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# Work ethic and economic development: An investigation into Weber's thesis

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## ABSTRACT

This paper argues that the capitalist spirit associated with Max Weber's Protestant Ethics is not associated with Protestantism but with the modernization phase of economic development. A preference for hard work is also found amongst other religions and non-religious people at times of high economic growth and decreases after the modernization phase. We find a robust relationship between the level and growth of economic development during an individual's childhood and this individual's work ethic. An epidemiological approach is applied to indicate that the direction of the relationship runs from growth and the level of economic development at the time values are formed, to work ethic. Protestant adherence has a positive relation with work ethic, but this relation is less robust than economic development.

## 1. Introduction

In his seminal publication, "The Protestant Ethic and the Spirit of Capitalism," Weber argues that the teaching of the Calvinistic branches of Protestantism leads to a life-long commitment to work and to being thrifty. The adherents of these denominations believe that God wants them to use time wisely. "Not leisure and enjoyment, but only activity serves to increase the glory of God. Unwillingness to work is symptomatic of the lack of grace" (Weber, 1930, pp. 104–105).

This claim was criticized almost immediately after publication of Weber's opus. Criticisms included: Weber's weak empirical basis, his one-sided interpretation of Protestantism and the lack of investigation of similar trends in Catholicism, and the causal relationship he is assumed to defend, namely between Protestant adherence and the capitalist spirit. Empirical literature testing the relationship suggested by Weber, finds mixed results (e.g. Andersen et al., 2017; Berger, 2010; Nunziata and Rocco, 2018; Spenkuch, 2017; Zafirovski, 2018; Zou, 1994). These results depend on the data used: small versus large datasets, the number and groups of countries considered, and on the method that is applied.<sup>1</sup> In short, the debate about the relationship between Protestantism and the Spirit of Capitalism has not ended yet, if it ever will.

The aim of this article is to shed light on Weber's theorized relationship by including the influence of social economic circumstances. We therefore connect the discussion on the relationship between Protestantism and the capitalist spirit with that on the relationship

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<sup>1</sup> In-depth investigations of certain Protestant sects in Africa and South America are inclined to conclude in favour of Weber's thesis that Protestantism is associated with taking initiative and hardworking (see e.g. the literature referred to in Berger, 2010). On the other hand, before the Protestant reformation some Catholic orders already promoting the capitalist spirit (Zafirovski, 2018). In some regressions Andersen et al. (2017) even find that the Cistercian order had a more important effect on economic development than Calvinism.

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between values and phases of economic development. We argue that the Protestant Ethic that Weber describes was not specific to Protestantism. The Protestant sects, to which Weber refers, were merely in a specific phase of economic development. This phase is characterized by the transition from a lower level of development to a higher level. Our hypothesis is that during such a period of transition, people value hard work because it will improve their position. The work ethic is high in this situation. It decreases again when individuals and societies reach a higher level of development. Self-actualization values become more important so that hard work is deemed less important. If we are right and data for all three phases are available, we expect to find a hump-shaped relationship between work ethic and the level of development: work ethic increases in a period of high growth and a relatively low income per head and diminishes when income is high enough and growth is relatively low. Our claim is therefore that the attitude towards work is unconnected to the religion people adhere to but connected to the phase of development of the persons, region or country.

In Section 2, we present Weber's thesis and draw attention to his qualifications with respect to causality and the conditions under which he thinks his thesis is valid. Section 3 presents our hypothesis supplemented with some empirical and historical studies confirming the relations suggested. Two quantitative methods are used to test our hypothesis: a multilevel regression and an epidemiological analysis. Multilevel or cross-section regressions have been applied in other studies (e.g. Becker and Woessmann, 2009). A disadvantage of this method is, however, that it cannot distinguish between the effect of institutions (educational facilities in their case) and values. Possibly, a certain dominant belief leads to both growth-enhancing institutions and pro-growth attitudes. The epidemiological approach is a novel way of separating the influence of beliefs from that of institutions. This method uses second-generation immigrants and relates their attitudes to the dominant values in their parents' country of origin. Assuming there is intergenerational transmission of values, we expect that second-generation immigrants' attitudes are influenced by dominant values in their parents' country of origin. This effect is independent from the institutions in the immigrants' host country and thus can confirm that values play a role. Values are central in Weber's and our argument. We therefore explicitly distinguish between the respondents' current attitude, work ethic, and the time they are supposed to have formed their values; the so-called formative years (see Section 4 for more details).

We contribute to the literature in at least three ways. First, we connect the literature on the effect of religion on values (e.g. van Hoorn and Maseland, 2013) with that on economic development and values (Galor and Moav, 2002; Guiso et al., 2003; Inglehart and Baker, 2000). Second, as far as we know, we are the first who explicitly distinguish between the influence of factors prevailing during respondents' formative years and current factors. Finally, this is the first paper to use the epidemiological approach for investigating the relevance of Weber's hypothesis about Protestantism.

The setup of the article is as follows. The next section provides a summary of Weber's thesis. Section 3 develops our hypothesis on the link between work ethics and the level of development. A description of the data and methodology is presented in Section 4. Section 5 contains the multilevel and epidemiological approach. Section 6 concludes.

## 2. Weber's Protestant Ethics thesis

Weber is motivated to his study of the Protestant Ethic by the observation that "business leaders and owners of capital, as well as the higher grades of skilled labor, and even more the higher technically and commercially trained personnel of modern enterprises, are overwhelmingly Protestant" (Weber, 1930, p.3). This observation does not only hold for Germany but "almost wherever capitalism [...] has had a free hand to alter the social distribution of the population in accordance with its needs, and to determine its occupational structure" (Weber, 1930, p. 3). This pattern can be explained by historical circumstances in which adherence to a particular faith is, to a certain extent, a result of economic conditions. However, in Weber's view, economic conditions alone cannot explain people's behavior. He illustrates this by means of an increase in wage, which need not necessarily lead to more effort. It could also reduce this effort because the worker wanted a certain level of income. From this Weber concludes, "[I]about must [...] be performed as if it were an absolute end in itself, a calling. But such an attitude is by no means a product of nature. It cannot be evoked by low wages or high ones alone but can only be the product of a long and arduous process of education." (Weber, 1930, p. 25). "This form of education is found among those having a specifically religious, especially Pietistic, background. One often hears and by statistical investigation confirms it, that by far the best chances of economic education is found among this group." (Weber, 1930, p. 26). As these quotes illustrate Weber suggests a cultural root of economic progress. He notes that areas dominated by Protestants (Calvinists) are more affluent than areas dominated by Catholics. His reasoning is that due to Calvinists' predestination doctrine, they want to know whether they are chosen and show that by a lifelong endeavor of hard work and no luxurious consumption. Such a behavior is a calling and thus the "principle explanation [...] must be sought in the permanent intrinsic character of their religious beliefs" (Weber, 1930, p.7).<sup>2</sup>

