



Journal of Applied Economics and Business Studies (JAEBS)

Journal homepage: <https://jaeb.umsida.ac.id>

ISSN (Print): 2523-2614

ISSN (Online) 2663-693X



Entrepreneurial Behavior, Institutional Trust and National Innovation: A Macro-Level Empirical Study

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ABSTRACT

Schumpeterian fundamentalism supports the argument that innovation is a dynamic process and novelties are initiated through economic agents namely the entrepreneurs; vis-à-vis a strong institutional environment is required to facilitate the innovation process. Therefore, the present study undertakes the macro-level empirical analysis on determining the impact of entrepreneurial behavior, property rights and state effectiveness on country's innovation. The data is of panel nature consisting of 55 countries and a time period from 2010 to 2016. The empirical analysis is done using system GMM (Generalized Method of Moments) estimation technique. The study shows that the fear of failure rate and total early stage entrepreneurs reduces innovation in a country whereas there is a significant positive relationship between established business entrepreneurs and innovation. However, perceived opportunities have an insignificant impact. This means that it is not inevitable that opportunities necessary trigger innovation. In addition, the study shows that property rights play an integral role in developing institutional trust which boosts entrepreneurialism to undertake innovative venture. On the other hand, state effectiveness is negatively related to innovation i.e. institutional trust is brought down in fragile countries which retard country's innovation.

Keywords

Innovation,
Entrepreneurship,
Property Rights

JEL

Classification

O31, L26, P48

1. Introduction

The legacy of innovation driven economic growth can be traced back to Schumpeter (1934) who describes entrepreneur as the one who carry out new combinations. Supporting this argument, Drucker (1985) realizes innovation as an important attribute of an entrepreneur. Economic prosperity is highly linked with entrepreneurial development of a country. United States, European Union and Asia Pacific Region are the practical illustrations who shifted from managed economies towards the entrepreneurial economy whose productivity gains is attributed to innovative entrepreneurship. Based on Solow

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model (Solow, 1956), the early strategies of economic prosperity put great emphasis on investment in new capital. Later, Romer (1986) replaced physical capital with knowledge capital and the policy goals focused on investment in R&D and human capital. However, it was observed under Swedish Paradox (Edquist & McKelvey, 1998) that the country produced lesser R&D intensive output despite spending heavily on R&D. Later, it was witnessed under European Paradox (Donatiello & Ramella, 2017) that Southern Europe performed well with respect to innovation despite weaknesses in their national innovation system. Such paradoxes compel one to rethink the model of national innovation. This gap is filled by knowledge spillover theory of entrepreneurship (Acs, Braunerhjelm, Audretsch & Carlsson, 2009) which does not consider entrepreneurship to be exogenously determined. Hirschman (1958) has also suggested that it is not the capital shortage that acts as a hindrance to development, but the real culprit is lack of entrepreneurial abilities.

Literature often narrates self-employment as a proxy to measure country's entrepreneurship level (Acs et al., 2009; Stam & Nooteboom, 2011; Maltby, 2013; Faggio & Silva, 2014). But this measure has its own caveats. It is too narrow as well as too broad. Since not all self-employed becomes entrepreneurs and not all entrepreneurs are self-employed vis-à-vis not all entrepreneurs are innovative. In this regard, Audretsch, Keilbach and Lehmann (2006) introduce us with the term of entrepreneurship capital. Entrepreneurship capital deals with entrepreneurial behavior which reflects not only the risk bearing and risk sharing attitudes but also the capacity to undertake innovation activities. So, along with the traditional factors of physical capital as suggested by Solow's Neoclassical Growth Model (Solow, 1956) and knowledge capital of Romer's Endogenous Growth Model (Romer, 1986), entrepreneurship capital (Audretsch, Keilbach & Lehmann, 2006) is a necessary ingredient for economic prosperity which brings productivity gains through innovation.

Defining innovation in macroeconomic perspective is troublesome as it is difficult to confine it within a particular domain. Nevertheless, a greater difficulty arises when it comes down to the measurement of innovation at macro-level. Past literature have used patent counts and R&D expenditures as proxies for innovation but these measures have their own limitations (Mansfield, 1986; Amesse et al., 1991; Prodan, 2005; Graham, et al., 2009; Acemoglu., Bimpikis, & Ozdaglar, 2011; Shaffer, 2011; Acs & Sanders, 2012; Llobet, & Suarez, 2013; Moser, 2013; Barasa et al., 2014; Savrul & Incekara, 2015; Fischer & Gamarra, 2017). Alternatively, Furman et al., (2002) examine multiple dimensions of national innovation framework to determine economy's potential towards innovation. In the same spectrum, some other innovation-oriented indices include global innovation index (GII), global competitiveness index, Bloomberg innovation index, knowledge economy index and European innovation scoreboard (Murray and Budden, 2017). Global innovation index (GII) is the most elaborative measure of innovation capacity for a nation which was

initiated by INSEAD in 2007.² It includes multiple dimensions of innovation using 80 indicators and seems more plausible to undertake international comparability of countries which are at the various stages of development in terms of national innovation. The present study has used GII as measure of national innovation capacity.

Entrepreneurship is never short of its supply, but its productive contribution differs substantially (Baumol, 1996). Strong institutional environment provides an incentive framework for innovative entrepreneurship which can be achieved through strong property rights and State legitimacy. Gerth and Mills (1946) explain Weberian definition of State as a legitimate use of force to exercise control over people and maintain order. The legitimacy will be lost if a country faces severe problems of security, governance and development. The property right institutions measure the extent to which the private property is secured from State's expropriation as well as protection from corrupt government officials who demand bribes in exchange for personal favors (Acemoglu and Johnson, 2005). According to Williamson and Kerekes (2011), trust is one of the important determinants of secured property rights i.e. effectiveness of property rights is a build-in phenomenon in societies that have strong cultural values and one of them is trust.

