Trust and Total Factor Productivity: What Do We Know About Effect Size and Causal Pathways?

Conal Smith[1]
Victoria University of Wellington

Abstract

This article explores what is known about the relationship between trust and total factor productivity (TFP). Generalized interpersonal trust is widely considered the best summary measure for social capital, and if this is the case the impact of trust should be reflected in estimates of TFP. A systematic review of the literature on trust, incomes, growth, and TFP finds relatively few articles on the latter despite a developed literature on trust, income, and growth. Using a development accounting framework, a simple model of the relationship between trust and TFP is set out and the size of the impact of trust on TFP is estimated empirically using a cross-country panel dataset based on the European Social Survey (ESS). Despite the limitations of the ESS, estimates of the magnitude of the impact of trust on TFP are broadly similar to those from the only other similar study identified (Bjornskov and Meon, 2015), which is based on the World Values Survey. A counterfactual estimate of TFP is used to illustrate the magnitude of the effect of trust on TFP, highlighting that the impact of trust is non-trivial in real terms, even for high-trust countries.

Interest in the relationship between trust and incomes has a long history. Adam Smith mentions the importance of trust in *The Wealth of Nations* (Evensky, 2011), and Kenneth Arrow famously asserted its importance in 1972, arguing that "virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence" (Arrow, 1972, p. 357). Although substantive analysis of the relationship between trust, incomes, growth, and productivity is scarce in the economic literature before the 1990s, recent decades have seen a significant body of empirical work emerge.

1 The author is a senior associate for the Institute for Governance and Policy Studies at the Victoria University of Wellington, and has worked as a senior economist at the OECD. The support of the New Zealand Productivity Commission in the production of this article is gratefully acknowledged. Tim Hughes and Margaret Galt (New Zealand Treasury) along with Patrick Nolan (NZ Productivity Commission), and Andrew Sharp (CSLS) provided valuable feedback on earlier drafts of the article. Email: conal.smith@vuw.ac.nz

Conceptual work linking trust to incomes had its origins largely in the political science literature (e.g. Putnam, 1993; Fukuyama, 1995), but this was soon followed by econometric analyses of the empirical relationship between trust and growth (e.g. Knack and Keefer, 1997; Zak and Knack, 2001) taking advantage of the increasing availability of large cross-country survey datasets containing measures of interpersonal trust (e.g. the World Values Survey). The period from 2000 to 2019 has seen a steady growth in the number of articles on this topic and increasingly sophisticated analysis of the causal relationship between trust and incomes.[2]

The role of trust is particularly of interest in the context of monitoring sustainable development and thinking about issues of growth, consumption, and well-being within an intergenerational context. The capital stocks approach to defining sustainability places emphasis on ensuring that the needs of current generations (current well-being) can be met without depleting the capital stocks that represent the resources available for future production. This approach forms the basis both of attempts to develop a unidimensional metric of intergenerational wealth that can be used to assess the genuine net wealth position of a country (e.g. Arrow *et al.*, 2012) as well as national and international attempts to better understand the trade-offs between current and future well-being (e.g., Treasury, 2018; Smith, 2018; OECD, 2013, 2015). Typically, four stocks of capital are identified: produced capital, natural capital, human capital, and social capital, although knowledge capital is also sometimes added to capture the cumulative impact of innovation and scientific discovery over time.

While produced, natural, and human capital are, albeit to varying degrees, relatively well understood, social capital remains more elusive. It is, however, important. The intangible part of the capital stocks (human plus social capital) account for a large proportion of total variation across countries in GDP per capita (World Bank, 2006; Hamilton and Liu, 2013). In this context social capital is generally taken to be "networks and shared norms, values and understandings that facilitate cooperation" (OECD, 2001). Generalized interpersonal trust is, perhaps, the best candidate measure for this definition of social capital (OECD, 2001, 2017; Scrivens and Smith, 2012). As discussed in the body of this article, and unlike many other proposed approaches to measuring social capital, generalized trust can be clearly defined, measured robustly, and has clear causal pathways whereby it facilitates cooperation and through this contributes to the production process.

Given that standard approaches to calculating total factor productivity (TFP) only address produced capital and human capital (labour), we would expect to see the impact of social capital, and hence trust, reflected in estimates of TFP. This article explores what is known about the re-

2 A search of the Econlit database on the terms "trust" and "growth" shows 51 articles in 2000 and 2001, 48 articles in 2002 and 2003, rising to 120 in 2016 and 2017.

lationship between trust and total factor productivity. The aim is threefold: (1) to summarize what is known from the empirical literature on the size of the relationship between trust and productivity; (2) to articulate what is known about the causal mechanisms whereby trust is thought to affect productivity and growth; and (3) to investigate the plausible magnitude of the impact trust on TFP.

The article has five main sections. Following this introduction, section 1 summarizes the existing literature on the measurement of trust and addresses the validity of trust measures. This is important to the substantive analysis that follows as the credibility of estimates of the trust/TFP relationship depend crucially on whether trust measures are themselves credible. Section 2 sets out the results of a systematic literature review on the relationship between trust, income, growth, and productivity. This includes a brief discussion of the review methodology followed by a more detailed look at estimates of the impact of trust on these outcomes. A discussion of the possible different causal relationships between trust and growth is also included. In section 3 a formal model of the relationship between trust and TFP is outlined and the data that will be used to test this model is discussed. Section 4 presents the results of the empirical analysis and discusses their implications. Finally, section 5 provides a brief conclusion.

Trust and Trust Measures

While information is available on a wide range of different aspects of trust, the focus for this article and for most of the credible empirical literature on social capital is generalized interpersonal trust. This captures a person's belief that other people not known to the respondent can be expected to act in a trustworthy manner (i.e. to act consistently with expectations of positive behaviour). Typically, generalized interpersonal trust is measured through a subjective question like the following:

On a scale from zero to ten, where zero is not at all and ten is completely, in general how much do you trust most people?

While there are a number of minor variations in the precise wording of questions on generalized interpersonal trust used internationally, it is clear that these mostly capture information on the same underlying construct (OECD, 2017; Gonzalez and Smith, 2017).[3] Although the question itself does not specify who "most people" is intended to refer to, it is clear from response data that the question is usually answered with respect to other people within the respondent's community, but not primarily family or friends (Gonzalez and Smith, 2017).

The Economic Relevance of Trust

Before reviewing the literature on the validity of trust measures and the impact of trust on incomes and productivity, it is use-

3 The most commonly used alternative, used in the World Values Survey, asks "generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people".

ful to briefly sketch how trust is thought to affect economic outcomes. This serves to flesh out the motivation for looking at trust and productivity as well as providing some context for the discussion of the validity of trust measures. Two examples will suffice to set out the prima facie case that trust affects productivity and hence to provide the motivation for this article.

The core mechanism by which trust is thought to impact productivity is via transaction costs. First, in a high-trust environment, there is less need for costly processes to mitigate risk on the context of moral hazard and principal/agent problems. For example, one reviewer of an early draft of this article who has a role in managing the finances of two organizations noted that in one they are required to obtain a second signature on any cheque over $10,000, while in the other a second signature is not required. These different levels of trust are associated with quite significant levels of labour input and hence productivity due to the time involved in obtaining the second signature.

Trust also affects productivity through confidence. The more risk one associates with interacting with others, the higher the discount rate on investments with a future pay-off. Low trust will therefore tend to create a bias towards short-term investments and interactions with known parties at the expense of potentially more productive uses of resources.

The validity of trust measures

The ability to build a sound understanding of the relationship between TFP and trust depends crucially on the ability to meaningfully measure trust. It is important, therefore, to have a good understanding of the degree to which the standard question on generalized trust described above is a valid and robust measure of peoples' belief that others will act in a trustworthy manner. Given that trust is not something that can be directly observed, this means assessing the degree to which the survey measure of trust used here correlates with other proxy measures of trust (convergent validity).

There are two primary sources of data on interpersonal trust that can be used to assess convergent validity. The first of these involves looking at the correlation between different survey questions on trust and at how responses from different sources vary with respect to trust. The second main source of information on convergent validity lies in the results of experimental studies. There is now a large body of experimental data that can be used to validate survey questions on trust. Finally, although more limited in scope, there is a small body of evidence on the bio-physical correlates of trust that is also relevant.

Knack (2001) provides a good overview of the validity of generalized trust measures from the perspective of convergent validity. He notes, in particular, that data from the *Reader's Digest* 'lost wallet' experiments which involved dropping wallets containing a sizeable (US$50 in 1996) quantity of money in public places across a range of different major cities around the world supports the validity of survey measures of generalized trust. Despite the relatively low sample size for this experiment, the proportion of wallets returned correlates with country values of the WVS measure of

generalized trust at 0.65 ($p < 0.01$). When per capita income is controlled for, the correlation is even stronger. This finding has been replicated subsequently (Felte, 2001; Shanahan, 2007) and is reinforced further by Helliwell and Wang (2010) who note that the proportion of lost wallets returned in the *Reader's Digest* experiment correlates well with data from an expectation question on whether a lost wallet would be returned, which in turn correlates well with the WVS generalized trust question.

