PRELIMINARY

CULTURE, INSTITUTIONS AND THE WEALTH OF NATIONS

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Abstract: We construct an endogenous growth model including a cultural variable along the dimension of individualism-collectivism. The model predicts that more individualism should lead to more innovation because of the social rewards associated to innovation in an individualist culture. This cultural effect may offset negative effects of bad institutions on growth. Collectivism on the other hand should lead to higher efficiency gains but these are static and not dynamic, unlike the effect of individualism on innovation. We provide strong evidence of a causal effect of individualism on income per worker and total factor productivity as well as on innovation. We use measures of distance of blood type frequency as an instrument proxying for the parental transmission of culture to their offspring. The effect of culture on long-run growth remains very robust even after controlling for the effect of institutions. We give evidence of a two-way causal effect between culture and institutions.

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1. Introduction

One of the central questions in economics of growth and development is why disparities in income and development across countries are large and persistent. Despite decades of the quest to identify the fundamental forces explaining these differences, the question continues to puzzle the profession as the bulk of the differences is attributed to variation in productivity which, in words of Zvi Griliches, is a measure of our ignorance. However, it is widely perceived that the key conduit of economic growth and productivity enhancements is innovation bringing new goods and services as well as new ways to produce existing goods and services. In this paper, we argue theoretically and empirically that culture plays a key role in stimulating innovations and hence explaining long-run economic growth.

The contention of culture being a central ingredient of economic development goes back to at least Max Weber who, in his classical work "The Protestant Ethic and the Spirit of Capitalism," argued that the protestant ethic of Calvinism was a very powerful force behind the development of capitalism in its early phases. Weber's work was in direct opposition to Karl Marx who viewed culture as being determined by the economic interests of the various social classes. Weber on the contrary saw culture as the driving force behind differences in economic development. Although Landes (1998) and others argued that culture played a fundamental role in explaining the wealth of nations, there has so far not been very little theoretical or empirical work examining the effect of culture on long-run growth and development.

We define culture as *the set of values and beliefs people have about how the world (both nature and society) works as well as the norms of behavior derived from that set of values*. Defined in this way, culture affects not only social norms but also economic behavior such as the propensity to save or to innovate and many other economic choices such as fertility choices, investment in education, charitable contributions or the willingness to contribute to public goods. Culture is directly related to institutions in the sense that culture, like formal political or legal institutions imposes constraints on individual behavior which is how North (1990) defines institutions. Roland (2004) has argued that culture tends to be more slow-moving than political or legal institutions. Therefore, one can argue that culture might have an important effect on the choice of political and legal institutions itself. One can thus hypothesize that culture is the basic force underlying formal institutions and thus long-run growth.

In particular, we investigate theoretically and empirically one aspect of culture that may be relevant for long-run growth: the difference between *individualism* and *collectivism.* This distinction captures only one aspect of differences between cultures across the world. Nevertheless, it is a distinction that can be argued to potentially have important economic effects. It is also the main distinction that Greif (1994, 2006) has been using in his path-breaking work on the economic effects of culture.

What are the main elements of the distinction between individualism and collectivism that we are emphasizing in our theory? Individualism emphasizes individual freedom and achievement. Individualist culture therefore awards social status to individual achievement such as important discoveries, innovation or great artistic achievements. On the other hand, individualism can make collective action more difficult because individuals pursue their own interest without internalizing collective interests. Collectivism on the other hand makes collective action easier in the sense that individuals internalize group interests better. However, it also encourages conformity and discourages individuals from standing out. This framework implies that individualism should encourage innovation, everything else equal, but collectivism should have an advantage in coordinating production processes and in various forms of collective action.[1]

We put these ingredients in an endogenous growth model. The model is standard in many respects. There is a competitive sector producing final goods using labor and intermediate inputs. However, collectivist culture gives a competitive edge in the production of final goods and so does the quality of intermediate inputs which is the result of innovation. Households own the firms producing intermediate inputs and derive utility not only from consumption but also from social prestige associated with producing a higher than average quality of intermediate products. This social prestige is stronger in individualistic cultures than in collectivist cultures. present in an individualist culture but not in a collectivist culture. The quality of intermediate inputs is determined by effort put into research which in turn is a function of the monetary and social status rewards to innovation. Government can act in a predatory way by expropriating profits which are rents from innovation. The main result generated by the model is that individualism leads to higher long-term growth via stronger incentives to innovate due to the culturally induced

[1] There might also be an advantage of collectivism in terms of public good provision. We do not explore this aspect in this paper.

social rewards. This positive effect of social status rewards may offset the negative effects of predatory institutions. Furthermore, although collectivism generates static efficiency gains, it has no growth effects.

We bring the model to the data by testing the effect of individualism versus collectivism on long-run growth. Since one can argue that culture might be endogenous to economic outcomes, finding a convincing causal effect of culture on long-run growth requires having a valid instrumental variable. Our main instrumental variable is a measure of genetic distance between population in a given country to population in the USA. We know from Bisin and Verdier (2000, 2001) and others that parental transmission of culture is a fundamental determinant of the cultural values of individuals. Obviously, parents transmit their cultural values as well as their genes to their offspring. Populations that interbreed a lot should be genetically close and also culturally close because a very similar parental transmission mechanism is at work in both cases. Therefore, measures of genetic distance can be seen as a proxy tracking differences in parental transmission of cultural values. To be clear, we *do not* claim that genes have any effect on culture.

Since there are no identified genetic causes for why some countries became wealthier than others, genetic distance is very likely to satisfy the exclusion restriction. We strengthen the quality of our instrumental variable by using only "neutral" genetic markers (such as from mitochondrial DNA) which have no direct effect on genetic fitness. Thus, these markers are excellent instrumental variables (IVs) to correct for potential endogeneity of culture. In our baseline specifications, we use genetic distance based on frequencies of blood types which is the genetic information available for the largest number of countries.

Genetic distance data have been used by Guiso et al. (2009) and by Spolaore and Wacziarg (2009) in a context that is close but different in various aspects from our paper. Guiso et al. (2009) interpret genetic distance as proxying both cultural and genetic dissimilarity which is a source of a potential bias distorting people's propensity to trust each other and engage in trade. Spolaore and Wacziarg (2009) view genetic distance as a barrier to the diffusion of technologies as peoples that are more distant from each other will communicate less and thus benefit less from technological innovation. We use genetic data in a more indirect way as instrument for cultural attributes that potentially affect long-run growth of countries.

Using genetic differences as an instrument for culture, we find a strong causal effect of individualism on income per worker, total factor productivity, and innovation thus supporting our theory. Even after controlling for measures of institutions which were found before (e.g., Hall and Jones, 1999, Acemoglu et al., 2001) to determine long-run growth, culture continues to plays a statistically significant and quantitatively important role so that culture has an effect on economic development that is independent of institutions. Furthermore, we find that there is a two-way causality between culture and institutions thus suggesting that institutions are in part determined by culture. Our results are robust to the introduction of different types of controls and different measures of long-run growth as well as to using alternative instrumental variables (also used in Licht et al. (2007) and Tabellini (2008a)) based on linguistic peculiarities of individualist cultures. In summary, culture is empirically relevant for understanding economic development and should be included in theories of economic growth.

Our findings contribute to nascent literature emphasizing the effects of culture on economic outcomes. Using a game theoretical approach, Greif (1994, 2006) studied the effects of individualist versus collectivist beliefs on contract formation, social stratification and the expansion of markets in the late Medieval trade in the Mediterranean. Bisin and Verdier (2000, 2001) examined the dynamics of intergenerational transmission of cultural preferences taking into account family choices of cultural transmission and effects of social environment. Tabellini (2008b) studied how cultural transmission of values of cooperation can affect the form of institutions which in turn reinforces norms of cooperative behavior. Doepke and Zilibotti (2008) developed a model to explain the cultural transmission of the values of the pre-industrial middle class (thriftiness, hard work) in the industrialization process as well as their eventual social success and the demise of the landed aristocracy. Fernandez, Fogli and Olivetti (2004), Fernandez and Fogli (2009) and Giuliano (2007) examined the effects of culture on fertility choices, family living arrangements and labor supply decisions. Knack and Keefer (1997) considered the effect of social capital on economic performance.[2] Guiso et al. (2003, 2009) examined the effect of trust on economic attitudes and international trade patterns and Giuliano et al. (2006) investigated the link between geography, genetic distance, transportation costs and economic variables. Tabellini (2008) and Licht et al. (2007) provide evidence of a causal link

[2] Knack and Keefer (1997) use two instrumental variables for trust: *i*) the percentage of a country's population belonging to the largest "ethnolinguistic" group; *ii*) the number of law students in 1963 as a percentage of all postsecondary students.

from culture to institutions and Jellema (2009) provides evidence of a causal link from cultural practices to a society's basic achievements (e.g., writing, wheel, money) documented for different cultures in Murdock's (1967) *Ethnographic Atlas*.

The rest of the paper is organized as follows. In section 2, we present our model. In section 3, we present our empirical analysis of how culture can affect economic development. Section 4 examines the interplay between institutions and culture. Section 5 makes concluding remarks.

2. The Model

Consider an economy producing two goods: a final good Y_t and a continuum of intermediate goods $x_{it}, i \in [0,1]$. The final good is produced by a competitive sector. Firms in this sector maximize profit

$$\Pi_t = Y_t - \int_0^1 p_{it} x_{it} - w_t L_t \tag{1}$$

subject to the production function constraint:

$$Y_t = \eta L_t^{1-\alpha} \int_0^1 (F_{it} x_{it})^{\alpha} di \tag{2}$$

where i and t index variety and time, p_{it} is the price of x_{it}, w_t is the wage rate, F_{it} is the quality of intermediate good x_{it} , $L_t \equiv \int_0^1 L_{it} di$ is aggregate labor input, and η is an efficiency parameter capturing how easy it is to combine intermediate inputs.

