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Does Trust Promote Growth?

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Abstract

We examine the effect of generalized trust on long-term economic growth. Unlike in previous studies, we use Bayesian model averaging to deal rigorously with model uncertainty and attendant omitted variable bias. In addition, we address endogeneity and assess whether the effect of trust on growth is causal. Examining more than forty regressors for nearly fifty countries, we show that trust exerts a positive effect on long-term growth and, based on the posterior inclusion probabilities, suggest that trust is an important driver of long-term growth. Our results also show that trust is key for growth in countries with a weak rule of law.

JEL-Classification: O43, O10, Z13
Keywords: trust, economic growth, Bayesian model averaging

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1 Introduction

The importance of trust has been recognized for some time in the economic literature. Many major economics scholars have highlighted the role of trust in economic development (Smith (1997 [1766]) and Keynes (1936), among others).

Knack and Keefer (1997) and Zak and Knack (2001) pioneered the modern literature on the trust-growth relationship using data on generalized trust obtained from the World Values Survey database. Controlling for several standard determinants of growth, they document that trust is positively associated with growth. Their contribution has been followed by a number of studies (Aghion et al. (2010), Algan and Cahuc (2010), Nunn and Wantchekon (2011), Tabellini (2010), among others) that focus on evaluating the casual effect of trust on growth in greater detail and find that trust indeed has a positive effect on growth.

A related body of literature – the empirical growth literature – highlights the role of model uncertainty (Fernandez et al. (2001a), Sala-i-Martin et al. (2004), Ley and Steel (2009), Eicher et al. (2011)). The potentially plentiful determinants of growth and many competing growth theories naturally yield high uncertainty about which model is the correct model of economic growth (Durlauf et al., 2008). [1] Therefore, the true growth model is treated as unknown in this literature. Beugelsdijk et al. (2004) and Berggren et al. (2008) examine the effect of trust on growth using the updated version of the original dataset from Zak and Knack (2001). To assess the degree of model uncertainty, Beugelsdijk et al. (2004) and Berggren et al. (2008) employ extreme bounds analysis. Their results suggest that the effect of trust on growth is sensitive to the conditioning set of regressors and to the composition of the sample.

In summary, the previous literature has produced two types of studies: 1) studies that explicitly consider the endogeneity of trust but address the issue of model uncertainty in a somewhat *ad hoc* manner (i.e. those that fail to formally address model uncertainty and the attendant omitted variable bias), and 2) studies that more consistently address the issue of model uncertainty but ignore the endogeneity of trust.

We contribute to this body of literature and try to avoid the pitfalls of the studies in categories 1) and 2). We investigate the effect of trust on growth, and we formally address *both* endogeneity and model uncertainty (as well as attendant omitted variable bias). Therefore, we evaluate the somewhat pessimistic view presented by Beugelsdijk et al. (2004) and Berggren et al. (2008) regarding the importance of social capital. For this reason, we rigorously address model uncertainty within formal probabilistic reasoning using Bayesian model averaging (BMA). Unlike extreme bounds analysis[2], BMA is well grounded in statistical theory (Raftery, 1995, Raftery et al., 1997). Model uncertainty is a part of the

[1] Model uncertainty has also been recognized as an important issue in the political science literature. See Montgomery and Nyhan (2010) for a recent discussion.

[2] Leamer (1978) develops extreme bounds analysis as an *ad hoc* form of sensitivity analysis that can be used to address model uncertainty.

estimation procedure, and the assumption that all specifications are equally likely to be true is relaxed. This is important because extreme bounds analysis treats all regressions equally regardless the fit of regression is good or bad. Therefore, the regression models generating the upper and lower bounds might be flawed and overestimate the degree of uncertainty. In addition, Beugelsdijk et al. (2004) and Berggren et al. (2008) do not address the issue that trust is likely to be determined simultaneously with growth and therefore that the corresponding coefficient for the effect of trust on growth should be estimated inconsistently. We follow the methodology developed by Durlauf et al. (2008) and use the BMA, together with a two-stage least squares analysis, to address the endogeneity of trust.

In addition, the BMA can evaluate the effect of dozens of regressors jointly within a coherent framework and can therefore substantially reduce concerns regarding omitted variable bias, which is an issue in studies that employ a more traditional model selection approach. The BMA also indicates the posterior inclusion probability (PIP), which is the probability that a given regressor should be included in the correct model for economic growth. As a result, we are able to rank all of the regressors according to the PIP. Clearly, this is impossible without BMA techniques, and such results shed more light on the importance of trust for growth in comparison with other factors. To the best of our knowledge, this evidence is not available so far.

Based on more than 40 regressors for nearly 50 countries around the world, our results suggest that generalized trust is a robust determinant of long-term economic growth. Our BMA estimation shows that trust exhibits a high posterior inclusion probability (0.6-0.8), which indicates that trust is very likely to belong in the correct model of economic growth. Therefore, our results do not support the previous suggestion that the effect of trust on growth is strongly sensitive to the conditioning set of regressors. In addition, we find that trust is especially conducive to growth in countries with low-quality formal institutions.

The paper is organized as follows. Section 2 discusses the relevant literature. Section 3 briefly introduces Bayesian model averaging. Section 4 presents the data. The results are available in section 5. Conclusions are provided in section 6. An appendix with additional results follow.

2 Related Literature

Excellent surveys of the literature evaluating the effect of culture on growth are provided by Guiso et al. (2006), Beugelsdijk and Maseland (2011) and Nunn (2012). However, these surveys are very broad, and because our focus is much narrower, we discuss only recent studies directly addressing the effect of macro trust on economic performance. How can trust affect growth? Theoretically, trust can influence economic activity in a variety of ways.