Weber's argument rests on his interpretation of the concept of predestination as developed in Calvinism. According to the doctrine of predestination, God has already decided from the very beginning of human life whether persons will be saved and will go to heaven after their death. This leaves believers with a lot of uncertainty. How can one know that one has been saved? Calvinists believe that success in this world is a sign of belonging to God's chosen ones. This sign cannot be a single act but must be a lifelong endeavor. It is important that

<sup>2</sup> The entire quote is: "However, it is a fact that the Protestants (especially certain branches of the movement to be fully discussed later) both as ruling classes and as ruled, both as majority and as minority, have shown a special tendency to develop economic rationalism which cannot be observed to the same extent among Catholics either in the one situation or in the other. Thus the principle explanation of this difference must be sought in the permanent intrinsic character of their religious beliefs, and not only in their temporary external historico-political situations" (Weber, 1930, p.7). Note that this emphasis on culture illustrates that Weber worked in the tradition of the German Historical School, according to which an economic analysis had to include "the nature of customs and of law, the power of customary feelings and cultural ideas which also govern whole economies" (Schmoller, 1874, p. 264).

one uses one's time to the glory of God. The acts God wants, do not primarily involve praying and other actions oriented at afterlife, but acts in which one shows a lifelong commitment to one's profession, one's calling. This means a lifelong exhibition of self-control by means of work and not wasting money on idle activities. Such behavior leads to a life with the focus on discipline in work and in the rest of one's private life, so that the proceeds of one's efforts are not spent unwisely but saved and invested in economic activities.

Three observations have to be made. First, Weber argues that the predestination doctrine inspires an attitude of lifelong activity: in order to demonstrate that one is saved, one works hard. However, logically, one could also argue that this doctrine might instead lead to a passive attitude. After all, why should one bother to work hard, if God has already made up his mind? If we are already predestined, one could just as well become lethargic. Weber deliberately interprets his observations as revealing a causal relationship between predestination and hard work.<sup>3</sup>

Second, a large part of the critique on Weber has questioned this assumed causal connection. This critique is unfair. At several places in the book, Weber explicitly mentions that he focuses on one direction – from religion and values to economic circumstances – but that the opposite direction could equally be true. "(I)t is, of course, not my aim to substitute for a one-sided materialistic an equally one-sided spiritualistic causal interpretation of culture and of history. Each is equally possible [ ...]" (Weber, 2030/2001, p. 125). This quote illustrates that Weber's reasoning was meant to be an alternative for Marx's materialism.

Finally, at the end of the book Weber hints at the possibility of his hypothesis lasting only temporarily. He writes "The puritan wanted to work in a calling: we are forced to do so [ ...]. Perhaps it will so determine them until the last ton of fossilized coal is burnt." (Weber, 1930, p. 123). He further notes: "victorious capitalism, since it rests on mechanical foundations, needs its (asceticism) support no longer [ ...]. No one knows [ ...] whether at the end of this tremendous development entirely new prophets will arise, or there will be a great rebirth of old ideas and ideals" (Weber, 1930, p. 124). We read these phrases as a hint that certain sets of values could be connected to a particular phase of development and that "temporary external historico-political situations" might be of more importance than adherence to a certain religion. In particular, our hypothesis is that the phase of economic development is more important for explaining the Protestant ethic than is the Protestant belief in predestination.

### 3. Values and phases of economic development

Several authors have discussed the influence of economic development on values and attitudes (see i.a. Inglehart and Baker, 2000; Rostow, 1959, 1990). Marini (2004) combines these theories by distinguishing three phases of economic development: antiquity, modernity, and contemporaneity (see Fig. 1). Each of these phases is characterized by certain economic circumstances and values associated with it. Antiquity is characterized by low income per capita and low growth. Consequently, the only way of improving one's material position is by obtaining a large share of the common pie. Only those of high status have any real chance of improving their situation, and rent seeking and hierarchy are characteristic of these societies. For the majority, there will be no possibility of improving their situation, and this can lead to fatalism and apathy. Present-day examples are South Italy (Banfield, 1958) and parts of India (Rajan, 2019, pp. 110–112).

During modernity, income per capita is low at the beginning but grows at a relatively high speed. Due to changes in technology and/or political conditions in this period, large parts of the population find it possible to improve their situation. Improvement is possible if they work hard, save their money for investment in productive activities, take initiative, and want to achieve something (McClelland, 1961). During this phase, people value hard work and material improvement. Weber was referring to religious sects that were at that time living through this phase of modernity. Note that many of these groups lived in The Netherlands or North America during the industrialization period (see van Bavel, 2016).

A high level of income per capita characterizes the phase labelled contemporaneity by Marini (2004) and post-modernity by Inglehart (1997). Since income is already at a high level, growth is slower than in modernity. Technical constraints may limit this growth; it becomes increasingly difficult to improve production processes. For many, there is sufficient income to take care of their daily necessities. They value a higher income less than they would have done had they been poor. This leads to a preference for the immaterial aspects of life and ultimately to a higher level of wellbeing. These goals are "emphasized *after* people have attained material security, and *because* they have attained material security" (Inglehart, 1997, p.35, italics in original). Obtaining material security is less of a priority because it has already been achieved.

Our claim is that Weber's hypotheses refer to situations in which people go through the modernity phase. During that phase (perhaps particularly at the beginning of that phase), people have to discipline themselves, work in a rational way and work hard. Their prosperity is even greater if they save the proceeds of their work and invest this money in new profitable projects. The dominant values will then support these activities, so that hard work and thrift are in high regard. In the empirical cases Weber refers to, some Protestant sects adhered to these values.<sup>4</sup> Rostow (1990) also refers to the link between activities and beliefs when he claims that there must be "modern men" to implement the new techniques and the new values that modernity has delivered.

