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BEHAVIOURAL ECONOMIC & SOCIAL ANALYSIS

Trust and total factor productivity:

What do we know about effect size and causal pathways?

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CONTENTS

1 INTRODUCTION

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). 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.

Conceptual work linking trust to incomes had its origins largely in the sociological 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[1] and increasingly sophisticated analysis of the causal relationship between trust and incomes.

The role of trust is particularly of interest in the context of monitoring sustainable development and thinking about issues of growth, consumption, and wellbeing within an intergenerational context. The capital stocks approach to defining sustainability places emphasis on ensuring that the needs of current generations (current wellbeing) 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 wellbeing (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). Generalised interpersonal trust is the best candidate measure for social capital in this context (OECD, 2001, 2017; Scrivens and Smith, 2012). 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 relationship between trust and total factor productivity. The aim is threefold: (1) to summarise 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 in OECD countries. The first two questions are addressed through a literature review focusing on empirical quantitative analyses of the relationship between trust and income, economic growth, or productivity. This review summarises what is known about the magnitude of the relationship between trust, incomes, growth, and productivity and then discusses the causal pathways associated with the impact of trust. The third question makes use of data from the European Social Survey to estimate the size of coefficient for trust on tfp and illustrates what this implies for OECD countries via a counter-

[1] A search of the Econlit database on the terms "trust" and "growth" shows 51 articles over the 2000-2001 period and 48 over the 2002-2003 period rising to 120 for 2016-2017.

factual example where all OECD countries are assumed to have the same levels of interpersonal trust.

Following the introduction, section 2 of the paper summarises 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 3 sets out the results of a systematic literature review on the relationship between, 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 4 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 5 presents the results of the empirical analysis and discusses their implications. Finally, section 6 provides a brief conclusion.

2 TRUST AND TRUST MEASURES

While information is available on a wide range of different aspects of trust, the focus for this paper and for most of the credible empirical literature on social capital is generalised 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, generalised 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 generalised interpersonal trust used internationally[2], it is clear that these mostly capture information on the same underlying construct (OECD, 2017, Gonzalez and Smith, 2017). It is useful at this stage to highlight the difference between generalised interpersonal trust, which is the main focus here, from limited or particularised trust and from institutional trust.

Generalised trust refers to trust in people who are not known to the respondent or to trust in situations where the person being trusted is not specified. This can be contrasted with limited trust, which focuses on persons known to the respondent, including family, friends and people living in the respondent's immediate neighbourhood. Empirically, these two types of trust are not highly correlated across countries and are associated with different outcomes (Delhey and Welzel, 2011). As will be discussed later, it is generalised interpersonal trust that has both a strong empirical association with better economic performance and a clear theoretical explanation for the causal relationship. Limited trust is not associated with better economic outcomes in the same way at either the empirical or theoretical level (OECD, 2017).

Institutional trust is used to refer to all types of trust in institutions, with evidence supporting trust in *political institutions*, *law and order institutions* and *non-governmental institutions* as the broad categories for which people are able to provide meaningful responses (Gonzalez and Smith, 2017). Unlike limited trust, there is some evidence that institutional trust is important in terms of economic outcomes (OECD, 2017). However, the relationship is weaker than for generalised interpersonal trust (OECD, 2017), and is likely to operate primarily via the effect of institutional quality on generalised interpersonal trust (Uslaner, 2002).

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 generalised 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 in practice 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, and potentially the strongest source of evidence, 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

[2] 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".

relevant.

Knack (2001) provides a good overview of the validity of generalised 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$50 in 1996) quantity of money in public places across a range of different major cities around the world supports the validity of survey measures of generalised trust. Despite the relatively low sample size for this experiment, the proportion of wallets returned correlates with country values of the WVS measure of generalised trust at 0.65 ($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 generalised trust question.

Looking at a wider range of questions, Knack (2001) notes that responses to the WVS question on generalised 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 generalised 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 generalised trust and, using data from the German Socio-economic Panel, find a robust relationship between generalised trust and past instances of trusting behaviour.

Another source of evidence of convergent validity is the correlation between country-average levels of generalised 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 generalised trust measured in the WVS.

Going beyond survey data, there is now a large body of experimental evidence on the validity of measures of generalised 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 generalised trust[3] and trust as measured in the Trust Game (the proportion of the starting endowment sent by player 1 to player 2). While this might seem strong evidence against the validity of trust measures, Glaeser et al. also find that the survey-based measures of generalised trust are a strong and significant predictor of *trustworthy* behaviour in the Trust Game. In other words, the experimental evidence suggests that the standard generalised trust questions do collect valid data about a person's trustworthiness, but not about an individual person's willingness to trust ex ante.

Lazzarini et al (2004) repeat the same experiment in Brazil, while also investigating the impact of a face-to-face set-up as opposed to an anonymous set-up for the Trust Game. Their results confirm Glaeser et al.'s findings that survey-based measures of generalised trust correlate with individual trustworthiness in the Trust Game, but not with the individual's level of trust. Cox (2004) and Capra et al. (2007) explore the relationship between survey-based measures of trust and

[3] Using an index derived from the different questions on interpersonal trust – the Rosenberg question, whether people would take advantage of you if they got the chance, and would you say that most of the time people try to be helpful – Glaeser et al. (2000) find an insignificant negative relationship between survey-based measures of trust and experimental trust.

