CULTURE, INSTITUTIONS, AND THE WEALTH OF NATIONS

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Abstract—We argue that a more individualist culture leads to more innovation and to higher growth because of the social status rewards associated with innovation in that culture. We use data on the frequency of particular genes associated with collectivist cultures, as well as a measure of distance in terms of frequencies of blood types, and historic prevalence of pathogens to instrument individualism scores. The relationship between individualism and innovation/growth remains strong even after controlling for institutions and other potentially confounding factors. We also provide evidence consistent with two-way causality between culture and institutions.

I. 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 research, this question continues to puzzle the profession as the bulk of the difference is attributed to variation in productivity, a residual component not accounted for by observed factors. It is widely perceived that the key conduit of economic growth and productivity enhancements is technological innovation. In this paper, we argue that individualist culture plays a key role in stimulating innovations and, hence, in explaining long-run economic growth, alongside other important factors such as institutions and human capital.

The idea that culture is a central ingredient of economic development goes back to at least Max Weber who, in his classic work, *The Protestant Ethic and the Spirit of Capitalism* (2002), argued that the Protestant ethic of Calvinism was a powerful force behind the development of capitalism in its early phases. Weber saw culture as the driving force behind differences in economic development. Although Landes (1998) and others have argued that culture played a fundamental role in explaining the wealth of nations, little systematic work has examined theoretically and empirically the effect of culture on innovation, long-run growth, and development.

To be clear, 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*. This definition highlights that culture affects not only social norms but also economic behavior, such as the propensity to save or to innovate, and many other economic decisions such as fertility choices, investment in education, charitable contributions, or the willingness to contribute to public goods. Culture is directly related to institutions, broadly defined, in the sense that culture, like formal political or legal institutions, imposes constraints on individual behavior.

We focus on only one dimension of culture that may be relevant for long-run growth: individualism versus collectivism. Individualism is a cultural trait that emphasizes personal freedom and achievement. It therefore awards social status to personal accomplishments such as important discoveries, innovations, great artistic or humanitarian achievements, and all actions that make an individual stand out. In contrast, collectivism emphasizes the embeddedness of individuals in a larger group. It encourages conformity to a group and loyalty to and respect for one's superiors, and it discourages individuals from dissenting and standing out. Although one may obviously contemplate other cultural dimensions, cross-cultural psychologists consider the individualism-collectivism distinction to be the main dimension of cultural variation (Heine, 2007).

Several main differences between individualism and collectivism play a role in our theory. Because individualism emphasizes personal freedom and achievement, it awards social status to personal accomplishments such as important innovations. It can also make collective action more difficult because individuals pursue their own interest without internalizing collective interests. Collectivism makes collective action easier because individuals internalize group interests to a greater degree. However, it also encourages conformity and discourages individuals from dissenting and standing out. Individualism should thus encourage innovation more, but collectivism should have an advantage in coordinating production processes and in various forms of collective action. Despite this trade-off, we argue that individualism has a dynamic effect in terms of innovation, whereas collectivism has a static effect. As a result, individualistic culture has an edge in long-run economic growth.

In bringing this argument to the data, we would like to have a reliable measure of cultural differences from centuries ago to see how they affected long-run growth. However, our measure of individualism is from the second half of the twentieth century and exists only as a cross-sectional variable. In principle, this is not necessarily damning for our research if culture changes slowly. Nevertheless, this mistiming in the measurement of culture raises several concerns. In particular, our measure of culture might be endogenous to economic outcomes. Therefore, finding a convincing causal effect of culture on long-run growth would require a valid instrumental variable (IV). It is extremely

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difficult to find foolproof IVs for cross-country regressions. We have nevertheless come up with several IVs that are jointly strongly suggestive of a possible causal link from individualism to long-run growth. For the first set of IVs, we use information on the prevalence of certain genes in a population (the frequency of the S-allele in the serotonin transporter gene 5HTTLPR, making people more prone to depression when confronted with stressful events, and the frequency of the G allele in polymorphism A118G in the μ-opoid receptor gene, creating a stronger psychological pain from social exclusion), as well as historical pathogen prevalence in a particular geographical area. According to recent advances in genetics and psychology, these genes appear to directly affect personality traits. Chiao and Blizinsky (2010), Way and Liebermann (2010), and others argue that communities with a higher frequency of these two genes and with a higher pathogen prevalence developed social norms to adapt to this genetic and epidemiological environment. These data are good candidates for IVs, and they can be argued to satisfy the exclusion restriction. The two genetic variables are not plausibly correlated to income per capita through any other channel than collectivism. Unfortunately, cross-country coverage is limited to approximately forty countries for the two genetic variables, which are perhaps the cleanest IVs one can currently obtain in this kind of work.

Another IV that is more widely available worldwide is a measure of genetic distance between the population in a given country and the population in the United Kingdom, the second most individualistic country in our sample. A large literature studying values of descendants of immigrants as a function of the country of origin (see Fernandez, 2010, for a survey) documents that parental transmission of culture is a fundamental determinant of the cultural values of individuals. Obviously parents transmit their genes as well as their cultural values to their offspring. Populations that interbreed a lot should be genetically and culturally close because a similar parental transmission mechanism is at work in both cases. Therefore, measures of genetic distance can be seen as a proxy measure of differences in cultural values. In this case, we do not postulate a causal relationship between genes and cultural attributes such as individualism. We exploit instead the correlation between genetic distance and cultural differences across populations as both genes and culture are transmitted from parents to offspring. Since there are no identified direct genetic causes for why some countries became wealthier than others, genetic distance can be argued to satisfy the exclusion restriction. Furthermore, we use only neutral genetic markers that have no direct effect on fitness (e.g., the ability to think, run, work) and thus economic or cultural outcomes; consequently, we can exclude reverse causality. We use genetic distance based on frequencies of blood types, which is available for the largest number of countries. A potential drawback of genetic distance is that there could be channels other than individualism through which genetic distance can be indirectly related to long-run growth (e.g., another cultural dimension). Because of this objection to our exclusion restriction argument, we combine this variable with the other IVs mentioned above and apply standard statistical tests for the exclusion restriction. Our measure of genetic distance successfully passes these tests, and one can thus feel comfortable using it as an IV for a set of countries larger than one can cover with the genetic variables mentioned.

Our econometric results suggest a statistically and economically significant effect of individualism on income per worker. According to some of our estimates, a 1 standard deviation increase in the individualism score nearly doubles income per worker. Our results are robust to the introduction of different types of controls and different measures of long-run growth, as well as to using dyadic regressions or alternative IVs based on linguistic properties of individualist cultures. Although our estimates are based on cross-country variation, these estimates are also remarkably consistent with regional variation within countries like Italy, where there exists considerable cultural variation across regions. In addition, the effects of individualism on total factor productivity and innovation are also very strong, suggesting that the effects we estimate capture more than simple technological diffusion.

To isolate the effect of individualism on economic development from alternative channels, we employ a battery of checks and tests. First, we explore how our results vary across subsamples of countries that were differentially exposed to these alternative channels. For example, we report results estimated on a sample of African, Asian, or European countries to exclude the possibility that our results are influenced by the Americas and Oceania where colonization by European settlers was particularly important. Our results are remarkably consistent across subsamples based on continents or levels of development. We also take into account migrations that have taken place between countries over the last 500 years, exploiting the Putterman and Weil (2010) data, and our results hold if we restrict our sample to countries having roughly the same ethnic composition as 500 years ago.