The parameter η is assumed to be a decreasing function of individualism in a given culture. This assumption captures three basic facts. First, combining inputs in production requires coordination of workers/units. Second, such coordination is easier to achieve in collectivist cultures that value harmony, conformity and team effort. Third, collectivist countries may be good at incremental innovations which however have diminishing returns (i.e., one can relatively easily improve a cassette player but one needs a radical innovation to move to a CD player).

For example, Aoki (1990, 2001) shows that the organization of the Japanese firm compared to the American firm leaves more room for worker initiative to intervene in case of an unexpected problem in the production process. One manifestation of the importance of culture in this respect is a common finding that blind copying of production techniques from collectivist

culture to individualistic cultures led to poor results. The attempt to copy the Japanese organization inside US automobile factories failed to lead to catch up with the efficiency of Japanese automobile firms as is exemplified by the failure of the Saturn experience at General Motors.

Other facts are consistent with our modeling of the trade-off between the innovation advantages of individualism and the production advantages of collectivism. The color TV was invented by RCA, an American firm but Japan ended up making the best TV sets. Sony invented the walkman which was a great consumer success starting in the 80s. However, the invention behind it, that of the compact cassette was made by Philips, a European firm. Similarly, Sony introduced the VCR but the technology had been invented by Ampex, an American company, which was unable to make its VCR affordable to households.

Intermediate goods are produced by entrepreneurial households who solve the following optimization problem

$$\max \sum_{t=0}^{\infty} \beta^t (\ln C_{it} + \phi F_{it} / F_t) \tag{3}$$

subject to

$$F_{it} = \lambda(1 - L_{it}) F_{i,t-1} \tag{4}$$

$$C_{it} + A_{it} = (1 + r_t) A_{i,t-1} + \Pi_t + (1 - \tau)\pi_{it} + w_t L_{it} \tag{5}$$

$$\pi_{it} = p_{it} x_{it} - x_{it} \tag{6}$$

where $F_t \equiv \int_0^1 F_{it} di$ is the average level of quality of intermediate goods in the economy, A_{it} is the amount of wealth, L_{it} is the fraction of labor supply devoted to producing the final goods, $1 - L_{it}$ is the fraction of labor supply devoted to research, π_{it} is the profit from market power in producing an intermediate good. Labor supply and the marginal cost of producing the intermediate variety are normalized to one for all households.

Equation (5) is the standard budget constraint. Equation (6) is the profit from producing an intermediate variety. Equation (3) is the value function showing that the instantaneous utility is derived from consumption goods and from having a superior than average quality of the produced intermediate good. The choice of the log utility function for consumption is standard in

growth models. It makes the analysis easier as income and substitution effects offset each other and hence it is easy to construct a balanced growth path consistent with the Kaldor facts.

The term $\phi F_{it} / F_t$ in the utility function is meant to capture the social status reward from innovation. We assume that ϕ is increasing in the level of individualism. Hence, the social status reward for developing a better technology is higher in individualist cultures than in collectivist cultures. This assumption is consistent with numerous studies documenting that individualistic societies permit more innovation than collectivist societies by providing a higher status for individuals making important discoveries. In contrast collectivist societies emphasize the role of collective effort and give less status reward to innovation. They reward conformity more and discourage individuals from standing out. There is also ample evidence (see Merton 1973) that social reward with heightened status is the most significant part of total reward for scientists. Since innovating entrepreneurs are small relative to the economy, we assume that an entrepreneur *i* takes F_t as given when deciding how much labor to allocate to research.

Equation (4) is the law of motion for the quality of the intermediate good. It is a positive function of labor supply devoted to research. We assume a deterministic law of motion for simplicity only. We also assume that $\lambda(\cdot)$ is an increasing function of labor supply devoted to research. To simplify the algebra , we assume that elasticity $\varepsilon = (1-L_{it})\lambda'(1-L_{it}) / \lambda(1-L_{it})$ is constant in $1-L_{it}$.

The government taxes profits of intermediate producers at rate τ and spends the receipts on (wasteful) consumption *G* which does not provide any utility to households.

$$G_t = \tau \int_0^1 \pi_{it} di \tag{7}$$

Note that profit π_{it} is the only source of rents in this economy. The tax τ can also be interpreted as the level of expropriation risk, predatory behavior, lack of rule of law and institutional weakness more generally. We will henceforth interpret high levels of τ as predatory institutions expropriating rents generated by innovations.

The following equations present market-clearing conditions: equilibrium between aggregate demand and aggregate supply (8), equilibrium on the consumer goods market (9) and labor market equilibrium (10):

$$C_t + G_t = Y_t \tag{8}$$

$$C_t = \int_0^1 C_{it} di \tag{9}$$

$$L_t = \int_0^1 L_{it} di \tag{10}$$

Profit maximization in the final good sector implies that

$$\partial \Pi_t / \partial L_t = (1-\alpha)\eta L_t^{-\alpha} \int_0^1 (F_{it} x_{it})^{\alpha} di - w_t = (1-\alpha) Y_t / L_t - w_t = 0 \tag{11}$$

$$\partial \Pi_t / \partial x_{it} = \alpha \eta L_t^{1-\alpha} F_{it}^{\alpha} x_{it}^{\alpha-1} - p_{it} = 0 \tag{12}$$

Given the demand for the intermediate goods (12), the entrepreneurial households' optimality conditions are

$$1 / C_{it} = q_{it} \tag{13}$$

$$q_{it} = \beta(1 + r_{t+1}) q_{i,t+1} \tag{14}$$

$$\mu_{it} \lambda'(1 - L_{it}) F_{i,t-1} = q_{it} w_t \tag{15}$$

$$\mu_{it} = \phi \frac{1}{F_t} + q_{it}(1-\tau)\alpha^2 \eta L_{it}^{1-\alpha} F_{it}^{\alpha-1} x_{it}^{\alpha} + \beta \left\{ \mu_{i,t+1} \lambda(1 - L_{i,t+1}) \right\} \tag{16}$$

$$\alpha^2 \eta L_t^{1-\alpha} F_{it}^{\alpha} x_{it}^{\alpha-1} = 1 \tag{17}$$

Equation (13) is the standard relationship between consumption C_{it} and the marginal utility of wealth q_{it}. Equation (14) is the Euler equation for consumption. Equation (15) captures the instantaneous optimality condition for the allocation of labor to research and production activities. The return on labor has to be equalized between research and the final goods sector. Equation (16) is the Euler equation for the quality F_{it} where μ_{it} is the shadow value of F_{it}. The value of a marginal increase in quality (the right hand side of equation on (16)) has three terms. The first is the social status derived from developing a better technology (the first term on the left hand side). The second is the after-tax marginal revenue product from selling x_{it} units of the intermediate good of higher quality, and hence facing a larger demand from the final good sector. The third term captures the dynamic gains from better technology. By increasing the level of technology today an entrepreneur prepares the stage for future increases in the level of technology (see equation (4)). Equation (17) is the first order condition for the level of produced intermediate inputs. It states that the marginal revenue product from producing an additional unit of an intermediate input has to be equal to the marginal cost of producing this additional unit (recall that the marginal cost is normalized to one).

We can then derive the following result in the symmetric equilibrium:

Proposition 1: On a balanced growth path, the ratio of labor devoted to research $1-L$ to labor devoted to producing final goods L is given by:

$$\frac{1-L}{L}=\left\{\phi+\frac{(1-\tau)\alpha^2}{[1-\tau\alpha(1-\alpha)]}\right\}\frac{\varepsilon}{1-\beta}\frac{[1-\tau\alpha(1-\alpha)]}{(1-\alpha)} \tag{18}$$

The ratio $\frac{1-L_t}{L_t}$ is increasing in ϕ and decreasing in τ and is independent of η. In addition, $\partial^2(\frac{1-L_t}{L_t})\big/\partial\phi\partial\tau<0$.

Proof: See the appendix.

Proposition 1 indicates that the share of labor devoted to research should be increasing in the level of individualism (a higher ϕ) and decreasing in the strength of predatory institutions (which corresponds to a larger τ). Intuitively, a higher social status reward to innovation (higher ϕ) increases the allocation of labor to innovation. This culturally embedded incentive to innovate comes on top of the monetary reward to households via higher profits from innovation.

The fact that a high level of predatory institutions (higher τ) has a negative effect on innovation is less novel. Note that the latter effect is due to the fact that taxes are levied directly on the profit of intermediate goods so that τ directly affects incentives to innovate. If taxation were on final output for example, its distortionary effect on innovation would be absent and would affect only consumption.[3]

Note also that the cost of individualism captured by a low value of η only affects the level of output but not the rate of innovation. Indeed, parameter η is not present in equation (18). The intuition is that a higher level of η will lead to the same proportional increase in the equilibrium level of intermediate output and equilibrium the level of final output. Since returns to labor are equalized in the research and final good sector, changes in η do not affect the equilibrium level of allocation of labor between research and the final good sector.

The proposition also states that the negative effect of taxes on research effort becomes smaller when the status derived from research effort increases. In other words, high status rewards can counteract high tax rates because while income and wealth can be expropriated, social status cannot.[4] Thus even if a country has bad institutions, there can still be incentives to

[3] Note that profits in the final goods sector are equal to zero in equilibrium and cannot be a source of taxation. If labor income were taxed instead, there would be a *positive* effect of τ on innovation.

