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Abstract

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Keywords: Social trust, Innovation, Incomplete contracting

JEL Classifications: F39, G39, O31, O47

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Abstract

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1. Introduction

Countries grow at vastly different rates. A powerful engine for economic growth is technological innovation (Chang et al., 2018; Kogan et al., 2017). Therefore, understanding the forces driving innovation can shed light on what accounts for the disparity in economic development observed around the world. Prior research has documented a number of country-specific determinants of innovation that can be mostly characterized as formal institutions, such as bankruptcy regimes, shareholder rights, labor laws, financial development, and stock market liberalization.[1] However, it is not clear whether a country's informal institutions, such as social capital, have any impact on innovation, and if so, through what channels the impact takes place.[2] This is surprising given that innovation is a contract intensive economic activity (Aghion and Tirole, 1994) and social capital constitutes an integral part of a country's overall contracting environment (Guiso, Sapienza, and Zingales, 2004). We fill this void by focusing on trust, a key dimension of social capital, and investigating if and how it affects corporate innovation.

Trust is defined as the subjective belief that an individual assigns to the event that a potential counterparty takes an action that is at least not harmful to that individual (Gambetta, 1988).[3] Our first hypothesis postulates that a higher level of trust in a society enhances innovation. Innovation is a contract intensive endeavor that requires inputs from multiple parties such as employee-inventors, firms, and investors (Aghion and Tirole, 1994). Its success depends on the effectiveness of contracts that govern the relationships among these parties. Incomplete contracting thus represents a major obstacle to the innovation process. This problem is further exacerbated by the high investment risk and information asymmetry associated with innovation, as these elements make it more difficult to clearly delineate the ownership of intellectual assets, the division of control rights, and the allocation of returns. Under such conditions, trust can act as an informal contracting mechanism and play an economically important role in mitigating the incomplete contracting problem (Williamson, 1993; Carlin, Dorobantu, and Viswanathan, 2009).

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[1] See, e.g., Acharya and Subramanian (2009), Brown, Martinsson, and Petersen (2013), Acharya, Baghai, and Subramanian (2013), Hsu, Tian, and Xu (2014), and Moshirian et al. (2019).

[2] Guiso, Sapienza, and Zingales (2006, 2010) synthesize and improve upon a number of different definitions of social capital proposed in the sociology and economics literatures. They define social capital as "persistent and shared beliefs and values that help a group overcome the free rider problem in the pursuit of socially valuable activities."

[3] As with other aspects of culture, trust is deeply rooted in individuals' ethnic, religious, familial, and social backgrounds and is a relatively persistent behavioral trait (Putnam, 1993; Fukuyama, 1995; Guiso, Sapienza, and Zingales, 2006, 2010). It has also been shown that trust acts as a substitute for formal institutions at the country level (Guiso, Sapienza, and Zingales, 2004; Carlin, Dorobantu, and Viswanathan, 2009; and Aghion et al., 2010).

More specifically, there are three reasons why trust can facilitate innovation. First, one of the keys to innovation success is collaboration, where inventors within a firm or across firms contribute their efforts, resources, knowledge, and capabilities toward a common objective (e.g., Fountain, 1998; Dovey, 2009). However, when inventors are concerned about opportunistic behavior by collaborating partners, such as shirking, ex-post holdup, and intellectual property expropriation, they may have less incentive to make relationship-specific investments (Khanna and Mathews, 2016; Fang, Lerner, and Wu, 2017). In high trust countries, we expect inventors to be more willing to contribute and share resources and expertise with each other, because they consider opportunistic behaviors by their partners less likely. Greater contribution and freer exchange of intellectual inputs can increase the likelihood and efficiency of collaboration and lead to higher innovation output. We label this view *the collaboration channel*.

Second, both theory (Manso, 2011) and experimental evidence (Ederer and Manso, 2013) suggest that optimal incentive contracts that motivate innovation should exhibit substantial tolerance for failure and reward long-term success. A high level of trust from investors can provide firms with more insurance against early failure, because investors in high-trust environments are less likely to attribute bad outcomes to managerial opportunism and penalize managers for unsuccessful innovation efforts. Consistent with this notion, Hilary and Huang (2015) show that firms located in areas with higher social trust utilize lower-powered executive compensation schemes and are less likely to fire their CEOs for poor performance, implying that trust can be a substitute for formal incentive contracts in encouraging more risk taking by managers. The same argument applies to the employer-employee relationship as well. According to a survey conducted among 16,000 employees in 17 countries by the advisory firm, LRN, high-trust companies are deemed 11 times more innovative than their peers by the respondents. LRN summarizes its survey results as "*when innovation fails, it's because companies don't put enough faith in employees to let them take risks*."[4] Taken together, we posit that a high trust environment is more conducive to innovation because it fosters greater tolerance for short-term failure and encourages managers and employees to take more risk. We term this view *the failure tolerance channel*.

Third, innovative firms typically have an expanded set of investment opportunities. As a result, they are likely to exhaust internal capital and rely heavily on external finance (Brown,

[4] Why trust motivates employees more than pay – Jennifer Reingold (*Fortune*, April 27, 2016).

Fazzari, and Petersen, 2009; Brown, Martinsson, and Petersen, 2012). When financial markets cannot observe the full spectrum of managerial actions, managers tend to steer their investment choices toward safer and shorter-term ones to mitigate information asymmetry and funding difficulties. A higher level of trust reduces investors' concern about managerial moral hazard and increases the supply of capital (Guiso, Sapienza, and Zingales, 2008a; Bottazzi, Da Rin, and Hellmann, 2016; Giannetti and Wang, 2016; Levine, Lin, and Xie, 2017; Dudley et al., 2017). Thus, trust can promote corporate innovation by increasing firms' access to external finance and allowing them to pursue riskier and longer-term investments. We call this view *the funding channel*.

By contrast, our second hypothesis argues that a higher level of trust in a society may impede corporate innovation. A healthy dose of skepticism among collaborating parties during the course of creative discovery and decision making is essential to innovation. Peer challenging and monitoring can lead to elevated efforts, refined ideas, and improved processes, thereby increasing the odds of successful and impactful innovation. When collaborating parties are too trusting of each other, they can develop affinity and underinvest in mutual monitoring and challenging. As a result, innovation efforts may fail to achieve the desired outcomes. Similarly, in the investor-firm or firm-employee relationship, when principals are too trusting of agents, they may underinvest in monitoring efforts, resulting in reduced incentives for agents to expend the necessary time, energy, and resources on developing impactful innovations.[5]

To test our two competing hypotheses, we construct a large international sample of 10,067 country-industry-year observations based on both publicly traded and privately held firms across 41 countries over the 1991-2008 period. Following the prior literature (La Porta et al., 1997; Guiso, Sapienza, and Zingales, 2008a, b; Ahern, Daminelli, and Fracassi, 2015; Pevzner, Xie, and Xin, 2015), we measure social trust as the average response in each country-year to the following question in the World Values Surveys (WVS): "*Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people*?" To measure innovation output, we collect global patent information from the Orbis patent database. This dataset allows us to observe both the number of patents a country generates and the number

[5] Butler, Giuliano, and Guiso (2016) find a hump-shaped relation between trust and economic performance at the individual level. Their interpretation is that individuals who are too trusting of others tend to assume extremely high social risk and be cheated more often, ultimately performing less well than those with a belief close to the mean trustworthiness of the population.

of citations these patents receive post-registration. Therefore, we are able to explore the effect of social trust on both the quantity and quality of innovation output.

Our analysis shows that industry-level innovation output is significantly and positively related to the level of trust in a country. More importantly, we find a stronger relation between industry-level innovation output and social trust for industries with greater innovation potential. This cross-industry variation suggests that trust enhances an industry's innovation output by harnessing and unleashing the industry's innovative potential. In particular, a one standard deviation increase in a country's social trust leads to 10% more patents and 13% more patent citations (relative to their respective sample means) in high innovation potential industries vs. low innovation potential industries. Our findings continue to hold in an extensive set of robustness checks using alternative model specifications and measures of trust and innovation output.

Endogeneity is an important consideration of our empirical analysis, because social trust is related to many country-level characteristics, some of which can be unobservable and difficult to control for. Therefore, the relation we document between trust and innovation may be the artifact of these omitted variables missing from our empirical models. We employ two approaches to address the endogeneity concerns. First, we augment our baseline regressions by controlling for additional country-level characteristics as well as paired country-year and industry-year fixed effects. This strategy ensures that our results are not driven by either time-invariant or time-varying country and industry attributes that may be simultaneously correlated with trust and innovation. Second, we follow Algan and Cahuc (2010) and construct an inherited trust measure. Because this measure captures a component of trust that is passed by early immigrants who moved from foreign countries to the U.S. many decades ago to their U.S. descendants, it is unlikely to be contaminated by those countries' current conditions that drive innovation. We then examine the relation between inherited trust and innovation. Our findings remain intact through all these tests.

In further analysis, we provide evidence on three underlying economic channels through which social trust promotes innovation, namely, *the collaboration channel*, *the failure tolerance channel*, and *the funding channel*. First, we find that the effect of trust on innovation is more pronounced in countries with weaker contract enforceability and poorer intellectual property protection. This evidence suggests that as an informal contracting mechanism, trust can assuage inventors' concern about intellectual property expropriation and ex-post holdup, thereby encouraging more collaboration and spurring more innovation. Second, social trust plays a more important role in enhancing innovation in countries with creditor-friendly bankruptcy regimes and weaker employee protection. This finding supports the failure tolerance channel that trust promotes corporate innovation by alleviating firms' and employees' concerns about potentially high costs of innovation failure. Third, the impact of trust on innovation is more pronounced among countries where corporate information environments are more opaque due to poor financial disclosure and weak accounting standards. This finding is consistent with the funding channel that trust mitigates information asymmetry and reduces investors' concern about moral hazard, thereby increasing firms' access to external capital.

Overall, our findings represent the first large-sample multi-country evidence that trust has an economically important effect on corporate innovation activities. Furthermore, our study imparts a deeper understanding of the relation between trust and innovation by proposing and substantiating several specific channels through which trust can impact innovation. As such, we contribute to two major strands of literature in economics and finance: one on how economic decisions and performance relate to culture and in particular trust,[6] and the other on economic factors driving innovation.[7]

Given the critical role of innovation as the engine for value creation and growth for individual firms and national economies, our findings shed light on a direct mechanism underlying the real beneficial effects of trust previously documented in the literature.[8] In addition, while prior research has identified a number of country-level determinants of innovation, our study highlights that a country's informal institutions, in particular social trust, affect innovation output as well. In fact, our results indicate that trust plays an especially prominent role when formal

[6] In addition to macroeconomic growth and firm performance, social capital and trust have been linked to international trade and investment (Guiso, Sapienza, and Zingales, 2009), financial development (Guiso, Sapienza, and Zingales, 2004, 2008a), financing decisions (Duarte, Siegel, and Young, 2012; Bottazzi, Da Rin, and Hellmann, 2016), mergers and acquisitions (Ahern, Daminielli, and Fracassi, 2015), corporate earnings announcements (Pevzner, Xie, and Xin, 2015), and international portfolio holdings (Karolyi, 2016).

[7] These factors include, e.g., creditor rights (Acharya and Subramanian, 2009), shareholder protection (Brown, Martinsson, and Petersen, 2013), labor laws (Acharya, Baghai, and Subramanian, 2013), financial market development (Hsu, Tian, and Xu, 2014), stock market liberalization (Moshirian et al., 2019), and religious beliefs (Benabou, Ticchi, and Vindigni, 2015).

[8] Prior research finds that social capital affects economic performance at both the country (Knack and Keefer, 1997; La Porta et al., 1997; Zak and Knack, 2001) and the firm (Guiso, Sapienza, and Zingales, 2015; Lins, Servaes, and Tamayo, 2017) levels.

laws and regulations are lacking, suggesting that trust can help mitigate the incomplete contracting problem and facilitate contract-intensive economic activities such as innovation.

2. Data, variables, and sample

2.1. Data and sample

We construct our innovation output measures based on Bureau van Dijk's Orbis patent database, which records global patents filed to 94 regional, national, and international patent offices.[9] The source of the database is the Worldwide Patent Statistical Database (PATSTAT) maintained by the European Patent Office (EPO). The Orbis patent database links 36 million ultimately granted patents to both public and private firms in the Orbis database from 1850 to 2012.

