TRUST AND DEVELOPMENT

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Abstract

In this paper we examine the linkages between social trust and economic development using, for the first time, a panel of data. We confirm earlier cross-sectional studies finding that trust is a significant factor in development and also show for the first time that trust significantly interacts with both investment in physical and human capital. We provide a robustness analysis of our results via a set of jackknife experiments on our main equations and the trust coefficients and interactions are very tightly distributed indicating that the results are not highly sample dependent. We also consider whether trust directly influences investment and find, that in a panel framework it does not, unless we allow for a trust-education interaction in the investment equation.

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1 Introduction

Explaining differential patterns of development is one of the most significant challenges in all of economics. Most modern growth theory suggests that, in equilibrium, long run growth rates should be equalized and that relative income levels should differ according to levels of accumulation of physical and human capital. However, this view often begs the question of what are the root causes of differential capital accumulation. A second avenue of research argues that capital accumulation is an insufficient explanation of income differences and searches for additional variables beyond the basic paradigm that might help explain differential patterns of development (in either income levels or growth rates). A third approach is to consider the possibility that input productivity varies systematically across countries.

In this paper we take one particular concept of interest in the literature, namely trust, and investigate its role in development via all three of the above approaches. The dataset employed in this analysis is more comprehensive than datasets used by previous studies both in terms of the number of countries and time periods that we consider. We find that trust not only exerts a positive direct influence on real per-capita GDP, but also enhances the efficiency of existing human and physical capital inputs. This relationship is shown to be robust not only to changes in the underlying data as shown by a series of jacknife tests, but also to splitting the sample as evidenced by Chow test results. Furthermore, conditioning on trust and its interaction with human capital, human capital accumulation is found to have a statistically significant impact on the level of per-capita income. This stands in stark contrast to Islam's (1995) results where human capital accumulation, when considered in a panel framework, does not play a statistically significant role in the level of per-capita GDP. Furthermore, we investigate trust's role in this accumulation of physical capital. Our results reveal that trust contributes in a positive manner to the level of physical capital via a significant interaction with human capital.

Our paper is organized as follows. Section 2 reviews the literature on development and

trust. Section 3 contains a discussion of the data and the model. Section 4 provides regression results. Section 5 concludes.

2 Literature review

2.1 Theoretical Literature Review

Research on economic development is largely based upon the Neoclassical Growth Model (NGM) paradigm. Solow's seminal work (1956, 1957) highlighted the essential roles that labor, physical capital, and technology play in the macroeconomic production function. Mankiw et al. (1992) augment Solow's original model with human capital. In many cases, however, these versions of the model have not held up under empirical scrutiny. For example, Caselli et al. (1996) reject both versions of the model. In addition, Grier and Grier's (2007) empirical examination of the growth theories reveals a paradox of both input convergence and income divergence, a phenomenon which cannot be explained by mainstream growth models. Third, Hall and Jones (1999) attribute differences in per-capita income levels to differences in total factor productivity (TFP), not accumulation.

For these reasons and more, empirical development research has pursued the identification of several additional factors, both exogenous and endogenous, which might further enhance our understanding of economic growth. Several of these factors include human capital (Islam (1995)), financial development (Aghion et. al. (2005), Levine (1997, 2005), and Levine et al. (2000)), international capital flows (see Edison et. al. (2004) for a survey), quality of institutions (Acemoglu et al. (2001), Rodrik et al. (2004)), social infrastructure (Hall and Jones (1999)[3]), government spending and inflation. While each of these avenues yields significant insight into the nature and structure of economic growth, another intriguing causal agent in the development process is social capital. Social capital is the by-product of inter-

[3]In many respects, our work can be seen as complementary to Hall and Jones. According to Hall and Jones, differences in per capita income are primarily explained by differences in TFP. They show that these TFP differences can be attributed to social infrastructure. In this paper, we employ a specific measure of social infrastructure, namely trust, and investigate its role not only in TFP differences, but also in the productivity of specific inputs and accumulation of capital. We thank an anonymous referee for this valuable insight.

personal relationships that exist between members in a society, and is associated with the types and quantities of externalities that these social networks produce. Higher levels of positive externalities yield a higher level of social capital, which can have a beneficial impact on macroeconomic outcomes.

Social capital's influence on the macroeconomy has been discussed by several different individuals. Olson (1982) focuses on groups which reduce the stock of social capital, such as political coalitions which impose heavy distributional demands upon the government and, in large enough numbers, produce economic decline. Fukuyama (1999) also provides examples of groups, such as the KKK and Mafia, which reduce society's level of social capital. Putnam (1993a), however, emphasizes the opposite. He argues that a crucial component in the formation of new social capital is associational activity.

Many researchers have empirically verified the benefits that social capital has on economic outcomes. Coleman (1988) shows that social capital, as embodied in family and community relations, is very important to the accumulation of human capital. Putnam (1993a) finds that regions of Northern Italy grew faster than Southern Italy after the Second World War due to the presence of social capital. Putnam and Helliwell's (1995) results reveal that regions of Italy with high levels of social capital grew faster than regions without high levels of social capital, holding initial income constant.