[4] One can argue that predatory institutions and individualist culture should not coexist easily and that under an individualist culture, there will eventually be strong pressures to reform political institutions so as to limit the

innovate if there is a high enough status reward to innovation. Clark (2007) argues against the view that institutions are important for long-run growth by pointing to the fact that institutions in England around the time of the Industrial Revolution were not better than in many developing countries today whose institutional weaknesses are precisely cited as the main cause for underdevelopment. Our model shows that the negative effect of predatory institutions on long-run growth can be offset by the social status reward to innovation under an individualist culture. Note also that $\lim_{\tau \to 1} \frac{1-L}{L} = \phi \frac{\varepsilon}{1-\beta} \frac{[1-\tau\alpha(1-\alpha)]}{(1-\alpha)}$ and thus, if $\phi = 0$, no labor is devoted to research when institutions are fully predatory. In other words, if culture were absent in this model, predatory institutions would result in lack of innovation. With zero research effort, the growth rate in the economy is also equal to zero.

We now turn to the properties of the economy on the balanced growth path. First, from equation (4) on a balanced growth path we get that $\gamma_F = F_t / F_{t-1} = \lambda(1-L)$ and consequently $\text{sgn}(\partial\gamma_F / \partial\phi) = \text{sgn}(\partial(\frac{1-L}{L}) / \partial\phi)$ and $\text{sgn}(\partial\gamma_F / \partial\tau) = \text{sgn}(\partial(\frac{1-L}{L}) / \partial\tau)$. The results of Proposition 1 thus carry over to the growth rate of technology. It will be higher the higher the social status reward and the lower the level of taxation are.

Along a balanced path in a symmetrical equilibrium, $Y_t = \eta L^{1-\alpha} F_t^{\alpha} x_t^{\alpha}$. Using equation (17), we get $x_t = \alpha^2 Y_t$ so that $Y_t = (\eta\alpha^{2\alpha})^{1/(1-\alpha)} L F_t^{\alpha/(1-\alpha)}$ and therefore $\gamma_Y = Y_t / Y_{t-1} = \gamma_F^{\frac{\alpha}{1-\alpha}}$. We conclude that the growth rate of output in the economy is determined by the growth rate of technology which is pinned down by rewards to innovation. From equation (11), we have $\gamma_W = w_t / w_{t-1} = Y_t / Y_{t-1} = \gamma_Y$. Given that $x_t = \alpha^2 Y_t$ and equations (6), (7), and (8), we have $C_t = Y_t - G_t = [1-\tau\alpha(1-\alpha)]Y_t$. Therefore, $\gamma_C = C_t / C_{t-1} = Y_t / Y_{t-1} = \gamma_Y$ and thus, $\gamma_C = \gamma_W = \gamma_Y$. In other words, income, consumption and wages grow at the same rate. From (14) and (13), we have $r_t = (C_{t+1} / C_t) / \beta - 1 = \gamma_Y / \beta - 1$ and thus the interest rate is constant. Finally, note that the value of capital, which is equal to the present value of profits generated in the intermediate goods sector, is proportional to output and hence the capital-output ratio is constant on the balanced growth path. These results show that the model also fits the Kaldor facts about economic growth.

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executive powers of government. This would point towards a causal effect from culture to institutions. This observation is discussed in the empirical section. See also Roland (2004).

To summarize, the endogenous growth model derived in this section can match the basic Kaldor facts on economic growth but predicts importantly that a higher level of individualism in a country's culture should lead to higher long-run growth because of the social status reward attached to innovation, an effect that is independent of the monetary reward to innovation.

While there is a trade-off between the benefits and costs of individualism and collectivism, in our model the benefits of individualism affect the output *growth rate* while the costs of individualism affect the *level* of output. In the collectivist culture, the opposite is true. Although there is a strong argument for the advantages of individualist culture for long-run growth via cultural incentives to innovate, one could think of other models where collectivism might affect not only the static output level but also long-run growth. For example, in a collectivist culture, there might be better public good provision which might be complementary to private innovation, a feature that is not present in this model. We need solid empirical evidence to find out which cultural features might have more favorable effects on long-run growth and we test below empirically for the effect of individualism and collectivism on long-run growth. In any case, our model has the advantage of i) spelling out precise mechanisms via which culture may affect long-run growth, and ii) making the distinction between cultural effects that might affect either the level of output or the rate of long-run growth.[6]

3. Data

A key question for our empirical analysis is how to measure individualism. A well-known measure of individualism (and other cultural dimensions) at the country level was developed by Hofstede (2001) who used surveys among IBM employees in about 30 countries. Now with new waves of surveys and replication studies, Hofstede's measure of individualism has been expanded to almost 80 countries.[7] In a nutshell, the individualism score measures the extent to which it is believed that individuals are supposed to take care of themselves versus be strongly integrated and loyal to a cohesive group. Individuals in countries with a high level of the index value personal freedom and status, while individuals in countries with a low level of the index

[6] Much of previous research on culture's effects (e.g., Knack and Keefer (1997) and Guiso et al. (2009)) focused on trust, social capital and similar concepts emphasizing collective effort. In contrast, we stress the individual's freedom from the collective in his or her aspirations . Our finding that individualism leads to higher development does not contradict previous results on the importance of trust, social capital, etc. for economic development. One can view our results as emphasizing growth effects, while previous studies as highlighting the level effects.

[7] The most current version of the data is available at http://www.geert-hofstede.com/.

value harmony and conformity. Although Hofstede's data were initially collected mostly with the purpose of understanding differences in IBM's corporate culture, the main advantage of Hofstede's measure of individualism is that it has been validated in a number of studies. For example, consistently across various studies and measures of individualism (see Hofstede (2001) for a review), the United Kingdom, the USA and Netherlands are among the most individualistic countries, while Pakistan, Nigeria and Peru are among the most collectivist countries.[8][9]

We also use the data base established by cross-cultural psychologist Shalom Schwartz built with the purpose of establishing a core set of values that have a common cross-cultural meaning. Schwartz gathered survey responses from K-12 schoolteachers and college students for a total of 195 samples drawn from 78 nations and 70 cultural groups between 1998 and 2000. Each sample generally consists of 180-280 respondents for a total of over 75,000 surveys. Schwartz's value survey consists of 56-57 value items that ask respondents to indicate the importance of each as "a guiding principle in *my* life." Schwartz believes that it is crucial to identify what he calls *value types* which reflect the type of motivational goals that each individual expresses. As such, he identifies a list of 10 such value types. These value items are intended to be items that have an equivalent meaning across cultures. These value types have been used to create cultural mappings. In particular, similar to the individualistic-collectivist dimension of cultures in Hosftede (2001), Schwartz differentiates cultures along the autonomy-embeddedness dimension. In autonomous cultures, people are viewed as autonomous, bounded entities. They are encouraged to cultivate and express their own preferences, feelings, ideas, and abilities, and to find meaning in their own uniqueness by pursuing their own ideas and intellectual directions independently (intellectual autonomy) and by pursuing positive experiences for themselves (affective autonomy). In contrast, meaning in life for people in cultures of embeddedness comes largely through social relationships, through identifying with the group, participating in its shared way of life, and striving toward its shared goals. Embedded cultures emphasize maintaining the status quo and restraining actions that might disrupt in-group solidarity or the traditional order. Although measures of individualism in Hofstede and Schwartz

[8] Hosftede's indexes as well as measures of individualism from other studies use a broad array of survey questions to establish cultural values. Usually, factor analysis is used to summarize data and construct indexes. In Hosftede's analysis, the index of individualism is the first factor in work goal questions about, e.g., value of personal time, freedom, interesting work, etc.

[9] South Africa has a high score of individualism because Hosftede's survey was administered to whites. None of our results change in any important way when we exclude South Africa from our analysis.

are based on different sources and indentifying procedures, the correlation between these measures of individualism in Hofstede and Schwartz is fairly high and ranges between 0.55 and 0.65. The key advantage of using Hosftede's measure rather than Schwartz's measures is that Hosftede's measure of individualism is one-dimensional while Schwartz captures individualism with the two variables of autonomy and embeddedness.

As we will discuss later in great detail, the causality between culture (individualism in particular) and economic outcomes can flow in both directions. For example, our model suggests a causal effect of culture on growth where more individualist countries may be wealthier because individualism fosters innovation. On the other hand, a more affluent economy can support a more individualist culture. Indeed, there is a long tradition in social sciences starting with Marx claiming that economic development affects a country's culture.

To address this potential endogeneity problem, we use a measure of genetic distance between people in different countries as an instrumental variable (IV). To be clear, we do not claim that genes have any effect on culture. Rather we use genetic distance as a measure of proximity between cultures. To the extent culture is transmitted mainly from parents to children, so are genes. Genetic markers can thus be used as a proxy for cultural markers. This instrumental variable should thus be seen as a proxy measure of cultural transmission.

The genetic data originate from Cavalli-Sforza et al. (1994) which provides measures of genetic markers for roughly 2,000 groups of population across the globe. These data contain allele frequencies (alleles are variants taken by a gene) for various ethnic groups. Since we want to eliminate the feedback from economic outcomes to genetic variation, we focus on neutral genetic markers which are not related to evolutionary fitness. These markers are thus potentially excellent instrumental variables.

Although there are many genetic markers potentially useful for our analysis, our benchmark instrument is the Euclidian distance of frequency of blood types in a given country relative to the frequency of blood types in the USA. Using the frequency of blood types is attractive because, apart from being neutral genetic markers, the frequency of alleles determining blood types is the most widely available genetic information and thus we can construct the most

comprehensive (in terms of country coverage) measure of genetic distance.[10] Another key advantage of utilizing frequency of blood types is that we can exploit alternative sources of information (e.g., Red Cross) about frequency of blood types to check our data from DNA studies.[11] In a series of robustness checks, we will also employ additional measures of genetic distance constructed in Cavalli-Sforza *et al.* and used in Spolaore and Wacziarg (2009).

