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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.

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1. Introduction

One of the most widely accepted stylized facts in development economics is that the closer one gets to the equator, the lower income per capita levels are (Sala-i-Martin, 1997; 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, 2013; Sachs 2001), the availability of domesticable plants and animals (Diamond, 1997; Olsson and Hibbs, 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 and Robinson, 2001; Easterly and Levine, 2003; Rodrik et al., 2004; Acemoglu and Robinson, 2012).

In addition to these two accepted channels, a third possible channel has been suggested by Ibn Khaldun (1377) and, perhaps most famously, by de Montesquieu (1748), echoed in more recent times by historians (Huntington, 1915; Toynbee, 1959) and political leaders such as Mahathir bin Mohamed (1970) and Lee Kuan Yew (Barr, 1999). The argument holds that “people are...more vigorous in cold climates” (de Montesquieu, 1748, p161). This is because heat drains energy, but also be-

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cause hot climates breed indolence due to the associated natural abundance. Colder climates, with their clearly demarcated seasons, create the necessity for people to work hard and save in order to survive. "The barrenness of the earth renders men industrious, sober, inured to hardship, courageous, and fit for war; they are obliged to procure by labor what the earth refuses to bestow spontaneously. The fertility of a country gives ease, effeminacy, and a certain fondness for the preservation of life" (ibid, p196). 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 almost completely lacking (see [Piergalini and Nichols, 2016](#) for a rare exception).

In this paper, we provide a novel empirical assessment of the climate-culture-economy hypothesis. We do so in two steps. First, in the main part of our analysis, we investigate the relation between climate and work ethic. We follow the methodology developed in [van Hoorn and Maseland \(2010, 2013\)](#), to trace differences in the subjective wellbeing effects of unemployment between individuals across climates. While we consider this our most important contribution, for completeness we also consider the channel from work ethic to economic performance. In a subsequent second step, we therefore relate 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 find 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, 2010](#); [Gorodnichenko and Roland, 2017](#); [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 behavior.

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.

2. 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, 2011](#)). 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 and Weil, 2010](#)). Agricultural suitability has also been linked to democracy, through an effect on human capital accumulation ([Haber and Menaldo, 2011](#)). 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, 2000](#)). Pathogen prevalence has, through its impact on colonial settlement, been similarly linked to the development of an extractive institutional framework ([Acemoglu and Robinson, 2001](#); [Acemoglu and Robinson, 2012](#)).

Beyond formal institutions, a long tradition of authors, including reputable names such as De Montesquieu, Alexander von Humboldt, David Hume, Friedrich List, and J.S. Mill, have theorized about a link between climate, cultural attitudes and economic performance ([Boianovski, 2013a](#); [2013b](#)). Two mechanisms have been suggested. First, heat has direct energizing effects on the body, reducing the inclination to work directly. A hot climate may "deprive the body of all vigor and strength. Then the faintness is communicated to the mind; there is no curiosity, no enterprise, no generosity of sentiment; the inclinations are all passive; indolence constitutes the utmost happiness" ([de Montesquieu, 1748](#), p162-3). Such a reduced inclination to work effort may over time become a cultural norm, translating into lower economic performance. The second mechanism also focuses on work ethic but relates it to necessity. In this argument, tropical areas provide an abundance of

resources and energy, allowing people to survive with relatively little effort. In the words of Hume (1777, 267) “the warmth and equality of weather in the torrid zone, which renders clothes and houses less requisite for the inhabitants, and thereby remove, in part, that necessity, which is the great spur to industry and invention.” Abundance means that hunting and gathering are viable strategies to garner energy. Since such a life-style involves little in terms of capital goods and the types of food produced typically do not lend themselves to storage, there is little incentive to put in extra effort to save a surplus (Morris, 2017). What is important, though, is working together. The main threats in tropical environments come from predatory animals and diseases which are equally abundant. Such conditions induce communal lives in which people hunt or protect themselves and their livestock collectively. This leads to the formation of (informal) institutions that promote cooperation but discourage competition among people, further reducing incentives for individuals to work hard to get ahead. Thus, climatic abundance is considered to breed indolence (de Montesquieu, 1748, p273), which over time may translate into a cultural norm.

