1-2018

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Economic Modelling 68 (2018) 293–305

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/econmod

Trust and macroeconomic performance: A two-step approach

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ARTICLE INFO

JEL Classification:
O43
O47
O50
Z13

Keywords:
Trust
Per capita income
Investment

ABSTRACT

We reexamine the role of trust in macroeconomic performance using a new econometric method, a two-step approach adopted by Di Tella et al. (AER, 2001). In the first step, the measure of trust is constructed from the micro-regression of trust. This method allows us to extract the component of trust that is not influenced by individual-level socio-economic factors. In the second step, measures of macroeconomic performances are regressed on this improved measure of country-level trust. We find a strong positive relationship between the level of trust and real GDP per person stipulated by an increase in investment. Our results also indicate that the impact of trust on macroeconomic variables estimated by previous studies is biased upwards.

1. Introduction

The empirical literature on economic growth has identified factors that play important roles in explaining the economic performance of contemporary societies ranging from, but not limited to, human capital, natural resources, colonial origins, geography, institutions, and financial development (Acemoglu et al., 2001, 2002; Arestis and Demetriades, 1997; Gallup et al., 1999; Sachs and Warner, 1999). More recently, the link between social capital (defined as the interpersonal trust of citizens) and economic growth has attracted increasing attention of economists, as some recent contributions attest (Temple and Johnson, 1998; Coleman, 1988; Putnam, 1995; Whiteley, 2000; Zak and Knack, 2001; Deng et al., 2012; Tabellini, 2010; Algan and Cahuc, 2010).

Social capital is an element inherent in every commercial transaction; its existence works to reduce transaction costs, minimize the deadweight burdens of enforcing agreements, and lessen the risks of fraud and theft. These benefits enable economic agents to efficiently negotiate solutions to collective action problems while greatly diminishing principal-agent problems, which directly influences economic outcomes (Arrow, 1972; Whiteley, 2000). The indirect effects of social capital on growth work through the agency of other growth-enhancing factors. For instance, a high-trust environment is arguably conducive to greater investment in both physical and human capital, which in turn leads to better economic performance (Zak and Knack, 2001). Using panel data, Dearmon and Grier (2009) show that while generalized trust does explain income differences across countries, it does not directly influence investment. Bjørnskov (2012) shows that trust affects growth through its effect on schooling and the rule of law. Bjørnskov (2017) provides a survey of literature outlining main channels through which social trust affects economic growth, with collated empirical evidence supporting these arguments. Trust can affect economic growth through its effect on education, investment, innovation or institutions, and/or it can affect economic growth directly by reducing the transaction costs.

While the relationship between trust and income is clear, an important but difficult aspect shared by all the existing studies on trust is how trust should be measured at the country level, as we generally get information about an individual's level of trust through surveys. As this variable is not available at the country level, many studies including those by Zak and Knack (2001), Dearmon and Grier (2009), and Bjørnskov (2012) resort to averaging individuals' responses in a survey conducted in a particular country and use these as a measure for that country. This method, however, may not yield a good measure for country-level trust because individuals' perception regarding interpersonal trust is influenced by their personal characteristics and their personal experiences. For instance, divorced individuals are more likely to express lower trust than those in a stable marriage. Levels of trust also differ among individuals according to their levels of education and income (Dinesen, 2013).

Algan and Cahuc (2010) addressed this problem by extracting the inherited component of country-level trust from the trust levels of immigrants of those countries to the U.S. They used the country fixed effects in micro-regressions as a proxy for trust in the immigrants' home countries. However, the trust measure obtained in this way is plagued

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http://dx.doi.org/10.1016/j.econmod.2017.07.020
Received 10 February 2017; Received in revised form 6 July 2017; Accepted 29 July 2017
Available online 05 August 2017
0264-9993/

with a number of shortcomings. First, the trust of immigrants to the U.S. may diverge from their level of trust in their home countries due to temporary shocks or traumatic experiences encountered over time or at the time of migration. Studies on the determinants of trust confirm that temporary shocks substantially alter an individual's level of trust (Alesina and La Ferrara, 2002; Guiso et al., 2008; Nunn and Wantchekon, 2011). Also, Helliwell et al. (2016) show that the footprint effect of trust is about one-third as large in immigrants' destination countries as compared to their trust level in their home countries. They also show that immigrants from a high-trust country tend not to carry their high level of trust to their new country of residence. Second, obtaining country-level trust by incorporating country fixed effects produces a relative rather than an absolute value for a measure of trust. That is, as Algan and Cahuc (2010) used Sweden as a reference group, the inherited trust of all countries in their sample consists essentially of a measured level of trust for each country relative to that of Sweden. For that reason, any changes of trust on the part of Swedish immigrants to the U.S. may potentially distort the measure of trust for immigrants from all other countries, even if their levels of trust have not altered after migration.

The objective of this paper is to obtain a measure of trust at the country level which is independent of individual-level socio-economic factors such as employment status, income, education, marital status, or religious affiliation. In this paper, we address all these concerns by applying the two-step methodology used by Di Tella et al. (2001) and Wolfers (2003). Di Tella et al. (2001) propose a two-step approach to use individual-level survey data to obtain a country-level life satisfaction measure. Wolfers (2003) examines the cost of business cycle volatility by using individual-level survey data to calculate various country-level measures of life satisfaction and suggests that the two-step approach is a preferable alternative. We adopt their methods to extract a measure of country-level trust from individual-level survey data and then reexamine the causal impact of trust on cross-country income and investment. In the first step, a trust variable is constructed by regressing individuals' perception of trust on their corresponding characteristics to obtain averaged residuals for each country and each year using individual country survey data. Then, using the classical growth model, the relationships between the estimated measure of trust and per capita income and investment are examined after controlling for the other macro variables that have been found to be important in the growth literature. We find strong evidence of a positive effect of trust on income and investment. After correcting for various possibilities of endogeneity, we find that a one standard deviation improvement in trust accounts for an approximately 12 percent rise in real GDP per person, which qualitatively confirms the findings of Arrow (1972) and Whiteley (2000). However, unlike Dearmon and Grier (2009), we find a positive relationship between trust and investment.

This paper contributes to the extant literature in a number of ways. First and foremost, we construct a new and improved measure of trust obtained from individual survey responses. Unlike the trust variable used by Zak and Knack (2001), Dearmon and Grier (2009), and Bjørnskov (2012), our approach has an important advantage which addresses the measurement problem by removing the variations in trust due to individual-level socio-economic factors. With this improved measure, we are able to reduce the bias in the estimate of the impact of trust on economic performance. Second, through the use of combined datasets from the World Values Survey (2009) and the European and World Values (2006), we have been able to cover a larger sample of countries than those examined by Zak and Knack (2001) and Dearmon and Grier (2009).[1]

The rest of this paper is structured as follows: Section 2 sets up a simple theoretical model that links social trust to macroeconomic performance closely following Zak and Knack (2001). Section 3 specifies the estimation methods used and the details of the data presented in this paper. The analysis of the micro-regressions used to construct the trust measure for each country is presented in Section 4. In Section 5, we show evidence of the relationship between trust and macroeconomic variables followed by an extensive stability analysis. Finally, some concluding remarks and policy implications are presented in Section 6.