First, trust may be related to schooling; in high-trust environments human capital may be transmitted more easily (Bjornskov, 2012). Using data from 50 countries for the period 1976–2005, Dearmon and Grier (2011) find that trust is conducive to human capital accumulation. Similarly, Ozcan and Bjornskov (2011) find that trust exerts a positive effect on human development. Bjornskov (2012) estimates a system of equations model in which generalized trust can affect growth via several transmission mechanisms, including schooling, trade, rule of law and investments. Examining these transmission mechanisms, Bjornskov (2012) finds that strongest effects are exerted by schooling and governance.

Second, trust may also be linked to governance. Undertaking reforms and policy innovations may be more beneficial for policy makers in more trusting societies. Citizens are more likely to believe that policy innovations are not the result of pressure by special interest groups and therefore are more likely to reward politicians favorably. For example, Knack (2002) shows that reforms are more likely in those U.S. states that exhibit a higher degree of generalized trust.

Third, a number of studies document a positive link between trust and investment (Zak and Knack, 2001, Carlin et al., 2009, Bjornskov, 2012). Zak and Knack (2001) develop a theoretical model in which economic agents may either engage in production or verify whether the activity of other economic agents is opportunistic. As a result, economic agents in a highly trusting environment enjoy lower transaction costs, which stimulates economic activity. Ahlerup et al. (2009) develop a game-theoretical model that shows that the effect of social capital on growth depends on the quality of institutions. With well-functioning formal institutions, the effect of social capital decreases. However, the importance of social capital increases in an environment with weak institutions. Guiso et al. (2008) show that trust determines stock market participation. They also find that even if individuals participate in the stock market, they buy fewer stocks in an environment characterized by less trust.

Fourth, trust may be conducive to trade. Greif (1994) indicates that trust was already an important aspect of international trade in medieval times. Yu et al. (2011) examine the impact of trust on trade and find that the effect of trust is more important, if the quality of formal institutions is low. Therefore, their results suggest that trust and high-quality formal institutions are substitutes. Guiso et al. (2009) find that trust exerts a positive effect on international trade and that the importance of trust rises as more sophisticated products are traded.

Fifth, trust may have an effect on various government measures. Aghion et al. (2010) investigate the effect of distrust on government regulation and find that regulation serves as a substitute for trust. Working in this vein, Carlin et al. (2009) develop a theoretical model that predicts that when social capital is valuable, trust and regulation will be substitutes. In contrast, trust and regulation can be complementary in an environment with less valuable social capital.

The literature investigating the effect of culture on growth has also focused on examining to what extent the effect of culture on growth is robust to the inclusion of institutions and which dimensions of culture are most conducive to growth. Tabellini (2005) shows how culture, which is measured as a set of indicators including trust, has significantly affected economic development in Europe. Gorodnichenko and Roland (2011) analyze which dimensions of culture are the most conducive to growth. Their regression analysis shows that even though many dimensions of culture are likely to influence growth, the degree of individualism is the most important and robust determinant of growth. Similarly, Jellema and Roland (2011) use principal component analysis to examine which institutional factors most influence growth and find that authoritarian culture is detrimental to long-term growth.[3]

The previous literature also documents the extreme persistence of culture. Nunn and Wantchekon (2011) analyze the impact of the slave trade on mistrust in Africa. They find that slave trade shocks have a very persistent effect, literally lasting for centuries. Similarly, Guiso et al. (2009) and Grosjean (2011) show that changes in trust are very slow and that large shocks typically persist for centuries. Algan and Cahuc (2010) highlight the importance of inherited trust to economic growth in the 20th century.

A related component of the literature highlights the importance of measuring social trust. Beugelsdijk (2006) questions the validity of generalized trust measures from the World Values Surveys, the data typically used by researchers to estimate the effect of generalized trust on economic performance. He argues that this measure strongly reflects the quality of institutions. In contrast, Uslaner (2008) is more skeptical about the role of institutions in building trust but understands trust to be driven more by income inequality. La Porta et al. (1997), Glaeser et al., (2000), Alesina and La Ferrara (2002) and Bjornskov (2006) analyze the determinants of trust empirically. Nevertheless, to address the concerns put forth by Beugelsdijk (2006), researchers should control for as many regressors as possible, including those that indicate the quality of institutions. The use of BMA is especially fruitful in this regard because the BMA approach can effectively process dozens of regressors systematically at once. Related empirical evidence by Gorodnichenko and Roland (2012) shows that the effect of culture on growth remains robust even after one controls for various measures of institutions.

[3] Note that principle component analysis is one way how to address multicollinearity. Alternatively, BMA can be employed to address this issue, as indicated in the following section.

Using the data on trust in U.S. regions, Dincer and Uslaner (2010) widen the scope of the possible impact of trust and show that trust positively contributes not only to economic growth but also to the growth rates of housing prices and employment.

3 Bayesian Model Averaging

Following its development in statistics, primarily in the 1980s, BMA has gained popularity in the economics literature during the 1990s and 2000s. It is typically used to assess the robustness of results transparently and rigorously, especially in an environment with many competing theories and possible determinants. In a similar vein, BMA techniques are often used for forecasting in data-rich environments. The textbook treatment of BMA is available in Koop (2003) and Koop et al. (2007). Feldkircher and Zeugner (2009), Ley and Steel (2009) and Eicher et al. (2011) discuss using BMA to identify the determinants of long-term growth. BMA was introduced to political science by Bartels (1997); however, somewhat surprisingly, it was not used in many other applications. For this reason, Montgemery and Nyhan (2010) provide an extensive discussion of BMA that emphasizes how BMA can be useful in political science.