The Orbis patent database has a much wider coverage than the National Bureau of Economic Research (NBER) Patent and Citation database because the NBER database only records patent filings to the U.S. Patent and Trademark Office (USPTO). Previous international studies on innovation, e.g., Acharya and Subramanian (2009), Hsu, Tian, and Xu (2014), and Acharya, Baghai, and Subramanian (2014), mainly rely on the NBER database to construct innovation output measures. However, as acknowledged in these studies, doing so may lead to a sampling bias because firms in many countries, especially emerging economies, do not file patent applications to the USPTO and this bias varies across countries and over time (Chang et al., 2018; Koh et al., 2016). The Orbis database mitigates this bias because it covers patents filed by firms to both domestic and overseas patent offices.

We measure social trust using data from the World Values Surveys (WVS). We obtain industry-level data at the two-digit International Standard Industrial Classification (ISIC) from the United Nations Industrial Development Organization (UNIDO) Industrial Statistics database and country-level data from the World Development Indicator (WDI) database compiled by the World Bank.

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[9] Compared to the National Bureau of Economic Research (NBER) Patent and Citation database compiled based on information from the United States Patent and Trademark Office (USPTO), the Orbis database has a much broader coverage. In addition to the patents filed in the U.S. administrated by the USPTO, the Orbis database covers patents filed in 93 non-U.S. patent offices (including national patent offices and regional and international organizations, such as the European Patent Office (EPO) and the African Intellectual Property Organization). Therefore, we can more comprehensively measure a country's innovation level using the Orbis database. Nevertheless, our results are robust to using patents from the NBER's USPTO database (see Section 3.4 and the Internet Appendix Table IA8).

Our initial sample consists of all industries in countries that are jointly covered by the Orbis, WVS, UNIDO, and WDI databases. We match patent data with industry-level data using the crosswalk from the International Patent Classification (IPC) to the ISIC provided by Lybbert and Zolas (2014). We further filter the sample according to the following criteria. First, due to the limited coverage of the UNIDO database, our sample only includes manufacturing industries with two-digit ISIC codes from 15-37.[10] Second, similar to previous studies, e.g., Hirshleifer, Low, and Teoh (2012), we exclude countries that have no patent at all during the entire sample period. Third, in accordance with prior studies (e.g., Acharya and Subramanian, 2009, Hsu, Tian, and Xu, 2014, and Moshirian et al., 2019), we remove the U.S. from our sample but use the patent filings by U.S. firms as a control for the global trend in industry-level patenting activities and innovation potential.

Our final sample consists of 23 industries in 41 countries from 1991-2008. The sample period begins in 1991 because the WVS data cover few countries prior to 1990 and we lag the trust measure by one year in our analysis. The sample period ends in 2008 because the UNIDO data are incomplete after 2008. Due to missing values for the trust measure and control variables, our main sample is an unbalanced panel with 10,067 industry-country-year observations.

2.2. Measuring innovation output

Following previous studies (e.g., Aghion, Van Reenen, and Zingales, 2013; Seru, 2014), we measure innovation output using two proxies. The first proxy is the number of successful patent applications by firms in each ISIC industry-country-year cohort (*Patent*). We use the patent application date rather than the grant date in the analysis because the application date is closer to the actual time of inventions compared to the grant date (Hall, Jaffe, and Trajtenberg, 2001). Although innovation output is not directly observable, patents offer a good indicator of the level of innovation output since patenting is one of the most important ways for firms to protect their intellectual property.[11] However, a firm may protect its inventions in multiple jurisdictions by

[10] Manufacturing industries are the most innovative industries according to the 2008 Business R&D and Innovation Survey by the National Science Foundation (available at http://www.nsf.gov/statistics/infbrief/nsf11300). Furthermore, patenting innovation is important to manufacturing industries because these industries heavily rely on patents as a means of appropriating new technologies (Cohen, 1995).

[11] Another measure of firms' innovation activities is research and development (R&D) expenditure, which mainly captures the quantitative input to the innovation process (Aghion, Van Reenen, and Zingales, 2013). However, data availability is better for patents than for R&D expenditure, especially for non-U.S. firms (e.g., Koh and Reeb, 2015; Koh et al., 2016). Koh and Reeb (2015) find that many innovative U.S. firms strategically avoid reporting R&D expenditures in their financial statements. Non-U.S. firms are even more likely to have such reporting discretion

filing patent applications to patent offices in different countries, all of which are recorded by the Orbis patent database. We deal with this issue by counting one patent per innovation. For example, if a U.K. firm patents an innovation in the U.K., the U.S., and Japan, we count this as one patent by the U.K. firm. Another issue is that a patent application on the same invention can be filed to different patent offices on different dates. To determine the actual year of innovation for these cases, we choose the earliest application date for an innovation.

Patent counts only reflect the quantity rather than the quality of innovation. As more significant patents are expected to be cited more frequently by other patents, forward citations of patents can better capture the technological or economic significance of innovation (Hall, Jaffe, Trajtenberg, 2005). Consequently, we use the number of citations received by patents of firms in each ISIC industry-country-year cohort as our second proxy for innovation output (*Citation*). Because patents in certain technology classes and years tend to receive more citations (Hall, Jaffe, and Trajtenberg, 2005), we adjust raw citations using time-technology class fixed effects recommended by the prior literature, e.g., Atanassov (2013), Hirshleifer, Low, and Teoh (2012), and Chang et al. (2015). Specifically, citation counts adjusted for time-technology class fixed effects are defined as raw citation counts scaled by the average citations in the same year, technology class, and country cohort.

Despite the wide acceptance and usage of the above innovation output measures (see, e.g., Acharya and Subramanian, 2009; Hsu, Tian, and Xu, 2014; Moshirian et al., 2019), they are subject to certain limitations. For example, not all inventions meet the patenting criteria and firms may keep some inventions secret for strategic purposes.

2.3. Measuring social trust

Following the previous literature, e.g., La Porta et al. (1997) and Guiso, Sapienza, and Zingales (2008a, b), we define social trust (*Trust*) as the average response of a country's survey participants to the question "*Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people*?" in each survey year. In particular, we code the response to this question as one if a survey participant responds that most people can be trusted and zero otherwise, and then calculate the mean of the responses in each country year as

(Koh et al., 2016). Therefore, results based on reported R&D expenditures as the dependent variable are confounded by the concern that firms strategically disclose R&D as permitted by a country's accounting standards.

our measure of social trust.[12] Our results are robust to an alternative measure of trust based on survey responses to a different WVS question (see the Internet Appendix).

2.4. Control variables

We control for several industry and country characteristics that may be correlated with social trust and innovation. To account for the heterogeneity in size and economic development across different industries in a country, we follow previous literature (e.g., Acharya and Subramanian, 2009; Acharya, Baghai, and Subramanian, 2014; Hsu, Tian, and Xu, 2014) and control for the percentage of value added of a two-digit ISIC industry over the total value added in a country each year (*VA*). We further control for a country's macroeconomic conditions since social trust is positively associated with economic development (La Porta et al., 1997; Knack and Keefer, 1997) and wealthier countries produce more innovations (Acharya and Subramanian, 2009; Acharya, Baghai, and Subramanian, 2013). We use the logarithm of GDP per capita (*Ln*(*GDP*)) as a proxy for a country's macroeconomic conditions. All dollar amounts are in real terms at the constant national prices in 2000 U.S. dollars.

We also include the ratio of a country's import plus export over its GDP (*Trade*) to capture the country's trade openness. Free trade can encourage firms to patent their inventions to protect domestic sales and secure foreign sales (Acharya and Subramanian, 2009; Hsu, Tian, and Xu, 2014; Chang et al., 2018).

Hsu, Tian, and Xu (2014) document financial development as an important determinant of a country's patenting activities. Guiso, Sapienza, and Zingales (2004, 2008a) find that social trust promotes financial development. Therefore, we control for a country's financial development, which is defined as the ratio of stock market capitalization plus domestic credit provided by the banking sector over GDP (*FinDev*). Our results are robust to controlling for equity and credit market development separately.

Additionally, we control for a country's formal institutions. In particular, we consider two variables related to formal institutions. The first variable is the economic freedom index (*EconFree*) compiled by the Fraser Institute. This index has a comprehensive coverage of a

[12] Several studies investigate the validity of the WVS trust measure using the Berg, Dickhaut, and McCabe (1995) trust game and reach mixed conclusions (Glaeser et al., 2000; Lazzarini et al., 2003; Fehr et al., 2003; Bellemare and Kroeger, 2007). Sapienza, Toldra-Simats, and Zingales (2013) argue that senders' behavior in a trust game reflect both their own trustworthiness and their beliefs about others' trustworthiness, and show that the WVS trust measure mostly captures the latter.

country's formal institutions including the effectiveness of the legal system, the extent of corruption, the protection of private property rights, and the openness of labor, financial, and product markets. The index captures the resilience of formal institutions in the country (Gwartney, Lawson, and Hall, 2011). The second variable is an index measuring the strength of a country's intellectual property protection (*IPPro*) constructed by Park (2008). Prior studies show that economic freedom and intellectual property protection promote innovation activities (e.g., Kreft and Sobel, 2005; Fang, Lerner, and Wu, 2017). In addition to reducing firms' incentive to invest in innovations, weak intellectual property protection can lead firms to keep their innovations secret rather than filing patents for them. Therefore, controlling for intellectual property protection can also account for firms' patenting incentives.

Finally, as pointed out by Hall, Jaffe, and Trajtenberg (2001) and Cohen, Nelson, and Walsh (2000), the patenting propensity in different industries varies over time. We thus control for the time trend of industry-level patenting activities. Specifically, we follow Acharya and Subramanian (2009) and Moshirian et al. (2019) and include the median number of patents applied by U.S. firms in each ISIC industry-year cohort as a proxy for the industry-level patenting intensity or innovation potential (*Intensity*). We choose the U.S. as the benchmark to adjust for the global industry-time trend because the U.S. has arguably the most comprehensive patent data across different technology classes over time, the most developed financial markets to fund the technological growth opportunities, and the most favorable research environment in the world. Therefore, patenting activities by U.S. firms in different industries can serve as reasonable indicators for each industry's innovation potential.

2.5. Sample distribution

Panel A of Table 1 reports the sample distribution of the aggregate patent and citation counts and the average social trust score by country. Column (1) shows the number of observations for each country. Columns (2) and (3) report the aggregate innovation measures. Specifically, in column (2), Japan has 328,727 patents, the largest number among all countries, followed by Korea, China, and Germany, while Indonesia has only 5 patents, which is the lowest among all sample countries, followed by Jordan, Egypt, and Morocco. However, column (3) indicates that patents of Japanese and German firms receive more citations than those of Korean and Chinese firms, which suggest a noticeably larger impact of innovation by Japanese and German firms. The observation that patents from developed countries are technologically more significant than those from emerging economies highlights the importance of using patent citations as a measure of innovation output.

Social trust also displays large cross-country variations as shown in column (4). In particular, Sweden and Norway have the highest scores of 0.656 and 0.653 followed by China and Finland, while Brazil and Philippines have the lowest scores of 0.048 and 0.076 followed by Malaysia and Turkey. To safeguard against the possibility that any particular country's social trust measure is contaminated by large errors and drives our results, we perform a robustness check to ensure that our results are not sensitive to excluding any one country from our analysis.

[Insert Table 1 about here]

Panel B of Table 1 presents the sample distribution of average values of industry innovation output, industry value added (in millions of U.S. dollars), and industry innovation intensity across 23 industries. Columns (2) and (3) indicate that patent counts and citations vary significantly across industries. Specifically, industries of machinery and equipment (ISIC 29), office, accounting, and computing machinery (ISIC 30), and chemicals and chemical products (ISIC 24) have the highest number of patent counts (368, 314, and 301) and citation counts (513, 503, and 623). In contrast, recycling (ISIC 37), leather (ISIC 19), and tobacco (ISIC 16) industries have the lowest number of patent counts (1, 5, and 6) and patent citations (1, 5, and 5).

Moreover, as observed in column (4), industries that contribute the highest value added are the food and beverage industry (ISIC 15) and chemical industry (ISIC 24) with an average value of $12.58 billion and $11.66 billion, respectively, while industries that contribute the lowest value added are the recycling industry (ISIC 37) and leather industry (ISIC 19) with an average value of $0.29 billion and $0.76 billion, respectively. Finally, column (5) shows that the innovation intensity measure constructed using the U.S. data displays a generally similar pattern as the average number of patents and patent citations in our sample countries.

2.6. Summary statistics

We report the summary statistics of variables in Panel A of Table 2. All variables are winsorized at the 0.5% level at both tails of their distributions. The means of *Patent* and *Citation* are 123 and 190, respectively. The standard deviations of these two variables are quite large, which are 440 and 714, respectively. Given that innovation measures are highly skewed, we use the logarithm of one plus each innovation output proxy, i.e., *Ln*(1+*Patent*) and *Ln*(1+*Citation*), in the regression analyses. For country level variables, the mean of *Trust* is 0.31, and the means of

Ln(*GDP*), *Trade*, *FinDev*, and *EconFree*, and *IPPro* are 8.75, 0.69, 1.49, 6.90, and 3.5 respectively. With respect to industry-level variables, we find that the means of *VA* and *Intensity* are 0.047 and 0.1, respectively.

