Trust and growth in the 1990s: a robustness analysis

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We conduct an extensive robustness analysis of the relationship between trust and growth for a later time period (the 1990s) and with a bigger sample (63 countries) than previous studies. In addition to robustness tests that focus on model uncertainty, we use Least Trimmed Squares, a robust estimation technique, to identify outliers and investigate how they affect the results. We find that the trust-growth relationship is less robust with respect to empirical specification and to countries in the sample than previously claimed, and that outliers affect the results. Nevertheless trust seems quite important compared with many other growth-regression variables.

1. Introduction

Wherever people trust each other they trade, and by trading they get richer. This intuition is developed in numerous studies that suggest that social capital in some form is beneficial for economic growth (see e.g. Putnam, 1993; Fukuyama, 1995; La Porta *et al.*, 1997; Dasgupta and

Sergaldin, 2000; Glaeser *et al*., 2000).[1] Empirical studies lend support to this line of reasoning, most notably Knack and Keefer (1997), Zak and Knack (2001), and Beugelsdijk *et al.* (2004), which find that generalised trust (henceforth referred to merely as trust) promotes economic growth.[2] Beugelsdijk *et al*. conclude that the relationship between trust and economic growth is highly robust in terms of statistical significance and reasonably robust in terms of the size of the estimated effect. In this paper we examine this conclusion by taking the robustness analysis further.

We begin by investigating whether previous results on the trust–growth relationship, shown by Beugelsdijk *et al.* to hold 1970–1990, hold also for the 1990s. Like them, we use robustness tests that focus on model uncertainty and examine the size, spread and statistical significance of the trust coefficient when the control variables are varied. We do this using new data on trust from the fourth version of the World Values Survey (WVS) (Inglehart *et al*., 2004), as well as new data on growth. Our sample is substantially bigger: it encompasses 63 countries, if 9 trust observations from the Latinobarómetro (2004) are included. This constitutes an increase from 29 countries in Knack and Keefer and 41 in Zak and Knack and Beugelsdijk *et al.* Adding new countries is especially relevant since Beugelsdijk *et al.* report a distinct sensitivity of the results to the countries included in the sample. We report results for three samples of countries throughout this paper.

Furthermore, we extend the robustness analysis by introducing a novelty: we apply the robust estimation technique Least Trimmed Squares (LTS) to measure the impact

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[1] For a theoretical model, see Zak and Knack (2001), where trust is defined as the time people spend in production rather than in verifying that others do not cheat or behave opportunistically. High-trusting societies are societies in which such transaction costs are low, which stimulates investment and production.

[2] For other results from the literature on the determinants of economic growth, see e.g. Barro (1991, 1997), Sala-i-Martin (1997), Durlauf and Quah (1999), and Temple (1999).

of outliers (i.e. observations that deviate from the general pattern) in a systematic fashion. This is an important but often neglected matter to investigate when assessing robustness.

These extensions of previous studies of the trust–growth relationship make it possible to offer a firmer conclusion about its robustness. Even though the overall picture is one of mixed results, as robustness as such is a multidimensional concept, our findings point to a weaker relationship than in previous studies. Nevertheless, trust still seems more robustly related to growth than many other growth-regression variables.

2. Robustness, empirical strategy and data

2.1 Robustness and empirical strategy

There is no universally accepted definition of robustness – the concept is multifaceted and continuous rather than dichotomous – which is why most studies in this area incorporate a variety of robustness criteria.[3] Usually, the focus is on the robustness of the results with respect to the model specification – i.e. extreme bounds analysis that looks at the statistical significance and sign of the estimated coefficient. We incorporate these types of tests into our analysis.

However, there are other ways, often overlooked, along which results may be fragile with respect to the empirical specification. One such way concerns how the size of the estimated coefficients changes as the control variables are varied. We conduct such a study by looking at the distribution of the estimated trust coefficient. The rationale for this type of test, following McCloskey (1985), McCloskey and Ziliak (1996), Florax *et al.* (2002) and Ziliak

[3] See Florax *et al*. (2002).

and McCloskey (2004), is that whereas the statistical significance of an estimated coefficient is used for establishing the existence of a relationship between two variables, the real-world relevance of a relationship depends on the size and the precision of the estimate. Like Beugelsdijk *et al.* (2004) we investigate such matters thoroughly.

And as pointed out in Rousseeuw and Leroy (1987), OLS estimates are quite sensitive to outliers, i.e. observations that deviate from the linear pattern formed by the majority of the data.[4] Outliers occur frequently in datasets because of measurement errors, because some observations may be drawn from a different population with a different type of relationship between the variables of interest or because of exceptional but irrelevant events (e.g. earthquakes). Applying OLS on a dataset contaminated by outliers may result in severely biased estimates. In the extreme case, one single outlier can result in an infinite bias of OLS estimates, i.e. it has a breakdown point of 0 percent.[5] To deal with this problem, robust regression methods, i.e. methods that have a breakdown point greater than zero, can be applied. By comparing the OLS estimates with robust estimates it is possible to assess the relationship's sensitivity to outliers. And as more countries are added to the sample, stability is also indicated by how the distribution and the mean of the trust coefficient change.