Under weak State legitimacy and fragile property rights entrepreneurship becomes evasive which is unproductive for the society. Entrepreneurial activities involve uncertainties (Von Mises, 1998; Choi and Shepherd, 2004; McMullen and Shepherd, 2006; Knight, 2012) and trust building helps to realize potential gains by reducing uncertainties. Therefore, one cannot undermine the legitimate role of institutions in an innovation-driven economy. Aim should be to tailor the institutional environment in such a way that evasive entrepreneurial activities be made more costly so that the resources could be shifted towards more productive opportunities. This can be done by promoting institutional trust through well-defined property rights and provision of strong legal system. Institutional trust helps in building entrepreneur's confidence in exploiting innovative opportunities. Hall and Jones (1999), North (1991), Rodrik, Subramanian and Trebbi (2004) and Acemoglu and Johnson (2005) explain that well-developed institutions directly affect the property rights. Similarly, Rodrik (2004) points out in growth perspective that rich countries are the ones where investors feel protected in terms of property rights.

Institutional trust is the utility that individuals get from satisfactory performance of institutions and deliverance of public services (Mishler & Rose, 2001; Christensen & Laegreid, 2005). OECD report (OECD, 2013) defines trust as governments' ability to

² INSEAD is an acronym for Institut Européen d'Administration des Affaires European which is French for European Institute of Business Administration. Since then this construction is published annually in collaboration with Cornell University and World Intellectual Property Organization (WIPO). GII captures the richness of a country in innovation from multiple dimensions and ranks the country on a scale from 0 to 100.

manage social and economic issues. In fragile States, weak institutional structure reduces the legitimacy of State policies which lower down entrepreneur's trust on the system. Until the rule of game is not visibly predominant, the legitimacy of policies cannot be established and entrepreneurs cannot gain trust in the institutions. If a country is not effective in implementing policies in the political, social and economic context then institutional trust is lost. States' inability in effective deliverance of public services reduces entrepreneurs' confidence on institutions and innovation activities are discouraged. The present study uses property rights and State effectiveness score as proxies for institutional trust.

Extant literature examines role of entrepreneurs towards economic growth by concentrating mainly on the development of real economy (Gort & Klepper, 1982; Acs & Audretsch, 1988; Baumol, 1996; Audretsch & Thurik, 2001; Grebel, Pyka & Hanusch, 2003; Wong et al., 2005; Hanusch & Pyka, 2006; Anokhin & Schulze; 2009). Literature have also settled on the fact that an entrepreneur is an inherent innovator (Schumpeter, 1934; Miller, 1983; Drucker, 1985; Lumpkin & Dess, 1996; Shane & Venkataraman, 2000; De Mel et al., 2009; García, Jin & Salomon, 2013). These studies have examined the firm level activities. Nevertheless, limited literature is available that provides direct link between entrepreneurs and innovation at macro-level (Draghici & Albuлесcu, 2014). Many studies have associated innovation with patents counts (Mansfield, 1986; Amesse et al., 1991; Graham, et al., 2009; Acemoglu, Bimpikis, & Ozdaglar, 2011; Shaffer, 2011; Acs & Sanders, 2012; Llobet, & Suarez, 2013; Moser, 2013) which is an output indicator and R&D expenditure (Prodan, 2005; Barasa et al., 2014; Savrul & Incekara, 201; Fischer & Gamarra, 2017) which is an input indicator. The major drawback of using R&D expenditure is that it includes efforts for both innovation as well as imitation activities (Moreno et al., 2005). On the other hand, there are activities that contribute to existing stock of knowledge but do not get patented (Moreno et al., 2005; Tebaldi & Elmslie, 2008). Similarly, there are certain patents that do not develop into innovations (Moreno et al., 2005). In addition, the relevance of such indicators is questionable when it is evaluated for developing countries which hardly invest in formal R&D and also do not apply for patents. Therefore, innovation cannot be confined to just R&D and patents. To fill this gap, the present study considers global innovation index (GII) to measure innovative capacity of a nation. In the institutional context, d'Agostino and Scarlato (2016), Anokhin and Schulze (2009), Dincer (2019), Fischer and Gamarra (2017) and Tebaldi and Elmslie, 2013) have examined the role of institutional quality on innovative output but none undertook the analysis from the perspective of institutional trust which is a necessary ingredient for determining credibility of institutions. The trust building hypothesis is tested by Tedika and Agbor (2016) but this study has limited scope from the point of data analysis. The present study aims to fill the literature gap by bringing new empirical evidence on the relationship of entrepreneurial behavior and institutional trust with innovation in a macro-economic perspective.

2. Literature Review

The key to innovation is through entrepreneurship development. Entrepreneurs are the main source of bringing change in the economic system through innovation. Therefore, economic innovation is largely attributed to entrepreneurial activities. Audretsch and Thurik (2001) discuss fundamental elements necessary for the development of entrepreneurial economy. Knowledge has emerged as the vital ingredient of a production process and the comparative advantage is shifting on the basis of innovation activities. Moreover, knowledge spillover helps to flourish entrepreneurial activities. Shane and Venkataraman (2000) explains entrepreneurial activities as the discovery of new ways of producing goods and services and exploiting the opportunities for better organizing the economic activities, processes and the markets. Thus, trust is required to facilitate the process of entrepreneurial activities which acts as a cornerstone for innovation and technological advancement.