[Insert Table 2 about here]

In Panel B of Table 2, we show the Pearson correlation matrix of the main variables discussed above. The correlation between *Ln*(1+*Patent*) and *Ln*(1+*Citation*) is quite high at around 0.96. More importantly, the correlation between the two measures of innovation output and trust are 0.43 and 0.45, respectively, both significant at the 1% level. In line with previous literature, we find that social trust has a positive and significant correlation with *Ln*(*GDP*) and *FinDev*. In addition, consistent with Zak and Knack (2001), we find that social trust is positively and significantly correlated with formal institutions such as *EconFree* and *IPPro*, suggesting that countries with higher social trust also have better formal institutions.

3. Empirical findings

3.1. The effect of trust on innovation output

We begin our investigation of how trust affects innovation output by estimating Eq. (1) below.

$$Innovation_{i,j,t} = \alpha + \beta Trust_{j,t-1} + \gamma' X_{i,j,t-1} + Industry_i + Country_j + Year_{t-1} + \varepsilon_{i,j,t-1} \quad (1)$$

where *Innovation* represents the two innovation output measures, i.e., *Ln*(1+*Patent*) and *Ln*(1+*Citation*), for industry *i*, country *j*, and year *t*. Our main explanatory variable is *Trust* in country *j* measured in year *t*-1. *X* represents the control variables for industry *i*, country *j*, and year *t*-1 as described earlier in Section 2.4. Table 3 presents the regression results. Since trust evolves very slowly, the variation in trust is primarily cross-sectional. In columns (1) and (2) of Table 3, we only include industry and year fixed effects in the regressions to account for the effect of time-invariant industry characteristics and business cycles. Despite the limited time-series variation in each country's trust measure, to ensure that our results are not driven by some time-invariant country characteristics, we further control for country fixed effects in columns (3) and (4) of Table 3. The coefficient of interest is β, which captures the relation between trust and innovation. We adjust standard errors for country-level clustering.

[Insert Table 3 about here]

We find that social trust has a positive and significant relation with industry-level innovation output measured by both the number of patents and the number of citations received by patents, with the *t*-statistics of the coefficients on *Trust* ranging from 2.0 to 3.3. The positive relation between social trust and corporate innovation is not only statistically significant but also economically meaningful. Specifically, a one standard deviation increase in social trust (0.153) is associated with a 50% increase in the number of patents and a 34% increase in the number of patent citations, relative to their respective means.[13] These results are consistent with the hypothesis that social trust enhances industry-level innovation output in a country.

With respect to the control variables, we find that (i) *VA* is significantly and positively associated with innovation in all regressions, suggesting that larger industries in a country produce more innovation, (ii) *Ln*(*GDP*) has a positive, albeit insignificant, coefficient, indicating that wealthier countries tend to be more innovative, (iii) *FinDev* has a positive and significant coefficient, consistent with more developed financial markets facilitating innovation (Acharya and Subramanian, 2009; Hsu, Tian, and Xu, 2014), and (iv) in line with Fang, Lerner, and Wu (2017), *IPPro* has a positive and significant association with innovation output. Finally, in the presence of country fixed effects, *Intensity* has a positive and significant coefficient, indicating that the patenting activities of U.S. firms in a given industry are positively correlated with those of non-U.S. firms in the same industry.

3.2. The effect of trust on innovation across industries

In this section, we follow the previous literature (Acharya and Subramanian, 2009; Moshirian et al., 2019) and examine whether the relation between trust and innovation varies across industries with different innovation potential. Toward that objective, we interact trust with an industry's innovation potential (*Intensity*) and include the interaction term as an additional explanatory variable. Our conjecture is that if trust facilitates innovation activities, its effect should be greater in industries with greater innovation potential.

To ensure that trust is not merely picking up the effects of other country-level characteristics, we control for the interaction terms between *Intensity* and a country's GDP per capita, trade openness, financial development, economic freedom and intellectual property protection. In addition, to account for the possibility that high-trust countries happen to possess certain comparative advantages in industries with high innovation potential, we follow Acharya and Subramanian (2009) and proxy for a country's comparative advantage in a particular industry by

[13] Because $d[Ln(1+y)]/dx = 1/(1+y)\times dy/dx$, $dy = d[Ln(1+y)]/dx\times(1+y)\ dx$. For example, when quantifying the effect of the change in *Trust* (dx) on the change in *Patent* (dy), we increase *Trust* by one standard deviation (0.153), so $dx = 0.153$. The change in *Patent* (dy) from its mean value (123.4) is then equal to $3.214\times(1+123.4)\times0.153 = 61.17$, which amounts to 50% of the mean value of *Patent*.

the industry's share of value-added in each country-year. We include its interaction term with *Intensity* as another control variable. Given that our focus is on the differential impact of trust across industries, which exhibit both cross-sectional and time-series variations in their innovation potential, this allows us to further control for country fixed effects for more rigorous identification.

We thus estimate the augmented model in Eq. (2) below:

$$Innovation_{i,j,t} = \alpha + \beta Trust_{j,t-1} \times Intensity_{i,t-1} + \theta Trust_{j,t-1} + \gamma' X_{i,j,t-1} + \delta' X_{i,j,t-1} \times Intensity_{i,t-1} + Industry_i + Country_j + Year_t + \varepsilon_{i,j,t-1} \, . \quad (2)$$

The coefficient on the interaction term between *Trust* and *Intensity*, β, is to capture any differential impact of trust on innovation output across industries with varying degrees of innovation potential. To the extent that trust plays a more important role in facilitating innovation efforts in more innovation intensive industries, we expect β to be positive.

[Insert Table 4 about here]

Columns (1) and (2) in Table 4 report the coefficient estimates of Eq. (2) without controlling for the interactions of control variables and industry innovativeness, while columns (3) and (4) present the estimates of Eq. (2) with the full set of controls. Consistent with our expectation, the coefficients of *Trust*×*Intensity* are positive and significant in all regressions, suggesting that the relation between trust and innovation is more pronounced in more innovation intensive industries. This cross-industry variation is economically sizable. Specifically, based on the results in columns (3)-(4), a one standard deviation increase in trust is associated with a 10% larger increase in patents and a 13% larger increase in patent citations (relative to their respective means) in more innovative industries (with *Intensity* at the 75th percentile) than in less innovative industries (with *Intensity* at the 25th percentile).

We also find that the coefficient on the standalone term *Trust* loses significance in most regressions, suggesting that it is through harnessing and unleashing an industry's innovation potential that trust leads to more innovation output. In addition, given that the coefficients on *Trust*×*Intensity* remain positive and significant even when we control for all the other interaction terms, it appears that trust plays a distinct role in the innovation process that is above and beyond a country's economic conditions, financial development, and formal institutions, or comparative advantage in an industry. Overall, the results in this section highlight the importance and uniqueness of trust in promoting innovation particularly in high innovation intensity industries.

3.3. Identification

While the results in Table 4 are consistent with trust enhancing innovation output, we employ additional identification strategies in this section to bolster our confidence in such a causal interpretation. Even though we have controlled for a comprehensive list of industry-level and country-level variables in Table 4, the "omitted variable" problem remains a concern.[14] We address this issue in two ways. First, we augment the regression model in Eq. (2) with additional controls. Second, we follow Algan and Cahuc (2010) and estimate the inherited component of social trust based on the beliefs of descendants of immigrants to the U.S. We then re-estimate the regressions of innovation output using the inherited trust rather than the trust measure from the WVS. We continue to include all control variables and their interactions with industry innovation intensity in the new regressions, but for brevity, only report the coefficients of *Trust*×*Intensity*, *Trust*, *Intensity*, and the newly added variables.

3.3.1. Additional control variables

The first set of additional control variables we include in this section fall in three categories: (1) major regulatory actions or changes in a country's financial markets that may not be fully captured by the financial development measure included in the baseline model in Table 4, (2) other dimensions of national culture, and (3) important features of an industry in a country. Specifically, we follow previous literature (e.g., Levine, Lin, and Wei, 2017; Acharya and Subramanian, 2009; Moshirian et al., 2019) and consider a country's insider trading law enforcement (*ITLaw*), bankruptcy code change (*ΔBC*), and stock market liberalization (*Lib*). *ITLaw* is a binary variable that equals one in the year of a country's first insider trading enforcement case and thereafter, and zero otherwise (Bhattacharya and Daouk, 2002). *ΔBC* is the change in a country's bankruptcy code in (Acharya and Subramanian, 2009), where information on bankruptcy codes is from Djankov, McLiesh, and Shleifer (2007). *Lib* is a binary variable that equals one in the year of a country's official stock market liberalization and thereafter, and zero otherwise (Bekaert, Harvey, and Lundblad, 2005).

[14] A related concern is reverse causality, i.e., innovation affects trust among individuals in a society. This is unlikely to drive our results for two reasons. First, trust evolves very slowly because it is deeply rooted in individuals' ethnic, religious, familial, and social backgrounds and is a relatively persistent behavioral trait (Putnam, 1993; Fukuyama, 1995; Guiso, Sapienza, and Zingales, 2006, 2010). Second, it is not clear whether all innovation can have an impact on social trust, and for those that can, whether they build or erode trust.

With respect to other dimensions of national culture, we control for individualism and hierarchy constructed using the WVS data. We also construct two important industry-level variables, namely industry fixed capital intensity (*CapIntensity*) and industry product market competition (*HHI*), where the former is defined as the log of an industry's fixed capital formation over the number of employees in each country-year and the latter is defined as an industry's Herfindahl index in each country-year.[15]

We re-estimate Eq. (2) with these additional control variables and their interactions with *Intensity* and present the results in Panel A of Table 5. We find that the coefficient estimate of *Trust*×*Intensity* remains positive and significant.

[Insert Table 5 about here]

Next, we follow Acharya and Subramanian (2009) and include country-by-year and industry-by-year fixed effects in our regressions to account for the confounding effects of any time-varying unobservable country- and industry-level characteristics. Panel B of Table 5 presents the results. We find that the coefficient of *Trust*×*Intensity* continues to be positive and significant, attesting to the robustness of our main finding.[16]

Finally, we include the interactions of *Trust* with all the control variables and re-estimate the regressions. The results in Panel C of Table 5 show that the positive and significant coefficients of *Trust*×*Intensity* remain intact even after the inclusion of these additional interaction terms in the regressions. Overall, the results in this section suggest that our findings are unlikely to be driven by a country's legal, financial, and social environments and important industry characteristics.[17]

3.3.2. Inherited trust and innovation

To further mitigate the omitted variable concern and ensure that causality runs from trust to innovation, we follow Algan and Cahuc (2010) and estimate the inherited component of social trust based on the beliefs of descendants of immigrants to the U.S. The rationale behind this

[15] The sample size becomes substantially smaller because information on industry fixed capital formation and the number of employees is missing for many observations in the UNIDO database. Our results are robust if we do not include these two industry level variables. Moreover, due to lack of data on private firms' sales, we employ the Herfindahl index estimated using the sales of public firms from Datastream as a proxy for industry product market competition.

[16] Controlling for country-by-year paired fixed effects subsumes the additional country-level controls.

[17] In untabulated tests, we also find that our results are robust to further controlling for a country's economic inequity, average years of schooling, foreign direct investment, and economic uncertainty, or replacing the formal institutions control in Eq. (2) with a country's legal origin.

approach is that children inherit their parents' social capital (e.g., Rice and Feldman, 1997; Putnam, 2000; Guiso, Sapienza, and Zingales, 2006), and the trust inherited by U.S. descendants from their ancestors who immigrated to the U.S. from different countries at different time periods (usually decades ago), is unlikely to be driven by the current political, economic, and industry conditions of their countries of origin. Therefore, any relation between the inherited trust and innovation should be less susceptible to endogeneity concerns.