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 (Beugelsdijk and Maseland, 2010). A prominent example is Alesina et al. (2013), who show that geo-climatic characteristics favoring plow agriculture over shifting cultivation have made a long lasting imprint on gender roles in societies. Santos Silva et al. (2017) make a similar argument, tracing gender egalitarianism back to climate zones characterized by moderate seasonality and ubiquitous fresh water. Maseland (2013) shows that the prevalence of certain parasites associated with warmer climates has effects on attitudes, translating into a culture that negatively affects institutional quality. Davis (2016) adds to this that the risk involved in agriculture, resulting from climatic variation, determines attitudes towards individual responsibility. Environments with highly unpredictable rainfall tend to develop collective insurance mechanisms to protect individuals against crop failures. In contrast, in areas where rainfall is highly predictable, crop failure is more closely related to individual effort. In such a context collective risk-sharing arrangements are less viable. Since rainfall variability is strongly associated with the arid belt straddling the equator at about 30° latitude, we can expect more individualism in colder climates.

Though so far staying away from the especially controversial issue of work ethic, this new ‘climate and culture’ literature discusses many closely related value patterns. The emphasis on cooperation over competition and individual responsibility in warm climates, resulting from the specific threats and opportunities offered by hot environments, is likely to translate into a broader cultural orientation of collectivist values. Colder climates induce people to spend more time indoors, resulting in an emphasis of the private over the public sphere that fosters individualism. A literature focusing on pathogen prevalence (which is generally associated with warmer climates) has linked pathogens 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 (Sen, 1999; and Halperin et al., 2005). 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. As both the emphases on the collective over the individual and on social order over new experiences remove incentives for individuals to get ahead of others, a lower work ethic may be considered part of these wider cultural patterns (Davis and Wu, 2019; Gorodnichenko and Roland, 2017). Likewise, the role of climate in the formation of time preferences is also closely related to work ethic arguments (Galor and Ozak, 2016). The main challenge of surviving in cold climates comes from scarcity, especially during winter seasons during which it is difficult to produce or collect food. Cold and a lower abundance of resources makes planting and sedentary life-styles more viable compared to hunting and gathering. Since planting requires a longer time horizon and the concentration of intensive activity in the agricultural season, this stimulates increased work efforts now for higher rewards later in time (Galor and Ozak, 2016). Hume (1777) adds to this that agriculture in cold climates also involves a more careful planning, stretching over multiple years (Bioanovsky, 2013a). Lack of year round food availability in cold climates thus stimulates the formation of norms and attitudes that promote postponed gratification, and, thus, saving and innovation (Galor and Ozak, 2016). As longer time-horizons imply increased incentives to work hard in the present in order to produce surpluses for the future, this cultural effect is conceptually strongly associated with impact on the work ethic. All in all, there is ample reason to believe that the cultural effects of culture hypothesized by de Montesquieu and others may be relevant. In light of these recent results, a direct investigation into the supposed climatic effects on work attitudes is overdue.

We propose the following framework (Fig. 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.

We will mainly aim to assess the empirical relevance of Channel 1–2 in the relation between climate and work ethic, while also checking for the relevance of Channels 2 and 3. The literature provides evidence that there is a positive correlation between motivation to work and productivity (e.g. Kruse, 1992; Belorgey et al., 2006; Grant, 2008; Herzberg et al., 2011) as well as between productivity and macroeconomic performance (e.g. Verdoorn, 1949; Kaldor, 1957; Jorgenson et al., 1987;

Fig. 1. Geographical climate, work ethics and development.

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.