According to Sautet (2005) “Entrepreneurship is not dependent on the resources in an economy. Rather, the key is the quality of institutions that permit the exploitation of resources and opportunities.” This is because prevailing institutional arrangements determine the uncertainties in profits and risks that determine not only the probability but also the nature of entrepreneurial activities. Therefore, a robust institutional environment is required for shaping innovation activities by an entrepreneur. Sarbah and Xiao (2013) examine the role of trust for the entrepreneurship development and its growth. The study discusses that strong institutions need to be developed that incorporate the practices upon which the trust could be built. The study has limited scope as it has only targeted few selected entrepreneurs at micro level in Ghana region. The qualitative analysis is undertaken while the quantitative side has been ignored. Similar hypothesis is also tested by Kodila-Tedika and Agbor (2016) who suggest that half of the entrepreneurial spirit is compelled through trust considerations. Therefore, regions like Sub-Saharan African countries can expand their entrepreneurial activities by formalizing the trust building institutions. For the measurement of trust, the World Value Survey (WVS) has been utilized. In addition, the study has also considered reverse causality where greedy entrepreneurs can create mistrust through exploitation of institutional weaknesses.

Aidis (2017) argues that supportive institutional environment helps to nurture entrepreneurship which is more innovative and productive. Such conducive conditions are provided through property rights and good governance that helps institutional trust building. The study provides insights for post-Soviet countries in the context of institutional reforms and concludes that fragile rule of law, high corruption and excessive regulation can impede entrepreneurial development. Acs, Desai and Klapper (2008) point out that institutional environment play an important role in determining the cross-country differences in entrepreneurial activities. The impact of various country level characteristics are examined

on entrepreneurial activities which include political risk, economic risk, law and order, financial development, GDP per capita and regulatory barriers. Acs and Amorós (2008) analyzed the impact of gross domestic product and global competitiveness index (GCI) on entrepreneurial dynamics by using dataset from GEM's Adult Population Survey. It is suggested that competitiveness brings production efficiency but fails to achieve positive impact on entrepreneurship and innovation in developing countries. Similarly, Levie and Autio (2008) examined the impact of finance, government policies, government regulations and programs, education and training, R&D, infrastructure, internal market openness, and social and cultural norms on entrepreneurship. The fixed effect GLS methodology was applied. The results show a strong and positive impact of education and training on new business activity but no impact on growth expectations of entrepreneurial activities. This relationship is strongly influenced by a country's level of economic development.

Henrekson and Sanandaji (2011) determine the bilateral relationship between institutions and entrepreneurial development. Innovative activities could be productive, unproductive or destructive depending upon the incentive structure faced by entrepreneurs. Policy makers must consider such interactions while designing the rules of game. Therefore, institutional change must be evaluated on the basis of type of entrepreneurship that it promotes. Elert and Henrekson (2017) also conclude a bidirectional relationship between institutions and entrepreneurship. Entrepreneurial activities are heavily influenced by institutional environment. Institutions, typically the regulatory framework, lag behind the technology driven entrepreneurship and innovation. Under such circumstances, when this gap widens, evasive entrepreneurship is the usual response of entrepreneurs. On the other hand, entrepreneurs also influence the institutional framework through its productive or evasive activities. Similarly, Samadi (2019) also confirms the existence of bi-directional causality between entrepreneurship and institutions but the long-run relationship holds for innovation-driven economies and not for factor-driven and efficiency-driven economies. Depending upon the institutional environment, entrepreneurial activities can be productive or unproductive that may reinforce or weaken the institutional quality.

The empirical examination on the relationship between innovation and institutions is undertaken by Tebaldi and Elmslie (2013). The study applies IV technique on the cross-country data and finds that creation of technical knowledge is not possible in the absence of good institutional quality. This study shows a significant positive impact of control of corruption, protection of property rights, judiciary effectiveness and market-friendly policies on patent production. This relationship is noteworthy not only in the technology frontier countries but also among countries that are far from technology frontier. Although geography affects the innovation levels but that only takes place through institutions. Anokhin and Schulze (2009) examine that control of corruption will enhance innovation and entrepreneurship in a country. Since, it increases the trust on State and institutional

ability to enforce rules and laws effectively. The rise of transaction costs and other implicit costs associated with corruption cause hindrance to economic activities. As a result, the prospective entrepreneurs fail to get benefit from innovation investment. d'Agostino and Scarlato (2016) develop an empirical link between government institutions and economic growth through intermediating role of innovation. The study confirms that inclusive institutions magnify the effects of technology shocks on economic growth. Therefore, the formulation of incentive system for technological innovation must be accompanied by improved governance structure and strong political systems.

The micro-level analysis on the mediating role of institutional quality on innovative output is undertaken by Barasa et al. (2014). It is observed that regional institutional quality strengthens the positive impact of firm's R&D activities on innovative output. Better institutional environment enables firm to extract more value from its resources. Firms that operate under poor institutional environment do not conduct R&D and fails to benefit from innovative output. Therefore, policy makers must focus on good governance at national as well as regional level. Dincer (2019) studies long-run relationship between corruption and innovation. The quantity and quality of patents is taken as a measure of innovation. It is observed that corruption slows down innovation. However, the study provides no details on the channels through which this negative relationship exists. Fischer and Gamarra (2017) also study the relationship between institutional quality and innovation. The impact of democracy, corruption and political rights is determined on gross R&D expenditures, patent activity and productivity. It is found that institutional backwardness hampers the potential benefits from productive technology. Therefore, institutional framework in developing countries needs to be improved to guarantee the success of R&D investment.