We continue with a brief formal description of BMA. Suppose we have a dependent variable Y (for example, GDP growth) with a number of observations n (the number of countries in the case of cross-sectional growth regressions) and k regressors $X_1.....X_k$. The researcher wants to identify the regressors $X_1.....X_k$ that are robust determinants of Y. The researcher typically specifies a core model with a subset of the regressors $X_1.....X_k$ and then includes additional regressors within the set of $X_1.....X_k$ to assess the robustness of the core model results. In many applications, this procedure is conducted in a somewhat idiosyncratic and non-transparent manner. Importantly, this procedure may also inflate the true significance of regression coefficients. Clearly, the risk of omitting some important regressor is far from negligible. For BMA, the number of explanatory variables is restricted only by the number of observations and therefore, studies that use the BMA typically employ many more regressors than traditional model selection studies. As a result, the use of BMA is also likely to reduce omitted variable bias. The BMA technique offers an alternative to this somewhat vague model search procedure and, as the name suggests, focuses on model averaging rather than on model selection.

The standard procedure in the cross-sectional growth determinants literature involves estimating model $Y = \alpha_1 X_1 + .. + \alpha_k X_k + e$, where $e \sim N(0, \sigma^2 I)$ (assume for the sake of simplicity that X_1 is a constant) using OLS. Typically, there is substantial uncertainty regarding which of the potentially plentiful X's should be included. As a result, there are $l = 2^k$ subsets of X's that can be considered regressors, and therefore, there are $M_1....M_l$ regression models to be examined. Let us denote the vector of parameters of the i-th model as $\theta_i = (\alpha, \sigma)$ .The likelihood function of i-th model, $pr\,(D \mid \theta_i, M_i)$, summarizes all of the information about θ_i based on available data D. The marginal likelihood, defined as the probability density of the data, D, conditional on M_i, can be written as follows

$$pr\,(D \mid M_i) = \int pr\,(D \mid \theta_i, M_i)\, pr\,(\theta_i \mid M_i)\, d\theta_i, \tag{1}$$

the marginal likelihood is therefore a product of the likelihood function $pr\left(D \mid \theta_i, M_i\right)$ and the prior density $pr\left(\theta_i \mid M_i\right)$ integrated over the parameter space. Using $pr\left(D \mid M_i\right)$ one can determine from the prior probability that M_i is a correct model, which we denote as $pr\left(M_i\right)$. Bayes' theorem yields the posterior model probability of M_i, $pr\left(M_i \mid D\right)$ as

$$pr\left(M_i \mid D\right)=\frac{pr\left(D \mid \theta_i, M_i\right) pr\left(M_i\right)}{\sum_{l=1}^{i} pr\left(D \mid M_l\right) pr\left(M_l\right)} \tag{2}$$

and the posterior inclusion probability of a given regressor, $pr\left(\alpha_j \neq 0 \mid D\right)$, is then found by taking the sum of the posterior model probabilities across those models that include the regressor. The posterior inclusion probability is of primary importance here because it measures the probability that a given regressor belongs to the correct model. This approach has been recently generalized to the panel data setting to explicitly account for unobserved heterogeneity among countries (Moral-Benito, 2012).

Even using modern computers does not make it possible to evaluate all of the possible models and we use the MC^3 algorithm to reduce the computational requirements (Madigan and York, 1995). MC^3 approximates the posterior distribution of the model space by simulating a sample from that space. We take 1 000 000 burn-ins and 3 000 000 draws, which yields a sufficiently high correlation between the analytical and MC^3 posterior model probabilities (approximately 0.99 in our case).

The parameter priors must be specified to implement BMA. In general, priors specify the researcher's information or the beliefs that he or she holds before he or she sees the actual data. Because the degree of belief is not particularly high in the growth regression context, uninformative priors are typically employed. The priors affect the marginal likelihood in (1). To address this issue, we conduct the estimations using several parameter priors to clarify the robustness of the results (Eicher et al., 2011, Feldkircher and Zeugner, 2009, and Ley and Steel, 2009).

The first prior is defined as follows.

$$pr\left(D \mid M_i\right) \approx c - 1/2BIC_i, \tag{3}$$

where

$$BIC_i = n \log\left(1 - R_i^2\right) + p_i \log\left(n\right) \tag{4}$$

In (3) and (4), c is a constant; R_i^2 stands for the coefficient of determination and p_i for the number of regressors. This prior is typically labeled UIP. Next, we consider the g-prior, proposed by Fernandez et al. (2001b):

$$pr(\alpha_1 \mid M_i) \propto 1, \tag{5}$$

$$pr(\sigma \mid M_i) \propto 1, \tag{6}$$

$$pr\left(\alpha^{(k)} \mid \sigma, M_i\right) \sim N\left(0, \left(g_k Z^{(k)\prime} Z^{(k)}\right)^{-1}\right), \tag{7}$$

where $Z^{(k)}$ denotes the matrix of size $n \times p_k$ and p_k demeaned regressors are included in M_i. It is worth noting that values of g that are close to zero imply a less informative prior and that $g = 1$ gives the same weight to the information indicated by the data and the prior. Two different values of g are examined. $g = 1/\max(N, k^2)$ is preferred by Fernandez et al. (2001b) and is labeled BRIC. $g = 1/(\ln N)^3$ corresponds to the Hannah-Quinn criterion. The third commonly employed g-prior is $g = 1/k^2$ (Foster and George, 1984) but this prior is identical to $g = 1/\max(N, k^2)$ in our setting.

Next, we also use parameter priors that were not previously employed in the growth literature (except Feldkircher and Zeugner, 2009), the so-called hyper-g prior (Liang et al, 2008).

$$\pi(g) = \frac{a}{a-2}(1+g)^{a/2}, \tag{8}$$

We use two different hyper-g priors. The first one sets the prior expected value of that shrinkage factor at UIP, the second one sets it at BRIC. Thus, overall, there are five different parameter priors that we employ to empirically determine the effect of interpersonal trust on long-term economic growth.

We use a uniform model prior; doing so gives equal prior probability to all models M_i. As a result, $pr(M_i) = 1/L$ for each i. We choose this model prior because Eicher et al. (2011) show that it performs well in forecasting exercises.