We would like to stress that while we focus on work ethic throughout this paper, we use this mainly as a specific illustration of a general cultural channel of climate effects. We do not rule out—and actually expect—this specific effect to be part of a broader pattern of cultural orientation with repercussions for economic development. As we argued, the specific environment of abundant tropical climates may foster long-term, cooperative attitudes over competition and individual interest-seeking. Work ethic is but one aspect of this. A lower work ethic in hot climates may very well be part of a wider cultural orientation.

3. 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 Fig. 1. In order to estimate the effects of climate on work ethic, we follow the approach pioneered in van Hoorn and Maseland (2010; 2013) and advanced further in Davis and Wu (2019) and Davis and Gao (2020). This ‘experienced preferences’ method, as it may be called (Maseland and van Hoorn, 2010), 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:

$$SWB_{ijt} = \alpha + \beta UNEMP_{ijt} + \mu GeoClimate_j + \gamma (UNEMP_{ijt} \times GeoClimate_j) + \theta X_{ijt} + \rho Y_{jt} + \varepsilon_{ijt} \quad (1)$$

where '*GeoClimate_j*' stands for '*COLD_j*' or '*WININT_j*'; X_{ijt} and Y_{jt} are matrices of individual i level and country j level addition controls during survey year t , respectively, α , β , μ , and γ are parameters, θ and ρ are vectors of parameters, and ε_{ijt} is the residual term.

To measure SWB, we will make use of the [World Value Survey \(1981–2014\)](#) 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 [Eq. \(1\)](#), 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.

3.2. Work ethic and income

After we will have investigated whether climate is related to differences in work ethic, we will then briefly 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:

$$SWB_{ijt} = \hat{\delta}_{jt} + \hat{\eta}_{jt} UNEMP_{ijt} + \hat{\lambda}_{jt} X_{ijt} + \nu_{ijt} \quad (2)$$

where SWB_{ijt} is subjective wellbeing of respondent i in country j at time/year t ; X_{ijt} is a matrix of all other additional individual level controls such as income, education, health, age, and marriage status; ν_{ijt} is residual term; and $\hat{\delta}_{jt}$, $\hat{\eta}_{jt}$ and $\hat{\lambda}_{jt}$ are parameters to be estimated for each country j and time t .

We will store all country-level estimated coefficients $\hat{\eta}_{jt}$, 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 $\hat{\eta}_{jt}$ 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:

$$\tilde{\eta}_{jt} = \tilde{\delta} + \tilde{\zeta} Cold_j + e_{jt\eta} \Rightarrow \hat{\eta}_{jt} = \tilde{\delta} + \tilde{\zeta} Cold_j \quad (3)$$

$$PcGDP_{jt} = \hat{\ell} + \hat{\xi} \hat{\eta}_{jt} + \hat{\psi} Cold_j + e_{jty} \quad (4)$$

Where $\hat{\psi}$ measures direct effect of Cold climate on per capita GDP ($PcGDP_{jt}$); the product $\tilde{\zeta} \times \hat{\xi}$ measures the indirect effect of $Cold_j$ on $PcGDP_{jt}$ via the mediation variable $\hat{\eta}_{jt}$; and the total effect is the sum of the direct and the indirect effects, $\hat{\psi} + \tilde{\zeta} \times \hat{\xi}$. The validity of these effects requires that we assume the error terms ($e_{jt\eta}$, e_{jty}) are uncorrelated and both normally distributed. The interpretation of the two structural equations is simultaneous.

4. 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 socioeconomic 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).

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

Table 1
Data.

Survey wave	Survey years	Number of countries	Number of respondents
1981	1981–1988	10	13,586
1990	1989–1994	18	24,558
1995	1995–1999	54	77,129
2000	2000–2004	41	60,045
2005	2005–2009	58	83,975
2010	2010–2014	60	86,272
Total	1981–2014	100	345,565

Table 2

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%

“totally unhappy” and “4” stands for “very happy”. The main explanatory variables are thus, see Eq. (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° North and 35° South,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 The individual-level control variables that we use are employment indicator dummies, marital status dummies, education, gender and age of a respondent³ 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

5. Estimation results

5.1. Channel 1: Climate and work ethic

5.1.1. 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 2).

