Agricultural Returns to Labor and the Origins of Work Ethics

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Abstract

We examine the historical determinants of differences in preferences for work across societies today. Our hypothesis is that a society's work ethic depends on the role that labor has played in it historically, as an input in agricultural production: societies that have for centuries depended on the cultivation of crops with high returns to labor effort will work longer hours and develop a preference for working hard. We formalize this prediction in the context of a model of endogenous preference formation, with altruistic parents that can invest in reducing their offsprings' disutility from work. To empirically found our model, we construct an index of potential agricultural labor intensity, that captures the suitability of a location for the cultivation of crops with high estimated returns to labor in their production. We find that this index positively predicts work hours and attitudes towards work in contemporary European regions. We find support for the hypothesis of cultural transmission, by examining the correlation between potential labor intensity in the parents' country of origin and hours worked by children of European immigrants in the US.

JEL Classification: J22, J24, N30, N50, Z13

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1 Introduction

Attitudes towards work have been connected to economic development since Max Weber's famous thesis on the Protestant work ethic and the rise of capitalism. Changing work patterns (de Vries, 1994; Voth, 1998) and an increasing importance placed on the values of hard work and diligence (Anthony, 1977) marked the passage from a peasant society to industrialization in England, while the Confucian work ethic has been credited with part of the success of the East Asian "miracle" economies (Liang, 2010). Today, attitudes toward work and leisure vary widely across countries, with the divide between the US and Europe being the most well known example of this variation (Alesina, Glaeser and Sacerdote, 2006). Though one can see how hard-working individuals and societies might end up doing well, the origin of such values is not obvious, since work also entails disutility. In fact, for some authors, the question is "not why people are lazy or why they goof off but why, in absence of compulsion, they work hard" (Lipset, 1992). This study suggests that a norm of hard work develops when returns to work outweigh its costs. In particular, we examine the hypothesis that a work ethic forms when labor constitutes a relatively profitable input in the production process.

Studies in evolutionary anthropology suggest that attitudes are shaped as part of the interaction of humans with their environment and that cultural norms that have been proven useful will be selected and transmitted more successfuly than others, through both vertical and horizontal socialization (Boyd and Richerson, 1985). A relatively recent literature in economics has used these insights to show how preferences can be endogenously chosen and transmitted from parents to offspring in response to the environment (Bisin and Verdier, 2001; Tabellini, 2008; Doepke and Zilibotti, 2008).[1] A number of empirical studies have shown that geography and the mode of production has an impact on diverse aspects of culture, including cooperative behavior (Henrich et al., 2001), trust (Durante, 2010), gender norms (Alesina, Giuliano and Nunn, 2013), time preferences (Galor and Ozak, forthcoming), and cognitive patterns (Talhelm et al., 2014).

[1] For empirical evidence on this intergenerational transmission process see, for example, Dohmen et al. (2012).

Our study builds on these ideas and develops a theory of how a preference for work can arise and persist in societies in which labor has high returns in production. We look for the origins of work ethic in the pre-industrial agricultural production structure of modern economies, both because agriculture was the main mode of production in human societies for a very long time, and also because it continues to play an important role in many developing countries today. Our main hypothesis is that high returns to labor effort in agricultural production, or, alternatively, a high agricultural labor intensity, should provide an incentive for investment in a preference for work. Other things equal, societies cultivating crops more dependent on labor effort, will have to provide a higher labor input in equilibrium. Since a larger share of the total output depends on the provision of labor, norms that reduce the disutility of labor will be useful in these societies, and will prevail, just as the anthropological literature suggests. Such norms can then persist and be perpetuated through socialization mechanisms. As in models of cultural transmission (Bisin and Verdier, 2000, 2001), altruistic parents who care about their children's utility, will invest more in their offsprings' preference for work when their future income relies more on it.

Equilibrium utilization of labor in agriculture depends on many things, including the availability of capital or other production factors, the production technology and environmental conditions. Nevertheless, when we hold the rest of these factors constant, different crops are produced through different cultivation processes and impose "technological constraints" determining the marginal product of labor for given factor input ratios. Rice is perhaps the most notable example of a labor intensive crop (Bray, 1986). A number of studies document its higher requirement of labor input in equilibrium, as demonstrated by the choices of farmers who cultivate rice alongside other crops. Esther Boserup records that farmers in India allocate 125 work days per hectare for wet paddy rice, while only 33-47 days per hectare for dry wheat (Boserup, 1965). Similar observations in contemporary China show that farmers spent 12-25 days of work per mu (approx. 0.165 acres) of rice versus 4-10 days of work per mu of wheat (Bell, 1992). These studies are supported in their conclusions by studies from environmental scientists. Ruthenberg (1976) notes that marginal returns to labor in wheat production are "lower and decrease more rapidly with greater employment of labor" when compared with rice production.

The laborious nature of rice cultivation has been theorized to have an impact on the

work ethic of those societies that have historically depended on this crop for sustenance (Davidson, 2009). "If man works hard the land will not be lazy", is a Chinese proverb that illustrates the popular understanding of the connection between hard work and potential agricultural returns (Arkush, 1984). In popularized social science writings the connection is sometimes drawn between the high academic achievement of Asian students and their industriousness, shaped by the "tradition of wet-rice agriculture and meaningful work" (Gladwell, 2008).

In this study, we test the intuition that agricultural labor intensity leads to a culture of high work values in a systematic way. We start by showing theoretically that high marginal returns in agricultural production will endogenously lower the disutility from work, when altruistic parents can invest in their offsprings' work preferences. We then take this prediction to the data. The first step in this process is to obtain an estimate of how labor intensive is the production of different crops under conditions of traditional and largely non-mechanized agriculture. We use data from the 1886 Prussian agricultural census, which is, to our knowledge, one of the oldest available censuses containing yield information disaggregated by crop. Assuming optimizing behavior on the part of farmers, we structurally back out the share of labor relative to land in each crop's production. This provides us with an implicit ranking of crops in terms of labor intensity. We then combine this ranking with data on soil and climate suitability for each crop from FAO, in order to create a composite measure of "potential" labor intensity. Our measure is in practice a weighted average of relative suitabilities for different crops, where the weights are the crops' estimated labor intensities, and it is meant to capture the likelihood that agricultural production in an area will be on average more dependent on labor.

We then show that this measure of potential labor intensity predicts work hours and attitudes towards work in European regions today. Using data from the European Social Survey, we find that a higher potential labor intensity leads to a higher number of actual and desired weekly work hours, as well as to a higher difference between actual and contracted work hours, controlling for country fixed effects and a number of individual and regional controls. These results do not depend on the specific Prussian data we use to compute the labor intensity of different crops. We obtain similar rankings of crops in terms of labor requirements and similar results using data from the US Census of Agriculture and

agronomic measures of crop-specific man hours per acre. Furthermore, our measure of labor intensity only has predictive power for work-related outcomes and attitudes, but not for other measures of values or beliefs.

We provide evidence that part of the persistent effect of labor intensity on work attitudes is through cultural transmission. Our estimates get larger in magnitude when we exclude from our sample first and second generation immigrants, whose culture has been shaped by historical conditions in the region of their ancestors and not of their current home. Conversely, when looking at the children of European immigrants in the US, who carry different cultures but face a similar institutional environment, we find that potential labor intensity in their parents' country of origin has a significant and positive effect on the number of hours they work weekly.

Our study contributes to two growing strands of literature. One broadly examines the long-run impact of geography on economic and political development (Diamond, 1999; Michalopoulos, 2012; Haber, 2012; Mayshar et al., 2015). The other one focuses specifically on the historical determinants of culture. Similarly to Alesina, Giuliano and Nunn (2013) and Galor and Ozak (forthcoming), we emphasize the role played in the formation of norms and preferences by historical long-lasting production processes. Other studies stressing the role of history for the formation of culture are Guiso, Sapienza and Zingales (2013), who show that Italian cities with a past of self-governance have higher levels of social capital today, Nunn and Wantchekon (2011), who demostrate that trust levels in Africa today can be explained by historical exposure to the slave trade, and Voigtländer and Voth (2012) who find that anti-semitic attitudes persist at the city-level in Germany over more than 800 years.[2]

Most empirical studies investigating the determinants of work norms have focused on the role of Protestantism, in an attempt to test part of the original Weber hypothesis. Spenkuch (2011) uses data from the German Socio-Economic panel to show that historical

[2]Becker et al. (2015) document the persistent effects of being part of the Habsburg empire on attitudes towards the state, while Grosjean (2011) finds empirical support for the persistence of a culture of honor in the US South dating back to settlement of the area by Scots-Irish immigrants in the late 18th century. More recently, Becker, Enke and Falk (2016) show that the global distribution of risk, time and social preferences has been partly determined by the migratory movements of humans out of Africa in the very distant past.

adoption of protestantism in German precincts affects work hours and earnings of individuals today. Brügger, Lalive and Zweimüller (2009) find significant differences in attitudes towards unemployment in the two sides of the border dividing Protestants from Catholics in Switzerland. Andersen et al. (2012) find that the historical presence of Cistercian monasteries, that pre-dated Protestantism, but were characterized by similar values of hard work and thrift, affects work attitudes in England today.