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 generalised 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, covering 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 countries, both developing countries (e.g. Cameroon and Uganda) and developed countries (e.g. the United States and Sweden). Contrary to earlier experimental studies, Johnson and Mislin find a significant positive correlation between the WVS measure of generalised trust and trusting behaviour in experimental games, but no relationship with trustworthiness. This finding is replicated and reinforced in a larger study that extends Jonson and Mislin's work to 167 studies in 36 countries and which is able to examine both intra-country variation in experimental and survey trust as well as inter-country variation in the same dataset (Carlin, Love, and Smith, 2017). One explanation for this apparent contradiction between the work of Glaeser and Lazzarini on the one hand and Johnson and Mislin on the other, is that the 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.[4]

A final source of information to assess the convergent validity of generalised 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 generalised 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 significant limitation, it is of less significance than might be initially thought. As will be discussed in section 3, most of the plausible causal pathways for the impact of trust on growth and 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.

[4] 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, ε_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.

3 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 for articles containing the word "trust" and one or more of the terms "income", "growth", or "productivity". This yielded a total of 373,955 articles. An identical search was conducted on Google Scholar, yielding 2,940,000 articles. These searches clearly produced an exceptionally large number of titles and included a very large number of articles that were ultimately unrelated to the relationship between trust and productivity. There was therefore a need to filter the articles manually down to only those producing an empirical estimate of the relationship between trust and either income, growth, or productivity. This was done by scanning the article titles and journals and, where the focus of the article was not clear from this alone, reviewing the article abstract. For both databases the list of articles was scanned in the order of relevance to the search terms and, once it became apparent that the manual scanning was identifying no further relevant articles, the process was terminated.

To ensure that the literature search process did not omit important articles due to the scanning process a second method was used to add articles to the database. This was based on a review of the bibliographies of the articles identified through the manual scanning. After both processes were complete, a total of 19 articles were identified as of direct relevance for the literature review. To be included in the review the articles had to include an empirical estimate of the relationship between generalised interpersonal trust[5] and either the rate of economic growth, levels of per capita income, or a measure of productivity. This is a very small proportion of the total academic literature on trust but reflects the relatively narrow scope of the criteria for inclusion in this study. Because 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 scope for original empirical studies on the relationship between trust and productivity has itself been relatively limited.

Table 1, below, provides a summary of the relevant articles identified through the literature survey[6]. There are 19 articles included in the table written between 1997 (Knack and Keefer) and 2015 (Pervaiz and Chaudhary). 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), the unit of analysis (country, state, region, intra-country) 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 & 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 standardised 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 studies draw on various

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

[6] One potentially relevant recent study – Xiong, Westland, 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.

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 standardised regression coefficients so that the magnitude of estimated impacts can be compared between studies.

Of the 19 studies included in table 1, 16 of them produce estimates of the relationship between a 1% change in the proportion of people replying "people can usually be trusted" to the WVS generalised trust question or a similar trust measure and the percentage point change in the growth rate of per capita GDP. Of the other four studies one focuses on the change in per capita income (Algan and Cahuc, 2010), one focuses on labour productivity (Yamamura and Shin, 2010), and one focuses on the growth rate of tfp (Bjornskov and Meon, 2009). Knack and Keefer (1997) also provide an estimate of the impact of trust on tfp alongside the more common estimate of the relationship between trust and growth.

Table 1. Estimates of the relationship between trust, income, growth, and productivity

Authors	Da	Coefficie	Unit	Focus	Approach	Data	Causali
La Porta et al	1996	**0.0207**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	
Knack and Keefer	1997	**0.0820**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	
		0.0860	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	IV
		0.0127	1% increase in trusters on % change in tfp growth rate	Productivity	Cross-section	Cross-country	
Whitely	2000	**0.5700**	1% change in log trust on % change in the growth rate	Growth rate	Cross-section	Cross-country	
	2000	**0.0161**	1% change in trust index on % change in growth rate	Growth rate	Cross-section	Cross-country	
Zak and Knack	2001	**0.0630**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	
		0.0450	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	
		0.0600	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	IV
Beugelsdijk, Van Schaik, and de Groot	2004	**0.0610**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	
Beugelsdijk & Van Schaik	2005	0.0110	1% increase in trusters on % change in growth rate	Growth rate	Panel	European Regions	RE
Ahlerup, Olsson and Yanagizawa	2007	**0.0668**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	IV
Berggren et al	2007	**0.0620**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	
		0.0320	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	
Dincer and Uslaener	2007	**0.0530**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	US States	
		0.047	1% change in trusters on % change in growth rate	Growth rate	Cross-section	US States	IV
Boulila et al	2008	**0.024**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	IV
Bjornskov and Meon	2009	**0.0049**	1% increase in trusters on % change in tfp growth rate	Productivity	Cross-section	Cross-country	IV
Dearmon and Grier	2009	**0.048**	1% change in trusters on % change in growth rate	Growth rate	Panel	Cross-country	IV
Roth	2009	**0.1800**	1% change in trusters on % change in growth rate	Growth rate	Panel	Cross-country	FE
		-0.0030	1% change in trusters squared on % change in growth rate	Growth rate	Panel	Cross-country	FE
Algan and Cahuc	2010	**$ 316.89**	1% point change in trusters on per capita income ($US)	Income level	Panel	Cross-country	FE
Tabellini	2010	**0.0600**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	European Regions	IV
Yamamura and Shin	2010	**0.0500**	1% change in trusters on % change in labour productivity	Productivity	Panel	Japan	FE
Horvath	2012	**0.0300**	1% change in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	IV
Bjornskov	2012	**0.0402**	1% increase in trusters on % change in growth rate	Growth rate	Cross-section	Cross-country	IV
Pervaiz and Chaudhary	2015	0.0044	1% change in trust/safety index on % change in growth rate	Growth rate	Panel	Cross-country	FE

IV = instrumental variable; FE = fixed effects; RE = random effects.