Furthermore, results may be fragile in other ways, e.g. with respect to different measures of relevant variables or with respect to changes in a relationship over time. Hence, there are many dimensions in which results may or may not be robust. To make an overall judgement, all the dimensions must be assessed and weighed against each other, and the conclusions must be based on informed judgement rather than a simple check of whether a certain test is passed.

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[4] Such points may have an unusual value for the dependent variable, for a regressor or for both.

[5] For a technical definition of "breakdown point", see Rousseeuw and Leroy (1987), p. 9.

In line with this, our empirical analysis partly follows Beugelsdijk *et al.* and consists of three parts, in each case making use of the newer and more comprehensive data, described in more detail below.

First, following Leamer (1985), Levine and Renelt (1992) and Sala-i-Martin (1997), who point out that results of cross-country growth regressions need to be tested for robustness with respect to the empirical specification, we investigate the sensitivity of the statistical significance of trust when the control variables are varied. We look at four tests:

(i) the strong extreme bounds test (indicating whether all of the estimated coefficients are statistically significant at the 5 percent level and of the same sign),

(ii) the weak extreme bounds test (indicating whether at least 95 % of the estimated coefficients are statistically significant at the 5 percent level and of the same sign),[6]

(iii) the strong sign test (indicating whether all of the estimated coefficients have the same sign), and

(iv) the weak sign test (indicating whether at least 95 percent of the estimated coefficients have the same sign).

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[6] We do not use the weighted weak extreme bounds test or the cumulative density function test, following a critique of the weighted extreme bounds analysis expressed by Sturm and de Haan (2002a). As shown by them, the varying number of observations in the regressions due to missing observations is problematic. First, the goodness-of-fit measure that is obtained may not be a good indicator of the probability that a model is true. Second, the weights constructed in this way are not equivariant for linear transformations of the dependent variable.

The basic idea of extreme bounds analysis, following Leamer (1985), is to systematically vary certain control variables to see what happens to statistical significance of the estimates of the variable of interest. A regression equation of the following kind is used (in country i):

$$\Delta Y_i = \alpha + \boldsymbol{\beta} \mathbf{F}_i + \gamma x_i + \boldsymbol{\delta} \mathbf{C}_i + u_i, \qquad (1)$$

where ΔY_i refers to growth in GDP *per capita*, where $\mathbf{F}_i$ is a vector with the fixed variables that are always included in the regressions, where x_i refers to the variable of interest (trust in our case), where $\mathbf{C}_i$ is a vector with three variables from the set of switch variables, and where u_i is an error term. We investigate the effects on the statistical significance of γ when varying **C.** This is done by including three switch variables at a time in all possible combinations (which has become the standard way of conducting this kind of test) and using data for up to 63 countries for the 1990s.

Second, we investigate how the size and precision of the estimated trust coefficient change as the switch variables are varied. To enable a broad assessment, we provide histograms of the distributions of all estimated trust coefficients; and we report the average and the median estimated coefficients, as well as standard deviations and max-min ratios. All of the robustness tests with respect to the empirical specification are carried out for three different samples of countries.

Third, and this is a novel test of the robustness of the trust-growth relationship, we apply the robust estimation technique LTS.[7] This technique was pioneered by Rousseeuw (1984) and is described and advocated by e.g. Temple (1999), Zaman *et al.* (2001) and Sturm and de Haan (2002b). The idea is to use a method that is "robust against the possibility that

[7] Zak and Knack (2001), as noted on p. 310, apparently use some form of robust estimator to downweight cases with large residuals, but it is not clear how this is done.

one or several unannounced outliers may occur anywhere in the data" (Hubert *et al.*, 2004, p. 1515) by, in this case, fitting the majority of the data and identifying outliers as the cases with large residuals.

Outliers are defined on the basis of the following procedure, as outlined in Rousseeuw and Leroy (1987). First, the 75 percent of the observations that give the best fit (that minimize the sum of the squared residuals) are identified, which produces a regression line. Then the remaining 25 percent of the observations are added, and their residuals are computed from the fitted values of the first-stage regression. Countries with a standardized residual above a certain value, approximately 2.5, are identified as outliers. This procedure concentrates on the observations that best approximate the model to be estimated. After this identification, Reweighted Least Squares (RLS) is used for inference by giving outliers the weight zero and other countries the weight one. The advantage of LTS compared with single-case diagnostics like Cook's distance and DFITS is that it can handle cases with several jointly influential outliers. As we use LTS with a breakdown point of 25 percent, the method can handle cases where up to 25 percent of the observations are jointly influential.[8]

We think that the conclusion in Beugelsdijk *et al.*, that the size of the trust-growth relationship depends on which countries are included in the sample, makes the systematic LTS/RLS procedure very valuable. Also, it is quite unlikely that the additional countries are perfectly representative for the population of all countries.

[8] For practical-technical information about the LTS estimator and its application, see Rousseeuw and Van Driessen (1999) and Verboven and Hubert (2004).

