TRUST, LANDSCAPE, AND ECONOMIC DEVELOPMENT

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This paper examines the effect of trust on economic development. The key difficulty in estimating a causal effect of trust on economic development, is that it is endogenous to economic development. Therefore, to identify a causal effect from a cultural variable such as trust to economic development, we have to find some exogenous source of variation in trust. This paper estimates the effect of trust on economic development using new instrumental variables. The instruments used for trust are the mean elevation and the terrain ruggedness. In this context, the paper examines the relationship between trust and the logarithm of real Gross Domestic Product per capita. The paper focuses on trust in people from another nationality, trust in people from another religion, trust in people you know personally, trust in people you meet for the first time, trust in your family, and trust in your neighborhood. The results show that these variables have a statistically significant positive association with economic development. These results are robust after the inclusion of control variables such as the fractionalization indicator, continental dummies, and indicators for the legal origin and the colonial origin. The paper also conducts two stage least squares regressions. The second stage is a regression of the logarithm of real Gross Domestic Product per capita on each of the trust variables. In the first stage, the geographic factors that statistically explain trust, such as elevation and terrain ruggedness, are used as instrumental variables. The results of the empirical estimation show that trust, instrumented by these geographic variables, explain cross country variations in economic development.

Keywords: Geography, Trust, Economic Development
JEL classification: O1, N1, Z1

1.   INTRODUCTION

This paper examines the effect of trust on economic development. There is a growing literature that argues that trust is one of the main determinants of current economic development. According to these studies, a prerequisite for the success of market economies is to depart from closed group interactions and to expand transactions

to anonymous others. In this context, trust facilitates the extension of anonymous exchange. Trust is also likely to improve the functioning of institutions as it minimizes the need for external enforcement of contractual agreements. This decreases the cost of transactions. On the other hand, lack of trust is associated with suspicion and fear of fraud. This increases the cost of transactions. Thus, generalized trust and trustworthiness are considered essential for successful economic performance. Accordingly, trust is expected to have a positive association with economic development.

Nevertheless, the literature cannot determine easily the causal effect of trust on economic development. The key difficulty in estimating a causal effect of trust, as a component of culture, is that it is endogenous to economic development. Some studies, such as Inglehart and Baker (2000), argue that the modernization theory stresses that economic development has predictable effects on culture and social life. Other studies argue that industrialization produces pervasive social and cultural consequences. Therefore, to identify a causal effect from a cultural variable such as trust to economic development, we have to find some exogenous source of variation in trust. In other words, when we estimate the effect of trust on economic development, we have to use instrumental variables.

The purpose of this paper is to identify new instruments for trust. The instruments used are the geographic characteristics pertinent to the topography of the terrain in a country. Specifically, the mean elevation and the terrain ruggedness are used as instrumental variables for trust. Elevation and terrain ruggedness reflect natural barriers that impede different groups of people from communicating and interacting with each other. These inconsistent landscapes can hinder the feeling of trust and possibly exacerbate a sense of alienation and suspicion towards others who are kept at a distance by the uneven topographic features of the terrain. Rugged terrain also hinders trade between communities. This does not allow the members of these communities an opportunity for interaction and communication that permits trust to flourish. Rugged terrains are also costly to traverse, which does not facilitate mobility and travel from one area to another. This serves as an impediment to communication between different groups of people who are separated from each other by the irregular features of the terrain.

There are several studies that investigated the effect of trust on economic development and long run economic growth. For instance, Knack and Keefer (1997) investigate whether social capital has an economic payoff by exploring the relationship between interpersonal trust and economic performance. In their empirical analysis, they focus on the role of trust as the most important indicator of social capital. The results show a statistically significant effect of trust on growth. Zak and Knack (2001) extend their analysis by adding other countries to the sample. The authors also conclude that trust has a significant effect on aggregate economic activity. Guiso *et al*. (2009) address the question of whether cultural biases affect economic exchange using data on bilateral trust between European countries. The authors attempt to explain why the perception of trustworthiness differs so greatly across Europe, and explore the economic consequences