These results are confirmed in a more systematic analysis (Tables 3 and 4). Table 3 presents 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 first 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 varies across climates: does it hurt more to be unemployed in colder climate zones?

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.

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).

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 ethic.

Table 3

Cold climate and subjective well-being of unemployed people.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
UNEMP	−0.231*** (0.0311) [.793]	−0.255*** (0.0319) [.775]	−0.213*** (0.0326) [.808]	−0.219*** (0.0347) [.804]	−0.165*** (0.0327) [.848]	−0.174*** (0.0349) [.840]	1.054*** (0.177) [2.87]
COLD	−0.171*** (0.00831) [.843]	−0.470*** (0.00934) [.625]	−0.241*** (0.0113) [.786]	−0.340*** (0.0119) [.712]	−0.324*** (0.0114) [.723]	−0.425*** (0.0120) [.654]	−0.397*** (0.0117) [.672]
UNEMP × COLD	−0.159*** (0.0287) [.853]	−0.121*** (0.0292) [.886]	−0.169*** (0.0295) [.844]	−0.154*** (0.0336) [.857]	−0.194*** (0.0296) [.824]	−0.161*** (0.0338) [.852]	−0.0968** (0.0385) [.908]
Observations	266,817	259,379	252,430	205,435	252,430	205,435	252,430
(Pseudo) R2	.035	.044	.055	.054	.063	.063	.065
Sample	All	All	All	NPS	All	NPS	All
FURTHER CONTROLS							
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Incentives	No	Yes	Yes	Yes	Yes	Yes	Yes
Institutional quality	No	Yes	Yes	Yes	Yes	Yes	Yes
Culture and Religion	No	No	Yes	Yes	Yes	Yes	Yes
Evolutionary factors	No	No	No	No	Yes	Yes	Yes
Extra interactions	No	No	No	No	No	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 and welfare expenditure as a percentage of GDP. The results remain the same in both cases. *Institutional quality* includes rule of law and national level average unemployment. *Culture and Religion* include individual'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 diversity measured by the 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; odds-ratios between brackets; *** $p < .01$, ** $p < .05$, * $p < .1$. **Sample:** All = the whole sample; NPS = Non-protestant society.

Table 4

Intensity of winter climate and subjective well-being of unemployed people.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
UNEMP	−0.175*** (0.0377) [.839]	−0.165*** (0.0386) [.848]	−0.121*** (0.0392) [.886]	−0.0817* (0.0420) [.922]	−0.0980** (0.0393) [.907]	−0.0576 (0.0422) [.944]	1.034*** (0.179) [2.82]
WININT	−0.0214*** (0.000352) [.979]	−0.0306*** (0.000384) [.970]	−0.0242*** (0.000427) [.976]	−0.0236*** (0.000452) [.976]	−0.0215*** (0.000429) [.979]	−0.0215*** (0.000453) [.979]	−0.0221*** (0.000433) [.978]
UNEMP × WININT	−0.00613*** (0.00123) [.994]	−0.00501*** (0.00125) [.995]	−0.00606*** (0.00125) [.994]	−0.00748*** (0.00137) [.993]	−0.00616*** (0.00125) [.994]	−0.00747*** (0.00137) [.993]	−0.00389*** (0.00147) [.996]
Observations	266,817	259,379	252,430	205,435	252,430	205,435	252,430
(Pseudo) R-square	0.041	0.052	0.060	0.059	0.066	0.066	0.068
Sample	All	All	All	NPS	All	NPS	All
FURTHER CONTROLS							
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic Incentives	No	Yes	Yes	Yes	Yes	Yes	Yes
Institutional quality	No	Yes	Yes	Yes	Yes	Yes	Yes
Culture and Religion	No	No	Yes	Yes	Yes	Yes	Yes
Evolutionary factors	No	No	No	No	Yes	Yes	Yes
Extra interactions	No	No	No	No	No	No	Yes

Notes: see Table 3.