Various papers have treated theoretically the transmission of values for work and leisure (Bisin and Verdier (2001), Lindbeck and Nyberg (2006), Doepke and Zilibotti (2008)). The only study we are aware of that in any way deals with the effects of labor intensity in agricultural production is Vollrath (2011). This paper finds that labor intensive pre-industrial agriculture can stall industrialization, since it causes a larger share of the population to be employed in agriculture and lowers output per capita. Using relative suitabilities for wheat versus rice, the paper establishes this correlation in cross-country data. Our study suggests an alternative path through which labor intensity can affect industrialization, when preferences are endogenous. When work norms are generally strong, the incentive for capital accumulation is more pronounced, as, for any given level of capital, more labor will imply a higher marginal return from its use. This can in fact lead to more capital accumulation in labor intensive hard-working societies, once an industrial sector has been introduced.[3]

The paper is organized as follows. In section 2 we present a simple model of endogenous preferences, in which a high agricultural labor intensity leads to a higher work ethic. Section 3 explains the construction of our measure of potential labor intensity. In sections 4 and 5 we test our main hypothesis with European survey data and demonstrate the robustness of our results to different measures of labor intensity and work attitudes and to falsification tests. In section 6 we provide evidence for the cultural transmission of work attitudes. Section 7 discusses limitations and possible extensions of our study and section 8 concludes.

[3]Confucian values, which place an important weight on hard work and discipline, are thought by many scholars to contribute the cultural basis for the recent "miracle" growth of — labor-intensive, traditionally rice-growing — East Asian economies, much in the same way that the Protestant work ethic led to the rise of capitalism in the West (Hofstede and Bond, 1988; Chan, 1996; Liang, 2010).

2 A model of work ethic formation

In this section, we formalize how the structure of production can contribute to the long run formation of a work ethic. In our model, work constitutes a burden on an individual's welfare, but parents can, through a costly investment, shape the preferences of their offspring to reduce the adverse utility impact of hours worked. We refer to preferences under which the disutility effect of work is small, i.e. when individuals are more tolerant towards work, as representing a high work ethic. The value of having such a tolerance towards hard work is increasing in the actual number of hours that an individual will end up working.

We assume that adults receive instantaneous utility depending on consumption and hours worked of the form $U(c,h;\gamma)$ with $U_c \geq 0$, $U_{cc} < 0$, $U_h < 0$, $U_{hh} \leq 0$, $U_{ch} = U_{c\gamma} = 0$, and $U_{h\gamma} > 0$.[4] Thus γ can be thought of as a preference parameter that moderates the adverse effects of hours worked. This work ethic is formed through a parental transmission mechanism similar to Doepke and Zilibotti (2008), with a law of motion given by

$$\gamma' = \rho\gamma + \Psi(I) \tag{1}$$

with $\Psi(0) = 0, \Psi_I > 0, \Psi_{II} < 0$, where I represents the investment costs of parents (in utility terms) in their offspring's work ethic. Individuals live for two periods, one as a child and one as a parent, and work and consume only in the latter. Parents are assumed to be fully altruistic with respect to the welfare their offspring receive as adults, which they discount at a time discount factor δ. A parent then solves the dynamic program

$$V(\gamma) = \max_{c,h,I} \left\{ U(c,h;\gamma) - I + \delta V(\gamma') \right\}$$

subject to the law of motion (1) and a resource constraint $c \leq F(h;T,\beta)$, where T is a fixed endowment of land, $F_h > 0$, $F_{hh} < 0$ and $F_{h\beta} > 0$. Parameter β thus determines how quickly returns to labor diminish in the production activity, and is thought to be a fundamental component of the production function. Optimal choices over work, consumption

[4] We also assume that the utility function satisfies the Inada type conditions $\lim_{c\to\infty} U_c = 0$ and $\lim_{c\to 0} U_c = \infty$.

and investment into offspring then require that

$$U_c(c^*, h^*; \gamma) F_h(h^*; T, \beta) = -U_h(c^*, h^*; \gamma) \tag{2}$$

$$1 = \delta V_\gamma(\gamma') \Psi_I(I^*) \tag{3}$$

$$V_\gamma(\gamma) = U_\gamma(c^*, h^*; \gamma) + \delta \rho V_\gamma(\gamma') \tag{4}$$

As is intuitive, an individual with a larger work ethic parameter γ will choose to work more hours, a relationship that follows directly from (2). Notice that a higher γ reduces disutility from labor, thus decreasing the right hand side of (2). In response, optimal hours worked (and consequently consumption) adjust upwards. The first order conditions have three further important implications. First, and again following from (2), a higher value of β leads to an increase in optimal hours worked. A larger β implies a higher marginal product of labor for given input levels, and as a consequence marginal benefits and costs of hours worked are equated at a higher work level. Second, the value of having a high work ethic (a high inherited value of γ) is increasing in the optimal amount of hours worked. This follows from the envelope condition (4) and the fact that U_γ is increasing in h^*, and makes intuitive sense: it is particularly beneficial to be tolerant of hard work, if the environment requires one to work many hours. Finally, parents invest more in the formation of the work ethic of their child if they expect it to be of high value, as can be seen in (3). Taken together, the optimality conditions show that parents will invest in their offspring's work preferences if they expect their child to work many hours. Hours worked in turn will be high if, among other factors, the local mode of production is characterized by slowly deceasing returns to labor, i.e. if β is high.

To analytically solve for the model's steady state, we specify the functional form of utility and of the production function as

$$U(.) = \log(c) - \frac{1}{\gamma} \frac{h^{1+\phi}}{1+\phi} \tag{5}$$

$$c = A T^{1-\beta} h^\beta \tag{6}$$

so that the consumption good is produced with a Cobb-Douglas production function in land and labor, where A represents total factor productivity. From (2), we then get that

equilibrium labor supply is given by

$$h^* = (\beta\gamma)^{\frac{1}{1+\phi}}$$

and thus increasing in both γ and β. This model has a unique steady state, i.e. a unique level of γ such that work ethics are constant across generations, determined by

$$\gamma^{ss} = \frac{\Psi(I^{ss})}{1-\rho} \tag{7}$$

$$1 = \frac{\delta}{1-\delta\rho}\frac{1-\rho}{\Psi(I^{ss})}\frac{\beta}{1+\phi}\Psi_I(I^{ss}) \tag{8}$$

Notice that the right hand side of (8) is decreasing in I^{ss}, which implies that steady state parental investment is increasing in β, as already reasoned from the first order conditions. It then follows directly from (7) that the work ethic is an increasing function of β. This model thus predicts the formation of a strong work ethic there where marginal returns to labor are high, for given levels of available land and total productivity.

While this model is kept very parsimonious for purposes of exposition, we discuss extended versions in the appendix to address two potential sources of concern. We first introduce an endogenous fertility choice, to investigate whether Malthusian population growth may counteract the development of a high work ethic in a labor intensive environment. We show that while the relationship between labor intensity and steady state population size is ambiguous, its effect on work ethics remains strictly positive. Intuitively, the first result comes from the fact that in an economy with high labor intensity, the possibility of the parent to invest in a valuable work ethic introduces a quality versus quantity trade-off, potentially reducing the optimal number of children.

We further study the case of subsistence agriculture by introducing a minimum consumption requirement. Whether this constraint is binding is an endogenous outcome in our model. In the region where the constraint binds, labor productivity becomes a crucial determinant of attitudes towards work. We derive the conditions under which labor intensity, as measured by β, continues to positively affect work ethics in subsistence agriculture. These conditions are more likely to hold as the economy moves closer to leaving the constrained area, and are essentially the same as in Vollrath (2011). To deal with the po-

tential confounding effect of productivity when the subsistence consumption level is barely reached, we will control for the overall suitability for rainfed agriculture in our estimations.

We conclude this section with a note on our choice of conceptual framework. We have modeled the formation of a work ethic as the result of the intergenerational transmission of preferences from parents to children. This transmission happens partly "automatically" (e.g. via the genetic intergenerational correlation of preferences) and partly via parental investment. Such a framework is well supported by micro-level empirical evidence (Dohmen et al., 2012), even though it is hard to disentangle empirically the relative importance of socialization as opposed to other intergenerational transmission mechanisms, like genetic transmission. An alternative, and, in our case, complementary mechanism is evolutionary in nature (Bowles, 1998; Galor and Michalopoulos, 2012): in places where returns to labor in agricultural production are high, individuals with a high work ethic will be economically more successful and will, as a result, also enjoy higher reproductive success. Adding to this a feedback mechanism, whereby those with high work ethic are more likely to adopt crops with high returns to labor (Galor and Ozak, forthcoming), would only strengthen the observed correlation between labor intensity and low disutility of work.

3 Measuring returns to labor

The main challenge in empirically testing the relation between agricultural returns to labor and work ethics lies in the measurement of labor returns. Societies with similar production modes and comparable productivity potentials will differ in how much labor they utilize relative to other factors depending on the nature of the main crops they cultivate. As several studies indicate, wheat and other cereals demand a lower labor to land ratio than rice (Boserup, 1965; Ruthenberg, 1976; Bell, 1992). This ranking in terms of labor intensity can presumably be generalized to include all important staple crops.

Agronomic studies often offer estimates of labor requirements in agricultural production. Unfortunately, few studies do so systematically for different crops, and those who do are focused on contemporary mechanized agriculture, usually in the US (Cooper, 1916; Wakeman Lenhart, 1945). FAO's Ecocrop database is the closest to a systematic survey of the characteristics of various crops under different production modes. Though labor inten-

sity is included in the recorded characteristics of crops in Ecocrop, its values are missing for most crops, with non-missing entries for only 3 out of the 15 most important staple crops wordwide.[5]

In order to obtain a more detailed and systematic ranking of crops in terms of labor intensity, we follow a procedure similar to the one suggested by FAO (Lee and Zepeda, 2001) for gauging the crop-specific marginal returns of various inputs in agricultural production. We describe a simplified version of this procedure below.