Trust and growth

Focusing first on estimates of the relationship between trust and growth contained in table 1, these range from 0.0044 (Pervaiz and Chaudhary, 2015) to 0.0860 (Knack and Keefer, 1997). Most of these studies (20 estimates from 15 studies) estimate a linear relationship between the percentage of trusting people in the population and the log of the growth rate. Across these 20 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 growth rate of per capita income.

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 percent 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 Bergren et al (2007) and Boulila et al (2008) undertake systematic robustness testing using extreme bounds

analysis (EBA)[7]. Findings are mixed, with both studies finding that the sign of the relationship between trust and growth is robust, but Bergren 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 make some attempt to 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 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 good 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 panel data on trust 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[8]. 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 generalisability 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 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 get around 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 USA 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,

[7] 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% of regressions and a soft test of robustness if they remain the same in 95% of regressions.

[8] 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 generalised trust. Given that generalised 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.

this can be used to create a database of trust values at the country level going back to the start of the 20th 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 papers in table one (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 (2009) 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 allows 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% increase in people trusting others in the population resulting in a 0.05 percent 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 flow-on from trust to factor accumulation accounts 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/rule of law 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 on other outcomes, with more trustworthy societies generating higher quality institutions in practice and higher quality institutions in turn, reinforcing generalised trust (Uslaner, 2002, 2008).

Yamamura and Shin's estimate of the impact of trust on labour productivity is higher (0.5) than the closest equivalent estimate from Bjornskov and Meon (0.28 for the impact of trust[9]). However, this is unsurprising given that the labour productivity measure used by Yamamura and

[9] The estimate of the impact of trust on the level of tfp in Bjornskov and Meon (0.28) is higher in absolute terms than the impact of trust on the tfp growth rate discussed in the preceding paragraph (0.0049) but, of course, measures something different. It is the level estimate, however, that is most comparable to the estimate of the impact of trust on labour productivity included in Yamamura and Shin.

Shin will capture the impact of capital accumulation as well as efficiency effects while the tfp estimate excludes factor accumulation. More generally, Yamamura and Shin's analysis, while focused exclusively on Japan, is consistent with Bjornskov and Meon as well as Knack and Keefer in identifying both a direct effect of trust on productivity and in this accounting for only a small part of the total impact of trust on income growth.

Causal pathways

A diverse range of different accounts have been put forward for how trust might affect incomes. These range from the very general to the very specific. While some accounts simply describe the causal mechanism in very general terms – such as referring to transaction costs and taking the exact causal pathway as a given – others provide more detail. The intent here is to provide a description of the main causal pathways at a level of detail that can be linked back to specific empirical results. Even though the primary focus for this article is on the relationship between trust and productivity it is useful to consider the full range of potential causal pathways in order to place the trust/productivity relationship in context.

In discussing the causal pathways whereby trust affects incomes, three broad transmission channels are identified. 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 too produce in a low trust setting become viable at higher levels of trust.

A number of the key empirical papers 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 impacts on 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 percent and 150 percent. 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 generalised interpersonal trust (discussed at the start of section 2) 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.

4 DATA AND METHOD

The literature reviewed in section 3 is relatively limited from the perspective of understanding the relationship between trust and tfp in that most of it draws from the WVS and there are therefore very 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 report 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 generalised trust question of 5 or more[10] for each ESS wave. Information on tfp was obtained from the Penn World Tables covering the same period. 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. In fact, while the ESS dataset clearly does not represent the range of societies found across the globe, it is highly diverse. In addition to Western Europe, the ESS contains data on a wide range of Eastern European countries with very different political traditions to the West, including Russia and the Ukraine as well as a range of post-communist EU countries. The dataset also includes Israel and Turkey. This group of countries has a wide range of trust scores, with 13 country/year observations with below 40 percent trusters covering Bulgaria, Cyprus, Greece, Poland, Portugal and Turkey, as well as 36 country/year observations with more than 80 percent trusters including observations from Denmark, Finland, Great Britain, Israel, the Netherlands, Norway, and Sweden. The lowest mean country trust value was 21.6 percent (Turkey, 2008) and the highest 93.4 percent (Sweden, 2006).

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. If the ratio of noise to signal is higher within the dataset, this will be reflected in a smaller estimated coefficient and lower statistical significance. Ultimately this issue is potentially serious, but since the existing literature is dominated almost exclusively by the WVS, looking at the ESS is likely to add value. Although the time period is shorter than would be desired, 16 years presents a reasonable window in which to observe changes in both tfp and trust.