of these perceptions on trade, foreign direct investment, and foreign portfolio investment. The authors find that trust is affected by cultural aspects of the trusting and the trusted country, such as their history of conflict, and religious, genetic and somatic similarities. They also find that lower bilateral trust leads to less trade between the two countries, less foreign direct investment and less foreign portfolio investment. Tabellini (2010) estimate the effect of specific cultural traits, such as trust, on regional economic development in Europe. The author uses the historical literacy rates and the quality of political institutions as instruments for these cultural attributes. The author finds that the exogenous component of trust due to these historical factors is strongly correlated with current regional economic development in Europe. Algan and Cahuc (2010) attempt to examine the effect of trust on economic growth. The authors show that inherited trust of descendants of immigrants to the United States is significantly influenced by the country of origin and the timing of arrival of their forbears. They use the inherited trust of the descendants of the immigrants as a time varying measure of inherited trust in their country of origin. They find that trust has a persistent component that explains a significant share of the economic backwardness of developing countries and the economic differences between developed countries. This paper, however, argues that the geographic characteristics of a country can shape the cultural attitudes that are pertinent to economic performance.

In this context, this paper examines the relationship between trust and the logarithm of real Gross Domestic Product per capita. The paper focuses on some trust variables that are extracted from the World Values Survey, such as trust in people from another nationality, trust in people from another religion, trust in people you know personally, trust in people you meet for the first time, trust in your family, and trust in your neighborhood. The results show that trust has a statistically significant positive association with economic development. These results are robust after the inclusion of control variables such as the fractionalization indicator, continental dummies, and indicators for the legal origin and the colonial origin.

The paper also conducts two stage least squares regressions. The second stage is a regression of the logarithm of real Gross Domestic Product per capita on each of the trust variables. In the first stage, elevation and terrain ruggedness are used as instrumental variables for trust. The results of the empirical estimation show that trust, instrumented by these geographic variables, explain cross country variations in economic development.

The remainder of the paper is organized as follows: Section 2 includes the literature review, Section 3 includes a discussion of the data, Section 4 includes the empirical estimation, Section 5 concludes.

2. LITERATURE

Several studies investigate whether certain geographic characteristics can influence

income levels and economic growth. These geographic features include the latitude, the distance from the tropics, whether the climate is temperate or tropical, whether the country is landlocked or coastal, the prevalence of geography specific diseases, the isolation and distance from core markets, the types of crops produced, the geological mineral deposits, the topography of the terrain, and others.

For instance, Bloom *et al*. (1998) show that the dominant factors hindering Africa's economic growth include various aspects of tropical geography. The authors find that the percentage of land in the tropics has a negative effect on economic growth. On the other hand, the authors find that the coastal population density has a positive effect on economic performance. Theil and Galvez (1995) and Irvine and Tervio (2002) find that the countries' latitude explains cross country variation in income per capita. Bloom *et al*. (2003) found that the probability of being in high income level equilibrium is higher in temperate countries. Zuleta (2012) argue that the positive correlation between absolute latitude and income per capita is due to the fact that countries located far from the equator suffered more profound seasonal fluctuations in climate. This induces a higher level of savings to smooth consumption. This is consistent with the empirical evidence on the industrialization of some countries and the stagnation of others.

Gallup *et al*. (1999) argue that some geographic factors have large effects on income levels and economic growth. These factors include the distance from the tropics, the percentage of land in the tropics, the percentage of population within 100 kilometers of a coast or ocean navigable river, and the proximity to core markets. The authors find that tropical areas are hindered in development by higher disease burdens and limitations on agricultural productivity. The authors also find that coastal areas and areas linked to oceans by navigable waterways are favored in development, while landlocked countries are at a disadvantage due to their lack of access to the sea.

Sachs (2001) shows that tropical underdevelopment can be attributed to the fact that agricultural productivity for major crops are higher in temperate zones than in tropical areas. This is due to the fragility of tropical soil which are weathered by heavy precipitation, the prevalence of crop pests and parasites, the higher rates of plant respiration, and the loss of water due to the high temperatures evaporation of surface water. The author also shows that the burden of disease is considerably higher in the tropics which reduces labor productivity, physical abilities, and cognitive capacities. He also argues that the ecology of the tropics supports a high level of infectious diseases transmission and higher rates of overall morbidity. The author finds that the percentage of population in temperate zones has a significant negative effect on the infant mortality rate and a significant positive effect on life expectancy.

Masters and McMillan (2001) examine the effect of new climatic data, the absence of winter frost, on economic growth. The authors argue that frost can have a major influence on agricultural productivity by helping control plant and animal diseases, and by facilitating the buildup of deeper topsoils. Frost can also have influence on health by helping control the transmission of diseases. The authors find that economic growth increases sharply with the frequency of winter frost.