The interaction terms provide this information. Throughout all models, we find that being out of a job has an additional negative effect on subjective well-being for people living in colder climates. Being unemployed lowers everyone's well-being, but it hurts more 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 2–7. 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.

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

This figure portrays the happiness of people unemployed per climate zone, using the grand mean happiness of all people in the climate zone as reference. It shows that the negative impact of unemployment on subjective well-being is substantially larger in colder climates, providing support for De Montesquieu's thesis about the negative impact of hot climates on work ethic.

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 to differences 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 these controls and unemployment, further adding a Protestant society dummy and its interaction (Model 7). Our finding that unemployment has a significant additional negative effect in colder climates remains.

Another concern about our interpretation of the results may be that unemployment is likely to be endogenous to some extent. Most importantly, differences in work ethic may drive differences in people's efforts to find a job. However, we note that such endogeneity would work against finding any unemployment effects on well-being in the first place. Insofar as unemployment is a choice, it should not be associated with lower subjective well-being. Otherwise, people would choose differently. The SWB-effects of unemployment therefore by definition capture only the impact of non-voluntary, exogenous unemployment. For this reason, we argue that endogeneity is not a main concern in our set-up.

Fig. 2 graphically summarizes our results. In this figure, we compare the impacts of unemployment on happiness between different climate zones. It portrays the average happiness of the unemployed with the grand mean happiness of all people (employed and unemployed) in that climate zone depicted as a reference. We see that the mean happiness of those unemployed in the cold climates is substantially lower than the mean happiness of all the cold climate dwellers. In contrast, the mean happiness of the unemployed in a warm climate is only slightly lower than the overall mean of all the people of the climate zone. Overall, happiness in warm climates is slightly higher than in cold climates.

To see whether these results depend on our measure of climate, we repeat the analysis using 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. Results remain the same (Table 4).

Our multilevel analysis confirms the above results (Table 5). For both the cold climate dummy (Columns 1–4) and the winter intensity variable (Columns 5–8) we find that the interaction effect between unemployment and cold climate is consistently negative, although it loses significance at conventional levels when including all interaction-controls in the winter intensity models. These results broadly support the hypothesis that unemployment hurts more in colder climates.

Finally, we want to evaluate whether the work ethic effect of climate stands on its own, or is part of a broader cultural orientation in the directions of individualism or long-term orientation. To investigate this possibility, we add individualism and long-term orientation and their interactions with unemployment to the model. Data on these cultural orientations come from Hofstede (2001). If we still observe a climate-induced effect on work ethic once we control for a individualism/long-

Table 5
Multilevel Analysis (MLA).

VARIABLES	Mixed Ordered Logit Dependent variable: ordered SWB							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
UNEMP	-.165*** (0.032)	-.075 (0.052)	-.175*** (0.034)	-.098* (0.054)	-.100*** (0.038)	-.031 (0.056)	-.022*** (0.039)	-.0157*** (0.057)
COLD	-.324*** (0.012)	-.394*** (0.012)	-.271 (0.175)	-.342* (0.168)				
UNEMP × COLD	-.195*** (0.027)	-.099*** (0.037)	-.270** (0.028)	-.249*** (0.038)				
WININT					-.026*** (0.000)	-.024*** (0.001)	-.018*** (0.006)	-.019*** (0.006)
UNEMP × WININT					-.006*** (0.001)	-2.20 ^{E-3} (1.45 ^{E-3})	-3.13 ^{E-3} *** (1.21 ^{E-3})	-1.75 ^{E-3} (1.48 ^{E-3})
Constant	–	–	–	–	–	–	–	–
Observations	252,430	252,430	252,430	252,430	252,430	252,430	252,430	252,430
Number of groups	2	2	90	90	2	2	90	90
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institutional quality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Culture and Religion	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Evolutionary distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Extra interactions	No	Yes	No	Yes	No	Yes	No	Yes

Notes: this table presents the results of a multilevel ordered logit 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. Columns 1–2 and 5–6 use individuals nested in climates. Models 3–4 and 7–8 use individuals nested in countries.