Since the genetic data are available at the level of ethnic groups while our analysis is done at the country level, we aggregate genetic information using ethnic shares of population from Fearon (2003). Specifically, if we define blood frequency f_{bec} for blood type *b* and ethnic group *e* in country *c*, then the country level blood frequency for type *b* is calculated as $\overline{f}_{bc} = \sum_e s_{ec} f_{bec}$ where s_{ec} is the share of ethnic group *e* in the population of country *c*.

In addition to DNA-based IVs, we also employ an instrumental variable based on linguistic peculiarities of individualistic cultures. Specifically, in languages where the pronoun cannot be dropped in a sentence, there is a greater differentiation between the individual (first person of the singular) and the community whereas in languages where pronouns can be dropped there is less emphasis on such a differentiation. It has been documented (see e.g. Kashima and Kashima, 1998) that prohibition of pronoun drop is more strongly correlated with individualism. This instrumental variable was used in Licht et al. (2007), Tabellini (2008a) and other papers studying the effects of culture on socioeconomic outcomes.

The sources of data on economic outcomes are standard. We take income per worker data from the Penn World Tables (version 6.3). To control for differences in factor endowments, we use data on total factor productivity (TFP) from Hall and Jones (1999) and Jones and Romer (2010). These two measures have been widely used as measures of long-run growth in the literature.

Since the main conduit of individualism's effect on growth in our theoretical model is innovation, we proxy the intensity of innovations with *innovation performance index* and *log patents per million population* from Economist Intelligence Unit (2007, 2009; henceforth EIU). EIU constructs *patents per million population* as the sum granted to applicants (by residence)

[10] In contrast, Spolaore and Wacziarg (2009) use genetic information for about 40 ethnic groups while we use the full spectrum of genetic information. We complement genetic information from Cavalli-Sforza *et al.* (1994) with Mourant *et al.* (1976) and Tills *et al.* (1983).

[11] In some cases, we have information on the distribution of phenotypes of blood groups. In these cases, we convert phenotypes into genotypes using the Bernstein formula.

from the 82 economies by three major government patent offices—the European Patent Office, the Japanese Patent Office, and the US Patent and Trademark Office. The data are averaged over 2002-2007. Although the use of patent data has a number of problems, this is the single best available measure for innovation outputs. *Innovation performance index* incorporates information on patents and alternative indicators of innovation output such as royalty and license fee receipts as a percentage of GDP, high-technology manufacturing output per head, high-technology services output per head, etc. As documented in EIU (2007, 2009), these measures are highly correlated with other proxies for innovation performance such as citations from scientific and technical journals; UNIDO estimates for 2000 of the share of medium- and high-technology products in a country's manufacturing output and its manufacturing exports; and the results of a survey question from the World Economic Forum's Global Competitiveness Report that asked respondents to rate the extent to which companies were adept at, or able to absorb, new technology. Thus, these measures of innovation are likely to capture salient features of innovative activities across countries.

4. Baseline econometric specification and results

Our theoretical model predicts that more individualistic countries should be more affluent since individualism encourages innovation. Consistent with this prediction, Figure 1 shows that countries with more individualistic cultures enjoy a higher level of income, TFP and rates of innovation. Also, innovation is strongly positively correlated with income and TFP (Figure 2). These raw correlations, some of which were reported earlier in Hofstede (2001), are informative but they do not control for other factors and cannot be interpreted as causal relationships.

To address these concerns, we employ the following basic econometric specification:

$$Y_i = \alpha C_i + \beta X_i + e_i \tag{19}$$

where i indexes countries, Y_i measures an economic outcome (e.g., log income per worker), C_i is a measure of culture, X_i is a vector of control variables and e_i is the error term. The vector X_i includes commonly used controls for geography such as countries' longitude and latitude and a dummy variable for being landlocked. In addition to this standard set of controls, we include the percentage of Muslims in a given country to ensure that our results are not driven by a Muslim effect. Finally, X_i includes a set of dummy variables for continents.

As discussed above, genetic distance is our main instrumental variable to deal with reverse causality in equation (19). Figure 3 shows that countries with more individualistic cultures are genetically similar to each other. The same applies to countries with collectivist cultures. At the same time, countries with individualist and collectivist cultures are genetically distant from each other. The strong negative correlation between genetic distance (computed relative to USA, which has a highly individualistic culture) and individualism suggest that genetic distance may be a strong instrument.

Table 1 presents the OLS and IV estimates for the basic specification (19) where the dependent variables is log income per worker. Irrespective of whether we use controls and continental dummies, the coefficient on individualism is positive and significant. Specifically, a one standard deviation increase in individualism (say from the score of Venezuela to Greece, or from that of Brazil to Luxemburg) leads to 60 to 87 percent increase in the level of income which is a large effect. The magnitude of the effect is roughly similar regardless of whether we introduce continental dummies and control variables. The IV estimates are slightly larger than the OLS estimates which probably suggests that the instrumental variable corrects for measurement errors and thus for the attenuation bias. Note that the first stage fit is strong in all columns and thus our results are not likely to suffer from problems associated with using weak IVs. Overall, these empirical results confirm the insights from our theoretical model and strongly suggest that the advantages of individualism outweigh its disadvantages relative to collectivism and thus that individualism has a causal effect on the wealth of nations.[12]

One may be concerned that our results are driven by a set of countries which for historical reasons were disadvantaged in economic development. Likewise, if our theory explains income differences at the global scale, it is reasonable to expect our theory to explain income differences within continents where countries may be more similar. These concerns are important because, for example, Albouy (2008) argues that the theory of institutions as the fundamental cause of economic development has weak or no empirical support once African countries are excluded or when one focuses exclusively on African countries. More generally, we are interested in whether our results survive when we consider more homogenous countries.

[12] Although we use GDP per worker in 2000 in our baseline regressions, the results are very similar when we use the level of income from other decades.

In Table 2, we report regression estimates for each continent separately and for OECD economies. By and large, we confirm our basic finding that individualism leads to higher income per worker. Importantly, even if we focus on OECD countries or relatively more developed countries in Europe and the Americas, individualism can explain a large fraction of variation in income. Although the coefficient on individualism is somewhat smaller for the subsample of developed countries, it does not necessarily mean that culture is less important. It simply reflects the fact that variation in incomes and individualism is more compressed in these countries and thus, with less variation in our key variables, measurement errors can have a stronger attenuation bias. This observation can also explain why the estimated coefficients are the largest for Africa where countries are extremely diverse in the level of development and individualism. For example, Morocco has the highest individualism scores (same level as Argentina) whereas Nigeria, Sierra Leone and Ghana have the lowest scores (same as China, Singapore, Thailand and Vietnam). In summary, our results are not driven by a particular continent and the effect of culture is significant also within continents.

From Hall and Jones (2009) and others, we know that the main factor behind differences in incomes is differences in the level of TFP across countries. In Table 3, we replicate our estimation of equation (19) when log TFP rather than log income per capita is the dependent variable. Again, we find strong and positive effects of individualism on productivity. A one standard deviation in the individualism score leads to a 17 to 27 percent increase in TFP. Note that the effect on TFP is smaller than the effect on income. This should be expected since differences in income per worker are due to differences in factor accumulation on top of differences in TFP.

Table 4 reports results for a series of robustness checks. In column (1), instead of using as instrument for culture the Euclidian distance of frequency of blood types A and B in a country relative to the USA, we use the Mahalanobis distance which takes into account the covariance between variables when calculating the distance.[13] In column (2), we use the distance between the frequency of blood types A and B relative to the USA separately so that there are two instrumental variables instead of one. In column (3), we use the Euclidian distance for both blood types but this time relative to the UK rather than the USA. In column (4), instead of using

[13] The Mahalanobis distance between a vector x and y picked randomly from a distribution X and Y is $d_M(x,y) = ((x-y)'\Sigma_{xy}^{-1}(x-y))^{1/2}$ where Σ_{xy} is the covariance matrix between X and Y.

the Cavalli-Sforza et al. (1994) data on blood types, we use the data from the Red Cross. Although the Red Cross data are available for a smaller set of countries, it does not require us to use ethnic shares in population to aggregate genetic data to the country level. In columns (5) and (6), we use the genetic distance data used by Spolaore and Wacziarg (2009). Their data also comes from Cavalli-Sforza et al. (1994) data. In contrast to our blood distance, Spolaore and Wacziarg (2009) take genetic distances calculated by Cavalli-Sforza et al. (1994) for a larger set of genes. However, with a larger set of genes, the distance can be computed for only 42 subgroups of the world population. Similar to our approach, Spolaore and Wacziarg (2009) aggregate ethnic data to the country level using shares of ethnic groups in country populations. Column (7) uses the prohibition of pronoun drop as an instrument whereas in column (8), it is used as an instrument on top of blood distance. In all these robustness checks aimed at assessing the sensitivity of our results to using alternative measures of genetic or linguistic distance between cultures, we find very similar results.

In Table 5, we explore if our results are sensitive to alternative measures of individualism. Specifically, we re-run the basic specification (19) for Schwartz's embeddedness and autonomy measures used as the dependent variables. Again, we find that individualism leads to higher levels of income.

Finally, we perform a more direct test of our theory by regressing measures of innovation on individualism (Table 6). With and without controls, we see a strong robust effect of individualism, confirming the channel going from individualism to innovation and to income and productivity.

To summarize, we have shown empirically a strong causal effect from culture to long-run growth and the level of innovation. These findings are consistent with the predictions of our theoretical model indicating that more individualist cultures should lead to more innovations and hence higher economic development.

5. Culture and institutions

We now turn to the issue of the relationship between culture and institutions in the context of long-run growth. We have documented a strong causal effect of culture, along the individualism-collectivism dimension, on log income per worker and TFP. The work by Acemoglu et al. (2001) on the other hand had established a causal effect of institutions on long-run growth. This raises

three interconnected questions. First, does culture have an effect separate from the effect of institutions? This question is important because culture and institutions are correlated and it is possible that culture simply captures the effect embodied in institutions. Second, what is the relative importance of culture and institutions in explaining economic development? This questions aims to assess the quantitative importance of culture and institutions once they are considered simultaneously as factors determining economic development. Third, is it possible to establish causation between culture and institutions? In other words, we want to uncover which of these factors is a more basic force in the sense that it not only causes income differences but also the variation in the other factor.