Conclusions regarding the nature of the relationship between social capital and development are, in many cases, applicable to trust as well. In fact, much of the literature has argued that "trust is an essential component of social capital" (p. 170, Putnam(1993a)), and has used trust as a measure of social capital. Bjornskov (2006a) assesses the validity of this argument using principal component analysis on a cross section of countries. He finds that trust is the sole component of social capital that determines governance and life satisfaction. As a result, a discussion of both social capital and trust and their respective relationships to economic outcomes are relevant for this paper.

The existence of a direct link between trust and economic phenomena has also been widely

acknowledged in the literature. Arrow (1972) notes that trust should reduce costs for transactions that occur over time. Putnam (1993b) writes that "Social capital enhances the benefits of investment in physical and human capital." (p. 36). Durlauf and Fafchamps (2004) expand the concept of efficiency gains by identifying three channels through which trust could help facilitate economic endeavors. These transmission channels include information sharing, group formation, and coordination.

Thus, there are four distinct ways trust could foster development. First, trust could directly impact growth. Second, efficiency gains in investment may occur by reductions in transaction costs and increases in information sharing. Third, since physical capital investment occurs over a period of time, the level of trust could influence the rate of accumulation, which is further described in Section 2.2 below. Fourth, as Coleman (1988) noted, trust could increase the efficiency of human capital. Before investigating each of these channels, we will first review the relationship between trust and growth.

2.2 On The Link Between Trust and Growth

The foundational paper on social capital's role in economic development is Knack and Keefer's (1997) paper. They employ a cross sectional regression on 29 countries and show that trust is a significant causal component of growth. Zak and Knack (2001) broaden the sample to 41 countries. Their cross section results show that a 15 percentage point increase in trust yields a 1 percentage point increase in economic growth. Beugelsdijk et al. (2004) verify the robustness of Zak and Knack's (2001) results using the sample of 41 countries.

Fukuyama (1995) hypothesizes that increases in trust should foster efficiency gains in large scale activities. Using a cross sectional regression, La Porta et al. (1997) confirm this hypothesis by showing that trust promotes cooperation and efficient outcomes in government, large organizations, and social structures. In addition, Knack (2002) also finds that trust is a significant predictor of government performance using a cross sectional framework. Uslaner (2002) finds that social trust is affiliated with positive economic outcomes such as volunteering,

charity, and advocating policies which promote economic growth. Bjornskov (2004) finds that trust is associated with lower levels of corruption, while Bjornksov (2006b) shows that social trust affects both schooling and rule of law.

Trust and trade openness are also closely related. Chan (2007) notes that Rodrik (1997) hypothesizes that global integration can foster a breakdown in the underlying social structure. Chan (2007) investigates this causal chain from openness to trust and identifies income inequality as a key component in this relationship. If income inequality is below a certain threshold, then increases in trade openness will produce gains in trust. At higher values of income inequality, this relationship decreases and eventually turns negative. The reverse relationship, that of trust upon trade, has also been investigated. Butter and Mosch (2003) determine increasing trust by one standard deviation can foster changes of up to 150% in bilateral trade. Guiso et al. (2007) find that trust formation is influenced by cultural biases and plays a significant role in determining the extent to which countries will trade with one another.

Many of these empirical investigations have relied on trust data gathered from a series of surveys (a.k.a. waves) that are sponsored by the World Values Survey (WVS) organization. Before the addition of this fourth wave, prior researchers had been limited in their choice of empirical specification to a cross sectional framework. Strictly speaking, while three waves are sufficient for a panel, the small number of countries surveyed in the first wave made the use of a panel impractical. However, with the addition of a fourth WVS wave, we are now able to perform a time series analysis of the data. This represents one of the main contributions of our research.

A time series analysis has the potential to yield some different insights that the cross section regression employed by prior researchers. In some cases, significant parameters in the cross section become insignificant when placed into the panel framework. Therefore, inferences drawn from cross section results are not necessarily robust to a panel specification. A famous example of this parameter instability is human capital. Mankiw et al. (1992), using

cross section analysis, find that the human capital component is significant in the augmented Solow Model. However, Islam (1995) shows that the human capital component is insignificant when employed in a panel framework. Therefore, we would like to assess whether the issue of parameter instability over time extends to trust and its role in development.

There is also some evidence that trust's relationship to economic growth might vary between developing and developed countries. That is, the efficacy of certain measures of social capital on development might vary according to income level. For example, Putnam (2000) finds US's social capital (as measured by associational activity) has declined since the 1950's, yet, as Durlauf and Fafchamps (2004) note, this coincides with a period of significant economic growth. Therefore, the example of the US could be interpreted as an example of an inverse, rather than direct, relationship between social capital and economic growth for a wealthy country. Knack and Keefer (1997) also find that trust has the largest direct impact on developing countries. Therefore, we will also investigate whether trust's coefficient varies by grouping countries into two categories on the basis of income.

