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Social trust and Firms Innovation in Chinese Provinces

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The Research Focus

Research focus:

- social trust fosters cooperation and hence boost innovation within the radius in which it is disseminated (Fukuyama 1995).

- We use social trust as collective asset to test whether in Chinese provinces with higher social trust, firms' innovation in terms of number of patents applications is more pronounced

Preliminary outcome:

- number of patents increases in provinces with higher level of social trust. This is robust to a series of sensitivity analysis and to a specification strategy using IV.

- We also conduct a model extension using firms' financial constraint and separating between state-owned vs non-state-owned firms.

- We see that the coefficient of social trust is even higher among firms with more pronounced financial constraint, and it is statistically significant in correlation to non-state-owned firms but not in correlation to state-owned firms.

Contribution

- In line with the research agenda proposed by Alesina and Giuliano (2015) – to look at the role of institutions and cultural aspects on different market economies

- So far, the literature has focused on social trust and R&D investments across OECD at the country level (Akçomak & Ter Weel, 2009; Ndubuisi, 2020) also at regional level (Akçomak & ter Weel, 2009; Miguélez et al., 2011; Crescenzi et al. 2012)

- Little attention to a transition economy like China

- Transition in terms of formal institutions and institutional quality (Yi et al. 2017)

- <u>Contribution</u>
- Enrich the research on the role of informal institutions on firms' innovation performance in transition economies

- The role of informal institutions in the regional economic performance of an emerging economy experiencing a clear acceleration in industrialisation and urbanisation (Li et al. 2019, Wang and Su 2018). This links with increasing innovative performance (Crescenzi et al. 2013).

- Transition economic periods – inevitably informal institutions have a key role in shaping the economic evolution and performance of the different regional economic geography within that country (Cui 2017)

The Role of Social Trust (Social Capital Theory)

- Trust enhances economic performance (Bjørnskov 2018, Putnam et al 1993; Fukuyama 1995), improves financial development (Guiso et al. 2004; 2008; 2009) firm productivity (Bloom et al 2012), investment (Knack and Keefer 1997)

- Social trust: informal institution reflecting the average trustworthiness of people and the expectation that they will comply with both formal rules and informal social contracts.

- Trust increases cooperation and lowers transaction cost, as creates ties and mutual collaboration among business partners essential for high-risk innovation investments (Bjørnskov and Méon 2015, Crescenzi et al. 2013; Dettori et al. 2010)

- For firms, a context with high social trust facilitates firms to consider longer-run investment decisions, looking at riskier but potentially more productive processes (Bjørnskov and Méon 2015).

The Role of Social Trust (Social Capital Theory)

- Trust
- facilitates knowledge exchange, transmission of information, and idea creation promoting firms' innovation (Murphy 2002);
- enhances innovation as it reduces opportunistic behaviour within informal contracting, reduce asymmetric information within firm (Gupta et al 2020);
- improves merger performance (Wang & Li, 2017),
- promote venture capital (Bottazzi et al., 2016),
- helps companies obtain commercial credit (Wu et al., 2014),
- reduces relational risk (Ndubuisi, 2020);
- Peer-to-Peer lending (Duarte et al., 2012)
- and equity financing (Gupta et al., 2018) by improving corporate financing environment.

Motivations: Chinese Context

Innovation is a core part of China's economic development and transformation (Peng et al. 2021).

Chinese economy: transition economy from mainly export oriented (cost advantage) to a more complex economy increasingly relying upon R&D-led innovation and international partnership (Bruche, 2009; Kuchiki and Tsuji, 2010)

Initially this transition has attracted many studies, mainly at country level (Popkin and Iyengar, 2007; Parayil and D'Costa, 2009; Santangelo 2005; Fu and Soete 2010),

Recent attention at regional level (Crescenzi et al 2012; Liu et al. 2014 Yi et al. 2017)

We pick up from Crescenzi et al (2012 - JEG): the new research frontier for studies aspects of innovation are the emerging economies like India and China. Growing spending over the years in R&D/GDP.

Interesting: higher R&D/GDP at a country level does not affect much innovation. Suggestion to check at regional level for different reasons

Motivations: Chinese Context

Uneven innovation patterns across Chinese regions (in terms of patenting and other economic factors)

Their evidence suggest that Chinese innovation is highly influenced by its regional economic geography: innovation tend to be higher in context with higher agglomeration of activities, better infrastructures and more industry specialization.

- From the Institutional Perspective

This perspective has been gaining attention in the last years with a clear focus on the role of the quality of formal institutions on regional innovation in China (Yi et al. 2017; Liu et al. 2014)

Economic and Institutional Regional disparities (Liu et al. 2014). Regional formal institutions are responsible to make effective at local level policies and regulations from Central Government (Liu et al. 2014).