To derive the crop-specific equilibrium share of labor, we need to make some minimal assumptions on the behavior of farmers and the form of agricultural production. In particular, we assume that farmers efficiently use their resources and allocate their available land to different crops so as to equalize marginal returns to land.[6] This implies the additional assumption that land, at least at the margin, is not crop-specific, namely that all crops from the farmer's available crop set can potentially grow on the same land. Finally, we consider a Cobb-Douglas production function with constant returns to scale in land and labor.[7] We can then write the profit maximization problem of a representative farmer in region j as

$$\max_{H_{i,j},T_{i,j}} \sum^{i} \left(P_{i,j}Y_{i,j} - r_j T_{i,j} - w_j H_{i,j}\right)$$

where $P_{i,j}$ is the market price of crop i in region j, $Y_{i,j}$ is the output of crop i with $Y_{i,j} = A_{i,j}T_{i,j}^{1-\beta_i}H_{i,j}^{\beta_i}$, and $T_{i,j}$ and $H_{i,j}$ are usage of land and labor with respective region specific prices r_j and w_j. Finally, β_i represents the crop specific labor intensity of production.

Efficient usage of land by the farmer implies the following first order condition resulting from the above optimization problem

[5] According to this classification, wetland rice is a high labor intensity crop, while barley and rye is a low labor intensity one.

[6] In other words, farmers behave as profit maximizers, though, if we substitute crop-specific prices with calories, we can also think of them as maximizing agricultural surplus in calorie terms. The problem set-up in terms of profits also assumes that markets of both agricultural inputs and output are competitive.

[7] For the moment, we abstract from capital. To the extent that its use is negligible or does not differ across crops, this simplification will not be important for our results, and is often assumed by studies estimating factor shares in traditional agriculture (see for example, Wilde (2013)), including Kopsidis and Wolf (2012), who estimate agricultural productivity in Prussia using census data. In theory, we can include capital — or any number of crop-specific inputs — in the production function, so long as we have data on their use. The problem in practice is that almost no agricultural census, contemporary or historical, includes information on crop-specific use of machinery or animals.

$$(1-\beta_i)\frac{P_{i,j}Y_{i,j}}{T_{i,j}} = r_j$$

Reshuffling terms and taking logs this relation becomes

$$\log(P_{i,j}Y_{i,j}) = \log(r_j) - \log(1-\beta_i) + \log(T_{i,j}) \tag{9}$$

which can be estimated with data on crop values and on land allocated to the cultivation of different crops. This is information available in most contemporary agricultural censuses. Notice that $\log(1-\beta_i)$ is the share of land in the production of crop i, a crop-specific characteristic that can be empirically captured by a crop fixed effect. $\log(r_j)$ is the region-specific price of land, which is in turn captured by a regional fixed effect. The regression form of (9) then becomes

$$\log(P_{i,j}Y_{i,j}) = \gamma_j + \delta_i + \alpha \log(T_{i,j})$$

Using the estimates of the crop fixed effects δ_i, it is then straightforward to back out the share of labor β_i, since from the structural model $\delta_i = -\log(1-\beta_i)$. In practice, since one of the crop fixed effects will be dropped in the estimation, we express the labor shares of the rest relative to that numeraire.

We estimate the above equation using data from the 1886 Prussian agricultural census, the earliest historical census that we are aware of which provides information on crop-specific yields per unit of land harvested for a number of food crops. The census was conducted by the Royal Prussian Statistical Office and it has been digitized and made available as part of the ifo Prussian Economic History Database (Becker et al., 2014). We have data on total output and output per hectare for wheat, barley, rye, oats, potato, field bean and pea for 518 Prussian counties (Kreise).[8] We combine this with price information from the same year collected by the Prussian Statistical Office. Price information is not available at the county level, so our estimation rests on the assumption that agricultural output prices

[8]We average winter and summer harvests of wheat, rye and barley, and add up grain and straw to get to the final output in kilograms.

are equalized across Prussia. Normalizing the labor share of wheat to equal 0.4, we derive estimates for the labor shares of the remaining crops, presented in Table 1.[9] It is reassuring for our choice of specification that the estimate of α is statistically not distinguishable from one with high levels of confidence, as theory would suggest.

Having obtained a measure of the share of labor in the production of these 7 crops, under the assumptions previously laid out, we proceed to construct our main variable of interest, an index of *potential labor intensity*. We use data on agroclimatic suitability for each crop from FAO's Global Agro-Ecological Zones Database (Fischer et al., 2002)[10] and combine them with the estimated labor shares in an index of the form

$$\text{Potential labor intensity}_r = \sum_i \beta^i \frac{\text{suitability}_{ir}}{\sum_j \text{suitability}_{jr}}$$

where r indexes regions and i indexes crops. The index for each region is a weighted average of the relative suitabilities for different crops, where the weights are the crops' labor intensities. We normalize this to take on values from 0 to 100. The intuition behind it is that labor intensity will more likely be higher in a region that is relatively more suitable for more labor intensive crops. Figure 1 depicts the distribution of potential labor intensity across European regions. There is significant variation both across and within countries. In the following section, we will investigate whether this measure predicts preferences for work in Europe today.

4 Main Empirical Results

Before examining whether potential labor intensity is correlated with contemporary work ethics, it would be desirable to show that the intermediate link between labor intensity and attitudes, namely hours worked in the past in societies dependent on agriculture, also

[9] We choose 0.4 for the labor intensity of wheat production, following Clark (2002) and Allen (2005), who both estimate a value close to 0.4 for labor's share of income in wheat, using historical data from England. The estimates of relative labor intensities do not depend on the specific value chosen for this normalization.

[10] The database reports the suitability of each 5 by 5 arc-minute grid cell globally for the cultivation of different crops. The model used to compute it considers each crop's technical production requirements and their interaction with each location's land and agroclimatic resources and constraints. In the empirical analysis we will directly control for the most important factors that affect suitability of a location for any given crop, such as temperature, precipitation, slope and elevation, as well as for overall suitability for rainfed agriculture.

holds. Unfortunately, work time is a variable that is rarely recorded in official statistics and for which only fragmentary estimates exist for pre-industrial times (Voth, 1998). Some early country-level estimates of hours worked come from Huberman and Minns (2007), who report average weekly work hours in 1870 for a number of European and North American countries. Though these do not refer specifically to agricultural labor, Figure 2 shows that they are positively correlated with potential labor intensity at the country level. Despite the small number of observations, the positive correlation lends credit to our hypothesis, particularly because it is documented for a time period when no welfare regulation or restrictions on work time were yet in place in most developed nations.

For our main analysis, we use data from all seven waves of the European Social Survey, which is conducted every two years, from 2002 to 2014. The ESS collects individual-level information on a number of background characteristics, social attitudes and human values. We rely on two main outcome variables: the total number of hours respondents report normally working per week in their main job and the difference computed between weekly hours contracted and weekly hours normally worked. The survey also asks individuals to report the number of hours they would ideally choose to work weekly. The question is phrased "How many hours a week, if any, would you choose to work, bearing in mind that your earnings would go up or down according to how many hours you work?". This question directly captures the tradeoff between consumption and leisure that features centrally in our theoretical framework, and we use it as an additional measure of work ethic. Table 2 reports summary statistics for these measures and for the rest of the variables included in the empirical analysis. Figure 3 shows that there is a positive correlation between the regional averages of these three variables and potential labor intensity.

Our main specification is

$$Y_{irc} = \alpha + \beta \text{Potential labor intensity}_{rc} + X_{irc}\gamma_1 + Z_{rc}\gamma_2 + \theta_c + \epsilon_{irc}$$

where Y_{irc} is the outcome variable for individual i living in region r of country c, X_{irc} is a vector of individual controls, Z_{rc} a vector of regional geographic and economic controls and θ_c is a country fixed effect. We focus throughout on individuals aged 25 to 60 — the youngest retirement age in our sample — and, when examining actual work hours, we

further restrict the sample to those who have a paid job at the time of the survey.

In columns (1), (5) and (9) of Table 3 we report our baseline estimates of the effect of potential labor intensity on actual hours, overtime and desired weekly work hours respectively, controlling only for a parsimonious set of individual characteristics (gender and age dummies), that are unlikely to have been influenced by labor intensity, and indicators for the ESS survey wave. The effect is significantly positive for all measures.

Since potential labor intensity is a measure constructed on the basis of relative suitabilities for different crops, there is a concern that it captures some of the geographic and climatic factors that determine these suitabilities. To address this concern we control in columns (2), (6) and (10) for a number of potentially important geographic and climatic variables. Temperature, precipitation, the slope of the terrain and elevation, are all determinants of crop suitability considered in the FAO models. We control for these variables, as well as for latitude and longitude, to capture other spatial patterns that potentially affect work ethics, but are not related to labor intensity. Including these controls reduces somewhat the magnitude of the estimates on worked hours and overtime, but increases the estimated effect on desired weekly hours. We also control for a measure of land suitability for rainfed agriculture from FAO. Land suitability is highly (negatively) correlated with potential labor intensity, as can be seen in Table B.1 in the Appendix, but it is a measure that captures land productivity rather than returns to labor, and thus it is encouraging that our estimate survives its inclusion.

Country fixed effects capture factors affecting attitudes towards work that differ at the country level, such as labor laws and collective agreements, unemployment and welfare provision, as well as GDP, a variable strongly negatively correlated with the number of actual worked hours at the country level. In columns (3), (7) and (11), we additionally control for the log of regional income and regional unemployment, both measured in 2007.[11] Regional GDP per capita shows a large positive correlation with hours worked and overtime, but its inclusion does not substantially change the estimated effect of potential labor intensity.

[11] Data for these variables come from the ESS and the chosen years are the ones for which we have the fewest missing values.

