Trust and RD Investments: Evidence from OECD Countries

Ndubuisi, Gideon

Maastricht University, UNU-MERIT, NODAC Consulting

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Gideon Ndubuisi
UNU-MERIT/Maastricht University
ndubuisi@merit.unu.edu

Abstract

This paper contributes to the literature on the innovation effect of social trust by analyzing the mechanisms linking social trust and R&D Investments. High social trust level can ease firms' credit constraints by reducing moral hazards and information asymmetries problems which make raising external capital difficult and expensive for firms. It can also reduce relational risks that expose firms to ex-post holdup or outright intellectual property expropriation. Using data from 20 OECD countries, I test these mechanisms by evaluating whether more external finance dependent and relational risks vulnerable sectors exhibit disproportional higher R&D investments in countries with high social trust level. The empirical results confirm that high social trust level encourages investments in R&D. Importantly, the results indicate that sectors which depend more on external finance and those sectors that are more vulnerable to relational risks experience a relatively greater increase in R&D investments in countries with high social trust. The results underline access to external credit and reduction in relational risks as causal pathways linking social trust and R&D investment.

JEL: *A13; O17; O31; O43*
Keywords: *Social Trust, Innovation; R&D Investments; Relational Risks; Credit Constraints*

1. Introduction

Innovation activities such as investment in Research and Development (R&D) has been identified as an important determinant of income per capita and long-run productivity growth (Romer, 1990; Grossman & Helpman, 1991; Aghion & Howitt, 1992). Therefore, understanding the drivers of innovation activities is a relevant policy question. Relatedly, the relationship between social capital, particularly social trust, and innovation activities has been gaining increasing interest in the literature (Dakhli & De Clercq, 2004; Akçomak & ter Weel, 2009; Kaasa, 2009; Doc & Acs, 2010; Akçomak & Müller-Zick, 2018; Thompson, 2018; Xie *et al.,* 2019). However, while existing studies document a positive association between social trust level and innovation activities, little empirical evidence exists on the exact mechanisms through which social trust affects innovation activities. Using industry-level data on R&D investments in 20 OECD countries over the period spanning 1990-2008, this paper is an attempt to fill this gap in the literature.

Specifically, this paper identifies and empirically test two causal mechanisms, easing credit access and reduction in relational risks, which directly link social trust and R&D investments. These mechanisms build on the well-established literature suggesting that access to credit and effective contract enforcement, which are relational risks reducing, incentivize R&D investments (Brown *et al.,* 2009; Brown *et al.,* 2012; Agénor *et al.,* 2014; Khanna & Mathews, 2016; Seitz & Watzinger, 2017; Fang *et al.,* 2017). On the one hand, R&D investment is a cost-intensive activity often requiring external financing because R&D investing firms easily exhaust their internal funds.[1] On the other hand, investments in R&D, say, in new product development often require collaboration with multiple parties or making relationship specific-investments. This exposes the investing firm to *ex-post* holdup or outright intellectual property expropriation which can discourage investment in new product development. Accordingly, the causal mechanisms considered in this paper evaluate how high social trust level encourages investment in R&D by reducing firms' external finance constraints and relational risks problems which can reduce research efforts.

[1] Related to this is the fact that R&D investment though a cost-intensive activity is characterized with huge uncertainty. Hence, sourcing external fund is one of the ways firms diversify risk. However, to protect their proprietary information, R&D investing firms may be unwilling to fully divulge all information concerning their R&D activities to credit lenders. This creates information asymmetry that further constrains R&D external financing. However, high social trust level, which can be thought as cultural values and social discipline against opportunistic tendencies, can dissipate firms concern over divulging their proprietary information.

Firstly, high social trust level can reallocate capital in the credit market by reducing moral hazards and adverse selection problems which make raising external capital difficult and expensive for firms. The intuition is that in a high trusting society, being opportunistic (i.e. moral hazard) would go contrary to the society's ingrained moral values and it usually attracts social sanctions and stigmas. Therefore, borrowers in such a society would have a lower likelihood of default as they are bounded by high moral standards, while credit lenders would be more willing to lend to borrowers from such a society because of a reduced concern over default risks. High social trust level can also expand credit access by reducing information asymmetries between borrowers and credit lenders (i.e. adverse selection). Pevzner *et al.* (2015) argue that firms in high trusting societies are less likely to manipulate their financial results. Consequently, investors perceive their financial reports as more credible and are more likely to invest in firms from such a society. The foregoing arguments are consistent with plethora of studies that indicate high social trust level increases firms' access to external capital (Duarte *et al.,* 2012; Wu *et al.*, 2014; Chen *et al.,* 2016; Bottazi *et al.,* 2016; Levine *et al.,* 2018) or the supply of bank credit (Guiso *et al.,* 2004; Cruz-García & Peiró-Palomino, 2019).

Secondly, social trust as an informal institution mitigates relational risks that may lead to underinvestment in new research projects. Seitz & Watzinger (2017) argue that when active markets for inputs do not exist or firms are unable to write enforceable contracts with input suppliers, firms might be unwilling to invest in the development of a new product if a supplier delivering an essential input can *ex-post* extract all the rents resulting from a successful research effort. While they centred their argument around formal contract enforcement, the conventional view is that informal institutions such as trust is an integral part of a country's overall contracting environment and it either complements or substitutes formal contract enforcement mechanisms where governments are either unable or unwilling to provide one (Knack & Keefer, 1997; Guiso *et al*., 2004; Mccannon *et al.,* 2017). In which case, the social trust offers similar gains as formal contract enforcement. This conclusion is in line with studies suggesting that high social trust level encourages economic activities by reducing opportunistic behaviours (Lyons & Mehta, 1997; Dyer & Chu, 2003; Wang *et al*., 2011).

To evaluate the above mechanisms, I exploit cross-industry variations on the extent of external finance dependence and exposure to relational risks which may suggest the relative dependence of an industry on social trust level. The identification assumptions are then as follows. First, because high social trust level is generally thought to reduce moral hazards and adverse selection problems that impede firms' access to external credit, high trust level should disproportionately benefit firms that are more dependent on external finance to fund R&D investments once other factors are controlled for. Secondly, because high trust level reduces relational risks, high trust level should disproportionately benefit firms that are more vulnerable to relational risks once other factors are controlled for. Hence, this paper evaluates whether more external finance dependent and relational risk vulnerable industries experience higher R&D investments in countries with high social trust level compared with those industries in countries with low social trust level.

I test this hypothesis using the empirical approach developed by Rajan & Zingales (1998). The approach tests the hypothesis by simply examining how the interaction of country-specific indicator of social trust level and industry-specific indicator external finance dependence on the one hand, and relational risks, on the other hand, affects industry R&D investments. As an empirical measure of industry R&D investment, I use the ratio of R&D expenditure to value-added. Following the existing literature (Knack & Keefer, 1997; Wu *et al.*, 2014; Pevzner *et al.,* 2015; Chen *et al.,* 2016; Bottazi *et al.,* 2016; Levine *et al.,* 2018), I measure social trust level as the proportion of a country's population in a year that "agrees" with the statement in the World Value Survey: "Most people can be trusted". External finance dependence is measured using the industries' finance dependence originally computed by Rajan & Zingales (1998). The index measures for each industry, the share of capital expenditures not financed with cash flows from operations. Because firms in these industries depend more on external finance to fund their activities, they are more prone to financial frictions in the credit market. Lastly, I proxy industries' vulnerability to relational risks using Nunn (2007) "contract intensity index". The index measures for each industry, the proportion of intermediate inputs which are not traded on active markets. Because these goods are not traded on active markets, the require relation specific investments to be made, thereby exposing the R&D investing firm to relational risks.

