INVESTIGATING THE IMPACT OF CIVIL LIBERTIES AND CREATIVE CLASS ON INNOVATION OUTPUT AND ECONOMIC GROWTH: AN EMPIRICAL CASE STUDY FOR PAKISTAN

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Abstract
Innovations play a crucial role to foster the economic growth and sustainable development by addressing urgent economic and social needs, and by enhancing productivity and competitiveness. Due to its significance, this study examines the impact of civil liberties and creative class on innovation output in case of Pakistan. Innovation output is proxied by patent and trademark applications of residents of Pakistan. The study employs a time series data over the period of 1982-2014 and negative binomial method to test the hypotheses empirically. The results implicitly support the hypotheses that lesser civil liberties are negatively related to the innovation output. Whereas, explicitly lesser civil liberties negatively but insignificantly related to the patent applications and are significantly positively related to the trademark applications. Creative class and school enrollment positively significantly related to the innovation output. Other factors such as, political rights and foreign direct investment negatively insignificantly relates to the trademark applications whereas positively significantly relates to patent applications. Expenditures on education as percentage of GDP (Proxy of R&D) negatively and significantly relates to trademark applications but negatively insignificantly to patent applications.

Keywords: Creative Class, Civil Liberties, Innovation, economic growth, Gross domestic product (GDP)

Introduction

An overview

It has been recognized that innovations play a crucial role to foster the economic growth and development by addressing urgent needs, challenges, enhancing competitiveness and total factor productivity in an economy. In this competitive world, it seems not possible to sustain the economic growth, and to be competitive in global market, without broad-based technological as well as social innovations.

According to Schumpeter, innovations are essential to explaining economic growth (Sledzik, 2013). Innovation can make difference in addressing urgent development needs and developing

countries have to build innovation capacity early in the development process in order to possess learning capacities for the catch-up to happen (OECD, 2012, p.4).

In addition, innovation involves the generation of new ideas and transforming such ideas into a product or process. Innovation can be of different types that is something new to the country or firm. It could be a diversified product or intangible service in the existing social and technological practices (Edquist, 2008). Furthermore, innovation could be either social or technological, "social innovations are new solutions(products, services, models, markets and process, etc.). These solutions, simultaneously, meet social needs(more effectively than existing solutions) and lead to new or improved capabilities and relationships and/or better use of assets and resources. In other words, social innovations are both good for society and enhance society's capacity to act (The Young Foundation 2012. 18, as cited in Bound et al 2015). Whereas, technological innovation is to produce new knowledge, combining the existing knowledge and transforming it into a useful and novel product and process (Edquist, 1997, p.16).

A Case study of Pakistan

As it is defined above, innovations could be both technological and social but both are important in fostering the economic growth. Countries all around the globe are making every effort to double the pace of innovative activities, so is the case of Pakistan. Global innovation index ranks the countries innovativeness between 0-100, higher number means more innovative is the country. Pakistan is ranked at 119 out of 128 countries in global innovation index 2016 report (GII, 2016). This situation indicates the less innovativeness in Pakistan and demands to probe the causes.

The low rank of Pakistan on global innovation index provides bases for the empirical estimations as well as for theoretical reasoning to answer how certain variables are affecting innovation output the country. In addition, it demands to know why culture of innovation does not prevail in the country. Which forces are in the way to hinder or to foster the technological advancement and creation as well as the diffusion of the new knowledge? How situation can be improved to promote innovativeness at the individual, societal and institutional level.

To probe the answers, this study is carried out by considering civil liberties and creative class as main factor influencing innovation output. Rationale behind to take civil liberties and creative class in this study for the empirical estimation is inspired by the insight that, as suggested by the Knutsen (2015) democracies outperform autocracies in a way that under the rule of autocrats civil liberties are being opressed which reduces the flow of economically important ideas and information. This in the long run reduces the speed of technological change. Based on this standpoint, an argument is built in this study to look into the problem—which is intended to be the contribution of this study—that the provision of less civil liberties and complete instability and unrest among the political institutions has adversely effected the very fabric of creative culture in the country, thereby, resulting into the less productive creative class and domestic resources.

Along with other potential factors (e.g., PRIT, R&D, FDI and ENLOROLLMENT) influencing innovation, civil liberties and creative class are taken as main variables of interest in this study. Civil liberties, as discussed above, are considered as a proxy of enabling environment variable for innovation. Civil liberties constitute such an environment, which allows explorations, and encourage the generation as well as the flow of ideas and, at the same time, it constitutes a tolerant environment towards the unconventional or nontraditional ideas. Concisely, civil liberties nurture diversity which in turn enables new, nontraditional as well as productive perspectives. While, creative class is a potential consumer of the freedoms or civil liberties, so any restriction on the provision of freedoms affects the performance of this class accordingly.