2.2 The data

This study makes use of three samples, encompassing new data, not least from the fourth version of the WVS. We present all results for all three samples, which are described in Figure 1.[9]

Table 1 The three samples[#]

Name of sample	Small	Intermediate	Full
Countries	39	54	63
Time period	1990–2000	1990–2000	1990–2000
Source for Trust	Inglehart et al. (2000), Inglehart et al. (2004)	Inglehart et al. (2000), Inglehart et al. (2004)	Inglehart et al. (2000), Inglehart et al. (2004), Latinobarómetro (2004)

[#]Our small sample corresponds to that in Zak and Knack and Beugelsdijk *et al.,* but there the number of countries is 41 (Luxembourg and Nigeria are not included in our small sample due to a lack of data on *Schooling*) and the time period is 1970–1990 (as *Trust* data from 2000 are not included in the other studies). The countries are specified in Table A2.

The variables are divided into four groups: the dependent variable, the variable of interest (*Trust*), the fixed variables, and the switch variables. The fixed variables are control variables that are included in all regressions, whereas the switch variables are included and varied when we investigate robustness with respect to the empirical specification. We list the four groups below. Descriptive statistics and sources for all variables can be found in Table A1 in the Appendix. Values for *Trust* and *Growth* per capita are listed in Table A2 in the Appendix.

[9] The risk for measurement errors probably increases as more countries are added to a dataset, since it is usually the rich countries with high-quality statistical services that are included first.

(i) Dependent variable (1): *Growth* per capita: annual growth of real GDP chain *per capita*, 1990–2000.

(ii) Variable of interest (1): *Trust*: the percentage of respondents in each country agreeing with the statement "most people can be trusted" rather than with the alternative "you can't be too careful in dealing with people" (earlier versions of the WVS) or "you need to be very careful in dealing with people" (the latest, fourth version of the WVS). [10] The WVS has been conducted in 1981, 1990–91, 1995–96, and 1999–2002. For each country, we use the first non-missing value in the three latest versions of the WVS. We include additional values for Greece from the Eurobarometer survey and for New Zealand from a government survey;[11] in addition, we add values from nine Latin American countries for 1995 from the Latinobarómetro (2004) [12].[13]

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[10] We do not think this change is of any importance for our study. Furthermore, Glaeser *et al.* (2000) report that the quoted question from the WVS in fact measures *trustworthiness* rather than *trust*. However, for our purposes this will be of minor concern as long as trust and trustworthiness are correlated positively across countries.

[11] See Zak and Knack (2001), p. 307.

[12] The Latinobarómetro survey question is consistent with the one from Inglehart *et al*. (2004). It is formulated thus (in Spanish): "Hablando en general, ¿Diría Ud. que se puede confiar en la mayoría de las personas o que uno nunca es lo suficientemente cuidadoso en el trato con los demás?" (Own translation: "Would you say that the majority of persons can be trusted or that one can never be sufficiently careful in dealing with people?")

[13] The questions were virtually identical in all these surveys. Whilst we cannot rule out a framing effect – i.e. that the replies to the identical questions differed because of differences between the surveys overall – we think this risk is small. In the WVS itself there is a similar, small risk that the comparability between countries is not perfect, stemming from the fact that the questions are asked in different languages which may entail different interpretations of certain terms (such as "most people").

(iii) Fixed variables (3): *Schooling:* the average number of years in school, 1990; *Investment-good price*, the price level of investment;[14] *Real GDP* per capita, in thousands of USD, 1990.

(iv) Switch variables (20): Control variables that are included in all possible combinations of three.

How were the fixed variables and the switch variables chosen? The three fixed variables were picked because they have been shown to be robustly linked to economic growth in previous empirical studies. As for the switch variables, we started with the full set of Beugelsdijk's *et al.* variables and then implemented some changes on the following grounds. We have removed a few variables for three reasons: poor data, moving forward the time period under study, and avoiding reducing the sample size too much. We have also exchanged some variables, as we believe we have found better data. In total, 68 potential switch variables are in our original dataset. Out of these the 20 listed in Table A1 in the Appendix were chosen, as they have a correlation coefficient with *Trust* of less than 0.25 in absolute value. This procedure limits the problem of multicollinearity and increases comparability (cf. Beugelsdijk *et al.*, pp. 123–124).[15] For reasons of comparison, we also use all 68 switch variables in the extreme bounds analysis in section 3.2.

One thing that should be pointed out is that because the data we use for the countries not included in previous studies are relatively new, from 1995 and 2000, it stems from the end of the period for which our dependent variable is measured. As in previous

[14] It has been more common to measure investments by their share of GDP, but we choose this price variable for two reasons: it can be regarded as an exogenous proxy (as investments as a share of GDP tend to be endogenous with respect to growth); and Beugelsdijk *et al.* use it, which increases comparability between our two studies.

[15] Furthermore, looking at the correlation coefficients between the switch variables, these are everywhere quite low (only above 0.5 in one case and distinctly lower in almost all other cases).

studies, there may be a problem of reverse causality. However, we think that the risk for this being more problematic in our study is rather small, since we obtain similar results when only using the countries looked at in Beugelsdijk *et al.* as when using the full sample (see the following section).