Looking at a wider range of questions, Knack (2001) notes that responses to the World Values Survey (WVS) question on generalized trust are strongly correlated with items from the same survey relating to respondents' attitudes towards taking advantage of others (e.g. cheating on taxes or not reporting damage to a parked vehicle). These correlations focus on people's assessment of their own trustworthiness rather than on whether other people can be trusted, so the measures are sufficiently different to add substantial information. Knack and Keefer (1997) note that the relationship between generalized trust and attitudes towards taking advantage of others, like that between trust and the proportion of lost wallets returned, is stronger after controlling for per capita income. Naef and Schupp (2009) look at the relationship between people's past trusting behaviour (e.g. lending personal possessions, lending money, leaving the door unlocked) and measures of generalized trust and, using data from the German Socio-economic Panel, find a robust relationship between generalized trust and past instances of trusting behaviour.

Another source of evidence of convergent validity is the correlation between country-average levels of generalized trust and evaluations by foreigners of how trustworthy people from different countries are. Knack (2001) reports that, using Eurobarometer data on "how much you would trust people from different countries", there is a 0.45 correlation (p=0.056) with generalized trust measured in the WVS.

Going beyond survey data, there is now a large body of experimental evidence on the validity of measures of generalized trust. This rests largely on lab experiments using one or more variants of the Trust Game (Berg and McCabe, 1995). Glaeser *et al.* (2000) provided the first systematic use of laboratory experiments to validate survey measures of trust. Using a sample of 189 Harvard students, the authors found no significant relationship between the standard WVS measure of generalized trust and trust as measured in the Trust Game. This result is replicated by Lazzarini *et al.* (2004). While this might seem strong evidence against the validity of trust measures, Glaeser *et al.* also find that the survey-based measures of generalized trust are a strong and significant predictor of *trustworthy* behaviour in the Trust Game.

Cox (2004) and Capra *et al.* (2007) explore the relationship between survey-based measures of trust and experimental results in more detail. By including measures of other-regarding preferences — both experimental and survey-based — these authors show that trusting behaviour in the Trust Game is predicted well by the standard WVS question once altruism is controlled for. Finally, Gachter *et al.* (2004) report that the standard generalized trust question is associated with co-

operation in the public goods game.

All these studies share one limitation: they use a small and largely unrepresentative sample of participants in the experimental games. This raises the issue of whether the results can be extended to the population as a whole. Johnson and Mislin (2011, 2012) undertake a thorough meta-analysis of experimental studies involving the Trust Game and find a significant positive correlation between the WVS measure of generalized trust and trusting behaviour in experimental games.[4] This finding is replicated in an extension of Johnson and Mislin's work which is able to examine both inter-country and intra-country variation in experimental and survey trust in the same dataset (Carlin, Love, and Smith, 2017). One explanation for this apparent contradiction between the work of Glaeser on the one hand and Johnson and Mislin on the other, is that Johnson and Mislin consider the relationship between country-average levels of trust in both survey responses and experimental results, while the studies citied earlier look at individual-level correlations.[5]

A final source of information to assess the convergent validity of generalized trust measures is provided by Fehr (2009), who discusses a series of experiments analysing the effect of oxytocin (a neurotransmitter highly associated with pro-social behaviour in mammals). In an experimental set-up, players of the Trust Game who received a nasal spray containing oxytocin immediately before the game showed significantly higher levels of trusting behaviour than those who received a placebo spray. Fehr argues convincingly that, in this experimental design, one can effectively rule out the possibility that oxytocin affected trust via affecting player's general altruism or their risk preferences. This study hence suggests instead that the measures of trust produced by the Trust Game capture genuine trusting behaviour and are strongly grounded in a neuro-physical mechanism.

Taken collectively, the body of evidence on generalized trust suggests that such measures capture meaningful information, albeit with some degree of noise. The validity of trust measures is particularly well supported at the aggregate level where there is excellent evidence of convergent validity across countries and regions using a wide range of different metrics including both other survey measures, behavioural data, and experimental results. At the individual level measurement error is a much more significant factor. Although this is a major limitation, it is of less significance than might be initially thought. As will be discussed in the next section, most of the

4 The meta-analysis covers 162 replications of the Berg and McCabe trust experiment across 35 countries and over 23,000 respondents. Although most of these studies are small (the average sample size is 148), they cover a wide range of both developing and developed countries.

5 To understand the apparently conflicting results from Glaeser compared to Johnson and Mislin, consider a simple model where the reported trust ($T_{i,c}$) of individual i in country c is a function of the average actual trustworthiness (W_c) of a person in country c and an error term (ϵ_i) associated with the personality of individual i so that $T_{i,c} = f(W_c, \epsilon_i)$. In Glaeser's within country study there is no variation in W_c so the lack of correlation between survey and experimental trust should be interpreted as showing that the error terms ϵ_i for survey and experimental measures of trust are uncorrelated. Johnson and Mislin (and other similar cross-country studies) allow for W_c to vary as well, and hence pick up a correlation between experimental and survey trust measures.

plausible causal pathways for the impact of trust on productivity are linked to what variation in trust across regions and countries can tell us about expected trustworthiness in different places and the impact of this on productivity and capital accumulation.

Literature Review

Review method

To investigate the relationship between trust and productivity a formal survey of the literature was undertaken. This involved a search on the Econlit database and Google Scholar for articles containing the word "trust" and one or more of the terms "income", "growth", or "productivity"[6].

To be included in the review the articles had to include an empirical estimate of the relationship between generalized interpersonal trust and either the rate of economic growth, levels of per capita income, or a measure of productivity.[7] Table 1 provides a summary of the relevant articles identified through the literature survey.[8] There are 20 articles written between 1997 (Knack and Keefer) and 2015 (Pervaiz and Chaudhary) included in the table. This low number reflects the fact that the number of databases containing information on trust has historically been relatively limited (with the World Values Survey carrying much of the weight prior to the mid-2000s).

The table notes the focus of the study – whether this was the rate of economic growth, levels of per capita income, or some measure of productivity – as well as the nature of the dataset used for the study (cross sectional vs panel data), and the approach to identifying causality (if any). The majority of the articles use cross-country datasets to examine the relationship between trust and economic outcomes, but two studies use within country variation in outcomes (Dincer and Uslaener, 2007; Yamamura and Shin, 2010) and another two use regional variation within and across countries (Beugelsdjik and Van Schaik, 2005; Tabellini, 2010).

For each study included the table lists the coefficient from either the model favoured by the author (where this is clear) or the most fully specified model (i.e. the model including the most complete set of controls). As far as possible the coefficients have been standardized so as to make estimates for different studies comparable. One of the strengths, but also one of the main limitations, of the empirical literature on trust and growth is that many stud-

6 Responses were then manually filtered down to only those producing an empirical estimate of the relationship between trust and either income levels, income growth, or productivity. To ensure that the literature search process did not omit anything important, the bibliographies of the articles identified through the manual scanning were in turn searched for additional references.

7 Ideally this should be a variant of the standard question on generalized interpersonal trust, but other measures clearly focusing on the same concept were included.

8 One potentially relevant recent study – Xiong, Westlund, Li, and Pu (2017) – was dropped from the analysis and is not included in Table 1. Although potentially interesting in terms of looking at inter-regional variation in trust and TFP in China, the study measures trust through a synthetic measure weighting trust and voting through principal component analysis and weighting responses by respondent education. The resulting coefficients are difficult to compare with other studies and the education weights appear somewhat arbitrary.

Table 1: Estimates of the Relationship Between Trust, Income, Growth, and Productivity

Authors	Date	Coefficient	Data	Causality
Trust and GDP Growth Rate *Coefficients are impact of a 1 percentage point increase in trusters in the population on the % change in the GDP growth rate.*				
La Porta *et al.*	1996	**0.0207**	Cross-section	
Knack and Keefer	1997	**0.0820**	Cross-section	
		0.0860	Cross-section	IV
Whitely**	2000	**0.5700**	Cross-section	
Zak and Knack	2001	**0.0630**	Cross-section	
		0.0450	Cross-section	
		0.0600	Cross-section	IV
Beugelsdijk, Van Schaik, and de Groot	2004	**0.0610**	Cross-section	
Beugelsdijk & Van Schaik	2005	0.0110	Panel	RE
Ahlerup, Olsson and Yanagizawa	2007	**0.0668**	Cross-section	IV
Berggren *et al.*	2007	**0.0620**	Cross-section	
		0.0320	Cross-section	
Dincer and Uslaener	2007	**0.0530**	Cross-section	
		0.047	Cross-section	IV
Boulila *et al.*	2008	**0.024**	Cross-section	IV
Dearmon and Grier	2009	**0.048**	Panel	IV
Roth	2009	**0.1800**	Panel*	FE
		-0.0030	Panel*	FE
Tabellini	2010	**0.0600**	Cross-section	IV
Horvath	2012	**0.0300**	Cross-section	IV
Bjornskov	2012	**0.0402**	Cross-section	IV
Pervaiz and Chaudhary	2015	0.0044	Panel	FE
Trust and income levels *Coefficients are impact of a 1 percentage point increase in trusters in the population on $US per capita income.*				
Algan and Cahuc	2010	**316.89**	Panel	FE
Trust and labour productivity growth *Coefficients are impact of a change of 1 in the natural logarithm of the proportion of trusters in the population on the % change in labour productivity.*				
Yamamura and Shin	2010	**0.0500**	Panel	FE
Trust and TFP growth *Coefficients are impact of a 1 percentage point increase in trusters in the population on the % change in the TFP growth rate.*				
Bjornskov and Meon	2015	**0.0049**	Cross-section	IV
Knack and Keefer	1997	0.0127	Cross-section	

Note: IV = instrumental variable; FE = fixed effects; RE = random effects. Coefficients in **bold** are significant at p<0.05. Coefficients marked with a * are for the same quadratic equation capturing the effect of trust (0.1800) and trust squared (-0.0030). The coefficient marked ** is on log(trusters) rather than on the percentage of trusters in the country.

ies draw on various iterations of the WVS. This means that many studies face similar constraints in terms of the possible analysis but also means that it is relatively straight forward to produce standardized regression coefficients so that the magnitude of estimated impacts can be compared between studies.