Due to limited availability of data, it will be difficult to test all three phases for the same unit; country, region or group of persons.

<sup>3</sup> This can be considered as evidence that Weber works in the tradition of the German Historical School, and wants to tell a story opposite to that of Karl Marx, i.e. that values determine actions, and not that material conditions determine beliefs.

<sup>4</sup> Note that Protestantism is a denomination within Christianity, so he referred to the most individualized forms of the Christianity. Other large religions, Islam, Hinduism and Buddhism, also have different dominations, which can be distinguished on the degree of obedience to a hierarchy and the emphasis on personal responsibility for one's salvation or for this world. Of course, the characteristics of modernity are not restricted to religious people. Those not belonging to any religion also have an idea about the importance of work, leisure and saving.

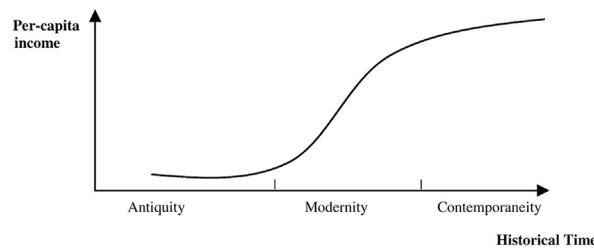


Fig. 1. Three phases of economic development. Source: Marini (2004), Figure 2.

One could argue that from the end of the 1960s onwards, Malaysia moved from the antiquity through the modernity phase. In the beginning of the 1970s, Malaysian Prime Minister Mahathir claimed that Malays were easy going and unfitted to survive competition by others in particular the Chinese. In the 1980s, his “Look East” campaign set South Korea and Japan as examples. The campaign cultivated an Eastern work attitude and other “social and economic characteristics that were specifically Japanese and Korean” (Maseland, 2006, p. 167). In the 1990s, these values were presented as Islamic. Mahathir propagated “highly Protestantized form of Islam” which underscored the importance of the pursuit of knowledge, thrift and hard work (Lee and Ackerman, 1997, p. 36). One can have doubts about the degree this change in perspective was supported by the population at large.<sup>5</sup> Nevertheless, it illustrates an awareness of the link between economic performance and values.

Kunio (2006) also voices such an awareness of the importance for a change in values when an economy changes from one phase to another. He attributes Japan’s remarkable post-war economic performance to Japan’s culture. “The Japanese attach importance to (1) materialistic pursuits; (2) hard work; (3) savings for the future; and (4) investment in education. These preferences may be influenced by income, prices and other economic factors, but they are also influenced by the existing culture” (Kunio, 2006, p. 83). He notices that from the 1990s onwards, the Japanese are less frugal and feel less constrained in consuming luxury goods. “Culture changes as income rises. [...] Culture that is growth-promoting at one stage may cease to be so at a later stage” (Kunio, 2006, p. 98).

Other studies aim at testing or refuting Weber’s hypothesis and thus focus on the relation between values and economic performance during the modernity phase only (Redding and Hsiao, 1990). study family business by Overseas Chinese, who still feel an emotional link with China. They attribute the success of these firms to a strong work ethic directed at material awards and to the importance of the family. The latter ensures that even those in power will not siphon off too much of a company’s wealth as this wealth belongs to the family and not to the individual. Berger (2010) mentions different cases in which groups that show an increase in material progress adhere to work ethics similar to the ones emphasized in Weber’s Protestant Ethics.

In the rest of the paper, we test our hypothesis by means of two methods: a multilevel approach (Section 5.1) and the epidemiological approach (Section 5.2). The epidemiological approach is meant to distinguish the influence of values from those of institutions.

#### 4. Data and method for testing economic development and work ethic

##### 4.1. Dependent and independent variables

We set out to examine quantitatively whether it is Protestantism or the level of a country’s development that influences respondents’ capitalist spirit. We focus specifically on the work ethic, as this is an integral part of Weber’s thesis. Work ethic is therefore the dependent variable in our analyses. It is measured by five items from the EVS (2017) and WVS (2015), which are: “To fully develop your talents, you need to have a job,” “It is humiliating to receive money without having to work for it,” “People who don’t work turn lazy,” “Work is a duty towards society,” and “Work should always come first, even if it means less spare time.” This measure is used in previous research in the context of Weber’s work ethic (Norris and Inglehart, 2011, p. 164; Stam et al., 2013) and specifically captures the work ethic where work is seen as a duty. The scale is constructed by taking the average of at least three valid scores on the five items and ranges from 1, a low work ethic to 5, a high work ethic.<sup>6</sup>

Our main independent variables are the level of economic development, economic growth, and Protestant adherence. We measure the level of development by GDP per capita and economic growth with GDP per capita growth. Both indicators are measured during childhood socialization. GDP per capita and growth data is acquired from the Maddison Project Database (Bolt et al., 2018). The focus is on the level of development until the individual is 10 years old. We assume that attitudes toward work are developed during the formative years, usually from around birth until the age of 10. The oldest respondent in our sample, for example, is born in 1920. The level of development during this respondent’s formative years is the average GDP per capita and its growth between 1920 and 1930.

The same approach is applied in the epidemiological approach. When measuring the level of development of the mother’s home country, we focus on the phase of development of the country during the formative years of the mother. We connect these formative

<sup>5</sup> In Chapter 6 of his study, Maseland presents the same facts but then emphasising the importance of power and Mahathir’s attempt to stay in office. De Jong (2009, pp. 101–103) uses the term politicized culture for cases in which politicians seem to have a great influence on the perception of the economic situation. He mentions Malaysia and the African Renaissance in South Africa as examples.

<sup>6</sup> Cronbach’s alpha has a sufficient score of 0.70.

years to the level and growth of economic development of mothers' home countries during these years. To give an example, if the respondent is born in 1950, we expect their parents to be born around 1925. We take the period of 1925 until 1935 as the benchmark for which we then calculate the level and growth of economic development.

At the individual level, the dummy denoting Protestant adherence measures whether a respondent belongs to the Protestant denomination. In the EVS and WVS, respondents are asked whether they belong to a religious denomination and, if so, to which one. We also include the individuals that consider themselves Baptists or Methodists, because Weber specifically mentions these denominations.<sup>7</sup> Evangelicals are also counted as Protestant adherents. The Protestant dummy is therefore constructed by designating Protestant, Baptists, Methodists and Evangelicals as 1, and other categories, including the non-religious, as 0.<sup>8</sup>

The percentage of Protestant adherence per country is gathered from the Religious Characteristics of States Dataset Project (Williams et al., 2019). This dataset combines estimates from several present-day and historical sources. We use the percentage of Protestants of this dataset to indicate Protestant adherence in a society.