Easterly and Levine (2003) find evidence that some geographic characteristics such as proximity to the tropics, germs and crops affect economic development through institutions. The authors use some geographic variables, such as the latitude, a dummy for major crop production and whether the country is landlocked, as instruments for institutions and find that the geographic endowments help explain cross country variations in institutional development which significantly explains economic development.

Nunn and Puga (2012) show that although terrain ruggedness in Africa hinders trade and productive activities which adversely affect economic development, rugged terrain also afforded protection to those being raided during the slave trades. Enslavement took place through raids and kidnapping. Hills, caves and cliff walls provided lookout posts and hiding places for those trying to escape. Since the slave trade hindered subsequent economic development, unfavorable geographic conditions in the form of terrain ruggedness had an indirect positive effect on the levels of income.

This paper considers the effect of the geographic characteristics on economic development through its effect on the cultural attributes that are pertinent to economic performance.

3. DATA

There are 47 countries that are included in the analysis, namely: Armenia, Australia, Azerbaijan, Belarus, Chile, China, Colombia, Cyprus, Ecuador, Egypt, Estonia, Germany, Ghana, Iraq, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Malaysia, Mexico, Morocco, Netherlands, Nigeria, Pakistan, Peru, Philippines, Poland, Qatar, Romania, Russia, Rwanda, Slovenia, South Korea, Spain, Sweden, Taiwan, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United States of America, Uruguay, Uzbekistan, Yemen, and Zimbabwe. This sample is limited due to the availability of countries in the World Values Survey data. The summary statistics of all variables used in the analysis are included in Table 1.

Table 1. Statistical Summaries

Variable	Observations	Mean	Standard Deviation	Min	Max
GDP per capita	47	9.292571	0.9944901	7.125494	11.62254
Elevation	47	677.3824	623.5491	9.1667	2988.048
Rugged1	47	1.397128	1.106847	0.037	4.287
Trust1	47	34.1766	16.68607	8.8	80.3
Trust2	47	36.21064	15.10796	9.1	75.3
Trust3	47	75.77021	13.1298	41.9	96.9
Trust4	47	21.45745	10.44956	5.4	56.9
Trust5	47	96.28085	3.699215	81	100
Trust6	47	70.6383	12.80853	33.9	89.4

3.1. Development

The measure of development is the real Gross Domestic Product per capita in 2011 which is derived from the Penn World Tables 8.0. The variable used is the real Gross Domestic Product at constant 2005 national prices. This variable is divided by the population to calculate the real Gross Domestic Product per capita. The logarithm of the real Gross Domestic Product per capita is used in the analysis.

3.2. Landscape

The elevation variable measures the mean elevation in meters above sea level. This variable is extracted from the University of Harvard Center for International Development.[1] The terrain ruggedness index is compiled by Nunn and Puga (2012). The index was originally devised to quantify topographic heterogeneity in wildlife habitats providing concealment for preys and lookout posts.[2]

3.3. Trust

The trust variables are extracted from wave 6 of the World Values Survey (2010-2014). The questions ask how much you trust different groups of people. The survey question wording is stated as follows: "I'd like to ask you how much you trust people from various groups. Could you tell me for each whether you trust people from this group completely, somewhat, not very much or not at all?" The list of groups include: (1) people of another nationality, (2) people of another religion, (3) people you know personally, (4) people you meet for the first time, (5) your family, (6) your neighborhood. The variable used in the analysis is the percentage of people who answered they trust completely, or trust somewhat, the groups considered. The variables are denoted Trust1, Trust2, Trust3, Trust4, Trust5, Trust6, respectively.

3.4. Controls

Several control variables are used in the analysis to check the robustness of the results. The first is the legal origin indicators which are compiled by La Porta *et al.* (1999). The list[3] includes the British common law, the French civil law, the socialist law, the German civil law, and the Scandinavian law. The authors argue that the legal tradition in countries implanted by colonial powers has profoundly shaped national approaches to property rights protection and the degree to which the state intervenes in

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[1] www.cid.harvard.edu/ciddata/geographydata.htm.

[2] The detailed definition of the variable can be found in http://diegopuga.org/data/rugged/.