Of the 20 studies included in Table 1 only three focus directly on productivity (Knack and Keefer, 1997; Yamamura and Shin, 2010; Bjornskov and Meon, 2015). Algan and Cahuc (2010) examine the relationship between trust and income levels, while the other sixteen studies estimate the relationship between a 1 percent change in the proportion of people replying "people can usually be trusted" to the WVS generalized trust question or a similar trust measure and the percentage point change in the growth rate of per capita GDP. These latter articles are included here as the effect

of trust on productivity is one of the causal pathways hypothesised for the impact of trust on income levels and growth.

Trust and Growth

Focusing first on estimates of the relationship between trust and growth contained in Table 1, the linear specifications range from 0.0044 (Pervaiz and Chaudhary, 2015) to 0.0860 (Knack and Keefer, 1997). Most of these studies (19 estimates from 14 studies) estimate a linear relationship between the percentage of trusting people in the population and the log of the growth rate. Across these 19 estimates, the mean of the coefficients is 0.0456 implying that a 10 percentage point increase in the percentage of trusting people in the population is associated with approximately half a percentage point increase in the annual output growth rate.

Two studies included in Table 1 model a non-linear relationship between trust and growth. Whitely (2000) estimates the relationship between the logarithm of the proportion of trusting people in the population and the log of per capita income growth. The coefficient here implies a broadly similar order of magnitude for the impact of trust on growth as Zak and Knack (2001) or Tabellini (2010) over the range of trust values observed in the WVS but weights increases in trust more highly in environments with relatively low levels of trust. Roth (2009) finds a parabolic relationship between trust and growth, with growth increasing until the proportion of trusting people in the population reaches 30 per cent and declining thereafter.

Only two of the 22 coefficient estimates (Pervaiz and Chaudhary, 2015; Beugelsdjik and Van Schaik, 2005) are not statistically significant in the author's preferred model. Both Berggren *et al* (2007) and Boulila *et al* (2008) undertake systematic robustness testing using extreme bounds analysis (EBA).[9] Findings are mixed, with both studies finding that the sign of the relationship between trust and growth is robust, but Berggren *et al.*'s finding that the statistical significance is not robust in terms of EBA.

The causality column of Table 1 highlights the approach adopted to identifying causality in each study. Of the 22 coefficients for the relationship between trust and growth, 10 have no formal identification strategy other than controlling for the standard independent variables commonly used in the empirical analysis of growth (typically initial income level, the price of investment goods, and a measure of human capital). Another 9 coefficients are from studies that address issues of causality through the use of an instrumental variable. In all cases the instrument used is a historical or geographic feature of the countries in the study. This approach is credible in the sense that the instruments are exogenous and correlated with trust. However, in all cases they are also certainly

9 Extreme bounds analysis tests the sensitivity of coefficient estimates to changes in model specification by systematically re-estimating the model swapping in a large number of different potential independent variables. A coefficient is deemed to pass a hard test of robustness if its sign and significance remain the same in 99 per cent of regressions and a soft test of robustness if they remain the same in 95 per cent of regressions.

correlated with other features of the country that might influence the growth rate such as institutional characteristics or development pathway. In this sense, the instruments provide solid evidence that it is not growth causing trust, but no evidence that it is trust driving growth as opposed to another country-specific factor that might drive both trust and growth.

Only three of the growth studies featured in Table 1 have an identification strategy that addresses these issues. Both Roth (2009) and Pervaiz and Chaudhary (2015) use country-level panel data on trust containing multiple observations for the same countries over time and are therefore able to produce a fixed effects estimate of the impact of trust on growth, while Beugelsdjik and Van Schaik (2005) use a random effects model. Roth, using multiple waves of the WVS finds a significant but parabolic relationship between trust and growth. Pervaiz and Chaudhary, on the other hand, find no significant relationship, but use a substantially different measure of trust to all other studies considered in Table 1 which may partly explain this result.[10] Beugelsdjik and Van Schaik find no impact of trust on growth across European regions but do find a significant positive impact from active civic engagement. However, they express some scepticism as to the generalizability of their results, noting issues in the measurement of trust.

Of the three studies discussed above using panel data to examine the relationship between trust and growth, Roth (2009) considers the widest range of countries over the longest period of time and uses the best measure of trust. However, even taking this into account, the net weight of evidence from these studies for a causal impact of trust on growth must be considered weak. It is for this reason that the study by Algan and Cahuc (2010) looking at the relationship between trust and per-capita income is important. The vast majority of the studies included in Table 1 make use of data from the WVS, which has only 6 waves in total, with the first wave being 1989. Country coverage between waves is inconsistent, creating significant challenges in building a balanced panel dataset of countries for which it is possible to observe changes in trust alongside changes in incomes, growth, or productivity.

Algan and Cahuc circumvent the limitations of the WVS by leveraging the fact that, at the individual level, trust is partly an inherited characteristic. Trust measures are included in the American General Social Survey (AGSS) as is information on country of origin for the respondent, their parents, and their grandparents as well as the date of migration to the United States for each of the above (if a migrant). This makes it possible to estimate the impact of country of origin (self, parents, grandparents) on the trust of survey respondents. Because the date of migration varies, this

10 Pervaiz and Chaudhary use the Index of Interpersonal Safety and Trust developed by the International Institute of Social Studies at Erasmus University as their measure of trust. This index combines over 40 different items from a wide range of sources and includes measures of risk of crime, perceived safety, and limited trust as well as a few measures of generalized trust. Given that generalized trust is only a relatively small component of the index – and that the theoretical grounds for the other elements of the index to affect growth are relatively weak – it is perhaps unsurprising that no significant relationship is identified.

can be used to create a database of trust values at the country level going back to the start of the 20^{th} century grounded in inherited trust.

Focusing on the period from 1935 and 2000, Algan and Cahuc are able to provide a fixed-effects estimate of the impact of a change in inherited trust over this period on GDP per capita. This sits in the development accounting tradition (impact of factor endowments and TFP on incomes) rather than the growth accounting tradition adopted by most of the other articles in Table 1 (which consider the impact of the rate of change in factor endowments on the rate of change in income). Although this makes a direct comparison of the magnitude of the impact of trust on incomes between Algan and Cahuc and the other articles in Table 1 difficult, Algan and Cahuc do provide strong evidence that the relationship between trust and growth is causal (from trust to growth) and that this relationship is not simply proxying for some other country-specific unobserved variable. It thus lends significant strength to the view that the relationship found in other studies is causal.

Trust and Productivity

Although TFP is certainly a significant pathway for how trust affects incomes in all of the studies listed in Table 1 (as will be discussed in the next section), only three studies actually directly estimate the relationship between trust and productivity. Knack and Keefer (1997) investigate the impact of trust on the growth rate of TFP as part of their broader look at the relationship between trust and growth, while for Bjornskov and Meon (2015) TFP is the primary focus of their investigation. Yamamura and Shin (2010) are an outlier among the studies considered here in that they focus on the impact of trust on labour productivity but are valuable in that the Japanese panel data that they use allow for a relatively strong identification strategy by capturing variation in Japanese regions over time.

Knack and Keefer's original analysis found a low positive coefficient for the impact of trust on TFP growth that was not statistically significant within the (small) sample that formed the basis of their analysis. Bjornskov and Meon essentially extend the analysis of Knack and Keefer to a larger sample of countries by drawing on additional waves of the WVS as well as the Latinobarometer, the Asian barometer, and the Afrobarometer and the Danish Social Capital project. As well as increasing the sample size, the wider range of countries provides a better distribution of high, medium, and low trust countries within the sample.

Within the wider sample Bjornskov and Meon find that trust has a statistically significant positive impact on TFP that is robust to a wide range of different specifications and covariates. The size of the coefficient is, however, relatively small, with a 10 percentage point increase in the share of trusters in the population resulting in a 0.05 percentage point increase in the rate of TFP growth. This is consistent with their estimate that, when looking at income levels rather than growth rates, changes to TFP accounts for roughly a quarter of the impact of trust on income while the impact of trust on factor accumulation ac-

counts for the remaining three quarters of this effect. The only situation under which trust was not significantly correlated with the TFP growth rate was when institutional quality was introduced as a covariate. This is unsurprising given that institutional quality and trust are strongly correlated themselves (OECD, 2017). In fact, institutional quality is certainly one of the main mediating factors for how trust impacts other outcomes, with more trustworthy societies generating higher quality institutions in practice and higher quality institutions in turn, reinforcing generalized trust (Uslaner, 2002, 2008).