All regressors except trust are constructed so that they are exogenous to growth (see the next section for the data description). As a result, trust and growth can be simultaneously determined. To address the endogeneity of trust, we use the methodology developed by Durlauf et al. (2008). We instrument trust using genetic distance data (from Spolaore and Wacziarg, 2009), the absolute latitude and a dummy for former colonies (the instruments are described in the data section in greater detail). We use the predicted trust level as the regressor in our BMA model.[4]

[4] Recently, two unpublished papers developed full-fledged instrumental variables methodology for use in BMA, see Eicher et al. (2012) and Koop et al. (2011). Given that we have only one endogenous regressor, we employ the Durlauf et al. (2008) approach.

It is important to note that instrumental variables regressions provide consistent estimates but that these may be severely biased if the instruments are weak. We use the F-statistic from the first stage regression to assess whether our instruments are weak. Staiger and Stock (1997) show that the F-statistic from the first-stage regression should be sufficiently high and propose the statistic should generally be above 10. When this is true, the bias is likely to be small. In addition, the instruments must be exogenous to the regressand – economic growth in our case. Clearly, the absolute latitude and whether the country was under colonial rule in the 19th century are exogenous to the country's recent economic growth. The current genetic distance data are very likely to be exogenous to the current growth rate because the degree of migration across countries is unlikely to be so high that it would substantially change the typical genetic pattern in any given country. For the robustness check, we also use the genetic distance data from the year 1500 but fail to find any change in our regression results.

4 Data

To analyze the cross-sectional growth determinants, we employ the widely used Fernandez et al. (2001a) dataset. The original dataset contains 41 regressors from 72 countries, allowing for a total of 2^{41} models (e.g. more than 2 trillion). To this dataset, we add the measure of generalized trust from the World Values Survey[5], which is available for 46 of these 72 countries. The World Values Survey is conducted in dozens of countries; typically, more than 1000 respondents in each country answer various questions related to their values in responding to the survey. The survey also includes a question about the respondent's degree of trust; the respondents are asked, 'Generally speaking would you say that most people can be trusted or that you can't be too careful in dealing with people?'. The final change to the Fernandez et al. (2001a) dataset is that we use long-term growth between 1960-2005 rather than 1960-1992. The dataset covers both developed and developing countries. In addition, it is noteworthy that various economic, political, geographical, demographic, social and cultural variables are considered as potential determinants of growth.

More specifically, the list of regressors is as follows: GDP level in 1960, Fraction Confucian, Life expectancy, Equipment investment, Sub-Saharan dummy, Fraction GDP in mining, Fraction Hindu, Non-equipment investment, Rule of law, Degree of capitalism, Size of labor force, Fraction Muslim, Fraction Protestants, Black market premium, Latin American dummy, High school enrollment, Ethnolinguistic fractionalization, Primary school enrollment, Civil liberties, Fraction Buddhist, Spanish colony dummy, Number of years of open economy, Fraction of population speaking English, French colony dummy, Outward orientation, Political rights, Age, War dummy, British colony dummy, Fraction Catholic, Public education share, Primary exports, Exchange rate distortions, Fraction speaking a foreign language, Absolute latitude, Population growth, Area, Workers-to-population ratio, Standard deviation of black market premium, Fraction Jewish, and Revolutions and coups. Some regressors, such as the Sub-Saharan dummy, are exogenous to economic growth. Other regressors are constructed to minimize potential endogeneity issues, i.e., the data typically come from the 1950s or 1960s. Further details about the dataset are available in Fernandez et al. (2001a).

We use data from the following countries: Algeria, Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Canada, Colombia, Costa Rica, Denmark, Dominican Rep., Ecuador, El Salvador, Finland, France, Germany, Ghana, Guatemala, Honduras, Chile, India, Ireland, Italy, Japan, Jordan, Mexico, the Netherlands, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Portugal, Spain, Sweden, Switzerland, Taiwan, Tunisia, Uganda, the United Kingdom, the United States, Uruguay, Venezuela, and Zimbabwe.

To instrument trust, we use genetic distance data, the absolute latitude and a dummy for former colonies. For the genetic distance data, we use F_{ST} distance from Spolaore and Wacziarg (2009). F_{ST} distance is a measure of genetic differences based on indices

[5] These data are kindly provided on the website of Berggren et al. (2008).

of heterozygosity, i.e. the probability that two alleles at a given locus that is selected randomly from two populations will be different. As a consequence, a larger F_{ST} distance means a greater separation between populations. We expect that more distant populations that experience less mixing are likely to trust each other less due to a lack of knowledge (i.e., the correlation between F_{ST} distance and generalized trust is expected to be negative). Note that Desmet et al. (2011) show that genetic distance data are well correlated with cultural heterogeneity. More specifically, we use the weighted F_{ST} distance, which represents the expected genetic distance between two randomly selected individuals, with one from each country. As in Gorodnichenko and Roland (2012), the U.S. is used as benchmark given its high degree of individualism.

We expect that the absolute latitude and generalized trust will be negatively correlated. One reason may be that the countries that are closer to the equator have a higher prevalence of infectious diseases and experience lower trust (see Hall and Jones, 1999, for further discussion about the use of absolute latitude as an instrumental variable). Absolute latitude is also used as an instrumental variable for trust in Ahlerup et al. (2009).

Finally, we use a dummy variable that represents whether the country was a former colony. The dummy variable takes a value of one if the country was a European colony in the 19th century. We hypothesize that the past colonial experience will have a negative effect on current generalized trust. For example, Nunn and Wantchekon (2011) find a very persistent effect (one that has lasted for approximately about 400 years) of the slave trade on distrust. We also used a dummy for Africa, a dummy for whether the country was a colony of European countries in the 20th century, and genetic data for 1500, but these had little effect on the results.