Donges, Meier and Silva (2019) highlight that institutions affect economic growth through innovation. This study is carried out in an empirical setting of timing and geography of French occupation after the French Revolution in Germany. It is examined that inclusive institutions and financial development complements the innovative output. Those regions that underwent institutional reforms performed better in innovative output compared to those that were not driven by these reforms. The efficient legal systems foster business creation and incentivize innovation. Hanusch and Pyka (2006) identify innovation as the driving force for economic development. Innovation occurs as a result of entrepreneurial decisions regarding novelties created at micro-level. This leads to emergence of new industries through the transformation of industrial organization and structure. Due to high competition, old manufacturing firms are compelled to engage themselves into innovation and some might seek collaboration with new entrepreneurs. Such co-existence contributes heavily towards technological progress. Amaghouss and Ibourk (2013) examine the impact of entrepreneurial activities and innovation on economic growth. The total entrepreneurial participation rate, rate of owned business and patents counts had a positive impact on

economic growth, but nascent entrepreneurship showed insignificant result. Braunerhjelm (2010) develops the relationship of knowledge, entrepreneurship and innovation with economic growth. The knowledge driven innovation is an outcome of R&D activities. Despite this the role of entrepreneurial initiatives cannot be ignored which may appear with a lag. Entrepreneurs help to bridge the gap between pace of knowledge development and fast pacing opportunities by speeding up knowledge creation and exploitation. Therefore, entrepreneurs play an important role in knowledge based economy through its contribution towards innovation.

3. The Model

Endogenous growth model (Romer, 1986; Lucas, 1988) puts great emphasis on human capital and knowledge-based inputs as determinants of economic growth. On the other hand, Ehrlich, Li and Liu (2017) developed a framework of endogenous growth through accumulation of entrepreneurial human capital. The present study develops a model by borrowing from the analytical framework of Romer (1986), Lucas (1988) and Ehrlich, Li and Liu (2017) to determine the factors that influence country level innovation through entrepreneurial efforts as an employer of innovation-based inputs. Casson and Wadeson (2007) treats entrepreneur as an employer who does not take up a one-time managerial decision to exploit profitable opportunities. In fact, an entrepreneur is in continuous efforts to sustain those profits by overcoming the diminishing returns through innovation. Therefore, a country’s innovation, both in terms of demand for innovation-based inputs as well as supply of innovation outputs, is strongly correlated with the entrepreneurial attitudes and entrepreneurial activities. In addition, Hirschman (2005) proposes that decision-making of a potential entrepreneur is highly associated with institutional factors. The potential entrepreneurs are discouraged to commercialize new knowledge capital if it is subjected to rent seeking (Hoff & Stiglitz, 2001). Therefore, such institutional constraints act as barriers to innovation. Lack of trust in institutions results in coordination failure among economic agents that brings a worse-off situation for all, a concept similar to coordination failure (Hoff, 2000). The present study develops a macroeconomic model of innovation as follows:

$$INN = Z f(E, T) \dots\dots\dots (1)$$

Where INN = innovation, E = entrepreneurial human capital, T = institutional trust, Z= exogenous factors to innovation.

$$\varphi = \frac{INN(t) - INN(t-1)}{INN(t-1)} \dots\dots\dots (2)$$

$$INN(t) = INN(t - 1)(\varphi + 1) \dots\dots\dots (3)$$

Where, ϕ is the rate of change of innovation. Excluding the factor Z and differentiating equation (1) w.r.t. time (t):

$$\frac{dINN}{dt} = \frac{\delta f}{\delta E} \cdot \frac{dE}{dt} + \frac{\delta f}{\delta T} \cdot \frac{dT}{dt} \dots \dots \dots (4)$$

Divide equation (4) by INN

$$\frac{dINN}{dt} / INN = \left\{ \frac{\delta f}{\delta E} \cdot \frac{dE}{dt} + \frac{\delta f}{\delta T} \cdot \frac{dT}{dt} \right\} / INN \dots \dots \dots (5)$$

Dividing and multiplying right-hand-side of equation (5) with E and T:

$$\frac{dINN}{dt} / INN = \left\{ \frac{\delta f}{\delta E} \cdot E / INN \cdot \frac{dE}{dt} / E + \frac{\delta f}{\delta T} \cdot T / INN \cdot \frac{dT}{dt} / T \right\} \dots \dots \dots (6)$$

Where

$\frac{dINN}{dt} / INN = \phi$ which represents the rate of change in innovation,

$\frac{dE}{dt} / E =$ change in entrepreneurial human capital,

$\frac{dT}{dt} / T =$ institutional trust building over time,

$\frac{\delta f}{\delta E} \cdot E / INN =$ share of entrepreneurial human capital in total innovation,

$\frac{\delta f}{\delta T} \cdot T / INN =$ share of institutional trust building in total innovation.

Thus, changes in national innovation depend upon changes in entrepreneurial human capital and institutional trust building in the economy as well as their contributions in total innovation.

The entrepreneurial human capital in time t depends upon entrepreneurial behavior (E_b) which consists of entrepreneurial attitudes (E_{att}) and entrepreneurial activities (E_{act}) i.e. $E(t) = E_b(t) = E_{att}(t) + E_{act}(t)$. The entrepreneurial attitudes are measured through perceived opportunities (PO) and fear of failure rate (FFR). Entrepreneurial activities are measured by total early-stage entrepreneurial activities (TEA) and percentage of established business entrepreneurs (EBO).³ The institutional trust building is captured through enactment of property rights (PR) and State effectiveness score (SES). According to Mishler & Rose (2001) and Christensen and Laegreid (2005), State's ability to effectively deliver its services triggers institutional trust in the society. Whereas, Williamson and Kerekes (2011) conclude that trust is one of the important determinants of secured property rights. The

³ The definition of entrepreneurial behavior is taken from GEM website.

present study takes foreign direct investment (FDI) as the Z factor. Past literature has developed a strong association between FDI and technology diffusion which might contribute towards building national innovation capacity (Walz, 1997; Blyde, 2003; Loukil, 2016; Osano & Koine, 2016).