2. Theory

To understand the link between trust and the macroeconomic performance, we construct a simple representative agent model following Zak and Knack (2001). The agent enters an investment contract with an investor who produces goods and services for the economy. The moral hazard problem manifests in the form that the actual return is known to the investor, but not the agent. The investor can deviate from the agreed contract and cheat. However, the agent can investigate the trustworthiness of the investment in order to reduce the risk. Thus, in a society with higher level of interpersonal trust, the agent will devote less resources in investigating trustworthiness of the investor and thus more resources are used for production, instead. To formalize the model, we assume that a representative agent chooses consumption (c), assets (A) and time for investigation (i) in order to maximize a lifetime utility given by

$$Max_c \int_0^\infty U(c)e^{-\beta t}dt \tag{1}$$

where β is the rate of time preference. $U_c > 0$ and $U_{cc} < 0$. For simplicity, we assume that the supply of labor is inelastic and the agent is endowed with one unit of time every period. Thus, labor supply, n, can be written as:

$$n = 1-i \tag{2}$$

where i is the amount of time spent in investigating trustworthiness of the investor. The agent's budget constraint is given by

$$\dot{A} = wn + AR\varphi(i, T) - c \tag{3}$$

where wn is labor income, $AR\varphi(i, T)$ is income from the investment contract, A is assets invested under the contract, R is the gross return from the investment, and $\varphi(i, T) \in (0, 1)$ is an investigation technology which allows the agent to detect the accuracy of return reports by the investor. We assume that the return to investigation rises with investigation time, but exhibits a diminishing return $\varphi_i > 0$ and $\varphi_{ii} < 0$. T denotes the exogenous social trust or the existing social capital.[2] We also assume that the return to investigation rises with social trust ($\varphi_T > 0$), but the marginal return falls with social trust ($\varphi_{iT} < 0$). In a perfectly trustworthy society where $T \to \infty$, $\varphi = 1$ and $i = 0$.

The Lagrangian function for the optimization problem can be written as

$$L = U(c)e^{-\beta t} + \lambda e^{-\beta t}[w(1-i) + AR\varphi(i, T) - c - \dot{A}] \tag{4}$$

The optimality conditions are

$$U_c(c) = \lambda \tag{5}$$

$$R\varphi(i, T) = \beta - \frac{\dot{\lambda}}{\lambda} \tag{6}$$

$$w = AR\varphi_i(i, T) \tag{7}$$

Eq. (5) equates the marginal utility of consumption to the shadow price of wealth. Eq. (6) is the Keynes-Ramsey rule which describes the intertemporal allocation of consumption. Eq. (7) presents the optimal allocation of time between working and investigating the trustworthiness of the investor.

[1] Zak and Knack (2001) used the WVS to obtain trust levels for 41 countries while Dearmon and Grier (2009) obtained trust levels for 51 countries. We estimate the level of trust for 94 countries and territories.

[2] Unlike Zak and Knack (2001), we assume social trust is an exogenous variable.

The transversality condition requires that the agent satisfies his intertemporal budget constraint

$$\lim_{t\to\infty}\lambda e^{-\beta t}A = 0 \tag{8}$$

The representative investor uses the assets and hires labor to produce goods and services. The production function is given by

$$Y = F(A, n) \tag{9}$$

where $F_A>0, F_n>0, F_{AA}<0$, and $F_{nn}<0$. We assume that the production function is linearly homogenous in both inputs, implying that $F_{AA}F_{nn} - F_{An}^2 = 0$. The market is assumed to be perfectly competitive and the corresponding profit-maximization condition is given by

$$R = F_A(A, n) \tag{10}$$

$$w = F_n(A, n) \tag{11}$$

In the steady state where $\dot{A} = 0$ and $\dot{\lambda} = 0$, we obtain

$$F_n(\tilde{A}, \tilde{n})\tilde{n} + \tilde{A}F_A(\tilde{A}, \tilde{n})\varphi(\tilde{i}, T) - \tilde{c} = 0 \tag{12}$$

$$F_A(\tilde{A}, \tilde{n})\varphi(\tilde{i}, T) = \beta \tag{13}$$

$$F_n(\tilde{A}, \tilde{n}) = \tilde{A}F_A(\tilde{A}, \tilde{n})\varphi_i(\tilde{i}, T) \tag{14}$$

With Eq. (2), we can solve for $\tilde{A}, \tilde{c}, \tilde{i}$ and $\tilde{n}$ where "~" denotes a steady-state value of an endogenous variable. Using Eq. (2), and Eqs. (13–14) we can easily show that[3]

$$\frac{d\tilde{A}}{dT}>0; \frac{d\tilde{i}}{dT}<0$$

The results show that a society with higher levels of interpersonal trust has higher investment levels and lower amounts of time spent on verifying the possible fraud. Thus, more resources are put into the production process ($d\tilde{Y}/dT > 0$).

3. Estimation methodology and data description

3.1. Estimation methodology

To estimate the causal impact of trust on income and investment, we specify the regression model as follows:

$$Y_{ct} = \beta_0 + \beta_1 T_{ct} + \beta_2 X_{ct} + u_{ct} \tag{15}$$

$$I_{ct} = \delta_0 + \delta_1 T_{ct} + \delta_2 Z_{ct} + e_{ct} \tag{16}$$

where Y_{ct} and I_{ct} are per capita income and investment in country c at time t, respectively. T_{ct} represents the level of trust as conditioned by individual characteristics including age, gender, education, income, employment status and religious affiliation. X_{ct} and Z_{ct} represent vectors of time-varying control variables including past per capita income, investment, human capital, economic openness, and political institutions, while u_{ct} and e_{ct} denote error terms.

In respect to estimating Eqs. (15) and (16), we encountered a major data limitation which is that the measure of trust is not available at the country level. The conventional methodology presented in the literature has been to average responses obtained from survey data to questions regarding general trust which are then used as the measure of trust in a particular country (Zak and Knack, 2001; Dearmon and Grier, 2009; Bjørnskov, 2012). However, this method suffers from a serious measurement problem because individual responses can be influenced by personal characteristics and past experiences (Alesina and La Ferrara, 2002; Guiso et al., 2008; Nunn and Wantchekon, 2011). For this reason, the trust variable obtained from averaging survey responses may not correctly measure trust as a cultural trait that exists in a country and that has been passed on from one generation to the next.

[3] Detail is provided in the Appendix A.

To overcome this problem, we follow the approach adopted by Di Tella et al. (2001) and Wolfers (2003). We construct a country-level trust variable (T_{ct}) by making use of the following individual-level equation:

$$S_{ict} = \alpha_0 + \alpha_1 H_{ict} + \xi_{ict} \tag{17}$$

where i stands for individuals, S_{ict} represents various individuals' perceived levels of trust and H_{ict} is a vector of individual characteristics including gender, age, employment status, income, education, marital status, and religious affiliation. The term of interest is the error term ($\hat{\xi}_{ict}$), the estimates of which for each individual are averaged over each country and survey year to obtain our estimated measure of trust at the macro level. Since we also include income at the micro level, this may introduce reverse causality between trust and income. However, one may argue that this reverse causality, if it exists at all, may exist at the macro level. We will address this issue in detail in the sub-section describing robustness checks.

3.2. Data description

We examine the influence of social capital (trust) on income and investment using the combined data obtained from the World Values Survey (WVS) and the European Values Survey (EVS). The variables representing social capital are sourced from the WVS and EVS. The WVS has been administered to representative samples of people in 85 countries in five waves (1981–1984; 1989–1993; 1994–1999; 1999–2004 and 2005–2009) and the EVS to samples of people in 49 countries in four waves (1981–1984; 1990–1993; 1999–2004 and 2008–2009). The data sources consist of two large-scale, cross-national, longitudinal surveys that include a large number of questions. The administration of these surveys has been replicated since the early 1980s. The WVS and the EVS have agreed to use a common dictionary of terms in order to harmonize the variables and the data obtained. With a few exceptions, a given country has participated in either an EVS wave or in a WVS wave, but not in both.[4] Therefore, the data obtained from both sources can be merged using the instructions and syntax provided on their websites.[5] Merging the two sources substantially increases the number of observations as well as the number of countries. The observations do not represent a continuous time series since the surveys have been conducted in different years for the various countries included in the waves. Missing observations of some key variables has restricted our consideration to only 94 countries and territories. Table 1 displays the sample countries with their years of surveys.

The survey question related to our variable of interest, generalized trust, is worded as follows: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" Two responses are provided: (1) "Most people can be trusted" and (0) "You can't be too careful." Other controlled variables are age, gender, education, employment status, religious affiliation and income. In particular, while age and gender are binary variables, education is assessed on an 8-point scale with the lowest category being "inadequately completed elementary education" and the highest being "completed university with a degree." For the purpose of the current study, the employment status of respondents has been re-categorized into three groups: employed and working either full-time or part-time, employed by others or self-employed; unemployed; and inactive which includes retired individuals, students and housewives. We control for eight main religious affiliations including Buddhist, Hindu, Muslim, Jew, Orthodox Christian, Protestant, Catholic, and

[4] The data for Sweden in 1999 that appears in both surveys are exactly the same; thus, those data obtained from the WVS waves were removed before the merge.