Second, we introduce controls for alternative determinants of economic development. Individualism may, for example, be correlated with the quality of institutions (Hall & Jones, 1999; Acemoglu, Johnson, & Robinson, 2001), human capital (Barro & Lee, 2001), legal origin (La Porta et al., 1998), ethnic fractionalization (Fearon, 2003), speed of technology diffusion (Spolaore & Wacziarg, 2009; Fogli & Veldkamp, 2012), and remoteness from Europe (Redding & Venables, 2004)—key variables that have been argued to affect economic performance. Controlling for these additional factors does not change our conclusions that individualism explains a significant fraction of variation in economic development. Furthermore, individualism and income per capita continue to be strongly related even in dyadic regressions where we can control for country fixed

effects, thereby ruling out explanations based on a large class of potentially relevant but omitted variables. Thus, individualism has an effect on economic development that is independent of institutions and other commonly suggested factors, and our estimates are not driven by any omitted variable bias we could think of.

We also examine the interactions between individualism and institutions, measured by the average protection against expropriation risk as in Acemoglu et al. (2001), using our IVs for individualism and the Acemoglu et al. (2001) settler mortality instrument for institutions. We cannot exclude a two-way interaction, with culture affecting institutions and institutions affecting culture. However, when using settler mortality data constructed by Albouy (2012), we find that the link from institutions to culture is much weaker and loses robust significance. This result is consistent with Roland (2004), who argues that culture tends to change more slowly than political or legal institutions and might thus have an important effect on the choice of political and legal institutions.

Third, we examine within-country variation of occupational choices across ethnic groups so as to further minimize the effects of potentially omitted factors in our cross-country regressions. Our theory predicts that people from more individualistic cultures should work in research-oriented occupations, which require independent thinking, more frequently than persons raised in the traditions of more collectivist cultures. Using U.S. Census data, we find that people from more individualistic cultures are more likely to become scientists and researchers.

While we cannot completely rule out the possibility of an omitted variable driving both individualism and economic development, one may find it difficult to propose a plausible, quantitatively important alternative that we did not attempt to control for. Together with the evidence based on cross-cultural psychology and the effects of genetic endowments on collectivist culture, these results show that individualism is empirically relevant for understanding economic development.

Our findings contribute to the literature on the effects of culture on economic outcomes (see Spolaore & Wacziarg, 2013, for a review). Greif (1994) modeled the effects of individualist versus collectivist beliefs on contract enforcement and the expansion of markets in the late medieval trade in the Mediterranean. Bisin and Verdier (2000) examined the dynamics of intergenerational cultural transmission, together with the effects of the social environment. Tabellini (2008, 2010) studied how the cultural transmission of cooperative values 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 preindustrial middle class (thriftiness, hard work) in the industrialization process. Doepke and Zilibotti (2013) show how in entrepreneurial societies, innovation and risk taking create incentives for cultural transmission of values of thrift and risk taking, which in turn sustain a high level of entrepreneurship and innovation. 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. Aghion et al. (2010) found a negative correlation between trust and the level of regulation in societies. Guiso, Sapienza, and Zingales (2003, 2009) examined the effect of trust on economic attitudes and international trade patterns, and Giuliano, Spilimbergo, and Tonon (2014) investigated the link between geography, genetic distance, transportation costs, and economic variables. Tabellini (2008) and Licht, Goldschmidt, and Schwartz (2007) provide evidence consistent with a causal link from culture to institutions.

Section II presents our argument for how individualism and economic growth can be related. In section III, we discuss the data used in our empirical analysis. Section IV contains our empirical analysis of how individualism can affect economic development. Sections V and VI examine the interplay of individualism, institutions, and other factors. In section VII, we investigate occupational choices of various ethnic groups in the United States. Section VIII concludes.

II. The Economic Argument

In this section, we synthesize how individualism/collectivism can affect long-term growth and development via innovation and production. Our discussion is intentionally narrative to formulate the argument in general terms (online appendix A presents a simple endogenous growth model, which we find useful in making our argument precise and in differentiating static and dynamic effects of culture).

While technological innovations are generally seen as the central conduits of economic growth and development, a central question is how innovation is stimulated. Obviously monetary rewards from patents and market power, for example, provide strong incentives for innovation. However, other important dimensions, such as social status, can also compensate innovators for their efforts. Our main hypothesis is that individualistic societies permit and encourage more innovation than collectivist societies by providing a higher social status for individuals who make important discoveries. There is ample evidence (Merton, 1973) that social reward with heightened status is the most significant part of the total reward for scientists. Indeed, many probably have dreamed of becoming the first to discover a new element, a new law, or a new technology. By stimulating more innovations, individualism gives a dynamic advantage that can lead to higher economic growth. In contrast, collectivist societies give less social status reward to innovation. They reward conformity more and discourage individuals from dissenting (see Bond & Smith, 1996).

High-status rewards can counteract the disincentive effects of high tax rates because, while income and wealth

can be expropriated, social status cannot. Even if a country has poor institutions with high expropriation risk, there can thus still be incentives to 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 no better than in many developing countries today, whose institutional weaknesses are seen as the main cause of their underdevelopment. Bringing individualist culture into the picture, which historians have shown to exist in England at least since the thirteenth century (Macfarlane, 1978), the negative effect of predatory institutions on long-run growth can be offset by the social status reward of innovation in an individualist culture.

The comparative advantage of collectivist societies is hypothesized instead to be on the production side, which involves combining inputs and hence requires coordination of workers and units. Such coordination is easier to achieve in collectivist cultures that value harmony, conformity, and team effort. For example, Liker (2003) documents that teamwork and consensus building are defining features of the Japanese way to run business. Efforts to copy the Japanese organization inside U.S. automobile factories failed since American carmakers could replicate lean production but could not imitate Toyota's culture. Because better coordination among workers is likely to run into diminishing returns, the production advantage of collectivism is static and may be interpreted as a level effect.

While the vast majority of fundamental innovations were made in the United States and Western Europe (see Harrison, 2004), which have a highly individualistic culture, collectivist countries may be good at incremental innovations. For example, the color TV was invented by RCA, an American firm, but Japan ended up making the best TV sets. Sony invented the Walkman, a great consumer success in the 1980s. However, the key invention of the compact cassette was made by Philips, a European firm. Similarly, Sony introduced the VCR, but the technology was invented by Ampex, an American firm that was unable to make its VCR affordable to households. One can argue that incremental innovations have diminishing returns (e.g., one can relatively easily improve a cassette player in terms of design and functionality, but one needs a radical innovation to create a CD player) and gains from incremental innovations are limited in the long run. The technological frontier is thus likely to be pushed by individualistic societies. Collectivist societies may be able to close some of the gap in technology through the international diffusion of technology, but this diffusion is a gradual process: growth theories emphasize that the tacit and idiosyncratic nature of technological knowledge makes it impossible to transplant new technologies costlessly and immediately to other countries. Investments are needed to master an existing technology and adapt it to local conditions (see Aghion & Howitt, 2009). As a result, one should observe a stationary distribution of income differences with more individualist "leaders" being richer since they are a few steps ahead of collectivist "laggards."

This reasoning can also shed new light on episodes of reversal of fortune. In the Malthusian stage when labor is allocated almost exclusively to the production of final goods (e.g., food, clothes) and virtually no labor is allocated to innovation, collectivist societies, which have a greater level of coordination, may be richer than individualistic societies. This prediction is consistent with China being richer, more urbanized, and more densely populated than much of Western Europe in 1500. However, as the economy exits the Malthusian stage (e.g., after the Black Plague), the collectivism-individualism difference across cultures starts to play a new and different role. Since individualistic societies grow faster than collectivist societies after the Malthusian stage, countries with an individualistic culture eventually become richer and more affluent than collectivist countries that initially had a higher level of development, thus yielding a reversal of fortune.

In summary, there is a trade-off between the benefits and costs of individualism and collectivism. Our narrative suggests that the benefits of individualism affect the output growth rate, while the costs of individualism affect the level of output. In the long run, the former effect, which is dynamic, should thus dominate the latter effect, which is static. Hence, despite the short-run trade-off, countries with a more individualistic culture should unambiguously grow faster and eventually enjoy a higher level of output. In what follows, we explore empirically whether cultural attributes such as individualism/collectivism are strong predictors of incomes, productivity, and innovation.