3. Robustness results

This section presents the results from our three types of robustness tests. First we present basic OLS regressions for our three samples (3.1); then extreme bounds analysis focusing on the sign of the estimated *Trust* coefficient and its statistical significance (3.2); followed by a similar investigation of the size and precision of the *Trust* coefficient (3.3); and regression results when outliers are deleted, through the application of the robust estimation technique LTS in conjunction with RLS (3.4). All tests are carried out for the three samples specified in Table 1.

3.1 Basic regressions for three samples

It is useful to first take a look at the results from basic OLS regressions for the three samples of countries, as reported in Table 2. The regressions all contain the variable of interest, *Trust*, as well as the three fixed control variables.

Table 2 OLS#

	Dependent variable: *Growth* per capita		
	Small sample	Intermediate sample	Full sample
Trust	0.046*	0.067***	0.062***
	(0.024)	(0.018)	(0.019)
Real GDP *per capita*	-0.184*	-0.157**	-0.154**
	(0.074)	(0.063)	(0.064)
Investment-good price	-0.004	0.010	0.015
	(0.018)	(0.009)	(0.009)
Schooling	0.282	0.063	0.134
	(0.176)	(0.156)	(0.155)
Observations	39	54	63

#Standard errors in parentheses. All estimated equations include a constant term not reported here.

*significant at 10%; ** significant at 5%; *** significant at 1%

Sources and variable definitions: see Table A1. Sample list: see Table A2.

The *Trust* estimates in the basic model specification looked at here seem fairly robust when more countries are added. It is clear that the size and the statistical significance of the *Trust* coefficient are greater in the two larger samples, reinforcing that *Trust* seems economically important. An increase in the share of people who believe that most people can be trusted by 10 percentage units entails an increased annual growth rate of 0.62 percentage units, on average, when the largest sample is considered. Of the fixed variables, only *Real GDP* per capita exhibit a statistically significant relationship with the dependent variable.

3.2 Extreme bounds analysis

Here, we look at what happens to the sign and the statistical significance of *Trust* as the set of control variables is varied in a systematic way. The results are found in Table 3. They are based on the basic regressions in Table 2, with the addition of all possible combinations of three switch variables, which gives a total of 1,140 regressions. Again, the results are presented for three different samples of countries.

Table 3 Robustness results with respect to model specification for *Trust* for three samples#

	Small sample	Intermediate sample	Full sample
Share of regressions where *Trust* is statistically significant	29.3 %	63.6 %	49.3 %
Number of regressions where *Trust* takes a negative sign	0	0	0
Observations	36-39	37-54	45-63

Total number of switch variables: 20.

Number of regressions in each column: 1,140.

Sources and variable definitions: see Table A1. Sample list: see Table A2.

How robust, then, is the statistical significance of *Trust* with regard to the empirical specification? We look at the four robustness tests listed in section 2.1. First, the strong extreme bounds test is not passed for any of the samples: for none of them is a 100 percent statistical significance share obtained at the 5 percent level. Second, neither is the weak extreme bounds test: for none of them is a 95 percent statistical significance share obtained at the 5 percent level. Third, the strong sign test is passed for all samples, as all estimated coefficients have the same, positive sign. Fourth, and by necessity, so is the weak sign test.

Compared to Beugelsdijk *et al.*, where the weak extreme bounds test was passed, our results point at a less robust relationship between *Trust* and *Growth* per capita.[16] While Beugelsdijk *et al.* report a 99.9 percent significance share for *Trust* at the 5 percent level, we report a much lower figure, 29.3 percent. Although the full sample implies a more robust relationship between *Trust* and *Growth* per capita than the small one, the relationship

[16] We do not include a robustness test of the fixed variables here. But interestingly, they do not seem as robustly related to growth as one would have been led to believe on the basis of the previous literature. Future research may wish to look deeper into the robustness characteristics of these particular variables.

seems to be less robust in the 1990s compared with the previously studied period 1970–1990.[17]

3.3 Size effect

How do the distribution and the mean of the estimated coefficients change as the 20 selected switch variables are varied in all possible combinations of three and as more countries are added? Figures 1–3 display the distribution of the estimates for *Trust* in the 1,140 regressions carried out for the three samples of countries.[18] Figure 1 shows the distribution for the small sample.