To address the first two questions, we augment the baseline econometric specification (19) with the average protection against expropriation risk between 1985 and 2009, a measure of institutions used by Acemoglu et al. (2001):[14]

$$Y_i = \alpha C_i + \gamma I_i + \beta X_i + e_i \tag{20}$$

where I_i is a measure of institutions in country i. Estimates of equation (20) (see Table 7) show that culture (individualism) remains significant even after including institutions in the OLS and IV specifications. Culture thus has a robust effect that is separate from institutions. Furthermore, even after controlling for protection against expropriation risk, the causal effect of individualism is large. A one standard deviation increase in the individualism score leads to a 47 to 73 percent increase in the level of income without instrument for institutions and to a 56 to 77 percent increase in the level of income when the institutional variable is instrumented using the settler mortality variable as in Acemoglu et al. (2001). Note that the size of the effect of culture on income remains fairly robust to including controls and a measure of institutions. We cannot say the same for the institutional variable which is rather sensitive to including controls and individualism in the regression. For example, with no controls and without culture (column (2) in Panel A of Table 7), a one standard deviation increase in protection against expropriation risk raises the level of income by 84 percent as can be seen in the OLS specification in panel A of Table 6. Once we introduce controls and individualism (column (5) in Panel A of Table 7), the effect is reduced by nearly one half. Note also that the coefficient on institutions does not increase in the IV estimation (panel B) once culture is included but rather tends to decrease, which was not the case in Acemoglu et al. (2001). Note also that the effect of institutions ceases

[14] Acemoglu et al. (2001) use the same data between 1985 and 1999.

to be statistically significantly different from zero when we apply the correction for settler mortality as in Albouy (2008) and include culture in the regression (columns 8 and 9 in panel B). At a minimum, these results suggest that culture has a very important effect on economic development. This effect is different from the effect induced by institutions, and the quantitative effects of culture and institutions on economic development are at least equally important.

The next question we address is whether culture causes institutions or vice versa. Arguments could go both ways. On one hand, one can argue that culture shapes institutions. When institutions are put in place, they correspond to a view of how the world works and are thus based on culture. The political transformations that took place in the Western world between the eighteenth and twentieth century from absolute monarchy and autocracy to republican and democratic regimes can be seen as based on the values of the enlightenment that go back to the Renaissance period and the rediscovery and reappropriation of the Greek culture of rationality and democracy. The French revolution led to the abolition of monarchy and profound institutional changes that were inspired by the ideals of the enlightenment. In contrast, large-scale revolts in China throughout its history led at best to the replacement of one emperor/dynasty by another one (Finer, 1997). This is because the Chinese imperial system was in line with the Confucianist culture and its view of the "good emperor" as father figure with the associated moral duties towards the people. Within that culture, dissatisfaction of the people tended to be interpreted as the result of having a "bad" emperor and replacing him with a "good" emperor who would behave according to the Confucianist moral cannons. Culture can thus be argued to affect institutional choices of a society.

However, one can also make an argument in favor of an opposite causal channel. People lived for centuries under empires characterized by different institutional organizations, be it the Chinese imperial system, the Ottoman empire, or the Austro-Hungarian empire. The administrative apparatus of empires (as well as of smaller political entities) made it possible to influence the world view of people living within its boundaries, usually by the spreading of religion, such as Islam under the Ottoman empire or Catholicism under the Austro-Hungarian empire.[15] For example, one can argue that Confucianism became widespread in China because it was adopted as the official ideology of the empire as early as the Han dynasty.

[15] Grosjean (2009) finds that having lived together under the same empire for more than 100 years reduced a measure of cultural distance between two localities by at least a third.

We thus test for the existence of two causal channels: from culture to institutions and from institutions to culture. For this test we employ two econometric specifications:

$$I_i = \vartheta_{C\to I} C_i + \beta_{C\to I} X_i + e_i \tag{21}$$

$$C_i = \vartheta_{I\to C} I_i + \beta_{I\to C} X_i + u_i \tag{22}$$

where I is a measure of institutions (i.e., protection against expropriation risk as in Acemoglu et al. (2001)), C is a measure of culture (i.e., individualism), X is a vector of controls, and e and u are error terms. In equation (21), individualism is instrumented with the blood distance we constructed before. In equation (22), protection against expropriation risk is instrumented with settler mortality. If we find that $\vartheta_{C\to I}$ is significant while $\vartheta_{I\to C}$ is not, culture can be interpreted as causing institutions. If $\vartheta_{I\to C}$ is significant while $\vartheta_{C\to I}$ is not, institutions can be interpreted as causing culture. Joint significance of $\vartheta_{I\to C}$ and $\vartheta_{C\to I}$ can be understood as indicating causation flows in both ways.

The results for equation (21) are reported in Panel A of Table 8. The effect of individualism on the strength of economic institutions is positive and significant thus implying a flow of causality from culture to institutions. This finding corroborates Tabellini (2008) and Licht et al. (2007). We report results for equation (22) in Panel B (which uses settler mortality from Acemoglu et al. (2001)) and Panel C (which uses settler mortality from Albouy (2008)) of Table 8. Results in Panel B indicate that causality also flows from institutions to culture. However, according to results in panel C, the effect of institutions on culture ceases to be significant once one introduces controls. Also note that the first stage fit in Panel C become quite poor so that the standard statistical inference probably overstates the significance of the estimated coefficients as weak instruments typically mean much wider confidence intervals. This finding suggests that the effect of institutions on culture might be less robust than the other way round. We must however be careful in interpreting all these results since they are based only on 35 observations, the countries for which the data on culture and institutions and their instruments overlap.

In brief, culture continues to have a strong effect on long-run growth even when including institutions as a control. There is an important contribution of culture to economic development that is independent of institutions. In terms of magnitudes, culture explains income differences across countries at least as much as institutions. Culture also has a causal effect on

institutions and is itself influenced by institutions although the latter direction of causation is less clearcut than the former.

6. Concluding remarks

There are clearly many pitfalls that should be avoided in research on culture. In our view, any research on economic effects of culture should not be seen as implying a "ranking" of cultures in the world or a need for cultural revolutions. On the contrary, this research is aimed to better understand the tradeoffs implied by different cultures which are deeply rooted and change very slowly. We must better understand the world we live in and the values and beliefs upon which people in different countries base their expectations, judgments and calculations. Identifying effects of culture on economic outcomes should be interpreted in a way that leads to better dialogue and communication across cultures.

On a more practical side, this research can help pinpoint effective margins of development policy and aid programs to developing countries. Depending on the strengths of various cultures, different emphases may have to be put on a spectrum of available policy tools. For example, in collectivist societies, aid for public good programs may be more effective than in individualist countries. In the latter, aid programs counting on local initiatives might be more effective. Alternatively, organizational support may have to be stronger for infrastructure projects in individualist societies whereas in collectivist societies, one may have to make special effort to encourage creative initiatives.

Research on the economic effects of culture is still in its infancy. We hope that our results showing the importance of culture for long-run growth will help to spur research in this direction.

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Table 1. Income and individualism.

	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Individualism	0.027***	0.025***	0.016***	0.021***	0.031***	0.038***	0.025***	0.035***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.006)	(0.008)	(0.009)	(0.010)
Continent dummies	No	Yes	No	Yes	No	Yes	No	Yes
Controls	No	No	Yes	Yes	No	No	Yes	Yes
Observations	78	78	78	78	78	78	78	78
R^2	0.381	0.621	0.485	0.649	0.372	0.573	0.46	0.603
1st stage F-stat					45.32	22.27	20.72	13.93
1st stage partial R^2					0.393	0.324	0.303	0.265

Notes: the dependent variable is log income (at purchasing power parity) per worker from the Penn World Tables. *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. The instrument is the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA. *Controls* include a dummy for landlocked countries, the percentage of Muslims in a country and absolute values of country longitude and latitude. Robust standard errors in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels.

Table 2. Income and individualism by region.

	Asia (1)	Europe (2)	Africa (3)	America (4)	OECD (5)
Panel A: OLS					
Individualism	0.037**	0.021***	0.062***	0.017***	0.012***
	(0.014)	(0.005)	(0.012)	(0.003)	(0.003)
Observations	20	28	11	17	31
R^2	0.24	0.378	0.611	0.524	0.251
Panel B: IV					
Individualism	0.058***	0.038**	0.080*	0.021***	0.015***
	(0.021)	(0.015)	(0.046)	(0.005)	(0.005)
Observations	20	28	11	17	31
R^2	0.164	0.121	0.553	0.482	0.237
1st stage F-stat	9.891	3.986	4.563	8.962	31.63
1st stage partial R^2	0.431	0.214	0.232	0.441	0.510

Notes: the dependent variable is log income (at purchasing power parity) per worker from the Penn World Tables. *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. The instrument is the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA. *Controls* include a dummy for landlocked countries, the percentage of Muslims in a country and absolute values of country longitude and latitude. Robust standard errors in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels.

Table 3. Total factor productivity and individualism.