4. Data

The present study is based on a panel data analysis, consisting of 55 countries and a time period of seven years from 2010 to 2016. The selection of countries and time period is on the basis of data availability.⁴ The national innovation capacity is measured by global innovation index (GII). The entrepreneurial behavior is measured through various indicators compiled by Adult Population Survey (APS) carried out under Global Entrepreneurship Monitor (GEM).⁵ These indicators include perceived opportunities (PO), fear of failure (FFR), established business ownership (EBO) and total early-stage entrepreneurial activities (TEA). Institutional trust is measured by two indicators i.e. property rights (PR) and state effectiveness score (SES). Lastly, foreign direct investment (FDI) is taken as a control variable. The detailed description of variables and data sources is given in Table 1.

Table 1: Description of variables and data sources

Variables	Description	Data Sources
Global Innovation Index (INN)	The index ranks the innovation performance of a country by using 80 indicators of innovation that includes political environment, infrastructure, education and business sophistication. The index takes the value between 0 to 100. A higher value indicates greater innovation.	INSEAD, Cornell University and World Intellectual Property Organization (WIPO)
Perceived Opportunities (PO)	Percentage of adult population who perceive good opportunities to start a firm in the area where they live	GEM Adult Population Survey (APS)
Fear of Failure Rate (FFR)	Percentage of adult population who perceive good opportunities to start a business, but the fear of failure prevents them from setting up a business	GEM Adult Population Survey (APS)
Established Business Ownership (EBO)	Percentage of adult population who are currently an owner/manager of an established business. They are owning/ managing or running a business that has paid salaries, wages, or any other payments to the owners for more than 42 months	GEM Adult Population Survey (APS)

⁴ The list of countries are provided in the appendix (Table 4).

⁵ Global national level data is retrieved from GEM website (<https://www.gemconsortium.org/data>)

Total Early-stage Entrepreneurial Activity (TEA)	Percentage of adult population who are either the owner/manager of a new business or are nascent entrepreneur	GEM Adult Population Survey (APS)
Foreign Direct Investment (FDI)	It reports the net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, as a percentage of GDP	World Development Indicators (WDI) ⁶
Property Rights (PR)	It is the assessment of ability to accumulate private property and wealth that are safe from unfair expropriation. The indicator belongs to the subcategory of the Index of Economic Freedom i.e. rule of law. The index is measured on a scale of 0 to 100.	The Heritage Foundation ⁷
State Effectiveness Score (SES)	Effectiveness score is a sub-indicator of state fragility index. The components included in effectiveness score are security, political, economic and social effectiveness. The score is between 0 to 13. The high value indicates greater fragility.	POLITY IV ⁸

5. Econometric Methodology

The functional form of the model is as follows:

$$\text{Innovation} = f(\text{Entrepreneurial Behavior, Property Rights, State Effectiveness, Foreign Direct Investment}) \dots \dots \dots (7)$$

The baseline model with its econometric specification is given below:

$$\text{INN}_{i,t} = \alpha + \beta \text{INN}_{i,t-1} + \delta_1 \text{PO}_{i,t} + \delta_2 \text{FRR}_{i,t} + \delta_3 \text{TEA}_{i,t} + \delta_4 \text{EBO}_{i,t} + \delta_5 \text{PR}_{i,t} + \delta_6 \text{SES}_{i,t} + \delta_7 \text{FDI}_{i,t} + \epsilon_{i,t} \dots \dots \dots (8)$$

Where INN represents innovation measured through global innovation index, PO is perceived opportunities i.e. the percentage of adult population who perceive good opportunities to start a business, and those who perceive good opportunities but fear of failure prevents them from setting up a business is represented by FFR i.e. fear of failure rate, TEA is total early-stage entrepreneurial activities representing nascent entrepreneurs and EBO are the established business entrepreneurs. These variables are used to measure

⁶ <https://databank.worldbank.org/source/world-development-indicators>

⁷ <https://www.heritage.org/index/explore?view=by-region-country-year&u=637256645917098083>

⁸ <http://www.systemicpeace.org/inscrdata.html>

entrepreneurial behavior. PO and FFR reflects the entrepreneurial attitudes whereas entrepreneurial activities are measured by the variables TEA and EBO. PR represents property rights and SES is the state effectiveness score. These two variables are used to measure institutional trust. FDI (foreign direct investment) is used as a control variable. Literature (Walz, 1997; Blyde, 2003; Loukil, 2016; Osano & Koine, 2016) has taken FDI as an important source of technology diffusion, which can be a source of innovation. δ 's are the slope coefficient of each explanatory variable. The subscript 'i' and 't' denotes cross sections and time period. α is the intercept and $\epsilon_{i,t}$ is the overall error term.

INN_{t-1} is the lagged value of dependent variable to indicate the dynamic nature of the model and β is its slope coefficient. Innovation activities are cumulative in nature i.e. the current level of innovation is dependent on its past levels (Lee, 2013). As Robinson (2009) states that the success of innovation depends upon the way it evolves. Hence, it is necessary to incorporate the dynamic model of innovation by incorporating its lagged impact. Koçak (2017) also estimates the dynamic model of innovation by examining the impact of institutional quality and measures innovation through patent applications. The dynamic model also helps to reduce panel bias when T is sufficiently smaller than N (Baum et al., 2003; Baltagi, 2008; Sarafidis, Yamagata and Robertson, 2009).

There are multiple econometric approaches to estimate equation 8. Table 5 (see appendix) provides some preliminary results of the model. The dynamic panel data model is estimated, where lagged dependent variable is taken as explanatory variable along with a list of regressors. The model is first estimated through pooled OLS which shows misleading parameter estimates in the presence of heteroskedasticity. In a multiple linear regression modeling, the assumption of exogeneity is violated if one of the regressors is correlated with the residual. The dynamic pooled OLS produce biased and inconsistent estimates as explored by Anderson and Hsiao (1982). The estimated pooled OLS also suffers from model misspecification (see Table 5, in appendix).