[3] The dataset can be found at http://scholar.harvard.edu/schleifer/publications/quality-government.

the economy. Accordingly, the legal origin has a significant influence on economic development.

Another set of control variables is the colonial origin indicator. The data distinguishes between British, French, Portuguese, Spanish, and other European (Dutch, Belgian and Italian) colonial origin for countries colonized since 1700. For countries under several colonial powers, the last one is counted provided that it lasted for 10 years or longer. Some studies analyzed the effect of the colonial heritage on current economic development. Colonial heritage is usually proxied by the identity of the colonial ruler, the period of colonization, or the degree of economic penetration by colonial power. These studies, such as Bertocchi and Canova (2002), Bruhn and Gallego (2012), and Feyrer and Sacerdote (2009), find that colonial origins has a significant effect on current economic development even after decolonization and independence.

The analysis also includes continental dummies. Continent indicators follow the definitions of the United Nations Statistics Division of 2000. The dummies are for Africa, Asia, Europe, Oceania, North America and South America.

Finally, the fractionalization indicator is used as another control variable.[4] Fractionalization measures the probability that two randomly selected individuals from a country are from different groups. We consider ethnic, linguistic and religious fractionalization. Some studies, such as Alesina *et al.* (2003), Montalvo and Reynal-Querol (2005), Campos *et al.* (2011), and Alesina *et al.* (2012) find that heterogeneity can hinder economic development. This is because the level of diversity along ethnic, linguistic and religious lines tend to formulate weaker institutions and inefficient public services. In addition, in highly diverse societies, the group that dominates power tend to expropriate as many resources from the other groups and restrict the rights of members of other groups.

4.   ESTIMATION

This section estimates the effect of trust on economic development. Ordinary least squares estimations are used to assess the relationship between the trust variables and economic development. Economic development is proxied by the logarithm of the real Gross Domestic Product per capita. Each regression is that of the logarithm of real Gross Domestic Product per capita on one of the trust variables, taken one at a time. Each regression is as follows

Logarithm of real GDP percapita = α + βTrust variable + error ,

where the trust variable can be Trust1, Trust2, Trust3, Trust4, Trust5, or Trust6. The

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[4] The dataset can be found at: http://www.anderson.ucla.edu/faculty_pages/romain.wacziarg/papersum.html.

first column in Table 2 shows the results of these regressions without control variables. Each coefficient is the outcome of a regression of the logarithm of real Gross Domestic Product per capita on each one of these trust variables. The results show that all the trust variables have a statistically significant positive coefficient with economic development. This implies that trust significantly explains cross country variations in the logarithm of real Gross Domestic Product per capita.

Table 2.   Effect of Trust on Economic Development

	No Controls	Fractionalization	Continental	Legal	Colonial
Trust1	0.22690*	0.12603*	0.15077*	0.17411*	0.19326*
	(0.01425)	(0.01867)	(0.02452)	(0.01810)	(0.01595)
Trust2	0.22328*	0.14501*	0.15076*	0.19643*	0.20567*
	(0.01104)	(0.02433)	(0.02061)	(0.02043)	(0.01555)
Trust3	0.12013*	0.10986*	0.13513*	0.11341*	0.11659*
	(0.00228)	(0.00565)	(0.00931)	(0.00420)	(0.00242)
Trust4	0.35591*	0.19903*	0.21346*	0.29194*	0.30555*
	(0.02824)	(0.03098)	(0.05382)	(0.04854)	(0.03777)
Trust5	0.09638*	0.09699*	0.09965*	0.09454*	0.09781*
	(0.00159)	(0.00317)	(0.00228)	(0.00200)	(0.00206)
Trust6	0.12720*	0.11386*	0.13987*	0.11595*	0.12450*
	(0.00386)	(0.00786)	(0.01096)	(0.00675)	(0.00521)

Notes: Ordinary Least Squares regression results. Coefficients for control variables are ommitted for space considerations. () includes heteroskedasticity consistent standard errors. * indicates statistical significance at 1%.

In order to assess the robustness of these results, Table 2 also includes the results of the regressions of the logarithm of real Gross Domestic Product per capita on the trust variables, one at a time, adding some control variables to each regression. Column 2 adds the ethnic, linguistic and religious fractionalization indicators. Column 3 adds the continental dummies. Column 4 adds the legal origin indicators. Column 5 adds the colonial origin indicators. The results show that in all specifications, the coefficients of every trust variable on economic development is highly statistically significant at the 1% level. The R-squared of all the regressions are above 0.8.