In addition, many of these empirical investigations insert trust directly into the regression equation, while implicitly ignoring the impact of trust on other inputs (such as investment or human capital). Pritchett (2006) argues that empirical specifications with un-modeled relationships (such as these interactions) can generate results that are inconsistent with empirical observations. However, by including these un-modeled relationships, we can provide a more nuanced understanding of reality. Therefore, there are several reasons to believe that the previously un-modeled interactions between trust and investment and trust and human capital might have an impact on the development process.

This relationship between trust and investment has been previously discussed in the literature. Most investments require transactions that are conducted over a period of time. The time element produces two distinct difficulties for the parties involved. First, each party has private information, which produces asymmetric information. Second, there is a general uncertainty regarding future states of the world. Contracts, which bind multiple parties in

legal agreement over the transaction period, represent an attempt to mitigate the problem of asymmetric information and uncertainty. These contracts, however, represent significant costs.

To the extent that trust increases efficiency in information sharing, the problem of asymmetric information could be reduced. Furthermore, high trust levels may also rationally mitigate concerns that the other party will take advantage of asymmetric information or uncertainty. Therefore, high trust levels may not only reduce contractual costs, but also legal costs by reducing litigiousness.

Loans, like contracts, occur over a period of time. Increasing levels of trust should produce a corresponding increase in information sharing that would allow banks to identify more successful projects. An increase in the number of successful projects would increase the efficiency of the bank loans, ceteris paribus. In addition, higher levels of trust would allow entrepreneurs to devote more time to project planning rather than monitoring their employees, which would increase the efficiency of investment. The potential validity of the investment channel is corroborated by empirical evidence. Guiso et al. (2004) and Calderon et al. (2002) find that financial institutions residing in areas with inefficient courts systems and low education benefit from higher trust levels. Zak and Knack (2001) show trust increases investment.

Trust may not only increase the efficiency of investment, but also increase the efficiency of human capital. While Coleman (1988) analyzed the relationship between social and human capital at the micro-level, we will assess its role at the macro-level. Bjornksov (2006b) finds that the macro-level impact of trust on schooling is both positive and significant. Knack and Keefer (1997) also state that a significant relationship exists between human capital and trust. Higher trust levels might produce increases in information sharing which would allow faster dissemination of new research and ideas regarding how to make production processes more efficient. In addition, high trust levels can also foster group formation and coordination that would be required to undertake large scale projects for innovation and research. Therefore,

efficiency gains in human capital produced by trust not only would increase GDP directly, but also indirectly by working through physical capital.

To summarize, we will investigate 1) the efficiency enhancing element of trust on human and physical capital, 2) trust's role in the accumulation of physical inputs, and 3) trust's direct role in development. In addition, the empirical specification is improved by the inclusion of a time element which will be used to assess the robustness of the results produced by the existing literature. Then, the robustness of our empirical results is verified using different econometric techniques.

3 Model & Data

We seek to put together a more comprehensive dataset than prior studies in order to not only assess existing results within the context of a panel, but also to extend these results. These datasets will allow us to examine not only the direct influence of trust on per-capita income, but also investigate its role in efficiency and input accumulation.

The five main datasets used in our empirical analysis are the Penn World Tables (PWT), the Barro-Lee education data set, the World Development Indicators (WDI), the International Financial Statistics (IFS) from the IMF, and the World Values Survey (WVS). WVS data are the limiting factors both in terms of the number of countries and the number of observations. For example, when the WVS dataset is combined with the three remaining datasets, the number of countries employed by our regressions is reduced from 102 to 51. In addition, with only 4 waves, the WVS dataset has, at most, 4 irregularly spaced observations per country.

However, in order to quantify trust according to the traditionally accepted paradigm, we need to use WVS data. In particular, question a165 from the WVS dataset is used, which reads: "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" Individual responses are either (1)- Most people can be trusted or (2)- Can't be too careful. We re-coded all responses of (2) with a value of

(0).[4] Following Grier and Tullock (1989), Islam(1995), and Dawson(1998), we then take each country/wave average as an observation. Wave 1 was conducted over years 1981-1984, wave 2 over years 1989-1993, wave 3 over years 1994-1998, and wave 4 over years 1999-2004.

While WVS has at most four observations per country corresponding to each wave, PWT, Mark 6.2, has annual observations of key macroeconomic indicators. Variables from the PWT dataset used in our regressions include real GDP per-capita ($RGDPPC$) and investment share of real GDP (Inv/GDP). Labor force growth (n) is constructed using annual observations from the WDI dataset on the total number of people over 15 who are in the labor force. Our variable, $n + g + d$, where g is technological growth and d is depreciation is assumed to be given by $n + .05$.[5] Data on education (edu) comes from the Barro-Lee dataset which covers education information for over 130 countries for 5 year intervals from 1960-1999. Edu is the percentage of total population over 15 which have reached, or "attained", the secondary education level.