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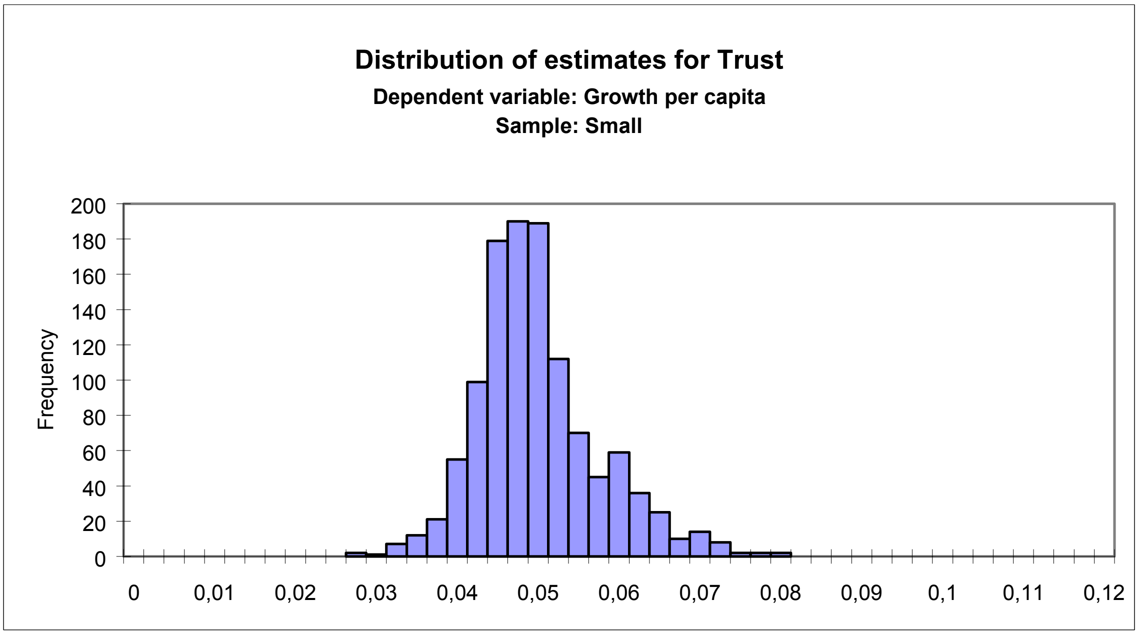
[17] We have also conducted a corresponding test using all 68 switch variables, which resulted in 50,116 regressions. The significance share for the small sample is then 22.3 percent; it is 44.6 percent for the intermediate sample; and 32.3 percent for the full sample. As expected, these shares are lower when additional variables that are more highly correlated with *Trust* are included. Of the four tests, only the weak sign test is passed – and it is passed for all three samples of countries. The data set containing all 68 switch variables can be found at http://www.

[18] Note that statistically insignificant estimates are included.

Fig. 1. The distribution of estimates for *Trust:* the small sample[#]

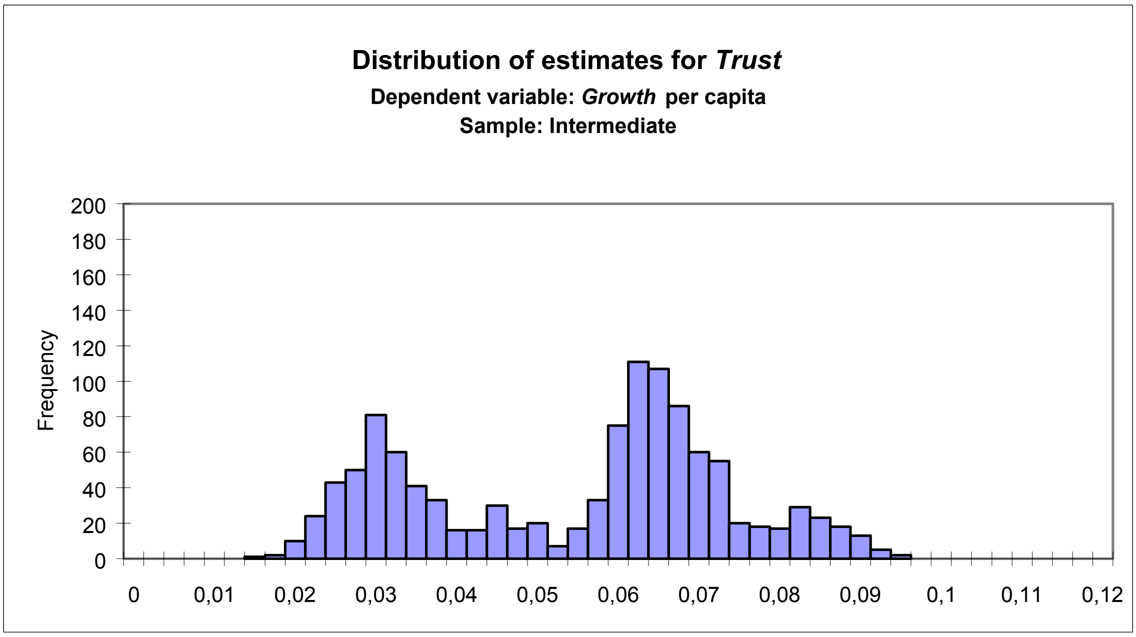


[#]Min: 0.026. Max: 0.080. Mean: 0.049. Median: 0.048. Standard deviation: 0.008. Max-min ratio: 3.1.

One might say that the relationship between *Trust* and *Growth* is fairly robust with respect to size effect for this sample. The spread around the mean is not excessive, and something like a bell shape can be observed. The small sample corresponds to the sample studied by Beugelsdijk *et al.* (but for a later time period), and our picture is quite similar to the one found in their article.

In Figure 2, the distribution for the intermediate sample is shown. Now, for the newer and bigger sample, a less robust relationship with respect to size effect can be detected. First, the spread is much greater: the max-min ratio is about 7 (compared to about 3 for the smaller sample). Second, the shape of the distribution is much more uneven. However, the mean is quite similar (0.049 in the smaller sample and 0.053 in the larger).