Weber's treaty on Protestantism and the concept of work as a calling introduced the influential idea that Protestantism (and in particular Calvinism and other reformed denominations) fundamentally influenced the development of a work ethic. Spenkuch (2011) finds support for this connection using microdata from Germany. Religious affiliation is a potentially endogenous control, but, given the prominence of Protestantism among theories explaining the work ethic, we are still interested in whether it makes the effect of potential labor intensity disappear. Columns (4), (8) and (12) include in the regression eight dummies for religion. Few of them (Jewish, Orthodox Christian, other non-Christian and non-religious) are positively and significantly correlated with desired weekly work hours and only Islam is significantly (negatively) correlated with actual hours worked and weekly overtime. In fact, for these latter two outcomes, the correlation with Protestantism is negative. More importantly, inclusion of these controls does not significantly affect the magnitude of our estimate, which, in the case of desired weekly work hours even increases.

Overall, the estimated effect of one standard deviation increase in potential labor intensity ranges between 14.5 and 24 minutes per week for actual work hours, between 12 to 15 minutes for weekly overtime and between 12 and 20 minutes per week for desired work hours. Though not very large, this effect is remarkably consistent across specifications and is of both statistical and of economic significance. Interestingly, few of the other included controls are consistently significant and most — with the exception of latitude and land suitability, which are both positively correlated with weekly work hours — are of negligible magnitude.

5 Robustness

We begin assessing robustness by considering an alternative measure of the preference for work, using a different dataset. The European Values Study (EVS) asks interviewed subjects "Please say how important is work in your life". Answers take on one of four values: 1 "Very important" 2 "Quite important" 3 "Not important" 4 "Not at all important". We use information from 4 waves of EVS (1981-1984, 1990-1993, 1999-2001 and 2008-2010) and recode the variable so that higher numbers are associated with a higher work ethic. Table 4 reports specifications identical to those in Table 3 using this measure as dependent variable.

The estimated effect is consistently positive and significant at the 5% level, and remains virtually unchanged after inclusion of geographic, economic or religious controls. None of the geographic controls has a significant effect on the measure of importance of work, and the effect of potential labor intensity on the outcome is of a similar order of magnitude as that of the regional unemployment rate.

A potential concern with our baseline measure of potential labor intensity is that the Prussian data used to compute it are not representative of optimal factor allocations to different crops. Furthermore, we use only one year of data, 1886, and though our estimation amounts to computing the average labor share across Prussian counties and thus removes some idiosyncratic variation, it is still possible that 1886 was a special year for Prussia in terms of average yields or crop prices. More generally, it would be desirable to check whether our ranking of crops in terms of labor intensity holds when computed with different data.

To address these concerns, we turn to the US Census of Agriculture, which provides information on crop yields by unit of land at the county level, from 1880 onwards. We use three census years, 1880, 1890 and 1900 and repeat the estimation of labor shares for each crop described in Section 3, this time including census-year fixed effects. This alternative measure is not perfect: the US Census does not list information for all crops available in the Prussian one, but only for potato, wheat, rye, oats and barley. There is also the concern that US agriculture in the period 1880-1900 was more mechanized than that of Prussia in 1886, so that capital might play a bigger role in the production of some crops and confound our results. Nevertheless, the US data yield a very similar ranking of crops as the Prussian ones. With the exception of barley, that is now more labor intensive than all other three cereals, the remaining crops retain their ranking. What is important, the potato is again significantly more labor intensive than cereals.

We use the US-based estimates of crop-specific labor intensity to recompute our measure of potential labor intensity at the regional level in Europe. Repeating the baseline estimation with the new measure yields coefficients that are both qualitatively similar and surprisingly close in magnitude to the baseline estimates. Column (1) of Table 5 shows that a standard deviation increase in potential labor intensity increases the number of weekly work hours by approximately 32 minutes (14.5 minutes in baseline). This effect is 15 minutes for weekly

overtime and 23 minutes for desired weekly work hours.

An additional advantage of using US data is that we can directly compare the resulting ranking of crops to estimates of crop-specific labor requirements from available agronomic studies. The U.S. Department of Agriculture (1922) reports man-hours per acre of land for various field crops and regions in the US. It finds the highest labor requirement for potatoes, followed by beans and corn. Oats, barley and wheat require a very similar, generally low, number of average man-hours; the ordering in terms of labor intensity is practically identical to that produced by our estimation using the US Census of Agriculture, with the exception of rye which is reported to be slightly more labor intensive than wheat.[12]

To make this comparison more systematic, we construct a new estimate of crop-specific labor intensity using the data on man hours per acre from the US Department of Agriculture. We make use of the fact that in an optimal allocation, labor to land ratios are proportional to labor intensity, since for a crop i and under the assumptions outlined in section 3, optimality requires $h_i/T_i = \beta_i/(1-\beta_i) * (r/w)$. Potential labor intensity based on these new crop-specific estimates significantly predicts all three work-related outcome variables, as can be seen in columns (2), (5) and (8) of Table 5. Notwithstanding the very different estimation method, coefficients are of similar size as in our baseline estimation, implying an increase of approximately 17 minutes in weekly work hours (13 for overtime and 25 for desired weekly hours) in response to one standard deviation increase in potential labor intensity.

Our ranking of crops by labor share indicates that, with wheat as the numeraire, cereals and pea are crops of low labor intensity, while the potato and the bean are more labor intensive. These latter two are also crops that were introduced in Europe from the New World. The potato arrived in the 16th century and saw widespread diffusion after 1800. While there existed varieties of bean native to Europe, the most common field bean of the *Phaseolus* genus was brought to the Old World during the Columbian exchange. Our conceptual framework is silent on the length of time required for the formation of a preference for work, and could allow for a recent crop of major significance like the potato (Nunn

[12] A practically identical ranking is provided by Cooper (1916) for the period 1902-1912.

and Qian, 2011) to impact relative factor allocations and parental investment decisions relatively quickly. Our results are, however, not solely driven by labor intensive New World crops. When we recompute our measure of potential labor intensity by dropping the potato and the bean, we get estimates of somewhat larger magnitude for weekly work hours and desired weekly hours and identical for weekly overtime (Columns (3), (6) and (9) of Table 5).

What other individual characteristics, preferences or beliefs are affected by agricultural labor intensity? We estimate our preferred specification, which includes geographic and economic (but not religious) controls (Column (3) of Table 3) using as outcomes a number of ESS variables capturing individual attitudes and human values. In Figure 4 we report estimates of the coefficient on potential labor intensity, with p-values adjusted for the false discovery rate within groups of different outcomes (q-values). Potential labor intensity does not have a significant impact on any of the outcomes that are unrelated to work. It continues having a positive and significant effect on weekly work hours and weekly overtime. The coefficient on desired work hours does not survive the correction for multiple comparisons, but remains positive and large compared to estimates for other outcomes. Taken together, these results support a work ethic-specific effect of potential labor intensity and increase our confidence in our baseline findings.

6 Persistence and cultural transmission

Cultural transmission is an important part of our story. Part of the work ethic is transmitted from parents to children and this vertical socialization mechanism is important both in the past, when returns to labor in agriculture determined optimal effort, but also potentially today, when work attitudes persist because of interaction with institutions or similar mechanisms. This suggests that our baseline estimates should become more precise if we remove from the sample immigrants, whose place of origin has potentially very different labor intensity from that of the region in which they currently live. We do this in Table 6. Columns (1), (3) and (5) report our baseline regression with individual and regional controls. Columns (2), (4) and (6) restrict the sample to native-born individuals, whose parents are also native-born. Restricting the sample leads to a larger — and, in the case of desired

hours, more precise — estimated effect of potential labor intensity.

To further assess the role of cultural transmission, we look at the children of immigrants in the US (Fernández and Fogli, 2006, 2009). Our measure of potential labor intensity is computed with European data and ignores a large number of crops that have for centuries constituted important staples for many societies outside of Europe, such as rice or corn. For this reason, we restrict our analysis to individuals whose parents migrated to the US from Europe. We use ten years of information (2002-2012) from the Current Population Survey and estimate the effect of potential labor intensity in the parental country on average weekly hours worked in the main and secondary occupation for a sample of employed second generation immigrants aged 25 to 65, the youngest age of retirement in the sample.

Columns (7)-(9) of Table 6 report the results. We consider the origin country of both father and mother, both separately and jointly. We include the same set of controls for the CPS sample as we do for the ESS survey, additionally controlling for survey year and state of residence indicators. GDP per capita and unemployment are computed for the country of the parent's origin. As is often the case in studies of transmission, the estimated effect of the mother's country is larger than that of the father, and the largest effect is found in the sample with parents from the same country of origin. An increase of one standard deviation in the potential labor intensity increases weekly work time by up to an hour and twenty-eight minutes, a large and significant effect.

7 Discussion

In this section, we address a number of remaining issues regarding our empirical strategy. An important one among them is the presence of capital and the differential possibility of mechanization across crops. In practice, our estimation backs out the share of labor through a crop fixed effect, which is taken to proxy for the share of labor in the total value of production after the contribution of land has been controlled for. This will be a good proxy for the labor share if crop-specific capital inputs matter relatively little. This is not very unlikely in the context of traditional agriculture, as it was practiced for centuries in Europe, before the introduction of mechanization and agronomic improvements. In the context of modern agriculture, crop-specific capital usage will be more relevant, but

not necessarily problematic for our estimates. Since mechanization has been a far more important labor-saving factor for land-intensive cereals than for labor-intensive tubers such as the potato (Knowlton, Elwood and McKibben, 1938; Elwood et al., 1939), it is likely that, by abstracting from capital, we overestimate the labor intensity of cereals and thus compress the true difference in labor intensity between them and the potato. Controlling for capital would show e.g. wheat to be even less labor-intensive than we now find it to be. In any case, it is reassuring that at least our ordering of crops in terms of labor intensity seems to be confirmed by existing estimates of labor requirements, expressed as man-hours per unit of land.