Causal Pathways

In discussing the causal pathways whereby trust affects incomes, three broad transmission channels are identified in the literature. These are factor accumulation, innovation, and allocative efficiency. Innovation and allocative efficiency represent channels by which trust will affect TFP. The impact of trust on factor accumulation, however, will affect income levels and rate of growth, and while it may affect labour productivity (via its impact on the capital/labour ratio), will not affect TFP.

Factor accumulation captures the impact of trust on levels of investment in produced and human capital. There are two mechanisms at work here. First, high trust societies are associated with better performing institutions. This is because high measured trust implies high average trustworthiness within a society. Strong institutions – particularly strong property rights – in turn create incentives for investment in productive assets (Whitely, 2000; Roth, 2009; Horvath 2012). Investment is inherently an expression of confidence in future states of the world, and the expected rate of return on investment is higher where there is higher confidence that the assets or the income stream resulting from them are not at significant risk of future expropriation. A similar logic applies to investments in human capital. If the risk of nepotism or favouritism in job allocation is seen as low, then the expected rate of return on investment in human capital is higher.

Trust also reduces transaction costs and this too affects investment levels. Roth (2009) notes that high levels of trust facilitate the provision of public goods by reducing the need to expend resources on enforcing compliance. This, in turn, potentially frees up resources for productive investment as well as increasing the range of investment opportunities as some public goods that would be too costly to produce in a low trust setting become viable at higher levels of trust.

A number of the key empirical articles on trust, growth, and productivity explicitly test the importance of factor accumulation on the trust/growth relationship. Knack and Keefer (1997) find that trust is related to measures of capital per worker and human capital, while Dearmon and Grier (2009) find that approximately three quarters of the impact of trust on growth flows through factor accumulation. Bjornskov (2012) finds large effects of trust on human capital, accounting for two thirds of the relationship between trust and growth.

While trust undoubtedly affects incomes through factor accumulation, there are a number of reasons why trust might improve allocative efficiency. Dearmon and

Grier (2009) make the case that higher trust implies fewer resources devoted to protecting property rights and monitoring people in a principal/agent context. This frees up these resources for more productive uses. They also emphasise the role of trust in building better institutions and the flow-on effects of this on allocative efficiency. Stronger institutions and less rent-seeking behaviour allow for less intrusive regulations and therefore fewer resources allocated to monitoring and enforcement. Several authors (Whitely, 2000; Dearmon and Grier, 2011; Horvath, 2012) note that stronger institutions and more secure property rights affects not just the incentive to invest, but also the time horizon for investments. Where there is a low level of confidence in the security of assets and income streams into the future, not only will there be less investment, but investment will also be skewed towards projects with a shorter time horizon.

Another important impact of trust on allocative efficiency occurs through its effect on trade. Here trust again likely acts through reducing transaction costs. International trade always involves an element of trust in that it is likely to require establishing a relationship with business partners potentially operating under a different legal regime. Trade with a high trust country with strong institutions requires less investment in monitoring principal/agent issues and implies a lower risk of expropriation of assets. Butter and Mosch (2003) estimate a gravity trade model using data from Eurobarometer on informal trust to show that a one standard deviation increase in trust is associated with an increase in bilateral trade of between 90 per cent and 150 per cent. In this sense trust can be thought of as reducing the effective distance between different countries for the purposes of trade.

Trust is also believed to affect the rate of innovation. There are two key reasons for this. The first of these is that innovation is partly a function of research, and research is subject to principal/agent problems. In particular, it is difficult and costly for the party commissioning research to observe the quality of the research being undertaken and the effort put in by researchers. In low trust environments this may lead to less investment in research and therefore less innovation (Naastepad and Storm, 2006). Greater trust within firms may also lead to greater continuity of employment and accumulation of 'tacit' knowledge (Kleinknecht, van Schaik, and Zhou, 2014).

The second transmission mechanism from trust to innovation is grounded in the observation that weak ties are important to innovation (Rauch 1993; Dearmon and Grier, 2009). It is through casual interactions with people who may not know each other well or have an ongoing relationship that information diffuses through society. Diffusion of this sort is thought to create opportunities to innovate by applying existing ideas in new contexts. Trust facilitates these sorts of interaction (weak ties). In fact, the standard measure of generalized interpersonal trust (discussed at the start of the first section) is essentially framed in terms of the respondent's level of confidence in weak ties. There are thus strong theoretical grounds for expecting trust to increase information flows and innovation.

Data and Method

The literature reviewed in the previous section is relatively limited from the perspective of understanding the relationship between trust and TFP in that most of it draws from the WVS which contains relatively few country/year observations. As a result, most of the studies are purely cross-sectional and those that are not are forced to draw together trust measures from a range of different sources (e.g. Bjornskov and Meon). In addition, most of the literature focuses on the trust/growth relationship rather than the trust/TFP relationship. In the last decade, however, additional datasets have become available containing high-quality information on trust.

The empirical section of this article makes use of the European Social Survey (ESS), a two-yearly survey of attitudes, values, and beliefs run across 32 countries in Europe since 2002. Using the ESS cumulative dataset gives information on 8 waves of the survey covering 2002 to 2016 and 374,729 responses. For the purposes of examining productivity this was aggregated to produce a cross-country panel dataset containing the proportion of the population with a value on the ESS generalized trust question of 5 or more out of 10 for each ESS wave.[11] Information on TFP was obtained from the Penn World Tables (Feenstra, Inklaar, and Timmer, 2015), covering the same period. The measure used, CTFP, captures the level of TFP relative to the United States with a value of 1.00. As will be outlined below, this is sufficient to model the relationship between trust and TFP.

There are two potential limitations of the ESS data that potentially impact using the data for any analysis of the relationship between trust and TFP. The first of these is that it consists of a sample of European countries. There might therefore be reason for concern that the dataset contains only a narrow range of different cultural models and little diversity in trust. The second potential issue with the ESS data is simply that the time period for the dataset covers only 16 years. Given that trust is likely to evolve relatively slowly over time, this raises the issue as to whether the ESS dataset contains enough meaningful variation in trust within countries relative to noise in the dataset to reach strong conclusions.

Table 2 reports the average level of trust for each ESS country for the first and the most recent waves in which each country participated as well as the difference between these two waves.[12] The Table also presents each country's TFP from the Penn World tables for the same year as the most recent trust observation. It can be observed that the ESS contains a highly diverse set of countries and captures important changes in trust over the period covered. In addition to Western Europe, it

11 This gives a similar proportion of the population in the high-trust group to the "most people can be trusted" response to the widely used WVS question.

12 Data from the New Zealand General Social Survey (NZGSS) is also included for descriptive purposes and in the counterfactual as the NZGSS trust question is comparable to that in the ESS. New Zealand is not included in the causal model as the earliest trust data for the NZGSS dates to 2014.

Table 2: Trust and TFP Data

Country	Trusters in population 2000* (%)	Trusters in population 2016** (%)	TFP level 2016*** (US = 1.00)	Change in trusters (percentage points)
Austria	64	68	0.82	4
Belgium	60	68	0.90	8
Bulgaria	34	34	0.70	0
Cyprus	49	39	0.76	-10
Czech Republic	50	62	0.57	11
Denmark	89	87	0.88	-3
Estonia	69	77	0.60	9
Finland	85	87	0.84	2
France	56	57	0.98	2
Germany	57	67	0.97	10
Greece	37	45	0.64	8
Hungary	51	55	0.55	4
Iceland	82	82	0.90	0
Ireland	70	75	1.10	5
Israel	63	72	0.78	8
Italy	59	58	0.76	-1
Lithuania	72	65	0.71	-7
Luxembourg	71	65	0.79	-6
Netherlands	77	81	0.94	3
New Zealand	-	92	0.87	-
Norway	87	89	0.98	2
Poland	41	50	0.87	9
Portugal	47	53	0.61	6
Russia	45	53	0.51	8
Slovakia	51	45	0.67	-5
Slovenia	47	55	0.60	8
Spain	62	65	0.85	3
Sweden	83	80	0.80	-3
Switzerland	72	78	0.95	6
Turkey	33	22	1.07	-12
Ukraine	52	53	0.45	0
United Kingdom	82	73	0.79	-10

Note: * 2000 or first available observation: 2004 for Estonia, Iceland, Slovakia, Turkey, Ukraine; 2006 for Bulgaria, Cyprus, Russia; 2010 for Lithuania. ** 2016 or most recent observation: 2004 for Luxembourg; 2008 for Turkey; 2010 for Greece; 2012 for Bulgaria, Cyprus, Slovakia, Ukraine; 2014 for Denmark. *** Reports the same year as the most recent trust observation. All data is from the ESS except for New Zealand which is based on the New Zealand General Social Survey. TFP data is taken from https://www.rug.nl/ggdc/productivity/pwt/. The inclusion of Turkey, which has an anomalously high value, has no significant impact on analysis on the results reported elsewhere in the article.

contains data on a wide range of Eastern European countries with different political traditions as well as Cyprus, Turkey, and Israel. A wide range of trust levels are evident in the dataset. In 2000, the lowest level of trust was found in Turkey (33 percent) while the highest level is Denmark (89 percent). In 2016, the most recent year in which data are available, Turkey remains at the lowest at 22 percent but the highest level of trust was reported in Norway at 89 percent. Over the 2000 to 2016 period the net change in trust ranges from a 12 percentage point fall in the share of the population who are trusters in Turkey to an 11 point increase in the Czech Republic. To gain a perspective on aggregate trends in trust between 2000 and 2016 it could be noted that 19 countries out of 30 experienced an increase in the share of the population that are trusters, with 9 countries experiencing a decline and two unchanged.