To capture individual specific effects, the panel fixed effect regression is estimated. But the diagnostics suggest inefficient estimates due to the presence of heteroskedasticity, serial correlation and cross sectional dependence. In addition, there might exist specification bias in the model which gives inconsistent estimations of the parameters i.e. the possibility of endogenous regressors. The instrumental variable (IV) or 2SLS regression technique provides a way to overcome the issue of endogeneity (Baltagi, 2008). It is a better econometric approach to obtain consistent parameter while dealing with the impact of moderating variable i.e. when some instrumental variables are uncorrelated with error term but highly correlated with one of the regressors (Wooldridge, 2002).

Under homoscedasticity, the 2SLS estimates are efficient (Roodman, 2009). However, in the presence of heteroskedasticity, the 2SLS estimates remain consistent but the standard

errors becomes inconsistent that prevents valid inferences (Baum, Schaffer and Stillman, 2002). GMM (Generalized Method of Moments) estimations is the usual approach that allows to cater the problem of endogeneity and provides better estimates whilst the presence of heteroskedasticity in IV/2SLS regression. GMM uses orthogonality conditions to allow efficient estimates when heteroskedasticity is present (Baum, Schaffer and Stillman, 2002). In addition, GMM estimator allows for over-identification of parameters as more moment conditions can be added than the number of parameters to be estimated (Wooldridge, 2001). Although literature provides limited guidance on how many are too many instruments but this number should not be greater than the number of cross sections (Roodman, 2009). The present study employs both difference GMM (Arellano and Bond, 1991) and system GMM (Blundell and Bond, 1998) estimations. Both estimators are designed for panel data when T is small and N is large. The estimated value of β coefficient for pooled OLS is considered the upper bound while the corresponding fixed effect estimate is considered a lower bound. If difference GMM estimate, for β , is closer to fixed effect estimate then finite sample bias is suspected due to weak instruments and system GMM is preferred (Bond, 2002). The parameters under system GMM is better determined than difference GMM when β (coefficient of lagged dependent variable) is higher than fixed effect but below the OLS estimates. In system GMM, variables are instrumented by using first differences in level equation and level instruments in first differenced equation. The Monte Carlo simulations also suggest that system GMM is more efficient (Blundell and Bond, 1998). The standard errors under two-step system GMM is reduced considerably compared to one-step system GMM.

6. Results and Discussions

The estimated results of difference GMM and system GMM are presented in Table 2. The estimates of short-run coefficients are provided and the value of β shows the speed of adjustment which also indicates the persistency of dependent variable. The results from system GMM estimation indicated that the lagged impact of innovation (INN) is statistically significant i.e. the present innovation depend upon past innovation levels. This is the reason of persistence dominance of technological advanced countries over the world. The result is consistent with Lee (2013) who determined that current technological innovation depends upon its past levels.

Table 2: Estimated result of Dynamic Panel Model using Difference and System GMM Approach (Dependent Variable: INN)

Variable	One-Step Difference GMM		Two-Step Difference GMM		One-Step System GMM		Two-Step System GMM		
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	
INN _{t-1}	-0.066	0.059	-0.069	0.070	0.318*	0.174	0.318***	0.0155	
PO	0.228**	0.089	0.241***	0.088	0.002	0.037	-0.003	0.011	
FFR	-0.226**	0.095	-0.278**	0.111	-0.104**	0.116	-0.105***	0.044	
TEA	-0.912***	0.279	-0.872***	0.298	-0.673***	0.175	-0.663***	0.034	
EBO	0.931***	0.265	0.940***	0.301	0.450**	0.200	0.444***	0.044	
FDI	-0.216	0.241	-0.189	0.283	0.048	0.030	0.048***	0.009	
PR	0.063	0.205	0.094	0.319	0.1823**	0.086	0.182***	0.009	
SES	-0.777	0.520	-0.875	0.642	-0.495	0.359	-0.472***	0.104	
Constant					27.828***	4.701	28.082***	0.824	
Diagnostics Tests:									
AR (1)	Prob. = 0.001		Prob. = 0.007		Prob. = 0.005		Prob. = 0.000		
AR (2)	Prob. = 0.415		Prob. = 0.626		Prob. = 0.351		Prob. = 0.127		
Hansen (J-Test)	Prob. = 0.214		Prob. = 0.165		Prob. = 0.185		Prob. = 0.185		
C-Test (Diff-in-Hansen)	GMM	Prob. = 0.989		Prob. = 0.984		Prob. = 1.000		Prob. = 1.000	
	IV	Prob. = 0.981		Prob. = 0.960		Prob. = 0.994		Prob. = 0.994	
No. of Instruments	49		48		54		54		
Cross Sections	54		55		55		55		
Total Observations	323		329		384		384		

***, ** and * indicates the significance level at 1%, 5% and 10% level, respectively. Year dummies are included in the model estimation. The probability of Hansen (J-test) suggests the joint validity of instruments. AR (1) indicates first order autocorrelation. Whereas, AR(2) test validates the hypothesis of no second order serial correlation. The difference-in-Hansen test which is also known as C-test (Baum, Schaffer and Stillman, 2003) is valid for the subsets of instruments. The number of instruments is also less than the total cross-sections.

The long-run coefficients are estimated using the STATA command nlcom, after applying the two-step system GMM. The results are provided in Table 3. The long-run coefficients measure the sustained impact of independent variables on dependent variable.