Several other variables are included to control for individual characteristics and the economic, institutional and social environment. Variables representing characteristics of individuals are: age, age-squared, employment status, gender and education. Employment status contains six categories: full time, part time, unemployed, pensioned, student and other. The highest educational level attained is divided into eight categories: ranging from "inadequately completed elementary education" to "university degree."

Checking for the robustness of our results, we also include religiosity of the respondent, social trust, income inequality and Polity scores. Religiosity is calculated for each respondent from four WVS/EVS items: whether the respondent is a member of a religious community, whether (s)he believes in heaven, whether (s)he believes in hell and whether the respondent visits religious services at least once a month (cf. Barro and McCleary, 2003). Social trust is constructed by taking the average response per country-by-year on the item of the WVS/EVS that asks 'do you think that most people can be trusted, or that you can't be too careful?'. Income inequality, reflected by the GINI score, is collected from the Standardized World Income Inequality Database (Solt, 2009). Polity V scores measure the democratic institutional environment. These scores reflect a country's democratic regime on a 21-point scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy) acquired from the Center for Systemic Peace.

The EVS and WVS waves that contain the relevant variables are waves 5, 6 and 7 of the WVS and 3 and 4 of the EVS. The multilevel analyses contain 87 countries covering all continents. Table 1 shows the descriptive statistics of the variables we use and their sources.

#### 4.2. Methodology and regression equations

A respondent's work ethic is related to Protestant adherence and the level of development. Two methods are used: (i) a direct method where we explain respondents' work ethic by Protestant adherence and the level of development and growth and (ii) an epidemiological approach, which explains second-generation immigrants' work ethic by Protestant adherence and level of development and growth of their mother's home country.

The first method is a two-level multilevel analysis estimated with the following equation:

$$\begin{aligned} work\ ethic_{ic} = & \gamma_0 + \gamma_1 DEV_j + \gamma_2 DEV_j^2 + \gamma_3 GROWTH_j + \gamma_4 GROWTH_j^2 \\ & + \gamma_5 Prot_{ic} + \gamma_6 X_{ic} + \gamma_7 CNT_c + u_j + \varepsilon_{ic} \end{aligned} \quad (1)$$

where subscript *i* refers to the individual level, *c* to the country at present, and *j* to the country level during the respondent's formative years. An individual's work ethic is explained by the country's level of development (DEV) and its square (DEV<sup>2</sup>) and growth (GROWTH) and its square (GROWTH<sup>2</sup>)<sup>9</sup> during the respondents' formative years, a dummy denoting whether the respondent adheres to Protestantism (Prot), a vector of individual controls (X), country fixed effects (CNT)<sup>10</sup> and error terms, (*u<sub>j</sub>* and *ε<sub>ic</sub>*).

Our hypothesis is that economic characteristics determine an individual's values. The most significant years for the development of an individual's values are the formative years, which are the years up to about 10 years of age.<sup>11</sup> Since institutions and economic conditions do not change rapidly, it could be that our estimates of work ethic are biased because there is a high correlation between current institutions and the institutions as they were during respondents' formative years.

In order to correct for this bias, we apply the epidemiological approach. This approach has been used in numerous other studies (Algan and Cahuc, 2010; Christopoulou and Lillard, 2015; Fernández and Fogli, 2006; van Hoorn, 2019) and assumes that parents pass their values to their children (vertical transmission). If correct, the events that were relevant in the parents' formative years will still indirectly influence their children's values. Given the fact that national institutions change slowly, this intergenerational transmission can be tested most appropriately if parents lived in another country during their formative years than the country in which their children

<sup>7</sup> Pietism and Calvinism were not mentioned in the item.

<sup>8</sup> Some previous studies (such as van Hoorn and Maseland, 2013) compare Protestants only to Catholics, whereas we compare Protestants adherents to all other religious or non-religious adherents. Our results are similar if we compare Protestants to Catholics.

<sup>9</sup> Although a squared GROWTH term does not necessarily arise from our hypothesis, we take into account that such a non-linear effect can be found in the regressions.

<sup>10</sup> We include country fixed effects so that the results are not driven by unobserved country heterogeneity. This could underestimate our results because we exclude the effect that country characteristics (such as time invariant institutions) have on work ethic.

<sup>11</sup> Hofstede (2001, p. 4) suggests that these are the first 10 years of people's lives and Hofstede et al. (2010, p. 9) refer to the first 10–12 years. When using 20 years as the formative years, instead of 10 years, we acquire similar but a bit less significant results. This substantiates the notion that the formative years, until age 10, are important in value formation and that this has an effect on attitudes later in life.