5 Results

5.1 Baseline Results

Figure 1 presents the scatter plot that show relationship between generalized trust and growth and clearly documents that there is a positive relationship between these two variables. This relationship is reconfirmed by the simple correlation coefficient with the value of 0.43. The value is different from zero at a 1% significance level.

Figure 1: **Trust and growth, cross-country evidence**

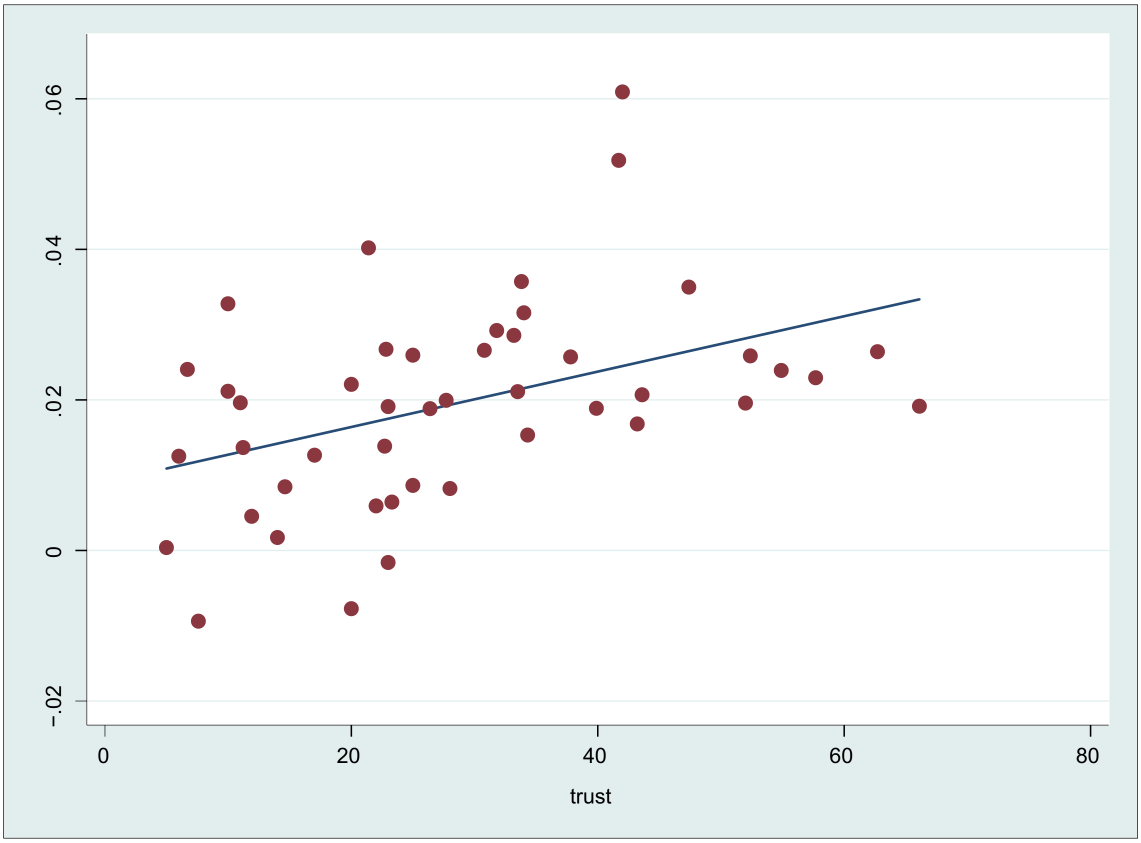

Table 1 presents the baseline results indicating the determinants of long-term growth. For the baseline case, we choose the UIP prior with the uniform model prior. Table 1 shows the posterior inclusion probability (i.e., the probability that any given regressor is included in the correct model, abbreviated as the PIP), the posterior mean and the posterior standard deviation for all 42 regressors. The variables are ranked according to their PIPs.

The results indicate that trust is a vital determinant of long-term economic growth. As expected, the posterior mean is positive. This finding suggests that long-term economic growth is greater in countries with greater generalized trust and is consistent with previous evidence that has emphasized that trust improves the smooth functioning of business or more generally reduces transaction costs in a society and ultimately contributes to growth (Whiteley (2000), Keefer and Zak (2001) or Dincer and Uslaner (2010)). Conversely, the results show that the effect of trust on growth is more robust than was previously thought (see Beugelsdijk et al. (2004) and Berggren et al. (2008)). [6]

In general, our findings for the other regressors are broadly consistent with previous evidence regarding the cross-sectional growth determinants within the BMA framework (Fernandez et al. (2001a). The correlation between the PIPs from our sample and those from the sample used by Fernandez et al. (2001a) is 0.63. The correlation is significantly different from zero at any conventional level but is still far from one. This is not very surprising because we reduce the sample size from 72 to 46 countries and because the data on trust are missing for some countries, especially low-income (typically African) countries.[7] The correlation value is influenced by the PIPs for 3 regressors. If we exclude them, the correlation rises to 0.85. These regressors are the war dummy, the primary exports and the sub-Saharan dummy – i.e., the variables that are more likely to matter in a sample with more low-income countries. Therefore, these results are broadly consistent with Masanjala and Papageorgiou (2008), who find that the drivers of growth in Africa are different from those in the rest of the world.

As a robustness check for our BMA, we estimate a simple OLS model with the regressors that have a PIP greater than 0.5 (i.e., those that are likely to be effective determinants of long-term growth). Our results show that all of these regressors are statistically significant at the 5% level (with the exception of population growth, which is significant at the 10% level) with the same coefficient signs as in Table 1. The R-squared value for this regression is 0.95. [8]

[6] Berggren et al. (2008) find that outliers play a role in the estimated effect of trust on growth. They emphasize that China is the main outlier that contributes to the positive effect of trust on growth. Note that our sample does not contain China.