The result from the empirical analysis confirms that high social trust level increases investments in R&D. Exploring the causal mechanisms through which social trust intensifies R&D efforts, the results are consistent with my hypothesis that more external finance dependent and relational risks vulnerable industries exhibit disproportional higher R&D investments in countries with high social trust level. This result is robust to a number of robustness checks. Calculating the sizes of the effect of either of the causal mechanisms shows a sizeable impact. For instance, the results suggest a one standard deviation expansion in the social trust level will increase R&D investment intensities by 1.5 percentage point for an industry at the average external finance dependent and by 4.8 percentage point for an industry at the average relational risk exposure. Either of these effects is greater than the sample average R&D investment intensity of 0.056, suggesting that the impact of social trust is substantial in economic terms. Given the essential role of R&D in determining income per capita and long-run productivity growth, the study underlines R&D as a possible pathway social trust affects economic growth, further divulging the causal mechanisms that link social trust and R&D investment. Accordingly, the findings of the paper beg the need for governments to identify the drivers of social trust and make concerted efforts toward investing in them.

This paper contributes to the growing literature on the innovation effect of social capital and trust by exploring the causal mechanisms on the trust-innovation nexus. In a closely related paper, Xie *et al.* (2019) regressed patent count and citations on social trust level interacted with industry patent intensity. Contrary to their study, the current paper focuses on R&D investment and how social trust, by easing firms' external credit constraints and exposure to *ex-post* relational risks, intensifies research efforts. Both papers are therefore distinct on how they proxy innovation activity and identify the effect of social trust on the outcome variable. This paper is also related to the broader literature examining the relationship between social trust and economic activities or outcomes such as the level of human and physical capital investment (Knack & Keefer, 1997; Zak & Knack, 2001; Dearmon & Grier, 2011), productivity (Bjørnsko & Meòn, 2015), stock market performance and financial development (Guiso *et al.,* 2004; 2008; Pelvzener *et al.,* 2008), trade, FDI and Migration (Guiso *et al*., 2009; Spring & Grossmann, 2016), among others, but has ignored the effect of trust on R&D especially at the industry level. Relatedly, this paper also contributes to

the literature on the country level drivers of R&D investments (Wang, 2010; Becker, 2014; Alam *et al.,* 2019) by evaluating for the first time in the literature the role of trust in this process.

The remainder of the paper is structured as follows. Section 2 discusses the research methodology, specifying the empirical model and different data sources used in the analysis. Section 3 presents the empirical results, while Section 4 concludes.

2. Data and Estimation Equation

The four most important variables in my empirical analysis are R&D investment intensities, measures of industry external finance dependence and exposure to relational risks, and data on social trust level. R&D investment intensities are calculated as the ratio of industry R&D expenditure to value-added at the 2-digit International System Industry Classification Revision (ISIC Rev.) 3.1. Data on R&D expenditures come from the OECD's Analytical Business Enterprise and Research (ANBERD) database, while data on industry value added comes from the OECD's STAN database. Owing to many missing observations on industry R&D expenditures in many countries and the availability of data on industry finance dependence and relational risks, the analysis is restricted to an unbalanced panel comprising 21 manufacturing industries in 20 countries over the period spanning 1990-2008. For the remaining few missing observations, I use linear interpolations to fill them up. The sample distribution of R&D investment intensities is described in Table 1A, 2A and 3A in the appendix.

Data on industry external finance dependence and relational risks come from Maskus *et al.* (2019) and Seitz & Watzinger (2017), respectively. Both variables are calculated from US data. The variables are country and time-invariant, but varies across industries. Specifically, the industry external finance dependence was computed following the definition of Rajan & Zingale (1998): the ratio of capital expenditures less cash flow from operations for all publicly-listed U.S firms in the Compustat database over the periods 1990–1999. The value for the median firm in each industry is then taken as the industry's external finance dependence value. By construction of this index, it follows that whilst firms with higher cash flow are able to use internal funds to finance capital expenditures including R&D, the same cannot be said about firms with lower cash flow which makes them depend more on external finance. Accordingly, because high social trust level

eases external credit constraints, firms will have the requisite capital to fund promising R&D projects. While this would be true across firms, it should apply more forcefully in more external finance dependent sectors and the marginal effects are also more likely to be stronger in those sectors given the greater efficiency of capital allocation.

As an indicator of industry exposure to relational risks, I use Nunn (2007) contract dependence index which has been aggregated at the 2-digit ISIC Rev. 3.1 by Seitz & Watzinger (2017). The index measures for each industry, the proportion of intermediate inputs which are not traded on active markets.[1] To compute the index, Seitz & Watzinger (2017) combines the 2002 United States Input-Output Use table (which provides information on the share of intermediate inputs used to produce a final good in 439 industries) with data on whether these intermediate inputs are reference-priced or sold through an organized exchange. They then aggregate the inputs at the 2-digit ISIC Rev. 3.1 level. Because these inputs are not traded on active markets, they require producers to make relationship specific-investments which are relational risks increasing. Such risks include either exposure to ex-post holdup or outright expropriation of intellectual property. Table 4A in the appendix lists the industries together with the indicators on contract and finance dependence used in the empirical analysis.

As it is obvious by now, the industry external finance dependence or relational risk vulnerability is not specific to the R&D intensity of the industry. Ideally, it would be better to use industry measure of external finance dependence that is specifically for expenditures related to R&D and relationship specific-investments that are directly targeted at R&D. While this is a limitation of this study, it does not compromise the main message of the paper because the indexes capture the overall industry external financial dependence and exposure to relational risks.[2] Further, the indexes are not country-industry specific. Whilst this is due to the lack of comparable cross-country data to compute such indexes, the empirical framework adopted in this paper treats the external finance dependence and relational risk vulnerability as a technological component of an industry. That is, it is for technological reasons that, say, the textile industry depends more on

[2] In the econometrics estimation, I also control for industry fixed effects and this should ideally reduce any measurement error induced on how the industry financial dependence and relational risks are computed.

external finance to fund its operation than the food products and beverages industry. In which case, what matters is only the ranking of industries along with these technological characteristics.

Finally, for the social trust level, I use the perception-based trust indicator from the World Value Survey (WVS) which has become the standard trust indicator. It is measured as the proportion of a country's population that "agrees" with the statement, "Most people can be trusted". Different studies have employed this variable to evaluate the effect of informal institution on different socioeconomic outcomes (Zak & Knack, 2001; Roy *et al.,* 2014). The variable is directly taken from the CANA Dataset (Castellacci & Natera, 2011).[3] However, the original data comes from the WVS, a cross-country based survey data that is collected since 1981 albeit countries enter the survey at a different point in time. The sample distribution of R&D investment intensities is described in Table 1A, 2A and 3A in the appendix.