All annual macroeconomic from WDI and PWT datasets are made consistent with WVS wave data by averaging over the years for which each WVS wave was conducted. That is, data affiliated with wave 1 are averages from 1981-1984, data associated with wave 2 are averages from 1989-1993, data connected with wave 3 are averages from 1994-1998, and data associated with wave 4 are averages from 1999-2004. For edu, the five year interval closest to the first year of the wave is selected.

Each regression includes a time dummy (td) for the last 3 waves. The total number of countries in our trust sample is 51. Some of these countries, however, only have one WVS observation, which prevents us from employing fixed effects. Thus, we have an unbalanced, irregularly spaced panel in evaluating the empirical results listed in the next section.

The basic cross country per-capita and investment accumulation regressions are:

$$\ln(RGDPPC_w) = \beta_0 + \beta_1 \ln(RGDPPC_{w-1}) + \beta_2 \ln(n_w + g + d) + \beta_3 \ln(Inv/GDP_w) +$$

[4] Following Calderon et al. (2002), we do not weight the $trust$ variable.

[5] Mankiw et al. (1992) make a similar assumption.

$\beta_4 \ln(edu_w) + \beta_5 \ln(trust_w) + \varepsilon_t$

$\ln(Inv/GDP_w) = \beta_0 + \beta_1 \ln(RGDPPC_{w-1}) + \beta_2 \ln(edu_w) + \beta_3 \ln(trust_w) + \beta_4 \ln(P_{Inv_w}) + \varepsilon_t$[6]

where w represents the wave. Time/wave dummies are included in all our estimations, but are omitted from the above equations. In certain specifications, we also include an interaction term between *trust* and a capital input in order to assess *trust*'s impact on the productivity of that capital input.

In our per-capita income regressions, we will also treat Inv/GDP as endogenous and verify the robustness of our results via 2sls. As a robustness check for the investment accumulation regression, some additional variables are also employed in the investment equation. These variables include $inflation$, *st. dev. of* $inflation$, and *real gdp growth*. IFS Inflation data is the "percentage change in CPI over corresponding period of previous year.", which is further divided by 100. The standard deviation and mean of inflation are then calculated for each wave. Real gdp growth rate is the annual percentage change in per-capita gdp which is averaged over each corresponding wave.

4 Results

4.1 Per-Capita Income Regressions

We estimate our models using an unbalanced panel of 51 countries over the 4 waves of trust data which gives us 119 observations and is by far the largest dataset employed in the empirical literature. The specific countries and their corresponding waves are listed in A1.1, while their summary statistics are listed in Table A2.1.

Regression results for this panel framework are shown in Table 1. Columns 1 and 2 estimate the baseline model in a panel framework without trust. Like Islam (1995), we find in column 1 that *edu* is not significant in this specification. When we endogenize Inv/GDP in

[6]Investment equation is based on Zak and Knack (2001).

column 2 and instrument for it using its lagged value, we find very similiar results. Columns 3 is the baseline model found in column 1, except with trust directly added directly to the regression. The results of column 3 confirm the findings of the existing cross-sectional literature (i.e., Knack and Keefer (1997), Zak and Knack (2001)), where trust has a positive and significant impact on income. The robustness of these results is verified in column 4 by assuming endogenity of Inv/GDP and adjusting for it via instrumental variables. Columns 5 and 6 investigate the trust's role in raising input efficiency. We investigate the role of trust on physical capital's efficiency in column 5 and examine trust's role in the efficiency of human capital in column 6.

Returning to column 3, the direct impact of *trust* on changes in per-capita income levels is substantial. A one standard deviation increase (about 16 percentage points) in *trust* will increase $RGDPPC$ by 2.4% . This movement in *trust* is equivalent to moving from Austria (wave 4 trust= .334) to New Zealand (wave 3 trust= .490). Regression results in column three also reveal that a one standard deviation increase (34.6%) in Inv/GDP produces a 6.3% increase in $RGDPPC$. Edu, however, is insignificant.

Moving from column 3 to columns 5 and 6, we find that trust enhances the efficiency of both Inv/GDP and Edu. Column 5's results indicate that an increase of one standard deviation in Inv/GDP, at the mean level of *trust*, produces a 7.4% increase in $RGDPPC$. If, however, the impact of a one standard deviation increase in Inv/GDP is re-evaluated at the mean plus one standard deviation of trust, the result is an 8.6% increase in RGDPPC. Therefore, the efficiency of physical capital is higher in areas with higher levels of trust. Another column 5 result indicates a one standard deviation increase in *trust* at the mean level of Inv/GDP produces a 2.8% increase in $RGDPPC$.