[Insert Table 6 about here]

We estimate the inherited trust using data from the General Social Survey (GSS) during the period of 1977-2008. The GSS records information on the trust beliefs of U.S. descendants of immigrants, and their ancestors' immigration periods and countries of origin. Similar to Algan and Cahuc (2010), we define U.S. descendants as the second-generation Americans (at least one parent born abroad), third-generation Americans (at least two grandparents immigrated to the U.S. and both parents were born in the U.S.), and fourth-generation Americans (more than two grandparents born in the U.S. and both parents born in the U.S.). After removing unidentified countries of origin and observations with missing values, we obtain a sample of 10,373 individual responses to the survey by U.S. descendants of immigrants from 33 countries. We infer the inherited trust by estimating Eq. (3) below:

$$iTrust_{i,c,t} = \gamma_0 + \gamma_1 X_{i,t} + Origin_c + Year_t + \varepsilon_{i,c,t}. \quad (3)$$

iTrust is a binary variable that takes the value of one if respondent *i* with country of origin *c* in year *t* answers "*Most people can be trusted*" to the question "*Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people*?", and zero if the respondent answers "*Can't be too careful*". *X* represents a vector of individual characteristics measured in year *t*, such as age, age squared, gender, education, employment status, religion, and income category. In addition, we include in the regression the country-of-origin fixed effects and year fixed effects. To avoid perfect multicollinearity, we do not include the country of origin indicator for Yugoslavia. By doing so, we essentially treat the trust inherited by Yugoslavian Americans as the reference group in our sample. While year fixed effects account for the impact of shocks in a particular year, the coefficient estimates of the country-of-origin fixed effects capture the inherited component of social trust for each country

(*InheritedTrust*). In other words, this regression estimates the portion of a U.S. person's trust belief that is determined by his/her ancestor's country of origin.[18]

We tabulate the regression results of Eq. (3) in Panel A of Table 6. Comparing the inherited trust measure (the coefficients of the country fixed effects) with the WVS trust measure, we find that country ranks based on the two measures are generally consistent. The signs of the coefficients of control variables in Eq. (3) are largely consistent with those in Algan and Cahuc (2010). We then replace the WVS trust measure in Eq. (1) and Eq. (2) with the inherited trust measure and re-estimate the regressions.

Table 6 Panel B presents the regression results. In Panel B.1, the results are based on pooled Ordinary Least Squares (OLS) regressions, while in Panel B.2, the results are estimated using the Fama-MacBeth (1973) approach to account for the fact that *InheritedTrust* is time-invariant. Regressions in columns (1)-(2) do not include the interactions of explanatory variables with *Intensity*, while those in columns (3)-(6) include the interactions. Moreover, regressions in columns (3) and (4) control for industry fixed effects and those in columns (5) and (6) further control for country fixed effects. We find that in columns (1)-(2), *InheritedTrust* has a positive coefficient that is significant at the 5% and 1% level in Panels B.1 and B.2, respectively. In columns (3)-(6) of both panels, *InheritedTrust*×*Intensity* has a positive and significant coefficient at the 1% level. Overall, these results provide additional support for a causal interpretation of the relation between trust and innovation.

3.4. Robustness tests

To ensure the validity of our results, we conduct a battery of robustness tests by employing various alternative variable definitions and model specifications (see the Internet Appendix). We find that none of the following variations has a material impact on our results: (*a*) using per capita patent counts and citation counts as the dependent variables to further account for the effect of industry size (e.g., an industry with more employees may have a higher level of innovation output); (*b*) using two alternative measures of innovation output, i.e., the number of innovative firms and patent family size, as dependent variables; (*c*) replacing *Trust* with social distrust, which is measured as the percentage of survey participants in each country who responded affirmatively to the following question in the WVS: "*Do you think most people try to*

[18] It is not to be confused with a two-stage least squares (2SLS) regression, which estimates a predicted value of each country's trust based on at least one valid instrument along with all the other control variables.

take advantage of you?"; (*d*) clustering standard errors at both country and year levels to mitigate the concern about the residual correlation in both country and year dimensions following the suggestion of Petersen (2009); (*e*) measuring trust in year *t*-5 ($Trust_{t-5}$) instead of year *t*-1 to reflect the long-term nature of innovation process (Manso, 2011); (*f*) excluding patents first filed by domestic firms with foreign patent offices to alleviate the concern that multinational corporations may choose to setup a R&D center overseas or acquire innovative foreign firms for their innovation; (*g*) conducting an analysis at the three-digit IPC class level following Hsu, Tian, and Xu (2014); and (*h*) repeating our analysis using a sample of firms whose patents are granted by the USPTO to mitigate the concern that our finding is driven by the differences in patent granting practices across countries; and (*i*) adding the quadratic term of *Trust* to Eq. (1) to investigate the possibility of non-monotonicity in the relation between trust and innovation.

In addition, in untabulated tests, we exclude Eastern Bloc countries before 1995 because of the regime changes in these countries in the early 1990s. Also, for all the countries in our sample, we exclude one of them at a time from the analysis. Our results remain intact, suggesting that the Eastern Bloc countries or any other country in particular is unlikely to be responsible for our findings.

4. Economic mechanisms

In this section, we explore cross-sectional variations in the relation between trust and innovation to shed light on the specific channels through which social trust can enhance innovation.

4.1. The collaboration channel

Innovation often entails the contribution of effort, intellectual inputs, and financial resources from multiple individuals and entities (Dougherty, 1992; Van de Ven, 1986), and its success hinges on the extent to which contractual arrangements can ensure sufficient investments by collaborating parties (Aghion and Tirole, 1994). Concerns about ex-post holdup or outright expropriation of intellectual property can reduce collaborating parties' incentives to make relationship-specific investments (Khanna and Mathews, 2016; Fang, Lerner, and Wu, 2017). Effective contract enforcement and strong intellectual property protection can encourage collaboration among innovators by allowing them to capture the returns from their investments in highly risky innovative projects (Seitz and Watzinger, 2017; Lerner, 2009). However, writing and enforcing contracts on to-be-developed innovative products are particularly challenging and expensive. Meanwhile, legal protection for innovators' intellectual inputs against potential expropriation by their peers can be quite costly as it requires robust monitoring.

As an alternative, trust can increase the likelihood and efficiency of collaboration by mitigating collaborating parties' concerns about opportunistic behaviors of their partners. Following this logic, we expect trust to play a more important role in facilitating collaboration and enhancing innovation output when the probability of ex-post holdup and intellectual property expropriation is higher ex ante. To examine this conjecture, we use the contract enforceability index constructed by Djankov et al. (2003) and the intellectual property protection index created by Park (2008) to capture the risks of ex-post holdup and intellectual property expropriation. The contract enforceability index, which has a scale from 0 (the lowest enforceability) to 10 (the highest enforceability), measures the relative degree to which contractual agreements are honored and complications presented by language and mentality differences. The intellectual property protection index is based on five unweighted scores that cover (i) inventions that are patentable, (ii) membership in international treaties, (iii) duration of protection, (iv) enforcement mechanisms, and (v) restrictions. We first partition the sample at the sample median of these two indices and then estimate the regression specified in Eq. (2) in each subsample.[19] Panel A of Table 7 presents the results for the subsample regressions.

[Insert Table 7 about here]

We find that the coefficients of *Trust*×*Intensity* are significantly positive in the subsamples of countries with weaker contract enforceability or intellectual property protection, but are insignificant in the other subsamples. These results suggest that trust indeed has a more pronounced effect on innovation in more innovative industries when collaboration would have been more difficult due to the higher risks of ex-post holdup and intellectual property expropriation. As such, they provide support for our collaboration channel conjecture.

4.2. The failure tolerance channel

Innovation involves a high probability of failure due to its dependence on various unpredictable conditions (Holmstrom, 1989). For risk-averse agents, the optimal incentive scheme that nurtures innovation should exhibit substantial tolerance for early failure and reward

[19] Given that our partitioning variables in this section are country-level variables, we partition the sample by country rather than by country-industry, which leads to unbalanced numbers of observations for the subsamples.

for long-term success (Manso, 2011). Debtor-friendly bankruptcy regimes and strong legal protection for employees alleviate firms' and employees' concerns about the adverse impact of innovation failure and hence encourage their risk-taking and innovation efforts (Acharya, Baghai, and Subramanian, 2014; Acharya and Subramanian, 2009). In lieu of such formal protections, a higher level of trust can encourage innovators to undertake risky ventures with less concern about potential adverse repercussions from failure, e.g., forced liquidation for firms and involuntary job separation for employees. In essence, trust can act as an informal insurance scheme for innovators and induce more risk-taking from them in the innovation process. Hence we expect the disproportionate positive impact of trust on innovation in more innovative industries to be stronger in countries with creditor-friendly bankruptcy regime or those with poorer employment protection, where the potential costs of innovation failure to innovators are higher.

To test this conjecture, we partition our sample into countries with debtor- or creditor-friendly bankruptcy regimes based on the debt enforcement information from Djankov et al. (2008). We also partition the sample into countries with strong and weak employee protection based on the median of the employee protection index from Botero et al. (2004). We classify a country's bankruptcy regime as debtor friendly if reorganization is likely to be used in bankruptcy proceedings, and creditor friendly if foreclosure or liquidation is likely to be used. The employee protection index is computed as a sum of the employment laws index, collective relations laws index, and social security laws index. A higher employee protection index indicates better employee protection. We then re-estimate Eq. (2) in each subsample and present the results in Panel B of Table 7.

We find that the effect of trust on innovation is primarily concentrated in the subsamples of countries with creditor-friendly bankruptcy regimes or those with weak employee protection, where there is less insurance afforded to firms and employees by laws and regulations. Specifically, the coefficient estimates of *Trust*×*Intensity* are positive and significant at the 1% level in these subsamples, but are insignificant in the subsamples of countries with debtor-friendly bankruptcy regimes and those with strong employee protection. These results support the proposition that by fostering higher tolerance for failure, trust encourages risk-taking and promotes innovation, particularly when the costs of innovation failures are high for firms and employees.

4.3. The funding channel

Innovative firms are often in need of external financing because they can easily exhaust internal funds (Brown, Fazzari, and Petersen, 2009; Brown, Martinsson, and Petersen, 2012, 2013). Given the nature of their investments, these firms tend to face greater information asymmetry and higher costs of capital, which may hinder their innovation efforts. Investors in high trust countries perceive less information asymmetry (Pevzner, Xie, and Xin, 2015; Garrett, Hoitash, and Prawitt, 2014), are less concerned about managerial moral hazard, and are more willing to supply capital to firms (Guiso, Sapienza, and Zingales, 2008a; Bottazzi, Da Rin, and Hellmann, 2016). Therefore, trust can promote corporate innovation by increasing firms' access to external capital. We expect this role of trust to be more important in countries with poor financial disclosure and lax auditing and accounting standards, where corporate information environments are more opaque and external finance is more costly.

To examine this conjecture, we partition our sample at the sample median of a country's financial disclosure score or the strength of auditing and accounting standards and re-estimate Eq. (2) separately in each subsample. Information on a country's financial disclosure score is from the *Global Competitiveness Report* 1999, which measures the level and effectiveness of financial disclosure in different countries. This score has been used in many prior studies, such as Gelos and Wei (2002) and Jin and Myers (2006). Information on the strength of a country's auditing and accounting standards is from the *Global Competitiveness Report* 2003-2004, when *Global Competitiveness Report* first compiles this measure. Table 7 Panel C reports the regression results. We find that the coefficient estimates of *Trust*×*Intensity* are positive and significant at the 1% level in the subsamples of countries with lower financial disclosure scores or weaker auditing and accounting standards, but are insignificant in the subsamples of countries with higher financial disclosure scores or more stringent auditing and accounting standards. These findings are consistent with our funding channel conjecture that trust enhances innovation in more innovative industries by mitigating information asymmetry between investors and firms and improving firms' access to external capital.

Overall, our analyses in this section identify a variety of circumstances under which trust performs a more critical function in facilitating innovation activities, and thus provide valuable insights into how trust improves the efficiency of the innovation process.[20]

5. Additional analysis based on patent originality and generality

To further capture the fundamental nature and importance of innovation, we follow Hsu, Tian, and Xu (2014) by constructing two additional patent citation-based innovation measures, namely, patent originality and generality (*Originality* and *Generality*). Following Hall, Jaffe, and Trajtenberg (2001), we first calculate a patent's originality score as one minus the Herfindahl concentration index of technological classes at the three-digit IPC class level for all prior patents that it cites. Therefore, a patent with a high originality score is inspired by prior inventions from a wide range of technological classes instead of only closely related technological classes. Such patents are considered more original. Likewise, we calculate a patent's generality score as one minus the Herfindahl concentration index of technological classes for all the citations it receives. A patent with a high generality score has widespread impact on future patents from various technological classes. Similar to citations, an improvement in patent originality and generality is particularly meaningful for emerging economies because it not only reflects the intricate novelty of inventions but also indicates the profound influence of inventions on innovations in other scientific areas.