In what follows, to test my hypothesis that more external finance dependent and relational risk vulnerable industries experience higher R&D investments in countries with high social trust level compared with those industries in countries with low social trust level, results based on estimating variations of the following equation will be presented:

$$R_{sit} = \delta_s + \delta_i + \delta_t + \theta * T_{it} + \gamma * x_s T_{it} + \varphi * r_s T_{it} + \rho * Ind_{sit} + \tau * inf_{it} + \mu_{sit} \quad (1)$$

where $R_{si,t}$ is R&D investment intensity in industry *s* in country *i*, δ_s is industry fixed effect. δ_i and δ_t are country and year fixed effects, respectively. T_{it} is a country measure of social trust level. x_s is a measure of industry external finance dependence, while r_s is a measure of industry exposure to relational risks. In the baseline regression, I follow Maskus *et al.* (2019) and control for the industry share in GDP computed as industry production divided by GDP. I also account for a country macroeconomic environment using the country inflation rate. Data on industry annual production comes from the OECD's STAN database, while data on GDP and inflation rate come from the World Development Indicators (WDI). Based on the hypothesis, γ and φ are the parameters of interest and are expected to be positive and statistically significant at all time. On

[3] Castellacci and Natera (2011) use imputation methods to fill-in missing observations for different countries. We kindly refer the reader to the article for more detailed description about the data.

the one hand, a positive γ suggests that social trust does reduce credit market frictions thereby expanding firms access to external finance with which they can use to fund R&D. On the other hand, a positive φ suggests that social trust reduces potential relational risks which may reduce firms' research efforts. This identification strategy builds on the seminal work of Rajan & Zingales (1998) that interacted industries' indicator of external finance dependence with a national indicator of financial development to study the impact of financial development on the output growth of credit-constrained industries.

In the robustness section, I further control for a number of variables. First, I control for the overall development of a country using its income per capita. Original data used to compute this indicator come from the Penn World Table version 9. To isolate the effect of social trust from formal contracting institutions, I use the rule of law index from the World Governance Indicator. Data on the variable is only available for a number of countries from 1996. Between the periods 1996-2002, the data is only available on two years interval. To minimize missing observations in these periods, I take averages such that the observation in 1997 is the mean value between 1996 and 1998.[4] I also control for the level of patent rights protection in a country since R&D often yields intangible assets which are protected by patents. For this, I use the Ginarte & Park (1997) index. The index is available on five years interval for a number of countries beginning in 1960. To minimize losing observations, I extrapolate the observations such that the values, say, in 1990 is the same for 1991 until 1994 while the value in 1995 is the same for 1996 until 1999, and so on.[5] Maskus *et al*. (2019), among others, found that (formal) financial development matters decisively for R&D investment. Accordingly, I use the financial development index from the IMF database to proxy the overall financial development of a country. I also use it to isolate the effect of formal financing channel from informal financing channel. To further differentiate the differential effect of social trust in my analysis, I control for each country's human and physical capital level. Data on both variables come the Penn World Table version 9.0. Finally, I isolate the effect of social trust in the credit and relational risks vulnerable industries from other industry characteristics by controlling for other industry characteristics such as skill and capital intensity, and asset tangibility. Data on these variables come from Seitz & Watzinger (2017) and Maskus *et al.* (2019).

[4] In an unreported result, I find that using this index with the missing observations do not change my conclusion.
[5] In an unreported result, I find that using this index with the missing observations do not change my conclusion.

3. Empirical Results

This section proceeds in two sub-sections. The first section presents the baseline regression results, whilst the second section presents the robustness checks on the baseline results.

<<Insert Table 1>>

3.1. Baseline Results

Table 1 displays the baseline result on the effect of social trust level on R&D investment. The dependent variable for each reported regression in the table is industry R&D investment intensity. Before exploring the causal pathways through which social trust level affects investment in R&D, I first conduct a preliminary analysis by estimating the average effect of social trust level on R&D investments. Specifically, I regress industry R&D investment intensities on social trust level excluding the interaction terms comprising "social trust and industry external finance dependence", and "social trust and industry relational risk vulnerability". Column 1 shows the result. The coefficient estimate of social trust is positive and statistically significant at 1 per cent. The magnitude of the coefficient estimate in the column suggests that a one standard deviation expansion in social trust level will increase investment in R&D by 1.07 percentage points.

This result is somewhat consistent with the extant literature which documents a positive association between social trust and innovation (Akçomak & ter Weel, 2009; Kaasa, 2009; Akçomak & Müller-Zick, 2018; Thompson, 2018). However, it extends the literature by providing first empirical evidence on the effect of social trust level on R&D investment, i.e. an innovation input activity, other than on innovation outcomes using the patent count that has been the focus of previous studies. Along this line, the result contributes to the broader literature examining how social trust affects the real sector (Knack & Keefer, 1997; Zak & Knack, 2001; Dearmon & Grier, 2009; 2011). Specifically, this literature has examined the effect of social trust on productivity, and investments in physical and human capital. The result adds to this literature by underling investment in R&D as another pathway social trust affects the real sector. As retrospection, social trust can encourage investments in R&D by encouraging information exchange and collaboration, and reducing transaction costs, external financing constraints and opportunistic behaviours.

Next, Columns 3-5 show the results when I empirically test two of these casual mechanisms, access to external credit and reduction on relational risks, through which social trust can affect R&D investment. I begin by regressing industry R&D investment intensities on social trust level and its interaction with industry external finance dependence in Column 3 and exposure to relational risks in Column 4. In both cases, the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ are positive and statistically significantly different from zero at all conventional level. These suggest that more external finance dependent and relational risks vulnerable industries experience a relatively faster increase in R&D investment in high trusting countries. In Column 5, I jointly include both interaction term variables in a single regression and find that the initial results still hold. Importantly, the respective estimated coefficients of the interaction term variables enter with the same statistical significance level and almost the same magnitude as when included one at a time. These suggest that the two interaction terms identify distinct economic mechanisms through which social trust level determines industry R&D investment intensities. On the one hand, the result on the interaction term comprising social trust and external finance dependence is consistent with my underlying argument that high social trust level reduces borrowers' moral hazard and adverse selection problems which impede access to external credit. On the other hand, the result on the interaction term comprising social trust and industry relational risks vulnerability is consistent with my argument that social trust, as an integral part of contracting institutions, mitigates ex-post holdup or outright intellectual property expropriation that can discourage firms' research efforts.