III. Data

A well-known measure of individualism (and other cultural dimensions) at the country level was developed by Hofstede (2001) who initially used surveys of IBM employees in about thirty countries. With new waves of surveys and replication studies, Hofstede's individualism index has been expanded to nearly 100 countries.[1] The individualism score measures the extent to which it is believed that individuals are supposed to take care of themselves as opposed to being strongly integrated and loyal to a cohesive group. Individuals in countries with a high score value personal freedom and status, while individuals in countries with a low score value harmony and conformity. Hofstede's index, as well as the measures of individualism from other studies, are based on factor analysis using a broad array of survey questions to establish cultural values. In Hofstede's analysis, the index of individualism is the first factor in work goal questions about the value of personal time, freedom, inter-

[1] The most current version of the data is available at http://www.geert-hofstede.com/. Appendix C provides the list of questions. See Hofstede (2001) for more details.

esting and fulfilling work, and so on. This component loads positively on valuing individual freedom, opportunity, achievement, advancement, and recognition and negatively on valuing harmony, cooperation, and relations with superiors. Similarly, the emphasis on harmony, cooperation, and good relations with superiors fits well with the notion of collectivism we have given and strongly suggests greater capacity for coordination within the group but also a stronger sense of conformity and a fear of sticking out. Although Hofstede's data were initially collected mostly with the purpose of understanding differences in IBM's corporate culture, the main advantage of his measure of individualism is that it has been validated in a number of studies. For example, across various studies and measures of individualism (see Hofstede, 2001, for a review) the United Kingdom, the United States, and the Netherlands are consistently among the most individualistic countries, while Pakistan, Nigeria, and Peru are among the most collectivist. Appendix figure D2 represents a world map of Hofstede's individualism scores.

The causality between individualism and economic outcomes can flow in both directions. More individualist countries may be wealthier because individualism fosters innovation. On the other hand, a more affluent economy may create a more individualistic culture. Indeed, there is a long tradition in the social sciences claiming that economic development affects a country's culture.

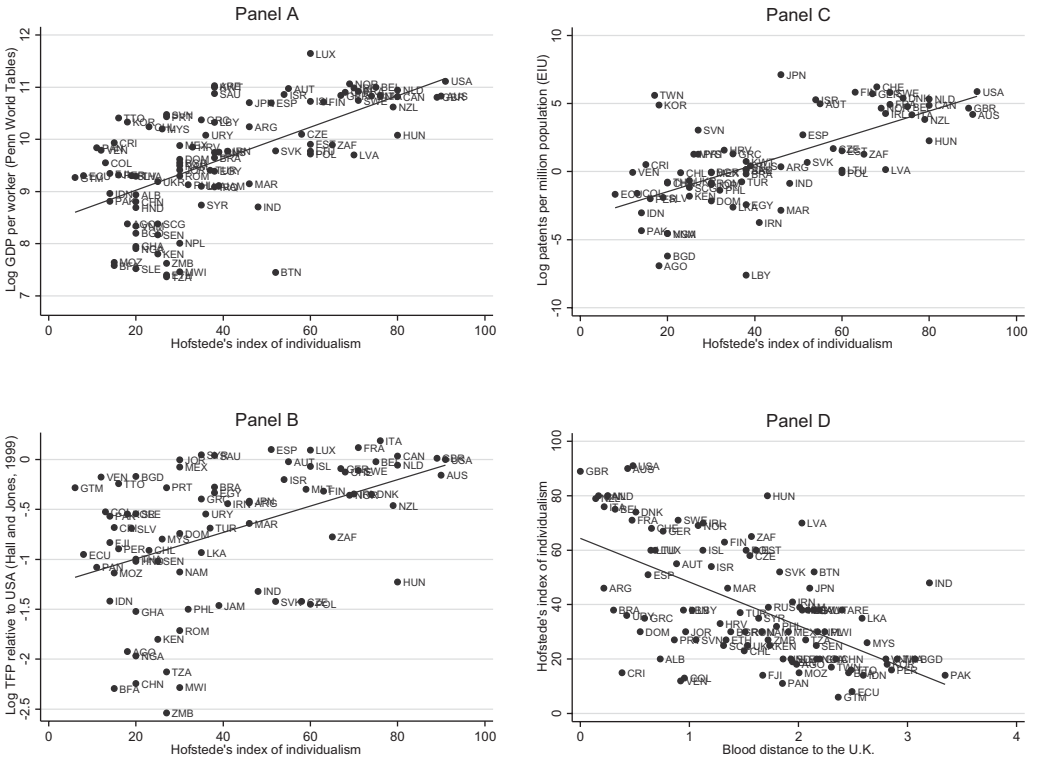
To address this potential endogeneity problem, we use a number of IVs. We first use genetic and epidemiological data that have been linked empirically to collectivism. Chiao and Blizinsky (2010) document a strong correlation between collectivism and the presence of a short (S) allele in the polymorphism 5-HTTLPR of the serotonin transporter gene SLC6A4. This allele is known to put individuals at greater risk for depression when exposed to life stressors. The mechanism linking individual genetic traits and culture is that a collectivist culture protects individuals from these stressors by embedding them more strongly in communities with strong social links, thus providing psychological support networks. These data are complemented by data assembled in Inglehart et al. (2014) for 43 countries. In addition, we use data from Way and Liebermann (2010) showing that collectivism is also strongly correlated with the G allele in polymorphism A118G in the μ-opioid receptor gene that leads to higher stress in case of social rejection. The argument is that collectivist culture can be seen as providing psychological protection from social rejection. These data are complemented by various other sources (see appendix F) for 34 countries. Finally, we use epidemiological data on pathogen prevalence put together by Murray and Schaller (2010) for 96 countries, complementing earlier work by Fincher et al. (2008).[2] Murray and Schaller argue that stronger pathogen prevalence pushed communities to adopt more collectivist values as a defense mechanism created to cope with greater pathogen prevalence by emphasizing tradition, putting stronger limits on individual behavior, and showing less openness toward foreigners.

We combine each of these IVs with a measure of genetic distance between people in different countries and perform statistical tests of overidentification to check whether genetic distance meets the exclusion restriction. As argued above, genetic markers can be used as a proxy for cultural transmission from parents to children. To be clear, we do not postulate a causal effect between genetic distance and cultural distance. Instead, we exploit the correlation between cultural and genetic transmission from parents to offspring. Since economic development is unlikely to affect genetic pools in a matter of a few centuries, one can reasonably expect that genetic distance is a good IV for differences in cultural attributes. These genetic data are taken from Cavalli-Sforza et al. (1994), who provide measured genetic markers for roughly 2,000 ethnic groups across the globe. As these authors discussed, genetic variation for countries not affected by massive colonization since 1500s was largely determined during the Neolithic migration of early humans thousands of years ago. We focus on neutral genetic markers that are not related to evolutionary fitness. Specifically, we use the Mahalanobis distance between the frequency of blood types in a given country and the frequency of blood types in the United Kingdom, the second most individualistic country in our sample.[3] Using the frequency of blood types is attractive because, apart from being neutral genetic markers (i.e., different blood types do not cause a higher level of intelligence, output, or individualism), the frequency of alleles determining blood types is the most widely available genetic information. Another key advantage of utilizing frequency of blood types is that we can exploit alternative sources of information (e.g., Red Cross; Mourant, Kopec, & Domaniewska-Sobczak, 1976; Tills, Kopec, & Tills, 1983) about frequency of blood types to corroborate our data from DNA studies. 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 $\bar{f}_{bc} = \sum_e s_{ec} f_{bec}$ where s_{ec} is the share of ethnic group e in the population of country c.