The Relationship Between Trust and Productivity

Although most modern analyses of the drivers of productivity are grounded in

the framework of an endogenous growth model (Romer, 1994), TFP is typically estimated empirically using a simpler framework based ultimately on the Solow-Swan growth model (Solow, 1956; Swan, 1956). In a Solow-Swan framework TFP is calculated as a residual based on the difference between the rate of growth of real GDP per capita and growth in the capital to labour ratio. This being the case, any factors impacting on the growth of GDP per capita not captured in the elements of growth in the capital to labour ratio (essentially the rate of growth of the capital stock and of the labour supply) will end up reflected in the estimate of TFP. Hence, if trust functions as a factor of production, we would expect to see it reflected in TFP.

The article uses a basic development accounting framework to examine the impact of trust on TFP. Equation 1 sets out a basic Cobb-Douglas production function for a country:

$$Y = AK^{\alpha}L^{\beta} \quad (1)$$

where K is the capital stock per worker, L is the mean human capital per worker, Y is output per capita, and A is total factor productivity.

Using the log rule we can convert this to a linear equation:

$$\ln(Y) = \ln(A) + \alpha\ln(K) + \beta\ln(L) \quad (2)$$

We can empirically estimate the model if we have the appropriate data with country (η) and year (θ) fixed effects.

$$\ln(Y) = \eta + \theta + \alpha\ln(K) + \beta\ln(L) + \epsilon \quad (3)$$

A comparison of equations (2) and (3) shows that TFP is the residual in equation (3), giving us the identity (4) below.

$$\ln(A) = \ln(Y) - \eta - \theta - \alpha\ln(K) - \beta\ln(L) \quad (4)$$

If we wish to incorporate social capital into this model as an important factor of production we can adapt equation 1 as follows:

$$Y = \hat{A}K^{\alpha}L^{\beta}S^{\gamma} \quad (5)$$

where S is social capital and $\hat{A}$ is TFP after adjusting for the impact of trust. Note that social capital in the sense in which it is used here is assumed to be a non-rival good, so per capita social capital is equivalent to total social capital. We can re-write equation (5) in log-linear terms (6):

$$\ln(Y) = \ln(\hat{A}) + \alpha\ln(K) + \beta\ln(L) + \gamma\ln(S) \quad (6)$$

To estimate equation (6) in practice with fixed effects we obtain (7) below:

$$\ln(Y) = \eta + \theta + \ln(\hat{A}) + \alpha\ln(K) + \beta\ln(L) + \gamma\ln(S) \quad (7)$$

which can be re-arranged to give us an identity for $\hat{A}$ (8).

$$\ln\left(\hat{A}\right) = \ln(Y) - \eta - \theta - \alpha\ln(K) - \beta\ln(L) - \gamma\ln(S) \quad (8)$$

A comparison of equations 4 and 8 shows that $\ln(Y) - \eta - \theta - \alpha\ln(K) - \beta\ln(L)$ is equivalent to ln(A), which allows us to re-write equation 4 as follows:

$$\ln(A\ ) = \ln\left(\hat{A}\right) + \gamma\ln(S) \quad (9)$$

Although this manipulation of the basic derivation of TFP is straightforward, it highlights two important facts. First, it provides an empirical definition for underlying TFP ($\hat{A}$), defined as TFP where social capital *is treated as a capital stock* (i.e. as a factor of production). In this case $\hat{A}$ can be calculated from the residual of regressing ln(S) on ln(A). This is of some intellectual interest given that the economic models underlying the standard approach to measuring sustainability (e.g. OECD, 2013, 2015; New Zealand Treasury, 2018) implicitly treat social capital as a factor of production.

The second important point is that, if we assume that social capital (of which trust is the best available measure) functions as an important factor of production, then the impact of trust will be reflected empirically in estimates of TFP. One implication of this is that the bivariate relationship between trust and TFP ought to be stronger than the bivariate relationship between trust and GDP.[13] This, as it turns out, is exactly what we see in the empirical data (Algan and Cahuc, 2013).

Estimating equation 9 empirically is relatively straightforward with the aggregate ESS dataset described above. Note that, unlike most of the literature described in section 2, the ESS dataset contains multiple country/year observations so it is possible to adopt a fixed effects specification for the model. In addition, because all of the observations come from the same dataset it is possible to have a high degree of confidence that the results are not influenced by survey effects. This provides a stronger causal attribution than is possible in much of the existing literature.

Only one key decision needs to be made in estimating the model, which is the nature of the functional relationship between trust and social capital. If the relationship is linear then we should estimate $\ln(A\ ) = \gamma\ln(T) + \ \epsilon$, where T is trust. However, it is also possible that the relationship is non-linear such that T $\approx$ ln(S). In this case we would estimate $\ln(A\ ) = \gamma T + \ \varepsilon$. The latter approach appears to be more common as it is the implicit assumption in most of the studies considered in section 3.

Results

Table 3 below presents the results of a series of estimates of equation 9 above with different assumptions about the functional relationship between trust and social capital. Column 1 reports the results of a simple linear regression of the proportion of trusters in the population on TFP.[14] As is expected from theory and prior literature the bivariate relationship is strong and positive. Column 2 adds in country and year

13 To see why this is so consider that changes in real GDP will be a function of changes in the capital to labour ratio, changes in underlying or "actual" TFP (possibly thought of as technological change) and changes in trust. However, changes in measured TFP will be a function only of changes in underlying or "actual" TFP and changes in trust thus removing a major source of noise in the relationship.

14 In the literature drawing on the WVS, a truster is a person replying "people can usually be trusted" in the dichotomous WVS question. As the ESS uses a 0-10 response scale for generalized trust, a truster is defined here as a person with a score of 5 or higher on the ESS generalized trust question.

fixed effects. Once these are added the significance of the relationship drops to the $p<0.05$ level and the magnitude of the coefficient roughly halves. This is unsurprising as, in the absence of fixed effects, trust will be capturing any country-specific factor associated with trust in the cross-section.

Column 3 on Table 3 repeats column 2 but with a one-year lag to TFP (i.e. trust at time t is regressed on TFP at time $t+1$). This provides stronger assurance that any causal effect goes from trust to TFP rather than vice versa. However, introducing the lag in column 3 has little material impact on the coefficient size or significance.

Columns 4 to 6 in Table 3 move from examining the general relationship between trust and TFP to an estimate that can be interpreted in terms of model 9 of the preceding section. In particular, these three estimates follow the wider academic literature and assume that that $T \approx \ln(S)$. The cross-sectional result (4) are largely similar to those obtained from looking simply at trust and TFP, albeit with a slightly larger coefficient. Moving to a fixed effects specification (column 5), we find that the coefficient remains very similar to that in column 2, but the significance drops slightly to just above than the 0.05 level ($p=0.075$). Using lagged TFP makes no real difference to the size or significance of the coefficient.

The coefficient for trust in column 5 is most closely comparable to the equivalent estimate reported by Bjornskov and Meon (2015) in Table 1. The Bjornskov and Meon estimate produces a larger coefficient at 0.00468 than that reported in Table 3 (0.00281), although the two estimates are of the same order of magnitude. This raises the question as to which is the better estimate? Bjornskov and Meon's underlying data covers a wider range of countries including countries at widely differing stages of economic development. By contrast, the ESS dataset has a narrower range of countries, all of which are European or closely associated. However, the ESS dataset has considerably more country/year observations and uses a consistent survey instrument to measure trust across all of them. The larger size of the dataset has the advantage that the estimates in Table 3 include both country and year fixed effects, while Bjornskov and Meon only incorporate country fixed effects. However, the Bjornskov and Meon result is stronger in terms of statistical significance ($p<0.01$ compared to $p<0.1$), suggesting that their result should probably take precedence over the ESS result.

Column 7 of Table 3 reports the results of a regression that assumes $\ln(T) \approx \ln(S)$. This is perhaps the most straightforward interpretation of equation 9 in the method section but is not widely favoured in the academic literature. In practice, however, the functional form makes relatively little difference. The coefficient from column 7 implies a relatively smaller impact from trust on TFP compared to column 5, but this effect is not large.