Innovation is higher in regions with more effective formal institutions (Yi et al. 2017).

We want to look at the informal institutional aspects

Chinese Provinces Between Innovation and Trust

- Chinese development and innovation cannot ignore the role of informal institutions as social trust (Chan et al. 2015; Chem 2017)
- China: vast territory where the development of religion, history, language, and social culture in different regions is extremely uneven, resulting in huge differences in the level of social trust between regions (Ang et al. 2012).
- China is a typical "relational" society influenced by Confucianism where trust is a key principle of life advocated by Confucianism and is the cornerstone of the normal operation of a "relational" society (Li et al., 2020).
- The influence of social trust shaped by traditional Confucian culture on economic activities is still prominent.
- Trusting relationship with local external partners promotes subsidiaries' innovative outcomes. The results are obtained by collecting and processing fresh data of MNE subsidiaries in Beijing, Shanghai and Guangzhou (Williams & Du, 2014).

Data and Variables

- Social Trust: Chinese General Social Survey (CGSS)

- "In general social interactions or contacts that do not directly involve money interests, do you think there are many people you can trust among strangers?”
- Likert scale (1-5) "mostly untrustworthy", "mostly untrustworthy", "half of the trustworthy and untrustworthy", "mostly trustworthy" and "mostly trustworthy“

- Firm financials and patent statistics were obtained from the China Stock Market & Accounting Research Database (CSMAR).

- Span period 2012 – 2017

Dependent Variable

- Patent applications (Crescenzi 2012; Bernstein, 2015; Faleye et al., 2014; Gupta et al., 2020; Hasan et al., 2020)

- Patents can provide necessary information about the intangible assets of the enterprise such as market value (Chen et al., 2017). Reliable measure of innovative output (Crescenzi et al 2012; Sedgley and Elmslie, 2004)

- Variable Patent applications expressed in Ln to mitigate the positive skewness of the distribution of patent applications (Gupta et al., 2020; Hasan et al., 2020)

Dependent Variable – Patent Application Downside

- Not all industries tend to patent with the same intensity and, in an emerging country context (Crescenzi et al 2012)
- patents measure invention and tend to be biased towards particular sectors of the economy where inventions are protected via patenting (Crescenzi et al 2012)
- Conversely, patent-based innovation indicators fail to account either for the differentiated degree of novelty of patented products (Crescenzi et al 2013)
- Many inventions are nonpatentability in particular as regards process innovation
- patent counts include both domestic and foreign firms, meaning that they may not fully capture domestic innovation capacity (Li and Pai, 2010; Wadhwa, 2010)

- Multinational firms' location patterns closely match those of patents (Crescenzi at al 2012)

Variables - (Chen et al., 2017; Gupta et al., 2020; Hasan et al., 2020),

Table 1 Definitions of Variables

Variable Name	Definitions
Patent applications (Innov)	Natural logarithm of annual patent applications
Social trust (Trust)	Measured from CGSS
Financial constraints (FC)	Measured from SA index
Firm size (Size)	Natural logarithm of company's total assets
Firm age (Age)	Company listing age
Financial leverage (Lev)	Total liabilities/total assets
Fixed assets ratio (FAR)	Fixed assets/total assets
Profitability (ROA)	Net profits/total assets
The proportion of the first largest shareholder (Top1)	The number of shares held by the largest shareholder/total equity
Duality (Dual)	1 if the chairman and general manager are the same person, 0 otherwise
Board structure (Board)	Independent directors / total directors
GDP	GDP of each province
Year dummies (Year)	1 when in the year, 0 otherwise
Industry dummies (Ind)	1 when in the industry, 0 otherwise

Note: Patent and firm characteristics data from 2012 to 2017 are collected from China Stock Market & Accounting Research Database (CSMAR). Provincial social trust is computed using data from the 2012 edition Chinese General Social Survey (CGSS). Provincial GDP of each year is obtained from China Statistical Yearbook. Source: Compiled by authors.

Summary Statistics

Table 2 Descriptive statistics

Variable	N	Mean	STD	Min	Max
Patent	12008	89.630	457.300	1	20107
LN(patent+1)	12008	3.171	1.405	0.693	9.909
Trust	12008	3.277	0.004	3.266	3.289
ROA	12008	0.037	0.447	-48.320	1.126
Size	12008	7.773	1.238	1.609	13.210
Age	12008	16.210	5.471	3	117
FAR	12008	0.220	0.154	0	0.948
LEV	12008	0.414	0.617	0.008	63.970
Top1	12008	35.170	15.020	0.290	89.990
Dual	12008	0.288	0.453	0	1
Board	12008	0.375	0.056	0.182	0.800
GDP	12008	10.470	0.626	7.546	11.400
FC	12008	-3.728	0.254	-7.385	-2.120