**Table 1**  
Descriptive statistics.

Variable	Mean	Sd	Min	Max	Source	Definitions
<b>Dependent variable</b>						
Work ethic	3.71	.77	1	5	World Values Survey and European Values Study (WVS/EVS)	Attitude towards work
<b>Country characteristics</b>						
Log GDP per capita ×1000, until age 10	1.33	.91	-1.28	3.22	Maddison database	Log mean GDP per capita from birth of respondent until age 10
GDP per capita growth, until age 10	.02	.04	-.33	.17	Maddison database	Mean GDP per capita growth from birth of respondent until age 10
Social trust	.30	.19	.02	.77	WVS/EVS	Aggregate of trust item 'whether people can be trusted or you can't be too careful'
GINI coefficient	47.24	6.22	31.37	65.38	Standardized World Income Inequality Database	Index of inequality, higher is more inequality
Polity V score	6.77	7.57	-10	10	Center for Systemic Peace	Country's democratic regime, higher is more democratic
% of Protestant adherence	.16	.24	0	.98	Religious Characteristics of States Dataset Project	% of people adhering to Protestant religion
<b>Mothers' ancestral country characteristics</b>						
Log GDP per capita ×1000, until age 10	8.61	.90	6.61	10.22	Maddison database	Log mean GDP per capita from mothers' birth until age 10
GDP per capita growth, until age 10	.03	.03	-.02	.089	Maddison database	Mean GDP per capita growth from mothers' birth until age 10
% of Protestant adherence	.26	.33	0	.95	Religious Characteristics of States Dataset Project	% of people adhering to Protestant religion in mothers' home country
<b>Individual variables</b>						
Protestant	.16	.37	0	1	WVS/EVS	Whether respondent belongs to a Protestant based religion
Age	.43	.17	.15	1.08	WVS/EVS	Age in years/100
Female	.53	.50	0	1	WVS/EVS	Gender
Religiosity	.61	.36	0	1	WVS/EVS	Intensity or religious adherence
Thrift	.35	.48	0	1	WVS/EVS	Whether respondent considers thrift an important child quality
Employment status			1	8	WVS/EVS	Employment status of respondent
<i>Full time</i>	.37					
<i>Part time</i>	.08					
<i>Self-Employed</i>	.10					
<i>Retired</i>	.15					
<i>Housewife</i>	.13					
<i>Student</i>	.07					
<i>Unemployed</i>	.08					
<i>Other</i>	.02					
Education			1	8	WVS/EVS	Highest attained educational level
<i>No education</i>	.07					
<i>Elementary education</i>	.13					
<i>Incomplete technical/vocational education</i>	.11					
<i>Complete technical/vocational education</i>	.17					
<i>Incomplete university prep. education</i>	.12					
<i>Complete university prep. education</i>	.19					
<i>Incomplete university</i>	.08					
<i>Completed university</i>	.14					
Religious denomination			0	6	WVS/EVS	Religion to which respondent adheres to
<i>Protestantism</i>	.14					
<i>Buddhism</i>	.03					
<i>Hinduism</i>	.02					
<i>Islam</i>	.18					
<i>Orthodox</i>	.13					
<i>Roman Catholicism</i>	.32					
<i>No religion</i>	.18					

were born and raised. Second-generation immigrants meet this criterion. Similar to [Fernandez and Fogli \(2006\)](#), we take the country of origin of the immigrants' mother.<sup>12</sup> We expect the effect of economic conditions during the mothers' formative years to be weaker than

<sup>12</sup> Using fathers' home country gives similar results.

the influence of economic conditions in respondents' own formative years. The equation of this epidemiological approach is then:

$$\begin{aligned} work\ ethic_{ic} = & \gamma_0 + \gamma_1 DEV_h + \gamma_2 DEV_h^2 + \gamma_3 GROWTH_h + \gamma_4 GROWTH_h^2 \\ & + \gamma_5 Protadh_h + \gamma_6 X_{ic} + \gamma_7 CNT_c + \gamma_7 AncCNT_h + u_h + u_c + \varepsilon_{ic} \end{aligned} \quad (2)$$

Subscript h denotes the home country of the mother during the mother's formative years. It is different from equation (1) in that the estimation now comprises the independent variables denoting Protestant adherence in the mother's home country (Protadh) during the mother's formative years and fixed effects for mothers' home country (AncCNT). Both host and mothers' home country dummies are included to correct for the influence of host and mothers' home country factors on a respondent's work ethic. The home country is the ancestral country of the mother, the host country the country where the respondent is born.

## 5. Quantitative results estimating work ethic

### 5.1. Multilevel analysis: level of development during formative years and work ethic

Our hypothesis is that the level and growth of economic development has an effect on work ethic. For GDP per capita we think this first has a positive effect on work ethic and then a decreasing or even a negative effect, whereas growth has a positive effect on work ethic. This is represented by a positive coefficient for DEV and a negative one for DEV<sup>2</sup> and a positive coefficient for GROWTH in equation (1). A regression with these variables and the control variables confirms our hypothesis (Table 2, column 1). Growth during childhood socialization not only has a positive effect on work ethic but an increasing positive effect, denoted by the positive growth term and the positive squared term of growth. Weber's hypothesis is that Protestant adherence positively influences work ethics. This hypothesis is also confirmed (Table 2, column 2).

The relation still holds if Protestant adherence, GDP per capita (level and squared) and growth (level and squared) are included in the equation simultaneously (Table 2, column 3). GDP per capita levels and growth have similar coefficients and signs, as does Protestantism. Comparing the coefficients in column 2 and 3 for Protestantism and column 1 and 3 for GDP per capita, we find that the Protestant dummy coefficient decreases more than that of GDP per capita levels and growth.<sup>13</sup>

Considering the size effect of Protestant adherence on work ethic, we find that adhering to the Protestant religion or not is equivalent to about 25% of the standard deviation of work ethic. Work ethic is a five-point scale, and adhering to Protestantism compared to other religions and agnostics, increases work ethic by 0.0176. We calculate the marginal effect for GDP per capita variables when they are at their mean. GDP per capita levels and growth have a marginal effect at their means of 0.0312<sup>14</sup> on work ethic. This is nearly twice as much as the effect of the Protestant dummy.

The individual control variables indicate that work ethic increases with age when we include the levels and squared terms of GDP per capita and growth during childhood socialization. Age has a decreasing negative effect on work ethic if these variables are not included in regression (Table 2, column 2). Men have a higher work ethic than women and individuals who are full-time employed have a higher work ethic than others, except for the regression without GDP per capita. Then, retired respondents have an unexpectedly higher work ethic (Table 2, column 2). Respondents with a university degree or higher have the lowest work ethic compared to respondents with other educational degrees.<sup>15</sup>

The effect size of Protestant adherence is about 1/3rd of the effect of gender on work ethic. In other words, there is a positive effect of Protestant adherence on work ethic, but other individual characteristic, like gender and employment status, have more of an effect.<sup>16</sup>

### 5.2. Robustness checks for multilevel analyses

In this section we investigate whether the relation between work ethic and economic development still holds when accounting for possible moderating mechanisms (Table 3), when including time-varying country-level control variables (Table 4) and using different

<sup>13</sup> For a rough estimation we compare the differences in coefficient between column 1 and 3 for GDP per capita growth and level and between column 2 and 3 for Protestant adherence. On average, the coefficients for GDP per capita growth and levels decreases 1.78%, whereas the coefficient for Protestant adherence decreases 29.60%.

<sup>14</sup> The coefficients are multiplied with their mean (see Table 1 for the mean). For GDP per capita levels we acquire:  $0.0496 * 1.33 + -0.0296 * 1.7689 = 0.0136$ . GDP per capita growth gives:  $0.184 * 0.067 + 1.168 * 0.0045 = 0.0176$ . Summing these two numbers gives:  $0.0176 + 0.0136 = 0.0312$ .