Fig. 2. The distribution of estimates for *Trust:* the intermediate sample#

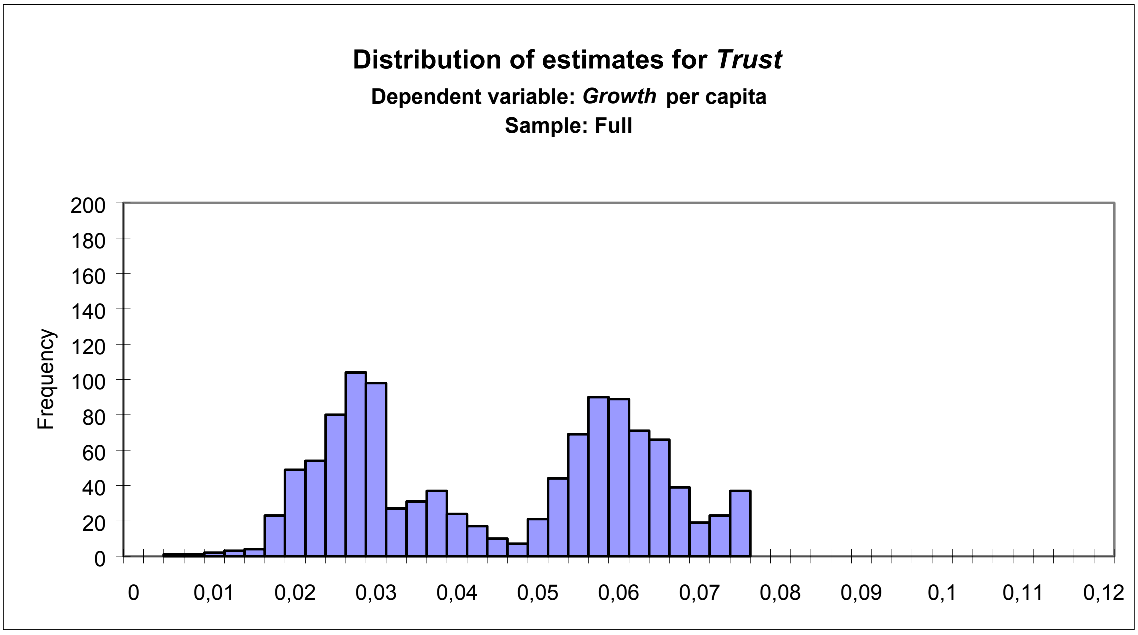


#Min: 0.014. Max: 0.094. Mean: 0.053. Median: 0.060. Standard deviation: 0.019. Max-min ratio: 6.8.

Lastly, Figure 3 shows the distribution for the full sample. Again, the picture is one of a less robust relationship than is displayed in the smallest sample, with a much larger spread (the max-min ratio is about 19) and with a more irregularly shaped distribution.[19] The mean is also lower, 0.044.

[19] As can be seen, for the two larger samples, the distributions take on a two-peaked shape. How can this be explained? We have the same number of regressions and the same switch variables; so as the sample is extended, some specifications generate higher and some generate lower estimates as compared to the smallest sample. An attempt to analyse which specifications generate this pattern did not reveal any economically intuitive explanations. The variables that are relatively more often in the peak with the higher estimates are *Landlocked*, *Real exchange-rate distortion* and *Military*, whilst *Scout*, *Area* and *Hindu* are somewhat overrepresented in the peak with the lower estimates.

Fig. 3. The distribution of estimates for *Trust:* the full sample#



#Min: 0.004. Max: 0.075. Mean: 0.044. Median: 0.047. Standard deviation: 0.018. Max-min ratio: 19.0.

To illustrate the implications of the results displayed in Figure 3, with estimates ranging from 0.004 to 0.075, consider an increase of *Trust* of 10 percentage units on average, all else equal. In the first case, this generates an increased annual growth rate of 0.04 percentage units; in the latter case, the increase is 0.75 percentage units. In the mean case, the increase is 0.44 percentage units.

Although the spread of the estimates of *Trust* increases as more countries are added, we think that on the whole the distributions behave quite well. The spread when the largest sample is used is not excessive, no negative signs occur and the mean does not change all that much. Compared with Beugelsdijk *et al.*, the spread appear to be greater in our study. The difference is explained by the inclusion of additional countries and not by the study of a later time period.

3.4 LTS

A further type of robustness test is to see whether the results are influenced by outliers. As pointed out above, some of the previous literature lacks a systematic usage of robust estimation techniques. Hence, we apply LTS in conjunction with RLS for inference in order to examine the impact of outliers on the results.

Table 4 shows the results for the basic model, with *Trust* and the three fixed variables as control variables. The first column is based on the full sample, and the ensuing columns are in each case based on a gradual elimination of outliers, starting with China, the country with the largest standardized residual.

Table 4 LTS and RLS#

	Dependent variable: *Growth* per capita				
Trust	0.062***	0.039*	0.033*	0.035*	0.032*
	(0.019)	(0.020)	(0.019)	(0.019)	(0.018)
Observations	63	62	61	60	59
Sample	Full	Excl	Excl	Excl	Excl
		China	China	China	China
			Ireland	Ireland	Ireland
				Nicaragua	Nicaragua
					Latvia

Sample: Full. Standard errors in parentheses. All estimated equations include a constant term and three fixed variables not reported here.