The results are also economically meaningful. Based on the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ in Column 4, a one standard deviation expansion in the social trust level will increase R&D investment intensities by 1.5 percentage point for an industry at the average external finance dependent (0.254) and by 4.8 percentage point for an industry at the average relational risk exposure (0.48). The sample's cross country-industry average R&D investment intensity is 0.056 percentage point while its maximum value is 4.548 percentage point. Therefore, both the 1.5 and 4.8 percentage points increase in R&D investment intensities are substantial in economic terms. Taking into account the cross country variations in social trust level, the result further suggests that, investment in R&D for an industry with the average external finance dependence will increase by 2.16 per cent in a country with social trust level at the 75th percentile (0.417) compared to a country with social trust level at the 25th percentile (0.246). In the same way, investment in R&D

for an industry with average relational risk exposure will increase by 68.56 per cent in a country with social trust level at the 75th percentile compared to a country with generalized trust level at the 25th percentile. To provide further context, consider moving from a country at the 75th percentile of social trust level to a country at the 25th percentile. This will widen the gap in R&D investment intensities between the industries at the 25th (ISIC 21 – Paper and Paper Products) and 75th (ISIC 32 – Radio, TV and Communication Equipment) percentiles of external finance dependence by 1.75 per cent. Similarly, it will also widen the gap in R&D investment intensities between the industries at the 25th (ISIC 18 – Wearing Apparel and Fur) and 75th (ISIC 33 – Medical, Precision and Optical Instruments, Watches and Clocks) percentiles of relational risk exposure by 5.86 per cent.

Finally, Column 6 substitutes the industry fixed effect with the industry external finance dependence and industry relational risks vulnerability. As expected, both indexes are negative and statistically significant, suggesting that industry credit constraints and relational risks vulnerability reduce investments in R&D.

3.2. Robustness Checks

The baseline result supports the hypothesis that "more external finance dependent and relational risk vulnerable industries experience higher R&D investments in countries with high social trust level compared with those industries in countries with low social trust level". In this section, I subject my main result on causal mechanisms through which social trust affect R&D to different sensitivity tests to ensure the robustness of the results. To conserve space, I only report coefficients that are reported in the baseline result.[6]

<< Table 2>>

3.2.1. Additional Control Variables

[6] In an unreported result, I perform two analysis. First, I log transform the dependent variable. Second, I define R&D intensity as the ratio of R&D expenditure to output. In both cases, the regression results are consistent with the baseline result.

As argued elsewhere (Rajan & Zingales 1998; Kroszner *et al.,* 2007), the empirical approach adopted in this paper is less susceptible to omitted variables bias or model misspecification due to the battery of country, sector and year fixed effects that are controlled for. However, to ensure that the baseline result is not driven by other confounding factors, Table 2 displays the results when I account for additional control variables both at the country and industry level. Panel A emerges when I control for additional country-level variables. Column 1 controls for patent rights protection, financial development, and human capital, while Column 2 further controls for formal institutional quality using the rule of law index. Because of missing observation on some country's patent right protection, the observation in Column 1 falls to 6172 from its previous value of 6214 in Table 1. In addition, due to the lack of observations on the rule of law index between the periods 1990-1995, the number of observations in Column 2 falls markedly to 4688 from its previous value of 6172 in Column 1. Notwithstanding these, the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ are consistently positive and statistically different from zero in Column 1 and 2. The results are consistent with those reported in the baseline result, by suggesting that more external finance dependent and relational risk vulnerable industries experience higher R&D investment intensities in countries with high social trust level compared with those industries in countries with low social trust level.

While the analysis so far focuses on industry external finance dependence and relational risks as two causal pathways social trust affects investments in R&D, it may well be that either of these characteristics correlates with other industry characteristics. If this is the case, the baseline result will be spurious. Accordingly, Panel B emerges when social trust indicator is interacted with other industry characteristics such as skill intensity (Column 3), Asset Tangibility (Column 4), and capital intensity (Column 5). These serve to isolate the causal impact of trust through the credit and relational risk channel from any other channel. Column 6 jointly controls for these additional industry characteristics. In all cases, the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ are positive and statistically significant at one per cent. The results are thus in line with the baseline result.

Finally, Panel C emerges when I use more stringent fixed effects to capture potential omitted time-varying variables at the country and industry level. Column 8 replaces the country fixed effects with country-year fixed effects to control for country time-varying factors that may affect

investment in R&D, while Column 9 replaces the sector fixed effect with sector-year fixed effects to control for potential influences of time-varying industry factors on R&D investments. Column 10 jointly controls for both time-varying country and industry fixed effects. In Columns 7-10, the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ are positive and statistically significant at one per cent. The result is therefore consistent with the baseline results and conclusion.

<<Table 3>>

3.2.2. Is the effect of social trust distinct from other variables

The social trust level in a country may capture other aspects of overall economic development and the quality of institutions more generally. To investigate whether the relationship I find is distinct from any other country or industry characteristics, I interact a variety of other country and industry characteristics with the industry external finance dependence and relational risks vulnerability indexes. The results for this exercise are reported in Table 3. I begin by including two interaction terms comprising "*industry production share in GDP and industry external finance dependence*" and "*industry production share in GDP and industry relational risks vulnerability"* in Column 1. Column 2 also includes two interaction term variables comprising "*inflation rate and industry external finance dependence*" and "*inflation and industry relational risks vulnerability"*. In both cases, the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ continues to be positive and statistically different from zero.

Next, Column 3 includes two interaction terms comprising "*financial development and industry external finance dependence*", and "*financial development and industry relational risk vulnerability*". The interaction terms are introduced to isolate the effect of social trust that may be due to the country's level of (formal) financial development.[7] Column 4 includes two additional interaction terms comprising "*rule of law indicator and industry external finance dependence*", and "*rule of law indicator and industry relational risk vulnerability*". This serves to isolate the effect of social trust level from picking any effect that may be due to the quality of the domestic formal contracting environment. Column 5 includes two additional interaction terms comprising "*per capita GDP and industry external finance dependence*", and "*per capita GDP and industry*

[7] Correlation between both variable is 0.35.

relational risk vulnerability". Income per capita is used here as a catch-up all term for the country's level of development. Hence, the included interaction terms serve to isolate the effect of social trust that may be due to the overall development level of the country. Column 5 jointly includes the interaction terms in Column 3-5. In all the columns, the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ continues to be positive and statistically different from zero, suggesting that external finance dependent and relational risks vulnerable industries experience a faster increase in R&D investment more in high trusting countries.

<<Table 4>>

3.2.3. Different samples

This section tests the robustness of the baseline result to changes in changes in the sample. I begin by testing whether my result is driven by any particular country in my sample. To this end, I estimate twenty different regressions excluding one country at a time. Table 4 reports the result of this exercise. Each row represent an independent regression. The Column titled "Country excluded" indicate the excluded country while performing the regression. In each case, the coefficient estimates of the variables of interest continue to be positive and statistically different from zero which are both consistent with the baseline result. Therefore, these results further suggest the baseline result is not driven by any specific country effect. It is also reassuring that the results are not influenced by the few countries we filled up the missing observations using linear interpolations.

<<Table 5>>

Next, I divide my sample into two using the mean year, 1999, as the cut-off and reevaluate the effect of social trust on R&D investment. Columns 1 and 2 in Table 5 report the results for the two periods: 1990-1998 and 1999-2008. Secondly, I divide the sample into three non-overlapping periods: 1990-1995, 1996-2001, and 2001-2008. Columns 3-5 in Table 5 show the results of this exercise. In all cases, the coefficient estimates of $x_s T_{it}$ and $r_s T_{it}$ continue to be positive and statistically different from zero at all conventional levels. These results suggest that the baseline result is time-independent.