[7] Another reason is that our dependent variable is calculated based on the data from 1960 to 2005, whereas Fernandez et al. (2001a) use the data for 1960–1992.

[8] These results are available upon request.

Table 1: **The determinants of growth, baseline results**

Variable	PIP	Post Mean	Post SD
GDP level in 1960	1	–0.015066	0.002473
War dummy	0.97	–0.008385	0.002699
Fraction Confucian	0.97	0.089060	0.026909
SD of black market premium	0.96	–4.94E-05	1.62E-05
Fraction Hindu	0.95	–0.091265	0.030508
Population growth	0.95	–0.589666	0.212866
Fraction GDP in mining	0.94	0.105029	0.039356
Size of labor force	0.94	3.24E-07	1.16E-07
Fraction Jewish	0.90	–0.526445	0.245591
Degree of capitalism	0.89	0.002593	0.001290
Fraction Protestants	0.86	–0.010658	0.005917
Outward orientation	0.82	0.003396	0.002174
Trust	0.81	0.000179	0.000117
Life Expectancy	0.69	0.000387	0.000344
Public education share	0.57	0.097867	0.109924
Number of years of open economy	0.42	0.002494	0.003841
Primary school enrollment	0.38	0.004341	0.008086
Rule of law	0.35	0.003299	0.006148
Political rights	0.29	–0.000300	0.000736
Equipment investment	0.28	0.016934	0.039397
Sub-Saharan dummy	0.28	–0.001173	0.004685
Age	0.28	–6.80E-06	1.49E-05
High school enrollment	0.27	–0.008393	0.023815
Civil liberties	0.27	–0.000251	0.000791
Ratio of workers to population	0.25	–0.000378	0.007735
Fraction Muslim	0.24	0.001189	0.004948
Fraction Catholic	0.23	0.000778	0.003581
French colony dummy	0.22	0.000735	0.002209
Fraction Buddhist	0.21	0.001735	0.005875
Primary exports	0.20	–0.001206	0.004988
Latin American dummy	0.19	–0.000191	0.001881
Ethnolinguistic fractionalization	0.19	0.000463	0.002003
Revolutions and coups	0.18	–0.000239	0.002032
British colony dummy	0.18	0.000252	0.001406
Non-equipment investment	0.17	0.002077	0.010338
Spanish colony dummy	0.16	–2.44E-05	0.001426
Area (scale effect)	0.16	3.15E-08	1.72E-07
Black market premium	0.16	0.000174	0.002170
Exchange rate distortions	0.16	–1.26E-06	1.62E-05
Absolute latitude	0.16	–1.49E-06	5.42E-05
Fraction of pop. speaking English	0.15	0.000131	0.001404
Fraction speaking foreign language	0.15	7.90E-05	0.001032

Table 2: **The effect of trust on growth, various prior structures**

	(1)	(2)	(3)
Posterior inclusion probability	0.81	0.84	0.64
Posterior mean	0.018	0.019	0.017
Posterior standard deviation	0.009	0.009	0.009
Parameter prior	g	g	hyper-g
Par. prior value	UIP	Hannah	BRIC
Model prior	Uniform	Uniform	Uniform

Notes: The posterior mean and standard deviation multiplied by 100. For the sake of brevity, the results for the other 41 regressors are not reported.

Table 2 focuses on sensitivity to selected prior structures and reports the results of the analysis of the effect of trust on growth.[9] For the sake of simplicity, the PIP, posterior mean and posterior standard deviation for all other 41 regressors are not reported but are available upon request. Eicher et al. (2011) find that the PIPs for some growth determinants vary depending on the prior structure. We find that the PIP for trust is approximately 0.8 for the fixed-g priors and that it is somewhat lower for the hyper-g priors. The posterior mean remains positive. The conditional posterior sign is positive in 99.7–99.9% of the cases depending on the prior structure (not reported). This result confirms that the sign for the effect of trust on growth is stable.[10]

5.2 Endogeneity Issues

In the World Values Survey, the first cross-country measures of trust are from the beginning of the 1980s, but for many countries, these data are not available before the 1990s, and, clearly, trust can be determined simultaneously with growth. In such cases, the baseline BMA analysis would estimate the effect of trust on growth inconsistently.

Given that the generalized trust is unlikely to change rapidly over time[11], it can be argued that the endogeneity bias is small. Nevertheless, it is important to empirically verify this claim so that we can have more confidence that the estimated effect of trust on growth is causal. We follow the methodology presented by Durlauf et al. (2008), who address endogeneity within BMA model. Our first stage regressions are reported in Table A.1. We find that all instruments are statistically significant at the 5% level, have

[9] We tried more prior structures than are presented here but failed to find different results.

[10] In addition, we also assess whether squared trust determines growth. Using several cross-sectional and panel data models, Roth (2009) finds a curvilinear relationship between trust and growth suggesting that too much trust harm growth (squared trust is found to have a negative effect on growth). We subject this finding to a robustness check within our econometric framework. However, our results do not indicate that a high level of trust is detrimental to growth. On the contrary, we find that squared trust exerts a positive effect on growth, although the posterior standard deviations are typically large. The PIP of squared trust is approximately 0.3, and the PIP of trust decreases somewhat to 0.7 using our baseline specification for the prior structure. These results are available upon request.

[11] The correlations between the trust levels across various iterations of the World Values Survey are higher than 0.9. Bjornskov (2012) argues that the benefits of panel data estimation are likely to be small.

Table 3: **The effect of trust on growth – instruments for trust and various prior structures**

	(1)	(2)	(3)
Posterior inclusion probability	0.67	0.68	0.66
Posterior mean	0.030	0.030	0.031
Posterior standard deviation	0.028	0.027	0.030
Parameter prior	g	g	hyper-g
Par. prior value	UIP	Hannah	BRIC
Model prior	Uniform	Uniform	Uniform

Notes: The posterior mean and standard deviation multiplied by 100. For the sake of brevity, the results for the other 41 regressors are not reported.

the expected coefficient sign and explain more than 60% of the variation in trust. The corresponding F-statistic is sufficiently above 10 (the value of the F-statistic is 25.9).