Next, we aggregate individual patents' originality and generality scores at the industry level and compute *Originality* and *Generality* in each two-digit ISIC industry, country, and year. Given that these two measures are also highly skewed, we use the logarithm of one plus the originality and generality scores, i.e., *Ln*(1+*Originality*) and *Ln*(1+*Generality*), in the regressions. We replace *Innovation* in Eq. (2) with *Ln*(1+*Originality*) and *Ln*(1+*Generality*) and re-estimate the regressions. Table 8 presents the results.

[Insert Table 8 about here]

We find that the coefficient estimates of *Trust*×*Intensity* are positive and significant at the 5% level, suggesting that trust can not only increase the output of innovation in a country but also

[20] The cross-sectional variations we report in this section are not driven by a small subset of countries. The pairwise correlations between the six sample partitioning variables used in this section are mostly below 0.5, and about half of them are statistically insignificant or even negative, especially those related to bankruptcy regime and employee protection.

enhance the originality and generality of innovation, particularly in industries with greater innovation potential.

6. Conclusion

We investigate two competing views on how social trust affects corporate innovation using a large sample of observations drawn from 41 countries around the world. Our analyses indicate that trust has a positive and significant relation with innovation activities in a country, and this relation is stronger in industries with more innovation potential. Our identification strategies point to a causal interpretation of these findings. The relation between trust and innovation exhibits interesting cross-sectional variations along several dimensions of country characteristics. Specifically, our evidence suggests that trust plays a more important role in enhancing innovation in countries with poor contract enforceability and weak protection for intellectual property, in countries with bankruptcy regimes that are unfriendly to debtors and weak protection for employees, and in countries with insufficient financial disclosure and lax accounting and auditing standards. These results highlight three economic channels through which trust enhances innovation, i.e., the collaboration channel, the failure tolerance channel, and the funding channel.

In terms of policy implications, our results suggest that countries, especially those with underdeveloped formal institutions, can improve the innovation output of their economy by fostering more trust in the society. One possible approach toward that objective would be a well thought-out public education program as suggested by Aghion et al. (2010), because public education can build trust by creating more opportunities for individuals to interact with each other and have shared experience and beliefs (Glaeser, Ponzetto, and Shleifer 2007). Such measures may be especially important for countries whose population is becoming more diverse in ethnic, religious, and cultural backgrounds, because their innovation effort may otherwise suffer as a result of the potential eroding effect of diversity on social trust (Putnam, 2007).

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Table 1: Sample distribution

The sample consists of countries with granted patents jointly covered by the United Nations Industrial Development Organization (UNIDO) Industrial Statistical database, the BVD Orbis database, the World Value Survey (WVS), and the World Development Indicator (WDI) database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. In Panel A, *Patent* is the total number of patents in a particular country over the sample period. *Citation* is the total number of patent citations adjusted for time-technology class fixed effects in a particular country over the sample period. *Trust* is the country average and is defined using the WVS.

Panel A: Sample distribution by country

Country	(1)	(2)	(3)	(4)
	N	*Patent*	*Citation*	*Trust*
Argentina	274	77	93	0.185
Australia	377	11,471	19,577	0.434
Brazil	351	448	236	0.048
Bulgaria	236	188	74	0.267
Canada	176	24,079	48,894	0.389
Chile	332	132	58	0.201
China	313	233,297	308,721	0.541
Colombia	222	24	9	0.124
Czech Republic	285	5,103	1,912	0.288
Egypt	181	12	4	0.358
Finland	401	21,558	30,663	0.532
France	46	15,597	18,512	0.187
Germany	229	180,375	310,727	0.335
Hong Kong	30	617	566	0.411
Hungary	368	1,058	379	0.261
India	374	3,567	5,564	0.357
Indonesia	161	5	5	0.477
Israel	133	4,413	8,583	0.235
Italy	69	2,392	2,500	0.292
Japan	394	328,727	635,239	0.417
Jordan	161	7	0	0.287
Korea	410	242,990	284,694	0.307
Lithuania	184	29	1	0.219
Malaysia	46	82	12	0.088
Mexico	397	456	446	0.257
Morocco	161	13	0	0.200
Netherlands	46	8,850	12,855	0.445
New Zealand	165	1,564	2,578	0.501
Norway	253	3,088	3,283	0.653
Philippines	269	15	14	0.076
Poland	368	6,174	1,297	0.224
Romania	223	726	68	0.193
Russia	298	6,492	5,062	0.254
Singapore	128	3,270	5,109	0.147
South Africa	345	2,501	2,789	0.182
Spain	399	25,201	13,679	0.306
Sweden	276	23,820	37,251	0.656
Switzerland	317	59,335	123,236	0.400
Turkey	394	4,280	821	0.113
United Kingdom	230	20,154	31,189	0.299
Venezuela	45	25	50	0.137
Total	10,067	1,242,214	1,916,750	0.300

Table 1: Sample distribution (cont'd)

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. In Panel B, all values are industry average at the two-digit ISIC. *Patent* is the total number of patents in a two-digit ISIC industry for each country each year. *Citation* is the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *$VA* is value-added (in $millions) in a two-digit ISIC industry for each country each year. *Intensity* is the median number of patents held by a U.S. firm in a two-digit ISIC industry each year. Variables in dollars are computed in real terms at constant national prices in 2000 U.S. dollars.

Panel B: Sample distribution by industry

ISIC	ISIC description	(1)	(2)	(3)	(4)	(5)
		N	*Patent*	*Citation*	*$VA*	*Intensity*
15	Food and beverages	472	80.155	165.213	12,578.010	0.103
16	Tobacco products	381	6.014	5.274	1,585.627	0.093
17	Textiles	473	166.291	239.601	3,295.159	0.118
18	Wearing apparel, fur	471	151.519	209.137	2,011.618	0.184
19	Leather, leather products and footwear	395	5.252	5.401	755.838	0.035
20	Wood products (excluding furniture)	470	21.616	24.339	1,869.829	0.037
21	Paper and paper products	473	33.288	45.920	3,194.209	0.073
22	Printing and publishing	468	115.550	159.383	4,676.522	0.099
23	Coke, refined petroleum products, nuclear fuel	422	30.552	56.193	3,338.233	0.069
24	Chemicals and chemical products	465	301.241	623.175	11,662.610	0.122
25	Rubber and plastics products	469	33.867	64.440	4,755.275	0.065
26	Non-metallic mineral products	470	71.293	103.734	4,929.833	0.037
27	Basic metals	473	96.360	135.802	7,827.476	0.048
28	Fabricated metal products	457	259.770	369.720	7,274.637	0.071
29	Machinery and equipment, not else classified	470	367.765	512.754	10,566.170	0.159
30	Office, accounting and computing machinery	357	314.224	502.983	2,145.166	0.229
31	Electrical machinery and apparatus	469	60.998	89.742	5,856.465	0.060
32	Radio, television and communication equipment	377	207.274	304.905	6,689.144	0.107
33	Medical, precision and optical instruments	455	264.158	420.478	2,461.858	0.192
34	Motor vehicles, trailers, semi-trailers	462	135.398	181.009	9,973.472	0.212
35	Other transport equipment	392	32.016	40.014	2,437.595	0.115
36	Furniture; manufacturing, not else classified	458	35.166	45.816	2,780.634	0.055
37	Recycling	268	0.659	0.628	286.261	0.030

Table 2: Summary statistics

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Patent* and *Citation* are the total number of patents and the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS. *VA* is the percentage of value-added in a two-digit ISIC industry over the total value-added for each country each year. *Ln*(*GDP*) is the log of GDP per capita. *Trade* is a country's imports plus exports as a fraction of GDP. *FinDev* is the ratio of stock market capitalization plus domestic credit provided by the banking sector over GDP. *EconFree* is the economic freedom index of a country from the Fraser Institute. *IPPro* is the intellectual property protection index of a country from Park (2008). *Intensity* is the median number of patents held by a U.S. firm in a two-digit ISIC industry each year. Variables in dollars are computed in real terms at constant national prices in 2000 U.S. dollars. Figures in bold in Panel B are statistically significant at the 1% level.

Panel A: Descriptive statistics

Variables	Mean	STD	Min	Q1	Median	Q3	Max
Panel A.1: Measures of innovation output (N = 10,067)							
Patent	123.395	439.639	0.000	0.195	4.389	40.752	5,161.243
Ln(1+*Patent*)	2.233	2.159	0.000	0.179	1.684	3.732	8.549
Citation	190.399	713.918	0.000	0.000	1.899	42.607	9,141.739
Ln(1+*Citation*)	2.081	2.394	0.000	0.000	1.064	3.775	9.121
Panel A.2: Explanatory variables (N = 10,067)							
Trust	0.309	0.153	0.028	0.203	0.296	0.400	0.680
VA	0.047	0.048	0.000	0.014	0.032	0.063	0.302
Ln(*GDP*)	8.746	1.230	5.852	7.927	8.597	9.980	10.611
Trade	0.689	0.519	0.152	0.415	0.591	0.777	4.216
FinDev	1.492	1.061	0.148	0.718	1.164	2.000	8.467
EconFree	6.902	0.999	4.276	6.196	6.985	7.601	9.028
IPPro	3.497	0.948	1.020	3.090	3.750	4.290	4.670
Intensity	0.101	0.060	0.015	0.058	0.092	0.123	0.376

Panel B: Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	*Ln*(1+*Patent*)	**1.000**								
(2)	*Ln*(1+*Citation*)	**0.958**	**1.000**							
(3)	*Trust*	**0.426**	**0.445**	**1.000**						
(4)	*VA*	**0.184**	**0.174**	0.007	**1.000**					
(5)	*Ln*(*GDP*)	**0.509**	**0.543**	**0.364**	-0.001	**1.000**				
(6)	*Trade*	**-0.051**	**-0.052**	**-0.076**	0.006	**0.136**	**1.000**			
(7)	*FinDev*	**0.457**	**0.512**	**0.256**	0.024	**0.542**	**0.179**	**1.000**		
(8)	*EconFree*	**0.346**	**0.415**	**0.319**	-0.006	**0.730**	**0.324**	**0.648**	**1.000**	
(9)	*IPPro*	**0.466**	**0.466**	**0.209**	**-0.030**	**0.657**	**0.250**	**0.471**	**0.686**	**1.000**
(10)	*Intensity*	**0.195**	**0.173**	0.000	**0.042**	0.004	0.017	0.013	0.004	0.003

Table 3: The effect of trust on innovation

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS. *VA* is the percentage of value-added in a two-digit ISIC industry over the total value-added for each country each year. *Ln*(*GDP*) is the log of GDP per capita. *Trade* is a country's exports plus imports as a fraction of GDP. *FinDev* is the ratio of stock market capitalization plus domestic credit provided by the banking sector over GDP. *EconFree* is the economic freedom index of a country from the Fraser Institute. *IPPro* is the intellectual property protection index of a country from Park (2008). *Intensity* is the median number of patents held by a U.S. firm in a two-digit ISIC industry each year. Variables in dollars are computed in real terms at constant national prices in 2000 U.S. dollars. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)	(3)	(4)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)	*Ln*(1+*Patent*)	*Ln*(1+*Citation*)
Trust	3.736**	4.002**	3.214***	2.239**
	(2.2)	(2.4)	(3.3)	(2.0)
VA	5.043***	4.839***	5.066***	4.763***
	(6.2)	(5.0)	(6.2)	(4.9)
Ln(*GDP*)	0.326	0.344	1.595	2.774
	(1.3)	(1.3)	(1.4)	(1.6)
Trade	-0.326	-0.464	-0.398	-0.215
	(-1.1)	(-1.3)	(-1.5)	(-0.9)
FinDev	0.639***	0.783***	0.197**	0.167*
	(2.8)	(3.1)	(2.1)	(1.7)
EconFree	-0.739**	-0.509	-0.149	-0.193
	(-2.5)	(-1.7)	(-0.9)	(-0.9)
IPPro	1.136***	1.020***	0.425***	0.363**
	(4.0)	(3.2)	(2.8)	(2.4)
Intensity	1.595	1.972	1.532*	1.814*
	(1.5)	(1.6)	(1.7)	(1.7)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes
Observations	10,067	10,067	10,067	10,067
R-squared	0.60	0.60	0.87	0.84

