respondent is located in a temperate zone outside 35 degrees North and 35 degrees South[[1]](#footnote-1), which is also consistent with the list of temperate countries by Gallup et al., (1999), and 0 otherwise; and (ii) an indicator of winter intensity (WININT), measured as an absolute deviation of winter temperature of the respondent’s location from an average warm tropical temperature in degree Celsius[[2]](#footnote-2). The individual-level control variables that we use are employment indicator dummies, marital status dummies, education, gender and age of a respondent[[3]](#footnote-3) that are obtained from the WVS.

At the national level, and as a second step in our empirical analysis, we will include a social security indicator that we obtain from the ILO (2016), expenditure on social security from IMF (2016), institutional quality indicators that came from the World Bank (2015), controls for culture and religion that we obtain from PEW (2016) and CIA (2016), and evolutionary distance obtained from the data collected by Mayer and Zignago (2011) for the French Institute for Research on the International Economy (CEPII in French), variables to be defined below. At the national level analysis, we use the GDP and productivity data from Feenstra et al., (2015) and as well as the abovementioned national level geographical, institutional and income indicators.

1. **Estimation results**
   1. **Channel 1: Climate and Work Ethic**
2. **Baseline results**

We start our analysis by comparing simple arithmetic means of subjective wellbeing (SWB) of unemployed people in different geographical climate zones with that of employed people in their respective climate zones. The results imply that, depending on the specification we use, the relative decrease in SWB due to unemployment in cold climates is 100-200% larger than the size of the decrease in SWB due to unemployment in warm climates. A simple arithmetic means based calculation of the changes in SWB due to unemployment also shows that the decrease in the SWB in cold climates is about twice the decrease in the SWB in warm climate zones (see Table B1 in the Appendix).

These results are confirmed in a more systematic analysis (Table 2). The table present the results of the ordered logit analysis for specifications with various controls and samples. In almost all specifications, we find that both unemployment and cold climate have significant negative effects on subjective well-being. What we are interested in, however, in this 1st step of our empirical analysis is not in explaining subjective well-being as such, but in seeing to what extent the well-being effect of unemployment is different across climates: does it hurt more to be unemployed in colder climate zones?

The interaction terms provide this information. Throughout all models, we find that being out of a job has consistently an additional negative effect on subjective well-being for people living in colder climates. In other words, being unemployed lowers everyone’s well-being, but especially so in colder climates. This result is significant at the 1% level in all but one of the models, where it is significant at the 5% level only. Moving from one specification to the other, we control for economic incentives to work (individual income, education as a proxy for job quality, the provision of social security, and national per capita income to capture potential relative income effects) and various national level institutional effects in Models 2-9. The robust significance of the unemployment-climate interaction indicates that it is driven by differences in intrinsic motivation rather than differences in externally determined rewards of employment.

It could be argued that the source of the difference in the work ethic is down to differences cultural or religious values (van Hoorn and Maseland, 2013, Chusmir and Koberg 1988) rather than climate. We therefore control for culture and religion at the individual and country level. We also re-estimate our model using a sub-sample by excluding respondents from predominantly Protestant societies [see Columns (4) and (6)]. The results are robust to these changes. Finally, in order to see whether any of these controls affect the impact of unemployment on well-being, we also include interactions between unemployment and national level average unemployment rate, a welfare state dummy, the share of Catholic or Muslim population as a proxy for religious influence, the share of welfare expenditures (as % GDP), a Protestant society dummy, and per capita GDP (Model 7). In doing so, our finding that unemployment has a significant additional negative effect in colder climate remains. Finally, columns (8) and (9) repeat the analysis by the winter intensity variable with a variable capturing the winter intensity in the countries of origin of the current population, tracing migratory routes back to 1500 (Putterman and Weil 2010) as proportion of population of cold climate origin since 1500.

**Table 2: Cold geographical climate and subjective well-being of unemployed people**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Ordered Logit**  **Dependent variable: ordered SWB** | | | | | | | | | |
| **VARIABLES** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |  |
| UNEMP | –.233\*\*\*  (.031) | –.264\*\*\*  (.033) | –.307\*\*\*  (.033) | –.303\*\*\*  (.035) | –.245\*\*\*  (.032) | –.268\*\*\*  (.035) | .088  (.077) | –.148\*\*\*  (.037) | .181\*\*  (.077) |  |
|  | [.791] | [.782] | [.735] | [.738] | [.783] | [.763] | [1.092] | [.862] | [1.198] |  |
|  |  |  |  |  |  |  |  |  |  |  |
| COLD | –.171\*\*\*  (.010) | –.472\*\*\*  (.014) | –.304\*\*\*  (.012) | –.478\*\*\*  (.013) | –.301\*\*\*  (.013) | –.448\*\*\*  (.014) | –.447\*\*\*  (.019) | –.228\*\*\*  (.015) | .054\*\*\*  (.019) |  |
|  | [.841 ] | [.632] | [.738] | [.620] | [.740] | [.639] | [.639] | [.795] | [1.055] |  |
|  |  |  |  |  |  |  |  |  |  |  |
| UNEMP×COLD | –.162\*\*\*  (.030) | –.119\*\*\*  (.027) | –.155\*\*\*  (.029) | –.080\*\*  (.034) | –.194\*\*\*  (.030) | –.115\*\*\*  (.034) | –.284\*\*\*  (.056) | –.309\*\*\*  (.034) | –.427\*\*\*  (.058) |  |
|  | [.849] | [.886] | [.857] | [.923] | [.824] | [.892] | [.753] | [.734] | [.652] |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Observations | 266,817 | 259,379 | 250,266 | 203,059 | 245,556 | 198,349 | 178,156 | 245,556 | 178,156 |  |
| (Pseudo) R2 | .035 | .044 | .046 | .046 | .054 | .054 | .058 | .049 | .051 |  |
| Sample | All | All | All | NPS | All | NPS | All | All | All |  |
| **FURTHER CONTROLS** | | | | | | |  |  |  |  |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Individual controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Economic Incentives | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Institutional quality | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Culture and Religion | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Evolutionary factors | No | No | No | No | Yes | Yes | Yes | Yes | Yes |  |
| Extra interactions | No | No | No | No | No | No | Yes | No | Yes |  |

Notes: this table presents the results of a regression of individual level subjective well-being on unemployment, climate and their interaction. The coefficient of the interaction term signifies the differential well-being effect of unemployment in cold and hot climates, which we interpret as an indicator of climate-induced work ethic. All models include a standard set of individual level control variables that affect people’s SWB, including six Employment type dummies, five Marital Status dummies, Health, Education, Sex, Age, and Age–squared. Further controls added in various specifications are:

**Economic Incentives** include individual’s income level, education, national per capita GDP, welfare state dummy (or alternatively welfare expenditure as a percentage of GDP).