In the same way that crop-specific capital inputs might bias our labor share estimates, any crop-specific unobserved factor will have a similar effect. Volatility and risk, to the extent that they are more important for some crops than for others, are an example of such a factor. Furthermore, we would expect the effect of labor intensity on the work ethic to be affected not just by the crop-specific, but also by the overall volatility of production. Returns to labor are lower when farmers are more uncertain of their total output, and so is the incentive to invest in a preference for work. Studies of peasant culture suggest indeed that fatalism and the belief that no amount of hard work can improve the peasants' situation decrease significantly when production becomes more predictable, for example through the introduction of irrigation that reduces dependence on rainfall (Arkush, 1984; Ortiz, 1971).

We do not explicitly deal with historical variation in forms of ownership structure and farm labor relationships, such as feudal serfdom or slavery. To the extent that farmers under serfdom are forced to work longer hours than they would otherwise optimally choose for themselves, without benefiting from the extra consumption, the incentive of parents to transmit a work ethic to their children will be lowered. On the other hand, longer demanded work hours offer parents a direct incentive for making their children hard-working and reducing their future disutility, so that the total effect of serfdom or slavery on work ethics will be ambiguous. In any case, regional differences in labor intensity within serfdom should still lead to differences in work attitudes. Labor intensive crops demand a higher labor input, even if that is chosen by the feudal lord and not the serf himself. If the nature of production forces children of serfs to work hard, then a higher work ethic will be beneficial for them.

Our theoretical framework was simple and used to demonstrate how the formation of a work ethic depends on the equilibrium labor share in an agricultural economy. We have not investigated theoretically how the work ethic persists once agriculture stops being the most important economic activity. One way in which this persistence can be explained is through the interaction of the work ethic with institutions, such as redistribution. If redistributive policies are chosen through majority voting, a society with high work norms will be more likely to choose low tax rates; individuals will then rely more on their own labor than on welfare, thus having an incentive to maintain a high work ethic. Such models of multiple steady states, in which institutions interact with work culture have been proposed by Bisin and Verdier (2004), Alesina and Angeletos (2005) and Bénabou and Tirole (2006).

8 Conclusion

This paper shows how a high work ethic, in the sense of a lower preference for leisure, arises and persists in societies with high labor returns in agricultural production. We show this relation holds theoretically when preferences can evolve endogenously as a result of parental socialization. We then quantify the relative labor input required in different crops using production data from 19th century Prussia and combine this information with agricultural suitability in an index of potential labor intensity. This measure of potential labor intensity positively correlates with various proxies of a work ethic. Individuals from European regions that are relatively more suitable for labor intensive crops work more hours per week, report a higher number of desired weekly work hours and consider work more important in their lives, controlling for country fixed effects, individual factors and regional economic and geographic characteristics. This effect is generally stronger for individuals native to their region of residence. US natives with European-born parents also work more hours when their parents come from countries with a higher potential labor intensity, a result that offers support to a cultural transmission mechanism.

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Figures and Tables

Figure 1: Potential labor intensity in the regions of Europe

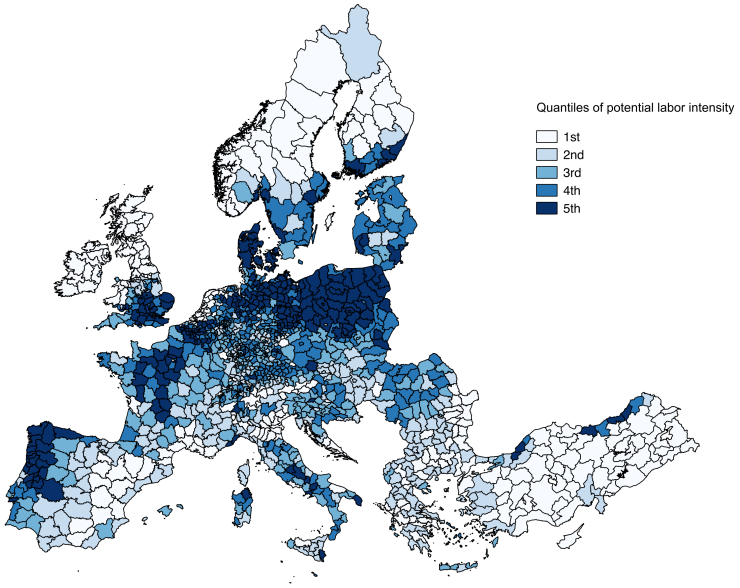
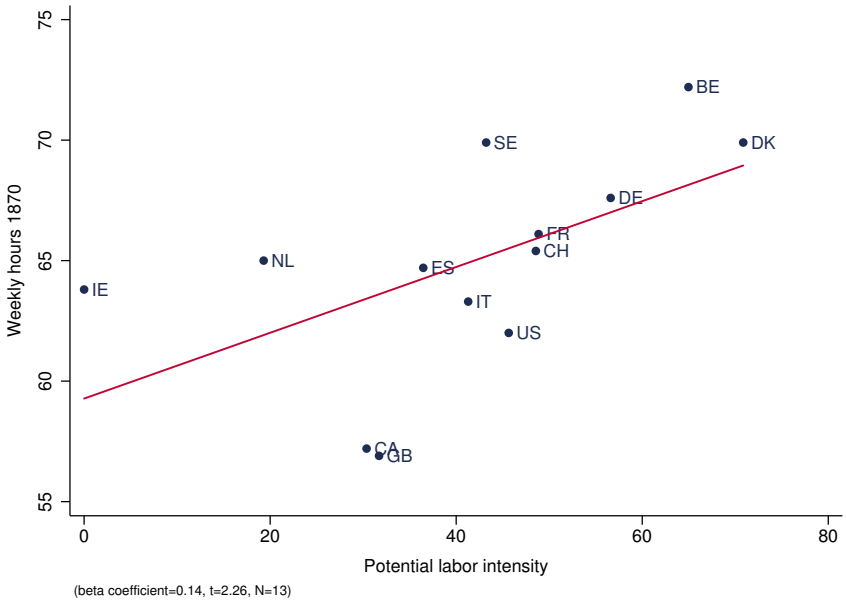
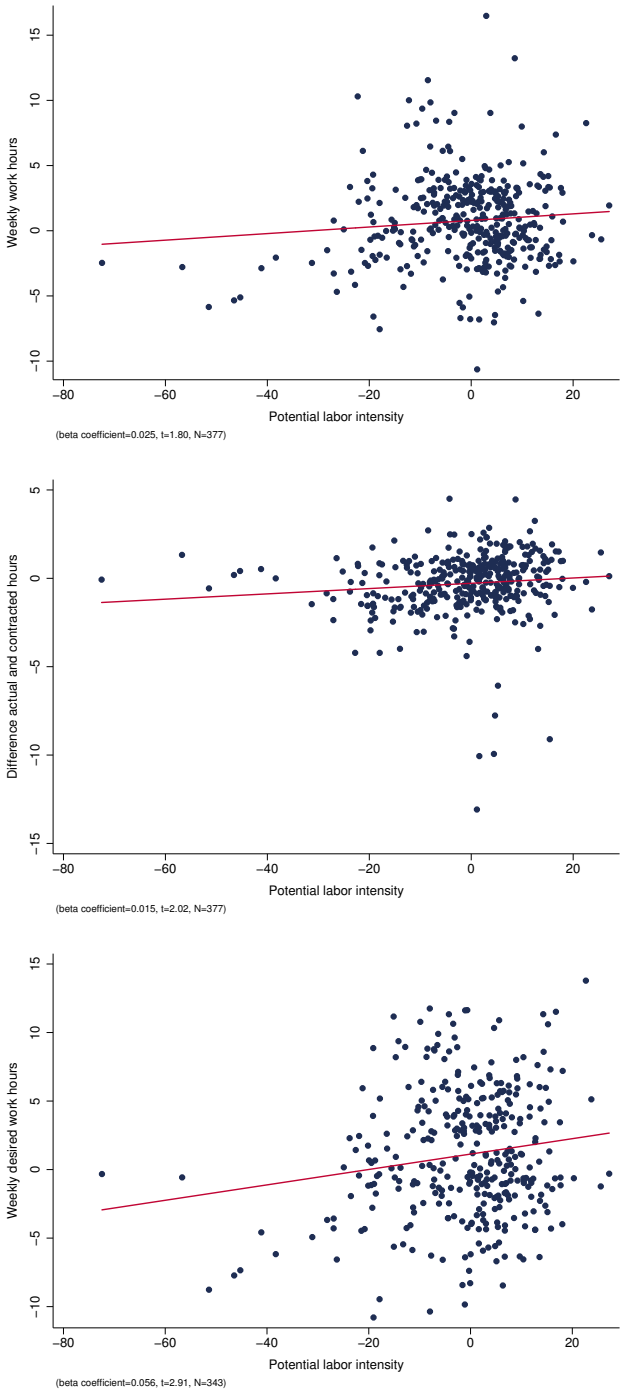