*significant at 10%; ** significant at 5%; *** significant at 1%

Sources and variable definitions: see Table A1. Sample list: see Table A2.

Table 4 suggests that outliers to some extent affect our results. Removing China, Ireland, Nicaragua and Latvia halves the size of the estimate and sharply reduces the degree of statistical significance, indicating that OLS results may be misleading or, at least, that they should be interpreted carefully. It is clearly China that is the most distinct outlier.[20] However, even with all four outliers removed, statistical significance at the 10 percent level as well as an economically significant size of the estimate are retained. For the great majority of the countries, an increase in *Trust* with 10 percentage units is still associated with an increased annual growth rate of 0.32 percentage units on average.

4. Concluding remarks

We have explored the relationship between trust and economic growth, taking previous investigations further in several respects. On the one hand, we have made use of the brand-new World Values Survey, with more data than has been available before, in an attempt to replicate previous robustness results, primarily those from Beugelsdijk *et al.* (2004), for the 1990s. We have looked at both statistical significance (primarily extreme bounds analysis) and size effects. On the other hand, we have expanded the analysis by looking at different samples of countries and by introducing a robust estimation technique, LTS, in combination with RLS for inference, in order to see to what extent outliers affect our results.

What have we found? Mainly that the trust-growth relationship is not quite as robust in the 1990s as it was in the period 1970-1990, according to earlier studies. For example, the weak version of the extreme bounds test is not passed for any sample; and as the sample increases, the mean of the trust estimates is reduced and the spread increases.

[20] We do not know exactly why China's effect on the results is so large. It may be because of measurement error, because China belongs to a different population than the other countries, because some exceptional but irrelevant events have taken place there – or because it differs on other, perfectly legitimate grounds. In any case, we think that an important benefit of the LTS/RLS method is its transparency: irrespective of the reason for there being outliers like China, it is clear that this particular country tilts the regression line quite a bit.

Furthermore, application of LTS indicates that the statistical significance of trust is weakened and the size of the estimate is distinctly reduced when four outliers are removed. This exemplifies that robust estimation techniques are vital in future econometric work. Nevertheless, compared to many other traditional growth variables, there is some basis for claiming that the trust-growth relationship is reasonably robust, albeit with certain qualifications. In this sense this study adds important nuances and insights to the previous literature.

Connecting this to broader issues, an important rationale for a study of this kind is that economic growth is at the top of most policy agendas around the world, which makes it essential to better disentangle the determinants of growth. Even though trust may not be as robustly related to growth as some earlier studies have claimed, it still seems quite important, not least in comparison with most other policy variables, which tend to fare worse in econometric tests of the kind that we have applied.[21]

Future research may wish to try to find out what, in turn, causes trust. Tentative steps have been taken, but much more needs to be done.[22] Furthermore, more versions of the WVS, with trust observations for several years for many countries, will facilitate panel-data analysis that may help sort out the causality problem of cross-country regressions. Case studies can be seen as a natural complement in this regard, through which it may be possible to trace the causal mechanisms through which trust affects growth. New ways of measuring trust would also be useful, in order to see whether the results are robust to the way this variable is measured.

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[21] The results presented here, as in other cross-country studies, must be interpreted with caution and should only be interpreted as suggesting *the possibility of* a *causal* relationship.

[22] See e.g. Knack and Zack (2002) and Hooghe and Stolle (2003).

Supplementary material

Our dataset is available at http://www.nek.uu.se/cgi/staffpage.pl?PId=141,lang=eng

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Appendix

Table A1 Variable specifications and descriptive statistics

Variable	Definition	# obs	Mean	Std dev	Min	Max	Source
Growth *per capita*	Annual growth rate in percent of real GDP (chain) *per capita*, 1990-2000: 100*[(Real GDP per capita$_{2000}$ / Real GDP per capita$_{1990}$)$^{1/10}$ – 1] Taiwan: 1990–1998	63	1.8	1.9	-2.6	7.7	Heston et al. (2002)
Trust	First value of trust 1990–2000, i.e. the share that agrees with the statement "most people can be trusted"	63	30.5	15.7	5.0	66.1	Inglehart *et al.* (2000), Zak and Knack (2001), Inglehart *et al.* (2004)
Schooling	Average years of schooling, 1990	63	6.7	2.6	2.2	12.0	Barro and Lee (2000)
Real GDP *per capita*	Real GDP (chain) *per capita*, thousands of USD in 1996 constant prices, 1990	63	10.2	7.6	0.7	26.5	Heston et al. (2002)
Investment-good price	The PPP of investment divided by the exchange rate times 100, 1990	63	79.0	33.5	12.5	177.7	Heston et al. (2002)
Openness	Exports plus imports divided by real GDP *per capita*, in current prices, 1990	63	57.4	29.0	15.0	154.6	Heston et al. (2002)
UK colony	Dummy with value 1 if former UK colony and 0 otherwise	63	0.2	0.4	0	1.0	Persson and Tabellini (2003); http://www.britishempire.co.uk; Encyclopaedia Britannica; *Nationalencyklopedin [Swedish National Encyclopedia]*
Language fractionalization	One minus the Herfindal index of linguistic group shares, 2001	62	0.3	0.3	0	0.9	Alesina et al. (2003)
Religious	One minus the Herfindal index of religious	63	0.4	0.2	0	0.9	Alesina et al. (2003)