[2] Murray and Schaller (2010) use nine pathogens: leishmanias, trypanosomes, malaria, schistosomes, filariae, leprosy, dengue, typhus, and tuberculosis.

[3] The advantage of using distance relative to the United Kingdom is that United Kingdom's population is genetically more homogeneous than the population in the United States (the most individualistic in the world) and that the United Kingdom is often described as the cradle of individualism and the Industrial Revolution. Indeed, the share of indigenous (as of year 1500) population in the modern United Kingdom is over 94%. Results are very similar when we use distance to the United States. Note also that we get similar results when we use the distance to the most collectivist countries (including Guatemala, Pakistan, Mozambique, and Tanzania).

FIGURE 1.—INDIVIDUALISM AND ECONOMIC OUTCOMES



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 United States is from Hall and Jones (1999). Log patents per million population is taken from EIU (2007, 2009). Blood distance to UK is the Mahalanobis 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 United Knigdom.

In a series of robustness checks, we also employ aggregate measures of genetic distance constructed in Cavalli-Sforza et al. (1994) based on a larger set of markers and that were used in Spolaore and Wacziarg (2009). In addition, we employ an IV 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 this differentiation. Kashima and Kashima (1998) and others document that prohibition of pronoun drop is strongly correlated with individualism.[4] This IV was used in Licht et al. (2007) and other work studying the effects of culture on socioeconomic outcomes.

The sources of data on economic outcomes are standard. We take income per worker data in 2000 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). 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 argument is innovation, we proxy for the intensity of innovations with log patents per million population from Economist Intelligence Unit (2007, 2009; henceforth, EIU). EIU constructs patents per million population as the sum of patents granted to applicants (by residence) from the 82 economies by three major government patent offices: the European Patent Office, the Japanese Patent Office, and the U.S. Patent and Trademark Office. As documented by the EIU (2007, 2009), this measure is highly correlated with other proxies for innovation performance, such as UNIDO estimates 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.[5]

IV. Baseline Econometric Specification and Results

Our argument predicts that more individualistic countries should be more affluent since individualism encourages innovation. Figures 1A to 1C indeed show that more individualistic countries have higher levels of income, TFP, and rates of innovation. Figure 1D shows that countries with more individualistic cultures are genetically less distant

[4] For example, English does not allow dropping pronouns, and it is the only language that capitalizes "I."

[5] The timing of data collection for the variables is provided in appendix G.

TABLE 1—INCOME AND INDIVIDUALISM

		Instrumental Variables						
	OLS	Blood Distance from the United Kingdom	Frequency of Short (S) Allele in the Polymorphic Region 5HTTLPR of Serotonin Transporter Gene (SLC6A4)		Frequency of G Allele in Polymorphism A118G in μ-Opioid Receptor Gene		Historical Pathogen Prevalence Index	
			Separate	Combined with Blood Distance	Separate	Combined with Blood Distance	Separate	Combined with Blood Distance
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Second stage: Regression of log income per worker on individualism								
Individualism	0.030***	0.046***	0.022**	0.035***	0.020***	0.026***	0.050***	0.050***
	(0.003)	(0.007)	(0.010)	(0.008)	(0.006)	(0.006)	(0.006)	(0.006)
First stage: Regression of individualism on IV								
Alternative IV			−1.027***	−0.445	−1.494***	−0.690	−23.038***	−17.535***
			(0.223)	(0.300)	(0.312)	(0.480)	(2.138)	(2.239)
Blood distance		−15.929***		−13.051***		−13.452***		−8.461***
		(2.373)		(4.560)		(5.213)		(2.481)
Observations	96	96	43	43	34	34	96	96
R^2	0.377	0.277	0.475	0.324	0.507	0.540	0.178	0.215
First-stage *F*-statistic		45.04	21.18	21.46	22.97	25.56	116.1	66.53
Over-id test *p*-value				0.129		0.254		0.399

The dependent variable in the second stage is log income (at purchasing power parity) per worker in 2000 from the Penn World Tables. *Individualism* is Hofstede's index of individualism. The instrument in column 2 is the Mahalanobis 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 United Kingdom. The instrument in columns 3 and 4 is from Chiao and Blizinsky (2010) and Inglehart et al. (2014), in columns 5 and 6 from Way and Lieberman (2010), and additional sources (see appendix F) in columns 7 and 8 from Murray and Schaller (2010). In columns 3, 5, and 7, the set of instrumental variables does not include blood distance from the United Kingdom. In columns 4, 6, and 8 the set of instrumental variables includes the blood distance from the United Kingdom and an alternative instrumental variable shown in the heading of the column. *Over-id test p-value* reports the *p*-value for the overidentifying restriction tests that instruments are correctly excluded. Columns 1–6 do not include controls. Columns 3 and 4 exclude Trinidad and Tobago, which is identified as an outlier in the first-stage regression. Columns 5 and 6 exclude Nigeria, which is identified as an outlier in the first-stage regression. Robust standard errors in parentheses. Significant at ***0.01, **0.05, *0.10.

from the United Kingdom. The converse applies to countries with collectivist cultures.

These raw correlations, some of which were reported in Hofstede (2001), are informative but do not control for other factors and cannot be interpreted as causal relationships. To address these concerns, we employ the following basic econometric specification:

$$Y_i = \alpha IND_i + \beta X_i + e_i, \quad (1)$$

where i indexes countries, Y_i measures an economic outcome (e.g., log income per worker), IND_i is a measure of individualism, X_i is a vector of control variables, and e_i is the error term.[6] The vector X_i includes commonly used controls for geography such as countries' longitude and latitude, a dummy variable for being landlocked, and a set of dummy variables for continents. In addition to this standard set of geographic controls, we include the percentages of population practicing major religions from Barro and McCleary (2003) to ensure that our results are not driven by differences in the composition of people following various religions.

Table 1 presents the OLS and IV estimates for the basic specification (1) where the dependent variable is log income per worker. In the basic OLS regression, column 1, the coefficient on individualism is positive and significant. A one standard deviation increase in individualism (say, from the score of Venezuela to Greece, or from that of Brazil to Luxembourg) leads to a 66% increase in the level of income, a large effect. Taking the blood distance to the United Kingdom as instrument, column 2, yields a somewhat larger estimate of the coefficient on individualism. In columns 3 and 4, the key instrument is the frequency of the short (S) allele in the polymorphism 5-HTTLPR of the serotonin transporter gene SLC6A4, which makes people more prone to depression when facing stressful events. In columns 5 and 6, the key instrument is the G allele in polymorphism A118G in the μ-opioid receptor gene that leads to higher stress in case of social rejection. Finally, columns 7 and 8 use historical pathogen prevalence as an instrument. The first stages for all IV regressions (columns 2–8) are strong. By and large, the estimates are similar across the specifications.

Note that when we include blood distance as a second IV (columns 4, 6, and 8), the estimated coefficient remains similar in magnitude to what one can obtain using instruments separately. Furthermore, the overidentifying restriction tests cannot reject the null of IVs being correctly excluded at any standard significance level. The results of the overidentification test, together with the coefficient magnitudes that are roughly similar, strongly suggest that blood distance picks up the link between genetic distance and cultural distance along the individualism-collectivism dimension. Spolaore and Wacziarg (2009) interpreted instead genetic distance as a proxy for barriers to the diffusion of knowledge. But how geographical distance, a prominent barrier to diffusion, affects individualism should not

[6] In appendix table D2, we report results for growth rates over long periods (data constructed in Maddison, 2003).