**Institutional quality** includes rule of law (or alternatively voice and accountability) and national level average unemployment.

**Culture and Religion** include individual’s adherence to her/his religion if she/he follows one (or alternatively respondent’s secular value calculated from factors such as beliefs in hell/heaven and tolerance toward homosexuality and sexual relationship outside of marriage) and country level percentage share of the population following Catholicism and Islam.

**Evolutionary factor** is an approximation for genetic advancement measured by two factors: the percentage of population that originate from cold climate zone since 1500 and logarithm of distance (in kilometers) of the respondent’s country from Ethiopia (the widely accepted place of human origin).

**Extra interactions** include the interaction of welfare variables, unemployment rate, society’s religion, protestant society, and per capita GDP with the unemployment dummy

Robust standard errors are given in the parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. **Sample: All = the whole sample; NPS = Non-protestant society.**

1. **Multilevel analysis**

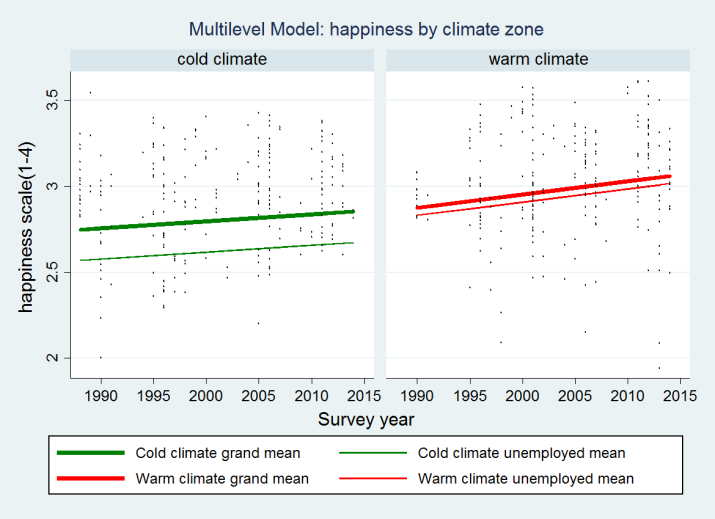
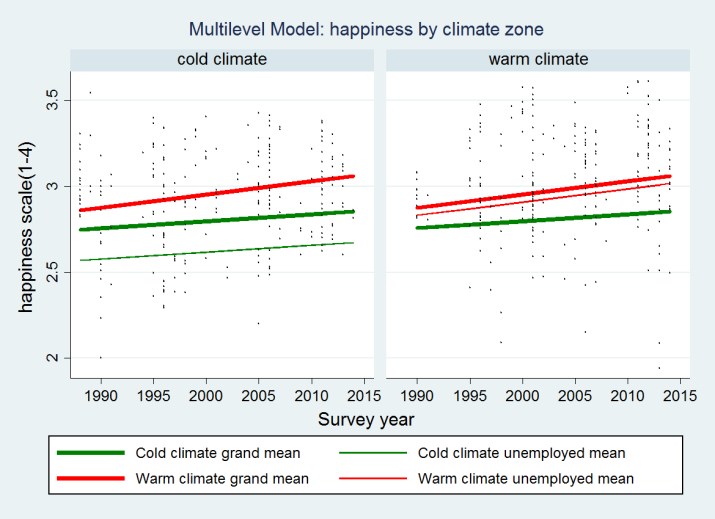
Our multilevel analysis also confirms the above results (See Table 3). In Table B5 (in the Appendix) we extend the analysis including the MLA using country of origin-climate as alternative measure for the main variable of cold geographical climate.

From Figure 2, we also see that the mean happiness of those unemployed in the cold climate is substantially lower than the mean happiness of all the cold climate dwellers. On the contrary, the mean happiness of those unemployed in a warm climate is only slightly lower than the overall mean of all the people of the climate zone. In these figures, we compare how less happy people become on average due to unemployment in different climate zones compared to a grand mean happiness of all people (employed and unemployed). The left side panel shows the grand mean of the respective climate zone only as a reference; whereas, the right side panel presents the grad means from both climate zones for the purpose of comparison in a broader and more precise manner. The right hand side panel shows that people from the warm climates are on average happier than the people from the cold climate zones. Consistent with the earlier results in Tables 2 and 3, the graphs in both panels show that the decrease in the SWB following unemployment is much larger for the people who live cold climate zones than the decrease for the people who live warm climate zones.

**Table 3: Additional sensitivity analysis, Multilevel Analysis (MLA)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Mixed Ordered Logit**  **Dependent variable: ordered SWB** | | | | | |  |
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |  |
| UNEMP | –0.264\*\*\* | 0.686\*\*\* | –0.190\*\*\* | –0.370 | –0.185 | 0.741\*\*\* |  |
|  | (0.036) | (0.024) | (0.065) | (0.278) | (0.177) | (0.007) |  |
| COLD | –0.348\*\*\* | –0.451\*\*\* | –0.390 | –0.631 |  |  |  |
|  | (0.045) | (0.047) | (0.268) | (0.390) |  |  |  |
| UNEMP×COLD | –0.195\*\*\* | –0.249\*\*\* | –0.267\*\* | –0.280\*\*\* |  |  |  |
|  | (0.023) | (0.028) | (0.119) | (0.074) |  |  |  |
| WININT |  |  |  |  | –0.027\*\*\* | –0.019\*\*\* |  |
|  |  |  |  |  | (0.009) | (0.002) |  |
| UNEMP×WININT |  |  |  |  | –0.005 | –0.006\*\*\* |  |
|  |  |  |  |  | (0.004) | (0.001) |  |
| Constant | -- | -- | -- | -- | -- | -- |  |
|  |  |  |  |  |  |  |  |
| Observations | 250,266 | 178,156 | 250,266 | 178,156 | 250,266 | 178,156 |  |
| Number of groups | 2 | 2 | 90 | 59 | 2 | 2 |  |
| Individual controls | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Institutional quality | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Culture and Religion | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Evolutionary distance | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Extra interactions[[4]](#footnote-4) | No | Yes | No | Yes | No | Yes |  |

Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

** **

**Figure 2. Multilevel Model: mean happiness (SWB) by climate zone and employment status**

In addition to using further interaction[[5]](#footnote-5) between unemployment and several other control variables, in Table B5, we substitute the climate indicators with migratory route variable that measures the percentage of local population that have come from cold climate over the past 500 years (i.e., since 1500). The results strengthen our argument. Being originated in the cold climate by itself does not have negative relation with the SWB, but originating in cold climate and being unemployed does. In columns (5) and (6we estimate the multilevel version of the specifications in which we still use the migratory route.