[5] The instructions and syntax to merge the two data-sets can be downloaded from the EVS website at http://www.europeanvaluesstudy.eu/evs/surveys/longitudinal-file-1981-2008/integratedvaluessurveys/ (last accessed September 9, 2013).

Table 1
Sample country by year and survey.

Country	Year	Study	Obs.	Country	Year	Study	Obs.	Country	Year	Study	Obs.
Albania	1998	WVS	766	Hungary	1999	EVS	514	Russian Federation	1995	WVS	990
Albania	2002	WVS	808	Iceland	1999	EVS	754	Russian Federation	1999	EVS	1,161
Andorra	2005	WVS	548	India	1990	WVS	2,270	Russian Federation	2006	WVS	964
Argentina	1995	WVS	741	India	1995	WVS	1,331	Rwanda	2007	WVS	1,039
Argentina	1999	WVS	1,082	India	2001	WVS	1,660	Saudi Arabia	2003	WVS	1,287
Armenia	1997	WVS	1,493	India	2006	WVS	1,368	Serbia	2006	WVS	941
Australia	1995	WVS	1,370	Indonesia	2001	WVS	782	Serbia and Montenegro	1996	WVS	1,036
Australia	2005	WVS	741	Indonesia	2006	WVS	1,589	Serbia and Montenegro	2001	WVS	1,679
Austria	1999	EVS	965	Iran	2000	WVS	1,341	Singapore	2002	WVS	1,259
Azerbaijan	1997	WVS	1,505	Iran	2007	WVS	2,523	Slovak Republic	1998	WVS	744
Bangladesh	1996	WVS	1,098	Iraq	2004	WVS	2,135	Slovak Republic	1999	EVS	919
Bangladesh	2002	WVS	1,181	Iraq	2006	WVS	2,379	Slovenia	1999	EVS	436
Belarus	1996	WVS	1,115	Ireland	1999	EVS	755	Slovenia	2005	WVS	669
Belarus	2000	EVS	460	Israel	2001	WVS	914	South Africa	1990	WVS	2,091
Belgium	1999	EVS	859	Italy	1999	EVS	1,194	South Africa	1996	WVS	2,092
Bosnia Herzegovina	1998	WVS	716	Italy	2005	WVS	522	South Africa	2001	WVS	2,155
Bosnia Herzegovina	2001	WVS	823	Japan	2000	WVS	423	South Africa	2007	WVS	2,340
Brazil	1991	WVS	1,293	Japan	2005	WVS	327	South Korea	1996	WVS	732
Brazil	1997	WVS	960	Jordon	2001	WVS	1,102	South Korea	2001	WVS	695
Brazil	2006	WVS	1,237	Kyrgyzstan	2003	WVS	819	South Korea	2005	WVS	731
Bulgaria	1997	WVS	474	Latvia	1996	WVS	600	Spain	1995	WVS	722
Bulgaria	1999	EVS	620	Latvia	1999	EVS	536	Spain	1999	EVS	597
Bulgaria	2006	WVS	681	Lithuania	1997	WVS	694	Spain	2000	WVS	688
Burkina Faso	2007	WVS	1,060	Lithuania	1999	EVS	651	Spain	2007	WVS	860
Canada	2000	WVS	1,192	Luxembourg	1999	EVS	410	Sweden	1996	WVS	800
Canada	2006	WVS	1,232	Macedonia	1998	WVS	384	Sweden	1999	EVS	687
Chile	1996	WVS	796	Macedonia	2001	WVS	834	Sweden	2006	WVS	668
Chile	2000	WVS	734	Malaysia	2006	WVS	1,176	Switzerland	1989	WVS	625
Chile	2005	WVS	718	Mali	2007	WVS	835	Switzerland	1996	WVS	791
China	2001	WVS	48	Malta	1999	EVS	696	Switzerland	2007	WVS	825
China	2007	WVS	121	Mexico	1996	WVS	1,460	Taiwan	1994	WVS	540
Colombia	1998	WVS	2,765	Mexico	2000	WVS	913	Taiwan	2006	WVS	866
Colombia	2005	WVS	2,373	Mexico	2005	WVS	1,138	Tanzania	2001	WVS	934
Croatia	1999	EVS	741	Moldova	1996	WVS	766	Thailand	2007	WVS	1,438
Cyprus	2006	WVS	947	Moldova	2002	WVS	817	Trinidad and Tobago	2006	WVS	918
Czech Republic	1998	WVS	372	Moldova	2006	WVS	980	Turkey	1990	WVS	48
Czech Republic	1999	EVS	563	Morocco	2001	WVS	576	Turkey	1996	WVS	1,357
Denmark	1999	EVS	725	Morocco	2007	WVS	1,169	Turkey	2001	EVS	1,148
Dominican Republic	1996	WVS	218	Netherlands	1999	EVS	390	Turkey	2001	WVS	2,789
Egypt	2000	WVS	2,628	Netherlands	2006	WVS	353	Turkey	2007	WVS	1,269
Egypt	2008	WVS	2,937	New Zealand	1998	WVS	781	Uganda	2001	WVS	533
El Salvador	1999	WVS	842	Nigeria	1990	WVS	770	Ukraine	1996	WVS	1,230
Estonia	1996	WVS	254	Nigeria	1995	WVS	1,491	Ukraine	1999	EVS	604
Estonia	1999	EVS	206	Nigeria	2000	WVS	1,842	Ukraine	2006	WVS	569
Ethiopia	2007	WVS	1,253	Northern Ireland	1999	EVS	548	Uruguay	1996	WVS	472
Finland	1996	WVS	763	Norway	1996	WVS	927	Uruguay	2006	WVS	379
Finland	2000	EVS	734	Norway	2008	WVS	628	USA	1995	WVS	1,022
Finland	2005	WVS	772	Pakistan	1997	WVS	709	USA	1999	WVS	823
France	1999	EVS	677	Pakistan	2001	WVS	1,219	USA	2006	WVS	751
France	2006	WVS	413	Peru	1996	WVS	848	Venezuela	1996	WVS	987
Georgia	2008	WVS	1,402	Peru	2001	WVS	1,389	Venezuela	2000	WVS	709
Germany	1997	WVS	786	Peru	2008	WVS	1,192	Vietnam	2001	WVS	287
Germany	1999	EVS	884	Philippines	2001	WVS	1,040	Vietnam	2006	WVS	730
Germany	2006	WVS	933	Poland	1999	EVS	978	Zambia	2007	WVS	1,107
Ghana	2007	WVS	1,384	Poland	2005	WVS	852	Zimbabwe	2001	WVS	687
Great Britain	1999	EVS	493	Puerto Rico	1995	WVS	819	**Total**		169,394	
Great Britain	2006	WVS	390	Puerto Rico	2001	WVS	587				
Greece	1999	EVS	758	Romania	1998	WVS	1,088				
Guatemala	2005	WVS	839	Romania	1999	EVS	965				
Hong Kong	2005	WVS	288	Romania	2005	WVS	1,444				

Note: The observations are available for the estimation.

Others. Finally, income is assessed on a ten-point scale with ten representing the highest income group.

Data for macro-regressions have been obtained from various sources. Specifically, initial income per capita and per-capita GDP as expressed in 1990 International Geary-Khamis dollars has been extracted from the Maddison's database (Bolt and Zanden, 2013). Investment data have been taken from the Penn World Table 7.1. Trade openness as measured by total trade as a percentage of GDP has also been extracted from the Penn World Table 7.1. Education, a proxy for human capital, has been taken from Barro and Lee (2013), and political institution as measured by the Polity 2 index has been obtained from the Polity IV database.[6]

[6] Table 3 contains summary statistics and sources of all macro-variables used in the estimations.