<sup>15</sup> Endogeneity in our findings can be a problem, but we do not think that this leads our result. Firstly, the economic development variables are on the country level when the respondent was growing up. This means that, apart from the difference in levels, there is quite a time lag between the dependent variable and the independent variable. For Protestant adherence we think that this might not be a big issue because people often adhere to the same religion they were born into or they lose their religion. Looking at the control variables, age, gender and education are probably not driven by endogeneity, although employment status likely is. Nevertheless, we think that for the main indicators in our analyses, the growth and level of economic development and Protestant adherence, the dominant effect runs from these indicators to work ethic.

<sup>16</sup> We test for outliers by dropping the countries that rank as the two highest and lowest of GDP per capita, Protestant adherence and work ethic. For GDP per capita we drop Ethiopia and Tanzania for their low score and Canada and Switzerland for their high score. Analogously, Iran, Lebanon and Turkey are dropped for their shared low score of Protestant adherence and Finland and Denmark for their high rank. Work ethic is lowest in Canada and New Zealand and highest in Tanzania and Ethiopia. These countries are also dropped. The results show that the non-squared effect of GDP per capita decreases a little in significance, though we find similar results to the main analyses in Table 2.



**Table 2**  
Multilevel analyses estimating work ethic.

	(1)	(2)	(3)
		Work ethic	
<i>Formative years level</i>			
GDP per capita until age 10, log	0.0502*** (4.56)		0.0496*** (4.50)
GDP per capita <sup>2</sup> until age 10, log	-0.0298*** (-10.85)		-0.0296*** (-10.78)
GDP growth until age 10	0.184*** (2.95)		0.184*** (2.95)
GDP growth <sup>2</sup> until age 10	1.167*** (3.11)		1.168*** (3.11)
<i>Individual level</i>			
Protestant		0.0250*** (4.81)	0.0176*** (3.38)
Age	0.714*** (5.92)	-0.686*** (-12.10)	0.714*** (5.92)
Age <sup>2</sup>	0.854*** (6.91)	1.285*** (20.95)	0.844*** (6.83)
Female	-0.0598*** (-18.28)	-0.0600*** (-18.39)	-0.0600*** (-18.34)
Employment status, full time = reference			
Part time	-0.0676*** (-11.06)	-0.0695*** (-11.36)	-0.0677*** (-11.07)
Self-Employed	-0.0101* (-1.83)	-0.00971* (-1.77)	-0.0100* (-1.83)
Retired	0.0105 (1.56)	0.0246*** (3.76)	0.0104 (1.54)
Housewife	-0.0932*** (-16.31)	-0.0860*** (-15.10)	-0.0930*** (-16.29)
Student	-0.0856*** (-11.72)	-0.0972*** (-13.83)	-0.0855*** (-11.72)
Unemployed	-0.0795*** (-13.15)	-0.0757*** (-12.56)	-0.0793*** (-13.11)
Other	-0.124*** (-11.41)	-0.115*** (-10.62)	-0.124*** (-11.40)
Education, no education = reference			
Elementary education	0.00513 (0.68)	0.0108 (1.45)	0.00499 (0.66)
Incomplete technical/vocational education	-0.0264*** (-3.41)	-0.0268*** (-3.52)	-0.0266*** (-3.44)
Complete technical/vocational education	-0.0539*** (-7.15)	-0.0480*** (-6.43)	-0.0541*** (-7.18)
Incomplete university prep. education	-0.0627*** (-7.84)	-0.0698*** (-8.86)	-0.0628*** (-7.86)
Complete university prep. education	-0.110*** (-14.45)	-0.100*** (-13.28)	-0.110*** (-14.47)
Incomplete university	-0.163*** (-18.38)	-0.149*** (-16.99)	-0.163*** (-18.40)
Completed university	-0.186*** (-22.71)	-0.177*** (-21.81)	-0.186*** (-22.70)
Fixed effects	Country	Country	Country
Observations	207265	208909	207265

Note: Multilevel analyses estimating work ethic. The two levels that are used are the formative years and individual levels. All data is from WVS and EVS except GDP data, which is gathered from the Maddison Project. \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

measures for religion (Table 5).

Firstly, we test for the possibility of a moderating effect between Protestantism and the level of development. It is possible that people adhere to Protestantism during the modernization phase, which then leads to a higher work ethic. Alternatively, Protestantism could influence work ethic, but only in times of economic development. We include a regression where Protestant adherence is interacted with the level and growth of economic development (Table 3, column 1). The variables at the formative years level still have the same signs and similar coefficients. The coefficients of the interaction term are significant for the non-squared indicators of GDP per capita and growth. The negative coefficient of the interaction between growth and Protestant adherence indicates that the positive relation of growth with work ethic is mitigated a little when an individual adheres to the Protestant religion.

**Table 3**  
Multilevel moderating analyses estimating work ethic.

	(1)	(2)	(3)	(4)
	Work ethic			
<i>Formative years level</i>				
GDP per capita until age 10, log	0.0502*** (4.46)	0.0531*** (4.84)	0.0481*** (4.36)	0.125*** (8.84)
GDP per capita2 until age 10, log	-0.0293*** (-10.21)	-0.0293*** (-10.69)	-0.0299*** (-10.89)	-0.0166*** (-3.66)
GDP growth until age 10	0.269*** (4.17)	0.167*** (2.68)	0.181*** (2.91)	0.374*** (3.03)
GDP growth2 until age 10	1.384*** (3.62)	1.178*** (3.15)	1.193*** (3.18)	0.415 (0.44)
<i>Formative years x individual level, interaction</i>				
GDP per capita until age 10, log x Protestant	0.0204* (1.71)			
GDP per capita2 until age 10, log x Protestant	-0.00506 (-1.25)			
GDP growth until age 10 × Protestant	-0.831*** (-5.15)			
GDP growth2 until age 10 × Protestant	-0.159 (-0.09)			
GDP per capita until age 10, log x Highest educational level				-0.0245*** (-12.06)
GDP per capita2 until age 10, log x Highest educational level				0.000706 (0.93)
GDP growth until age 10, log x Highest educational level				-0.0436* (-1.88)
GDP growth2 until age 10, log x Highest educational level				0.104 (0.64)
<i>Individual level</i>				
Protestant	0.0215** (2.09)	0.0413*** (3.58)	0.0788*** (7.11)	0.0156*** (3.00)
Religiosity		0.177*** (32.39)		
Protestant x Religiosity, interaction		-0.0754*** (-4.99)		
Protestant x Highest educational level, interaction			-0.0129*** (-6.22)	
Fixed effects	Country	Country	Country	Country
Observations	207265	207265	207265	207265