Our BMA results are available in Table 3. We find that the PIPs remain high (between 0.65–0.7) and that trust is still an important variable for growth. The coefficient for the effect of trust on growth is positive. As in Guiso et al. (2009), the coefficient on trust is larger (almost twice as large) once the instrumental variables for trust are considered.

The results for the other regressors remain largely unchanged. The results are reported in Table A.2 in the Appendix and are based on the prior structure that was used in Table 1. The initial GDP level, the war dummy, the fraction of Confucian individuals, the volatility of the black market premium, and the fraction of Hindu individuals consistently rank among the most important drivers of long-term economic performance irrespective of the prior structure. In our baseline regression reported in Table 2, the generalized trust regressor ranks thirteenth out of 42 regressors according to the PIP. When we address endogeneity, the importance of trust rises somewhat and trust ranks seventh and twelfth depending on the prior structure. According to the 2SLS-BMA results, trust is more important for growth both absolutely (its coefficient increases) and relative to the baseline estimation (its ranking according to the PIP improves). Overall, these results validate the baseline results indicating that trust is a robust and vital determinant of long-term economic growth.

5.3 Sub-sample issues

To thoroughly evaluate the robustness of the results, the previous literature on the determinants of long-term growth using BMA has emphasized not only the importance of examining the prior structure, but also the composition of the sample (Zak and Knack, 2001). Eicher et al. (2007) employ the iterative BMA and find that the drivers of growth differ sharply for the OECD and non-OECD countries. Similarly, Masanjala and Papageorgiou (2008) show that the drivers of growth in Africa are different from those in the

Table 4: **The effect of trust on growth in countries with a weak rule of law using various prior structures**

	(1)	(2)	(3)
Posterior inclusion probability	0.84	0.84	0.74
Posterior mean	0.048	0.049	0.036
Posterior standard deviation	0.028	0.028	0.030
Parameter prior	g	g	hyper-g
Par. prior value	UIP	Hannah	BRIC
Model prior	Uniform	Uniform	Uniform

Notes: The posterior mean and standard deviation of trust multiplied by 100. For the sake of brevity, the results for the other 23 regressors are not reported. Trust is instrumented by the genetic distance data, the absolute latitude and a dummy for former colonies.

rest of the world.[12] Therefore, we examine to what extent the composition of the sample has an effect on the trust-growth nexus. Unlike Eicher at al. (2007) and Masanjala and Papageorgiou (2008), we do not exclude the non-African or non-OECD countries; however, so that we can contribute meaningfully to this body of literature, we exclude countries with a strong rule of law (i.e., those with well-functioning formal institutions). Several previous studies of the effect of social capital on growth considered the interplay of social capital and formal institutions (Ahlerup et al., 2009, Guiso et al., 2009, Yu et al., 2011). We follow this body of literature and examine the data using the 2SLS-BMA to determine whether the estimated effect of trust on growth is indeed stronger in countries with a weak rule of law.[13] We exclude countries that received the highest score for the rule of law variable (a value of one).[14] However, Uslaner (2008) emphasizes that trust has emerged at the global level and has been influenced by country-to-country interactions. Therefore, the results based on this sub-sample must be interpreted with caution.

Our results are reported in Table 4. The importance of trust to long-term growth increases in terms of the PIP, whose values range between 0.74 and 0.84. In addition, the estimated coefficient for trust rises further: by approximately one third. Consistent with Ahlerup et al. (2009) or Yu et al. (2011), this suggests that trust is indeed more important in countries with weaker formal institutions. Regarding the overall ranking of the regressands according to the PIP, it is noteworthy that trust figures among the top three drivers of growth. This result is reported in Table A.3 in the Appendix, and the prior structure used for the BMA estimation is the same that used in Tables 1 and A.2 to facilitate comparison.

[12] In contrast, Dearmon and Grier (2009) argue that the effect of trust on growth is not very sample dependent.

[13] Another reason is that we do not have data for many African countries, in contrast to Masanjala and Papageorgiou (2008).

[14] These countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Japan, the Netherlands, Portugal, Spain, Sweden, Switzerland, Taiwan, the United Kingdom, and the United States. Following the exclusion of these countries, the number of regressors exceeds than the number of countries. Therefore, we have to exclude some regressors. We choose the regressors that are found in Table 1 to have the PIPs smaller than 0.25 and the fraction Confucian and fraction Jewish regressors because they had a value of zero in most observations. As a result, we have 23 regressors and 31 countries for this exercise.

6 Concluding Remarks

We examine the effect of generalized trust on long-term economic growth. A growing body of empirical literature has shown that trust has a causal effect on growth (see Aghion et al. (2010), Algan and Cahuc (2010) or Zak and Keefer (2001), among others). Nevertheless, existing evidence has also stated that the effect of trust on growth is not robust (Beugelsdijk et al. (2004) and Berggren et al. (2008)). Therefore, we focus on the robustness of the relationship between trust and growth, and assess the role of model uncertainty in depth.

The typical articles within this body of literature regress trust on growth and vary the conditioning variables to evaluate the robustness of the results. It has been shown that this strategy is more likely to yield significant results (Raftery et al., 1997). In addition, the choice of the conditioning regressors is somewhat *ad hoc*, especially in the growth literature, as there are dozens of possible determinants of growth (and there is thus a high degree of model uncertainty). Sala-i-Martin et al. (2004) and Fernandez et al. (2001) examine approximately 40 different growth determinants within a unified framework that is suitable for addressing model uncertainty: Bayesian model averaging. However, none of the previous studies evaluates the effect of generalized trust within this framework. We bridge this gap and investigate whether trust is a robust determinant of growth using a dataset very similar to that used by Fernandez et al. (2001) and Sala-i-Martin et al. (2004). It is important to emphasize that the previous studies that have analyzed model uncertainty have not addressed the simultaneous determination of trust and growth. We follow Durlauf et al. (2008) and combine the 2SLS model for trust with the BMA model to extend the previous literature.