For controls, see Table 3. Robust standard errors in parentheses; *** $p < .01$, ** $p < .05$, * $p < .1$.

Table 6
Work ethic or broader cultural orientations?

Variables	Ordered logit			Mixed ordered logit (MLA)		
	(1)	(2)	(3)	(4)	(5)	(6)
UNEMP	–0.0784 (0.0510)	–0.111 (0.0794)	.177 (0.141)	–1.154*** (0.357)	–0.0668 (0.0762)	.0370 (0.130)
COLD	–0.146*** (0.0107)	.0869*** (0.0169)	–0.171*** (0.0207)	–0.347** (0.167)	.0180 (0.185)	–0.307 (0.224)
UNEMP × COLD	–0.0799* (0.0446)	–0.411*** (0.0612)	–0.268*** (0.0804)	–0.234*** (0.055)	–0.346*** (0.0562)	–0.301*** (0.0724)
IDV	.00558*** (0.000225)		.00953*** (0.000442)	–0.00125 (0.00387)		.0106** (0.00472)
UNEMP × IDV	–0.00593*** (0.00106)		–0.00488** (0.00196)	–0.00163 (0.00142)		–0.00177 (0.00179)
LTO		–0.00642*** (0.000250)	–0.00119*** (0.000368)		–0.00473 (0.00335)	.00100 (0.00401)
UNEMP × LTO		–0.00146 (0.00121)	–0.00426*** (0.00156)		–0.00166 (0.00113)	–0.00248* (0.00140)
Observations	184,414	92,878	92,878	184,414	92,878	92,878
Number of groups				60	31	31
Pseudo R-squared	.0320	.0425	.0454	–	–	–

This table presents the effects on subjective well-being of unemployment in cold and hot climates, and interactions with individualism and long-term orientation. Results show that the negative well-being effect of unemployment remain substantially stronger in populations from cold climate countries when controlling for differential effects dependent on individualism and long-term orientation, except for Column 2. Robust standard errors in parentheses; *** $p < .01$, ** $p < .05$, * $p < .1$.

term orientation-induced effect, this suggests that the climatic work ethic effect is an independent phenomenon. If the impact of climate on work ethic disappears, it suggests that it is part of a broader change in cultural orientations. Table 6 reveals the results. The table provides limited evidence that individualism and long-term orientation are related to work ethic, since the interaction effects between cultural orientations and unemployment are negative and mostly significant. More importantly, however, the table shows that the work ethic effect is still present when including individualism and long-term orientation effects. This indicates that at least part of the effect of climate on work ethic is empirically independent of a wider cultural shift.

5.1.2. Cultural transmission

The arguments proposed by de Montesquieu and others suggest that climate has an effect on work ethic through the enervating effects of heat, and through the lower necessity/profitability of hard work in hot climates. De Montesquieu himself

Table 7
Climatic origins.

Variables	Dependent variable: ordered SWB			
	Ordered logit		Mixed ordered logit (MLA)	
	(1)	(2)	(3)	(4)
UNEMP	−0.0500 (0.0372)	.967*** (0.178)	−0.107*** (0.0371)	−0.350** (0.160)
Cold Climatic Origin	−0.241*** (0.0128)	−0.229*** (0.0130)	−0.281 (0.187)	−0.231 (0.180)
UNEMP × Cold Climatic Origin	−0.305*** (0.0339)	−0.223*** (0.0413)	−0.288*** (0.0315)	−0.259*** (0.0375)
Observations	244,796	244,796	244,796	244,796
Number of groups			91	91
R-squared	–	–	–	–
Further controls				
Individual controls	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Institutional quality & Incentives	Yes	Yes	Yes	Yes
Culture and Religion	Yes	Yes	Yes	Yes
Evolutionary distance	Yes	Yes	Yes	Yes
Extra interactions	No	Yes	No	Yes