Figure 2: Potential labor intensity and historical work hours



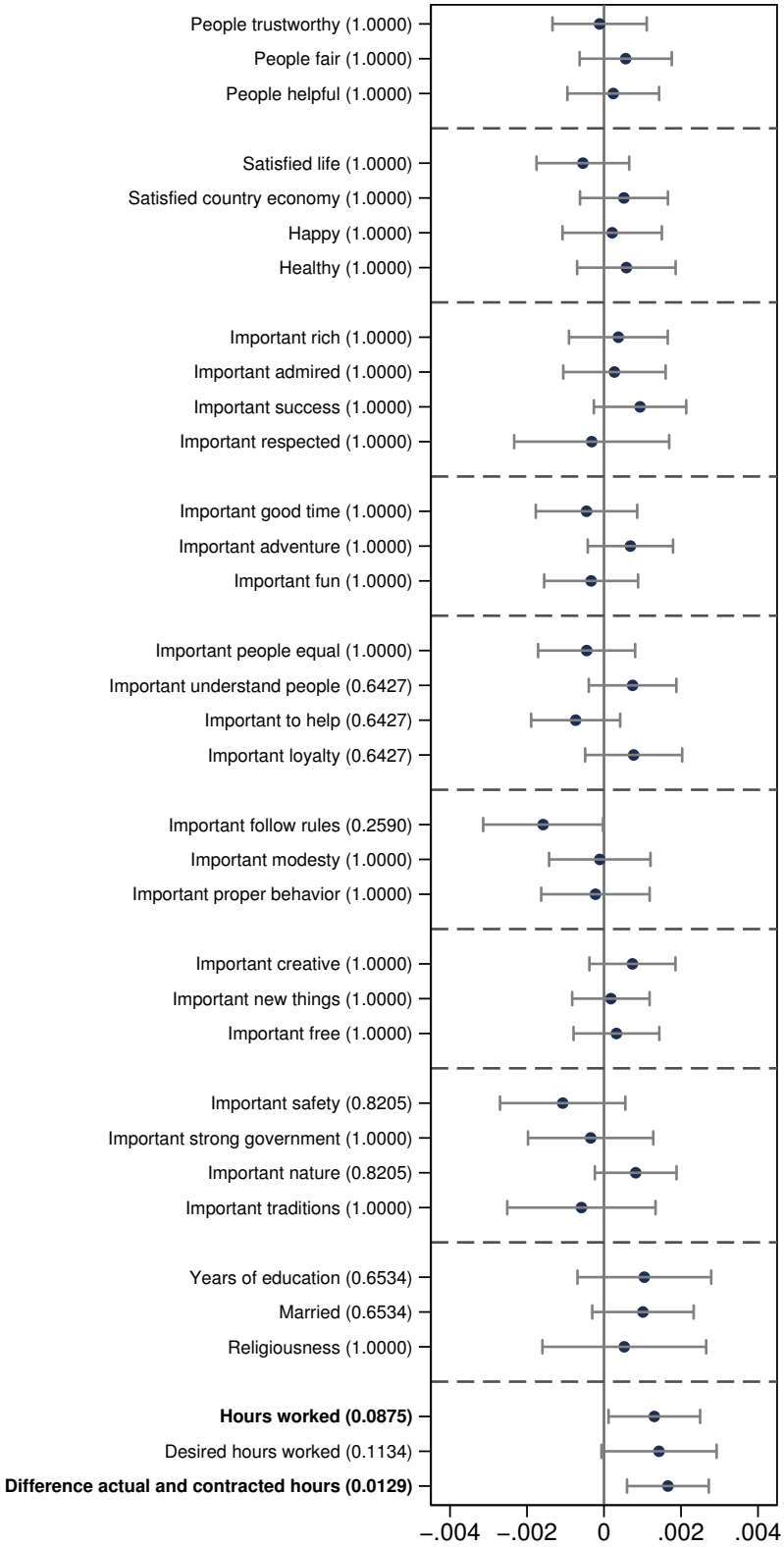
Notes: Estimates of average hours of work per week of full-time production workers are from Huberman and Minns (2007). They are largely based on historical reports of the U.S. Department of Labor and are averaged across genders and five economic sectors: Mining and Construction, Iron and Steel, Textile, Manufacturing and Services.

Figure 3: Correlation of potential labor intensity and work-related outcomes at the regional level



Notes: The figure plots average (lowest available NUTS level) residuals of all variables from an individual-level regression on gender, age dummies and indicators for ESS survey wave. The sample consists of individuals aged 25 to 60, and is further restricted to those working for pay in the upper and middle plot.

Figure 4: Labor intensity and other ESS attitudes



Notes: The figure plots the estimated effect of potential labor intensity on attitudes and human values reported in the ESS survey. All regressions include the full set of controls from column (3) of Table 3. Horizontal lines indicate 95% confidence intervals calculated using standard errors clustered at the NUTS region level. P-values adjusted for false discovery rate (q-values) in parentheses. Bold text indicates coefficients with q-value<0.10.

Table 1: Estimates of crop-specific labor shares from Prussian agricultural data

	Barley	Rye	Pea	Oat	Wheat	Potato	Bean
Labor share	0.079	0.149	0.299	0.370	0.400	0.571	0.601

Labor shares are computed as $1 - e^{-\delta_i}$, where δ_i is the crop-specific fixed effect in a regression of the log value of output on county and crop indicators and the log of county land allocated to the production of crop i. Land and output data are from the 1886 Prussian agricultural census and price data are from the Prussian statistical office. For more details on the calculation of labor shares see Section 3.

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min	Max	Obs.
Weekly work hours	40.55	13.01	0	140	145594
Weekly overtime	3.066	8.574	-130	140	141430
Desired weekly work hours	35.87	13.35	0	140	48038
Potential labor intensity	72.48	14.07	0	100	148422
Potential labor intensity (US)	49.65	16.18	0	100	148422
Potential labor intensity (Old World crops)	64.47	14.40	0	100	148422
Potential labor intensity (man hours per acre)	70.70	14.01	0	100	148422
Individual controls					
Female	0.525	0.499	0	1	149445
Age	42.95	10.10	25	60	149503
Catholic	0.312	0.463	0	1	143725
Protestant	0.123	0.329	0	1	143725
Orthodox	0.0703	0.256	0	1	143725
Jewish	0.000835	0.0289	0	1	143725
Muslim	0.0282	0.166	0	1	143725
Other Christian	0.0149	0.121	0	1	143725
Other non-Christian	0.00413	0.0642	0	1	143725
Non religious	0.432	0.495	0	1	147432
Geographic controls					
Temperature	8.696	3.429	-1.740	18.45	149503
Precipitation	803.8	263.1	275.8	1739.6	149503
Terrain slope index	7470.3	1912.1	1236.9	9953.9	149503
Elevation	308.9	321.5	0	2073.6	149503
Latitude	50.27	6.622	28.34	68.85	149503
Longitude	11.19	10.64	-21.67	41.81	149503
Land suitability	4.326	1.438	1.260	8.010	149503
Economic controls					
Log GDP per capita 2007	9.991	0.718	7.650	11.26	149503
Unemployment rate 2007	6.425	3.172	1.900	18.20	149503

Table 3: Baseline estimates

Dep. variable	Weekly work hours				Weekly overtime				Desired weekly work hours			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Potential labor intensity	0.0286***	0.0206**	0.0172**	0.0179**	0.0175***	0.0157***	0.0141***	0.0147***	0.0142*	0.0226**	0.0204*	0.0232**
	(0.00651)	(0.00842)	(0.00800)	(0.00827)	(0.00408)	(0.00456)	(0.00459)	(0.00459)	(0.00843)	(0.0110)	(0.0109)	(0.0111)
Temperature		-0.800***	-0.978***	-0.982***		-0.0801	-0.164	-0.147		0.368	0.222	0.267
		(0.285)	(0.311)	(0.308)		(0.142)	(0.142)	(0.142)		(0.369)	(0.377)	(0.375)
Precipitation		-0.00134	-0.000793	-0.000756		-0.000452	-0.000326	-0.000312		-0.00128	-0.000834	-0.000613
		(0.000816)	(0.000762)	(0.000765)		(0.000383)	(0.000385)	(0.000383)		(0.00119)	(0.00107)	(0.00112)
Slope		-0.000115	-0.0000538	-0.0000494		0.0000206	0.0000289	0.0000340		-0.000143	-0.0000932	-0.0000711
		(0.000148)	(0.000148)	(0.000149)		(0.0000846)	(0.0000815)	(0.0000797)		(0.000213)	(0.000213)	(0.000211)
Elevation		-0.00541***	-0.00609***	-0.00616***		-0.000444	-0.000974	-0.000867		0.000797	0.000410	0.000634
		(0.00176)	(0.00180)	(0.00178)		(0.000896)	(0.000876)	(0.000866)		(0.00192)	(0.00193)	(0.00190)
Land suitability		0.286*	0.325**	0.282**		0.0917	0.136*	0.115		0.320*	0.314*	0.305
		(0.146)	(0.140)	(0.142)		(0.0803)	(0.0803)	(0.0809)		(0.177)	(0.185)	(0.194)
Latitude		-0.336**	-0.444**	-0.443**		-0.0598	-0.110	-0.106		0.325	0.240	0.255
		(0.157)	(0.174)	(0.175)		(0.0765)	(0.0763)	(0.0763)		(0.208)	(0.217)	(0.219)
Longitude		0.0147	0.00283	0.00413		0.0123	0.0154	0.0145		0.149*	0.132*	0.148**
		(0.0566)	(0.0558)	(0.0568)		(0.0273)	(0.0261)	(0.0268)		(0.0764)	(0.0708)	(0.0738)
Regional GDP p.c.			0.883**	0.798**			0.634***	0.635***			0.234	0.347
			(0.409)	(0.400)			(0.215)	(0.209)			(0.571)	(0.601)
Regional unemployment rate			0.111*	0.106*			0.0232	0.0244			0.111*	0.0951
			(0.0578)	(0.0575)			(0.0260)	(0.0264)			(0.0662)	(0.0641)
Observations	111455	111455	111455	107116	108066	108066	108066	103862	47807	47807	47807	44535
R-squared	0.154	0.154	0.155	0.156	0.0204	0.0205	0.0208	0.0224	0.231	0.233	0.233	0.234
Religion dummies	N	N	N	Y	N	N	N	Y	N	N	N	Y

The sample consists of individuals aged 25-60. In columns (1)-(8) it is further restricted to individuals who have reported working for pay at the time of the survey. All regressions include country fixed effects, controls for gender, age dummies and indicators for ESS survey wave. Columns (4), (8) and (12) include dummies for the following groups: Catholic, Protestant, Jewish, Islamic, Orthodox Christian, other Christian, other non-Christian, non-religious. Standard errors are clustered at the NUTS region level. Significance levels: *** p< 0.01, ** p< 0.05, * p< 0.1.