4. Micro-regressions and measure of generalized trust

4.1. Who generally trusts more?

Based on individual-level survey data, we begin our analysis by constructing the trust variable at the country level. Particularly, micro-regressions are performed to extract the component of trust that is not influenced by socio-economic factors. Due to the binary nature of the dependent variable, Eq. (17) is estimated using the Probit method. However, as a robustness check we also employ the Ordinary Least Squares (OLS) estimation.[7] The results, along with those of the Probit marginal effects, are presented in Table 2.

In terms of the significance level and the magnitude of the coefficients, the results from both estimations are especially consistent in terms of a comparison of the results from the OLS estimation and the marginal effects. The coefficients for gender and marital status, in particular, are not statistically significant, suggesting that there is no difference in the levels of trust among these groups. However, the trust levels do increase with age; the probability of interpersonal trust rises by about 0.2 percentage points for each additional year. Interestingly, the results also show that people with better employment status, higher income, or higher education levels tend to exhibit higher levels of interpersonal trust. Using the unemployed as the reference group, the positive coefficients of the employed and the inactive imply that they are more likely to trust people than the unemployed do; the probability of interpersonal trust is about 4 percentage points higher for the employed and 2.8 percentage points higher for the inactive. Similarly, a one-unit increase in income raises respondents' trust by about 1.4 percentage points. One possible reason is that the unemployed and the low income groups are more risk-averse due to their unfortunate experiences. Finally, we also observe diverse levels of trust among religious groups, with Buddhists, Hindus, and Protestants reporting greater interpersonal trust.

Table 2
Micro-regression of trust.

	Dependent variable: TRUST		
	OLS	PROBIT	Marginal Effects
Male	−0.001	−0.002	−0.0005
	(0.002)	(0.007)	(0.002)
Age	0.002***	0.006***	0.002***
	(0.000)	(0.000)	(0.000)
Employed	0.037***	0.126***	0.040***
	(0.004)	(0.012)	(0.004)
Inactive	0.025***	0.087***	0.028***
	(0.004)	(0.013)	(0.004)
Income	0.014***	0.044***	0.014***
	0.000	(0.001)	(0.000)
Edu	0.009***	0.029***	0.009***
	(0.001)	(0.002)	(0.001)
Married	0.005	0.013	0.004
	(0.004)	(0.011)	(0.004)
Single	0.007	0.023	0.008
	(0.004)	(0.014)	(0.005)
Buddhist	0.039***	0.106***	0.035***
	(0.008)	(0.021)	(0.007)
Hindu	0.039***	0.119***	0.039***
	(0.006)	(0.019)	(0.006)
Muslim	−0.013***	−0.038***	−0.012***
	(0.004)	(0.012)	(0.004)
Jew	−0.030**	−0.095**	−0.030**
	(0.013)	(0.040)	(0.012)
Orthodox	−0.088***	−0.275***	−0.082***
	(0.004)	(0.013)	(0.004)
Protestant	0.033***	0.088***	0.029***
	(0.004)	(0.012)	(0.004)
Catholic	−0.076***	−0.245***	−0.076***
	(0.004)	(0.011)	(0.003)
Constant	0.067***	−1.258***	
	(0.007)	(0.023)	
(Pseudo) R^2	0.026	0.022	
Observations	169,394	169,394	

Note: ***, ** and * indicate significance level at the 99, 95 and 90 percent confidence interval, respectively. Standard error is in parenthesis.

4.2. The cross-country trust measure and its correlation with macro-variables

To construct the country-level trust variable, following Di Tella et al., (2001) and Wolfers (2003), we average the estimated residuals from Eq. (17) for each country and survey year. This measure of trust is not influenced by personal characteristics and socio-economic conditions. Table 3 provides a summary of the statistics of the measures of trust constructed from both the Probit and the OLS estimations. We also report the measure of trust computed by averaging the responses in the raw data for comparison purposes. Probit-estimated trust (TRUSTPR) and OLS-estimated trust (TRUSTOLS) are rescaled so that they are comparable with the averaged measure (TRUSTAVG). These measures are very highly correlated to one another.

Fig. 1 illustrates the levels of trust across countries and we observe that there are significant variations in levels of trust across countries. The Scandinavian nations exhibit the highest levels of trust, with Denmark topping the list, followed by Norway and Sweden. In these countries, bicycles are commonly left unlocked on the street, and small children in strollers can be left unattended on sidewalks outside restaurants while their parents are dining (Zak and Knack, 2001). The latter practice led to the arrest of a Danish mother in New York City (New York Times, 1997) and a Swedish mother in Massachusetts (Reuters, 2011). Two Asian countries, China and Vietnam, and a Middle-Eastern country, Saudi Arabia, are also among the top ten countries with a high level of trust among their citizens. Among the bottom ten countries are Sub-Saharan African countries including Zambia, Tanzania, Uganda, Ghana, and Rwanda. Trinidad and Tobago has the lowest level of trust and Malaysia and the Philippines are also among the ten countries with the lowest level of trust. We exploit these variations in the macro-regression analysis.

Next, we examine the correlations between the constructed measure of trust and various indicators concerning the business environment. On the one hand, this exercise provides an assessment of how well the constructed trust variable represents the true level of trust in each country. On the other hand, it provides preliminary evidence of the correlation between a country's trust level and its investment environment. Since a lower level of trust, which is strongly correlated with the lower trustworthiness of the population (Butler et al., 2016), raises the risks of fraud and theft, we use losses (calculated as a percentage of sales) due to theft, robbery, vandalism and arson as an indicator of the business environment. The losses are averaged over the period 2002–2013 within which the enterprise surveys were con-

[7] While Di Tella et al. (2001) use OLS estimations to obtain the measure of country-level life satisfaction, Wolfers (2003) uses the Probit model.

Table 3
Summary statistics of macroeconomic variables.

Variable	Description	Source	Obs.	Mean	Std.	Min	Max
RGDPPC	GDP per capita	Maddison's Database	171	9559	7799	563	31358
RINVTPC	Investment per capita	Penn World Table 7.1	175	3364	3413	25	16278
INVTSH	Investment share	Penn World Table 7.1	175	21.99	6.65	5.99	45.76
POLITY	Political institution	POLITY VI	167	15.84	5.49	0	20
OPEN	Trade openness	Penn World Table 7.1	175	73.75	48.0	12.52	377.79
EDU80	Education	Barro and Lee	160	6.56	2.60	0.62	12.03
TRUSTPR	Trust (Probit)	Estimated from WVS & EVS	174	0.32	0.143	0.038	0.742
TRUSTOLS	Trust (OLS)	Estimated from WVS & EVS	174	0.34	0.140	0.038	0.753
TRUSTAVG	Trust (Average)	WVS & EVS	174	0.27	0.149	0.028	0.742