Source: compiled by authors

Empirical Results: Baseline Model

Variables	(1) LN(patent+1)	(2) LN(patent+1)
Trust	6.663**	7.018***
	(2.605)	(2.333)
ROA	0.974***	2.058***
	(0.251)	(0.231)
Size	0.587***	0.621***
	(0.012)	(0.011)
Age	-0.015***	-0.007***
	(0.002)	(0.002)
PPE	-1.417***	-1.083***
	(0.081)	(0.085)
LEV	0.127*	0.313***
	(0.068)	(0.065)
Top1	-0.002**	0.001
	(0.001)	(0.001)
Dual	0.098***	0.036
	(0.024)	(0.022)
Board	0.564***	0.279
	(0.215)	(0.191)
GDP	0.203***	0.057***
	(0.019)	(0.017)
Observations	12008	12008
R-squared	0.255	0.439
Industry fixed effects	No	Yes
Year fixed effects	No	Yes

Note: Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Robustness Checks: Tobit Model and alternative innovation measure

Table 6 Results of Tobit model and alternative innovation measure

Variables	(1) LN(patent+1)	(2) PatentRD
Trust	7.018***	75.697***
	(2.318)	(28.518)
ROA	2.058***	5.598
	(0.229)	(3.485)
Size	0.621***	5.945***
	(0.010)	(0.625)
Age	-0.007***	-0.110***
	(0.002)	(0.030)
PPE	-1.083***	-9.677***
	(0.084)	(1.617)
LEV	0.313***	0.444
	(0.064)	(0.719)
Top1	0.001	-0.011
	(0.001)	(0.013)
Dual	0.036	2.117***
	(0.022)	(0.693)
Board	0.279	9.057***
	(0.181)	(2.730)
GDP	0.057***	0.720**
	(0.017)	(0.341)
Observations	12008	11108
R-squared	0.166	0.122
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Note: Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Robustness Check: IV – Specification Strategy

Table 7 Results for 2SLS with instrument variables

Variables	(1) first stage Trust	(2) second stage LN(patent+1)
Blood	0.0001427***	
	(42.181)	
Ethnic	-0.0012708 ***	
	(-22.504)	
Trust		14.2587**
		(2.369)
Firm controls	Yes	Yes
Province controls	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	12008	12008
R-squared	0.211	0.439
F-statistic	1038.74***	

Note: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Model Extension: Financial Constraint

Variables	(1) LN(patent+1)	(2) LN(patent+1)
Trust	7.018***	148.616***
	(2.333)	(39.308)
ROA	2.058***	2.157***
	(0.231)	(0.231)
Size	0.621***	0.608***
	(0.011)	(0.011)
Age	-0.007***	0.015***
	(0.002)	(0.004)
PPE	-1.083***	-1.071***
	(0.085)	(0.085)
LEV	0.313***	0.353***
	(0.065)	(0.066)
Top1	0.001	0.000
	(0.001)	(0.001)
Dual	0.036	0.032
	(0.022)	(0.022)
Board	0.279	0.158
	(0.191)	(0.192)
GDP	0.057***	0.061***
	(0.017)	(0.017)
FC		-123.197***
		(34.303)
Trust*FC		37.750***
		(10.467)
Observations	12008	12008
R-squared	0.439	0.442
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Note: Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Model extension: Heterogeneity analysis

Table 5 Heterogeneity analysis

	(1)	(2)	(3)	(4)
	LN(patent+1)			
Variables	Non-state-owned	State-owned	Non-high-tech	High-tech
Trust	8.582***	3.648	5.352*	10.924***
	(3.103)	(3.634)	(2.804)	(4.191)
All controls	Yes	Yes	Yes	Yes
Observations	7386	4414	8545	3463
R-squared	0.394	0.533	0.468	0.293
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Conclusions

- Innovation is higher in context with more social trust.
- This relationship is particularly more pronounced for more financially constraint firms and for Non-State-Owned firms rather than State-Owned Firms
- This is an interesting application to the radius of trust to innovation so far.
- Trust as characteristics of persistency (Giulietti et al. 2022) but as informal institutions, trust can also be exacerbated via formal institutions transmission mechanism (Beringan and Irwin 2012).

Conclusions

- In the literature of social psychology and institutional studies the interplay between formal and informal institutions facilitates institutional compliance (formal and informal) and reduces transaction cost (Beringan and Irwin 2012; Bjørnskov 2011; 2018).

- This is particularly valid in emerging economies experiencing aspects of institutional transitions (Douarin and Mickiewicz 2017)

- Further extensions of this paper will look at this synergy as might be able to provide more pragmatic policy recommendations in this respect

Further Steps

Additional robustness and model extensions

- Regional fixed effects
- Interaction between ST and FC for State-Owned and Non-State-Owned firms
- Mechanism Social trust and Financial Constraint
- Formal institutional quality
- Human capital (University density or graduates/population)

Conclusions

Thank you!