Table 4: The effect of trust on innovation across industries

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS. *VA* is the percentage of value-added in a two-digit ISIC industry over the total value-added for each country each year. *Ln*(*GDP*) is the log of GDP per capita. *Trade* is a country's exports plus imports as a fraction of GDP. *FinDev* is the ratio of stock market capitalization plus domestic credit provided by the banking sector over GDP. *EconFree* is a country's economic freedom index from the Fraser Institute. *IPPro* is a country's intellectual property protection index from Park (2008). *Intensity* is the median number of patents held by a U.S. firm in a two-digit ISIC industry each year. Variables in dollars are computed in real terms at constant national prices in 2000 U.S. dollars. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)	(3)	(4)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)	*Ln*(1+*Patent*)	*Ln*(1+*Citation*)
Trust×Intensity	16.291***	21.480***	10.078***	13.578***
	(5.4)	(6.4)	(3.3)	(3.9)
Trust	1.527	0.015	2.095**	0.745
	(1.4)	(0.0)	(2.0)	(0.7)
VA	4.993***	4.667***	4.149***	4.241***
	(5.8)	(4.5)	(3.0)	(2.9)
Ln(*GDP*)	1.617	2.802	1.442	2.619
	(1.4)	(1.7)	(1.2)	(1.5)
Trade	-0.390	-0.205	-0.373	-0.141
	(-1.4)	(-0.8)	(-1.3)	(-0.5)
FinDev	0.201**	0.172*	0.134	0.066
	(2.1)	(1.8)	(1.4)	(0.6)
EconFree	-0.151	-0.196	-0.001	-0.076
	(-0.9)	(-0.9)	(-0.0)	(-0.4)
IPPro	0.426***	0.365**	0.204	0.148
	(2.8)	(2.4)	(1.5)	(1.2)
Intensity	-3.598**	-4.949***	-16.516***	-20.399***
	(-2.5)	(-2.9)	(-3.7)	(-3.9)
VA×Intensity			5.198	0.955
			(0.6)	(0.1)
Ln(*GDP*)*×Intensity*			1.670**	1.770*
			(2.0)	(1.9)
Trade×Intensity			-0.147	-0.560
			(-0.2)	(-0.4)
FinDev×Intensity			0.694*	1.068**
			(1.8)	(2.3)
EconFree×Intensity			-1.443**	-1.149
			(-2.1)	(-1.5)
IPPro×Intensity			2.269***	2.227***
			(5.5)	(4.4)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	10,067	10,067	10,067	10,067
R-squared	0.87	0.85	0.88	0.86

Table 5: Controlling for potential omitted variables

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. In Panel A, *ITLaw* is a binary variable that equals one in the year of a country's first insider trading enforcement case and thereafter, and zero otherwise according to Bhattacharya and Daouk (2002). Δ*BC* is the change of bankruptcy code defined according to Acharya and Subramanian (2009), where bankruptcy code is from Djankov, McLeish, and Shleifer (2007). *Lib* is a binary variable that equals one in the year of a country's official stock market liberalization and thereafter, and zero otherwise according to Bekaert, Harvey, and Lundblad (2005). *Individualism* and *Hierarchy* are culture dimensions in WVS. *CapIntensity* is the log of fixed capital formation over the number of employees of an industry in each country-year. *HHI* is the Herfindahl index of an industry in each country-year, which is constructed using public firms' sales from Datastream. In Panel B, country-year and industry-year fixed effects are included in the regressions. In Panel C, the interactions between control variables and *Turst* are included in the regressions. Control variables are the same as those in Table 3. All regressions include the interactions of control variables with *Intensity*, and industry, country, and year fixed effects. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1) *Ln*(1+*Patent*)	(2) *Ln*(1+*Citation*)
Panel A: Controlling for potential country and country-industry level variables (N = 5,244)		
Trust×*Intensity*	6.702**	11.383***
	(2.2)	(3.1)
Trust	3.028***	1.140
	(3.0)	(0.9)
ITLaw	-0.134	-0.456
	(-0.5)	(-1.6)
Δ*BC*	-0.056	-0.241*
	(-0.4)	(-2.0)
Lib	-0.359	-0.533
	(-1.0)	(-1.5)
Individualism	-1.627	-2.143*
	(-1.7)	(-1.9)
Hierarchy	-1.633***	-1.335*
	(-3.1)	(-1.9)
CapIntensity	0.010	-0.037
	(0.2)	(-0.5)
HHI	0.225	0.019
	(1.2)	(0.1)
Intensity	-8.382*	-10.820**
	(-2.0)	(-2.2)
ITLaw×*Intensity*	2.110*	2.489*
	(1.8)	(1.9)
ΔBC×*Intensity*	-0.134	0.536
	(-0.2)	(0.6)
Lib×*Intensity*	-0.603	-0.029
	(-0.4)	(-0.0)
Individualism×*Intensity*	-1.627	-1.605
	(-0.4)	(-0.3)
Hierarchy×*Intensity*	-1.280	-2.667
	(-0.5)	(-0.9)
CapIntensity×*Intensity*	0.344	0.627
	(0.9)	(1.3)
HHI×*Intensity*	-3.702**	-2.583
	(-2.7)	(-1.5)

Panel B: Controlling for country-by-year and industry-by-year fixed effects (N = 10,067)		
Trust×Intensity	9.785**	13.433***
	(2.7)	(3.3)

Panel C: Controlling for the interactions of Trust and control variables (N = 10,067)		
Trust×Intensity	9.666***	12.931***
	(3.2)	(3.8)
Trust	-6.993	-10.286
	(-0.9)	(-1.0)
Intensity	-16.537***	-20.526***
	(-3.6)	(-3.9)

Table 6: Inherited trust and innovation

Panel A shows the regression to estimate inherited trust. The sample for this analysis consists of individual respondents covered by the General Social Survey (GSS) between 1977 and 2008. *Age* is the age of the respondent. *Gender* is a binary variable that equals one if a respondent is male, and zero if the respondent is female. *Education* is years of schooling of the respondent. *IncomeRank* takes the value of 1 to 12, where a higher value indicates a higher income category according to the GSS. *Employed* is a binary variable that equals one if a respondent's answer to his/her unemployment status is "No" and zero otherwise. *Unemployed* is a binary variable that equals one if a respondent's answer to his/her unemployment status is "Yes" and zero otherwise. *Catholic* is a binary variable that equals one if the respondent's religion is Catholic and zero otherwise. *Protestant* is a binary variable that equals one if the respondent's religion is Protestant and zero otherwise. Panel B shows the effect of inherited trust on innovation. The sample for this analysis consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the General Social Survey (GSS), and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *InheritedTrust* is the trust inherited by U.S. descendants of immigrants, which is estimated according to Algan and Cahuc (2010). Other variables are defined in the legend of Table 3. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Estimating inherited trust

Dependent variable	(1)	(2)
	Trust	
	Coefficient	*T-statistic*
Age	0.013***	(4.4)
Age^2	-0.000***	(-3.0)
Gender	0.017*	(1.9)
Education	0.040***	(18.7)
IncomeRank	0.001	(0.7)
Employed	-0.001	(-0.1)
Unemployed	-0.051**	(-2.5)
Catholic	0.036	(1.7)
Protestant	0.013	(0.9)
Africa	-0.150***	(-65.0)
Arabia	0.045***	(5.5)
Austria	0.167***	(20.1)
Belgium	0.205***	(21.3)
Canada	0.088***	(10.2)
China	0.114***	(9.9)
Czech Republic	0.069***	(8.2)
Denmark	0.154***	(27.3)
Finland	0.083***	(10.3)
France	0.103***	(15.7)
Germany	0.104***	(24.8)
Greece	-0.019**	(-2.3)
Hungary	0.087***	(12.9)
India	0.026**	(2.7)
Ireland	0.113***	(17.5)
Italy	0.023*	(1.8)
Japan	0.130***	(11.2)
Lithuania	0.060***	(3.9)
Mexico	0.004	(0.4)
Netherlands	0.065***	(25.8)
Norway	0.189***	(57.2)
Philippines	-0.186***	(-13.2)

Poland	0.080***	(7.0)
Portugal	-0.021	(-1.5)
Puerto Rico	-0.195***	(-18.0)
Romania	-0.259***	(-25.7)
Russia	0.085***	(7.0)
Spain	0.046***	(5.0)
Sweden	0.142***	(36.0)
Switzerland	0.188***	(22.5)
United Kingdom	0.118***	(23.5)
Yugoslavia	0.116***	(11.4)
Year FE	Yes	
Observations	10,373	
R-squared	0.12	

Table 6: Inherited trust and innovation (cont'd)

Panel B: The effect of inherited trust on innovation

Dependent variables	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)	*Ln*(1+*Patent*)	*Ln*(1+*Citation*)	*Ln*(1+*Patent*)	*Ln*(1+*Citation*)
Panel B.1: OLS regressions						
InheritedTrust×Intensity			18.666***	19.543***	18.679***	19.255***
			(3.9)	(3.9)	(3.9)	(3.9)
InheritedTrust	4.945**	5.366**	3.079*	3.423**		
	(2.5)	(2.8)	(1.8)	(2.1)		
VA	5.780***	5.989***	6.027**	4.656	6.386***	6.211***
	(5.3)	(4.2)	(2.3)	(1.5)	(3.6)	(2.9)
Ln(*GDP*)	-0.081	-0.183	-0.074	-0.167	3.523***	4.941***
	(-0.3)	(-0.7)	(-0.3)	(-0.7)	(4.1)	(3.3)
Trade	-1.113	-1.450**	-0.727	-0.839	0.161	0.309
	(-1.6)	(-2.1)	(-1.3)	(-1.5)	(0.8)	(1.1)
FinDev	1.044***	1.263***	0.935***	1.126***	0.109	-0.026
	(3.8)	(4.0)	(4.1)	(4.5)	(0.9)	(-0.2)
EconFree	-0.719**	-0.421	-0.625**	-0.397	-0.465**	-0.678**
	(-2.4)	(-1.4)	(-2.2)	(-1.5)	(-2.3)	(-2.2)
IPPro	1.048***	1.037***	0.759**	0.727**	-0.093	-0.074
	(3.0)	(2.9)	(2.4)	(2.3)	(-0.8)	(-0.5)
Intensity	2.444**	3.336**	-2.390	-5.742	-2.512	-5.834
	(2.4)	(2.8)	(-0.6)	(-1.0)	(-0.7)	(-1.0)
VA×Intensity			-5.823	7.554	-10.363	-9.956
			(-0.3)	(0.3)	(-1.1)	(-0.9)
Ln(*GDP*)*×Intensity*			-0.093	-0.207	-0.075	-0.225
			(-0.2)	(-0.3)	(-0.1)	(-0.3)
Trade×Intensity			-3.909*	-6.200**	-4.118**	-6.359**
			(-2.0)	(-2.6)	(-2.1)	(-2.7)
FinDev×Intensity			1.060	1.299	1.087	1.409
			(1.6)	(1.3)	(1.7)	(1.4)
EconFree×Intensity			-0.885	-0.174	-0.802	-0.054
			(-1.3)	(-0.2)	(-1.1)	(-0.1)
IPPro×Intensity			2.910***	3.158***	2.781***	3.044***
			(5.4)	(5.3)	(5.1)	(5.7)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	Yes	Yes
Observations	5,915	5,915	5,915	5,915	5,915	5,915
R-squared	0.72	0.72	0.73	0.74	0.90	0.88

Panel B.2: Fama-MacBeth regressions

InheritedTrust×Intensity			30.846***	30.102***	29.553***	29.837***
			(4.7)	(4.0)	(4.8)	(4.0)
InheritedTrust	7.284***	8.123***	4.176***	5.086***		
	(4.7)	(4.3)	(4.3)	(3.7)		
VA	5.551***	5.575***	5.847***	3.369***	6.403***	5.530***
	(14.6)	(12.5)	(6.5)	(3.4)	(9.7)	(5.6)
Ln(*GDP*)	0.042	-0.049	0.062	-0.023	0.319***	0.307**
	(0.6)	(-0.6)	(1.1)	(-0.3)	(3.3)	(2.8)
Trade	-2.112***	-2.634***	-1.438***	-1.525***	0.028	0.012
	(-5.3)	(-5.4)	(-4.6)	(-4.2)	(0.3)	(0.1)
FinDev	0.768***	0.966***	0.790***	1.035***	1.461***	1.696***
	(5.3)	(5.4)	(7.7)	(7.8)	(10.9)	(12.6)
EconFree	-0.689***	-0.312	-0.675***	-0.411	-1.462***	-1.464***
	(-3.5)	(-1.1)	(-3.6)	(-1.6)	(-4.0)	(-3.7)
IPPro	1.253***	1.153***	0.891***	0.748***	0.203	0.058
	(5.2)	(4.4)	(4.6)	(3.7)	(1.3)	(0.4)
VA×Intensity			-5.895	16.271*	-10.295**	-4.524
			(-0.9)	(2.0)	(-2.6)	(-0.6)
Ln(*GDP*)*×Intensity*			-0.172	-0.249	-0.115	-0.229
			(-0.7)	(-0.6)	(-0.4)	(-0.6)
Trade×Intensity			-6.802***	-11.175***	-7.151***	-11.126***
			(-5.3)	(-5.2)	(-5.1)	(-5.1)
FinDev×Intensity			-0.217	-0.717	-0.339	-0.644
			(-0.4)	(-1.0)	(-0.6)	(-0.9)
EconFree×Intensity			-0.140	0.990*	-0.130	0.967
			(-0.5)	(1.8)	(-0.4)	(1.7)
IPPro×Intensity			3.510***	3.935***	3.556***	3.918***
			(6.5)	(5.6)	(6.6)	(5.6)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	Yes	Yes
Observations	5,915	5,915	5,915	5,915	5,915	5,915
R-squared	0.79	0.80	0.81	0.81	0.92	0.91