The relationship between trust and productivity

Although most modern analyses of the drivers of economic growth are grounded in the framework of an endogenous growth model (Romer, 1994), tfp is estimated empirically using a simpler framework based ultimately on the Solow-Swann growth model (Solow, 1956; Swann, 1956). In a Solow-Swann 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

[10] 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.

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 paper uses a basic development accounting framework to examine the impact of trust on total factor productivity. Equation 1 sets out a basic Cobb-Douglas production function for a country:

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

where K is the capital stock per worker, L is the mean human capital per worker, Y is GDP per capita, and A is total factor productivity. Using the log rule we can convert this to a linear equation:

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

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

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

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

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

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

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

where S is social capital and $\hat{A}$ is total factor productivity 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):

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

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

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

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

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

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:

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

Although this manipulation of the basic derivation of tfp is simple, 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[11]. This, as it turns out, is exactly what we see in the empirical data (Algan and Cahuc, 2013).

[11] 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

Estimating equation 9 empirically is relatively straight forward with the aggregate ESS dataset described above. Note that, unlike most of the literature described in section 3, 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 than we should estimate $\ln(A) = \gamma \ln(T) + \varepsilon$, 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.

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.

5 RESULTS

Table 2 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[12] in the population on tfp. As is expected from theory and prior literature the bivariate relationship is strong and positive. Column (2) adds in country and year 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 2 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.

Table 2. 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
n	193	193	193	193	193	193	193
Adjusted R^2	0.220	0.919	0.921	0.213	0.932	0.934	0.932

*** p<0.001, ** p<0.01, * p<0.05, ^ p<0.1

Columns 4 to 6 in table 2 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 directly comparable to the equivalent estimate reported by Bjornskov and Meon (2009) in table 1. The Bjornskov and Meon estimate produces a larger coefficient at 0.00468 than that reported in table 2 (0.00281), although the two estimates are of

[12] 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 generalised trust, a truster is defined here as a person with a score of 5 or higher on the ESS generalised trust question.

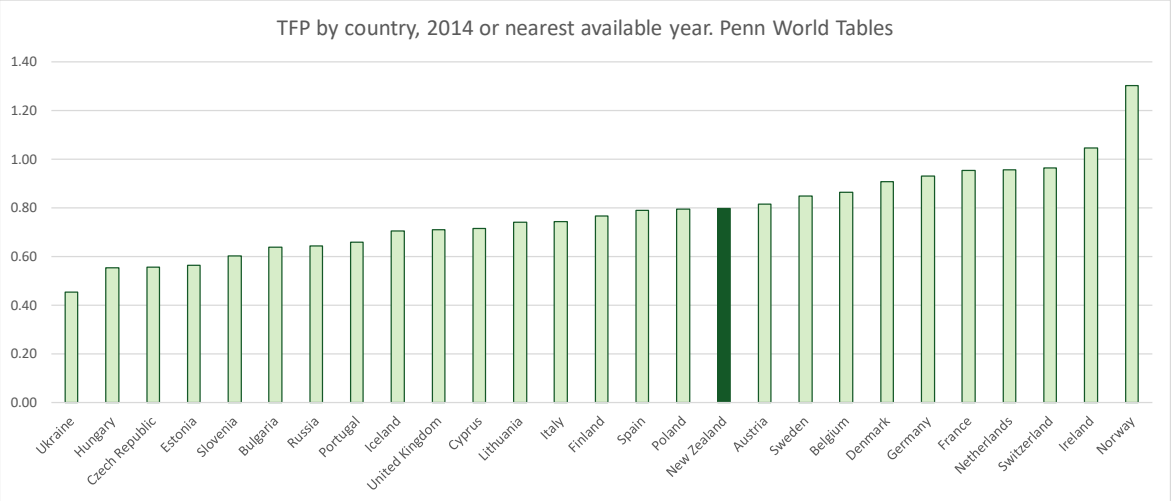
the same order of magnitude. This raises the question as to which is the better estimate? Bjornskov and Meon's underlying data covers a wider range of countries including countries at widely differing stages of economic development. By contrast, the ESS dataset has a narrower range of countries, all 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 2 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 2 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 2 provide support for the view that trust is a significant component of measured tfp, they do not communicate well whether this effect really matters for public policy. One way to explore this is to consider a simple counterfactual example. Figure 1 below[13] shows tfp figures for selected OECD countries in 2016. This sees New Zealand with a tfp of 0.8, slightly above the average value in the sample of 0.78. By contrast, New Zealand has the highest measured trust in the sample, with 91.3 percent of the population reporting a score of 5 or greater on the standard trust question (NZGSS, 2014) compared to an average of 64.6 percent (based on ESS data). The lowest trust in the sample is Bulgaria at 32.6 percent, while the second highest (after New Zealand) is Norway at 89.3 percent.

Figure 1. tfp by country, selected OECD countries



Source: Penn World Tables

In comparison to figure 1, figure 2 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 figure 2, each country's actual tfp is adjusted using the coefficient from column 7 in table 2. This is the log/log coefficient which 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 slightly from 0.8 to 0.76, and its ranking drops from 11th to 14th out of 27 countries.

[13] The data underpinning this table is presented in annex 1.