Counterfactual

While the estimates reported in Table 3 provide support for the view that trust is a significant component of measured TFP, they do not communicate well whether this effect really matters. One way to explore this is to consider a simple counterfactual example comparing the situation of coun-

Table 3: ESS Trust and TFP Regression Results

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent var	TFP	TFP	lag TFP	ln(TFP)	ln(TFP)	lag ln(TFP)	ln(TFP)
Trusters (%)	0.00621***	0.00279*	0.00266*	0.00782***	0.00281∧	0.00254∧	-
SE	0.000838	0.00133	0.00129	0.00108	0.00157	0.00149	-
ln(trusters)	-	-	-	-	-	-	0.144∧
SE	-	-	-	-	-	-	0.084
Country/Year FE	No	Yes	Yes	No	Yes	Yes	Yes
Observations	193	193	193	193	193	193	193
Adjusted R^2	0.220	0.919	0.921	0.213	0.932	0.934	0.932

Note: *** p<0.001, ** p<0.01, * p<0.05, ∧ p<0.1

tries with different levels of trust. Panel A in Chart 1 below shows TFP figures for selected countries in 2016.[15] This sees New Zealand with a TFP level, relative to 1.00 in the United States, of 0.87, slightly above the average value in the sample of 0.79. By contrast, New Zealand has the highest measured trust in the sample, with 91.5 per cent of the population reporting a score of 5 or greater on the standard trust question compared to an average of 64.0 per cent (for the unweighted mean of countries in the ESS data). Spain, by way of contrast, has a similar TFP level of 0.85, but a much lower level of generalized trust (65.0 per cent).

Panel B in Chart 1 below recalculates the TFP for each country in the sample as if they all shared the sample average level of trust. In recalculating TFP for Panel B, each country's actual TFP is adjusted using the coefficient from column 7 in Table 2. This is the log/log coefficient which generally gives the smallest effect size. Even with this coefficient, however, it can be seen that there are changes in both TFP levels and country rankings. New Zealand's TFP drops by 0.04 from 0.87 to 0.83, and its ranking drops from 11th to 14th out of 31 countries. Spain's TFP is almost unchanged, and it moves from two places below New Zealand to 2 places above New Zealand.

Panel C illustrates the results of a similar counterfactual to Panel B but using the coefficient from column 5 of Table 2 rather than column 7. This gives a generally larger impact from trust on TFP with the level of New Zealand's TFP dropping by 0.065 to 0.81 Using the coefficient from Bjornskov and Meon the results (not shown) shift New Zealand down another three places to 17th of 31 countries and drop TFP to 0.76 while Spain moves up another place in the rankings.

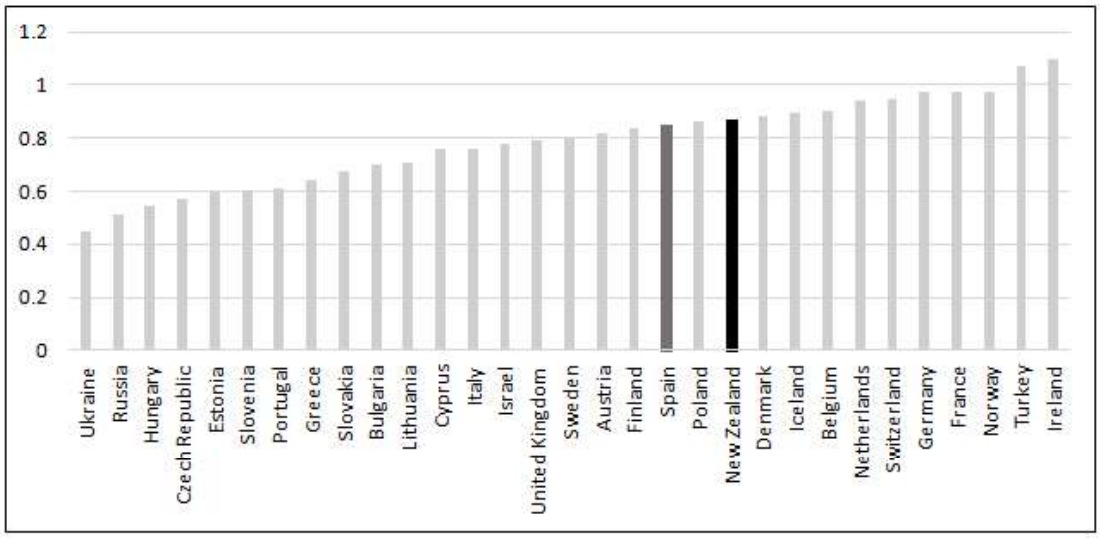
Discussion

The relationship between trust and income growth is robust across studies and it is possible to sketch the main points to emerge from a review of the literature relatively easily. First, estimates of the size of the effect are relatively consistent with a mean effect size of 0.0456. This implies that a 10 percentage point increase

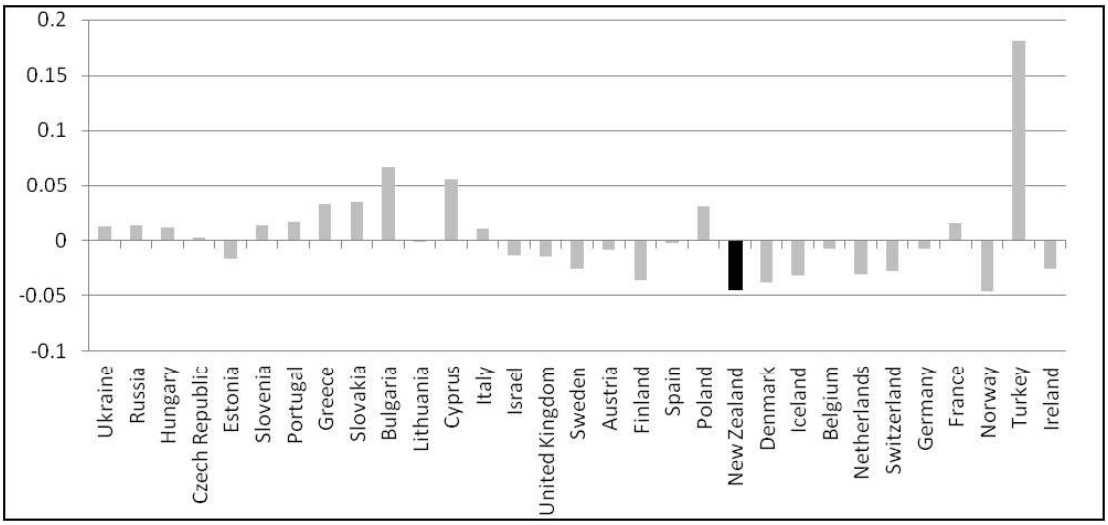
15 All ESS countries with a trust measure more recent than 2006 plus New Zealand which has broadly comparable data for 2014 and 2016.

Chart 1: The Impact of Trust on TFP Levels by Country, 2016 or nearest available year, United States = 1.00

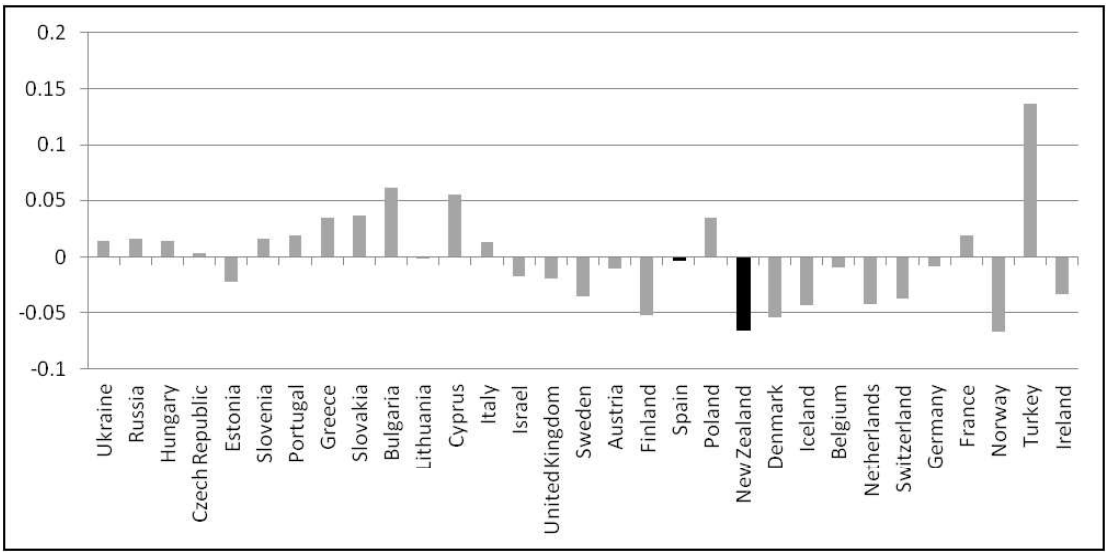
Panel A: TFP by Country



Panel B: Change in TFP by Country after Controlling for Differences in Trust (log on log)



Panel C: Change in TFP by Country after Controlling for Differences in Trust (linear on log)



Source: Penn World Tables. Reference TFP = USA, 2016.

in trusters in the population is associated with an increase in the growth rate of per capita GDP of just under half a percentage point. It is clear that the association between trust and growth does not derive from growth causing trust. The use of instrumental variable approaches as an identification strategy provide convincing evidence of this. However, the nature of the instruments used makes it impossible to eliminate the possibility that it is some other characteristic that varies at the country level which drives both growth and trust.