To isolate the impact of civil liberties and creative class on innovation a time series data over the period of 1982-2014 is examined by using Negative binomial distribution approach. The results suggest that civil liberties are statistically insignificant but still have a negative sign predicting any

decrease in the provision of civil liberties would lead to decrease in innovation output. Creative class is statistically significant and has a positive relationship with innovation output. Innovation output is being proxied by the patent and trademark applications of residents of Pakistan. Other variables, such as political rights index, appeared to be positive and significant against patent applications but insignificant and negative against trademark applications. Enrollment index is significantly positive related to both proxies of innovation output. Education expenditures as proxy of innovation is significantly negatively related to innovation output. Foreign direct investment is significantly related to patent but insignificantly related trademark application.

Literature Review

In this chapter, empirical review of the existing literature is carried out. In first section of the chapter, factors affecting innovation at firm and national level are discussed in detail. In the second section, literature review of civil liberties and creative class is presented, showing how civil liberties and creative class affect innovation and economic growth.

Factors affecting innovation

Measuring innovation or looking into its determinants has always been considered as a complex process. Nevertheless, as far as the factors effecting innovation activity in a country is concerned, in most of the existing literature it seems that there is a consensus among the economists that there is not a single factor determining or effecting innovation. Rather, innovations are influenced by the interactions among essential characteristics of institutions and organizations. These interactions are named as "national systems of innovation". Innovation process occurs over time and is influenced by the factors or characteristics of interacting institutions. This is because a firm cannot innovate in an isolated vacuum, to innovate, firms have to interact with the other firms and institutions as well to exchange and develop in terms of knowledge, information and services. By organizations, means not only the firms but also universities, research institutions, schools investment banks and government institutions. The characteristics of these institutions put constraints and, or encourage the firms to innovate, such as "laws" "health regulations" and culture and social rules Edquist (1997).

Later on number of studies strengthens the notion of "national innovation system", as Varsakelis (2006) by investigating the impact of quality of education and quality of political institutions on innovation hypothesized that higher the quality of education, more productive the innovation activity is, and more efficient are the political institutions of a country, more productive is the innovation. To verify the hypothesis, he used panel data set of the 29 countries over the period of 1995-2005 and for the quality of education used science and math's grades of the students, and used the enrollment of students in science higher education as proxy of the quality of education. Civil liberties and political rights index are used as proxy of the quality of political institutions. Finally, by using the fixed effect method concluded that civil liberties, political rights and research and development positively correlate with patents (proxy of innovation output). Math's and science grades are also positively and significantly affecting the innovation output but science higher education enrollment variable is insignificant.

Carney and Zheng (2009), by analyzing a cross section data set of 23 countries for the period of 2000-2006, explored the Singapor's innovation gap and stated that state's institutional arrangements generates conflicting innovation incentives and as a result undermine the innovative activities in the country. They further argued that any initiative by the Singapore's government to improve the situation would be undermined by the institutions generating disincentives and results would be opposite to the initiative. They carried out the study by using gross expenditures on research and development as outcome variable and as proxy of innovation output, arguing that patents, as innovation output is inappropriate variable because not all inventions are innovation and not all innovations are patentable. They presented their results; block holding index (shows market value of listed firms), rigidity of employment index (shows the rigidity of rules and regulations), and foreign direct investment (FDI) positively correlate with innovation output.

While investigating the determinants of innovation output in developing countries, Ghazal and Zulkhirbri (2015) used panel data of seven developing countries (including Pakistan) and used negative binomial and negative binomial with PCA method keeping in view the discrete nature of dependent variables (trademarks, patents and industrial desings) to probe which factors are affecting or determining the innvoation in developing countries. They came up with the conclusion that by increasing quality of governance developing countries could enhance the innovation output. Furthermore, findings of the research indicates that FDI in developing countries have positive impact on innovation output and by attracting more foreign direct investment (FDI) such countries could enhance their innovation activity. However, the impact of R&D (research and development) is negative and insignificant in case of developing countries. In addition to that, the education system of developing countries is not supporting the FDI and R&D towards producing more and more patent applications (Proxy of innovation output).

Mayhew, Simonoff, Baumol, Wiesenfeld, and Klein, (2012) conducted a large-scale primary study to explore the relation between innovation entrepreneurship and higher education. They used a sample of 3700 students (who passed their graduation) to examine a question that "what educational practice and experience influenced student's innovative entrepreneurial intentions"? To find the answer, they constructed six models and find that students with emotional stability were intended to innovate, and students who were open towards new experiences intend to innovate than those who were not. Asian students intended to innovate more than the students from other regions did. Furthermore, results of the study suggested that students with entrepreneurship enrollment, internship and research experience were more likely to intend to innovate. Finally, and more importantly, study reveals that a teaching practice in which students were encouraged to develop argument was significantly related the student's intentions to innovate and innovation can be influenced by a practice such as "assessment". That encourages creating, constructing and defending innovative solutions to the presented social problems. Bound, Gerhard, Hoelscher and Mildenberger (2015) formed a methodological framework to measure social innovation by defining two strategies. One is theoretical top down strategy, which includes screening of innovation or literature review, measurement tools and transfer to the city level. Second is bottom up empirical strategy, which consists of urban case study with expert's interviews on migrant's integration, city level systematic and measurement tools for capturing social innovation and transfer to the national level. In the chapter of top down strategy, they concluded that sequences of innovation are similar in technological, economic and social innovation. Whereas, in the bottom up strategy, case study revealed that social need structure, financial resources, political anchoring and support, social capital and networks influence the social innovation process at different stages.