* 1. **Channel 2: Work Ethic and Income**

In line with our theoretical framework as outlined by Figure 1, we next want to identify whether the climate induced-work ethic we observed has an effect on economic development. The results are given in Table 4.

**Table 4: Channel 2: Work Ethic and Income level**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Productivity | | |  | Per capita GDP (expenditure) | | |
| VARIABLES | (1) | (2) | (3) |  | (4) | (5) | (6) |
| Work Ethic | 0.241\* | 3.636\*\*\* | 1.227\*\* |  | 0.246\* | 3.651\*\*\* | 1.217\*\* |
|  | (0.130) | (1.254) | (0.590) |  | (0.133) | (1.264) | (0.599) |
|  |  |  |  |  |  |  |  |
| Constant | 9.189\*\*\* | 7.543\*\*\* | 8.711\*\*\* |  | 6.883\*\*\* | 5.231\*\*\* | 6.412\*\*\* |
|  | (0.092) | (0.623) | (0.296) |  | (0.092) | (0.627) | (0.300) |
|  |  |  |  |  |  |  |  |
| Observations | 227 | 227 | 227 |  | 227 | 227 | 227 |
| R-squared | 0.015 | -- | -- |  | 0.015 | -- | -- |
| Further controls | No |  | No |  | No |  | No |
| Model | OLS | 2SLS | 2SLS |  | OLS | 2SLS | 2SLS |
| Instrument | -- | IV-1 | IV-2 |  | -- | IV-1 | IV-2 |

Notes: IV-1: Protestant society, IV-2: Protestant society and cold climate.

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

Model 1 presents the results of a basic OLS regression of productivity on work ethic. Models 2 and 3 capture the same mechanism, instrumenting the work ethic measure with a Protestantism society dummy and climate. Models 4-6 repeat the same procedure with per capita income as dependent variable. While Models 3 and 6 reflect the full mechanism running from climate to productivity, it is quite obvious that the exclusion restriction supporting the use of climate as a valid instrument is not met. For this reason, this is not our preferred model.

In spite of that, results consistently show that an increase of work ethic, as estimated using the specification in section 4.2, translates into an increase of economic performance, i.e., higher productivity or income. However, these analyses tell us little about the economic significance of any cultural channel linking climate to economic performance. In the next sub-section, we use a more systematic analysis to show the link between Channels 1 and 2. In other words, we will show next whether the effect of geographical climate on income effectively runs via people work ethic or social behavior.

* 1. **Mediation analysis: channels 1 and 2 combined:**

In previous sub-sections we have provided supporting evidence for Channels (1) and (2) of our theoretical model (Figure 1). However, our results only apply to the case for the two channels separately. In this sub-section, we will therefore present the results of a more systematic analysis to test for both channels simultaneously. More specifically, we present the results where we test whether work ethic or informal institution mediates the effects of geographical climate on income level. Although there have been different approaches of mediation analysis that have been developed recently, we use Hicks & Tingley, (2011) method to check whether the effects are direct or mediating ones. The major reason why we use this method is that, compared to other existing methods, Hicks & Tingley, (2011) is more complete and provides sensitivity analyses.

Table 5 presents the results. We find that informal institutions, as measured by the estimated work ethic (WE), act as a mediator between cold geographical climate and GDP per capita, showing a significant mediation effect. To assess the sensitivity these results, Figure 3 presents the results of an estimation of the average causal mediation effect under a series of sensitivity parameter ρ values and corresponding 95% confidence intervals. Results show that the estimated average mediation effect is zero for only small range of the sensitivity parameter ρ.

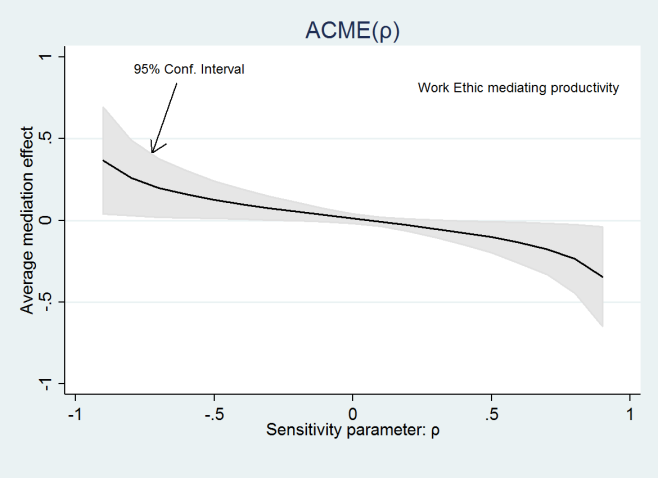
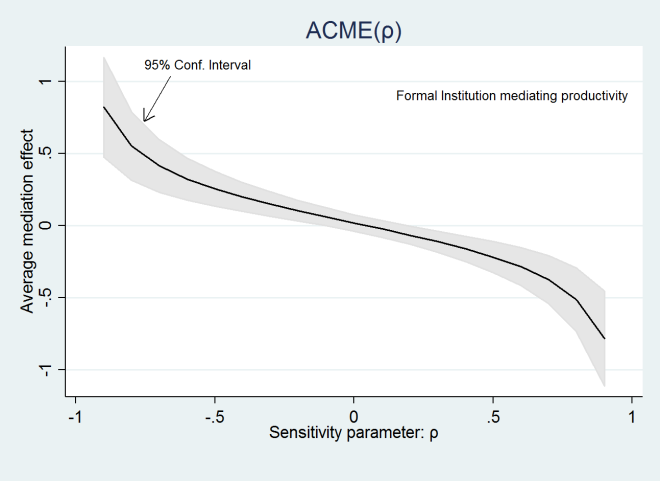
However, while the evidence of mediation is robustly statistically significant, it is marginal in size. The part of the effect of climate on income that runs via work ethic is negligible compared to the direct effects (see % total effect mediated). We conclude that a cultural channel offers no convincing explanation for differences in economic performance between climatic zones.

**Table 5: Mediation analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Informal Institution | | |  |
| Effects | (1) | (2) | (3) |  |
| Stage 1 |  |  |  |  |
| () | 0.167\*\*  (0.084) | 0.183\*\*  (0.092) | 0.198\*\*  (0.091) |  |
| () | 0.432\*\*\*  (0.086) | 0.437\*\*\*  (0.094) | 0.442\*\*  (0.094) |  |
| ACME | 0.012\* | 0.015\* | 0.012\* |  |
| Direct Effect | 0.440\*\* | 0.437\*\* | 0.450\*\* |  |
| Total Effect | 0.451\*\* | 0.452\*\* | 0.462\*\* |  |
| *% Tot. Eff. Mediated* | 0.025\*\* | 0.033\*\* | 0.027\*\* |  |
|  |  |  |  |  |
| Mediator |  |  |  |  |
| Further controls | Yes | Yes | Yes |  |
| The other institution | No | Yes | Yes |  |
| Religion | No | No | Yes |  |

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

Further controls: include all from the above, i.e., Social factor, Capital–Labour ratio & Evolution factor.