Note: Multilevel analyses estimating work ethic. The two levels that are used are the formative years and individual levels. All data is from WVS and EVS except GDP data, which is gathered from the Maddison Project. Other variables that are included in the analysis but not shown are age, age-squared, gender, education and employment status. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

The intensity of Protestant adherence could have an effect on the relation between Protestantism and work ethic. We measure the severity of individuals' religion by religiosity and interact this with Protestant adherence. Protestant adherence and religiosity both have a positive effect on work ethic, but their interaction term is negative (Table 3, column 2). That is, less religious Protestants have a higher work ethic than more religious Protestants.

Education might have an important influence on the results. Becker and Woessmann (2009) and Schaltegger and Torgler (2010) find that education plays an important role when analyzing Weber's Protestant ethic. Becker and Woessmann argue that human capital formation, in the form of literacy, was the trigger for economic prosperity and not ethics related to Protestantism. Schaltegger and Torgler find that work ethic is influenced by the interaction between religious denomination, i.e. Protestant adherence, and education. In the analyses of Table 2 we already include highest educational degree on the individual level as a control variable. In Table 3, column 3, we investigate whether the interaction between Protestant adherence and education is of importance. For ease of interpretation, the highest attained educational level is now recoded into a continuous variable. The positive coefficient of Protestant adherence increases by more than factor 4 compared to the coefficient that is found in column 3 of Table 2. The main relationship we are investigating, between growth and level of economic development and work ethic, does not change.

Table 3, column 4 presents the estimates of the interaction between the level and growth of economic development with an individual's highest attained educational level. The interaction coefficient between education and level of development is negative. Individuals with less education have a higher work ethic in countries with a higher GDP per capita level. Furthermore, work ethic is high when there is high growth, and even higher when it comes to an individual with less education. Those individuals, who have the least education, have the highest work ethic when a country is in a phase of high growth. This could indicate that individuals belonging to the lower classes of society have most to gain during a transition into modernization. These individuals can, in such a situation, acquire a

**Table 4**  
Multilevel analyses estimating work ethic with country-by-year controls.

	(1)	(2)	(3)
		Work ethic	
<i>Formative years level</i>			
GDP per capita until age 10, log	0.0337*** (3.04)	0.0455*** (3.06)	0.0457*** (3.07)
GDP per capita <sup>2</sup> until age 10, log	-0.0254*** (-8.95)	-0.0400*** (-10.48)	-0.0398*** (-10.43)
GDP growth until age 10, log	0.181*** (2.99)	0.125 (1.59)	0.156** (1.97)
GDP growth <sup>2</sup> until age 10, log	1.178*** (3.16)	1.379*** (2.96)	1.346*** (2.89)
<i>Country-by-year level</i>			
Social trust	0.135*** (3.97)		
GINI coefficient		-0.0584*** (-4.56)	
GINI coefficient, squared		0.000697*** (4.85)	
Polity V score			-0.00275*** (-5.01)
<i>Individual level</i>			
Protestant	0.0128** (2.39)	0.00276 (0.43)	0.00271 (0.42)
Fixed effects	Country	Country	Country
Observations	204733	120932	120932

Note: Multilevel analyses estimating work ethic. The two levels that are used are the formative years and individual levels. Other variables that are included in the analysis but not shown are age, age-squared, gender, education and employment status. \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

**Table 5**  
Robustness checks for multilevel analyses.

	(1)	(2)
		Work ethic
<i>Formative years level</i>		
GDP per capita until age 10, log	0.0559*** (4.87)	0.0581*** (3.90)
GDP per capita <sup>2</sup> until age 10, log	-0.0290*** (-10.18)	-0.0400*** (-10.42)
GDP growth until age 10	0.217*** (3.39)	0.167** (2.13)
GDP growth <sup>2</sup> until age 10	1.132*** (2.97)	1.444*** (3.11)
<i>Country-by-year level</i>		
% Protestant adherents		-0.00899*** (-3.63)
<i>Individual level</i>		
Buddhism	-0.00598 (-0.44)	
Hinduism	0.0400** (2.04)	
Islam	0.0637*** (6.90)	
Orthodox	0.00368 (0.34)	
Roman Catholicism	0.0421*** (6.54)	
No religion	-0.0908*** (-14.15)	
Fixed effects level	Country	Country
Observations	190445	117922

Note: Multilevel analyses estimating work ethic. Column 1 has two levels: the individual and the formative years level. Column 2 also includes the country-by-year level. Individual level controls included but not shown are age, age-squared, employment status, gender and education. \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

high work ethic because they can finally get somewhere by working hard.

Until now, we have assumed that individuals' work ethic is influenced by their values as these have been formed during their formative years and individual characteristics. However, current social, economic and institutional circumstances in a country could influence work ethic as well. We check for these three types of circumstances by including in the analyses, subsequently, an indicator for social trust, income inequality and democratic institutions. Social trust has a positive influence on work ethic (Table 4, column 1). A higher than average level of income inequality reduces work ethic. GDP per capita growth in the formative years and the Protestant dummy become insignificant (Table 4, column 2). Apparently, people are discouraged in their work ethic if growth favors only the rich. Remarkably, the Polity score shows a negative coefficient (Table 4, column 3). This means that a higher level of democratic institutional quality reduces work ethic. Being a Protestant becomes insignificant in regressions with the GINI coefficient and the Polity score. The variables representing our modernization hypothesis remain significant, except for the growth variable when the GINI coefficient is added to the relation.

Weber ascribes a high work ethic to belonging to the Protestant religion. In Section 3 we discussed other religions, including no religion, as possible bearers of high work ethic in a certain phase of their country's development. To see how Protestants hold up against other religions we run an analysis, which contains a dummy for the six major religions in the world and no religious adherents. Individuals who are Hindu, Muslim or Roman Catholic have a higher work ethic than Protestants (Table 5, column 1). We use country fixed effects in the analyses, so this result is not driven by difference between countries but within countries. The only group within a country with a significantly lower work ethic are individuals that adhere to no religion. Our hypothesis concerning the growth and level of economic development remains valid.