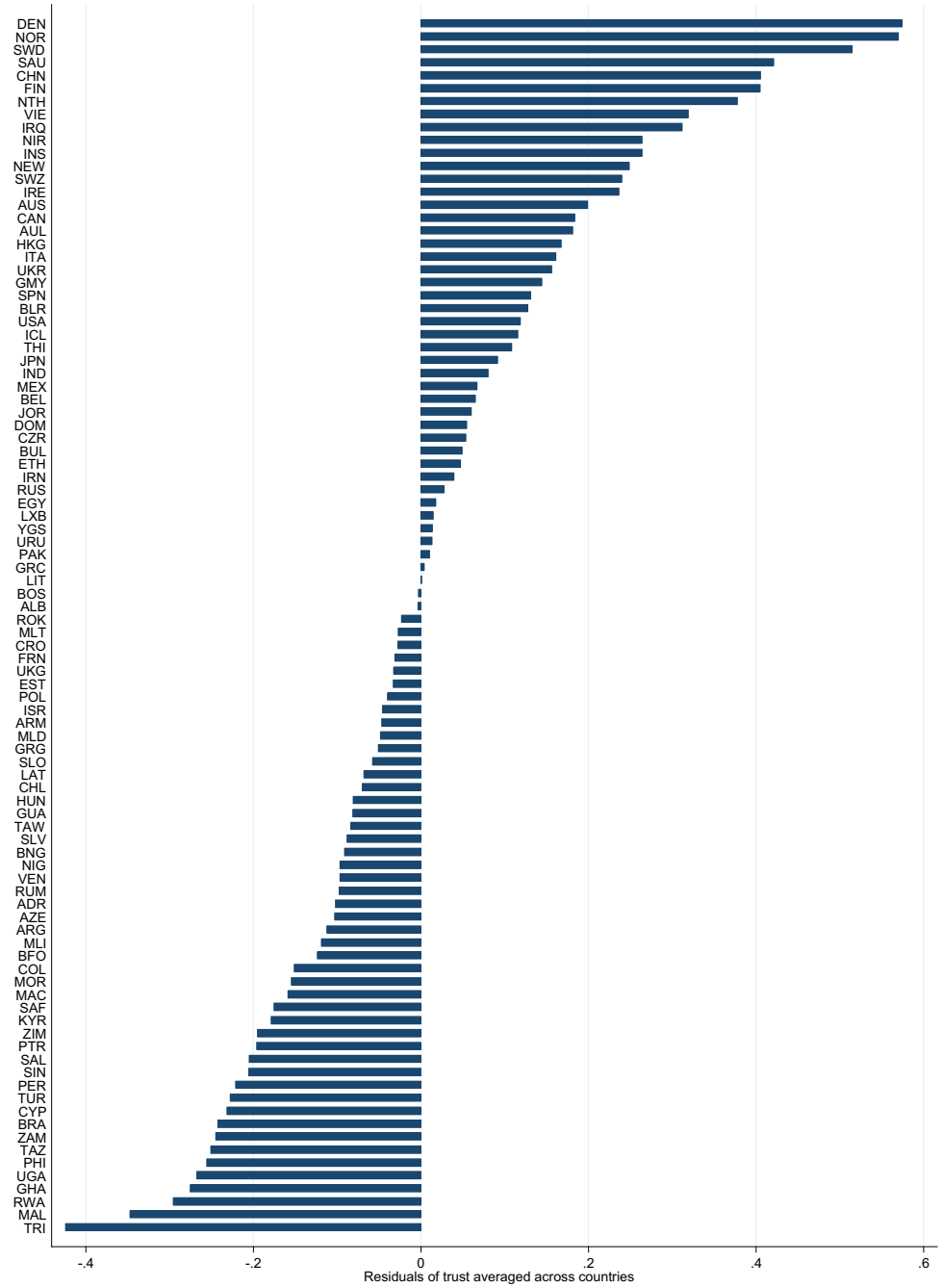

Fig. 1. : Level of trust across Countries.

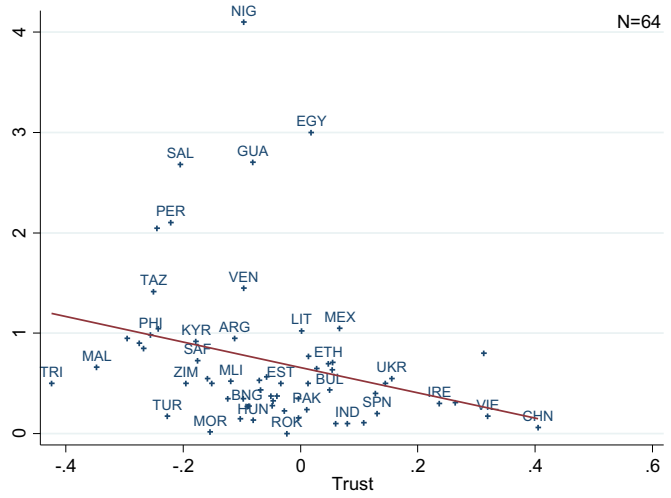

Fig. 2. Trust and sales loss.
Source: Loss due to theft, robbery, vandalism and arson (average 2002–2013) from World Development Indicators online (accessed 9/23/2014) and trust calculated by averaging the residuals of Probit micro-regression by country

Fig. 3. : Trust and income.
Source: Real GDP per capita (1990 International Geary-Khamis $) from Maddison's database and trust calculated by averaging the residuals of Probit micro-regression by country and year of survey

ducted. We should expect a country with a lower level of trust to have a higher percentage of losses, and that it will, therefore, exhibit a negative relationship between these factors.

Fig. 2 displays a scatter plot of the estimated level of trust and sales losses for each country. Because the surveys have, in most cases, been conducted in developing countries, our observations have thereby been reduced to 64 countries. The fitted line illustrates a negative relationship between trust and sale losses. China and Vietnam – countries with high trust levels – had on average incurred annual losses amounting to 0.06 and 0.175 percent of sales, respectively, while countries with low levels of trust such as the Philippines, Malaysia, and Trinidad and Tobago experienced larger losses of 1 percent, 0.66 percent and 0.5 percent, respectively.[8]

We then plot the relationship between the estimated levels of trust and income across countries. Fig. 3 illustrates a strong positive relationship between trust and income. Scandinavian countries such as Norway, Sweden, Denmark and Finland all have higher trust levels and higher income per capita. Countries such as Rwanda, the Philippines, Mali, Turkey and Brazil show lower trust levels and lower income. Columns 1–3 of Table 4 provide additional preliminary evidence of the correlation between trust and income. By controlling for income in 1973 as a proxy of the level of development, regardless of the measures of trust variable, we find that the regression coefficient of trust is positive and statistically significant, suggesting that a higher level of trust is associated with higher income per capita. One thing to note is that the coefficient of TRUSTAVG is significantly large. The estimate for TRUSTAVG is 1.042 while those for TRUSTPR and TRUSTOLS are about 0.7. We will discuss this in more detail in the next section.

Finally, we explore the association between trust and investment. Fig. 4 displays a scatter plot of trust and investment per capita. The association between these two variables is also strongly positive. Columns 4–6 of Table 4 show the results of simple regressions of investment per capita on estimated levels of trust. The results show that the coefficients are positive and statistically significant at the 99 percent confidence interval. These results are robust even when the investment variable is measured according to investment share of income rather than real investment per person (columns 7–9 of Table 4). Again, the coefficient estimate for TRUSTAVG is larger than that for TRUSTPR or TRUSTOLS.

[8] There are some outliers, however. Nigeria, for example, with a trust level well above that of Malaysia and the Philippines but below the average level, experienced the largest losses, amounting to more than 4 percent of sales.

5. The causal impact of trust on macroeconomic performance

The results presented in the preceding section provide evidence for a positive correlation between trust and income. However, correlation does not imply causation if endogeneity problems are not addressed. Endogeneity exists if there is a third factor that may simultaneously determine both income and trust. The two candidates for this possible third factor are trade openness and political institutions. The impact of trade openness on income has been documented by many studies. A country with a more open trade policy tends to have a higher standard of living and stronger economic growth (see Sachs and Warner, 1995; Frankel and Romer, 1999). Meanwhile, there is evidence that trade also influences culture and the cultural traits of a society (Holton, 2000; Machida, 2012). In the same vein, while Acemoglu et al. (2001) argue that the quality of institutions affects differences in cross-country income (see also Przeworski et al. (2000), Azman-Saini et al. (2010), Slesman et al. (2015)), Tabellini (2010) examines the data across European regions and finds that political institutions in the distant past in Europe determined individual cultural values and beliefs which are correlated with current economic development. Thus, trade openness proxied by total trade share of GDP and political institutions proxied by Polity 2 are controlled in the regressions to address this type of endogeneity problem.

Table 5 presents the results showing the causal impact of trust on income. Columns 1–3 report the results for TRUSTPR. The coefficient of trust in the regression is found to be positive and statistically significant at the 99 percent confidence level (column 1). It is also economically substantial. A rise in the level of trust of one standard deviation (0.14) potentially increases income per capita by about 12 percent. For other control variables we obtain expected signs. The positive coefficient for initial income is well-known. Our results are consistent with the existing empirical evidence that a country with a more democratic society or a more open trade policy tends to have higher income per person. This evidence warrants the inclusion of political institution and trade openness in the regressions. We replace initial income (RGDPPC73) by human capital (EDU80) which is proxied by Barro and Lee's (2013) estimates of educational attainment in 1980, and the results are reported in column 2. The coefficient of trust becomes larger and is still significantly positive at the 99 percent confidence level. This result suggests that the quality of life in a country's distant past has shaped its current level of trust, which then influences its current level of development. In column 3 we report results where we include both initial income and educational attainment and the trust coefficient reduces slightly to 0.727, implying an

Table 4
Trust, income and investment.