TABLE 2—INDIVIDUALISM AND ECONOMIC OUTCOMES

	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Continent dummies	No	Yes	No	Yes	No	Yes	No	Yes
Controls	No	No	Yes	Yes	No	No	Yes	Yes
				A. Log Income per Worker				
Individualism	0.030***	0.025***	0.017***	0.018***	0.046***	0.041***	0.027***	0.029***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.007)	(0.008)	(0.009)	(0.009)
Observations	96	96	96	96	96	96	96	96
R^2	0.377	0.631	0.707	0.753	0.277	0.557	0.690	0.734
First-stage F-statistic					45.04	22.69	14.31	13.35
First-stage partial R^2					0.341	0.234	0.192	0.181
				B. Total Factor Productivity from Hall and Jones (1999)				
Individualism	0.013***	0.012***	0.012***	0.014***	0.023***	0.027***	0.030***	0.031***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.007)	(0.008)	(0.007)
Observations	77	77	77	77	77	77	77	77
R^2	0.202	0.402	0.595	0.666	0.087	0.247	0.465	0.551
First-stage F-statistic					49.48	21.34	18.91	20.77
First-stage partial R^2					0.417	0.290	0.289	0.273
				C. Log Patents per Capita				
Individualism	0.099***	0.091***	0.071***	0.074***	0.129***	0.145***	0.130***	0.130***
	(0.012)	(0.012)	(0.016)	(0.016)	(0.023)	(0.030)	(0.037)	(0.035)
Observations	72	72	72	72	72	72	72	72
R^2	0.438	0.566	0.734	0.782	0.397	0.482	0.690	0.744
First-stage F-statistic					39.92	17.90	12.69	11.55
First-stage partial R^2					0.345	0.217	0.238	0.212

In panel A, the dependent variable is log income (at purchasing power parity) per worker in 2000 from the Penn World Tables. In panel B, the dependent variable is log total factor productivity relative to the United States from Hall and Jones (1999). In panel C, the dependent variable is log patents per million population taken from EIU (2007, 2009). Individualism is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. The instrument is the Mahalanobis 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 United Kingdom. Controls include a dummy for landlocked countries, the percentages of population practicing major religions in a country, and absolute values of country longitude and latitude. Robust standard errors in parentheses. Significant at ***0.01, **0.05, *0.10.

be systematically related to how, for example, a particular variation in the serotonin transporter gene SLC6A4 affects individualism. While our measure of blood distance might a priori reflect such barriers, the variation in SLC6A4 cannot be reasonably suspected of directly reflecting barriers to the diffusion of knowledge. If our measure of blood distance were to be interpreted as a measure of barriers in the diffusion of knowledge, then the coefficient on individualism in the second-stage regression should be quite different when we use two IVs (blood distance and the other genetic/epidemiological variable) compared to when we use only one IV (the other genetic/epidemiological variable). Indeed, if that were the case, these different IVs would pick different aspects of the variation in individualism, thus leading to different estimates and rejection in the test of over identifying restrictions. As we can see from table 1, this is not the case. The results in table 1 are thus consistent with both IVs picking up approximately the same aspects of the variation in individualism, confirming our interpretation of blood distance as a proxy for cultural distance. These clarifications are important because even if the IVs used in columns 3 and 5 are much more directly related to individualism and collectivism, they are currently available only for, respectively, 43 and 34 countries. Given that our blood distance IV covers many more countries and it passes the overidentification test in table 1 despite its potentially lower plausibility as an IV, for the rest of the paper, we use blood distance as an IV so that we can have additional robustness checks with more controls and subsamples, as well as more statistical power to reach sharper conclusions.[7]

In table 2, we introduce continental dummies (columns 2, 4, 6, and 8) and geographical controls for landlocked countries, absolute values of country longitude and latitude, and controls for the percentages of population practicing major religions (columns 3, 4, 7, and 8). The first four columns are OLS, and the next four are IV regressions. Even after controlling for these variables, we find a strong, robust relationship between individualism and log income per worker (panel A). The effect of individualism on TFP (panel B) is also strong but smaller than the effect on income. This is an expected outcome since differences in income per worker are due to differences in factor accumulation on top of differences in TFP.

Finally, we perform a more direct test of our theory by regressing a measure of innovation on individualism (table 2, panel C). With and without controls, we see a strong, robust effect of individualism. This finding is consistent with experimental evidence (Goncalo & Staw, 2006) showing that groups populated by individualistic persons generate more creative solutions to problems than groups populated by collectivist persons. This finding also highlights

[7] In appendix table D6, we show that the result survives when we use distance relative to the United States (the most individualistic country), use frequencies of blood types A and B separately, use Red Cross data on blood type frequencies, use the genetic distance data from Spolaore and Wacziarg (2009), use the prohibition of pronoun drop as an instrument, or use dyadic regressions (with and without country fixed effects).

TABLE 3—INCOME AND INDIVIDUALISM BY REGION

	Asia	Europe	Africa	America	Africa, Asia, and Europe	Africa and Asia	OECD	Non-OECD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. OLS								
Individualism	0.040**	0.025***	0.039**	0.018***	0.030***	0.040***	0.016***	0.027***
	(0.015)	(0.005)	(0.015)	(0.003)	(0.005)	(0.010)	(0.005)	(0.007)
Observations	22	34	18	19	74	40	30	66
R^2	0.227	0.444	0.306	0.465	0.639	0.490	0.295	0.478
B. IV								
Individualism	0.050**	0.061**	0.098**	0.024***	0.063***	0.065***	0.040***	0.058***
	(0.025)	(0.025)	(0.046)	(0.007)	(0.017)	(0.024)	(0.014)	(0.022)
Observations	22	34	18	19	74	40	30	66
R^2	0.214	−0.471	−0.358	0.413	0.439	0.420	−0.354	0.300
First-stage F-statistic	4.879	4.649	4.815	8.448	11.46	8.171	8.409	8.004
Partial R^2	0.262	0.131	0.179	0.335	0.150	0.204	0.267	0.118

The dependent variable is log income (at purchasing power parity) per worker in 2000 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 Mahalanobis 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 United Kingdom. The specification in columns 1–4 does not include controls. The specification in columns 5–8 includes continent dummies. Robust standard errors in parentheses. Significant at ***0.01, **0.05, *0.10.

that although countries may achieve a larger level of total factor productivity via diffusion of existing knowledge and willingness of people in individualistic cultures to accept new goods and services, as well as new ways of producing goods and services, individualism affects the creation of knowledge. In other words, individualism not only helps countries to approach the technological frontier, it also pushes the frontier.

To assess whether the magnitudes of individualism's effect on economic outcomes are plausible, consider differences between Italy's south and north, a prime example of the importance of cultural effects. In his classic book, Putnam (1994) argues that northern Italy is culturally similar to Switzerland and Germany (Switzerland has an individualism score of 68) while southern Italy is similar to Spain (the score is 51). Our baseline results (column 1 in table 2, panels A and B) predict that the difference in income per capita and TFP between Italy's north and south should respectively be $0.030 \times 17 \approx 49\%$ and $0.013 \times 17 \approx 22\%$. According to Italy's statistical office, income per capita in southern regions is about 50% lower than income per capita in northern regions. Using the methods developed in Hall and Jones (1999), Aiello and Scoppa (2000) estimate the difference in TFP across the two regions to be 27%. Thus, predictions from our cross-country regressions are remarkably similar to within-Italy variation in incomes and productivity and validate our parameter estimates.

Note that China is not at all an outlier in our estimations. Despite its very fast growth for recent last decades, China still remains relatively poor. Figure 1A illustrates that China is roughly half a log point below the regression line; it would have to grow by more than 50% before it crosses the regression line. Even if China's income per worker were as high as that of Mexico (approximately halfway between triple and quadruple of the observed income per worker in China), China would continue to look like a fairly typical case.

V. Exploring Other Channels

By focusing on the individualism/collectivism dimension, specification 1 does not include other potentially important determinants of economic development. To the extent these determinants are positively correlated with individualism, one may overstate the contribution of individualism to long-run growth. In this section, we address this concern about omitted variables.