However, trust is shown to be endogenous to economic development. Therefore, a two stage least squares regression is conducted to estimate the effect of trust on economic development, using instrumental variables. We use mean elevation and terrain ruggedness as instruments for trust. Figure 1 shows the relationship between elevation and each of the trust variables. These figures show a negative association between elevation and Trust1, Trust2, Trust3, Trust4, and Trust5. The graphs also show a weak positive relationship between elevation and Trust6. Figure 2 shows the relationship between ruggedness and each of the trust variables. These figures show a negative association between ruggedness and Trust1, Trust2, Trust3, Trust4, and Trust5. The

graphs also show a weak positive relationship between ruggedness and Trust6. The weak positive relationship between these geographic variables and Trust6, or trust in your neighborhood, is intuitive. This is because natural barriers can impede communications with other communities, but improve those interactions with neighbors. This allows these natural barriers, such as elevation and ruggedness, to enhance trust in the neighborhood.
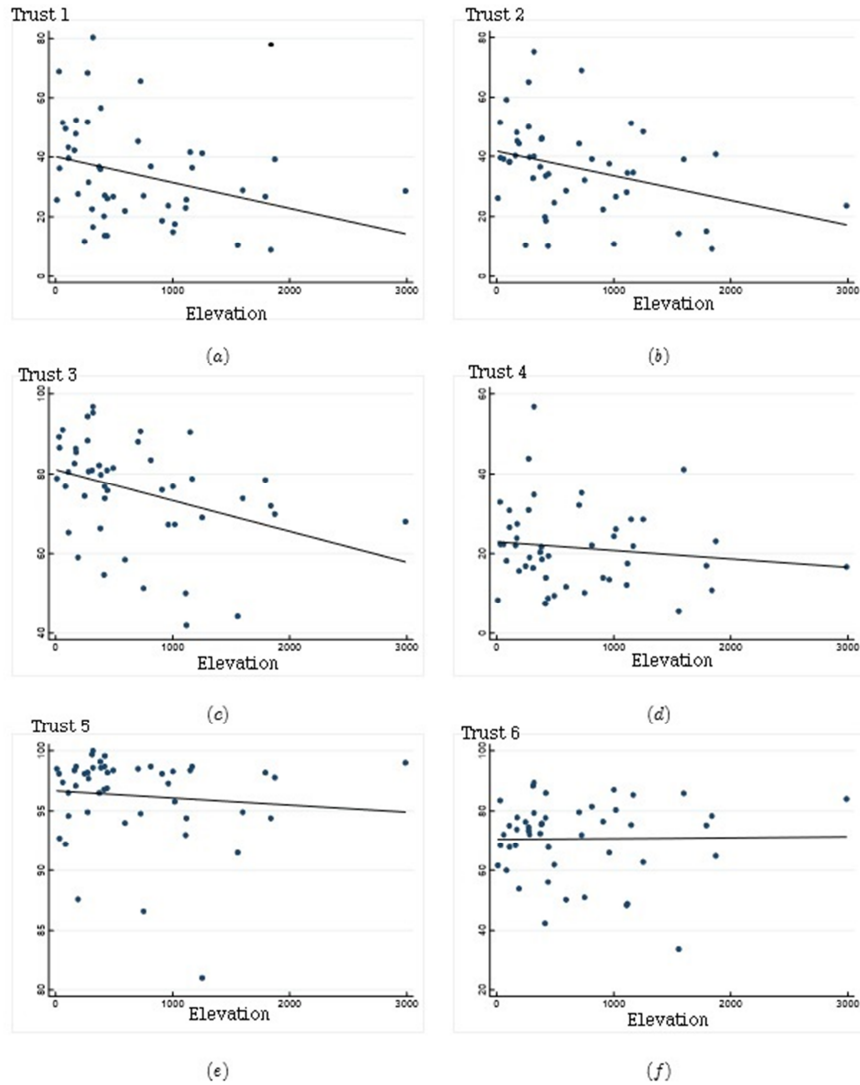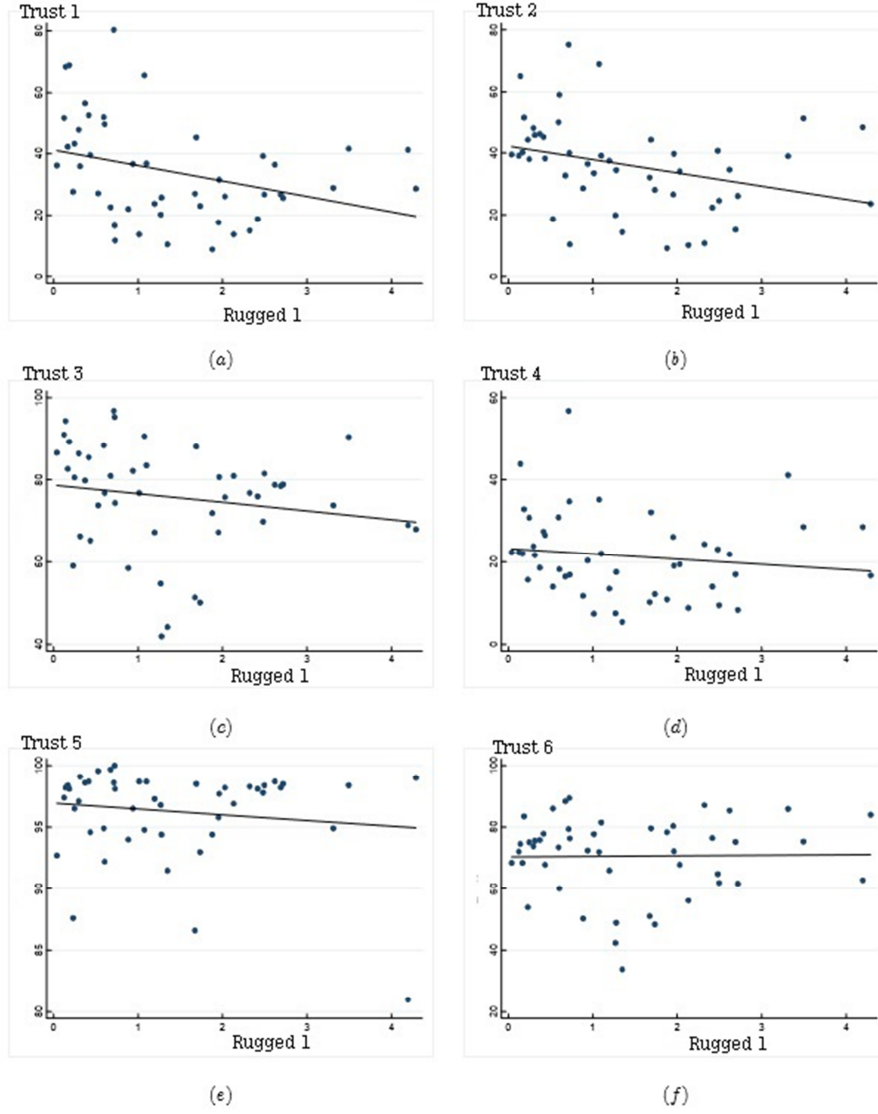