Table 3: The estimated long-run coefficients

Variable	Coefficient	Std. Error
FFR	-0.154***	0.012
TEA	-0.972***	0.049
EBO	0.651***	0.064
FDI	0.070***	0.013
PR	0.266***	0.010
SES	-0.691***	0.154
Constant	41.155***	0.868

***, ** and * indicates the significance level at 1%, 5% and 10% level, respectively. The long-run coefficient of each variable, measured as $(\delta_i/1 - \beta)$, explains the sustained impact on dependent variable.

In the long-run, the established business ownership (EBO) has a significant positive impact on innovation capacity. The result indicates that a 1% increase in EBO will increase the global innovation index (GII) by 0.65 points. EBO consists of those firms that usually observe economies of scale and larger firms are in a better position to undertake innovation as these tend to have access to sufficient resources to build-up new technologies as explained by De Mel, McKenzie and Woodruff (2009). They analyzed that there is a greater chance of process innovation with increase in firm size. Hence, established business entrepreneurs are inclined to innovate more. Innovation is risky in terms of costs, uncertainty and peril of failure. The prolonged presence of established entrepreneurs in the market gives them a competitive edge against the newly established early stage entrepreneurs who are usually the imitator in their early stage production. Hence it is wiser for early entrepreneurs to let the innovation be done by others and then jump into the pool later (Lumpkin & Dess, 1996). Therefore, entrepreneurs who have established business ownership contribute positively towards innovation as they have greater capacity to bear the risk of innovation. Kirchoff (1994) also suggests that entrepreneurs of the established firms have the ability to scale up production towards innovation.

The coefficient of total early-stage entrepreneurial activity (TEA), which is highly significant, shows that it has a negative relationship with innovation capacity i.e. 1% increase in TEA reduce the innovation index by 0.97 points. TEA includes that proportion of the adult population that own new businesses and are the nascent entrepreneurs. It has been observed by Picot et al., (1989) and Aldrich (1990) that nascent entrepreneurs are imitators and bring little or no additional knowledge to the society. Innovation involves novelty whereas the routines and abilities of nascent entrepreneurs differ significantly from already established firms (Koellinger, 2008). Therefore, it can be stated that early stage entrepreneurs are usually imitators and hence do not have a positive impact on innovation, thereby reducing the national innovation level. So, a country would innovate less that has a greater proportion of early-stage entrepreneurs that are not innovators, rather imitators, compared to those who have greater concentration of entrepreneurs with established business ownership. Peris, Ferreira and Fernandes (2018) also state that there is a significant difference in the relationship between innovation practices and TEA depending upon the level of economic development of a country. Moreover, the business models of early-stage entrepreneurs have greater uncertainty and high risk of failure which makes it difficult to attract highly competent and motivated employees who are necessary for such early-stage businesses to be innovative (Block, Fisch & Van Praag, 2017).

At macro level, the preferences and decision making of entrepreneurs depend highly upon the circumstances and the environment they operate in. Many studies have pointed out that the expected returns and uncertainty greatly influence the entrepreneurial behavior (Amit et al., 1995; Van Stel et al., 2006; Acs, Audretsch & Lehmann, 2013). Therefore, the

distribution of imitative and innovative business opportunities vary across countries and the potential failure is also relevant (Koellinger, 2008). The current study also supports this argument, as depicted in Table 3, that there is a significant negative relationship between entrepreneurs' fear of failure rate (FFR) and country's innovation. 1% increase in FFR reduces the innovation index by 0.15 points. This means that a higher rate of fear of failure will be a deterrence for entrepreneurs to take new initiatives for innovation. The estimates of one-step and two-step system GMM indicate that perceived opportunities in a nation have insignificant impact on its innovation capacity. Therefore, its long-run estimate is not calculated. The higher percentage of perceived opportunities for entrepreneurial activities could contribute significantly towards innovation but high risk of perceived failure discourages entrepreneurs to undertake innovative ventures even though there seem to exist good opportunities. As Koellinger (2008) describes that opportunities exist objectively, and it is not inevitable that those opportunities would certainly trigger innovation practices.

Innovation activities are risky in nature. Therefore, to thrive innovation, a strong and supportive institutional environment is required. The result in Table 3 shows a significant positive impact of property rights (PR) on innovation i.e. a 1 point increase in property rights index increases the value of GII by 0.26 points. Property rights play an important role in building up institutional trust that helps to nurture entrepreneurship which is more innovative and productive. Tebaldi and Elmslie (2013) also conclude the same impact of property right protection on patent counts. When private property and wealth will be safe from unfair expropriation, then there will be greater incentive for entrepreneurs to seek profits through innovation.

The coefficient of SES (State effectiveness score) is significant and negative. The high value of SES indicates greater inability of State to deliver its services and respond effectively under crisis. Hence, there is trust deficit in fragile States. The high value of SES will deteriorate institutional trust that reduces the innovation capacity of a nation. The result indicates that in the long-run, 1 point increase in SES will lower down the GII value by 0.69 points. A higher value of SES reduces peoples' confidence on reliability of State to carry out its activities. This uncertainty compels firms not to take innovative initiatives that are prone to risks. The result supports the argument provided by Speakman and Rysova (2015) who point out that risky ventures and innovation activities are highly suppressed among countries that are more fragile. Kaasa, Kaldaru, and Parts (2007) also states that investors are less risk averse when there is higher trust in the society and it enables firms to spend their finance and time in innovative activities. Similarly, Audretsch, Seitz and Rouch (2018) find that institutional trust play a vital role in stimulating innovation performance. However, the finding of present study contradicts with that of Kashi and Afsari (2014) who conclude no significant relationship between innovation and institutional trust in Asian countries.

Lastly, there is a significant positive impact of foreign direct investment on innovation. Similar results are also found by Walz (1997), Blyde (2003), Chang, Chen and McAleer (2013), Loukil (2016) and Osano and Koine (2016) i.e. FDI can be a source of innovation through the process of technology diffusion. FDI brings spillover effects on the economy by introducing new technologies which spur innovation.