$Trust$'s impact becomes even more pronounced with the inclusion of an interaction term between *edu* and *trust*. The coefficient on *edu* is transformed from negative and insignificant in column 3 (no interaction term) to positive and significant in column 6 (interaction term). Contrary to Islam (1999), this result indicates that human capital accumulation can have a

significant effect on the level of per-capita income. Thus, human capital accumulation can contribute to the observed differences in levels of per-capita income between countries.

A one standard deviation increase in *edu* (13 percentage points) in a country with the mean level of *trust* yields a 1.1% increase in $RGDPPC$. However, human capital becomes more efficient in areas with higher levels of *trust*. If we increase trust from its mean by one standard deviation, a one standard deviation increase in *edu* produces a 2% increase in $RGDPPC$. These results stand in stark contrast to the original regression (column 3) where *edu* had no significant impact on economic growth. The regression results also indicate that the marginal impact of a one standard deviation *trust* increase at the mean level of *edu* produces a 3% increase in $RGDPPC$.

4.2 Robustness Checks

In this section we provide evidence on the robustness of these results in two different ways. First, we perform a country by country jackknife exercise on our three main equations of interest. Second, we test whether the richer and poorer countries in our sample can be legitimately pooled together in a single regression equation. Third, we investigate the temporal stability of our results.

4.2.1 Jackknife results

We re-estimate each of our three main equations (equations 3, 5 & 6 of Table 1) 51 times, each time excluding one country. This eliminates anywhere between one and four observations at a time depending on how many waves of the trust survey are available for the country being eliminated. In this way we get a distribution of coefficients and can see how robust our results are to changes in the sample. These results are shown in Table 2. First, consider the jackknife results for equation 3 of Table 1 where *trust* enters only in a linear fashion as shown in Panel A, line 5 of Table 2. The average of the 51 estimated coefficients is 0.048 and the standard deviation of the mean is 0.003 indicating that the value of our *trust* coefficient is not very

dependent on the sample. Another way to see this is to note that the minimum value of the estimated coefficient is 0.036 and the maximum is 0.055. In the other two equations where *trust* enters both linearly and as an interaction, the coefficient on *trust* is still quite tightly distributed as can be seen in Table 2, line 5 of Panels B and C.

Turning to the *trust* interactions, the average of the 51 estimated coefficients for *trust* x Inv/GDP is 0.086 with a standard deviation of 0.007 (minimum value 0.055, maximum 0.114) while the average coefficient for *trust* x *edu* is 0.067 with a standard deviation of 0.006 (minimum value 0.040, maximum 0.10). These results help to show that our finding of the ubiquitous significance of *trust* in these GDP regressions is not highly dependent on the exact sample.

The coefficient values for lagged income and investment are extremely robust in all three jackknife experiments. (It is also worthwhile to note that the result showing that *edu* is positive and significant in the equation where it also interacts with *trust* is quite robust. In the jackknife of that coefficient, the average value is 0.105 with a standard deviation of 0.01 (minimum value 0.078, maximum 0.148)).

4.2.2 Sample Pooling Results

It has been argued that trust has a more pronounced impact on development in poorer countries. In order to investigate this possibility, we split our sample into two groups, developed and developing countries. Developed countries are classified as those which are in the top 25th percentile of income in wave 0 where wave 0 represents the average from 1976 to 1980. Developing countries are bottom 75th percentile of the income distribution in wave 0.

Chow tests are conducted on these two groups in order to assess equation stability. We do this for all three equations of interest. The resulting F-statistics are .95 for *trust* only equation, 1.81 for *trust* with physical capital interaction, and 1.66 for *trust* with human capital interaction which are distributed with (9, 101), (10, 99), and (10, 99) degress of freedom respectively. At the 5% significance level, we fail to reject the null of parameter

constancy between the developed and developing country samples. This result provides no evidence against the hypotheses that the richer and poorer countries can be legitimately pooled into a single regression equation.

4.2.3 Temporal Stability Results

Here we also employ a Chow test to assess the temporal stability of our results. We investigate coefficient stability between waves 1-3 and wave 4 for two distinct reasons. First, there exists significant variation in the size of each sampling period with wave 4 containing more than 35% of the data. This large number of observations concentrated in one wave justifies our choice for the break at this particular point. Second, wave 4 with its wider coverage of countries is a more likely place for a structural break. The first group consists of 77 observations obtained from waves 1-3 while wave 4 makes up the second group with 42 observations.

We conduct Chow tests for each of our three regressions of interest. These regressions include inserting (1) *trust* directly, (2) *trust* and an interaction with Inv/GDP, and (3) *trust* and an interaction with *edu*. We find an f-statistic of 1.66 for (1), 1.11 for (2), and 1.64 for (3) with (9, 101), (10, 99), and (10, 99) degrees of freedom respectively. Each of these Chow test is insignificant at traditional levels of significance. Therefore, we cannot reject the null of parameter constancy between waves 1-3 and wave 4.