Table 7: Economic mechanisms

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS. In Panel A, the contract enforceability index is from Djankov et al. (2003), and a country's contract enforceability is defined as high (low) if this index is above (below) the sample median. The intellectual property protection index is from Park (2008), and a country's intellectual property protection is defined as strong (weak) if this index is above (below) the sample median. In Panel B, we classify a country's bankruptcy regime as debtor friendly if reorganization is likely to be used in a bankruptcy proceeding, and creditor friendly if foreclosure or liquidation is likely to be used, based on the debt enforcement information from Djankov et al. (2008). The labor protection index is the sum of the employment laws index, the collective relations laws index, and the social security laws index from Botero et al. (2004). A country's labor protection is defined as strong (weak) if this index is above (below) the sample median. In Panel C, the financial disclosure index is from the *Global Competitiveness Report* 1999-2000. Financial disclosure in a country is defined as transparent (opaque) if this index is above (below) the sample median. The index for the strength of auditing and accounting standards is from the *Global Competitiveness Report* 2003-2004. Auditing and accounting standards are defined as strong (weak) if this index is above (below) the sample median. Other variables are defined in the legend of Table 3. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Economic mechanisms (cont'd)

Dependent variables	(1)	(2)	(3)	(4)
	Ln(1+*Patent*)		*Ln*(1+*Citation*)	
Panel A: Partitioning the sample based on costs of coordination				
	Low	High	Low	High
Sample partition based on the contract enforceability index (N_{high} = 4,118; N_{low} = 4,367)				
Trust×Intensity	1.052	15.742**	3.479	19.540***
	(0.2)	(2.9)	(0.5)	(3.2)
Sample partition based on the intellectual property protection index (N_{high} = 4,904; N_{low} = 4,754)				
Trust×Intensity	4.109	11.898***	7.438	13.063***
	(0.9)	(3.6)	(1.4)	(3.9)
Panel B: Partitioning the sample based on costs of failure				
	High	Low	High	Low
Sample partition based on the debt enforcement indicator (N_{high} = 4,802; N_{low} = 4,891)				
Trust×Intensity	1.003	12.364***	2.472	16.822***
	(0.3)	(3.5)	(0.6)	(4.0)
Sample partition based on the labor protection index (N_{high} = 5,048; N_{low} = 4,721)				
Trust×Intensity	3.434	12.266***	6.857	15.570***
	(0.8)	(3.1)	(1.5)	(3.3)
Panel C: Partitioning the sample based on costs of funding				
	Low	High	Low	High
Sample partition based on the financial disclosure score (N_{low} = 4,690; N_{high} = 4,809)				
Trust×Intensity	2.575	16.872***	5.014	19.277***
	(0.6)	(3.9)	(1.0)	(3.7)
Sample partition based on the strength of auditing and accounting standards (N_{low} = 3,998; N_{high} = 6,069)				
Trust×Intensity	1.021	16.362***	3.051	18.436***
	(0.2)	(3.7)	(0.6)	(3.6)

Table 8: The effect of trust on innovation originality and generality across industries

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Originality* (*Generality*) is defined as the total originality (generality) score of all patents in a two-digit ISIC industry for each country in each year. The originality (generality) score of a patent is calculated as one minus the Herfindahl index of the technology class distribution of all the patents that this patent cites (that cite this patent). *Trust* is defined using the WVS. Other variables are defined in the legend of Table 3. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Originality*)	*Ln*(1+*Generality*)
Trust×Intensity	6.971**	6.490**
	(2.6)	(2.5)
Trust	-0.591	-0.197
	(-1.0)	(-0.3)
VA	2.400***	1.987**
	(3.0)	(2.4)
Ln(*GDP*)	1.337***	0.925***
	(6.7)	(3.9)
Trade	0.022	-0.014
	(0.1)	(-0.1)
FinDev	0.034	0.046
	(0.4)	(0.6)
EconFree	0.001	-0.183**
	(0.0)	(-2.1)
IPPro	-0.002	-0.182**
	(-0.0)	(-2.4)
Intensity	-16.524***	-18.743***
	(-4.6)	(-4.5)
VA×Intensity	6.064	10.722
	(1.0)	(1.6)
Ln(*GDP*)*×Intensity*	0.878	0.892
	(1.5)	(1.1)
Trade×Intensity	-1.318	-1.090
	(-1.4)	(-1.1)
FinDev×Intensity	0.865	1.041**
	(1.6)	(2.1)
EconFree×Intensity	0.104	0.447
	(0.2)	(0.6)
IPPro×Intensity	1.282***	1.461***
	(2.7)	(3.2)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	8,310	8,310
R-squared	0.82	0.85

Internet Appendix

This Internet Appendix provides supplemental analyses and robustness tests for the main results presented in the paper. To avoid any confusion, we add the prefix "IA" for "Internet Appendix" to the table numbers in this section. Below is a list of the tables followed by a discussion of the results.

(1) In addition to industry fixed effects, we further account for the effect of industry size (e.g., an industry with more employees may have a higher level of aggregate innovation output) by replacing *Ln*(1+*Patent*) and *Ln*(1+*Citation*) with the logarithm of one plus per capita patent counts (*Ln*(1+*Patent/Emp*)) and the logarithm of one plus per capita citation counts (*Ln*(1+*Citation/Emp*)) in Eq. (2), where *Patent/Emp* and *Citation/Emp* are defined as *Patent* and *Citation* scaled by the total number of employees in each two-digit ISIC industry. We present the regression results in Table IA1. We continue to find significantly positive coefficients on *Trust*×*Intensity*.

(2) Following the previous literature (e.g., Acharya and Subramanian, 2009; Ernst, Richter, and Riedel, 2014), we use two alternative measures of innovation output as our dependent variables, i.e., the logarithm of one plus the number of innovative firms (*Ln*(1+*NFirm*)) and the logarithm of one plus patent family size (*Ln*(1+*PatFam*)). An innovative firm is defined as a firm with non-zero patents, and patent family size is defined as the number of filings of a particular patent

application around the world. We find that our results are robust to these two alternative measures of innovation output (see Table IA2).

(3) We construct a measure of social distrust (*Distrust*), the opposite of social trust, based on the percentage of survey participants in each country who responded affirmatively to the following question in WVS: "*Do you think most people try to take advantage of you?*" We then replace *Trust* with *Distrust* in Eq. (2) and present the regression results in Table IA3. We find that the coefficient estimates of *Distrust*×*Intensity* are always negative and significant at the 1% level, suggesting that our results are not sensitive to how we measure trust.

(4) To further mitigate the concern of any residual correlation between sample observations in both country and year dimensions, we employ a two-way clustering by clustering standard errors at both the country and year level following the suggestion of Petersen (2009). Our results are robust to this two-way clustering (see Table IA4).

(5) To capture the long-term nature of innovation processes (Manso, 2011), we measure trust in year *t*-5 ($Trust_{t\text{-}5}$) instead of year *t*-1 in Eq. (2). We then re-estimate the regressions and present the results in Table IA5. The coefficient estimates of $Trust_{t\text{-}5}$×*Intensity* are always positive and significant at the 1% level, suggesting that our findings are robust to accounting for the possibility of delayed response of innovation output to trust.

(6) Multinational corporations (MNCs) may choose to setup a R&D center overseas or acquire innovative foreign firms for their innovation. Thus a potential concern is that the level of trust in a firm's home country may not be relevant for all of the firm's innovation output. Although this possibility biases against our findings, we further alleviate the concern by excluding patents that are first filed by domestic firms with foreign patent offices, to the extent that such patents are likely to have originated from R&D centers and subsidiaries located overseas. We re-estimate the regression model and present the results in Table IA6. The coefficients of *Trust*×*Intensity* remain positive and significant, suggesting that our findings are unlikely to be driven by MNCs' overseas R&D and acquisition activities.

(7) Following Hsu, Tian, and Xu (2014), we conduct an analysis at the technology-class level. Specifically, we aggregate all variables at the three-digit International Patent Classification (IPC) class and re-estimate Eq. (2) with technology-class fixed effects instead of industry fixed effects. We present the regression results in Table IA7. We find that the baseline results do not change qualitatively as the coefficient estimates of *Trust*×*Intensity* are positive and significant at the 1% level in all the regressions.

(8) Given that patent granting practices differ across countries, our innovation output measures can be subject to measurement errors. If our finding is mainly driven by the correlation between trust and the error that captures the difference in patent granting practices across countries, the relation between trust and innovation we document can be spurious. To mitigate this concern, we repeat our analysis using a sample of firms whose patents are granted by the USPTO only.[1] We extract patents granted by the USPTO from the NBER Patent and Citation database from 1991 to 2003.[2] We then re-estimate Eq. (2) using the USPTO sample. Table IA8 reports the regression results. We find that the coefficient estimates of *Trust*×*Intensity* remain positive and significant at the 1% level.

(9) To examine whether the relation between trust and innovation is monotonic over the entire distribution of trust, we add the quadratic term of *Trust*, i.e., $Trust^2$, to Eq. (1) as an additional explanatory variable and re-estimate the regression model. We present the regression results in Table IA9. We find that *Trust* has a significantly positive coefficient, while $Trust^2$ has an insignificant and negative coefficient. The latter result provides some evidence that excessive trust may impede innovation, although this effect is not statistically significant. More importantly, the conclusion that we draw from our analysis remains intact, i.e., social trust promotes innovation.

[1] We choose the USPTO as the patent granting authority for this analysis based on two considerations. First, the U.S. is an ideal place for firms from different countries, which seek to compete in technology, to file patents to because of its large market size and leading status in technology (Cantwell and Hodson, 1991). Second, U.S. patents are a good indicator of technological advantages given its advanced patenting system (Kortum and Lerner, 1999).

[2] The NBER data end in 2006. However, we end the sample period in 2003 because there is an average two-year lag between the patent filing data and the patent granting date, which leads to incomplete patent data especially for those filed in 2004 and 2005.

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Table IA1: Using per capita innovation output measures as dependent variables

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent/Emp*) is the log of one plus the total number of patents in a two-digit ISIC industry over the total number of employees in the industry for each country each year. *Ln*(1+*Citation/Emp*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry over the total number of employees in the industry for each country each year. *Trust* is defined using the WVS data. *VA* is the percentage of value-added in a two-digit ISIC industry over the total value-added for each country each year. *Ln*(*GDP*) is the log of GDP per capita. *Trade* is a country's exports plus imports as a fraction of GDP. *FinDev* is the ratio of stock market capitalization plus domestic credit provided by the banking sector over GDP. *EconFree* is the economic freedom index of a country from the Fraser Institute. *IPPro* is the intellectual property protection index of a country from Park (2008). *Intensity* is the median number of patents held by a U.S. firm in a two-digit ISIC industry each year. Variables in dollars are computed in real terms at constant national prices in 2000 U.S. dollars. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Patent/Emp*)	*Ln*(1+*Citation/Emp*)
Trust×*Intensity*	8.845***	12.888***
	(6.8)	(5.7)
Trust	-0.497*	-1.204**
	(-1.7)	(-2.6)
VA	-0.149	-0.231
	(-0.2)	(-0.3)
Ln(*GDP*)	-0.160	-0.065
	(-0.6)	(-0.2)
Trade	-0.010	0.064
	(-0.1)	(0.5)
FinDev	0.071	0.080
	(1.4)	(1.3)
EconFree	0.013	0.016
	(0.2)	(0.2)
IPPro	0.003	-0.003
	(0.1)	(-0.1)
Intensity	-16.048***	-20.154***
	(-6.9)	(-6.4)
VA×*Intensity*	-12.074**	-12.082*
	(-2.4)	(-1.9)
Ln(*GDP*)×*Intensity*	1.630***	1.973***
	(5.1)	(4.4)
Trade×*Intensity*	-0.324	-0.412
	(-0.8)	(-0.7)
FinDev×*Intensity*	0.157	0.235
	(0.6)	(0.6)
EconFree×*Intensity*	-0.314	-0.255
	(-0.8)	(-0.5)
IPPro×*Intensity*	0.551**	0.557*
	(2.2)	(1.7)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	9,169	9,169
R-squared	0.73	0.72