So far, the analysis used panel data. More so, a longer panel data series was achieved by filling in some missing observations for the data on R&D. To ensure that the results are neither artefacts of the data panel structure nor driven by the few missing observations which were filled-up,[8] I transform the data into a time-invariant cross-sectional data by taking the sample averages. I achieve this in two ways. First, I take the averages of the variables over the periods 1990-2008. Secondly, I take the averages of the variables over the periods 1990-2006. Column 3 and 4 report the result of this exercise. In both columns, the initial results remain unchanged.

<<Table 6>>

3.2.4. Endogeneity

Until now, the empirical analysis has been silent about endogeneity issue. This is because I do not consider it a concern in my model. As noted in section 3.2.1 and elsewhere (Rajan & Zingales 1998; Kroszner *et al.,* 2007), the adopted empirical approach reduces potential endogeneity problems. Among others, this is due to the battery of industry, country and year fixed effects the model allows. In addition, section 3.2.1 controlled for time-varying industry and country factors, which further addresses concerns of omitted variable bias. Secondly, while it is clear from the analysis that R&D investment is affected by social trust level, it is unlikely that social trust at the country level would be affected by R&D investment at the 2-digit industry level. This alleviates any concern of reverse causality. A competing argument here would be that through repeated interactions, such as R&D collaboration, norms of trust and reciprocity are formed. While this argument is compelling, it is still unclear whether this would transform into a nationwide trust. Among others, this is because not all R&D activities can impact on social trust, and for those that can, they may either build or erode trust (Xie *et al.,* 2019).[9] Thirdly, the empirical approach adopted in the study traces the R&D investment effect of trust by exploring exogenous variations in industry technological components which are interacted with social trust level. Notwithstanding these, Table 6 reports the result when contemporaneous values of R&D investment intensities are

[8] In an unreported result, I rerun the regression without filling up the missing observations. I also construct a cross-sectional data without the filling up the missing observations. In both cases, the baseline result remain unchanged.

[9] For what it worth, some inter-firm activities that are considered to be born out of trust may be just a mere act of calculated self-interest.

regressed on a period lagged values of social trust level. As can be seen in the table, the results in the columns are consistent with our baseline results.

4. Conclusion

A growing body of literature now examines the relationship between social trust and innovation. This paper extends this literature by evaluating two causal mechanisms, access to external finance and reduction in relational risks, through which social trust can influence innovation activities. Firstly, high trust level can ease firms' credit constraints by reducing moral hazards and information asymmetries problems that can make raising external capital difficult and expensive for firms. Secondly, social trust, as an integral part of a country's overall contracting environment, can reduce relational risks that expose firms to ex-post holdup and/or outright intellectual property expropriation. Using industry-level data on R&D investments in 20 OECD countries over the period spanning 1990-2008, the paper finds suggestive evidence that high social trust level encourages R&D investments. It then tests the two mechanisms within the empirical approach developed by Rajan & Zingales (1998) by evaluating whether external finance dependent and relational risk vulnerable industries experience higher R&D intensities in countries with high social trust level compared with those industries in countries with low social trust level. The results provide robust evidence in support of the hypothesis: high social trust level exerts a positive influence on innovation activities by expanding access to finance and reducing relational risks.

Existing studies on the relationship between trust and innovation have largely focused on innovation outcome using patent count data (Akçomak & ter Weel, 2009; Kaasa, 2009; Akçomak & Müller-Zick, 2018; Thompson, 2018). Among others, this paper expands this literature by suggesting that social trust level leads to improved innovation outcomes, and ultimately economic growth, by incentivizing research effort either through easing credit constraints and/or reducing relational risks of R&D investing firms. It also contributes to the literature examining the impact of trust on investment decisions but has largely focused on investments in human and physical capital (Dearmon & Grier, 2009; 2011). Specifically, it provides evidence on the effect of trust on R&D investment decision, hence showing another way social trust level can influence the real sector of the economy. From a policy perspective, the results underline the importance of informal institutions such as social trust in encouraging R&D investment which has been identified as an

important component of income per capita and long-run productivity growth (Romer, 1990; Grossman & Helpman, 1991; Aghion & Howitt, 1992). Accordingly, it begs the need for governments to identify the drivers of social trust and make concerted efforts in investing in them.

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Table 1 – Social Trust and Investment in R&D: Baseline Regression

This table evaluates the effect of trust on average investment in R&D, and on external finance dependent and relational risks vulnerable industries over the period spanning 1990-2008. The dependent variable in each column is industry R&D investment intensity measured as the ratio of R&D

expenditure to value added. Industry external finance dependence (x_s) is measured as the ratio of capital expenditures less cash flow from operations over capital expenditures. Industry relational risk vulnerability (r_s) *is* measured as the share of its intermediate inputs that are neither traded on organized exchange nor referenced priced in trade journals. Both indexes are computed using data on U.S and they come from Maskus *et al.* (2019) and Seitz & Watzinger (2017), respectively. Industry is defined as the 3-digit ISIC Revision 2. Social trust (T_{it}) variable is taken from the World Value Survey and is measured as the proportion of a country's population that "agrees" with the statement, "Most people can be trusted". *"ind"* is the industry production share in GDP while *"lnf"* is the country inflation rate.

	[1]	[2]	[3]	[4]	[5]
T_{it}	**0.0890**	-0.1141	-0.3969	-0.5005	-0.509
	[0.0236]* **	[0.0946]	[0.1043]***	[0.1112]***	[0.1178]***
$x_s T_{it}$		**0.5621**		**0.4996**	**0.5868**
		[0.1008]* **		**[0.0884]*** **	**[0.0982]*** **
$r_s T_{it}$			**0.8801**	**0.8355**	**0.8087**
			[0.1566]* **	**[0.1491]*** **	**[0.1555]*** **
ind_{sit}	-0.4512	-0.3275	-0.3363	-0.359	-0.1684
	[0.0715]***	[0.0612]***	[0.0624]***	[0.0647]***	[0.0464]***
inf_{it}	-0.0021	0.0006	0.0006	0.0006	0.0006
	[0.0003]***	[0.0004]	[0.0004]	[0.0004]	[0.0004]
x_s					-0.1105
					[0.0306]***
r_s					-0.1308
					[0.0507]***
R-Squared	0.14	0.17	0.18	0.19	0.12
# Observation	6,214	6,214	6,214	6,214	6,214

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors in squared brackets. The columns contain unreported year, country and industry fixed effects.