A first major objection could be that our results reflect migration patterns from the colonization era in which European immigrants settled the Americas and Oceania. If our theory explains income differences at the global scale, it is reasonable to expect our theory to explain income differences within continents. These concerns are important; Albouy (2012), for example, argues that the institutionalist theory of economic development has weak or no empirical support when tested within continents. Table 3 reports regression estimates for each continent separately and for OECD only. Our basic finding that individualism leads to higher income per worker is largely confirmed. 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 likely reflects the fact that variation in incomes and individualism is more compressed in these countries, and thus measurement errors can have a stronger attenuation bias. This 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 individualism scores similar to those for Argentina and Spain, whereas Mozambique, Ghana, and Burkina Faso have some of the lowest scores in the world. Column 5 gives results for Africa, Europe, and Asia where there was no massive migration of European settlers. Note that the coefficient in the IV estimation is even larger than in the results from table 1 where the Americas and Oceania were included.

TABLE 4—INCOME AND INDIVIDUALISM BY INTENSITY OF MIGRATION FLOWS

Dep.Variable: Log Income per Worker in 2000	Baseline		Share of Indigenous People (as of 1500) in Current Population					
			0.8		0.9		0.95	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Individualism	0.030***	0.046***	0.040***	0.052***	0.040***	0.049***	0.045***	0.054***
	(0.003)	(0.007)	(0.004)	(0.008)	(0.005)	(0.009)	(0.005)	(0.011)
Observations	96	96	60	60	46	46	35	35
R^2	0.377	0.277	0.485	0.443	0.511	0.481	0.572	0.550
First-stage F-statistic		45.04		50.77		36.00		19.63
Partial R^2		0.341		0.462		0.456		0.431

The dependent variable is log income (at purchasing power parity) per worker in 2000 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 Mahalanobis 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 United Kingdom. In columns 3–8 using the data on migration flows since 1500 from Putterman and Weil (2010), we restrict the sample of countries to those having today a share of people indigenous as of 1500 at the level of more than 80%, 90%, and 95%. Robust standard errors in parentheses. Significant at ***0.01, **0.05, *0.10.

Another concern is related to cross-country migration flows that occurred over the centuries. Countries with bigger economic opportunities could have attracted migrants from places that also happened to have more individualistic cultures. To address this concern, we use the Putterman and Weil (2010) data on migration flows between 1500 and 2000. In column 1 of table 4, we replicate baseline OLS and IV regressions for our full sample. Then we gradually restrict the sample to countries whose share of indigenous population as of 1500 in today's population is larger than, respectively, 80% (columns 3 and 4), 90% (columns 5 and 6), and 95% (columns 7 and 8). We thereby eliminate countries that witnessed large migration flows since 1500. The coefficients remain highly significant as we restrict the sample and the point estimates get larger. The results of table 4 thus rule out the idea that our results reflect only migration patterns (most important, European settlers in the colonization period of the last 500 years) or the effects of being European (i.e., differences in individualism are not about Europe versus the rest of the world).

A second major objection could be that individualism proxies for other forces of economic development. For example, the quality of institutions has been shown to be a major cause of long-run growth (see Acemoglu et al., 2001). Because cultural attributes and institutions are correlated, culture might simply capture the effect of institutions. One needs to establish whether individualism has an effect separate from the effect of institutions and other potentially confounding forces.

Table 5 reports estimates of the effect of individualism when we control for a variety of additional factors that have been investigated in the empirical literature on growth, as well as other channels that might link individualism or genetic distance to growth. For example, individualism may be correlated with trust, which is often interpreted as a cultural norm that reduces transaction costs; as a measure of social capital, reflecting the density of social networks; or as a culture of participation and citizenship. Using generalized trust from the World Values Survey, we find a positive correlation between log income per worker and trust, but it is not robust. Once we regress log income per worker on both individualism and trust, trust ceases to be significant, while individualism remains robustly significant and quantitatively important.[8] In Gorodnichenko and Roland (2011), we examine a large number of alternative available measures of culture (including the other Hofstede indicators) and conclude that there is no robust effect on growth from cultural dimensions that are independent of the individualism-collectivism dimension. When analyzing the effect of culture on growth, the individualism-collectivism dimension thus appears to be the most robust relevant cultural variable. Note that this further validates our use of genetic distance as a valid instrument for individualism since other cultural channels are either nonrobust or are correlated with individualism.

One may argue that individualism is likely to arise only when the level of education is high, and thus that individualism may proxy for the quality of human capital. To rule out this alternative explanation, we control for the Barro-Lee measure of average years of schooling for people over the age of 15. This variable is only significant in regressions on log TFP (columns 5 and 6), and its inclusion does not affect the significance of individualism. We also control for average protection against expropriation risks, the share of people with a European descent in 1900, and legal origins, three popular measures of institutional quality. While legal origins and the share of people with a European descent do not have a robust association with our economic outcomes, protection against expropriation risks has a strong and robust association with the outcomes. Including these measures as additional regressors, however, does not alter our conclusions about the strong effects of individualism on income, patents, and productivity.[9]

Likewise, ethnic fractionalization, found in the literature to be associated with weaker institutions, and hence lower levels of output, does not appear to be a robust predictor of output, patents, or productivity. Furthermore, we do not find a statistically significant relationship between ethnic fractio-

[8] Although the raw correlation between trust and genetic distance is significant, this correlation disappears after controlling for basic factors such as longitude/latitude and landlocked dummy.

[9] In appendix tables D3–D5, we provide additional results for how controlling for the quality of institutions influences our estimates.

TABLE 5—EFFECT OF INDIVIDUALISM AFTER USING EXTENDED CONTROLS

	Log Income per Worker		Log Patents per Capita		Log TFP (Hall & Jones, 1999)	
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
Individualism	0.012**	**0.034*** **	0.065***	**0.165*** **	0.014**	**0.029*** **
	(0.005)	**(0.012)**	(0.019)	**(0.046)**	(0.006)	**(0.008)**
Trust	0.000	0.001	−0.002	0.002	0.002	0.002
	(0.003)	(0.002)	(0.008)	(0.008)	(0.002)	(0.002)
Protection against expropriation risk	0.105***	0.113***	0.427***	0.484***	0.098***	0.111***
	(0.016)	(0.014)	(0.061)	(0.077)	(0.020)	(0.018)
Years of schooling	0.022	−0.047	0.196	−0.099	−0.132**	−0.198***
	(0.041)	(0.048)	(0.206)	(0.237)	(0.054)	(0.044)
Ethnic fractionalization	−0.215	−0.331	−0.954	−1.322	−0.218	−0.163
	(0.320)	(0.309)	(0.876)	(1.052)	(0.313)	(0.280)
Legal origin						
French	0.214	0.329*	0.155	0.564	0.284	0.321*
	(0.228)	(0.192)	(0.566)	(0.454)	(0.194)	(0.164)
German	0.225	0.418*	1.428**	2.358***	0.193	0.326*
	(0.230)	(0.224)	(0.685)	(0.740)	(0.228)	(0.191)
Scandinavian	0.203	0.856	0.732	2.299	−0.041	0.174
	(0.588)	(0.634)	(1.630)	(1.804)	(0.811)	(0.638)
Log geographic distance from the United Kingdom	−0.013	0.109	0.031	0.872	−0.094	−0.023
	(0.205)	(0.180)	(0.446)	(0.589)	(0.190)	(0.140)
Share of Europeans, 1900	0.003	0.000	−0.035**	−0.054***	0.006	0.001
	(0.005)	(0.005)	(0.013)	(0.017)	(0.005)	(0.005)
Diffusion speed						
Intensive margin	0.491	0.312	3.638	4.829*	1.383**	1.303***
	(0.467)	(0.543)	(2.281)	(2.859)	(0.592)	(0.455)
Extensive margin	0.001	−0.008	−0.016	−0.080	−0.011	−0.018**
	(0.008)	(0.009)	(0.036)	(0.050)	(0.009)	(0.007)
Observations	74	74	64	64	62	62
R^2	0.914	0.873	0.928	0.851	0.869	0.841
First-stage F-statistic		7.547		6.856		14.230
Partial R^2		0.109		0.152		0.294