4.3 Investment Regressions

In order to assess the direct impact of *trust* on Inv/GDP, we employ a regression that is similar to Zak and Knack (2001), except extended to a panel framework. Summary statistics are reported in Table A2.2. First, however, we follow Zak and Knack in conducting a cross sectional regression on our dataset. The specification is of the following form.

$$\ln(Inv/GDP) = \beta_0 + \beta_1 \ln(RGDPPC_i) + \beta_2 \ln(edu_i) + \beta_3 \ln(trust) + \beta_4 \ln(P_{Inv_i}) + \varepsilon$$

Variables with the i subscript denote data taken from the initial wave 1 survey time frame.

$Trust$ and Inv/GDP represent averages over the four waves. These regression results, which are shown below, are consistent with Zak and Knack's (2001) results.

$$\ln(Inv/GDP) = -\underset{(0.671)}{1.19} + \underset{(0.058)}{0.178} \cdot \ln(RGDPPC_i) + \underset{(0.088)}{0.181} \cdot \ln(edu_i) + \underset{(0.070)}{0.140} \cdot \ln(trust) - \underset{(0.066)}{0.402} \cdot \ln(P_{Inv_i}) + \varepsilon$$

Here, we can observe that *trust* is both positive and statistically significant. Likewise, high P_{Inv_i} depresses investment whereas high income and education raise investment. The first column of Table 3 is the panel extension of the above cross sectional regression. In this specification, *trust* does not play a significant role in determining investment rates. This change of significance, however, has precedent in the economic literature. Islam (1995) showed that impact of *edu* was not robust when moved from a cross-sectional to panel framework. However, we identified that in the per-capita income equation, when the *trust-edu* interaction was included, *edu* did come to play a significant and positive role. In a similar manner, the investment specification may benefit from this *edu-trust* interaction. Therefore, we include an interaction between *trust* and *edu* in column 2.

Now in column 2, both *trust*'s and the interaction term's coefficient are significant indicating that a strong synergy is present between *trust* and *edu*. This result is consistent with the literature on the relationship between *trust* and *edu* (i.e., Bjornskov (2006)). In the first column, a one standard deviation increase in *edu* yields a 11.6% increase in Inv/GDP. However, when the interaction between *trust* and *edu* is included, one standard deviation in *edu* evaluated at the mean level of trust produces a 18.9% increase in Inv/GDP. [7]

Under higher levels of trust, the impact of education is even more pronounced. If we increase *trust* from its mean by one standard deviation, a one standard deviation increase in *edu* produces 22.6% increase in investment rate, an increase of nearly 4%. Thus, *trust* greatly enhances the effectiveness of human capital in determining the investment rate.

[7] Grier (2002) and Grier (2005) find that human and physical capital are endogenous. Our results indicate that *trust* might facilitate and further enhance these linkages. In other words, *trust* might represent the coupling mechanism between physical and human capital. We plan to address this in a future paper.

In addition to the jackknife of the investment regressions listed in Section 4.3.1, we have incorporated additional variables found in the literature (i.e., Pindyck and Solimano (1993)) into our regression of interest (column 2). $Inflation$, $st.\ dev.\ of\ inflation$, and $RGDP\ growth$ are entered one at a time. Results in columns 3-5 reveal that trust and its interaction are still positive and significant. Therefore, the conclusions drawn from column 2 are robust to the inclusion of these additional explanatory variables.

4.3.1 Jackknife results

Once again, we assess the robustness of our investment results to changes in the underlying sample by employing a jackknife. Removing one country at a time, each regression (represented by columns 1 and 2 of Table 3) is run 53 times. The results of this jackknife experiment are listed in Table 4. The first panel, Panel A, corresponds to the first column of Table 3. These jackknife results indicate that $RGDPPC$, edu, and P_{Inv} are all highly significant and robust to changes in the underlying sample. The jackknife results regarding trust reveal that its insignificance is robust to the underlying sample.

While this insignificance is robust to the data, it is clearly evident from Panel B that insignificance is not robust to the specification. Panel B which corresponds to the second column of Table 3 shows how employing a different regression model reveals that trust does contribute in a robust manner to investment. Here the mean value of the coefficient on trust is 0.321 with a small standard deviation of 0.032. Likewise, the interaction term is also positive and statistically significant as indicated by a mean of 0.279 and a standard deviation of 0.024.

5 Conclusions

This paper represents an additional step in understanding the macroeconomic consequences of trust on economic development. Our research validates prior claims in a more robust setting by employing a panel with a larger number of countries and a time dimension. Furthermore, we

find that the literature has, if anything, understated the impact of trust on development. We show trust to be a significant contributor to development by investigating several previously unexplored channels. These channels include 1) fostering input accumulation, 2) increasing efficiency of other inputs, and 3) directly increasing economic growth. Its significance in these new areas and robustness to empirical specification gives further credence to the importance of trust's role in development.