Figure 1. Elevation and Trust

Figure 2. Ruggedness and Trust

A two stage least squares regressions is conducted to answer the question of whether trust, instrumented by elevation and terrain ruggedness, have an effect on economic development. The regression is as follows:

Second Stage:
Logarithm of real GDP percapita = αTrust var iable + $\sum βControl variables + ε$,

First Stage: *Trust variable* $= \delta Elevation + \sigma Ruggedness + \epsilon.$

The Controls are a set of included exogenous variables. The error terms in the first and second stage regressions are ε and ϵ, respectively. Elevation and terrain ruggedness are considered excluded exogenous variables in that they are used as instrumental variables to extract the exogenous component of trust but are excluded in the second stage regressions.

Table 3 shows the second stage coefficients of each one of the trust variables. Column 1 of Table 3 shows the coefficient without the inclusion of control variables. The overidentifying restrictions test p-values are included in Column 2 of Table 3. The first stage p-values are included in Column 3 of Table 3. The instruments used are included in Column 4 of Table 3. Table 4 shows the coefficients for trust after the inclusion of some control variables. Column 1 of Table 4 shows the coefficients after adding the fractionalization indicators. Column 2 of Table 4 shows the coefficients after adding the continental dummies. Column 3 of Table 4 shows the coefficients after adding the legal origin indicators. Column 4 of Table 4 shows the coefficients after adding the colonial origin indicators.