Table 4: Labor intensity and importance of work, EVS data

Dep. variable	How important is work in your life				
	(1)	(2)	(3)	(4)	(5)
Potential labor intensity	0.00154***	0.00154**	0.00142**	0.00134**	0.00122**
	(0.000587)	(0.000597)	(0.000632)	(0.000600)	(0.000593)
Land suitability		0.000204	-0.000704	-0.00196	-0.00197
		(0.00453)	(0.00613)	(0.00529)	(0.00529)
Temperature			-0.0194	-0.0155	-0.0152
			(0.0119)	(0.0114)	(0.0116)
Precipitation			-0.0000382	-0.0000143	-0.0000191
			(0.0000339)	(0.0000306)	(0.0000304)
Slope			-0.00000109	0.00000518	0.00000507
			(0.00000592)	(0.00000537)	(0.00000537)
Elevation			-0.0000760	-0.0000237	-0.0000263
			(0.0000601)	(0.0000591)	(0.0000595)
Latitude			-0.00548	-0.00109	-0.000299
			(0.00799)	(0.00739)	(0.00754)
Longitude			0.00210	-0.00134	-0.00147
			(0.00262)	(0.00245)	(0.00251)
Regional GDP p.c.				-0.0552***	-0.0518***
				(0.0165)	(0.0165)
Regional unemployment rate				0.00928***	0.00981***
				(0.00218)	(0.00222)
Observations	58165	58165	58165	58165	58165
R-squared	0.0425	0.0425	0.0429	0.0447	0.0468
Religion dummies	N	N	N	N	Y

The sample consists of individuals aged 25-60. All regressions include country fixed effects, indicators for gender and age and EVS survey wave dummies. Column (5) includes dummies for the following groups: Catholic, Protestant, Jewish, Islamic, Orthodox Christian, Hindu, Other, non-religious. Standard errors are clustered at the NUTS region level. Significance levels: *** p< 0.01, ** p< 0.05, * p< 0.1.

Table 5: Using alternative measures of labor intensity

Dep. variable	Weekly work hours			Weekly overtime			Desired weekly work hours		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Potential labor intensity (US)	0.0334***			0.0158***			0.0240**		
	(0.0105)			(0.00506)			(0.0116)		
Potential labor intensity (man hours per acre)		0.0219**			0.0153***			0.0228**	
		(0.00856)			(0.00492)			(0.0110)	
Potential labor intensity (Old World crops)			0.0194**			0.0147***			0.0287**
			(0.00925)			(0.00516)			(0.0135)
Observations	111455	111455	111455	108066	108066	108066	47807	47807	47807
R-squared	0.155	0.155	0.155	0.0208	0.0208	0.0207	0.233	0.233	0.233

The sample consists of individuals aged 25-60. In columns (1)-(6) it is further restricted to those who have reported working for pay at the time of the survey. All regressions include country fixed effects and the full set of individual, survey wave, geographic and economic controls from column (3) of Table 3. *Potential labor intensity (US)* is computed using crop-specific labor shares estimated from the US Census of Agriculture, 1880-1900. *Potential labor intensity (man hours per acre)* is computed using data on crop-specific man hours per acre from the U.S. Department of Agriculture (1922). *Potential labor intensity (Old World crops)* excludes from the calculation of potential labor intensity the potato and the bean. Standard errors are clustered at the NUTS region level. Significance levels: *** p< 0.01, ** p< 0.05, * p< 0.1.

Table 6: Assessing the cultural transmission channel

Dep. variable	ESS						CPS		
	Weekly work hours		Weekly Overtime		Desired weekly work hours		Weekly work hours		
	Entire sample	Native of native parents	Entire sample	Native of native parents	Entire sample	Native of native parents	Father's country	Mother's country	Parents same country
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Potential labor intensity	0.0172**	0.0188**	0.0141***	0.0153***	0.0204*	0.0244**	0.0477*	0.0605**	0.0905**
	(0.00800)	(0.00837)	(0.00459)	(0.00484)	(0.0109)	(0.0108)	(0.0236)	(0.0293)	(0.0335)
Observations	111455	92645	108066	89860	47807	39635	2805	2939	1079
R-squared	0.155	0.161	0.0208	0.0231	0.233	0.241	0.136	0.122	0.200

The sample consists of individuals aged 25-60 in columns (1)-(6) and 25-65 in columns (7)-(9). In columns (1)-(4) and (7)-(9) it is restricted to those who have reported working for pay at the time of the survey. In columns (7)-(9) it is further restricted to second-generation European immigrants. Regressions in columns (1)-(6) include country fixed effects and the full set of individual, survey wave, geographic and economic controls from column (3) of Table 3. Regressions in columns (7)-(9) include the following controls: gender, age and state of residence indicators, land suitability, temperature, precipitation, slope, elevation, absolute latitude, longitude, GDP p.c. and unemployment rate in 2007 in the parent's country of origin. Standard errors are clustered at the NUTS region level in columns (1)-(6) and at the parent's country of origin level in columns (7)-(9). Significance levels: *** $p< 0.01$, ** $p< 0.05$, * $p< 0.1$.

A Appendix: Model Extensions

A.1 Work ethics and fertility choice

To investigate how population growth affects the results of our baseline model, we introduce an endogenous fertility choice following the literature on Malthusian growth (see for example Barro and Becker (1989)). The number of children is denoted by n, and they can be raised at a cost $\theta(n)$, $\theta_n > 0, \theta_{nn} \leq 0$, paid in consumption goods. The family holding of land is denoted with t and is distributed equally among children. Finally, N, $H = hN$ and $T = tN$ denote total population, aggregate labor and land supply, respectively.

A representative parent solves the program

$$
\begin{aligned}
V(\gamma, t; N = \max_{c,h,n,I} & \left\{ \log(c) - \frac{1}{\gamma}\frac{h^{1+\phi}}{1+\phi} - nI + a(n)V(\gamma', t'; N') \right\} \\
& s.t. \\
& c = wh + r_T t - \theta(n) \\
& \gamma' = \rho\gamma + \Psi(I) \\
& t' = \frac{t}{n}
\end{aligned}
$$

The first order and envelope conditions of this problem are

$$
\begin{aligned}
\frac{w}{c} &= \frac{1}{\gamma}h^{\phi} \\
n &= a(n)V'_{\gamma}\Psi_I \\
\frac{\theta_n}{c} + I &= a_n V' - a(n)V'_t\frac{t}{n^2} \\
V_{\gamma} &= \frac{1}{\gamma^2}\frac{h^{1+\phi}}{1+\phi} + a(n)V'_{\gamma}\rho \\
V_t &= \frac{r_T}{c} + a(n)V'_t\frac{1}{n}
\end{aligned}
$$

which together with the aggregate conditions

$$
\begin{aligned}
H &= hN \\
T &= tN \\
Y &= AT^{1-\beta}H^{\beta} \\
w &= \beta\frac{Y}{H} \\
r_T &= (1-\beta)\frac{Y}{T} \\
c &= \frac{Y}{N} - \theta(n) \\
N' &= nN
\end{aligned}
$$

define the equilibrium outcome. Notice that similar to the baseline model, the first order condition for labor, together with the wage equation and the resource constraint, implies that all else equal, a high labor intensity β will induce a higher equilibrium labor supply.

In the steady state with zero population growth, we have $n = 1$ and the dynamic equations hence become

$$\gamma = \frac{\Psi(I)}{1-\rho} \tag{10}$$

$$V_\gamma = \left(\frac{1}{1-a(1)\rho}\right)\frac{1}{\gamma^2}\frac{h^{1+\phi}}{1+\phi} \tag{11}$$

$$V_t = \frac{1}{1-a(1)}\frac{r_T}{c} \tag{12}$$

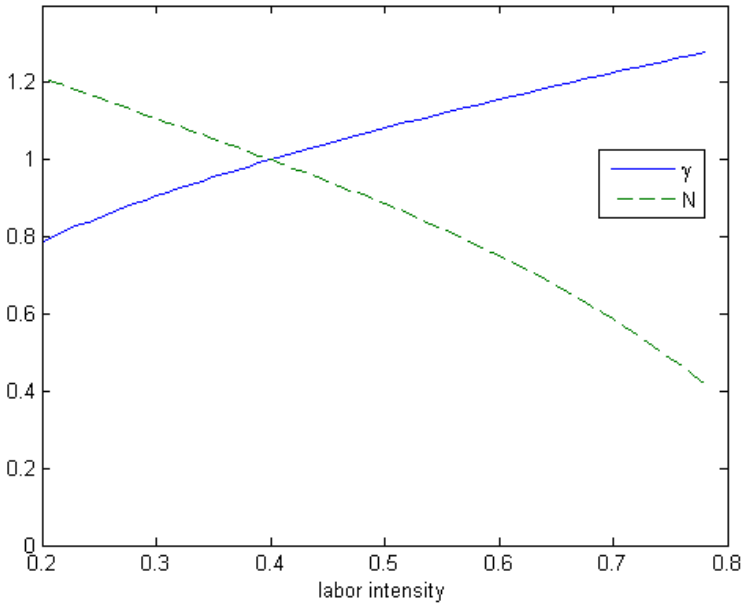
$$\frac{\theta_n(1)}{c} + I = a_n(1)V - a(1)V_t t \tag{13}$$

$$1 = a(1)V_\gamma \Psi_I \tag{14}$$

$$\frac{w}{c} = \frac{1}{\gamma}h^{\phi} \tag{15}$$

While this model does not have a general analytical solution, we can analyze for illustration purposes the special case in which $\theta(1) = 0$, i.e. the theoretical case in which the first child contributes as much to income as it costs. Under this assumption, labor supply collapses to $h = (\beta\gamma)^{\frac{1}{1+\phi}}$. Together with (10), (11) and (14), this implies that work ethics behave exactly the same as in the basic model and are hence increasing in the labor intensity of production.