In many ways, an understanding of trust's contribution to economic development could be considered nascent. Trust is a multidimensional topic with many unexplored research avenues in areas regarding the formation of trust, the appropriate aggregation of trust, and a deeper insight into the causal nexus through which trust acts.[8] Our research indicates that these questions are more important to economic endeavors than previously thought and should be further investigated.

[8]Durlauf (2002) notes that the foundations of trust could either be cultural or rational. Brock and Durlauf (2001) address econometric issues in social interactions.

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Tables

	Dependent Variable: ln(RGDPPC)					
	(OLS)	*(2SLS)*	*(OLS)*	*(2SLS)*	*(OLS)*	*(OLS)*
ln(*RGDPPC*) (lagged)	0.903***	0.910***	0.901***	0.910***	0.904***	0.895***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)
ln(*Edu*)	0.005	0.024	-0.027	-0.006	-0.014	0.106*
	(0.027)	(0.028)	(0.029)	(0.030)	(0.028)	(0.054)
ln(*n+g+d*)	-0.060	-0.066	-0.040	-0.046	-0.034	-0.027
	(0.048)	(0.050)	(0.048)	(0.048)	(0.046)	(0.046)
ln(*Inv/GDP*)	0.184***	0.135***	0.182***	0.128***	0.307***	0.179***
	(0.028)	(0.034)	(0.027)	(0.033)	(0.051)	(0.027)
ln(*Trust*)			0.048***	0.049***	0.197***	0.123***
			(0.017)	(0.017)	(0.055)	(0.031)
ln(*Trust*) X ln(*Inv/GDP*)					0.086***	
					(0.030)	
ln(*Trust*) X ln(*Edu*)						0.067***
						(0.024)
td2	0.113***	0.114***	0.116***	0.117***	0.118***	0.112***
	(0.028)	(0.030)	(0.027)	(0.027)	(0.026)	(0.026)
td3	0.036	0.036	0.054*	0.055*	0.056**	0.053*
	(0.028)	(0.029)	(0.028)	(0.029)	(0.027)	(0.027)
td4	0.066**	0.064**	0.077***	0.075***	0.075***	0.079***
	(0.027)	(0.027)	(0.026)	(0.027)	(0.025)	(0.025)
Nobs	119	119	119	119	119	119
R^2	0.9818	0.9882	0.9893	0.9889	0.99	0.99

Table 1. Per Capita Income Panel Regressions. Notes: Standard errors are in parentheses.

***,**,*: significant at 1%, 5%, 10% respectively.

Panel A- Jackknife of Table 1 Col. 2

	Mean	**Std. Dev.**	**Min.**	**Max.**
ln(*RGDPPC*) (lagged)	0.902	0.005	0.897	0.931
ln(*Edu*)	-0.027	0.008	-0.040	0.018
ln(*n+g+d*)	-0.040	0.011	-0.081	-0.010
ln(*Inv/GDP*)	0.182	0.007	0.150	0.201
ln(*Trust*)	0.048	0.003	0.036	0.055

Panel B- Jackknife of Table 1 Col. 3

	Mean	**Std. Dev.**	**Min.**	**Max.**
ln(*RGDPPC*) (lagged)	0.904	0.004	0.900	0.929
ln(*Edu*)	-0.014	0.006	-0.027	0.015
ln(*n+g+d*)	-0.034	0.010	-0.067	-0.006
ln(*Inv/GDP*)	0.306	0.015	0.261	0.376
ln(*Trust*)	0.196	0.013	0.136	0.238
ln(*Trust*) X ln(*Inv/GDP*)	0.086	0.007	0.055	0.114

Panel C- Jackknife of Table 1 Col. 4

	Mean	**Std. Dev.**	**Min.**	**Max.**
ln(*RGDPPC*) (lagged)	0.895	0.004	0.891	0.921
ln(*Edu*)	0.105	0.011	0.078	0.148
ln(*n+g+d*)	-0.027	0.010	-0.056	0.001
ln(*Inv/GDP*)	0.179	0.007	0.152	0.198
ln(*Trust*)	0.123	0.008	0.087	0.145
ln(*Trust*) X ln(*Edu*)	0.067	0.007	0.040	0.100

Table 2. Jack-knife coefficient distributions. Notes: Each coefficient was estimated 51 times by using data for N-1 countries in the sample.