Data limitations mean that the number of studies able to address issues of causality with greater rigour are rare. Of the four studies included in this review that are able to meet a higher standard of causality, two find no effect (Beugelsdijk and Van Schaik, 2005; Pervaiz and Chaudhary, 2015), one finds a significant parabolic relationship between trust and growth (Roth, 2009) and one finds a strong positive effect (Algan and Cahuc, 2010). As the article with the strongest identification strategy is the article finding the strongest effect, the balance of evidence should be taken as a weak presumption in favour of a causal relationship from trust leading to growth. This view is supported by the analysis of ESS data reported in this article.

All estimates of the relationship between trust and productivity suggest that the direct effect of trust on TFP accounts for only a proportion of the relationship between trust and income growth. About one quarter to one third of the effect of trust on growth goes via TFP while the rest of the impact is via the impact of trust on capital accumulation (human capital or investment in produced capital).

The empirical analysis from the ESS largely supports the earlier Bjornskov and Meon (2009) estimate of the impact of trust on TFP. Although the ESS results are only marginally significant, they are relatively close to Bjornskov and Meon in absolute magnitude (albeit a little smaller). Both the small size of the coefficient and the marginal significance are likely to be associated with the shorter time period and less diverse range of countries covered by the ESS given that generalized trust is a subjective measure and therefore relatively noisy in the short term, while meaningful change is likely to occur only gradually. A counter-factual analysis of the impact of trust on TFP suggests that the impact is meaningful in real terms. A fall in trust of nearly a third (from 91.5 per cent to 64.0 per cent) results in a fall in TFP that is between nearly 8% (ESS) and 14% (Bjornskov and Meon).

Taking these observations into account, there are three issues that are worth highlighting. First, generalized trust potentially matters for public policy in that the impact of trust on economic outcomes is non-trivial. The effect is also asymmetric across countries with different trust endowments. Rothstein and Uslaner (2005) highlight the circular nature of the relationship between trust and institutional quality, with high institutional quality a major determinant of interpersonal trust, and high levels of trust required for the effective functioning of institutions. This suggests that shocks to institutional quality or simply poor performance of institutions might potentially trigger a fall in trust. Although an in-depth analysis of this is beyond the

scope of this article, it is worth noting that Ireland and the United Kingdom both saw a marked fall in trust in the ESS dataset following the 2008 recession, while a similar fall is not evident in Denmark or Germany.[16]

The second issue to emerge from the literature review is the weakness of the trust literature at the micro-economic level. While the WVS-based literature along with the work of Algan and Cahuc paints a convincing picture linking trust and economic outcomes at the macro-economic level, there is much less empirical work at the micro-level. Yamamura and Shin (2010) aside, all the studies considered here focus their empirical tests on the net impact of trust at the aggregate level and leave the precise causal pathways to the realm of theory. Ideally it would be good to investigate the impact of trust at the firm and individual level to test the specific causal pathways identified in the literature. Do firms in higher trust environments invest more and for the longer term? Do individuals with higher trust make greater investments in human capital? Can we provide firm-level evidence for the link between weak ties and innovation?

Perhaps the main reason for the lack of empirical micro-economic studies on the impact of trust has been lack of data. The WVS normally has a sample size of about 1,000 individuals per country and lacks any ability to connect trust data to firms or small geographic areas. However, data that could support more detailed analysis is increasingly available with the integration of administrative data on firms and individuals with survey data containing trust measures into integrated research datasets in a number of OECD countries (e.g. Denmark, New Zealand). This offers the ability for a much more nuanced analysis of the relationship between trust and economic outcomes than has been possible in the past and has the potential to shed light on causal pathways at the level of the individual and firm.

Finally, it is worth commenting further on the relative size of the coefficients for trust on growth and on TFP. The larger coefficients on capital accumulation relative to TFP might seem to suggest that it is capital accumulation that is the most important causal pathway for trust on growth (Zak and Knack, 2001). While this is consistent with evidence that capital intensity does account for a large part of variation in labour productivity across countries, the long-term impact of even a moderate impact of trust on TFP is still potentially significant. This observation was the main point of the Swan-Solow growth model (Solow, 1956, Swan, 1956) and, to the extent that this observation is true empirically, then it is the impact on the rate of innovation and therefore TFP growth that is the most significant effect of trust.

Conclusion

Trust certainly matters. Even if one takes a sceptical view of the evidence for

16 Unfortunately a number of the European countries most severely impacted by the 2008 recession such as Greece and Italy simply dropped out of the ESS for the waves after 2008 (Italy) and 2010 (Greece).

causality from trust to growth and productivity, it remains the case that there is a robust association between trust and economic outcomes indicating that trust can be viewed as a proxy measure for whatever it is that does cause growth. It is also the case that levels of generalized trust can change over time. Algan and Cahuc document significant changes in trust over the course of the 20th century across a range of different countries. Using more recent data this is still apparent, with meaningful changes in trust observable in both the WVS and ESS.

This article brings together the available empirical evidence on the size of the relationship between trust, growth, and TFP, and explores the evidence for this relationship being causal. The size of the effect of trust on both growth and TFP is shown to be non-trivial. Although more of the impact of trust on growth goes via capital accumulation rather through productivity, the latter effect remains empirically important. Evidence for causality on the impact of trust is weaker due to data limitations, but the balance of the evidence tilts towards a causal impact.

The empirical analysis in this article strengthens the finding from Bjornskov and Meon that trust is an important component of measured TFP and illustrates the potential magnitude of this impact. The fact that models based on data from the ESS and WVS produce basically similar results despite covering different country samples, time periods, and even trust questions supports the view that the underlying relationship is robust. More generally, the relationship between trust and TFP implied by these results is consistent with the treatment of social capital as a factor of production in the capital stocks model of intergenerational well-being (OECD 2013, 2015).

The existence of trust data in official statistics opens the possibility for studies that directly test some of the causal pathways by which trust is thought to impact on growth and productivity. Regional, firm level, and individual variation in trust could be linked to information on firm level investments in produced capital and in research, as well as to individual variations in human capital accumulation. Such data is also important because it offers the ability to examine the microeconomics of what drives trust. For example, Putnam (1993) theorized that civic engagement builds trust, but there has been limited empirical testing of this hypothesis.

Finally, there is a need for work at the policy level to understand if and how national policy decisions affect social capital. While approaches such as the New Zealand Treasury's Living Standards Framework (New Zealand Treasury, 2018) identify social capital as an asset to be managed, they provide little in the way of guidance on a work programme or what management of social capital means in practice. The results of this article and the wider literature both suggest that the inclusion of social capital as an important asset to be managed is fundamentally correct, and that there are significant risks to not understanding how the dynamics and drivers of trust interact with policy settings. Addressing this should be an important area for economic management agencies.

References

Ahlerup, P., O. Olsson, and D. Yanagizawa (2009) "Social Capital vs Institutions in the Growth Process," *European Journal of Political Economy*, Vol. 25, No. 1, pp. 1-14.

Algan, Y. and P. Cahuc (2010) "Inherited Trust and Growth," *American Economic Review,* Vol. 100, No. 5, pp. 2060-2092.

Algan, Y. and P. Cahuc (2013) "Trust, Growth and Well-being: New Evidence and Policy Implications," IZA Discussion Paper, No. 7464.

Arrow, K. (1972) "Gifts and Exchanges," *Philosophy & Public Affairs,* Vol. 1, No. 4, pp. 343-362.

Arrow, K. J., P. Dasgupta, L. H. Goulder, K. J. Mumford and K. Olsen (2012) "Sustainability and the Measurement of Wealth," *Environment and Development Economic,* Vol. 17, pp. 317-353.

Berg, J., J. Dickhaut and K. McCabe (1995) "Trust, Reciprocity, and Social History," *Games and Economic Behavior,* Vol. 10, pp. 122-142.

Berggren, N., M. Elinder and H. Jordahl (2008) "Trust and Growth: A Shaky Relationship," *Empirical Economics*, Vol. 35, No. 2, pp. 251-274.

Beugelsdijk, S. and T. Van Schaik (2005) "Social Capital and Growth in European Regions: An Empirical Test," *European Journal of Political Economy*, Vol. 21, No. 2, pp. 301-324.

Beugelsdijk, S., H. L. De Groot and A. B. Van Schaik (2004) "Trust and Economic Growth: A Robustness Analysis," *Oxford Economic Papers*, Vol. 56, No. 1, pp. 118-134.

Bjørnskov, C. (2012) "How Does Social Trust Affect Economic Growth?," *Southern Economic Journal*, Vol. 78, No. 4, pp. 1346-1368.

Bjørnskov, C. and P. G. Méon (2015) "The Productivity of Trust," *World Development*, Vol. 70, pp. 317-331.