APPENDIX

APPENDIX

Financial Constraints

- Innovation activities and firms also depend on external financing (Brown et al., 2009). In particular, innovating firms choose debt financing as a common channel and use patents as collateral in securing such debt financing (Mann, 2018)

- Trust works as intangible asset boosting cooperation among firms, particularly those with more limited access to external financing (dei Ottati literature)

- <u>Mechanism to test</u>
- Run the baseline model regression where innovation is regressed by FC but without ST. Add then ST and check whether the magnitude and the statistical significance reduces. If so, it means that this variable is acting as a mechanism through which ST is effective.

Financial Constraint

- Financial constraint – social trust identifies the belief that the other members of the community, in general, are trustworthy.
- It reflects a regional asset driving economic exchanges to rely upon norms of cooperative behaviour, reducing transaction costs and facilitate individuals' institutional compliance (financial rules as well as business conducts)
- Social trust establishes what Dei Ottati calls a "custom of reciprocal cooperation" in which economic actors tend to comply with a code of conduct relying upon norms of cooperative behaviours and institutional compliance (Dei Ottati 1994).
- This is essential for keeping promises within both financial agreement (Guiso et al. 2004), business, subcontracting (Dei Ottati 1994) as well as non-paper contracts in high innovative sectors (Saxenian 1996).
- Within an extended radius of trust individuals tend to comply with norms of cooperative behaviour driving their preferences towards win-win solutions rather than disagreement (Bogaert et al. 2008).

Identification Strategy - IV

- Blood donation (Guiso et al. 2004; 2016) positive relationship btw blood donation and social trust. Blood donation in the literature of social capital is a factor characterising the civic spirit that likely boost even further the level of social trust within a society.

- Ethnic diversity (Alesina and La Ferrara 2005; Dinesen & Sønderskov, 2015) Ethnic and cultural diversity has negative impact on social trust. Ethnic groups are determined by historical factors and unlikely be drect determinants of patents applications.

Tobit model

- In this study, the number of enterprise patent applications is non-negative.
- Because there are some firms without patent applications (n. patent applications = 0) we use a tobit model (Yiao and Qiao 2023 *Sustainability*)
- In other words, it is censored data with 0 as the lower bound, which makes the traditional mean effect estimation model possibly biased.
- For this reason, following Cassiman and Veugelers (2006), the Tobit model is used to estimate the regressions.
- The first column of Table 6 reports the estimation results of the Tobit model.
- The coefficient of social trust remains positive and significant at the 1% level after controlling for the industry nd year fixed effect

Alternative measure of Innovation (Patent/R&D)

- It is important to consider the efficiency of firms' innovation process.
- Therefore, referring to prior studies, Patent/R&D is used as an alternative measure of innovation efficiency.
- It is defined as the total number of patents a company applied for in a year divided by the total R&D investment in that year (Hirshleifer et al., 2012; Hirshleifer et al., 2013; Acharya et al., 2014; Hasan et al., 2020).
- The second column of Table 6 reports the results after altering firm innovation variable.
- As can be seen, the coefficient of social trust is significantly positive, implying that an increase in the level of social trust significantly promotes firm innovation. The results are consistent.

State-Owned vs. Non-State-Owned firms

- State-Owned firms (unlike Non-State-Owned firms) tend to have less financial constraints as they take advantage of their political connections and government endorsement (Crescenzi et al 2013; Guan and Liu 2020)

- Location: politically-motivated
- State-owned firms tend to be less innovation-oriented and they tend to localise in geographical areas influenced by political motivations

Innovation

- Innovation is one of the key drivers of economic growth both at country and regional level (Andergassen 2009, Bae and Yoo 2015; Crescenzi and Rodriguez-Pose 2011; Crescenzi et al 2012; Romer 1986 Santacreu 2015).

The mechanism of social trust (Social Capital Theory)

- Trust increases cooperation and lowers transaction cost, as creates ties and mutual collaboration among business partners essential for high-risk innovation investments (Bjørnskov and Méon 2015, Crescenzi et al. 2013; Dettori et al. 2010)

- Knowledge exchange (Audretsch and Feldman, 2004)

- Trust reflects also expectation regarding others' willingness to reciprocate and collaborate (motivations for knowledge exchange and information sharing – see Crescenzi et al. 2013)

Other Control Variables
(Chen et al., 2017; Gupta et al., 2020; Hasan et al., 2020),

Company Characteristic Variables	**enterprise size (lnSize),** **enterprise age (lnAge),** **profitability (ROA),** **financial leverage (Lev)** **fixed asset ratio (FAR).**
Corporate Governance Variables	proportion of the first largest shareholder (Top1), board structure (Board), duality (Dual).
Region variable	GDP
Fixed effect	Year + Industry