	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Total factor productivity from Hall and Jones (1999)							
Individualism	0.011***	0.012***	0.008**	0.011***	0.016***	0.019***	0.016***	0.020***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Continent dummies	No	Yes	No	Yes	No	Yes	No	Yes
Controls	No	No	Yes	Yes	No	No	Yes	Yes
Observations	70	68	68	68	68	68	68	68
R^2	0.165	0.333	0.279	0.426	0.147	0.294	0.226	0.376
1st stage F-stat					44.58	20.5	20.69	13.57
1st stage partial R^2					0.423	0.342	0.34	0.297
	Panel B: Total factor productivity from Jones and Romer (2010)							
Individualism	0.018***	0.015***	0.007***	0.011***	0.023***	0.019***	0.014***	0.018***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.006)
Continent dummies	No	Yes	No	Yes	No	Yes	No	Yes
Controls	No	No	Yes	Yes	No	No	Yes	Yes
Observations	55	54	54	54	54	54	54	54
R^2	0.374	0.672	0.631	0.726	0.381	0.66	0.597	0.702
1st stage F-stat					38.46	19.31	18.38	11.27
1st stage partial R^2					0.454	0.37	0.354	0.31

Notes: the dependent variable is log total factor productivity relative to the USA from Hall and Jones (1999) and from Jones and Romer (2010). *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. The instrument is *blood distance*, the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA. *Controls* include a dummy for landlocked countries, the percentage of Muslims in a country and absolute values of country longitude and latitude. Robust standard errors in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels.

Table 4. Robustness checks.

	Mahal. distance	Distance for blood types A & B separately	Distance to UK	Red Cross blood info	Spolaore-Wacziarg		Pronoun drop	
					First distance	Nei distance	Individ.	Comb. With blood distance
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Individualism	0.030***	0.032***	0.035***	0.040***	0.058***	0.058***	0.019***	0.023***
	(0.005)	(0.006)	(0.006)	(0.011)	(0.012)	(0.013)	(0.005)	(0.005)
Observations	78	78	78	39	78	78	42	42
R^2	0.377	0.37	0.348	0.224	-0.101	-0.104	0.418	0.419
1st stage F-stat	48.76	25.36	59.12	21.14	17.97	15.78	48.35	43.23
1st stage partial R^2	0.401	0.406	0.445	0.4	0.22	0.216	0.547	0.663
		0.546						0.173

Notes: the dependent variable *log income per worker* (at purchasing power parity) is from the Penn World Tables. *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. In column (1), *Blood Distance* is computed with the Mahalanobis metric (instead of Euclidean). In column (2), *Blood Distance* from the use is computed as absolute value of the difference between a given country and the USA for each blood type (A and B) separately. Hence, distance for blood type A and distance for blood type B are used as instrumental variables. *Over-id p-val* is the p-value for the overidentifying restrictions test. In column (3), *Blood Distance* is computed relative to the United Kingdom (instead of the USA). In column (4), *Blood Distance* (relative to the USA) is computed based on data available from the Red Cross and similar agencies. In columns (5) and (6), the distance between nations is taken from Spolaore and Wacziarg (2009) who use a broader set of genetic polymorphisms. The first and Nei genetic distances for a given gene are computed as follows. Let p_{ij} be the frequency of gene i with L alleles in populations j=1,2. Then the first distance is $F_{ST} = \sum_{j=1}^{2} (p_{ij} - \overline{p}_i)^2 / \overline{p}_i(1-\overline{p}_i)$ where $\overline{p}_i = \frac{1}{2}(p_{i1} + p_{i2})$ and the Nei distance is $F_N = -\log\{J_{12} / (J_{11}J_{22})^{1/2}\}$ where $J_{12} = \sum_{k=1}^{L}\sum_{m=1}^{L} p_{k1}p_{m2}$ and $J_{dd} = 1 - \sum_{m=1}^{L} p_{md}^2$, $d = \{1,2\}$. See Table 1.10.1 in Cavalli-Sforza et al. (1994) for a more detailed description of how the first and Nei genetic distances are constructed. In columns (7) and (8), the linguistic instrument *Pronoun drop dummy* is a dummy variable (from Licht et al. 2007) equal to one if a language permits dropping a pronoun in sentences and zero others. In column (7), only *Pronoun drop dummy* is used as an instrumental variable. In column (8), *Pronoun drop dummy* and *Blood Distance* are instrumental variables. Robust standard errors in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels.

Table 5. Income and alternative measures of individualism (Schwartz).

	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
Embeddedness	-1.837***	-2.266***				
	(0.191)	(0.412)				
Affective autonomy			1.287***	1.571***		
			(0.145)	(0.310)		
Intellectual autonomy					1.736***	2.879***
					(0.218)	(0.622)
Observations	75	75	75	75	75	75
R^2	0.572	0.541	0.528	0.503	0.456	0.259
1st stage F-stat		27.41		23.91		20.74
1st stage partial R^2		0.229		0.253		0.159

Notes: the dependent variable is log income (at purchasing power parity) per worker from the Penn World Tables. *Intellectual autonomy* encourages individuals to pursue their own ideas and intellectual directions independently. *Affective autonomy* encourages individuals to pursue affectively positive experience for themselves. In *Embeddedness* cultures, people are viewed as entities embedded in the collectivity. A larger value of *Intellectual autonomy* and *Affective autonomy* corresponds to a greater level of individualism. A smaller value of *Embeddedness* corresponds to a greater level of individualism. Schwartz's *Intellectual autonomy, Affective autonomy,* and *Embeddedness* are taken from Licht et al. (2007). The instrument is the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA. Robust standard errors in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels.

Table 6. Innovation and individualism regressions.

	Innovation performance index		Log patents per million population	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A: No controls				
Individualism	0.060***	0.065***	0.095***	0.104***
	(0.007)	(0.014)	(0.012)	(0.022)
R^2	0.441	0.437	0.439	0.435
1st stage F-stat		42.48		42.48
1st stage partial R^2		0.411		0.411
Panel B: Controls				
Individualism	0.051***	0.078***	0.082***	0.125***
	(0.007)	(0.018)	(0.012)	(0.029)
R^2	0.672	0.629	0.670	0.628
1st stage F-stat		12.85		12.85
1st stage partial R^2		0.287		0.287
Observations	64	64	64	64

Notes: *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. *Innovation performance index* and *log patents per million population* are taken from Economist Intelligence Unit (2007, 2009). Panel A does not include controls. Panel B includes a dummy for landlocked countries, the percentage of Muslims in a country, absolute values of country longitude and latitude, and dummy variables for continents. The instrument is the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA.

Table 7. Relative effects of institutions and culture on economic development.

Panel A: Control for protection against expropriation risks.

	OLS			IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individualism	0.012***		0.027***	**0.024*** **	**0.031*** **	**0.020*** **	**0.029*** **
	(0.002)		(0.003)	**(0.005)**	**(0.008)**	**(0.007)**	**(0.009)**
Protection against expropriation risk	0.141***	0.169***		0.112***	0.093***	0.121***	0.101***
	(0.016)	(0.015)		(0.020)	(0.016)	(0.020)	(0.014)
Continent dummies	No	No	No	No	Yes	No	Yes
Controls	No	No	No	No	No	Yes	Yes
Observations	76	76	76	76	76	76	76
R^2	0.723	0.666	0.374	0.665	0.746	0.708	0.781
1st stage F-stat				38.44	20.89	20.18	13.96
1st stage partial R^2				0.393	0.297	0.301	0.255

Panel B: Instrument and control for protection against expropriation risks

	OLS			IV				
				Blood Distance	Settler mortality	Blood Distance + Settler mortality	Settler mortality (Albouy)	Blood Distance + Settler mortality (Albouy)
	(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)
Individualism	0.021***		0.007*	**0.033*** **		**0.025** **		**0.024* **
	(0.004)		(0.004)	**(0.009)**		**(0.011)**		**(0.013)**
Protection against expropriation risk		0.208***	0.192***		**0.255*** **	**0.129* **	**0.288*** **	**0.136**
		(0.023)	(0.024)		**(0.038)**	**(0.069)**	**(0.059)**	**(0.125)**
Observations	35	35	35	35	35	35	35	35
R^2	0.215	0.675	0.696	0.151	0.640	0.564	0.574	0.573
1st stage:								
F-stat					14.88	7.964	4.424	3.654
Partial R^2					0.424	0.424	0.174	0.185
F-stat				12.01		14.13		10.66
Partial R^2				0.377		0.553		0.482