Boulila, G., L. Bousrih and M. Trabelsi (2008) "Social Capital and Economic Growth: Empirical Investigations on the Transmission Channels," *International Economic Journal*, Vol. 22, No. 3, pp. 399-417.

Butter, Frank A. G. and Robert H. J. Mosch (2003) "Trade, Trust and Transaction Cost," Tinbergen Institute Discussion Paper, No. 03-082/3, Tinbergen Institute, Amsterdam and Rotterdam.

Capra, C. M., K. Lanier and S. Meer (2007) "Attitudinal and Behavioral Measures of Trust: A New Comparison," Working paper, Department of Economics, Emory University, Atlanta.

Carlin, R., G. Love and C. Smith (2017) "Measures of Interpersonal Trust: Evidence on Their Cross-National Validity and Reliability Based on Surveys and Experimental Data," OECD Statistics Working Papers, No. 2017/10, OECD Publishing, Paris, https://doi.org/10.1787/333c8ed0-en.

Cox, J. (2004) "How to Identify Trust and Reciprocity," *Games and Economic Behaviour,* Vol. 46, No. 2, pp. 260-281.

Dearmon, J. and K. Grier (2009) "Trust and Development," *Journal of Economic Behavior & Organization*, Vol. 71, No. 2, pp. 210-220.

Delhey, J., K. Newton and C. Welzel (2011) "How General is Trust in 'Most People'? Solving the Radius of Trust Problem," *American Sociological Review,* Vol. 76, No. 5, pp. 786-807.

Dincer, O. C. and E. M. Uslaner (2010) "Trust and Growth," *Public Choice*, Vol. 142, No. 59.

Evensky, J. (2011) "Adam Smith's Essentials: On Trust, Faith, and Free Markets," *Journal of the History of Economic Thought*, Vol. 33, No. 2, pp. 249-267.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015) "The Next Generation of the Penn World Table," *American Economic Review*, Vol. 105, No. 10, pp. 3150-3182, Available for download at www.ggdc.net/pwt.

Fehr, E. (2009) "On the Economics and Biology of Trust," *Journal of the European Economic Association*, Vol. 7, No. 2-3, pp. 235-266.

Felte, E. (2001) "Finders Keepers," *Reader's Digest*, April.

Fukuyama, F. (1995) "Trust: The Social Virtues and the Creation of Prosperity," Hamish Hamilton, London.

Gachter, S., B. Herrmann and C. Thoni (2004) "Trust, Voluntary Cooperation, and Socioeconomic Background: Survey and Experimental Evidence," *Journal of Economic Behavior & Organization*, Vol. 55, No. 4, pp. 505-531.

Glaeser, E., D. Laibson, J. Scheinkman and C. Soutter (2000) "Measuring Trust," *Quarterly Journal of Economics,* Vol. 115, No. 3, pp. 811-846.

González, S. and C. Smith (2017) "The Accuracy of Measures of Institutional Trust in Household Surveys: Evidence From the OECD Trust Database," OECD Statistics Working Papers, OECD Publishing, Paris, https://doi.org/10.1787/d839bd50-en.

Hamilton, K. and G. Liu (2013) "Human Capital, Tangible Wealth, and the Intangible Capital Residual,"OECD Statistics Working Papers, OECD Publishing, Paris, DOI: http://dx.doi.org/10.1787/5k4840h633f7-en.

Helliwell, J. and S. Wang (2010) "Trust and Well-being," NBER Working paper, No. 15911.

Horváth, R. (2013) "Does Trust Promote Growth?", *Journal of Comparative Economics*, Vol. 41, No. 3, pp. 777-788.

Johnson, N. and A. Mislin (2011) "Trust Games: A Meta-Analysis," *Journal of Economic Psychology,* Vol. 32, No. 5, pp. 865-889.

Johnson, N. and A. Mislin (2012) "How Much Should We Trust the WVS Trust Question?", *Economics Letters*, Vol. 116, No. 2, pp. 210-212.

Kleinknecht, A., F. van Schaik and H. Zhou (2014) "Is Flexible Labour Good for Innovation? Evidence From Firm-level Data," *Cambridge Journal of Economics*, Vol. 38, No. 5, pp. 1207-1219.

Knack, S. (2001) "Trust, Associational Life, and Economic Performance," MPRA Paper, No. 27247, University of Munich.

Knack, S. and P. Keefer (1997) "Does Social Capital Have an Economic Payoff? A Cross-country Investigation," *Quarterly Journal of Economics*, Vol 112, No. 4, pp. 1251-88.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. W. Vishny (1996) "Trust in Large Organisations," *American Economic Review, Papers and Proceedings*, Vol. 87, pp. 333-338.

Lazzarini, S., R. Madalozzo, R. Artes and J. de Oliveira Siqueria (2004) "Measuring Trust: An Experiment in Brazil," Insper Working Paper, No. 049/2004.

Naef, M. and J. Schupp (2009) "Measuring Trust: Experiments and Surveys in Contrast and Combination," IZA Discussion Paper, No. 4087.

Naastepad, C. and S. Storm (2006) "The Innovating Firm in a Societal Context: Labour-management Relations and Labour Productivity," in Verburg, R., J. Ott, and W. Dicke (eds), *Managing Technology and Innovation*, London, Routledge.

New Zealand Treasury (2018) "Living Standards Framework: Introducing the Dashboard," The Treasury, Wellington.

OECD (2001) "The Well-being of Nations," OECD Publishing, Paris, DOI: http://dx.doi.org/10.1787/9789264189515-en.

OECD (2013) "How's Life? 2013: Measuring Well-being," OECD Publishing, Paris, DOI: http://dx.doi.org/10.1787/9789264201392-en.

OECD (2015) "How's Life? 2015: Measuring Well-being," OECD Publishing, Paris, DOI: http://dx.doi.org/10.1787/how_life-2015-en.

OECD (2017) "OECD Guidelines on Measuring Trust," OECD Publishing, Paris, https://doi.org/10.1787/9789264278219-en

Pervaiz, Z. and A. R. Chaudhary (2015) "Does Trust Matter for Economic Growth and Human Development? Empirical Evidence from a Panel of Countries," *Pakistan Journal of Commerce and Social Sciences*, Vol. 9, pp. 916-927.

Putnam, R. (1993) "Making Democracy Work: Civic Traditions in Modern Italy," Princeton University Press, New Jersey.

Rauch, James E. (1993)"Productivity Gains from Geographic Concentration of Human Capital: Evidence from the Cities," *Journal of Urban Economics*, Vol. 34, pp. 3-33

Romer, P. M. (1994) "The Origins of Endogenous Growth," *Journal of Economic Perspectives*, Vol. 8, No. 1, pp. 3-22.

Roth, F. (2009) "Does Too Much Trust Hamper Economic Growth?", *Kyklos*, Vol. 62, No. 1, pp. 103-128.

Rothstein, B. and E. Uslaner (2005) "All For All: Equality, Corruption and Social Trust," *World Politics*, Vol. 58, No. 1, pp. 41-72.

Scrivens, K. and C. Smith (2013) "Four Interpretations of Social Capital: An Agenda for Measurement," OECD Statistics Working Paper, OECD Publishing, Paris, DOI: http://dx.doi.org/10.1787/5jzbcx010wmt-en.

Shanahan, E. (2007) "Excuse Me, Is This Your Phone?", *Reader's Digest,* July.

Smith, C. (2018) "Treasury Living Standards Dashboard: Monitoring Intergenerational Well-being," New Zealand Treasury, Wellington.

Solow, R. M. (1956) "A Contribution to the Theory of Economic Growth,"*Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94.

Swan, T. R. (1956) "Economic Growth and Capital Accumulation," *Economic Record*, Vol. 32, No. 2, pp. 334-361, http://dx.doi.org/10.1111/j.1475-4932.1956.tb00434.x

Tabellini, G. (2010) "Culture and Institutions: Economic Development in the Regions of Europe," *Journal of the European Economic Association*, Vol. 8, No. 4, pp. 677-716.

Uslaner, E. (2002), *The Moral Foundations of Trust*, Cambridge University Press.

Uslaner, E. (2008) "Trust as a Moral Value," in D. Castiglione, J. Van Deth and G. Wolleb (eds.), *The Handbook of Social Capital*, Oxford University Press, Oxford, pp. 101-121.

Whiteley, P. F. (2000) "Economic Growth and Social Capital," *Political Studies*, Vol. 48, No. 3, pp. 443-466.

World Bank (2006) "Where is the Wealth of Nations? Measuring Capital for the 21^{st} Century," The World Bank, Washington.

Xiong, A., H. Westlund, H. Li and Y. Pu (2017) "Social Capital and Total Factor Productivity: Evidence from Chinese Provinces," *China & World Economy*, Vol. 25, No. 4, pp. 22-43.

Yamamura, E. and I. Shin (2010) "Heterogeneity, Trust, Human Capital and Productivity Growth: Decomposition Analysis," *Journal of Economics and Econometrics*, Vol. 55, pp. 51-77.

Zak, P. and S. Knack (2001) "Trust and Growth," *Economic Journal,* Vol. 11, pp. 295-321.