	Dependent Variable: ln(Inv/GDP)				
ln(*RGDPPC*) (lagged)	0.320***	0.317***	0.364***	0.292***	0.293***
	(.0544656)	(0.052)	(0.054)	(0.050)	(0.050)
ln(*Edu*)	0.343***	0.850***	0.768***	0.636***	0.645***
	(.098432)	(0.184)	(0.183)	(0.178)	(0.178)
ln(*Trust*)	-0.006	0.322***	0.211*	0.267**	0.271**
	(.0601615)	(0.117)	(0.123)	(0.110)	(0.110)
ln(P_{Inv})	-0.454***	-0.580***	-0.594***	-0.516***	-0.516***
(lagged)	(.1119478)	(0.114)	(0.112)	(0.111)	(0.110)
ln(*Trust*) X ln(*Edu*)		0.278***	0.229***	0.197**	0.202**
		(0.087)	(0.087)	(0.086)	(0.086)
RGDP growth (lagged)			3.245**		
			(1.310)		
Inflation				-0.013	
				(0.017)	
St. Dev. of Inflation					-0.015
					(0.017)
td2	-0.059	-0.100	-0.042	-0.078	-0.077
	(.0989203)	(0.096)	(0.097)	(0.089)	(0.089)
td3	-0.045	-0.061	-0.03	-0.056	-0.054
	(.1007837)	(0.097)	(0.096)	(0.091)	(0.091)
td4	-0.13	-0.122	-0.141	-0.099	-0.098
	(.0935292)	(0.090)	(0.088)	(0.084)	(0.084)
Nobs	121	121	121	119	119
R^2	0.5606	0.5976	0.6187	0.5773	0.5779

Table 3. Investment Regressions. Notes: Standard errors are in parentheses. ***,**,*: significant at 1%, 5%, 10% respectively.

Panel A- Jackknife of Table 3 Col. 1

	Mean	**Std. Dev.**	**Min.**	**Max.**
$\ln(RGDPPC)$ (lagged)	0.320	0.019	0.279	0.431
$\ln(Edu)$	0.343	0.026	0.233	0.420
$\ln(Trust)$	-0.007	0.016	-0.070	0.053
$\ln(P_{Inv})$ (Lagged)	-0.454	0.025	-0.520	-0.345

Panel B- Jackknife of Table 3 Col. 2

	Mean	**Std. Dev.**	**Min.**	**Max.**
$\ln(RGDPPC)$ (lagged)	0.318	0.018	0.282	0.419
$\ln(Edu)$	0.849	0.058	0.618	0.950
$\ln(Trust)$	0.321	0.032	0.182	0.383
$\ln(P_{Inv})$ (Lagged)	-0.580	0.030	-0.656	-0.461
$\ln(Trust)$ X $\ln(Edu)$	0.279	0.024	0.180	0.351

Table 4. Jack-knife coefficient distributions. Notes: Each coefficient was estimated 53 times by using data for N-1 countries in the sample.

Appendix A.1

Country Name	Wave 1	Wave 2	Wave 3	Wave 4
Algeria				X
Argentina	X	X	X	X
Australia*	X		X	
Austria*		X		X
Bangladesh			X	X
Belgium*	X	X		X
Brazil		X	X	
Canada*	X	X		X
Chile		X	X	X
China		X	X	X
Colombia			X	
Denmark*	X	X		X
Dominican Republic			X	
Egypt				X
El Salvador			X	
Finland*		X	X	X
France*	X	X		X
Greece*				X
Hungary	X	X	X	X
Iceland*	X	X		X
India		X	X	X
Indonesia				X
Iran				X
Iraq†				X
Ireland	X	X		X
Israel*				X
Italy*	X	X		X
Japan*	X	X	X	X
Jordan				X
Korea, Republic of	X	X	X	X
Mexico		X	X	X
Netherlands*	X	X		X
New Zealand*			X	
Norway*	X	X	X	
Pakistan			X	X
Peru			X	X
Philippines			X	X
Poland		X	X	X
Portugal		X		X
Singapore*				X

Country Name	Wave 1	Wave 2	Wave 3	Wave 4
South Africa		X	X	X
Spain*	X	X	X	X
Sweden*	X	X	X	X
Switzerland*		X	X	
Taiwan†			X	
Tanzania				X
Turkey		X	X	X
Uganda				X
United Kingdom*	X	X	X	X
United States*	X	X	X	X
Uruguay			X	
Venezuela			X	X
Zimbabwe				X

A1.1 A List of Country and Waves. Note: * identifies Developed Countries. † identifies Investment regression-only countries.

Appendix A.2

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Real Per Capita GDP	119	14272.31	8641.78	858.94	34539.05
Investment Share of GDP	119	0.196	0.068	0.033	0.400
Education	119	0.389	0.130	0.027	0.723
Trust (Unweighted)	119	0.331	0.164	0.028	0.665
Labor Force Growth	119	0.015	0.013	-0.016	0.049

A2.1. Summary Statistics for the Per-Capita Income Regression.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Real Per Capita GDP (lagged)	121	12511.54	7647.87	604.87	30362.32
Investment Share of GDP	121	0.195	0.069	0.017	0.400
Education	121	0.387	0.131	0.027	0.723
Trust	121	0.333	0.163	0.028	0.665
P_{Inv} (lagged)	121	82.26	26.32	34.58	153.55
Real Per Capita GDP growth rate (lagged)	121	0.022	0.026	-0.047	0.121
Inflation	119	0.396	1.792	-0.005	15.382
St. Dev. of Inflation	119	0.353	1.814	0.003	14.659

A2.2. Summary Statistics for the Investment Regression.