To analyze whether it is indeed Protestant adherence or growing up in a Protestant society that leads to a higher work ethic, we conduct a multilevel analysis where we include the percentage of Protestant adherents in a country (Table 5, column 2). Work ethic is lower when the percentage of Protestant adherents in a country is higher. The relation with the level and growth of GDP per capita remains similar to our previous analyses.

### 5.3. The epidemiological approach

The epidemiological approach focuses on second-generation immigrants, for whom information about the birth country of parents is available. Three waves of the EVS/WVS include both the birth country of the father and the mother and the items used for creating our work ethic indicator. These are 5th EVS wave and the 6th and 7th WVS wave. In accordance with common practice, we focus on the mother's country of origin. Second-generation immigrants are those respondents who are born in the country they are currently living in but have a mother who was born and raised in a different country. We exclude respondents who have a father who is not an immigrant so that influences from non-immigrant fathers do not drive the result. Home countries of mothers are only included if at least 20 respondents have a mother from that country.<sup>17</sup> The educational level of the mother is also included so that we can account for differences in work ethic, which are the result of differences in mothers' educational level.

The regression results in Table 6, column 1 reveal that GDP per capita in mothers' home countries during their formative years still has the hump-shaped form we find in the previous regressions of Table 2, columns 1 and 3. The level of significance is lower than before. This is expected and probably because the mechanism is less direct than the one studied in Table 2. GDP per capita growth squared is now not significant and is thus omitted from the analysis. The non-squared growth coefficient is positive and significant. We also include Protestant adherence but have no data on the religious adherence of mothers. We therefore use a variable indicating the percentage of Protestant adherence in the home country of the mother during her formative years. Note that the analyses included fixed effects on the level of the home country of the mother (and host country of the respondent). The results in Table 6 indicate that respondents' work ethic is not influenced by whether their mother grew up during a time when her home country had a relatively high number of Protestant adherents.

If we take a sample from second-generation immigrants who have immigrant parents from different home countries, we would expect a decrease in the effect of mother's indicators. For the level of economic development, this is indeed the case (see Table 6, column 2). GDP per capita growth however increases in strength and significance, as does the percentage of Protestant adherents.

## 6. Conclusions

In this paper, we argue that the values represented by the Protestant Ethic as developed by Max Weber are not exclusively related to Protestantism but to the modernization phase of economic development. Weber observed this phase of development in areas dominated by Protestants at the time of his observations. From these observations, he concludes that a worldly asceticism consisting of a preference for work and a sober life are associated with Protestantism. We argue that this value pattern is associated with the modernization phase of a region's economic development and thus, in principle, can be found for any religion or for non-religious persons. We substantiate our claim by means of multilevel regressions encompassing 87 countries. In order to disentangle the influence of beliefs we also apply the epidemiological approach, which makes use of second-generation immigrants.

<sup>17</sup> This leaves us with the following countries: Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, France, Georgia, Germany, Great Britain, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Moldova, Montenegro, Netherlands, Norway, Poland, Romania, Russia, Serbia, Slovak Republic, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and Ukraine.

**Table 6**  
Estimating work ethic using the epidemiological approach.

	(1)	(2)
	Work ethic	
<i>Mother's formative years level</i>		
Mother's home country GDP per capita until age 10, log	8.878* (1.88)	7.611 (1.39)
Mother's home country GDP per capita <sup>2</sup> until age 10, log	-0.563** (-2.06)	-0.543* (-1.72)
Mother's home country GDP growth until age 10	11.65** (1.97)	21.26*** (3.16)
Mother's home country % Protestants adherents	-0.0604 (-1.61)	-0.0990** (-2.31)
<i>Mother's individual level</i>		
Mother's education, no education = reference		
Incomplete technical/vocational education	0.490*** (6.62)	0.397*** (5.35)
Complete technical/vocational education	0.201*** (3.02)	-0.119* (-1.75)
Incomplete university prep. education	0.253*** (3.85)	-0.00260 (-0.04)
Complete university prep. education	0.270*** (2.73)	-0.258*** (-2.95)
Incomplete university	0.644*** (7.83)	0.272*** (4.21)
Completed university	0.215* (1.75)	-0.0992 (-1.06)
Mother's education, continuous		
Fixed effects	Mothers' home country and host country	
Sample	R with immigrant mothers and fathers	R with immigrant mothers and father with a different home country
Observations	2115	2039

Note: Multilevel analyses estimating work ethic. The two levels that are used are mothers' formative years and the individual levels. Other variables that are included in the analysis but not shown are age, age-squared, gender, education and employment status. The samples of the analyses are as follows: Column 1 contains a sample of respondents with immigrant mothers and fathers. Column 2 contains a sample of respondents with immigrant mothers and father, each with a different home country \*  $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Our results show that both Protestant adherence and the level and growth of GDP per capita are apt indicators of work ethic. The level and growth of GDP per capita have a robust effect even when accounting for different model specifications or moderating effects. Protestantism often shows a positive association with work ethic. However, when comparing it with other religious denominations, Protestant are not the denomination with the highest work ethic. Furthermore, when considering the percentage of Protestant adherence in a country, instead of individual adherence, the coefficient has the tendency to turn negative.

We must note that Weber specifically denotes Calvinist and Pietists in his claim, which relates predestination to work ethic. In our empirical analysis, we do not make a distinction between specific sects of Protestantism. For example, Lutherans are also included as Protestant. This is not fully in line with Weber's reasoning. However, due to data limitations we are not able to separate different Protestant sects. As far as the authors know, previous empirical literature also did not make a distinction between these sects.

The results presented in this paper are not fully in line with the ones suggested by Weber.

Nevertheless, one can argue that Weber was aware of the timeliness of his observations. First, at various places he makes clear that these are only observations and a way of telling a story; a manner of understanding what is happening. Moreover, at the end of the book, he hints at the possibility that a time will come when his observations are no longer valid and developments lead to new views "entirely new prophets arise" (Weber, 1930, p. 124). In this paper, we did not focus on these new prophets but on the fact that different prophets will disseminate the same message when economic conditions are similar. Perhaps this is a somewhat more Marxist view than Weber would have liked.

## Data availability

The authors do not have permission to share data.

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## 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.

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