The dependent variable is log income (at purchasing power parity) per worker in 2000 from the Penn World Tables. In columns 1 and 2, log patents per million population taken from EIU (2007, 2009) in columns 3 and 4, and log total factor productivity (TFP) from Hall and Jones (1999) in columns 5 and 6. Individualism is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. The instrument is the Mahalanobis 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 United Kingdom. Legal origin is from La Porta et al. (1998). British legal origin is the omitted category. 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. Trust is percent of people agreeing that strangers can generally be trusted from the World Values Survey. Years of schooling is the average number of years of schooling for 15+ population in 1970 (from: Barro & Lee, 2001). Ethnic fractionalization is from Fearon (2003). Geographic distance from the United Kingdom is population-weighted distance taken from the CEPII database (http://www.cepii.fr/anglaisgraph/bdd/distances.htm). Share of Europeans in 1900 is from Acemoglu et al. (2001). Intensive margin and Extensive margin of technology diffusion are from Comin and Mestieri (2013). All regressions include controls (a dummy for landlocked countries, percentages of population practicing major religions in a country, and absolute values of country longitude and latitude) and continent dummies. The instrumented variables are in bold. Robust standard errors are in parentheses. Significant at ***0.01, **0.05, *0.10. Estimates on the instrumented variables are statistically significant at least at the 5% level when inference robust to weak instrumental variables (e.g., Anderson-Rubin) is used.

nalization, which also proxies for diversity, and output or any change in the estimates of the coefficients on individualism when we augment this specification with nonlinear terms in ethnic fractionalization (not reported); therefore, our results for individualism are different from and not confounded by the diversity effects emphasized by Ashraf and Galor (2013).

One may argue that individualism is likely to arise only when the level of education is high, and thus that individualism may proxy for the quality of human capital. To rule out this alternative explanation, we control for the Barro-Lee measure of average years of schooling for people over the age of 15. We find that its inclusion does not affect the significance of individualism.

Genetic distance may reflect geographical distance and thus international transport costs (see Giuliano et al., 2014) rather than cultural differences. To address this concern, we introduce the log of the population-weighted distance of a country from the United Kingdom, which proxies for transportation costs to and from the United Kingdom. Although this distance variable is negatively correlated with the log of income per worker, when it is combined with the individualism score, it is not statistically significant, while individualism remains robustly significant in both the OLS and IV specifications.

We argue that individualism's effect on growth works through a higher level of innovation. It is possible, however, that instead of creating new technologies and products, individualism leads to higher income and productivity only or mainly through faster absorption of existing technologies, Fogli and Veldkamp (2012) argued. In other words, diffusion of technologies may be faster in more individualistic societies, leading these societies to enjoy higher levels of productivity and income. We have already shown that individualism influences the intensity of creation of new technologies and goods as measured by patents. To further separate these two channels, we control for the extensive margin (the average time lag for a technology to appear in a country since the technology is invented) and the intensive margin (the speed at which a technology spreads in a country) of technology diffusion constructed by Comin and Mestieri (2013). Specifically, we average the values of a margin for each country across 25 technologies (e.g., Internet, synthetic fiber, cars) and use these averages

as additional regressors. If the diffusion channel matters more than the innovation channel, we should observe individualism becoming statistically and economically insignificant once we control for measures of the speed of technology diffusion. If the opposite is true, then including measures of the speed of technology diffusion should have no material effect on the estimated coefficients on individualism. We find that while these two margins of diffusion are strongly correlated with our outcome variables, the margins are not systematically correlated with the outcomes once we control for other country characteristics. Moreover, the coefficients on individualism are barely affected, suggesting that individualism matters more because of the innovation channel than because of the speed of diffusion channel. Again, this is clear evidence consistent with the channel we posit in this paper between individualism and long-run growth.

The control function approach adopted in table 5 is likely to bias the estimate of the downward effect of individualism. Indeed, many of the controls (e.g., trust, education) are potentially endogenous, but we do not have credible instruments for all of these variables, and the data sets for which all instruments could overlap would be considerably smaller. These potentially endogenous regressors are likely to be correlated with our IVs, and the error terms across first- and second-stage regressions are plausibly positively correlated. Therefore, by not instrumenting these potentially endogenous variables, our IV regressions in table 5 are likely to attribute some of the effects of individualism to these other regressors (see appendix B for a more formal derivation of this result). Thus, one could interpret our estimates on the individualism coefficients as conservative, and if we find a significant positive effect of individualism on growth, the true effect is likely to be larger.

In summary, although genetic distance may be correlated with noncultural factors or cultural factors other than individualism, none of the popular alternatives alters our main result that individualism plays an important role in determining economic development.

VI. Causal Channels between Culture and Institutions

Given that individualism plays a role that is independent of institutions, we naturally want to examine whether individualism affects institutions or vice versa. Arguments could go both ways. One can reason 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 in previous centuries 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 reappropriation of the Greek culture of rationality and democracy. The French Revolution led to 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 or dynasty by another one (Finer, 1997) because the Chinese imperial system was in line with the Confucianist culture and its view of the "good emperor" as a father figure with moral duties toward the people. Within that culture, dissatisfaction of the population tended to be interpreted as resulting from having a "bad" emperor. Replacing the latter with a "good" emperor who would behave according to the Confucianist moral canons was seen as the appropriate response. Culture can thus be argued to affect institutional choices of a society. One can also make a case in favor of an opposite causal channel. People lived for centuries under empires characterized by different institutional organizations—the Chinese imperial system, the Ottoman Empire, or the Austro-Hungarian Empire, for example. The administrative apparatus of empires (as well as of smaller political entities) made it possible to influence the worldview of people living within its boundaries, usually by spreading religions such as Islam under the Ottoman Empire or Catholicism under the Austro-Hungarian Empire. Confucianism became widespread in China in part because it was adopted as the official ideology of the empire as early as the Han dynasty. Institutions can thus be argued to have affected the spread of a specific culture, and also the degree of individualism and collectivism.

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:

$$INST_i = \upsilon_0 IND_i + \beta_0 X_i + e_i, \tag{2}$$

$$IND_i = \upsilon_1 INST_i + \beta_1 X_i + u_i, \tag{3}$$

where *INST* is a measure of institutions (i.e., protection against expropriation risk as in Acemoglu et al., 2001), *IND* is a measure of individualism, *X* is a vector of controls, and *e* and *u* are error terms. In equation (2) individualism is instrumented with the blood distance we constructed before. In equation (3) protection against expropriation risk is instrumented with settler mortality.

The results for equation (2) are reported in panel A of table 6. The effect of individualism on the strength of economic institutions is positive and significant, implying a causal effect of individualistic culture on institutions.[10] This finding corroborates Licht et al. (2007), who found similar results using different measures for culture and institutions. We report results for equation (3) in panel b of table 6. They indicate that causality also flows from institutions to culture when the instrument settler is mortality from Acemoglu et al. (2001). However, that effect ceases to be significant once one introduces settler mortality from Albouy (2012), and the first-stage fit becomes quite poor (panel C). One must, however, be careful in interpreting all these

[10] The sample size is restricted to be the same across panels in table 6. The estimates of υ_0 tend to be larger and more precisely estimated (thus yielding high statistical significance) when we allow for the maximum country coverage.