**Figure 3. Sensitivity test parameter**

For the sake of completeness, we also checked if informal institution mediates the effect of geographical climate on formal institutions (recall channel 3 in Figure 1). Informal institution shows significant mediation effect of cold climate on the development of formal institutions (see Table B6 in the Appendix). The results remain generally the same when we use Polity2 instead of regulatory quality. We also check the results using instrumental variable (IV) approach. The results remain consistent and they can be found in the appendix (section B) or can be provided if requested.

1. **Conclusions**

In this paper, we test the well-known thesis, as probably most famously professed by De Montesquieu in the 18th century, that differences in development between societies can partly be traced to climate-induced attitudes to work. Analysing differences in the discomfort caused by unemployment between peoples from different climatic zones, we find that societies in hotter climates systematically care less about being employed. This result suggests that climate indeed influences attitudes to work in the way proposed by De Montesquieu and others. At the same time, while we do find that such differences in work ethic are associated with higher development, we find that a climate-induced work ethic is only responsible for a very small part of the empirical relation between climate and economic outcomes. We conclude that climate matters for work ethic, but that this channel cannot serve as an explanation for the differences in development levels we observe around the world.

We would like to stress that our results should not be interpreted as evidence for a cultural superiority of peoples residing in temperate or cold climates. What we merely show is that different climatic conditions invite different cultural responses that are each tailored to the specific challenges the environment poses. There is no universal standard by which to evaluate these cultural responses and create some form of hierarchical ranking of them. Indeed, the fact that we find that climate-induced differences in work ethic are hardly responsible for the impact of climate on economic outcomes confirms the neutrality of our argument. More in general, our results imply that the literature on the impact of geography on institutional and economic development should play more attention to informal institutions in addition to formal ones.

Without refuting the importance of formal institutions as discussed by Acemoglu and Robinson (2012), this paper’s results indicate that their dismissal of culture as part of the story is premature. Geography and climate do not only affect formal institutions, but also play a role in the development of informal norms that are equally important for the way economies function. Combined with other recent research highlighting the impact of culture on institutional and economic development (Gorodnichenko and Roland 2016; Maseland 2013; Tabellini 2010), this suggests that the cultural channel in the geography-growth nexus should be taken more seriously.

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1. **Appendices**
2. **Data**

**Table A1: Survey Sample countries**

|  |  |
| --- | --- |
| **Survey wave** | **Country name** |
| **1981** | Argentina, Australia, Finland, Hungary, Japan, Mexico, South Africa, South Korea, Sweden, United States |
| **1990** | Argentina, Belarus, Brazil, Chile, China, Czech Republic, India, Japan, Mexico, Nigeria, Poland, Russia, Slovak Republic, South Africa, South Korea, Spain, Switzerland, Turkey |
| **1995** | Albania, Argentina, Armenia, Australia, Azerbaijan, Bangladesh, Belarus,  Bosnia & Herzegovina, Bulgaria, Chile, China, Colombia, Croatia, Czech Republic, Dominica, El Salvador, Estonia, Finland, Georgia, Germany, Hungary, India, Japan, Latvia, Lithuania, Macedonia, Mexico, Moldova, Montenegro, New Zealand, Nigeria, Norway, Pakistan, Peru, Philippines,  Poland, Puerto Rico, Romania, Russia, Serbia & Montenegro, Slovak Republic, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela |
| **2000** | Albania, Algeria, Argentina, Bangladesh, Bosnia & Herzegovina, Canada, Chile, China, Egypt, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kyrgyzstan, Macedonia, Mexico, Moldova, Montenegro, Morocco, Nigeria, Pakistan, Peru, Philippines, Puerto Rico, Saudi Arabia, Serbia & Montenegro, Singapore, South Africa, South Korea, Spain, Sweden, Tanzania, Turkey, Uganda, United States, Venezuela, Vietnam, Zimbabwe |
| **2005** | Andorra, Argentina, Australia, Brazil, Bulgaria, Burkina Faso, Canada, Chile, China, Colombia, Cyprus, Egypt, Ethiopia, Finland, France, Georgia,  Germany, Ghana, Guatemala, Hong Kong, Hungary, India, Indonesia, Iran, Iraq, Italy, Japan, Jordan, Malaysia, Mali, Mexico, Moldova, Morocco, Netherlands, New Zealand, Norway, Peru, Poland, Romania, Russia, Rwanda, Serbia & Montenegro, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Trinidad & Tobago, Turkey, Ukraine, United Kingdom, United States, Uruguay, Vietnam, Zambia |
| **2010** | Algeria, Argentina, Armenia, Australia, Azerbaijan, Bahrain, Belarus, Brazil, Chile, China, Colombia, Cyprus, Ecuador, Egypt, Estonia, Georgia, Germany, Ghana, Hong Kong, India, Iraq, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Libya, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Pakistan, Palestine, Peru, Philippines, Poland, Qatar, Romania, Russia, Rwanda, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Taiwan, Thailand, Trinidad & Tobago, Tunisia, Turkey, Ukraine, United States, Uruguay, Uzbekistan, Yemen, Zimbabwe |

1. **Saving and Work Attitude by Geographical Climates**

**Table B1: Simple arithmetic means of SWB by climate zone and employment status**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Employment status | Mean SWB,  On scale 1 to 4 (level) | % Change |
| Warm Climate | Employed | 3.0995 |  |
|  | Unemployed | 2.9795 | –3.87% |
| Cold Climate | Employed | 3.0496 |  |
|  | Unemployed | 2.8218 | –7.47% |