	Dependent variable:								
	Log(RGDPPC)		Log(RINVTPC)			INVTSH			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log(RGDPPC73)	0.890***	0.889***	0.873***	1.056***	1.055***	1.034***			
	(0.046)	(0.046)	(0.045)	(0.075)	(0.075)	(0.073)			
TRUSTPR	0.696**			1.281***			8.995***		
	(0.285)			(0.465)			(3.425)		
TRUSTOLS		0.718**			1.316***			9.226***	
		(0.292)			(0.476)			(3.506)	
TRUSTAVG			1.042***			1.730***			10.973***
			(0.267)			(0.437)			(3.259)
Constant	1.060***	1.046***	1.146***	−1.871***	−1.897***	−1.739***	18.947***	18.754***	18.876***
	(0.373)	(0.372)	(0.364)	(0.608)	(0.607)	(0.596)	(1.213)	(1.279)	(1.011)
Obs	168	168	168	168	168	168	172	172	172
Adj. R^2	0.727	0.728	0.741	0.599	0.599	0.617	0.033	0.034	0.057

Note: ***, ** and * indicate significance level at the 99, 95 and 90 percent confidence interval, respectively. Standard error is in parenthesis.

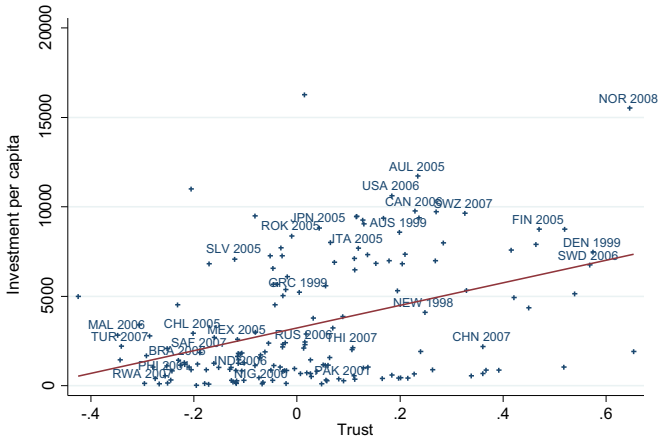

Fig. 4. Trust and investment.
Source: Real investment per capita (2005 constant $) from Penn World Table 7.1 and trust calculated by averaging the residuals of Probit micro-regression by country and year of survey

increase in income of about 10 percent in response to one standard deviation increase in trust; however, human capital turns out to be insignificant. The findings from columns 2 and 3 suggest that richer countries in the past tended to accumulate higher amounts of human capital, for which reason they remain ahead today. Overall, the results confirm our findings that trust influences a country's current level of economic development and is also influenced by past development. Hence, it is necessary to control for initial income to resolve this potential endogeneity of trust.

In columns 4–6 we report results for the OLS-estimated trust variable (TRUSTOLS). The coefficient for trust is positive and statistically significant. The results reported in column 6 suggest that a one standard deviation increase in trust (0.14) raises income by 12 percent, consistent qualitatively and quantitatively with our result for the Probit-estimated trust variable (TRUSTPR). Our results cannot be directly compared with those of Zak and Knack (2001) and Dearmon and Grier (2009) due to a couple of major differences. First, we use more waves and combine the WVS and EVS, and consequently our dataset has a larger number of sample countries, especially developing ones.[9] Second, we employ different data sources for income per capita. Still, to compare our results with the results using preferred trust measure in relation to the extant literature, we estimate the equation with the purely averaged trust (TRUSTAVG). In columns 7 – 9, we report results for the average measure of trust (TRUSTAVG). Although the coefficient for trust is qualitatively similar, the result in column 7 suggests that income would rise by 17 percent with a standard deviation increase in trust (0.15), 5 percentage points larger than the magnitude for the trust variables that are constructed by removing the individual and social-economic characteristics. This finding suggests that the average measure of trust would produce an upward biased estimate for the impact of trust on income.

To provide a clear picture about this issue of upward bias of the impact of trust on income when TRUSTAVG is included to represent the trust variable in a regression, we have created Fig. 5, which displays the predicted change in income per capita in its respective year if a country had the same level of trust as Norway in 2008. Norway is chosen for it has the highest level of trust in the sample. The bar graph is obtained based on the fully-fledged estimates reported in columns 3, 6 and 9 of Table 5 for which initial income, political institution, trade openness, and educational attainment are controlled. First of all, it is clear that there is little difference in the income effect of the two trust variables, either Probit-estimated or OLS-estimated trust. The variation of income resulting from changes in TRUSTPR is very similar to that from changes in TRUSTOLS. Second, the average trust measure (TRUSTAVG) produces a significant overstatement for the impact of trust on income. The overstatement is larger for countries with a larger trust gap from Norway. For example, if the Americans had experienced the same level of trust as Norway 2008, U.S. income would rise by about $12,000 as measured by TRUSTAVG, or by $8,200 as measured by TRUSTPR, producing an overstatement of about $3,800. For the very poor countries like Zambia and Tanzania whose income were about $700 and $600, their overstatement would be about $140, approximately 20 percent of their income.

Last but not least, it is important to note that a large variation of income, especially in rich countries, can be explained by the difference in trust. For example, Spain 2007, Italy 2005 and Germany 2006 would

[9] While the mean real income per capita in Dearmon and Grier (2009) is 14,272, our mean income is only 9,559.

Table 5
Causal impact of trust on income.

	Dependent variable: Log(RGDPPC)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TRUSTPR	0.854***	1.249***	0.727**						
	(0.283)	(0.380)	(0.296)						
TRUSTOLS				0.881***	1.283***	0.750**			
				(0.289)	(0.388)	(0.302)			
TRUSTAVG							1.148***	1.397***	1.054***
							(0.263)	(0.364)	(0.277)
Log(RGDPPC73)	0.774***		0.733***	0.774***		0.733***	0.760***		0.733***
	(0.054)		(0.072)	(0.054)		(0.072)	(0.052)		(0.069)
POLITY	0.028***	0.051***	0.019*	0.028***	0.051***	0.019*	0.028***	0.052***	0.021**
	(0.009)	(0.012)	(0.010)	(0.009)	(0.012)	(0.010)	(0.008)	(0.012)	(0.010)
OPEN	0.002**	0.002*	0.002*	0.002**	0.002*	0.002*	0.002**	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
EDU80		0.169***	0.024		0.169***	0.024		0.162***	0.015
		(0.025)	(0.024)		(0.025)	(0.024)		(0.025)	(0.023)
Constant	1.372***	6.306***	1.796***	1.354***	6.277**	1.780***	1.459***	6.356***	1.778***
	(0.373)	(0.237)	(0.478)	(0.372)	(0.241)	(0.478)	(0.363)	(0.224)	(0.466)
Obs	163	152	152	163	152	152	163	152	152
Adj. R^2	0.746	0.531	0.724	0.747	0.531	0.724	0.761	0.542	0.739

Note: ***, ** and * indicate significance level at the 99, 95 and 90 percent confidence interval, respectively. Standard error is in parenthesis.

have the same level of income as Norway 2008 if they had that same level of trust; and Trinidad and Tobago 2006, Singapore 2002 and France 2006 would be far richer than Norway 2008 if they had experienced Norway's trust. However, trust alone does not help close the income gap between the developed and developing world, especially those at the bottom of the income list. For example, Uganda, Bangladesh, Rwanda, Mali, Nigeria, Burkina Faso, and Zimbabwe would still stay behind even though their income would grow more than 30 percent, had their trust been the same as the level of trust in Norway. The results are still consistent with the growth literature that factors such as initial development, political institutions, trade openness, and education continue to play important roles in explaining income differences.