Robust standard errors in parentheses; *** $p < .01$, ** $p < .05$, * $p < .1$. This table presents the effects on subjective well-being of unemployment, the proportion of the population that descends from cold climate countries, and their interaction. Interaction effects show that the negative well-being effect of unemployment is substantially stronger in populations descending from cold climate countries.

is somewhat ambiguous about whether he thinks these effects are direct influences of climatic conditions or work through more enduring societal values and laws derived from climate. While he argues that climate determines societal laws, he also at times suggests that moving people from one climate to another alters their disposition towards work. Referring the army exploits, de Montesquieu writes that “northern peoples, transplanted into southern regions, did not perform such exploits as their countrymen who, fighting in their own climates, possessed their full vigor and courage” (De Montesquieu, 1748, p161). Modern economic theorists tend to stress inherited, cultural channels (Spolaore and Wacziarg, 2013) over direct effects, arguing that behavioral tendencies initiated by climate evolve into norms and values that are transmitted over generations even when the original conditions no longer apply.

To identify whether the effect we see is related to such a historical-cultural pattern rather than to the current climate, we repeat our analysis replacing the climate indicators with a climatic origin variable that measures the percentage of local population that have come from cold climate countries over the past 500 years (i.e., since 1500). Data on historical origins of populations are from Putterman and Weil (2010). Note that our use of national level data to describe the historical origins of populations stems from the fact that we are primarily interested in the (climate induced) role of cultural norms at the group level instead of values at the individual level. For such a purpose, the composition of the group in which cultural norms emerge is relevant. If one is interested in individual values, a different approach would be warranted (see Davis and Williamson, 2019).

Table 7 presents the results. Columns (1) and (2) present the ordered logit estimations. In columns (3) and (4), we estimate the multilevel version of the model in which we use climatic origin. The results strengthen our argument. Descending from a cold climate in itself does not have negative relation with the SWB, but cold climate-descend and unemployment does.

5.1.3. Within-country variation in climate and work ethic?

As a final robustness check on our findings with respect to the relevance of climate for work ethic, we estimated our basic model allowing for the possible importance of within-country variation in climate and hence work ethic. In doing so, that is by estimating our model at the sub-national level, we can also include country fixed effects which allows one to control for a range of potential confounding factors. Our climate indicator captures the average temperature of the coldest month during a year in the main city in a region (source: <https://en.climate-data.org>). We match this with the region in which interviews are conducted in the WVS. The corresponding estimation results are presented in Table 8. They show our main results still hold, in particular with respect to the negative impact on SWB of the cold climate –unemployment interaction. Similar within-country estimations for the WININT climate variable, not shown here, lead to very similar estimation results as shown in Table 8.

5.2. Channel 2: Work ethic and income

Although we consider the first part of the framework—relating climate to work ethic—the most important, for completeness we also want to address whether the observed differences have any effect on economic development. There is ample evidence that climate is related to economic development (Dell et al., 2014), but the extent to which this relation is driven

Table 8

The effect of climate on subjective well-being while allowing for within-country climate variation. Cold climate dummy (COLD = 1 if local winter temperature falls to 0 or below).

Variables	Ordered Logit		
	(1)	(2)	(3)
UNEMP	−0.203*** (0.0684)	−0.221*** (0.0685)	−0.185** (0.0727)
COLD	0.0876*** (0.0170)	0.0369* (0.0189)	0.0342* (0.0208)
UNEMP x COLD	−0.134** (0.0613)	−0.123** (0.0613)	−0.142** (0.0639)
Constant	−5.922*** (0.0781)	−5.787*** (0.0811)	−4.833*** (0.0998)
Observations	80,003	79,977	79,977
(Pseudo)R-sq.	0.088	0.089	0.144
Further controls	Yes	Yes	Yes
Year FE	No	Yes	Yes
Country FE	No	No	Yes

Robust standard errors in parentheses; *** $p < .01$, ** $p < .05$, * $p < .1$.