Table 2 – Social Trust and Investment in R&D: Controlling Additional Variable

This table tests the robustness of the baseline result to controlling for additional country variables in Panel A, additional industry characteristics in Panel B, and using more stringent time-varying country and industry fixed effects in Panel C. The dependent variable in each column is industry R&D investment intensity measured as the ratio of R&D expenditure to value added. Industry external finance dependence (x_s) is measured as the ratio of capital expenditures less cash flow from operations over capital expenditures. Industry relational risk vulnerability (r_s) *is* measured as the share of its intermediate inputs that are neither traded on organized exchange nor referenced priced in trade journals. Both indexes are computed using data on U.S and they come from Maskus *et al.* (2019) and Seitz & Watzinger (2017), respectively. Industry is defined as the 3-digit ISIC Revision 2. Social trust (T_{it}) variable is taken from the World Value Survey and is measured as the proportion of a country's population that "agrees" with the statement, "Most people can be trusted". *"ind"* is the industry production share in GDP while *"lnf"* is the country inflation rate.

	Panel A		**Panel B**				**Panel C**		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
T_{it}	-0.4977	-0.5341	-0.6172	-0.4218	-0.2213	-0.3723	-0.3353	-0.5175	-0.1699
	[0.1117]***	[0.1305]***	[0.1384]***	[0.1658]**	[0.1135]*	[0.1710]**	[0.2672]	[0.1173]***	[0.7608]
$x_s T_{it}$	**0.4981**	**0.5035**	**0.3823**	**0.4692**	**0.3664**	**0.288**	**0.4993**	**0.516**	**0.5158**
	[0.0885]* **	**[0.1036]*** **	**[0.0670]*** **	**[0.1062]*** **	**[0.0800]*** **	**[0.0566]*** **	**[0.0899]*** **	**[0.0915]*** **	**[0.0931]*** **
$r_s T_{it}$	**0.836**	**0.7883**	**0.5865**	**0.7962**	**0.6608**	**0.4757**	**0.8358**	**0.8695**	**0.8698**
	[0.1491]* **	**[0.1711]*** **	**[0.1166]*** **	**[0.1684]*** **	**[0.1331]*** **	**[0.0855]*** **	**[0.1510]*** **	**[0.1541]*** **	**[0.1561]*** **
ind_{it}	-0.3634	-0.3596	-0.4034	-0.3529	-0.3304	-0.3734	-0.351	-0.3489	-0.3355
	[0.0654]***	[0.0743]***	[0.0734]***	[0.0659]***	[0.0639]***	[0.0728]***	[0.0671]***	[0.0730]***	[0.0742]***
Inf_{it}	-0.0001	0.0011	0.0006	0.0006	0.0006	0.0006	0.0075	0.0005	0.0146
	[0.0004]	[0.0007]	[0.0004]	[0.0004]	[0.0004]	[0.0004]	[0.0219]	[0.0004]	[0.0666]
R-Squared	0.19	0.19	0.19	0.19	0.19	0.19	0.22	0.23	0.24
# Observation	6,172	4,688	6,214	6,214	6,214	6,214	6,214	6,214	6,214

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors in squared brackets. Columns 1-6 contain unreported year, country and industry fixed effects. Column 7 contains unreported sector and year fixed effects, and time-varying country fixed effects. Column 8 contains unreported country and year fixed effects, and time-varying sector fixed effects. Column 7 contains unreported sector and year fixed effects, and time-varying country fixed effects. Column 9 contains unreported year and time-varying country and sector fixed effects.

Table 3 - Social Trust and Investment in R&D: Distinguishing the effect of Social Trust

This table tests the robustness of the baseline result by distinguishing the effect of social trust from other industry and country characteristics. The dependent variable in each column is industry R&D investment intensity measured as the ratio of R&D expenditure to value added. Industry external finance dependence (x_s) is measured as the ratio of capital expenditures less cash flow from operations over capital expenditures. Industry relational risk vulnerability (r_s) *is* measured as the share of its intermediate inputs that are neither traded on organized exchange nor referenced priced in trade journals. Both indexes are computed using data on U.S and they come from Maskus *et al.* (2019) and Seitz & Watzinger (2017), respectively. Industry is defined as the 3-digit ISIC Revision 2. Social trust (T_{it}) variable is taken from the World Value Survey and is measured as the proportion of a country's population that "agrees" with the statement, "Most people can be trusted". *"ind"* is the industry production share in GDP while *"lnf"* is the country inflation rate.

	Industry Production share in GDP	Inflation Rate	Financial Development	Rule of Law	GDP Pc	All
	[1]	[2]	[3]	[4]	[5]	[6]
T_{it}	-0.4885	-0.4342	-0.3755	-0.4448	-0.2523	-0.3969
	[0.1110]***	[0.1106]***	[0.1012]***	[0.1326]***	[0.1151]**	[0.1704]**
$x_s T_{it}$	**0.4914**	**0.4543**	**0.3724**	**0.4354**	**0.2859**	**0.4428**
	[0.0887]* **	**[0.0910]*** **	**[0.0766]*** **	**[0.1109]*** **	**[0.1043]*** **	**[0.1660]*** **
$r_s T_{it}$	**0.8167**	**0.7192**	**0.6514**	**0.6533**	**0.4379**	**0.552**
	[0.1493]* **	**[0.1510]*** **	**[0.1287]*** **	**[0.1846]*** **	**[0.1744]** **	**[0.2778]** **
ind_{it}	0.3962	-0.4065	-0.42	-0.3653	-0.4024	-0.375
	[0.2344]*	[0.0648]***	[0.0691]***	[0.0747]***	[0.0647]***	[0.0746]***
Inf_{it}	0.0005	0.0052	0.0006	0.0009	0.0005	0.0008
	[0.0004]	[0.0009]***	[0.0004]	[0.0005]*	[0.0004]	[0.0006]
R-Square	0.19	0.19	0.20	0.20	0.19	0.20
# Observation	6,214	6,214	6,214	4,688	6,214	4,688

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors in squared brackets. The columns contain unreported year, country and industry fixed effects

Table 4 - Social Trust and Investment in R&D: Testing for Country Effect

This table tests whether the baseline result is driven by a country effect. It tests the robustness of the baseline result by dropping the countries in the sample one at a time while regressing the R&D investment intensities on the response variables. The dependent variable in each column is industry R&D investment intensity measured as the ratio of R&D expenditure to value added. Industry external finance dependence (x_s) is measured as the ratio of capital expenditures less cash flow from operations over capital expenditures. Industry relational risk vulnerability (r_s) *is* measured as the share of its intermediate inputs that are neither traded on organized exchange nor referenced priced in trade journals. Both indexes are computed using data on U.S and they come from Maskus *et al.* (2019) and Seitz & Watzinger (2017), respectively. Industry is defined as the 3-digit ISIC Revision 2. Social trust (T_{it}) variable is taken from the World Value Survey and is measured as the proportion of a country's population that "agrees" with the statement, "Most people can be trusted". *"ind"* is the industry production share in GDP while *"Inf"* is the country inflation rate.