We report the results from the estimation of the investment equation (Eq. (16)) in Table 6. Two alternative measures of investment are used: the logarithm of investment per capita (RINVTPC) and investment as a share of GDP (INVTSH). Column 1 presents the estimate for the impact of trust (TRUSTPR) on investment per capita by controlling for variations in past income across countries, political institutions, and trade openness. The coefficient for trust is positive and statistically significant, suggesting that higher trust promotes investment. The magnitude is also economically important. A rise in trust of one standard deviation raises per-capita investment by about 22 percent. In column 2 we report results when TRUSTPR is replaced by TRUSTOLS; the result does not change. The results suggest that a richer country invests more in physical capital than a poor one. A country with one percent higher GDP per capita in 1973 invested about 0.8 percent more. At the same time, the result from the average trust measure (TRUSTAVG) shows that the coefficient of trust is much larger than that for TRUSTPR, suggesting that the impact of trust is overstated, if not correctly measured.

We use an alternative measure of investment (calculated as the investment share of the GDP) as a dependent variable and the results are reported in columns 4–6 of Table 6. The coefficient for the trust variable is still positive and statistically significant. The results yield strong evidence for the impact of trust on investment. However, the coefficient for TRUSTAVG is still larger than that for TRUSTPR or TRUSTOLS, confirming the overstatement of the impact of trust when social trust is measured by averaging individuals' responses.

5.1. Additional robustness check

It is well documented that financial development plays an important role in determining the macroeconomic performance of a country (see Aghion et al. (2005), Levine (1997)). So, one may argue that leaving that out affects the estimate for the impact of trust on income. We add a share of domestic credits to the private sector in the income equation. The results are reported in Table 7. The main results do not change. The coefficients of the trust variables are positive and significant at the conventional level, although they are smaller. This is evidence that social trust also affects macroeconomic performance through its impact on the development of the financial system.[10] Comparing the results across the three measures of trust, the coefficient for TRUSTAVG is still larger than that for TRUSTPR or TRUSTOLS, again confirming the overstatement of the impact of trust when individuals' responses are averaged.

We have addressed the endogeneity concern by including variables that may influence trust and income simultaneously. However, the problem may still exist if there is a reversed causation between income and trust. According to the modernization theory, economic development has changed cultural norms and values, shifting societies from *absolute* values to values that are more trusting and participatory (Inglehart and Baker, 2000). Though we may have addressed this type of endogeneity at the micro level by including individual income as one of the regressors in the first-step regressions, one may still argue that the problem may also need to be addressed at the macro level. It has been an empirical challenge to find an instrument for trust, since any historical variables that determine trust level seem also to be correlated with income per capita. We use the lead variable of income in an

[10] See Ng et al. (2016) for the impact of trust on stock market depth and liquidity.

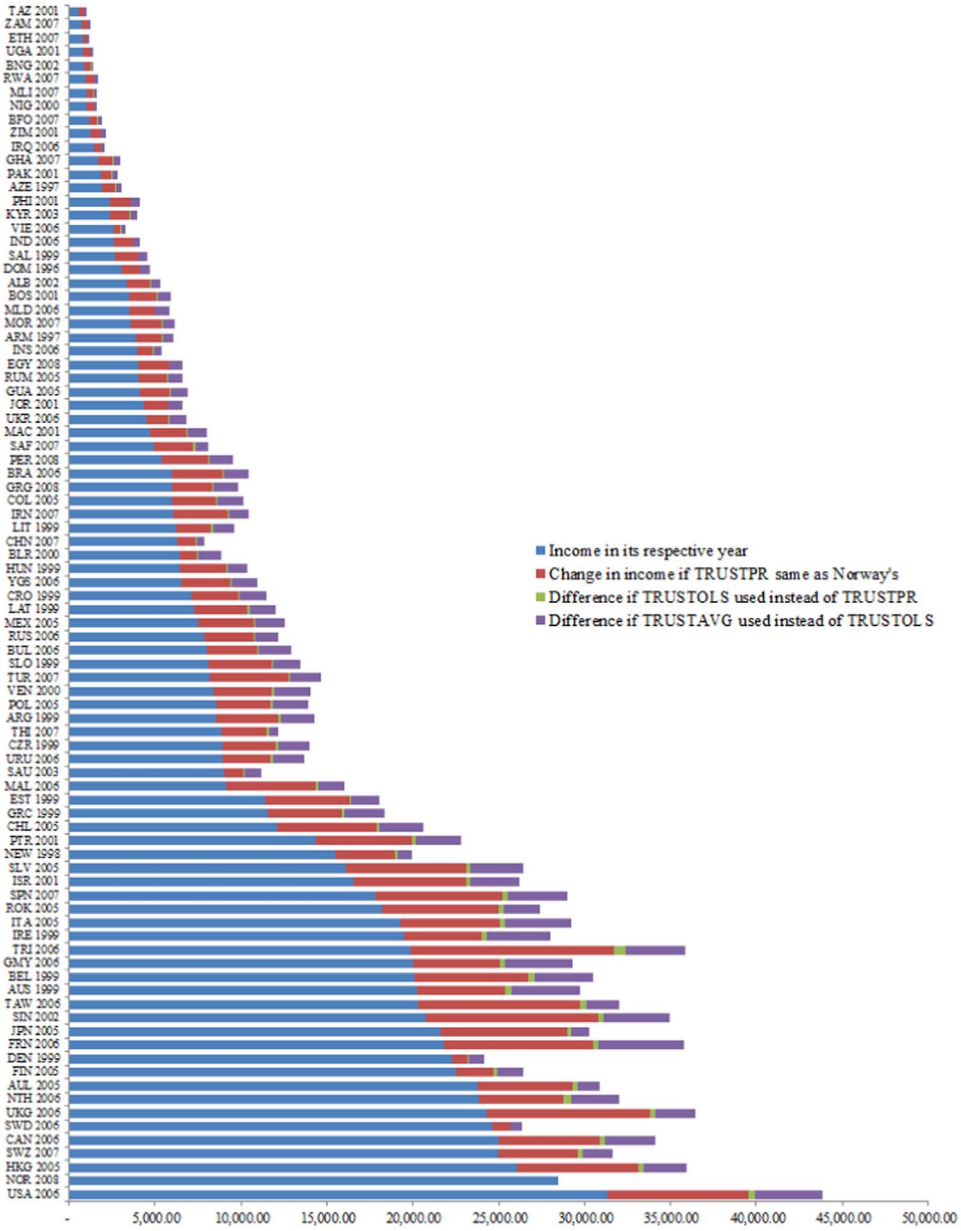

Fig. 5. Predicted change in income if trust is the same as Norway's.

attempt to resolve this problem. The idea is that a country's future per-capita income does not affect its levels of trust today. If there is a third variable, such as past income (i.e. income in 1973) that may co-determine future income and current level of trust, it is controlled for in the regressions (Algan and Cahuc, 2010).

These results for the income equation are shown in columns 1–6 of Table 8. Columns 1–4 use a lead ranging from one year to four years, while columns 5 and 6 employ a five-year and a ten-year average of income, respectively. The results are qualitatively and quantitatively consistent. The coefficient of trust is positive and statistically significant. The magnitude of the impact indicates that a rise in trust of one standard deviation increases the income of a country by about 12 to 14 percent.

We apply a similar strategy to the investment equation. Columns 7 – 10 use a lead ranging from one year to four years as a variable of investment per person, while columns 11 and 12 employ a five-year and ten-year average, respectively. Again, the results are both qualitatively and quantitatively consistent. A rise in trust of one standard deviation causes investment to rise by about 22 to 26 percent on average.

6. Conclusion

In this paper we explore the effect of trust on income and investment across countries focusing on the improvement of the measure of social capital (trust). A two-step approach proposed by Di Tella et al. (2001) and Wolfers (2003) to extract the component of country-level variables from individual-level surveys has been adopted to compute a country-level trust variable from individual-level surveys of trust. This improved measure of trust is not influenced by individual-level socio-economic factors. Indices of macroeconomic performance are then regressed on the estimated improved trust measure, among others. Our cross-country results suggest that low levels of trust account for the underdevelopment experienced by many developing countries. The impact of trust is also economically sizeable. The results also suggest that, contrary to the findings of Dearmon and Grier (2009), investment represents the main channel through which

Table 6
Causal impact of trust on investment.