Figure 2. Counterfactual tfp by country, selected OECD countries, log on log

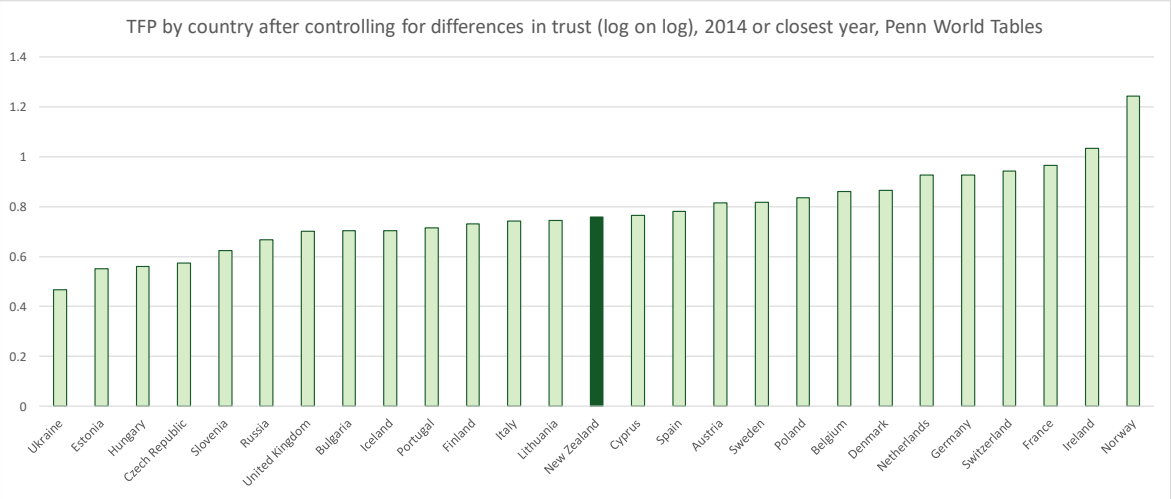
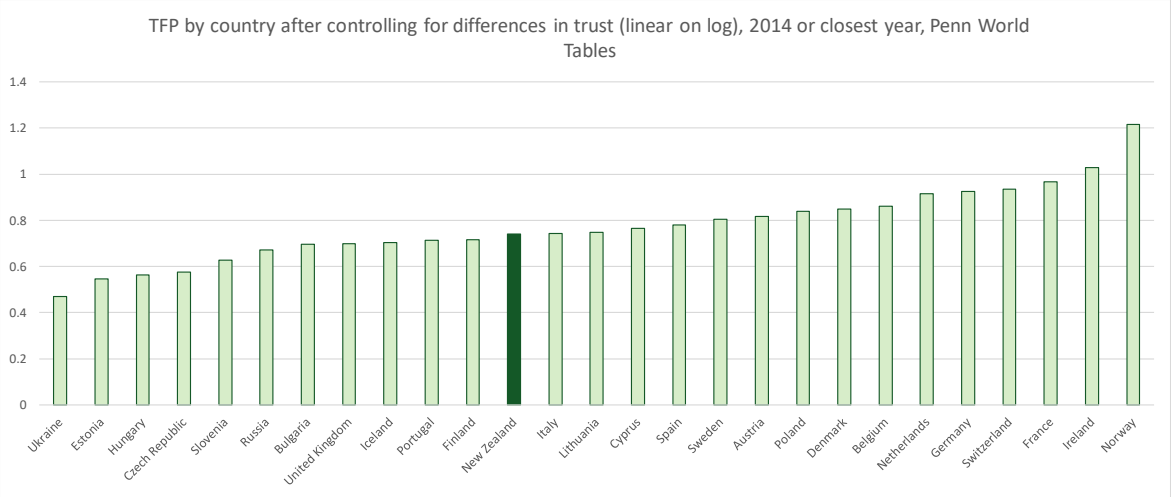


Figure 3 illustrates the results of a similar counterfactual to figure 2 but using the coefficient from column 5 of table 2 rather than column 7. This gives a larger impact from trust on tfp with the level of New Zealand's tfp dropping to 0.74 and the ranking dropping to 16th of 27 countries. Comparing figure 3 to figure 1, in figure 3 New Zealand's tfp is just above that of Finland and just below that of Italy. In contrast, in figure 1 New Zealand's tfp was well above both Finland and Italy, and just below that of Austria. Using the coefficient from Bjornskov and Meon the results (not shown) shift New Zealand down another two places to 18th of 27 countries and drop tfp from 0.8 to 0.7.

Figure 3. Counterfactual tfp by country, selected OECD countries, linear on log



Discussion

The relationship between trust and 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% increase in trusters in the population is associated with an increase in the growth rate 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 (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 paper with the strongest identification strategy is the paper 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.

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 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 generalised 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 91.3 percent to 64.6 percent) results in a fall in tfp that is between a quarter (ESS) and half (Bjornskov and Meon) as large in proportionate terms.