fractionalization	group shares, 2001						
Orthodox	Share of population that is Orthodox Christian, 2000	63	3.9	16.0	0	93.8	World Christian Database, http://www.worldchristiandatabase.org/wcd/; population from Heston et al. (2002), for Taiwan from http://www.census.gov/ipc/www/idbsum.html
Muslim	Share of population that is Muslim, 2000	63	11.5	28.0	0	98.1	Ditto
Buddhist	Share of population that is Buddhist, 2000	63	1.9	7.7	0	55.7	Ditto
Hindu	Share of population that is Hindu, 2000	63	1.7	10.1	0	79.8	Ditto
Jewish	Share of population that is Jewish, 2000	62	0.3	0.5	0	3.1	Ditto
Sub-Sahara	Dummy with value 1 if African country is located to the south of the Sahara and 0 otherwise	63	0.1	0.2	0	1.0	
Urban	Share of population in urban areas, 1990	62	60.7	19.1	11.2	96.4	United Nations (2003)
European language	Fraction of a country's population that speaks English, French, German, Portuguese or Spanish	63	0.4	0.4	0	1.0	Hall and Jones (1999); http://www.ethnologue.com
Area	Million square kilometres	63	1.2	2.4	0	10.0	Central Intelligence Agency (2004)
Mining	Fraction of GDP produced in the mining and quarrying sector, 1988	58	0	0.1	0	0.5	Hall and Jones (1999)
Scout	Dummy with value 1 if outward orientation based and 0 otherwise, 1988	55	0.4	0.5	0	1.0	King-Levine Dataset at http://www.worldbank.org/research/growth/ddkile93.htm; primary source: Syrquin and Chenery (1988)
Assassination	Number of political assassinations per billion inhabitants, 1980s	54	0	0.2	0	1.3	King-Levine Dataset at http://www.worldbank.org/research/growth/ddkile93.htm

Frankrom	Natural log of the Frankel-Romer forecasted trade share, derived from a gravity model of international trade that takes into account only country population and geographical features	50	2.6	0.7	0.9	4.0	Persson and Tabellini (2003); primary source: Hall and Jones (1999)
Military	Military expenditure as a share of GNI	58	3.0	3.0	0	21.0	World Bank (2001)
Real exchange-rate distortion	Real exchange-rate distortion, index, 1991	54	114.6	33.7	70.0	248.0	Levine and Renelt (1992); primary source: Dollar (1992)
Landlocked	Dummy with value 1 if landlocked country, i.e. country without a coastline, and 0 otherwise	63	0.1	0.4	0	1	Central Intelligence Agency (2004)

Table A2 Values of *Trust* and *Growth* per capita in the three samples

The small sample includes the following 39 countries:

Country	Trust	Growth *per capita*
Argentina	23.3	4.3
Australia	39.9	2.5
Austria	31.8	1.8
Bangladesh	21.0	2.8
Belgium	33.2	1.8
Brazil	6.7	1.5
Canada	52.4	1.9
Chile	22.7	4.9
Colombia	10.0	0.9
Denmark	57.7	2.0
Dominican Republic	26.4	5.2
Finland	62.7	1.6
France	22.8	1.1
Germany	37.8	1.6
Ghana	23.0	1.4
Great Britain	43.6	1.9
Greece	50.0	2.0
Iceland	43.6	1.6
India	34.3	4.0
Ireland	47.4	6.4
Italy	34.0	1.2
Japan	41.7	1.1
Korea	34.2	4.8
Mexico	33.5	1.8
Netherlands	54.9	2.2
New Zealand	37.0	1.5
Norway	65.1	2.8
Peru	5.0	2.5
Philippines	6.0	1.3
Portugal	21.4	2.6
South Africa	28.3	-0.3
Spain	33.8	2.2
Sweden	66.1	1.3
Switzerland	43.2	0.1
Taiwan	42.0	5.7
Turkey	10.0	1.8

Uruguay	22.0	2.9
USA	52.0	2.3
Venezuela	14.0	-0.8

The intermediate sample includes the following 15 additional countries:

Country	Trust	Growth *per capita*
Algeria	11.2	-0.1
China	60.3	7.7
Czech Republic	28.0	0.1
Egypt	37.9	2.6
Hungary	24.6	0.8
Indonesia	51.6	2.5
Jordan	27.7	1.2
Latvia	19.0	-2.6
Pakistan	30.8	1.4
Poland	34.5	3.4
Romania	16.1	-1.1
Slovakia	23.0	-0.5
Slovenia	17.0	1.9
Uganda	7.6	3.2
Zimbabwe	11.9	-1.6

The full sample includes the following 9 additional countries:

Country	Trust	Growth *per capita*
Bolivia	17.0	1.1
Costa Rica	11.0	1.8
Ecuador	20.0	-0.8
El Salvador	14.6	2.3
Guatemala	28.0	0.8
Honduras	25.0	-0.8
Nicaragua	20.0	-2.4
Panama	25.0	2.0
Paraguay	23.0	-0.6