	Dependent variable:					
	Log(RINVTPC)			INVTSH		
	(1)	(2)	(3)	(4)	(5)	(6)
TRUSTPR	1.578***			9.373**		
	(0.459)			(3.751)		
TRUSTOLS		1.619***			9.643**	
		(0.470)			(3.837)	
TRUSTAVG			1.942***			11.331***
			(0.428)			(3.541)
Log(RGDPPC73)	0.841***	0.841***	0.825***	−0.639	−0.642	−0.725
	(0.088)	(0.088)	(0.085)	(0.722)	(0.722)	(0.705)
POLITY	0.056***	0.056***	0.056***	0.188	0.188	0.187*
	(0.014)	(0.014)	(0.014)	(0.115)	(0.115)	(0.113)
OPEN	0.003*	0.003*	0.003*	0.022*	0.022*	0.022*
	(0.002)	(0.002)	(0.002)	(0.013)	(0.013)	(0.013)
Constant	−1.271**	−1.305**	−1.142*	19.53***	19.333***	20.263***
	(0.605)	(0.604)	(0.592)	(4.944)	(4.935)	(4.899)
Obs	163	163	163	163	163	163
Adj. R^2	0.632	0.632	0.650	0.040	0.040	0.062

Note: ***, ** and * indicate significance level at the 99, 95 and 90 percent confidence interval, respectively. Standard error is in parenthesis.

Table 7
Robustness checks: Including financial development (CREDIT).

	Dependent variable: Log(RGDPPC)		
	(1)	(2)	(3)
TRUSTPR	0.521**		
	(0.242)		
TRUSTOLS		0.541**	
		(0.248)	
TRUSTAVG			0.576***
			(0.238)
Log(RGDPPC73)	0.674***	0.674***	0.678***
	(0.047)	(0.047)	(0.047)
POLITY	0.018**	0.017**	0.018**
	(0.007)	(0.007)	(0.007)
OPEN	0.002*	0.002**	0.002*
	(0.001)	(0.001)	(0.001)
CREDIT	0.007***	0.007***	0.006***
	(0.001)	(0.001)	(0.001)
Constant	2.156***	2.146***	2.154***
	(0.325)	(0.324)	(0.323)
Obs	150	150	150
Adj. R^2	0.827	0.827	0.828

a country's level of trust may affect income. We establish our findings through the use of extensive robustness checks including the correction of various possible endogeneity issues.

Although our findings suggest that social trust as a culture accounts for income differences across countries, they do not imply that one country cannot be prosperous because of the existing lower level of trust. The results in this study also show that trade policy, political institutions and education also have significant effects. For example, Singapore, one of the richest nations, has a level of trust much lower than the global average, but its trade is more than three times the size of its GDP. So, for a country with a lower level of social trust, trade policy, education, and the quality of its political institutions can compensate for trust deficiency.

While we have constructed the level of trust using a new approach of aggregation and have examined an old question concerning the causal impact of trust on economic development, there are other broader questions to be answered and explored in terms of the ways in which trust contributes to economic and social development. A country's level of trust is a dynamic factor. While it determines social and economic outcomes, it is also affected by social and economic factors. People in countries that have gone through a period of war and genocide would have lower trust in one another. Countries that have just opened their doors to the outside world to receive an influx of goods and services may also be influenced by different cultures through communications and interactions in either social or business settings, which may affect the level of trust. Macroeconomic instability in a form of inflationary changes degraded the level of trusts in the financial systems (Ng et al., 2016). These indicate that factors such as political stability, macroeconomic stability, and openness yield potential positive externalities on macro-economic variables through increasing interpersonal trust.

Table 8
Robustness checks: Using leads and average of income and investment per capita.

	Log(RGDPPC)						Log(RINVTPC)					
	Lead 1	Lead 2	Lead 3	Lead 4	AVG 5	AVG 10	Lead 1	Lead 2	Lead 3	Lead 4	AVG 5	AVG 10
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
TRUSTPR	0.868***	0.914***	1.006***	0.955***	0.853***	0.866***	1.611***	1.687***	1.698***	1.896***	1.555***	1.628***
	(0.284)	(0.286)	(0.302)	(0.306)	(0.281)	(0.272)	(0.464)	(0.450)	(0.478)	(0.487)	(0.449)	(0.436)
Log(RGDPPC73)	0.772***	0.762***	0.744***	0.729***	0.776***	0.781***	0.850***	0.822***	0.792***	0.766***	0.852***	0.855***
	(0.055)	(0.055)	(0.056)	(0.058)	(0.054)	(0.052)	(0.089)	(0.087)	(0.089)	(0.094)	(0.086)	(0.084)
POLITY	0.028***	0.028***	0.029***	0.038***	0.028***	0.027***	0.056***	0.058***	0.056***	0.071***	0.055***	0.052***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.014)	(0.014)	(0.014)	(0.015)	(0.014)	(0.013)
OPEN	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.002	0.003*	0.002	0.003*	0.003*	0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	1.424***	1.508***	1.636***	1.656***	1.374***	1.344***	−1.269**	−1.085*	−0.775	−0.900	−1.322**	−1.314**
	(0.375)	(0.380)	(0.386)	(0.409)	(0.370)	(0.359)	(0.612)	(0.593)	(0.615)	(0.662)	(0.592)	(0.575)
Obs	163	162	157	144	163	163	163	163	159	145	163	163
Adj. R^2	0.744	0.735	0.728	0.732	0.749	0.761	0.629	0.640	0.607	0.620	0.645	0.655

Note: ***, ** and * indicate significance level at the 99, 95 and 90 percent confidence interval, respectively. Standard error is in parenthesis.

Appendix A

Using Eqs. (13) and (14), the steady-state condition for this economy is characterized by

$$F_A(\widetilde{A},1-\tilde{i})\varphi(\tilde{i},T)=\beta \tag{A1}$$

$$F_n(\widetilde{A},1-\tilde{i})=\varphi_i(\tilde{i},T)F_A(\widetilde{A},1-\tilde{i})\widetilde{A} \tag{A2}$$

Total differentiation of the two equations gives the following matrix form

$$\begin{bmatrix} \varphi F_{AA} & -(\varphi F_{An}-\varphi_i F_A) \\ (F_{An}-\varphi_i F_{AA}\widetilde{A}-\varphi_i F_A) & (\varphi_i F_{An}\widetilde{A}-F_{nn}-\varphi_{ii}F_A\widetilde{A}) \end{bmatrix}\begin{bmatrix} d\widetilde{A} \\ d\tilde{i} \end{bmatrix}=\begin{bmatrix} -\varphi_T F_A \\ \varphi_{iT}F_A\widetilde{A} \end{bmatrix}dT$$

where $D=F_{AA}\varphi(\varphi_i F_{An}\widetilde{A}-F_{nn}-\varphi_{ii}F_A\widetilde{A})+(F_{An}\varphi-F_A\varphi_i)(F_{An}-\varphi_i F_{AA}\widetilde{A}-\varphi_i F_A)$

Using (A1) and (A2) together with the assumption of a linearly homogenous production function, we can show that $F_{An}-\varphi_i F_{AA}\widetilde{A}-\varphi_i F_A=0$. Thus,

$$D=\varphi F_{AA}(\varphi_i F_{An}\widetilde{A}-F_{nn}-\varphi_{ii}F_A\widetilde{A})<0$$

Using the Cremer's rule gives the following results

$$\frac{d\tilde{i}}{dT}=\frac{\varphi F_{AA}\varphi_{iT}F_A\widetilde{A}}{D}<0$$

$$\frac{d\widetilde{A}}{dT}=\frac{-\varphi_T\varphi_i\widetilde{A}F_AF_{An}+\varphi_T F_A F_{nn}+\varphi\varphi_{iT}\widetilde{A}F_AF_{An}+(\varphi_T\varphi_{ii}-\varphi_i\varphi_{iT})\widetilde{A}(F_A)^2}{D}$$

With a very reasonable sufficient condition, $\varphi_{ii}\tilde{i}/\varphi_i<\varphi_{iT}\tilde{i}/\varphi_T$, it can be easily shown that $d\widetilde{A}/dT>0$.

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