7. Conclusion

The present study focuses on determining the impact of entrepreneurial behavior, property rights and state effectiveness on country level innovation. Past literature considers trust building as an important aspect of social capital. While examining the role of social networking on entrepreneurial activity, Casson and Giusta (2007) determine that government plays a significant role as trust-broker. Portela, Vázquez-Rozas, Neira, and Viera (2012) also conclude that public policies must focus on institutional and interpersonal trust to improve social environment which is necessary for developing an entrepreneurial society. Similar results are also found by Doh & Zolnik (2011). The present study contributes to the existing literature by undertaking a country-level analysis. Using suitable proxies to measure institutional trust, the impact is measured on national innovation capacity which is found positive.

Many studies have examined the role of entrepreneurship pertaining to innovation activities (Iyigun & Owen, 1999; Wennekers et al., 2005; Van Praag & Versloot, 2007; Burke & Fraser, 2011). Entrepreneurs affect innovation either through exiting established business entrepreneurs which enjoy economies of scale and are intensive in R&D activities or through increasing competition from emerging nascent firms which force existing firms towards innovation (Iyigun & Owen, 1999). The findings of this study also confirm the positive relationship between entrepreneurial behavior and innovation. Out of the four indicators of entrepreneurial behavior, fear of failure rate and total early stage entrepreneurs do not play a role in innovation. Rather, these two factors suppress innovation in a country. However, there is a significant positive relationship between established business entrepreneurs and innovation. Whereas perceived opportunities have an insignificant impact. This means that it is not inevitable that opportunities necessarily trigger innovation. In addition, the study shows that property rights play an integral role in developing institutional trust which boosts entrepreneurialism to exploit innovative opportunities. On the other hand, institutional trust is lost in fragile countries which retard country's innovation. Innovative entrepreneur loses confidence on legal system when a State fails to implement its policies effectively.

These results have some strong implications for countries in formulating policies to increase national innovation levels. Firstly, countries need to develop strong property rights protection to incentivize innovative entrepreneurs.

Secondly, the study observes that perceived entrepreneurial opportunities are not realized if fear of failure rate is high among potential entrepreneurs. Therefore, a favorable entrepreneurial ecosystem must be developed so that fear of failure rate can be reduced. Thirdly, such policies must be devised that could facilitate the early-stage entrepreneurs to grow into established businesses. Since established business ownerships are more competitive and contributes positively towards innovation. Lastly, institutional and legal framework must be strengthened to increase State legitimacy and enactment of property rights will cultivate institutional trust to help promote entrepreneurship towards innovation.

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APPENDIX:

Table 4: List of countries
Australia, Barbados, Belgium, Brazil, Chile, China, Colombia, Croatia, Denmark, Ecuador, Egypt, Finland, France, Germany, Greece, Guatemala, Hong Kong, Hungary, India, Iran, Ireland, Italy, Jamaica, Japan, Kazakhstan, Korea, Latvia, Lebanon, Macedonia, Malaysia, Mexico, Morocco, Netherlands, Norway, Panama, Peru, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Arab Emirates, United Kingdom, United States of America, Uruguay

Table 5: Estimated Results of Pooled OLS, Fixed Effect and Instrumental Variable Regression (Dependent Variable: INN)

Variable	Pooled OLS		Fixed Effect		2SLS /IV Regression	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
INN_{t-1}	0.414***	0.037	-0.061**	0.029	0.191***	0.068
PO	-0.003	0.023	0.051	0.032	0.348***	0.079
FFR	-0.069*	0.036	-0.099***	0.037	0.143	0.222
TEA	-0.455***	0.072	-0.279***	0.085	-1.882***	0.320
EBO	0.292***	0.072	0.151	0.108	1.492***	0.036
FDI	0.043	0.042	0.009	0.035	0.133*	0.069
PR	0.155***	0.018	0.169**	0.066	0.057	0.036
SES	-0.499***	0.187	-0.127	0.462	-1.647***	0.432
Constant	22.96***	2.248	40.59***	4.169	24.205**	11.21
Diagnostics Test:						
	Breusch-Pagan test $\chi^2(1)=0.74$ Prob.= 0.389		Hausman Test $\chi^2(8) = 194.10$ Prob.= 0.000		Endogeneity Test: Durbin (score) $\chi^2(4) = 114.463$ Prob. = 0.000	
	Ramsey RESET test F-statistic = 4.49 Prob. = 0.004 (Presence of omitted variable bias)		Pesaran test of cross sectional independence Prob. = 0.000		Wu-Hausman Test F-statistic= 39.67 Prob. = 0.000	
	F-test Prob. = 0.000		Modified Wald Test for heteroskedasticity $\chi^2(55)=5906.79$ Prob. = 0.000		Test for over identifying restrictions: Sargan (score) $\chi^2(5) = 9.068$ Prob. = 0.106	
			Wooldridge Test for autocorrelation F-statistic = 99.05 Prob. = 0.000		Basman Test $\chi^2(5) = 8.947$ Prob. = 0.111	
					Pagan-Hall test Statistic for heteroskedasticity: $\chi^2(13) = 8.947$ Prob. = 0.015	
Total Observations	384		384		377	

***, ** and * indicates the significance level at 1%, 5% and 10% level, respectively. Pooled OLS estimates are biased due to omitted variable bias. The F-test suggests that fixed effect model be applied. The Hausman test also validates the fixed effect model. Though, the diagnostics of fixed effect model show serious flaw in the validity of estimates. The post estimates of IV/2SLS regression show the validity of instruments as well as endogeneity of variables but there is strong evidence of heteroskedasticity.