**Table B2: Correlation between geographical climate and proxies for saving behavior**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Child quality | | |
|  | Age group | thrift and saving | independence | responsibility |
| Cold geographical climate | All | 0.0619\*\*\* | 0.0859\*\*\* | 0.0627\*\*\* |
|  | < 35 years | 0.0263\*\*\* | 0.0966\*\*\* | 0.0494\*\*\* |
| Winter intensity | All | 0.0776\*\*\* | 0.0748\*\*\* | 0.1055\*\*\* |
|  | < 35 years | 0.0429\*\*\* | 0.0995\*\*\* | 0.1048\*\*\* |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table B3: Geographical climate and saving attitude: Simple Linear regression**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variable: proxies for attitude towards saving | | | | | | | | |
|  | Child’s thrift & saving | | | | | Child’s independence | | | |
| VARIABLES | (1) | (2) | (3) | (4) |  | (5) | (6) | (7) | (8) |
| COLD | 0.072\*\*\* |  | 0.040\*\*\* |  |  | 0.118\*\*\* |  | 0.133\*\*\* |  |
|  | (0.002) |  | (0.003) |  |  | (0.002) |  | (0.003) |  |
| WININT |  | 0.003\*\*\* |  | 0.002\*\*\* |  |  | 0.004\*\*\* |  | 0.005\*\*\* |
|  |  | (0.000) |  | (0.000) |  |  | (0.000) |  | (0.000) |
| Constant | 1.862\*\*\* | 1.887\*\*\* | 1.890\*\*\* | 1.903\*\*\* |  | 1.722\*\*\* | 1.738\*\*\* | 1.806\*\*\* | 1.816\*\*\* |
|  | (0.004) | (0.003) | (0.005) | (0.005) |  | (0.003) | (0.003) | (0.007) | (0.008) |
|  |  |  |  |  |  |  |  |  |  |
| Observations | 343,612 | 343,612 | 141,652 | 141,652 |  | 343,611 | 343,611 | 141,654 | 141,654 |
| R–squared | 0.011 | 0.013 | 0.009 | 0.010 |  | 0.028 | 0.023 | 0.028 | 0.025 |
| Year FE | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |
| Sample | All | All | Age < 35 | Age < 35 |  | All | All | Age < 35 | Age < 35 |

Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table B4: Intensity of winter climate and subjective well-being of unemployed people**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Ordered Logit**  **Dependent variable: ordered SWB** | | | | | | | | | |
| **VARIABLES** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |  |
| UNEMP | –0.175\*\*\*  (0.038) | –0.165\*\*\*  (0.039) | –0.191\*\*\*  (0.039) | –0.138\*\*\*  (0.042) | –0.182\*\*\*  (0.039) | –0.150\*\*\*  (0.042) | 0.0306  (0.088) | –0.045\*\*\*  (0.013) | –0.018  (0.027) |  |
|  | [0.839] | [0.848] | [0.826] | [0.871] | [0.834] | [0.861] | [1.031] |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| WININT | –0.021\*\*\*  (0.000) | –0.031\*\*\*  (0.000) | –0.029\*\*\*  (0.001) | –0.031\*\*\*  (0.001) | –0.028\*\*\*  (0.001) | –0.032\*\*\*  (0.001) | –0.023\*\*\*  (0.001) | 0.031\*\*\*  (0.005) | 0.025\*\*\*  (0.007) |  |
|  | [0.979] | [0.970] | [0.971] | [0.969] | [0.972] | [0.968] | [0.977] |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| UNEMP×WININT | –0.006\*\*\*  (0.001) | –0.005\*\*\*  (0.001) | –0.005\*\*\*  (0.001) | –0.005\*\*\*  (0.001) | –0.006\*\*\*  (0.001) | –0.007\*\*\*  (0.001) | –0.005\*\*  (0.002) | –0.097\*\*\*  (0.012) | –0.124\*\*\*  (0.020) |  |
|  | [0.994] | [0.995] | [0.995] | [0.995] | [0.992] | [0.993] | [0.996] |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Observations | 266,817 | 259,379 | 250,266 | 203,059 | 245,556 | 198,349 | 178,156 | 245,556 | 178,156 |  |
| (Pseudo) R-square | 0.041 | 0.052 | 0.053 | 0.052 | 0.057 | 0.057 | 0.059 | 0.060 | 0.063 |  |
| Sample | All | All | All | NPS | All | NPS | All | All | All |  |
| **FURTHER CONTROLS** | | | | | | |  |  |  |  |  |  |  |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Individual controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Economic Incentives | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Institutional quality | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Culture and Religion | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Evolutionary factors | No | No | No | No | Yes | Yes | Yes | Yes | Yes |  |
| Extra interaction | No | No | No | No | No | No | Yes | No | Yes |  |

Robust standard errors are given in the parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.; WININT = winter intensity. **Sample**: All = the whole sample; NPS = Non-protestant society.

**FURTHER CONTROLS**

**Individual controls** include six employment type dummies, five marital status dummies, health, education, Sex, Age, and Age–squared.

**Economic Incentives** include individual’s income level, education, national per capita GDP, welfare state dummy (or alternatively welfare expenditure as a percentage of GDP).

**Institutional quality** includes rule of law (or alternatively voice and accountability) and national level average unemployment.

**Culture and Religion** include individual’s adherence to her/his religion if she/he follows one (or alternatively respondent’s secular value calculated from factors such as beliefs in hell/heaven and tolerance toward homosexuality and sexual relationship outside of marriage) and country level percentage share of the population following Catholicism and Islam.

**Evolutionary factor** is an approximation for genetic advancement measured by two factors: the percentage of population that originate from cold climate zone since 1500 and logarithm of distance (in kilometers) of the respondent’s country from Ethiopia (the widely accepted place of human origin).

**Table B5: Migratory routes and controlling for further interaction (MLA)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Dependent variable: ordered SWB** | | | | | |  |
|  | **Ordered Logit** | | | | Mixed ordered logit (MLA) | |  |
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |  |
| UNEMP | 0.686\*\*\* | 0.721\*\*\* | –0.148\*\*\* | 0.181\*\* | –0.125\* | –0.0621 |  |
|  | (0.185) | (0.198) | (0.037) | (0.077) | (0.076) | (0.111) |  |
| COLD | –0.451\*\*\* |  |  |  |  |  |  |
|  | (0.019) |  |  |  |  |  |  |
| UNEMP×COLD | –0.249\*\*\* |  |  |  |  |  |  |
|  | (0.057) |  |  |  |  |  |  |
| WININT |  | –0.023\*\*\* |  |  |  |  |  |
|  |  | (0.001) |  |  |  |  |  |
| UNEMP×WININT |  | –0.006\*\*\* |  |  |  |  |  |
|  |  | (0.002) |  |  |  |  |  |
| Migratory Route | 0.232\*\*\* | 0.304\*\*\* | –0.228\*\*\* | 0.054\*\*\* | –0.400\* | –0.0227 |  |
|  | (0.020) | (0.020) | (0.015) | (0.019) | (0.219) | (0.316) |  |
| UNEMP×Migratory Route |  |  | –0.309\*\*\* | –0.427\*\*\* | –0.280\*\*\* | –0.400\*\*\* |  |
|  |  |  | (0.034) | (0.058) | (0.108) | (0.092) |  |
|  |  |  |  |  |  |  |  |
| Observations | 178,156 | 178,156 | 245,556 | 178,156 | 245,556 | 178,156 |  |
| Number of groups |  |  |  |  | 87 | 59 |  |
| R-squared | -- | -- | -- | -- | -- | -- |  |
| **Further controls** |  |  |  |  |  |  |  |
| Individual controls | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Institutional quality & Incentives | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Culture and Religion | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Evolutionary distance | Yes | Yes | Yes | Yes | Yes | Yes |  |
| Extra interactions | Yes | Yes | No | Yes | No | Yes |  |

Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table B6: Informal institution as mediator of formal institution,

|  |  |  |
| --- | --- | --- |
|  | Dependent variable | |
|  | RegQual. | Polity2 |
| Effects | (2) | (3) |
| ACME | 0.024 | 0.050\*\* |
| Direct Effect | 0.512\*\* | 4.364\*\* |
| Total Effect | 0.536\*\* | 4.413\*\* |
|  |  |  |
| % of Total Effect mediated | 0.044\*\* | 0.011\*\* |
| Further controls | Yes | Yes |
| Mediator |  |  |

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

1. **Instrumental Variable (IV) Approach**

As part of the robustness checks, we also estimate the IV model.

**IV model specification:**

**Stage 1:**

  (C1)

where  and are parameters to be estimated, geographical climate indicator dummy and is the error term.

**Stage 2:**

 (C2)

is per capita GDP of country j at time (year) t; (i.e., work ethic from step 1) is the main explanatory variable here and is instrumented by climate variable,as specified in stage 1 to obtainfor stage 2 estimation; is a matrix of other national level controls; and  is residual term. Geographical climate (and migratory route as an additional alternative) is used to instrument the work ethics in the IV model. We don’t argue that climate and work ethics are the sources and the channels, but a source and a channel through which geography leads to divergence in wealth among nations. Thus, in addition to using more instruments that may influence work ethics (i.e., informal institution), we also include formal institution in our analysis.

As mentioned earlier, the work ethics is assumed to be some form of capital. Thus, capital–labour ratio and labour in the form of participation rate are included in the estimation, but the latter is not significant and, thus, excluded from the results tables below.

Table C1: Work ethics and per capita GDP, 2SLS model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | work ethic = –1 | | | | | |  | work ethic = 1 if | | | |
| VARIABLES |  |  |  | |  | |  |  |  |  |  |
|  | (1) | (2) | (3) | (4) | (5) | (6) |  | (7) | (8) | (9) | (10) |
| Work ethic | 9.279\*\* | 3.830\*\* | 4.940\* | 3.674\*\* | 4.300\*\* | 3.461\*\* |  | 2.837\*\* | 2.714\*\* | 2.370\* | 2.768\*\* |
|  | (4.271) | (1.657) | (2.573) | (1.454) | (1.723) | (1.378) |  | (1.420) | (1.258) | (1.243) | (1.226) |
| Evolution factor |  | 0.634\*\*\* |  | 0.535\*\*\* | 0.662\*\*\* | 0.521\*\*\* |  | 0.586\*\*\* | 0.482\*\*\* | 0.556\*\*\* | 0.486\*\*\* |
|  |  | (0.162) |  | (0.146) | (0.173) | (0.139) |  | (0.174) | (0.157) | (0.154) | (0.158) |
| Social factor |  | 0.010\*\*\* |  | 0.0015 | 0.010\*\*\* | 0.001 |  | 0.009\*\*\* | 0.0002 | 0.010\*\*\* | 0.0002 |
|  |  | (0.003) |  | (0.003) | (0.003) | (0.002) |  | (0.003) | (0.003) | (0.002) | (0.003) |
| Capital–Labour ratio |  |  | 0.012\*\*\* | 0.012\*\*\* |  | 0.012\*\*\* |  |  | 0.012\*\*\* |  | 0.012\*\*\* |
|  |  |  | (0.000) | (0.000) |  | (0.000) |  |  | (0.000) |  | (0.000) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Constant | 8.579\*\*\* | 3.209\*\* | 8.286\*\*\* | 3.925\*\*\* | 2.916\* | 4.064\*\*\* |  | 2.785 | 3.568\*\* | 3.249\* | 3.514\*\* |
|  | (1.052) | (1.549) | (0.574) | (1.385) | (1.644) | (1.317) |  | (1.939) | (1.739) | (1.711) | (1.729) |
| Observations | 230 | 225 | 230 | 225 | 225 | 225 |  | 225 | 225 | 225 | 225 |
| R–squared | –– | 0.020 | 0.031 | 0.122 | 0.023 | Yes |  | 0.019 | 0.125 | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | 0.024 |  | Yes | Yes | 0.017 | 0.131 |
| Instruments | A | A | A | A | B | B |  | A | A | B | B |
| **Diagonestics** |  |  |  |  |  |  |  |  |  |  |  |
| Endogeneity (H0: exogenous) | | | | | | | | | | | |
| Durbin Chi2 (p–value) | 36.71  (0.000) | 10.405  (0.001) | 24.503 (0.000) | 25.937 (0.000) | 14.459  (0.000) | 23.256 (0.000) |  | 11.614 (0.001) | 27.187 (0.000) | 8.270  (0.004) | 30.825  (0.000) |
| Wu–Hausman F–stat  (p–value) | 38.56  (0.000) | 9.552 (0.002) | 24.086 (0.000) | 25.538 (0.000) | 13.529  (0.000) | 22.594  (0.000) |  | 10.722 (0.001) | 26.938 (0.000) | 7.517  (0.007) | 31.115  (0.000) |
| Weak instr. (H0: weak ) | | | | | | | | | | | |
| F–stat (p–value) | 4.633  (0.033) | 7.091  (0.008) | 3.807  (0.052) | 7.015  (0.009) | 3.803  (0.024) | 3.542  (0.031) |  | 5.034  (0.026) | 4.976 0.027 | 2.589  (0.078) | 2.697  (0.069) |
| **Overid. restrictions test** |  |  |  |  |  |  |  |  |  |  |  |
| Sargan Chi2 (p–value) |  |  |  |  | 0.987  (0.321) | 1.649 (0.199) |  |  |  | 4.282  (0.039) | 0.0221  (0.882) |
| Basmann Chi2 (p–value) |  |  |  |  | 0.868  (0.352) | 1.447 (0.229) |  |  |  | 3.822  (0.051) | 0.0193  (0.889) |

Standard errors in parentheses;\*\*\* p<0.01, \*\* p<0.05, \* p<0.1; Instrument “A”: cold climate dummy; Instrument “B”: cold climate dummy and protestant society dummy [e.g., van Hoorn and Maseland (2013) show that people who live in protestant society have high work ethics]. **Religion factor** = share of Catholic and Muslim population (for they are conservative and tend to stick to scriptures over economic gains); **Social factor** = trust (trust in other people); **Evolution factor** = log of distance from Ethiopia.