Table 3. Two Stage Least Squares Regression Results

	No Controls (*standard errors*)	OIR (*p-values*)	First Stage (*p-values*)	Instruments
Trust1	0.30508* (0.01852)	(0.9491)	(0.0000)	Elevation, Rugged1
Trust2	0.28045* (0.01998)	(0.8300)	(0.0000)	Elevation, Rugged1
Trust3	0.12331* (0.00325)	(0.3070)	(0.0000)	Elevation, Rugged1
Trust4	0.44600* (0.04041)	(0.7499)	(0.0000)	Elevation, Rugged1
Trust5	0.09457* (0.00228)	(0.0355)	(0.0000)	Elevation, Rugged1
Trust6	0.12813* (0.00600)	(0.3934)	(0.0000)	Elevation, Rugged1

Notes: Standard errors are heteroskedasticity consistent. * indicates statistical significance at 1%.

The results show that the exogenous component of trust significantly explains economic development. In the case without any control variables, the coefficients of trust has a statistically significant coefficient with economic development. When the ethnic, linguistic and religious fractionalization control variables are added, the coefficients of trust in people of another nationality, and trust in people of another

religion are not significant. However, all the other coefficients are statistically significant. When we add continental dummies, the legal origin indicators, or the colonial origin indicators, the coefficients of all the trust variables are statistically significant.

Table 4. Two Stage Least Squares Regression Results

	Fractionalization	Continental	Legal	Colonial
Trust1	0.43974	0.35910*	0.37750*	0.30753*
	(0.26061)	(0.12951)	(0.08906)	(0.03170)
Trust2	0.34089	0.32233*	0.40711*	0.30180*
	(0.17528)	(0.09516)	(0.08499)	(0.04066)
Trust3	0.13315*	0.15840*	0.12387*	0.11911*
	(0.00953)	(0.01709)	(0.00766)	(0.00379)
Trust4	0.85091 *	0.44561*	0.56858*	0.44581*
	(0.40813)	(0.13078)	(0.11953)	(0.07071)
Trust5	0.09621*	0.08823*	0.08632*	0.09424*
	(0.00556)	(0.00817)	(0.00513)	(0.00364)
Trust6	0.13878*	0.13756*	0.11595*	0.12234*
	(0.01630)	(0.02618)	(0.01230)	(0.00850)

Notes: () includes heteroskedasticity consistent standard errors. * indicates statistical significance at 1%

The test of overidentifying restrictions addresses the following question: do elevation and terrain ruggedness explain economic development beyond their ability to explain trust? Specifically, the overidentifying restriction test has as its null hypothesis that elevation and ruggedness do not explain the logarithm of real Gross Domestic Product per capita beyond their ability to explain culture. According to the p-values of the test, the overidentifying restriction test does not reject the hypothesis that the instruments can be excluded from the second stage regression. This implies that elevation and ruggedness can not explain cross country variations in economic development beyond their ability to explain cross country variations in trust.

5.   CONCLUSION

This paper examines the effect of trust on economic development. There is a growing literature that argues that trust is one of the main determinants of current economic development. The key difficulty in estimating a causal effect of trust, as a component of culture, is that it is endogenous to economic development. Therefore, to identify a causal effect from trust to economic development, we have to find some exogenous source of variation in trust. In other words, when we estimate the effect of

trust on economic development, we have to use instrumental variables. The purpose of this paper is to identify new instruments for trust. The instruments used are the geographic characteristics pertinent to the topography of the terrain in a country. Specifically, the mean elevation and the terrain ruggedness are used as instrumental variables for trust.

In this context, the paper examines the relationship between trust and the logarithm of real Gross Domestic Product per capita. The paper focuses on trust in people from another nationality, trust in people from another religion, trust in people you know personally, trust in people you meet for the first time, trust in your family, and trust in your neighborhood. The results show that all the trust variables have a statistically significant positive association with economic development. These results are robust after the inclusion of control variables that include the fractionalization indicator, continental dummies, and indicators for the legal origin and the colonial origin.

The paper also conducts two stage least squares regressions. The second stage is a regression of the logarithm of real Gross Domestic Product per capita on each of the trust variables. In the first stage, elevation and ruggedness, are used as instrumental variables. The results of the empirical estimation show that trust, instrumented by these geographic variables, explains cross country variations in economic development.

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