Figure A.1: Work ethics and population size



Notes: Steady state values as a function of β. Both series are normalized to equal one at $\beta = 0.4$.

Solving numerically for the steady state, we investigate a large region of parameter values and functional form, and robustly find that the work ethics are a strictly increasing function of labor intensity. Figure A.1 illustrates how work ethics and population size depend on β, where the shown specification assumes a linear cost function of children $\theta(n) = 0.4n$. Interestingly, and the flip side of the result for work ethics, population is decreasing in labor intensity. As a work ethic becomes more valuable with high β, parents invest more in their offspring but reduce the quantity of children they have.

A.2 Work ethics in subsistence agriculture

In the theoretical results up to now, labor productivity had no effect on hours worked and the development of work ethics, since the income and substitution effect of a productivity increase cancel out. Instead, labor intensity was the sole determinant of attitudes towards work.[13] In this section, we briefly review the case of a subsistence agriculture by introducing

[13] An interesting example of this, within the context of a single crop, has been documented by Barker, Herdt and Rose (1985). Due to differences in the geographic and technological structure across rice farms in selected villages of Indonesia, Taiwan and the Philippines around 1970, the average labor productivity was lowest in

a minimum consumption constraint into the basic model, and discuss how this affects the role of productivity and labor intensity.

Consider again the basic model, extended with a minimum consumption requirement $c \geq \underline{c}$. We define a subsistence economy as an economy in which the hours optimally worked in the steady state of the unconstrained model are not sufficient to satisfy the minimum consumption requirement, i.e. $AT^{1-\beta}h_{ss}^{\beta} < \underline{c}$, $h_{ss} = (\beta\gamma_{ss})^{\frac{1}{1+\phi}}$. In this case, the equilibrium labor supply is given by

$$h = \frac{1}{T}\left(\frac{\underline{c}}{AT}\right)^{\frac{1}{\beta}} \tag{16}$$

Hours worked now depend negatively on the aggregate productivity A. If productivity is low in a subsistence economy, individuals will need to work more. By the same logic as discussed in the previous section, this increases the return to having a high work ethic and hence to parental investment. It follows that low productivity leads to a high steady state work ethic.

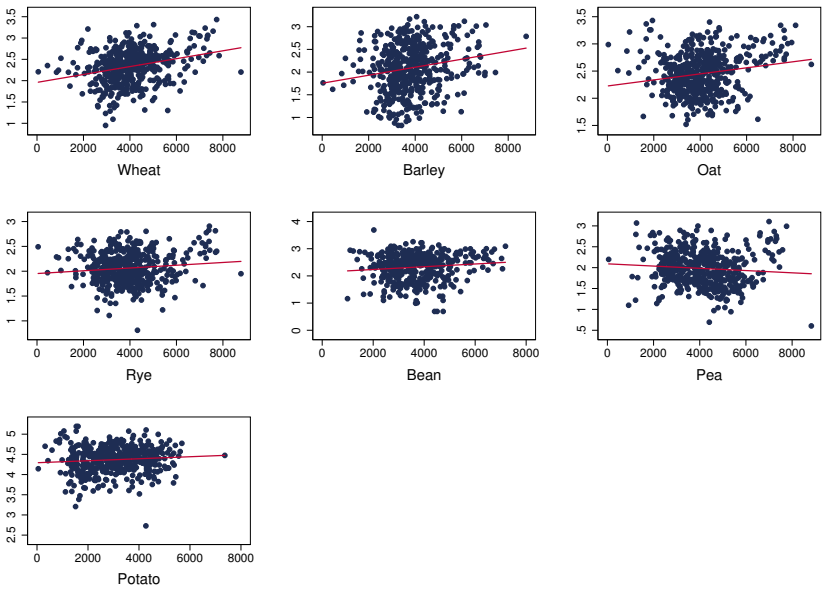
The effect of labor intensity is now ambiguous. Notice that β only has a positive effect on hours worked if the term in brackets of (16) is less then one, i.e. $AT > \underline{c}$. This result is similar to the one in Vollrath (2011), and indicates that in subsistence agriculture, labor intensity only has a positive effect on hours and hence on work ethics once productivity is already sufficiently developed. Finally notice that the minimum consumption requirement can lead to a multiplicity of steady states when β is sufficiently high, with one steady-state in the constrained region with low work ethics and one in the unconstrained region with high work ethics. This results from the fact that work ethics endogenously determine whether the consumption constraint is binding or not. We leave a deeper investigation of this topic, as well as potential interactions with an endogenous fertility choice, for further research.

Indonesia, followed by the Philippines and Taiwan. The authors estimate however that, for a given amount of labor input, the marginal product is higher in Indonesia and Taiwan than it is in the Philippines. They then use village level data to show that rice farmers work significantly less hours in the Philippines than in the other two regions. Returns to labor seemed to dominate labor productivity as a determinant of effort, as in the baseline version of our model.

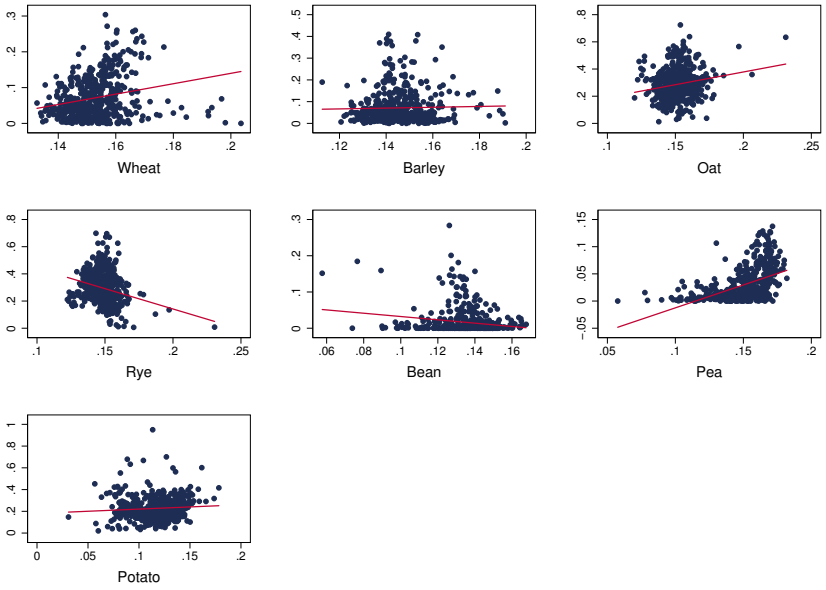
B Additional Figures and Tables

Figure B.1: Suitability, planted area and yields in Prussian counties

(a) Suitability and average yield per acre



(b) Suitability and share of total acres planted



Notes: The figure plots the correlation between average crop-specific suitability (y-axis) and average crop-specific yield per acre (upper panel) or share of total county acres planted with the crop (lower panel) in Prussian counties. Data is from the 1886 Prussian agricultural census.

Table B.1: Bivariate correlation matrix of geoclimatic variables in ESS sample

	Potential labor intensity	Temperature	Precipitation	Slope	Elevation	Land suitability	Latitude	Longitude
Potential labor intensity	1							
Temperature	0.0912	1						
	(0.077)							
Precipitation	-0.0625	-0.0918	1					
	(0.226)	(0.074)						
Slope	0.202	-0.00295	-0.458	1				
	(0.000)	(0.954)	(0.000)					
Elevation	-0.167	-0.0650	0.337	-0.804	1			
	(0.001)	(0.206)	(0.000)	(0.000)				
Land suitability	-0.417	-0.291	0.206	-0.626	0.504	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
Latitude	-0.0307	-0.859	-0.0374	0.374	-0.410	0.0896	1	
	(0.552)	(0.000)	(0.467)	(0.000)	(0.000)	(0.081)		
Longitude	-0.0360	-0.208	-0.425	-0.0199	0.0823	-0.0778	0.0387	1
	(0.486)	(0.000)	(0.000)	(0.698)	(0.109)	(0.130)	(0.452)	

P-values in parentheses.

Table B.2: Summary statistics: EVS and CPS samples

	EVS sample					CPS Sample of second generation immigrants				
Variable	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max	Obs.
Work important	3.544	0.642	1	4	59539					
Weekly work hours						40.95	11.61	0	110	4598
Potential labor intensity	74.11	9.255	0	100	58179	40.28	16.12	0	100	4465
Individual controls										
Female	0.539	0.498	0	1	59525	0.467	0.499	0	1	4598
Age	42.04	10.22	25	60	59539	44.27	10.22	25	65	4598
Geographic controls										
Temperature	9.532	3.709	-1.740	18.49	59539	9.265	3.460	-6.160	18.94	4465
Precipitation	784.0	252.4	0	2005.0	59539	820.9	168.5	354.1	1281.5	4465
Slope	7260.5	1942.8	0	9953.9	59539	7289.4	1453.3	3662.5	9762.7	4465
Elevation	317.1	297.9	0	2307.3	59539	315.3	223.1	0	1292.3	4465
Latitude	48.61	6.999	28.29	69.95	59539	49.06	5.735	31.03	64.50	4465
Longitude	11.69	11.11	-21.67	43.65	59539	10.28	15.51	-8.152	96.69	4465
Land suitability	4.238	1.528	0	8.170	59539	4.389	1.038	1.900	7.530	4465
Economic controls										
Log GDP per capita 2007	9.856	0.722	7.650	11.02	48661	10.10	0.557	7.719	11.02	4456
Unemployment rate 2007	7.175	3.744	1.900	23.50	48661	6.779	1.840	2.500	11.10	4290