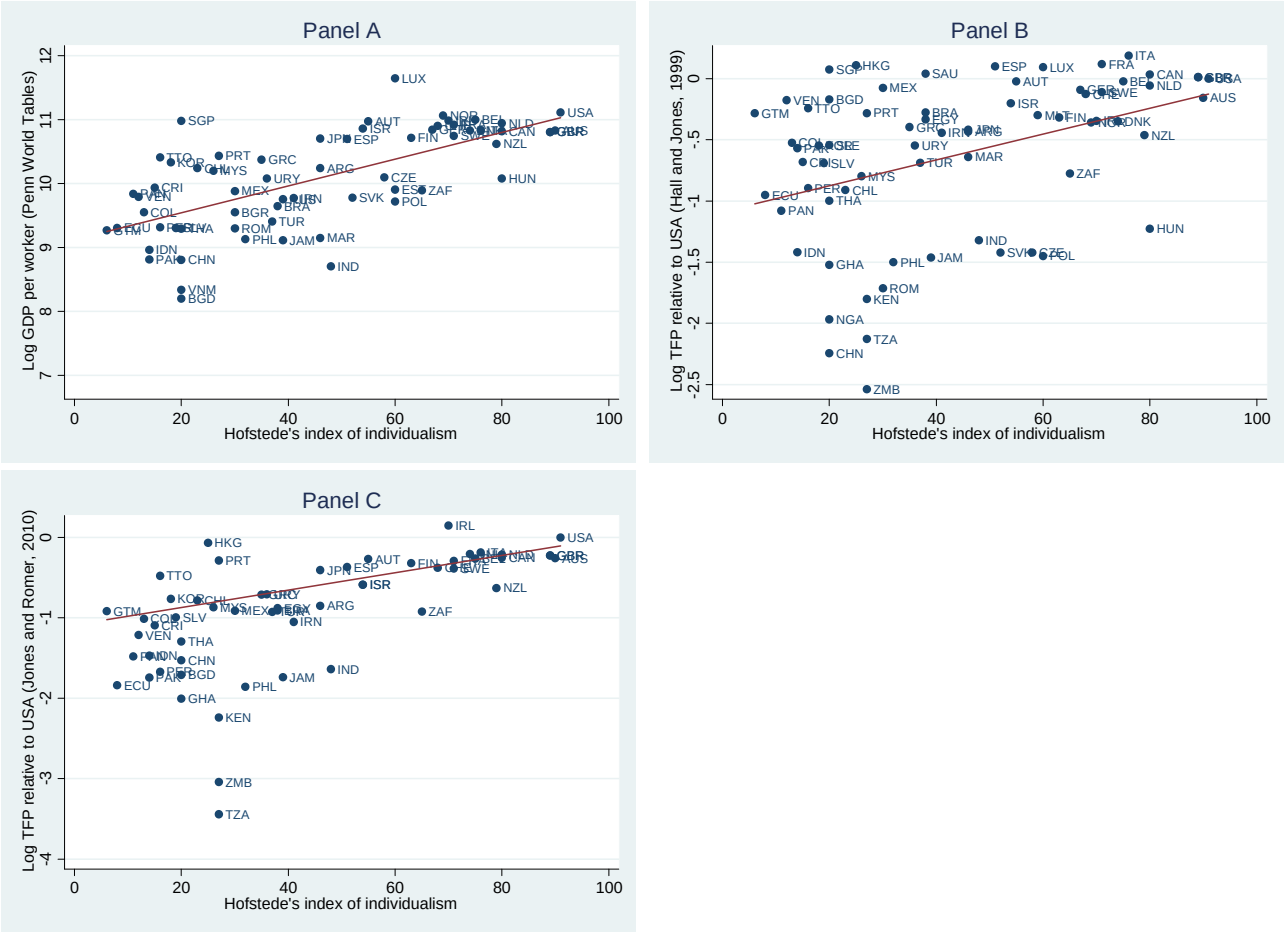
Notes: the dependent variable is log income (at purchasing power parity) per worker from the Penn World Tables. *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. *Protection against expropriation risk* , taken from the International Country Risk Guide, is averaged between 1985 and 2009. It is the same variable Acemoglu et al. (2001) used to approximate the strength of a country's institutions. A larger value of the index corresponds to a greater strength of institutions. The instrument is *blood distance*, the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA. The instrument for institutions (*Economic Risk*) is *Settler mortality* from Acemoglu et al. (2001) and *Settler mortality (Albouy)* from Albouy (2008). The Instrumented variables are in **bold**. Robust standard errors in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels.

Table 8. Causal effects between culture and institutions.

	OLS	IV			
	(1)	(2)	(3)	(4)	(5)
Panel A: Dependent variable = *Protection against expropriation risk*; Instrument = *Blood Distance*					
Individualism	0.073***	0.061*	0.107**	0.070*	0.116**
	(0.019)	(0.035)	(0.043)	(0.040)	(0.051)
Continent dummies	No	No	Yes	No	Yes
Controls	No	No	No	Yes	Yes
Observations	35	35	35	35	35
R^2	0.163	0.159	0.366	0.277	0.359
1st stage F-stat		12.01	9.046	12.31	6.683
1st stage partial R^2		0.377	0.340	0.316	0.281
Panel B: Dependent variable = *Individualism*; Instrument = *Setter mortality*					
Protection against expropriation Risk	2.245*	5.107***	5.772***	5.039***	4.604***
	(1.134)	(1.620)	(1.912)	(1.862)	(1.614)
Continent dummies	No	No	Yes	No	Yes
Controls	No	No	No	Yes	Yes
Observations	35	35	35	35	35
R^2	0.163	-0.102	0.123	0.045	0.364
1st stage F-stat		14.88	6.101	7.003	4.880
1st stage partial R^2		0.424	0.272	0.273	0.240
Panel C: Dependent variable = *Individualism*; Instrument = *Setter mortality (Albouy)*					
Protection against expropriation Risk	0.073***	6.274**	5.733*	5.596	4.534
	(0.019)	(2.732)	(3.146)	(3.824)	(2.944)
Continent dummies	No	No	Yes	No	Yes
Controls	No	No	No	Yes	Yes
Observations	35	35	35	35	35
R^2	0.163	-0.362	0.130	-0.063	0.373
1st stage F-stat		4.424	2.100	1.789	1.383
1st stage partial R^2		0.174	0.116	0.102	0.0896

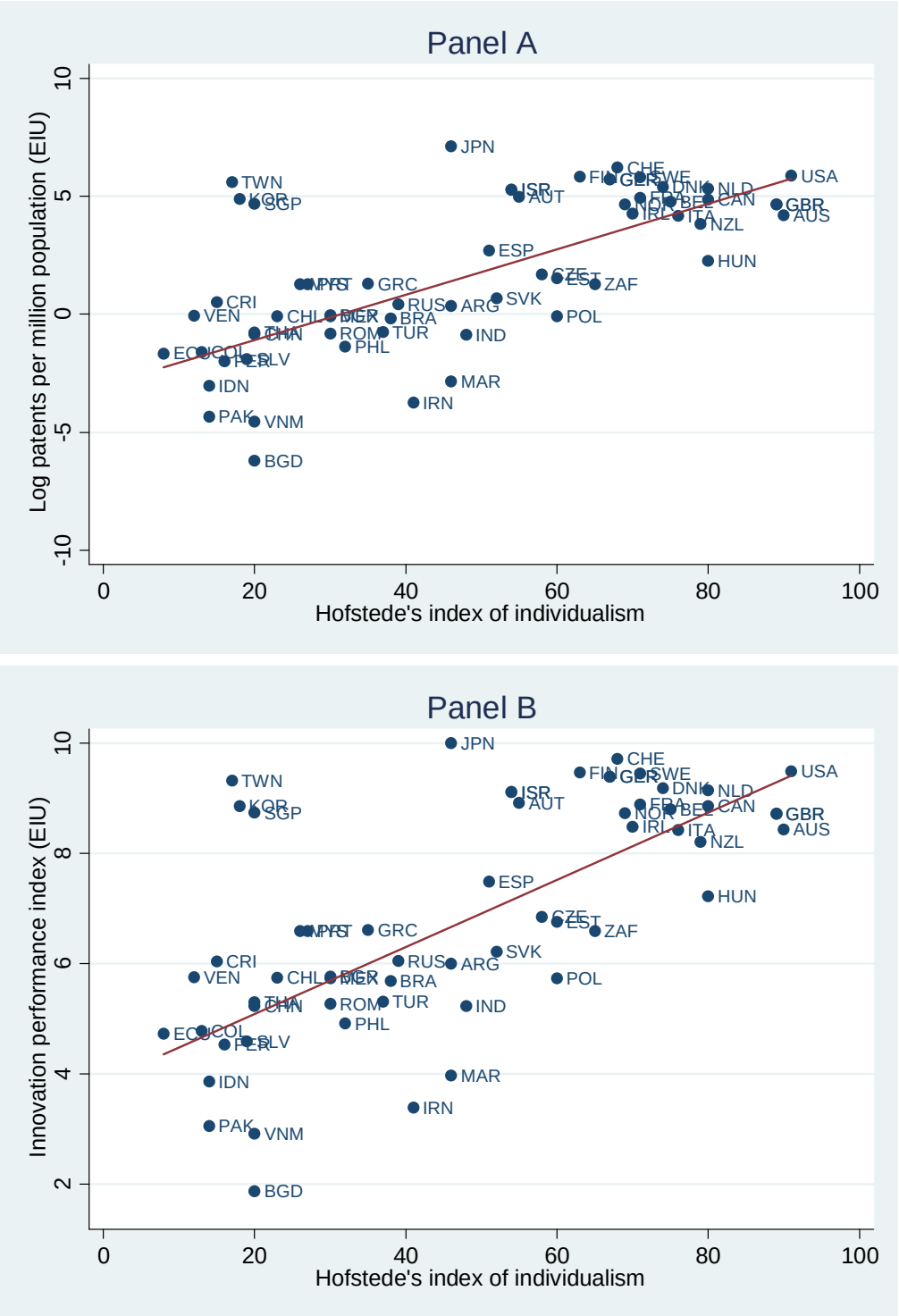
Notes: *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. *Economic risk* is from the International Country Risk Guide which Acemoglu et al. (2001) used to approximate the strength of a country's institutions. A larger value of the index corresponds to a greater strength of institutions. *Blood distance* is the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA. The instrument for institutions (*Economic Risk*) is *Settler mortality* from Acemoglu et al. (2001) and *Settler mortality (Albouy)* from Albouy (2008). *Controls* includes a dummy for Muslim countries, a dummy for landlocked countries, and absolute values of country longitude and latitude. Robust standard errors in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels.

Figure 1. Individualism and economic outcomes.