Country Excluded	T_{it}	$x_s T_{it}$	$r_s T_{it}$	ind_{it}	Inf_{it}	R-Squared	# Observation
Austria	-0.2856	**0.2871**	**0.4612**	-0.1188	-0.0001	0.11	6,005
	[0.0993]***	**[0.0278]*** **	**[0.0432]*** **	[0.0363]***	[0.0003]		
Belgium	-0.2857	**0.2854**	**0.4571**	-0.1183	-0.0001	0.11	5,983
	[0.1002]***	**[0.0278]*** **	**[0.0431]*** **	[0.0380]***	[0.0003]		
Canada	-0.2943	**0.3004**	**0.4614**	-0.0926	-0.0001	0.11	5,954
	[0.1027]***	**[0.0287]*** **	**[0.0448]*** **	[0.0359]***	[0.0003]		
Czech Rep.	-0.2973	**0.2968**	**0.471**	-0.1405	-0.0001	0.11	5,878
	[0.1000]***	**[0.0280]*** **	**[0.0432]*** **	[0.0395]***	[0.0003]		
Germany	-0.2812	**0.29**	**0.4478**	-0.1353	-0.0001	0.10	5,836
	[0.1018]***	**[0.0287]*** **	**[0.0444]*** **	[0.0368]***	[0.0003]		
Spain	-0.2858	**0.2987**	**0.4736**	-0.1249	-0.0001	0.11	5,836
	[0.1149]**	**[0.0286]*** **	**[0.0441]*** **	[0.0388]***	[0.0003]		
Finland	-0.3145	**0.2862**	**0.4989**	-0.0957	-0.0001	0.11	5,948
	[0.1054]***	**[0.0285]*** **	**[0.0448]*** **	[0.0369]***	[0.0003]		
France	-0.2733	**0.2758**	**0.4424**	-0.1377	-0.0001	0.10	5,836
	[0.1010]***	**[0.0277]*** **	**[0.0430]*** **	[0.0369]***	[0.0003]		
United King.	-0.3087	**0.2928**	**0.4828**	-0.1144	-0.0001	0.11	5,980
	[0.1047]***	**[0.0283]*** **	**[0.0442]*** **	[0.0359]***	[0.0003]		
Greece	-0.2597	**0.2824**	**0.4508**	-0.1101	0.0003	0.12	5,836
	[0.0972]***	**[0.0274]*** **	**[0.0424]*** **	[0.0363]***	[0.0003]		
Hungary	-0.3008	**0.2913**	**0.476**	-0.1285	-0.0001	0.11	5,900
	[0.1014]***	**[0.0277]*** **	**[0.0429]*** **	[0.0392]***	[0.0004]		
Ireland	-0.3022	**0.2986**	**0.4768**	-0.0555	-0.0001	0.11	5,890
	[0.1042]***	**[0.0282]*** **	**[0.0442]*** **	[0.0379]	[0.0003]		
Iceland	-0.3101	**0.2908**	**0.4881**	-0.1422	-0.0001	0.12	5,853
	[0.0984]***	**[0.0275]*** **	**[0.0442]*** **	[0.0428]***	[0.0003]		
Italy	-0.2892	**0.2953**	**0.4634**	-0.1119	-0.0001	0.11	5,836
	[0.1014]***	**[0.0284]*** **	**[0.0439]*** **	[0.0378]***	[0.0003]		
Japan	-0.2856	**0.2749**	**0.4661**	-0.1084	0.0000	0.1	5,948
	[0.1008]***	**[0.0289]*** **	**[0.0453]*** **	[0.0358]***	[0.0003]		
Mexico	-0.2956	**0.2936**	**0.4729**	-0.1249	0.0000	0.11	5,941
	[0.1086]***	**[0.0275]*** **	**[0.0427]*** **	[0.0380]***	[0.0004]		
Netherlands	-0.2508	**0.229**	**0.3488**	-0.0824	0.0000	0.13	5,836
	[0.0621]***	**[0.0167]*** **	**[0.0211]*** **	[0.0293]***	[0.0003]		
Norway	-0.2902	**0.292**	**0.4774**	-0.1039	-0.0001	0.11	5,976
	[0.1036]***	**[0.0297]*** **	**[0.0469]*** **	[0.0359]***	[0.0003]		
Poland	-0.2943	**0.2931**	**0.4707**	-0.1358	-0.0001	0.11	5,920
	[0.1016]***	**[0.0276]*** **	**[0.0426]*** **	[0.0387]***	[0.0004]		
Portugal	-0.3455	**0.3069**	**0.4966**	-0.1028	-0.0003	0.13	5,874
	[0.0976]***	**[0.0270]*** **	**[0.0413]*** **	[0.0375]***	[0.0002]		

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors in squared brackets. The columns contain unreported year, country and industry fixed effects

Table 5 - Social Trust and Investment in R&D: Shorter Time Panel and Cross-Sectional Analysis

This table tests the robustness of the baseline result by breaking the original sample into shorter time periods and a time invariant cross-sectional data. The dependent variable in each column is industry R&D investment intensity measured as the ratio of R&D expenditure to value added. Industry external finance dependence (x_s) is measured as the ratio of capital expenditures less cash flow from operations over capital expenditures. Industry relational risk vulnerability (r_s) *is* measured as the share of its intermediate inputs that are neither traded on organized exchange nor referenced priced in trade journals. Both indexes are computed using data on U.S and they come from Maskus *et al.* (2019) and Seitz & Watzinger (2017), respectively. Industry is defined as the 3-digit ISIC Revision 2. Social trust (T_{it}) variable is taken from the World Value Survey and is measured as the proportion of a country's population that "agrees" with the statement, "Most people can be trusted". *"ind"* is the industry production share in GDP while *"lnf"* is the country inflation rate.

	Shorter Time Panel					Cross-Section	
	[1990-1998]	[1999-2008]	[1990-1995]	[1996-2001]	[2001-2008]	[1990-2008]	[1990-2006]
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
T_{it}	-0.1384	-0.3172	-0.0895	-0.1767	-0.326	-0.2966	-0.2102
	[0.1053]	[0.1476]**	[0.1659]	[0.2049]	[0.1868]*	[0.0818]***	[0.1644]
$x_s T_{it}$	**0.1837**	**0.3635**	**0.1481**	**0.2681**	**0.3939**	**0.3552**	**0.3807**
	[0.0235]***	**[0.0431]*****	**[0.0272]*****	**[0.0395]*****	**[0.0553]*****	**[0.0990]*****	**[0.1015]*****
$r_s T_{it}$	**0.1765**	**0.4085**	**0.1081**	**0.3497**	**0.4025**	**0.2931**	**0.5624**
	[0.0432]***	**[0.0720]*****	**[0.0524]****	**[0.0684]*****	**[0.0915]*****	**[0.0817]*****	**[0.1738]*****
ind_{it}	-0.0884	-0.1659	-0.0755	-0.1387	-0.1711	-0.0073	-0.0439
	[0.0487]*	[0.0551]***	[0.0718]	[0.0585]**	[0.0695]**	[0.1220]	[0.1730]
inf_{it}	0.0003	0.0013	-0.0005	0.0001	0.0025	-0.053	-0.0054
	[0.0006]	[0.0012]	[0.0016]	[0.0007]	[0.0028]	[0.0220]**	[0.0020]***
R-Squared	0.14	0.13	0.12	0.16	0.13	0.36	0.16
# Observation	2,601	3,613	1,526	2,230	2,458	227	385

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors in squared brackets. The columns contain unreported year, country and industry fixed effects

Table 6 - Social Trust and Investment in R&D: Lagged Values of Trust

This table tests the robustness of the baseline result by regressing R&D investment intensities on a period lagged values of social trust. The dependent variable in each column is industry R&D investment intensity measured as the ratio of R&D expenditure to value added. Industry external finance dependence (x_s) is measured as the ratio of capital expenditures less cash flow from operations over capital expenditures. Industry relational risk vulnerability (r_s) *is* measured as the share of its intermediate inputs that are neither traded on organized exchange nor referenced priced in trade journals. Both indexes are computed using data on U.S and they come from Maskus *et al.* (2019) and Seitz & Watzinger (2017), respectively. Industry is defined as the 3-digit ISIC Revision 2. Social trust (T_{it}) variable is taken from the World Value Survey and is measured as the proportion of a country's population that "agrees" with the statement, "Most people can be trusted". *"ind"* is the industry production share in GDP while *"lnf"* is the country inflation rate.