Taking these observations into account, there are three issues that are worth highlighting as important for policy or further investigation in a New Zealand context. The first of these is related to the potential sensitivity of tfp in New Zealand to a shock in trust. The best available measures of trust levels in New Zealand compared to overseas suggest that New Zealand has a very high level of trust. The WVS wave 6 reports 55.3% of New Zealanders responding that "most people can be trusted" compared to an average of 33.9% across OECD and associated countries placing New Zealand as 4th highest out of 21 countries[14]. Comparing the European Social Survey (ESS, 2012-2014) to the New Zealand General Social Survey (NZGSS) 2014 shows even more striking results with 91.3% of New Zealanders reporting a trust score of 5 or more compared to an average of 63.5% across ESS member countries[15]. This implies a gap between trust levels in New Zealand and mean trust levels in comparable countries of between 21.4% (WVS) and 27.8% (ESS).

While these effects are illustrative rather than definitive, they underscore that as a very high trust country there is a significant down-side risk for New Zealand if trust is important to growth and productivity. By all available measures we are among the highest trust countries in the world leaving little room for improvement. However, trust levels vary within New Zealand (see box 1 below) and there is clearly significant scope for deterioration in levels of trust. The New Zealand Treasury's Living Standards Framework frames the Treasury's role in terms of managing the country's intergenerational wealth defined in terms of produced, human, natural, and social capital. As mentioned earlier (Scrivens and Smith, 2012), trust is the best available measure for social capital in this sense. The importance of trust to New Zealand and the associated downside risk suggest that substantive engagement on this issue at a public policy level would be valuable. Rothstein and Uslaner (2005) highlights 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 risks to institutional quality might be a starting point for such work.

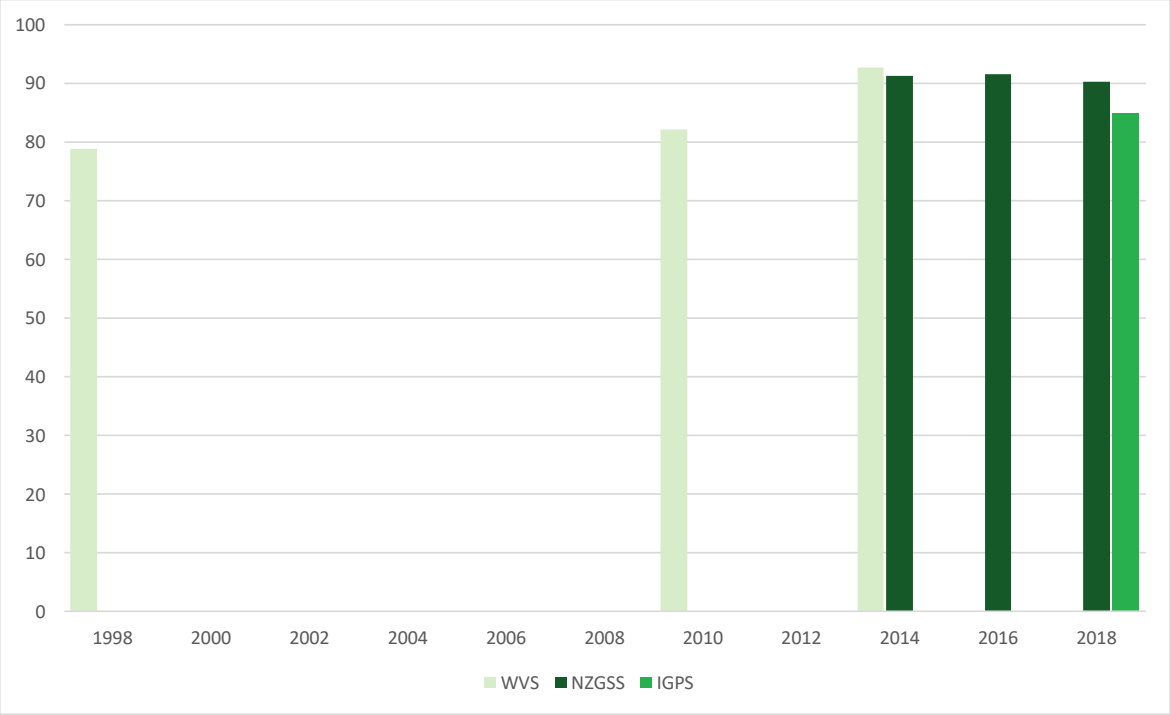
[14] For this comparison all countries that are both in the WVS wave 6 and either OECD or associated countries were included. See annex 2 for a full list.

[15] See annex 3 for a list of the countries included and underlying data.

Box 1. Trust in New Zealand

Data on trust in New Zealand is uneven in terms of coverage. Prior to the introduction of a generalised trust question to the NZGSS in 2014, the only available data on generalised trust for New Zealand is from the WVS. This provides three data points for New Zealand (1998, 2010, and 2014). Data from the NZGSS is available every second year from 2014 onwards, while the IGPS trust survey provides information on generalised trust from 2018. Of these surveys the IGPS trust survey and WVS are broadly similar in terms of sample size and response rate, while the NZGSS has a much higher sample size (c8500) and response rate (c80 percent). Nonetheless, the general pattern across the surveys is broadly similar with evidence of increasing levels of generalised trust through to 2016 and possible a minor decline subsequently.