Endogeneity test (i.e., H0: exogenous) has very low P–value and thus, we reject the null hypothesis at 1% level in all the specifications. This means that the instrumented variable is indeed endogenous and it is appropriate to use IV estimation approach. Weak instrument test (i.e., H0: weak instrument) in general rejects the null hypothesis at 5 to 10 % significance level implying that the instruments are valid. The overidentifying restrictions test (i.e., H0: additional instrument is valid) is not rejected in most of the specifications and that means that the second instrument is valid to be used as additional instrument. We also used a third additional instrument in a set of Instrument “C” which includes B and Trust. The additional instrument is generally valid; the results are not presented here for space reasons. Migratory route as an IV doesn’t satisfy the over-identifying restriction test and, thus, excluded.

Some literature recommends binary model estimation when the endogenous explanatory variable is binary like in columns (7) through (10) of Table C1. Thus, we estimate IV probit in its first stage and Maximum Likelihood method to obtain final estimates (see Table C4). Chi2 (p–value) are significant and the null hypothesis (Wald test of independence, H0:, i.e., no endogeneity) is rejected at 1% level in all the specifications. Thus, the Wald test of independence shows that it is appropriate in this case too to use the IV model instead of a plain probit regression.

Next we add formal institution to our analysis. Social factor (i.e., trust and regulatory quality) are excluded from the report since they are not significant in these specifications. Adding formal institution reduces the effect (showing both play role or showing informal institution is a way). In columns (4), (5), (8) and (9) we use productivity, as measured by output side per capita GDP. The results remain consistent. The results in Table C3, shows that the results remain the same when we use Polity2 as a measure of the quality of formal institution.

Table C2: Informal institution, formal institution and income

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | work ethic = –1 | | | | | | work ethic = 1 if | | | |
| VARIABLES | (1) | (2) | (3) | (4) | (5) |  | (6) | (7) | (8) | (9) |
| Formal Institution | 0.73\*\*\* | 0.210 | –1.542 | 0.066 | –0.139 |  | 0.179 | 0.464 | 0.118 | 1.382 |
|  | (0.190) | (0.297) | (2.427) | (0.269) | (1.219) |  | (0.328) | (2.037) | (0.239) | (1.769) |
| Work ethic | -- | 4.834\* | 5.821 | 4.009\*\* | 3.964\*\* |  | 3.222\* | 3.269\* | 2.108\*\* | 2.834\* |
|  |  | (2.755) | (3.685) | (1.935) | (1.938) |  | (1.796) | (1.853) | (1.006) | (1.660) |
| Capital–Labour ratio | 0.001\*\* | 0.001\*\*\* | 0.002\* | 0.0014\*\*\* | 0.0014\*\*\* |  | 0.001\*\*\* | 0.0013 | 0.0014\*\*\* | 0.0011\* |
|  | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |  | (0.000) | (0.000) | (0.000) | (0.000) |
| Evolution factor | 0.128\* | 0.672\*\* | 0.795\*\* | 0.614\*\*\* | 0.614\*\*\* |  | 0.596\*\* | 0.596\*\* | 0.496\*\*\* | 0.562\*\* |
|  | (0.074) | (0.289) | (0.397) | (0.230) | (0.228) |  | (0.258) | (0.262) | (0.175) | (0.249) |
| Constant | 8.28\*\*\* | 2.698 | 0.809 | 3.160 | 3.082 |  | 2.412 | 2.507 | 3.699\* | 3.293 |
|  | (0.733) | (2.820) | (4.360) | (2.222) | (2.251) |  | (2.975) | (3.093) | (1.925) | (2.600) |
| Observations | 229 | 222 | 222 | 210 | 210 |  | 222 | 222 | 210 | 210 |
| R-squared | 0.719 | -- | -- | -- | -- |  | -- | -- | 0.072 | -- |
| Year FE | Yes | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |
| Instrument | B | B | B | B | B |  | B | B | B | B |
| **Endogeneity test** |  |  |  |  |  |  |  |  |  |  |
| Durbin, Chi2 | 8.12\*\*\* | 20.46\*\*\* | 26.08\*\*\* | 20.99\*\*\* | 21.14\*\*\* |  | 27.23\*\*\* | 27.40\*\*\* | 19.22\*\*\* | 22.95\*\*\* |
| Wu–Hausman F–stat | 7.35\*\*\* | 19.39\*\*\* | 12.65\*\*\* | 19.89\*\*\* | 9.96 \*\*\* |  | 26.71\*\*\* | 13.38\*\*\* | 18.03\*\*\* | 10.92\*\*\* |
| **Weak Inst., F–stat** |  |  |  |  |  |  |  |  |  |  |
| Goveffectv | 15.71\*\*\* | -- | 2.64 | -- | 4.27\*\* |  | -- | 2.64\* | -- | 4.27\*\* |
| workethic | -- | 1.52 | 1.54 | 2.23 | 2.21 |  | 1.63 | 1.62 | 2.66\* | 2.52\* |
| **Overid. rest. test** |  |  |  |  |  |  |  |  |  |  |
| Sargan Chi2 | 14.3\*\*\* | 0.83 | -- | 0.03 | -- |  | 0.02 | -- | 0.917 | -- |
| Basmann Chi2 | 13.4\*\*\* | 0.71 | -- | 0.03 | -- |  | 0.018 | -- | 0.79 | -- |

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; Formal institution: = government effectiveness. The combination/joint IV is not strong for work ethics in some cases. The cold climate & prot. society are strong IVs for work ethics when separate. For formal institution (government effectiveness), combinations too are valid in all cases except in column (3).