Our results show that trust is indeed a vital determinant of long-term growth and that countries with a higher level of generalized trust grow more. Our Bayesian model averaging estimates indicate a very high post-inclusion probability (approximately 0.6–0.8) for trust, suggesting that trust is one of the top determinants of long-term economic growth and, more generally, supports the literature that has emphasized the importance of social capital in growth (Tabellini, 2010). This finding is also robust to the use of various parameter priors and to concerns regarding endogeneity in the trust-growth relationship. Finally, we find that the effect of trust on growth is stronger in countries with a weak rule of law.

An important issue for future research is to provide more evidence on how various dimensions of culture matter for growth (see also Gorodnichenko and Roland, 2011) and how these dimensions matter in relation to other growth determinants within the IV-BMA framework. Examining more dimensions of culture is vital because this body of literature (perhaps rightfully) use the generalized trust as a proxy for culture but various dimensions of culture are not necessarily strongly correlated. Doing so, it would deepen our knowledge about the interrelationship of culture and trust and more generally, about the effect of culture on growth.

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Appendix

Table A.1: **Are instruments relevant for trust?**

	Coefficient	Standard error
Absolute latitude	0.29**	(0.13)
Dummy for colonies	–16.88***	(4.28)
Genetic distance data	–0.004**	(0.002)
Adj. R-squared	0.63	
F-statistic	25.92	
No. of observations	46	

Note: *, **, *** denotes significance at the 10%, 5% and 1% level, respectively.

Table A.2: **The determinants of growth, trust instrumented**

Variable	PIP	Post Mean	Post SD
GDP level in 1960	1	–0.015109	0.002897
War dummy	0.90	–0.007250	0.003567
Fraction Confucian	0.90	0.076333	0.036816
SD of black market premium	0.85	–3.72E-05	2.19E-05
Fraction Hindu	0.85	–0.065698	0.039285
Size of labor force	0.79	2.36E-07	1.59E-07
Life Expectancy	0.73	0.000448	0.000354
Fraction GDP in mining	0.72	0.064403	0.052293
Degree of capitalism	0.71	0.001968	0.001577
Fraction Jewish	0.70	–0.402270	0.333405
Fraction Protestants	0.70	–0.006856	0.006006
Trust	0.66	0.000297	0.000279
Outward orientation	0.61	–0.002480	0.002498
Population growth	0.60	–0.271131	0.280456
Rule of law	0.54	0.007735	0.009321
Public education share	0.51	0.100027	0.124037
Fraction Muslim	0.38	0.003524	0.006751
Primary school enrollment	0.38	–0.003822	0.008561
Fraction Buddhist	0.36	0.005171	0.009316
Non-equipment investment	0.36	0.011960	0.021167
Number of years of open economy	0.34	–0.001810	0.003979
Fraction Catholic	0.30	0.000413	0.004149
Sub-Saharan dummy	0.30	4.97E-05	0.006081
Civil liberties	0.28	–0.000345	0.000955
Exchange rate distortions	0.26	–9.26E-06	3.59E-05
Political rights	0.25	–0.000218	0.000773
Ratio workers to population	0.25	–0.000719	0.005530
Age	0.25	–6.02E-06	1.49E-05
High school enrollment	0.23	–0.001826	0.020188
Absolute latitude	0.22	–5.61E-07	0.000100
Primary exports	0.22	–0.001077	0.003870
Latin American dummy	0.22	0.000250	0.002311
Fraction speaking foreign language	0.20	0.000217	0.001660
Equipment investment	0.20	0.007797	0.028969
Spanish colony dummy	0.20	0.000268	0.001876
Revolutions and coups	0.19	0.000186	0.002237
French colony dummy	0.19	0.000411	0.002069
Black market premium	0.18	0.000251	0.002544
British colony dummy	0.18	0.000215	0.001377
Ethnolinguistic fractionalization	0.17	6.77E-05	0.001804
Area (scale effect)	0.16	2.05E-08	1.79E-07
Fraction of pop. speaking English	0.16	0.000148	0.001636

Table A.3: **The determinants of growth, trust instrumented, weak rule of law**

Variable	PIP	Post Mean	Post SD
GDP level in 1960	0.94	–0.011470	0.004754
SD of black market premium	0.87	–3.17E-05	1.77E-05
Trust	0.84	0.000485	0.000283
War Dummy	0.77	–0.005862	0.004165
Rule of Law	0.76	0.014249	0.010337
Age	0.57	–4.35E-05	4.81E-05
Life Expectancy	0.49	0.000327	0.000434
Equipment Investment	0.37	0.063448	0.111047
Fraction Muslim	0.36	0.002507	0.004638
Degree of capitalism	0.36	0.021996	0.043425
Outward Orientation	0.33	–0.001751	0.003541
Ratio of workers to population	0.33	–0.003755	0.007675
Size of labor force	0.31	–1.48E-08	3.14E-08
Sub-Saharan dummy	0.27	0.000463	0.006184
Primary school enrollment	0.26	–0.002925	0.008964
Public education share	0.26	0.038196	0.101961
Civil Liberties	0.26	–0.000487	0.001471
Rule of Law	0.23	0.000305	0.000926
Fraction GDP in mining	0.20	–0.005935	0.028922
Political Rights	0.19	–2.74E-05	0.000890
Population growth	0.19	–0.035296	0.143074
Number of years of open economy	0.19	0.000527	0.002762
Fraction Protestants	0.18	–0.002266	0.011692