Table 9

Channel 2: Work ethic and income level.

Variables	Productivity			Per capita GDP (expenditure)		
	(1)	(2)	(3)	(4)	(5)	(6)
Work Ethic	.241* (0.130)	3.636*** (1.254)	1.227** (0.590)	.246* (0.133)	3.651*** (1.264)	1.217** (0.599)
Constant	9.189*** (0.092)	7.543*** (0.623)	8.711*** (0.296)	6.883*** (0.092)	5.231*** (0.627)	6.412*** (0.300)
Observations	227	227	227	227	227	227
R-squared	.015	–	–	.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; *** $p < .01$, ** $p < .05$, * $p < .1$.

by climate-induced cultural differences is an open question. Yet a true test of de Montesquieu's thesis requires also considering this second part of the climate-work ethic-economic performance nexus.

To do so, we estimate well-being effects of unemployment per country as proxy for national differences in work ethic. We subsequently regress economic performance indicators on these measures of work ethic. The results are given in Table 9.

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 3.2, is associated with 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.

5.3. 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 (Fig. 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 and 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 and Tingley (2011) is more complete and provides sensitivity analyses.

Table 10
Mediation analysis.

Effects	Informal Institution		
	(1)	(2)	(3)
Stage 1			
$COLD_{stage_1} (\tilde{\zeta})$	.167** (0.084)	.183** (0.092)	.198** (0.091)
$COLD_{stage_2} (\hat{\psi})$	.432*** (0.086)	.437*** (0.094)	.442** (0.094)
ACME	.012*	.015*	.012*
Direct Effect	.440**	.437**	.450**
Total Effect	.451**	.452**	.462**
% Tot. Eff. Mediated	.025**	.033**	.027**
Mediator	WE = $-1 \times \hat{\eta}_{jt}$	WE = $-1 \times \hat{\eta}_{jt}$	WE = $-1 \times \hat{\eta}_{jt}$
Further controls	Yes	Yes	Yes
The other institution	No	Yes	Yes
Religion	No	No	Yes

Standard errors in parentheses; *** $p < .01$, ** $p < .05$, * $p < .1$.

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

Fig. 3. Sensitivity test parameter.

Table 10 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, Fig. 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.

For the sake of completeness, we also checked if informal institutions mediate the effect of geographical climate on formal institutions (recall channel 3 in Fig. 1). We find that informal institutions show a significant mediation effect of cold climate on the development of formal institutions (see Table B1 in the Appendix). The results remain generally the same when we use Polity2 instead of Regulatory Quality as indicator for institutional quality. We also check the results using an instrumental variable (IV) approach, in which we regress economic performance on the variation in work ethic that is driven by climate. Since the assumption that climate is not linked to development through other channels than work ethic is probably not valid, this is not our preferred specification. However, the results remain consistent (see section C in the appendix).

6. Conclusions

In this paper, we test the well-known thesis most famously expressed by De Montesquieu in the 18th century that differences in development between societies can be traced partly to differences in climate-induced attitudes to work. Analyzing 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 negligible 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. In this sense, our study resonates with a common critique of work-ethic explanations of development, suggesting that they are more important as a legitimization for global economic inequality than as an explanation (Alatas 2013; Chang, 2007).

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.

What we do take away from our results is 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, 2017; Maseland, 2013; Tabellini, 2010), this suggests that the cultural channel in the geography-growth nexus should be taken more seriously.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jebo.2020.03.010](https://doi.org/10.1016/j.jebo.2020.03.010).

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