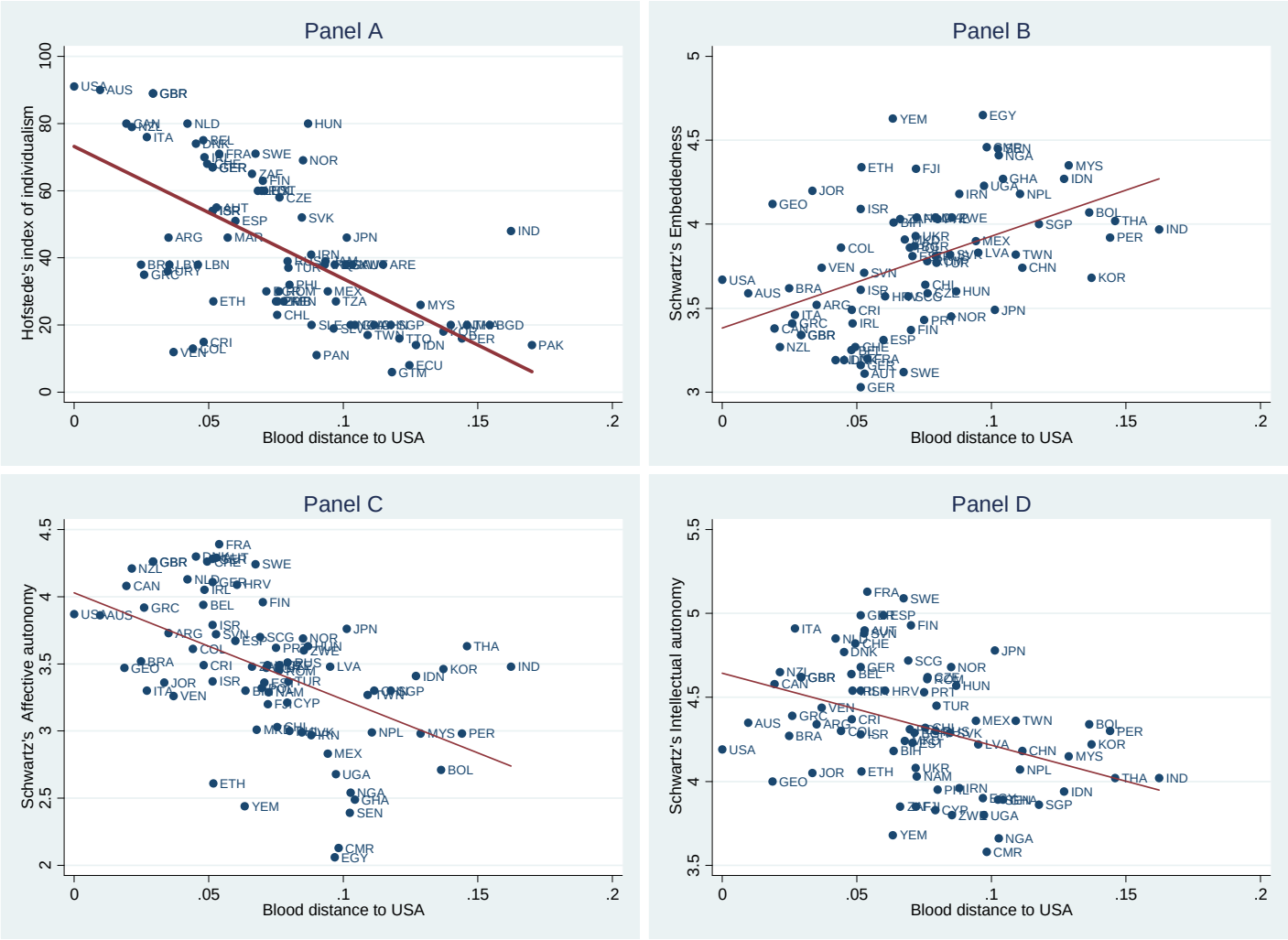
Notes: *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. Log income (at purchasing power parity) per worker is from the Penn World Tables. Log total factor productivity relative to the USA is from Hall and Jones (1999) and Jones and Romer (2010).

Figure 2. Individualism and Innovation.



Notes: *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. *Log patents per million population* and *innovation performance index* are taken from Economist Intelligence Unit (2007, 2009).

Figure 3. Genetic and cultural distance



Notes: *Individualism* is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. *Intellectual autonomy* encourages individuals to pursue their own ideas and intellectual directions independently. *Affective autonomy* encourages individuals to pursue affectively positive experience for themselves. In *Embeddedness* cultures, people are viewed as entities embedded in the collectivity. A larger value of *Intellectual autonomy* and *Affective autonomy* corresponds to a greater level of individualism. A smaller value of *Embeddedness* corresponds to a greater level of individualism. Schwartz's *Intellectual autonomy, Affective autonomy,* and *Embeddedness* are taken from Licht et al. (2007). *Blood distance to USA* is the Euclidian distance of frequency of blood types A and B in a given country relative to the frequency of blood types A and B in the USA.

APPENDIX

Proof of proposition 1:

In the symmetric equilibrium we have

$$Y_t = \eta L_t^{1-\alpha} F_t^{\alpha} x_t^{\alpha} \tag{A.1}$$

$$p_t = \alpha\eta L_t^{1-\alpha} F_t^{\alpha} x_t^{\alpha-1} = \alpha^{-1} \tag{A.2}$$

$$w_t = (1-\alpha)Y_t / L_t \tag{A.3}$$

$$x_t = \alpha^2\eta L_t^{1-\alpha} F_t^{\alpha} x_t^{\alpha} = \alpha^2 Y_t \tag{A.4}$$

$$\pi_t = p_t x_t - x_t = \alpha(1-\alpha)Y_t \tag{A.5}$$

$$G_t = \tau\alpha(1-\alpha)Y_t \tag{A.6}$$

$$C_t = Y_t - G_t = [1-\tau\alpha(1-\alpha)]Y_t \tag{A.7}$$

$$1/C_t = q_t \tag{A.8}$$

$$q_t = \beta(1+r_{t+1})q_{t+1} \tag{A.9}$$

$$\mu_t\lambda'(1-L_t)F_{t-1} = q_t w_t \tag{A.10}$$

$$\mu_t = \phi\frac{1}{F_t} + \beta\left\{\mu_{t+1}\lambda(1-L_{t+1})\right\} + q_t(1-\tau)\alpha^2\eta L_t^{1-\alpha}F_t^{\alpha-1}x_t^{\alpha} \tag{A.11}$$

$$\alpha^2\eta L_t^{1-\alpha}F_t^{\alpha}x_t^{\alpha-1} = 1 \tag{A.12}$$

$$F_t = \lambda(1-L_t)F_{t-1} \tag{A.13}$$

Using (A.3), (A.8) and (A.10), we have

$$\mu_t = \frac{1}{\lambda'(1-L_t)}\frac{1}{F_{t-1}}\frac{w_t}{C_t} = \frac{1}{\lambda'(1-L_t)}\frac{1}{F_{t-1}}\frac{(1-\alpha)Y_t/L_t}{[1-\tau\alpha(1-\alpha)]Y_t} = \frac{(1-\alpha)}{[1-\tau\alpha(1-\alpha)]}\frac{1}{L_t\lambda'(1-L_t)}\frac{1}{F_{t-1}}. \tag{A.14}$$

Plus this expression for μ_t into (A.11) to find

$$\frac{(1-\alpha)}{[1-\tau\alpha(1-\alpha)]}\frac{1}{L_t\lambda'(1-L_t)}\frac{1}{F_{t-1}} = \phi\frac{1}{F_t} +$$

$$\beta\left\{\frac{(1-\alpha)}{[1-\tau\alpha(1-\alpha)]}\frac{1}{L_{t+1}\lambda'(1-L_{t+1})}\frac{1}{F_t}\lambda(1-L_{t+1})\right\} + \frac{1}{C_t}(1-\tau)\alpha^2\eta L_t^{1-\alpha}F_t^{\alpha-1}x_t^{\alpha}$$

which simplifies to

$$\frac{(1-\alpha)}{[1-\tau\alpha(1-\alpha)]}\frac{1-L_t}{L_t}\frac{\lambda(1-L_t)}{(1-L_t)\lambda'(1-L_t)}\lambda'(1-L_t)\frac{F_t}{F_{t-1}} =$$

$$\phi + \beta\left\{\frac{(1-\alpha)}{[1-\tau\alpha(1-\alpha)]}\frac{1-L_{t+1}}{L_{t+1}}\frac{\lambda(1-L_{t+1})}{(1-L_{t+1})\lambda'(1-L_{t+1})}\right\} + \frac{(1-\tau)\alpha^2}{[1-\tau\alpha(1-\alpha)]}$$

Given $\varepsilon = (1-L_t)\lambda'(1-L_t)/\lambda(1-L_t)$ and (A.13), we can further simplify to

$$\frac{(1-\alpha)}{[1-\tau\alpha(1-\alpha)]}\frac{1-L_t}{L_t}\frac{1}{\varepsilon}=\phi+\beta\left\{\frac{(1-\alpha)}{[1-\tau\alpha(1-\alpha)]}\frac{1-L_{t+1}}{L_{t+1}}\frac{1}{\varepsilon}\right\}+\frac{(1-\tau)\alpha^2}{[1-\tau\alpha(1-\alpha)]}$$

On a balanced growth path, we have $L_t = L$ and thus

$$\frac{1-L}{L}=\left\{\phi+\frac{(1-\tau)\alpha^2}{[1-\tau\alpha(1-\alpha)]}\right\}\frac{\varepsilon}{1-\beta}\frac{[1-\tau\alpha(1-\alpha)]}{(1-\alpha)} \tag{A.15}$$

Note that $(1-L)/L$ is monotonically decreasing in L. We can then derive:

$$\frac{\partial(\frac{1-L}{L})}{\partial\phi}=\frac{\varepsilon}{1-\beta}\frac{[1-\tau\alpha(1-\alpha)]}{(1-\alpha)}>0 \tag{A.16}$$

$$\frac{\partial(\frac{1-L}{L})}{\partial\tau}=-\frac{\varepsilon\alpha^2}{1-\beta}-\phi\frac{\varepsilon\alpha}{1-\beta}<0 \tag{A.17}$$

$$\frac{\partial^2(\frac{1-L}{L})}{\partial\phi\partial\tau}=-\frac{\varepsilon\alpha}{1-\beta}<0 \tag{A.18}$$

End of proof of proposition 1.