Table IA2: Using alternative measures of innovation output

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*NFirm*) and *Ln*(1+*PatFam*) are the log of one plus the number of innovative firms and the log of one plus the patent family size in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS. Other variables are defined in the legend of Table IA1. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*NFirm*)	*Ln*(1+*PatFam*)
Trust×*Intensity*	3.585**	10.194***
	(2.3)	(3.4)
Trust	2.132**	1.940*
	(2.4)	(1.8)
VA	1.675**	4.302***
	(2.4)	(3.1)
Ln(*GDP*)	1.473**	1.464
	(2.2)	(1.2)
Trade	-0.397*	-0.379
	(-1.7)	(-1.3)
FinDev	0.105*	0.125
	(1.8)	(1.3)
EconFree	-0.022	0.012
	(-0.2)	(0.1)
IPPro	0.152	0.221
	(1.5)	(1.6)
Intensity	-5.929***	-17.290***
	(-2.8)	(-3.8)
VA×*Intensity*	2.981	5.226
	(0.5)	(0.6)
Ln(*GDP*)×*Intensity*	0.573	1.723**
	(1.7)	(2.1)
Trade×*Intensity*	-0.493	-0.097
	(-1.4)	(-0.1)
FinDev×*Intensity*	0.307*	0.672*
	(1.8)	(1.8)
EconFree×*Intensity*	-0.369	-1.437**
	(-1.2)	(-2.1)
IPPro×*Intensity*	0.765***	2.271***
	(4.5)	(5.4)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	10,067	10,067
R-squared	0.90	0.88

Table IA3: Using an alternative measure of trust

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Distrust* is defined as the percentage of survey participants who answer "Yes" to the question "*Do you think most people try to take advantage of you?*" from the WVS. Other variables are defined in the legend of Table IA1. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)
Distrust×Intensity	-9.076***	-12.804***
	(-3.0)	(-3.6)
Distrust	-0.928	-0.503
	(-0.7)	(-0.5)
VA	5.293***	5.575***
	(3.3)	(3.3)
Ln(*GDP*)	3.146***	3.820***
	(6.7)	(9.5)
Trade	0.399	0.768*
	(0.9)	(1.8)
FinDev	-0.367*	-0.391**
	(-2.0)	(-2.4)
EconFree	0.275	0.341
	(1.3)	(1.5)
IPPro	0.028	0.195
	(0.1)	(1.2)
Intensity	-11.933*	-12.775
	(-1.7)	(-1.5)
VA×Intensity	-6.390	-14.439
	(-0.6)	(-1.2)
Ln(*GDP*)*×Intensity*	2.198**	2.801***
	(2.4)	(2.8)
Trade×Intensity	-0.150	-0.714
	(-0.1)	(-0.4)
FinDev×Intensity	0.916*	1.134*
	(1.8)	(1.9)
EconFree×Intensity	-1.885	-1.900
	(-1.5)	(-1.3)
IPPro×Intensity	2.095**	1.587
	(2.1)	(1.4)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	4,081	4,081
R-squared	0.90	0.89

Table IA4: Clustering standard errors by both country and year

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS. Other variables are defined in the legend of Table IA1. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country and year, respectively. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)
Trust×Intensity	10.078***	13.578***
	(3.4)	(4.1)
Trust	2.095*	0.745
	(1.7)	(0.6)
VA	4.149***	4.241***
	(3.1)	(3.0)
Ln(*GDP*)	1.442	2.619
	(1.2)	(1.6)
Trade	-0.373	-0.141
	(-1.2)	(-0.4)
FinDev	0.134	0.066
	(1.5)	(0.7)
EconFree	-0.001	-0.076
	(-0.0)	(-0.4)
IPPro	0.204	0.148
	(1.6)	(1.3)
Intensity	-16.516***	-20.399***
	(-3.8)	(-4.1)
VA×Intensity	5.198	0.955
	(0.6)	(0.1)
Ln(*GDP*)*×Intensity*	1.670**	1.770**
	(2.2)	(2.0)
Trade×Intensity	-0.147	-0.560
	(-0.2)	(-0.5)
FinDev×Intensity	0.694*	1.068**
	(2.0)	(2.5)
EconFree×Intensity	-1.443**	-1.149
	(-2.1)	(-1.5)
IPPro×Intensity	2.269***	2.227***
	(5.7)	(4.4)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	10,067	10,067
R-squared	0.88	0.86

Table IA5: Lagging trust by five years

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. $Trust_{t-5}$ is defined using the WVS data and lagged for five years from the data year. Other variables are defined in the legend of Table IA1. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country and year, respectively. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)
$Trust_{t-5}$×*Intensity*	13.183***	16.816***
	(4.7)	(5.2)
$Trust_{t-5}$	1.546	1.003
	(1.2)	(0.8)
VA	5.099***	5.211***
	(3.2)	(3.1)
Ln(*GDP*)	1.700	2.814
	(1.4)	(1.6)
Trade	-0.416	-0.050
	(-1.2)	(-0.2)
FinDev	0.221*	0.124
	(2.0)	(0.9)
EconFree	-0.107	-0.128
	(-0.5)	(-0.5)
IPPro	0.166	0.114
	(1.1)	(0.7)
Intensity	-14.068***	-17.910***
	(-3.6)	(-3.8)
VA×*Intensity*	0.661	-2.644
	(0.1)	(-0.2)
Ln(*GDP*)×*Intensity*	1.528*	1.569
	(1.8)	(1.7)
Trade×*Intensity*	-0.434	-1.158
	(-0.4)	(-0.7)
FinDev×*Intensity*	0.861**	1.339**
	(2.1)	(2.6)
EconFree×*Intensity*	-1.683**	-1.367
	(-2.2)	(-1.5)
IPPro×*Intensity*	2.149***	2.150***
	(4.8)	(3.9)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	7,785	7,785
R-squared	0.88	0.86

Table IA6: Excluding patents first filed with foreign patent offices

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent_EF*) is the log of one plus the total number of patents filed at the domestic patent office in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation_EF*) is the log of one plus the total number of citations of patents filed at the domestic patent office, which are adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS data. Other variables are defined in the legend of Table IA1. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country and year, respectively. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1) *Ln*(1+*Patent_EF*)	(2) *Ln*(1+*Citation_EF*)
Trust×*Intensity*	9.867***	9.761**
	(3.0)	(2.5)
Trust	0.613	-1.898
	(0.3)	(-1.1)
VA	3.168**	2.320*
	(2.3)	(1.8)
Ln(*GDP*)	2.341*	3.329*
	(1.8)	(1.9)
Trade	-0.113	-0.109
	(-0.3)	(-0.3)
FinDev	0.294	0.189
	(1.5)	(0.9)
EconFree	0.045	0.007
	(0.3)	(0.0)
IPPro	0.418*	0.438**
	(1.7)	(2.2)
Intensity	-14.379***	-12.751**
	(-3.3)	(-2.5)
VA×*Intensity*	2.901	7.909
	(0.3)	(0.9)
Ln(*GDP*)×*Intensity*	1.381***	0.903
	(2.8)	(1.7)
Trade×*Intensity*	-1.048	-1.147*
	(-1.7)	(-1.9)
FinDev×*Intensity*	-0.325	0.084
	(-0.6)	(0.1)
EconFree×*Intensity*	-1.162	-0.932
	(-1.7)	(-1.2)
IPPro×*Intensity*	2.116***	1.905***
	(4.3)	(3.2)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	10,067	10,067
R-squared	0.82	0.77

Table IA7: Analysis at the technology-class level

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a three-digit IPC technology class for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a three-digit IPC technology class for each country each year. *Trust* is defined using the WVS data. *VA* is the percentage of value-added in a two-digit ISIC industry over the total value-added for each country each year. *Ln*(*GDP*) is the log of GDP per capita. *Trade* is the log of a country's imports plus exports as a fraction of GDP. *FinDev* is the ratio of stock market capitalization plus domestic credit provided by the banking sector over GDP. *EconFree* is the economic freedom index of a country from the Fraser Institute. *IPPro* is the intellectual property protection index of a country from Park (2008). *Intensity* is the median number of patents held by a U.S. firm in a three-digit IPC technology class in each year. Variables in dollars are computed in real terms at constant national prices in 2000 U.S. dollars. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)
Trust×*Intensity*	3.189***	4.945***
	(4.0)	(4.4)
Trust	0.044	-2.125**
	(0.1)	(-2.1)
VA	6.528	-2.933
	(1.4)	(-0.7)
Ln(*GDP*)	1.500	1.857
	(1.1)	(1.2)
Trade	-0.113	0.081
	(-0.5)	(0.3)
FinDev	0.073	0.012
	(0.6)	(0.1)
EconFree	-0.168	-0.150
	(-0.8)	(-0.6)
IPPro	-0.118	-0.040
	(-0.9)	(-0.3)
Intensity	-6.554***	-9.032***
	(-5.4)	(-5.4)
VA×*Intensity*	8.791	26.472***
	(1.2)	(3.7)
Ln(*GDP*)×*Intensity*	0.441*	0.625**
	(1.9)	(2.3)
Trade×*Intensity*	-0.181	-0.449
	(-0.7)	(-1.1)
FinDev×*Intensity*	0.207	0.343*
	(1.4)	(1.7)
EconFree×*Intensity*	-0.112	-0.048
	(-0.5)	(-0.2)
IPPro×*Intensity*	0.683***	0.622***
	(5.0)	(3.2)
Year FE	Yes	Yes
Technology-class FE	Yes	Yes
Country FE	Yes	Yes
Observations	33,807	33,807
R-squared	0.78	0.67

Table IA8: Trust and innovation – A sample of USPTO data

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the NBER Patent and Citation database, the WVS, and the WDI database between 1991 and 2003. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. Other variables are defined in the legend of Table IA1. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)
Trust×Intensity	5.947***	6.693***
	(3.2)	(3.4)
Trust	-0.138	-0.208
	(-0.2)	(-0.3)
VA	1.423	0.786
	(0.9)	(0.5)
Ln(*GDP*)	1.293**	1.114**
	(2.7)	(2.4)
Trade	0.362	0.416*
	(1.5)	(1.7)
FinDev	-0.104*	-0.158**
	(-1.8)	(-2.5)
EconFree	-0.026	-0.018
	(-0.3)	(-0.2)
IPPro	-0.157	-0.127
	(-1.4)	(-1.0)
Intensity	-14.350***	-15.289***
	(-4.8)	(-4.9)
VA×Intensity	15.453	20.299*
	(1.4)	(1.8)
Ln(*GDP*)×*Intensity*	1.272***	1.358***
	(2.8)	(3.0)
Trade×Intensity	-2.076*	-2.192*
	(-1.9)	(-2.0)
FinDev×Intensity	1.351**	1.393**
	(2.5)	(2.5)
EconFree×Intensity	-0.458	-0.493
	(-1.1)	(-1.2)
IPPro×Intensity	1.213**	1.225**
	(2.4)	(2.3)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	6,114	6,114
R-squared	0.88	0.87

Table IA9: Non-monotonicity in the relation between trust and innovation?

The sample consists of countries with granted patents jointly covered by the UNIDO Industrial Statistical database, the BVD Orbis database, the WVS, and the WDI database between 1991 and 2008. We only count each innovation once, i.e., an innovation patented in different countries is counted as one patent. *Ln*(1+*Patent*) is the log of one plus the total number of patents in a two-digit ISIC industry for each country each year. *Ln*(1+*Citation*) is the log of one plus the total number of patent citations adjusted for time-technology class fixed effects in a two-digit ISIC industry for each country each year. *Trust* is defined using the WVS data. Other variables are defined in the legend of Table IA1. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are clustered by country and year, respectively. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	(1)	(2)
	Ln(1+*Patent*)	*Ln*(1+*Citation*)
Trust	3.826*	3.811*
	(1.9)	(1.8)
$Trust^2$	-1.054	-2.714
	(-0.3)	(-0.7)
VA	5.066***	4.762***
	(6.2)	(4.9)
Ln(*GDP*)	1.576	2.724
	(1.4)	(1.6)
Trade	-0.385	-0.184
	(-1.4)	(-0.7)
FinDev	0.191*	0.151
	(1.9)	(1.5)
EconFree	-0.144	-0.180
	(-0.9)	(-0.8)
IPPro	0.419***	0.349**
	(2.8)	(2.3)
Intensity	1.531*	1.813*
	(1.7)	(1.7)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes
Observations	10,067	10,067
R-squared	0.87	0.84

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