	[1]	[2]	[3]
T_{it-1}	-0.1141	-0.3984	-0.5053
	[0.1226]	[0.1317]***	[0.1379]***
$x_s T_{it-1}$	**0.5697**		**0.5093**
	[0.1044]***		**[0.0919]*****
$r_s T_{it-1}$		**0.8918**	**0.8485**
		[0.1635]***	**[0.1560]*****
ind_{it}	-0.3512	-0.3529	-0.3759
	[0.0643]***	[0.0650]***	[0.0674]***
inf_{it}	0.0007	0.0007	0.0007
	[0.0005]	[0.0005]	[0.0005]
R-Squared	0.17	0.18	0.19
# Observations	5,830	5,830	5,830

* p<0.1; ** p<0.05; *** p<0.01. Robust standard errors in squared brackets. The columns contain unreported year, country and industry fixed effects

Appendix

Table 1A: Summary Statistics

This table presents basic summary statistics for the main variables employed in the empirical analysis.

Variable	# Observations	Mean	Std. Dev.	Min	Max	p(25)	p(75)
R&D Intensities (*R*)	6,305	0.056	0.173	0.000	4.548	0.004	0.048
Trust (*T*)	6,311	0.344	0.120	0.100	0.742	0.246	0.417
Finance Dependence	6,311	0.254	0.253	-0.121	0.944	0.123	0.328
Contract Dependence	6,311	0.480	0.224	0.070	0.910	0.280	0.690
Industry Share in GDP	6,215	0.026	0.028	0.000	0.232	0.008	0.032
Inflation Rate	6,311	4.424	5.357	-0.923	34.999	1.810	4.592

Table 2A: Correlation Matrix

This table presents correlation matrix for the main variables employed in the empirical analysis

	R&D Intensities	Trust	Finance Dependence	Contract Dependence	Industry Share in GDP	Inflation Rate
R&D Intensities	1.000					
Trust	0.079	1.000				
Finance Dependence	0.132	-0.050	1.000			
Contract Dependence	0.193	0.024	0.046	1.000		
Industry Share in GDP	-0.065	-0.061	-0.017	-0.175	1.000	
Inflation Rate	-0.086	-0.309	0.015	-0.011	0.025	1.000

Table 3A: Basic Country Characteristics

This table reports basic summary statistics on social trust level and R&D intensities for all countries in the sample used in the empirical analysis.

		Trust			R&D		
Countries	# Observations	Mean	Min	Max	Mean	Min	Max
Austria	209	0.331	0.303	0.351	0.068	0.002	0.454
Belgium	231	0.317	0.281	0.351	0.070	0.001	0.504
Canada	260	0.453	0.388	0.479	0.060	0.000	0.542
Czech Republic	336	0.268	0.239	0.285	0.025	0.000	0.360
Germany	378	0.347	0.320	0.378	0.072	0.001	0.487
Spain	399	0.318	0.200	0.385	0.031	0.000	0.183
Finland	266	0.564	0.488	0.627	0.032	0.000	0.162
France	378	0.231	0.188	0.258	0.100	0.000	0.540
United Kingdom	234	0.365	0.297	0.436	0.085	0.004	0.318
Greece	378	0.249	0.213	0.276	0.043	0.000	3.688
Hungary	314	0.243	0.218	0.272	0.010	0.000	0.120
Ireland	394	0.392	0.358	0.474	0.027	0.000	0.386
Iceland	361	0.423	0.404	0.437	0.069	0.000	2.600
Italy	378	0.309	0.277	0.337	0.039	0.000	0.481
Japan	266	0.417	0.391	0.460	0.113	0.006	0.446
Mexico	273	0.222	0.156	0.312	0.004	0.000	0.034
Netherlands	378	0.505	0.450	0.598	0.133	0.000	4.548
Norway	238	0.659	0.633	0.742	0.072	0.002	0.515
Poland	294	0.214	0.179	0.247	0.011	0.000	0.073
Portugal	340	0.168	0.100	0.214	0.059	0.000	1.917

Table 4A: Basic Industry Characteristics

This table presents average industry R&D intensities and industry share in GDP. It also present industry values on contract and Finance dependence which are used in the empirical analysis. Data on industry contract dependence comes from Seitz & Watzinger (2017). It is measured for each industry as the share of its intermediate inputs that are neither traded on organized exchange nor referenced priced in trade journals. Data on industry Finance dependence is from Maskus *et al.* (2019). It is measured for each industry as the industry's ratio of capital expenditures less cash flow from operations over capital expenditures. Both indexes are computed using data on U.S.

ISIC	ISIC Description	RDI Intensities	Industry Production Share in GDP	Contract Dependence	External Finance Dependence
15	Food products and beverages	0.008	0.104	0.16	0.181
16	Tobacco products	0.008	0.003	0.20	0.944
17	Textiles	0.015	0.014	0.46	0.262
18	Wearing apparel and fur	0.008	0.012	0.28	0.174
19	Leather, leather products and footwear	0.029	0.006	0.55	0.098
20	Wood and cork (except furniture)	0.005	0.014	0.45	0.156
21	Paper and paper products	0.009	0.019	0.50	0.123
22	Publishing, printing and reprod. of recorded media	0.002	0.026	0.74	0.096
23	Coke, refined petrol. products and nuclear fuel	0.073	0.028	0.07	-0.044
24	Chemicals and chemical products	0.101	0.053	0.26	0.791
25	Rubber and plastics products	0.026	0.020	0.29	0.300
26	Other non-metallic mineral products	0.012	0.022	0.35	-0.121
27	Basic metals	0.019	0.033	0.25	0.147
28	Fabricated metal products (exc. mach, and equip.)	0.009	0.032	0.43	0.166
29	Machinery and equipment nec	0.044	0.040	0.72	0.076
30	Office, accounting and computing machinery	0.232	0.014	0.79	0.502
31	Electrical machinery and apparatus nec	0.081	0.021	0.58	0.137
32	Radio, TV and communication equipment	0.189	0.021	0.91	0.328
33	Medical, precision and optical instruments, watches and clocks	0.105	0.009	0.69	0.643
34	Motor Vehicles	0.071	0.047	0.70	0.394
35	Other transport equipment	0.100	0.012	0.58	0.124