Figure 4. Generalised interpersonal trust in New Zealand: 1998 to 2018



The large sample size of the NZGSS means that it is able to provide a meaningful breakdown of trust across different sub-groups in the New Zealand population. Expressed in terms of the proportion of the population reporting a score of 5 or greater on the 0-10 generalised trust question in the 2018 NZGSS, trust increases slightly with age (from 86.5 percent in the 15 to 24 age group through to 93.3 percent in the 65 plus age group). Men are slightly more trusting than women (90.6 percent to 90.1 percent), but there is a relatively large gradient in education. Only 83.2 percent of the population with low qualifications are trusters compared to 95.7 percent of the population with a tertiary degree. Migrants are more trusting than the New Zealand born (93.7 percent and 94.6 percent respectively for long term and recent migrants compared to 88.6 percent for the New Zealand born population). This is likely to be related to New Zealand's immigration criteria which ensure that the migrant population is more educated, on average, than the New Zealand born population. There is significant diversity in levels of trust across ethnicity ranging from 80.9 percent (Māori) through to 86.5 percent (Pacific people), 91.2 percent (European), and 93.5 percent (Asian).

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 aside, essentially all of 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 1000 individuals and lacks any ability to connect trust data to firms or small geographic areas. The inclusion of survey data in Statistics New Zealand's Integrated Data Infrastructure (IDI) offers a possible way forward. Trust measures are available in the NZGSS and Te Kupenga, and can potentially be linked to a wide range of administrative data sources including the potential to link to firm level data. 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. While 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, this conclusion needs to be taken with a measure of caution. The main point of the Swan-Solow growth model (Solow, 1956, Swan, 1956) is that, in the long run, it is tfp that must be the main driver of economic growth. The rate of capital accumulation impacts the equilibrium level of income and how quickly the economy converges to equilibrium, but not the long run rate of growth. 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.

6 CONCLUSION

Trust certainly matters. Even if one takes a sceptical view of the evidence for 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 generalised 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. Both the WVS and the NZGSS show a gradually increasing trend in trust levels in New Zealand over the time period from 1998 to the present.

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 than productivity, the latter effect remains empirically important. Evidence for causality on the impact of trust is weaker due to data limitations, 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 for a high trust country. The fact that models 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 fairly 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 wellbeing that underpins the OECD's approach to measuring wellbeing (OECD 2013, 2015) as well as the New Zealand Treasury's Living Standards Framework.

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 micro-economics of what drives trust. For example, Putnam (1993) theorised that civic engagement builds trust, but there has been limited empirical testing of this hypothesis. While traditional academic datasets – such as the WVS – lacked the sample size for this type of analysis, larger official datasets open significant new opportunities.

Finally, there is a need for work at the policy level to understand how social capital should be managed at a national level. While approaches such as the New Zealand Treasury's Living Standards Framework identify social capital as an asset to be managed, they provide little in the way of guidance on a work programme. The review of the literature undertaken here suggests 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.

BIBLIOGRAPHY

Ahlerup, P., Olsson, O., & Yanagizawa, D. (2009). “Social capital vs institutions in the growth process”. *European Journal of Political Economy*, 25(1), 1-14.

Algan, Y. and P. Cahuc (2010), “Inherited trust and growth”, *The American Economic Review,* Vol. 100 (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 (4), pp. 343-362.

Arrow, K. J., Dasgupta, P., Goulder, L. H., Mumford, K. J., & Olsen, K. (2012). Sustainability and the measurement of wealth, *Environment and Development Economic, 17*, 317–353.

Berg, J., J. Dickhaut and K. McCabe (1995), "Trust, reciprocity, and social history", *Games and Economic Behavior,* 10, pp. 122-142.

Berggren, N., Elinder, M., & Jordahl, H. (2008). “Trust and growth: a shaky relationship”, *Empirical Economics*, *35*(2), 251-274.

Beugelsdijk, S., & Van Schaik, T. (2005). “Social capital and growth in European regions: an empirical test”. *European Journal of Political Economy*, *21*(2), 301-324.

Beugelsdijk, S., De Groot, H. L., & Van Schaik, A. B. (2004). “Trust and economic growth: a robustness analysis”. *Oxford economic papers*, *56*(1), 118-134.

Bjørnskov, C. (2012). “How does social trust affect economic growth?”, *Southern Economic Journal*, *78*(4), 1346-1368.

Bjørnskov, C., & Méon, P. G. (2015). “The productivity of trust”. *World development*, *70*, 317-331.

Boulila, G., Bousrih, L., & Trabelsi, M. (2008). “Social capital and economic growth: empirical investigations on the transmission channels”. *International Economic Journal*, *22*(3), 399-417.

Butter, Frank A.G.; Mosch, Robert H.J. (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,* 46*,* pp. 260-281.

Dearmon, J., & Grier, K. (2009). “Trust and development”. *Journal of Economic Behavior & Organization*, *71*(2), 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,* 76(5), pp. 786-807.

Dincer, O. C., & Uslaner, E. M. (2010). “Trust and growth”. *Public Choice*, *142*(1-2), 59.

Evensky, J. (2011). Adam Smith’s essentials: On trust, faith, and free markets. *Journal of the History of Economic Thought*, *33*(2), 249-267.

Fehr, E. (2009), "On the economics and biology of trust", *Journal of the European Economic Association,* 7 (2-3), pp. 235-266.

Felte, E. (2001), “Finders keepers”, *Reader’s Digest,* 2, 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 (4), pp. 505–531.