Table C3: Using Polity2 in IV estimation (New results )

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | work ethic = –1 | | | |  | work ethic = 1 if | | |
| VARIABLES | (1) | (2) | (3) | (4) |  | (5) | (6) | (7) |
| Formal Institution (Polity2) | 0.083\*\*\* | –0.011 | -0.038 | –0.017 |  | –0.023 | 0.031 | 0.037 |
|  | (0.025) | (0.017) | (0.097) | (0.066) |  | (0.022) | (0.047) | (0.038) |
| Work ethic | -- | 3.699\*\* | 4.421 | 3.858\* |  | 2.218\*\* | 1.813\* | 1.724\*\* |
|  |  | (1.530) | (3.079) | (2.294) |  | (1.028) | (0.973) | (0.849) |
| Capital–Labour ratio | 0.0001\*\*\* | 0.0012\*\*\* | 0.0013\*\*\* | 0.0013\*\*\* |  | 0.0014\*\*\* | 0.0012\*\*\* | 0.0012\*\*\* |
|  | (0.000) | (0.000) | (0.000) | (0.000) |  | (0.000) | (0.000) | (0.000) |
| Evolution factor | 0.121 | 0.544\*\*\* | 0.641\* | 0.565\*\* |  | 0.520\*\*\* | 0.386\*\* | 0.368\*\* |
|  | (0.0807) | (0.164) | (0.388) | (0.280) |  | (0.167) | (0.183) | (0.156) |
| Constant | 7.537\*\*\* | 3.826\*\* | 3.003 | 3.622 |  | 3.514\*\* | 4.670\*\*\* | 4.833\*\*\* |
|  | (0.668) | (1.516) | (3.362) | (2.498) |  | (1.736) | (1.802) | (1.578) |
|  |  |  |  |  |  |  |  |  |
| Observations | 216 | 209 | 209 | 209 |  | 209 | 209 | 209 |
| R-squared | 0.651 | 0.006 | -- | -- |  | -- | 0.202 | 0.241 |
| Further controls | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| Model | 2sls | 2sls | 2sls | 2sls |  | 2sls | 2sls | 2sls |
| Inst | B | B | B | C |  | B | B | C |
| **Endogeneity test** |  |  |  |  |  |  |  |  |
| Durbin, Chi2 | 14.28\*\*\* | 23.08\*\*\* | 23.55\*\*\* | 22.96\*\*\* |  | 20.11\*\*\* | 25.38\*\*\* | 25.27\*\*\* |
| Wu–Hausman F–stat | 13.24\*\*\* | 22.22\*\*\* | 11.30\*\*\* | 11.04\*\*\* |  | 19.06\*\*\* | 12.30\*\*\* | 12.31\*\*\* |
| **Weak Inst. F–stat(1st stage)** |  |  |  |  |  |  |  |  |
| Polity2 | 13.27\*\*\* | --- | 12.48\*\*\* | 10.22\*\*\* |  | --- | 12.48\*\*\* | 10.22\*\*\* |
| workethic | --- | 3.12\*\* | 3.97\*\* | 2.65\*\* |  | 2.72\* | 3.57\*\* | 2.45\* |
| **Overid. Restriction test** |  |  |  |  |  |  |  |  |
| Sargan Chi2 | 8.28\*\*\* | 0.11 | --- | 0.14 |  | 1.26 | -- | 0.04 |
| Basmann Chi2 | 7.45\*\*\* | 0.10 | --- | 0.12 |  | 1.09 | -- | 0.04 |

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; All the IV tests support the result except the over-identifying restriction test in column (1). Formal institution: Polity2

Table C4: Work ethics and per capita GDP, Maximum Likelihood IV Probit model,

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | work ethic = 1 if | | | | | | | |
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | |
| Work ethic | 1.469\*\*\* | 1.074\*\*\* | 0.669\*\*\* | 0.748\*\*\* | 1.489\*\*\* | 1.098\*\*\* | 0.696\*\*\* | 0.739\*\*\* | |
|  | (0.260) | (0.347) | (0.177) | (0.167) | (0.249) | (0.365) | (0.163) | (0.159) | |
| Evolution factor |  | 0.397\*\*\* |  | 0.293\*\*\* |  | 0.397\*\*\* |  | 0.288\*\*\* | |
|  |  | (0.083) |  | (0.052) |  | (0.083) |  | (0.051) | |
| Social factor |  | 0.009\*\*\* |  | – 0.001 |  | 0.009\*\*\* |  | – 0.001 | |
|  |  | (0.002) |  | (0.001) |  | (0.002) |  | (0.001) | |
| Capital–Labour ratio |  |  | 0.014\*\*\* | 0.014\*\*\* |  |  | 0.014\*\*\* | 0.014\*\*\* | |
|  |  |  | (0.000) | (0.000) |  |  | (0.000) | (0.000) | |
|  |  |  |  |  |  |  |  |  | |
| Constant | 9.061\*\*\* | 5.394\*\*\* | 8.556\*\*\* | 6.248\*\*\* | 9.056\*\*\* | 5.389\*\*\* | 8.518\*\*\* | 6.260\*\*\* | |
|  | (0.382) | (0.763) | (0.214) | (0.474) | (0.381) | (0.763) | (0.215) | (0.472) | |
| Observations | 230 | 225 | 230 | 225 | 230 | 225 | 230 | 225 | |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | |
| Instrument | A | A | A | A | B | B | B | B | |
| R–squared | –– | 0.115 | 0.021 | 0.149 | –– | 0.128 | 0.043 | 0.064 | |
|  |  |  |  |  |  |  |  |  | |
| Wald test of independence,  Chi2 (p–value) | 27.06 (0.000) | 7.73  (0.005) | 15.28  (0.000) | 18.03  (0.000) | 30.29  (0.000) | 7.12  (0.008) | 19.69  (0.000) | 20.18  (0.000) | |
| Overall Wald test,  Chi2 (p–value) | 92.05  (0.000) | 138.32  (0.000) | 609.22  (0.000) | 702.59  (0.000) | 95.46  (0.000) | 138.81  (0.000) | 608.48  (0.000) | 692.95  (0.000) | |
| Log likelihood | –422.059 | –391.966 | –308.174 | –288.439 | –421.748 | –391.951 | –305.630 | –286.606 | |

Standard errors in parentheses;\*\*\* p<0.01, \*\* p<0.05, \* p<0.1; ; Instrument “A”: cold climate dummy; Instrument “B”: A and protestant society dummy [e.g., van Hoorn and Maseland (2013) show that people who live in Protestant societies have higher work ethics.

1. This selection coincide with territories that experience snow falls during the winter as well as NASA map that divide cold climate zone from warm climate zone. This is also consistent with the countries Gallup et al., (1999) classified as non-tropical or temperate zone countries. [↑](#footnote-ref-1)
2. This is a more direct measure of geography than distance from the equator that is used in some studies (e.g. Hall and Jones, 1999). [↑](#footnote-ref-2)
3. See the note at the bottom of Table 2 for the full list. Similar controls were used by van Hoorn and Maseland (2013) in their analysis of the protestant work ethics. [↑](#footnote-ref-3)
4. The extra interactions refers to and include interaction of unemployment with welfare nations dummy, religiosity factor, average national unemployment , per capita GDP, expenditure on social security, protestant society, and evolutionary distance. [↑](#footnote-ref-4)
5. The extra interactions refers to and include interaction of unemployment with welfare nations dummy, religiosity factor, average national unemployment , per capita GDP, expenditure on social security, protestant society, and evolutionary distance. [↑](#footnote-ref-5)