TABLE 6.—CULTURE AND INSTITUTIONS

	OLS	IV			
	(1)	(2)	(3)	(4)	(5)
Continent dummies	No	No	Yes	No	Yes
Controls	No	No	No	Yes	Yes
A. Dependent Variable = Protection against Expropriation Risk; Instrument = Blood Distance					
Individualism	0.081***	0.087***	0.061	0.093**	0.061
	(0.017)	(0.033)	(0.045)	(0.042)	(0.054)
Observations	39	39	39	39	39
R^2	0.249	0.247	0.379	0.261	0.403
First-stage F-statistic		10.56	9.585	10.99	7.264
First-stage partial R^2		0.319	0.295	0.252	0.235
B. Dependent Variable = Individualism; Instrument = Setter mortality					
Protection against expropriation risk	3.083**	6.466***	7.701***	5.696***	7.001***
	(1.155)	(1.622)	(2.467)	(1.773)	(2.471)
Observations	39	39	39	39	39
R^2	0.249	−0.051	−0.107	0.122	0.082
First-stage F-statistic		15.41	5.170	9.157	4.054
First-stage partial R^2		0.379	0.206	0.298	0.186
C. Dependent variable = Individualism; Instrument = Setter Mortality (Albouy)					
Protection against expropriation risk	3.083**	8.617**	12.723	8.044	11.278
	(1.155)	(4.115)	(14.101)	(6.616)	(15.585)
Observations	39	39	39	39	39
R^2	0.249	−0.552	−1.629	−0.366	−1.015
First-stage F-statistic		2.720	0.495	1.115	0.313
First-stage partial R^2		0.108	0.0271	0.0553	0.0194

Individualism is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. Protection against expropriation risk (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 Mahalanobis 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 United Kingdom. The instrument for institutions (Economic risk) is Settler mortality from Acemoglu et al. (2001) and Settler mortality (Albouy) from Albouy (2011). Controls include a dummy for landlocked countries and absolute values of country longitude and latitude. Robust standard errors in parentheses. Significant at ***0.01, **0.05, *0.10.

results since they are based on only 39 observations, the countries for which the data on culture and institutions and their instruments overlap. In short, culture appears to have a causal effect on institutions and is itself influenced by institutions, although the latter direction of causation is less clear-cut than the former.

VII. Within-Country Evidence

Cross-country analysis may fail to control fully for differences in institutional factors or other sources of cross-country differences. However, we can examine the effect of culture within a given country, thereby holding institutional factors constant. Furthermore, by exploring within-country variation, we can rule out alternative explanations based on differences in for example diffusion costs or geography. Our model predicts that more individualistic cultures should ceteris paribus stimulate persons to choose research-oriented occupations that require independent thought and deviation from traditional ways of doing things. The unique feature of the United States as a country of immigrants from all over the world makes it an interesting object in studying the effects of culture. The epidemiological approach to culture pioneered by Fernandez and coauthors (see Fernandez, 2010), Giuliano (2007), and others exploit this feature. We use ethnicity, age, gender, birthplace, and educational attainment from the 1% and 5% public microdata (IPUMS) of the U.S. Census in 1970 and 2000, respectively. For the 2000 Census, ethnicity is based on the respondent's self-reported country of ancestry. For the 1970 Census, ethnicity is based on the respondent's response about the father's birthplace. Our sample includes only employed males aged 25 to 60 who have nonmissing information on ancestors (country of origin). We constrain the sample to individuals with nonmissing ethnicity information because we focus only on individuals who associate themselves with a particular culture (which could be different from the American one) and are likely to observe the traditions of their original cultures. We exclude women, those who are unemployed, and other ages to minimize the various possible selection effects.

We consider two subsamples. The first sample split is determined by whether an individual is born in the United States so that we can attenuate the effects of high-human-capital migration into the United States (high-human-capital migration from countries with low level of individualism could create a sample of highly individualistic U.S. persons from these countries, and thus the difference between persons from individualistic and collectivist cultures would not be reflected in the sample). The second sample split is based on educational attainment: all persons versus persons with a bachelor's (or higher) degree. The higher the level of education, the smaller should be the effect of differences in initial conditions and abilities across ethnicities on the estimates.

Our approach has two steps. In the first step, we estimate the following probit:

$$ROO_i = \Phi(X_i\beta + \Sigma_k \alpha_k D_{ik} + \text{error}), \quad (4)$$

TABLE 7.—PROPENSITY TO CHOOSE RESEARCH-ORIENTED OCCUPATIONS IN THE UNITED STATES

	2000 U.S. Census		1970 U.S. Census	
	Persons with All Levels of Education	Persons with Bachelor's Degree or Higher	Persons with All Levels of Education	Persons with Bachelor's Degree or Higher
	(1)	(2)	(4)	(5)
U.S.-born persons				
Individualism	0.008***	0.023***	0.011**	0.023***
	(0.002)	(0.005)	(0.005)	(0.008)
Observations	81	81	61	53
R^2	0.123	0.188	0.081	0.141
All persons				
Individualism	0.005***	0.016***	0.014***	0.028***
	(0.001)	(0.004)	(0.004)	(0.007)
Observations	81	81	63	63
R^2	0.131	0.181	0.130	0.209

The table reports Huber-robust estimate of parameter θ in specification 5. The dependent variable is the set of estimated coefficients α_k from regression. Individualism is Hofstede's index of individualism. A larger value of the index corresponds to a greater level of individualism. The definition of research-oriented occupations includes Life, Physical, and Social Science Occupations (codes 160–196 in the 2000 Census occupational classification system recorded in the IPUMS variable OCC). Ethnicity in the 2000 Census is based on the respondent's self-reported ancestry or ethnic origin (IPUMS variable ANCESTR1). Ethnicity in the 1970 Census is based on the respondent's response about father's place of birth (IPUMS variable FBPL). Standard errors in parentheses. Significant at ***0.01, **0.05, *0.10.

where i and k index individuals and ethnic groups, ROO is a dummy variable equal to 1 if an individual has a research-oriented occupation and 0 otherwise, D is a set of dummies of each ethnicity, and the vector X includes controls such as age, age squared, and a set of dummies for educational attainment. The omitted category in the set of ethnic dummy variables is British since the United Kingdom is the second most individualistic country in our sample.

In the second step, we estimate the following specification:

$$\hat{\alpha}_k = \theta \times IND_k + \text{error}, \tag{5}$$

where $\hat{\alpha}_k$ is the set of estimated coefficients $\hat{\alpha}$ in regression and IND is Hofstede's individualism score. Our theory predicts that θ should be positive.

Table 7 presents estimates of θ in regression (5). Note that $\hat{\theta}$ is larger when we constrain the sample to U.S.-born persons, as well as those with a certain educational threshold. The estimates of θ indicate that those from individualistic cultures are more likely to take research-oriented occupations than people from collectivist cultures. These estimates do not prove that people from individualist cultures are more successful at innovation than people from collectivist cultures, but they clearly suggest that culture is at work in the choice of such occupations.

VIII. Conclusion

We consider the hypothesis that individualism/collectivism can influence innovation and long-run growth and test this hypothesis using cross-country and microlevel data. We show a strong relationship between these cultural attributes and economic outcomes even after controlling for a broad range of alternative explanations. Although one should be cautious in interpreting our results as causal—we rely on nonexperimental data and therefore cannot rule out omitted factors completely—our IV estimates, as well as a large battery of checks and tests, provide a preponderance of evidence suggesting a plausible causal interpretation of this relationship.

There are many pitfalls to avoid in interpreting our results. By no means should our (or other) research on economic effects of culture be seen as implying a ranking of cultures in the world or a call for cultural revolution. On the contrary, this research is aimed at a better understanding of the effects of different cultures with deep roots in history and change very slowly. Identifying effects of cultural differences 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 aid. Depending on the strengths of various cultures, different emphases may have to be put on a spectrum of available policy tools. For example, aid for programs providing public goods may be more effective in collectivist societies than in individualist societies. 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, special effort might be needed 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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