Glaeser, E., D. Laibson, J. Scheinkman and C. Soutter (2000), "Measuring trust", *The Quarterly Journal of Economics,* Vol. 115 (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, No. 2017/11, OECD Publishing, Paris, *https://doi.org/10.1787/d839bd50-en*.

Guiso, L., P. Sapienz and L. Zingales (2006), "Does culture affect economic outcomes?", *The Journal of Economic Perspectives,* Vol. 20 (2), pp. 23-48.

Guiso, L., P. Sapienza and L. Zingales (2008), "Trusting the stock market", *The Journal of Finance,* Vol. 63 (6), pp. 2557-2600.

Hamilton, K. and G. Liu (2013), "Human capital, tangible wealth, and the intangible capital residual", *OECD Statistics Working Papers,* 2013/02, 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, National Bureau of Economic Research.

Johnson, N. and A. Mislin (2011), "Trust Games: A meta-analysis", *Journal of Economic Psychology,* Vol. 32 (5), pp. 865-889.

Johnson, N. and A. Mislin (2012), "How much should we trust the WVS trust question?", *Economics Letters,* 116, pp. 210–212.

Karlan, Dean (2005), "Using experimental economics to measure social capital and predict financial decisions", *American Economic Review*, Vol. 95 (5), pp. 1688-1699.

Kleinknecht, A., F. van Schaik, and H. Zhou (2014), "Is flexible labour good for innovation? Evidence from firm-level data", *Cambridge Journal of Economics (38)*, pp1207-1219

Klijn, E.H., J. Edelenbos and B. Steijn (2010), "Trust in governance networks: Its impact and outcomes", *Administration and Society*, Vol. 42 (2), pp. 193-221.

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,* 112 (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,* 87, pp. 333-38.

Lazzarini, S., R. Madalozzo, R. Artes and J. de Oliveira Siqueria (2004), "Measuring trust: An experiment in Brazil", *Insper Working Paper,* 049/2004.

Murphy, K. (2004), "The role of trust in nurturing compliance: A study of accused tax avoiders", *Law and Human Behaviour*, Vol. 28 (2), pp. 187-209.

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

Nooteboom, B. (2007), "Social capital, institutions and trust", *Review of Social Economy,* Vol.

65 (1), pp. 29-53.

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., & Chaudhary, A. R. (2015). "Does Trust Matter for Economic Growth and Human Development? Empirical Evidence from a Panel of Countries". *Pakistan Journal of Commerce and Social Sciences*, *9*(3), 916-927.

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

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

Romer, P. M. (1994). The origins of endogenous growth. *Journal of Economic perspectives, 8(1),* 3-22.

Roth, F. (2009). "Does too much trust hamper economic growth?", *Kyklos, 62(1),* 103-128.

Rothstein, B. and E. Uslaner (2005), "All for all: Equality, corruption and social trust", *World Politics,* 58(3), pp. 41-72.

Scrivens, K. and C. Smith (2013), "Four interpretations of social capital: An agenda for measurement", *OECD Statistics Working Paper,* 2013/06, 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 Wellbeing*. New Zealand Treasury, Wellington

Solow, R. M. (1956). "A contribution to the theory of economic growth". *The quarterly journal of economics, 70(1),* 65-94.

Swan, T. R., (November 1956). "Economic growth and capital accumulation". *Economic Record. 32 (2):* 334–361. doi: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*, *8*(4), 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*, *48*(3), 443-466.

World Bank (2006), *Where is the Wealth of Nations? Measuring Capital for the 21st Century*, The World Bank, Washington, DC.

Yamamura, E., & Shin, I. (2012). "Heterogeneity, Trust, Human Capital and Productivity Growth: Decomposition Analysis". *Journal of Economics and Econometrics*, *55*(2), 51-77.

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

Zelmer, J. (2003), "Linear public goods experiments: A meta-analysis", *Experimental Economics,*

ANNEX 1

Table 2. European Social Survey and NZGSS trust values (percentage reporting a score of 5 or more)

Country	Year	Percentage scoring 5+ on generalised trust	
Austria	2014	64.5	0.82
Belgium	2014	65.4	0.86
Bulgaria	2012	32.6	0.64
Cyprus	2012	39.6	0.71
Czech Republic	2014	52.7	0.56
Denmark	2014	88.3	0.91
Estonia	2014	74.5	0.56
Finland	2014	88.6	0.77
France	2014	59.1	0.95
Germany	2014	66.5	0.93
Hungary	2012	58.8	0.55
Iceland	2014	65.5	0.70
Ireland	2012	70.1	1.05
Italy	2012	64.2	0.74
Lithuania	2012	62.0	0.74
Netherlands	2014	80.6	0.96
New Zealand	2014	91.3	0.80
Norway	2014	89.3	1.30
Poland	2014	44.9	0.79
Portugal	2012	36.7	0.66
Russia	2012	49.9	0.64
Slovenia	2014	49.7	0.60
Spain	2012	68.8	0.79

Sweden	2014	82.4	0.85
Switzerland	2014	74.9	0.96
Ukraine	2012	52.0	0.45
United Kingdom	2012	70.2	0.71

Data Source: European Social Survey – most recent of 2012 and 2014 waves, NZGSS 2014, Penn World Tables.