Apart from the national level studies, there are studies at firm level, indicate that innovation occurs because of strong interactions among the institutional as well as organizational factors. Ahmed and Mahmud (2011) noted the same that the quality of top management in terms of education or experience and size of the firms are key factors effecting firms innovativeness in case of Pakistan. They used panel data consisting of 402 manufacturing firms for the period of 2002 and 2006-2007. Zemplinerova and Hromadkova (2012) examined the determinants of firm's innovation in case of Czech Republic by using the cross section data set over the period of 2004-2007 with primary aim to distinguish the relatoionship between growth, innovations and subsidies. This relationship is distinguished by constructing four interlinked questions of the interest. First, what are the determinants of the firms decission to innvoate. Second, what determins the innovation investment and, third, what determines innovation output and at fourth stage, adressed the firms' innvoation and productivity link. Using CDM (Crepon. Duguet and Mairesse) model, researhcers concluded that firms increasing in size decide to invest in innovation and firms with the foreign market orientation decide to innovate to remain competitive in the international market as well. In addition, findings of the study suggest that innoavtion ouptut of a firm has a positive relation with productivity, and any kind of subsidies by the government has significant negative impact on the innvoation ouptut. As

firms having subsidies invest more for innovation but output is less than those without subsidies, and innovation decreases as the size of the firm increases.

Literature Review of civil liberties and creative class

As it has mentioned above that Varsakelis (2006) argued that civil liberties have positive significant effect on innovation activity in a country. However, there is range of literature available suggesting importance of civil liberties and its link to the growth of an economy. As Isham, Kaufmann, and Pritchett (1997) argues that civil liberties has significant impact on the government-financed projects. Civil liberties encourage the people to hold the government accountable that has a healthy effect on the performance of the projects. They used a cross sectional data over the period of 1974 to 1984 to examine the performance of the government projects financed by the World Bank including credits from IDA (international development association) and loans from IBRD (international bank of reconstruction and development). They used rates of return on the government project as an efficacy indicator of the government and concluded that countries with more civil liberties are more likely to have better economic rate of return from government projects.

Zouhaier and karim (2012), investigating the relationship of democracy, investment and economic growth, argued that there is a strong relationship between the civil liberties and economic growth. Their findings suggest that political rights and civil liberties, first, positively relate to the investment and then to the GDP growth rate. To investigate the relationship, they used a sample of 11 countries from the MENA (Middle East and North Africa) region for the period of 2000-2009 and a dynamic model.

Benyishay and Betancourt (2010) linked civil liberties to the economic growth by constructing two prepositions: First, in the long run a key determinant of economic growth is rule of law and, second, provision of civil liberties as human rights is fundamental or basic indicator of prevalence of rule of law in a society. In addition, any violation of the human rights is not consistent (or would not be considered) as a prevalence of rule of law in a society. By using cross section data set of sixty countries, researchers concluded that civil liberties matter most in the second-generation (social and economic freedom) property rights that determine the economic development as an indicator of the rule of law. Furthermore, four sub categories (freedom of belief and expression, rule of law, associational rights and individual rights) of civil liberties in general outperform the other indicator of property rights in determining the long run growth and there is robustness in the empirical findings.

Falvey, Foster and Greenaway (2004) investigated the relationship between intellectual property rights and economic growth. By using panel data of 80 countries, they concluded that intellectual property rights protection (patent rights index used as proxy) significantly related to growth but depends on economic development. Further argued that IPR(Intellectual Property Rights) are positively related to the growth in high-income countries. This is because strong protection of intellectual property rights (IPR) in high-income countries encourages innovation and then this technology goes down stream towards the low income countries. However, intellectual property rights do not relate to the economic growth of middle income countries. Findings suggested that due to the lower scope of emulation in middle-income countries, IPR does not relate to their economic growth. Growth of the low-income countries positively correlates to IPR, not because of their domestic innovation output or research and development but through a channel. That is, IPR protection attracts the foreign direct investment (FDI) which results in transformation of knowledge and technology towards lower income countries. However, in case of middle-income countries, positive relation between intellectual property rights protection and economic growth is being offset by the slow technological diffusion and lower imitation.

Janjua and Samad (2007) examined the relation between patents index (proxy of intellectual property rights) and economic growth as case of middle-income developing countries and argue that IPR protection system does not contribute to the middle income countries including Pakistan. Further

states that other variables, such as economic freedom, civil liberties and political rights positively affect the process of growth. They used ten middle-income developing countries, used nine sub periods for the un-balance data from 1960-2005 and seven sub period for balanced data set over the period of 1970-2005, and used pooled least square for empirical estimation.

Fatah, Othman, and Abdullah (2012), while investigating the economic growth political freedom and human development, concluded that political rights are significantly related to the regional economic growth. Whereas, China and Indonesia have no significant relation with the political rights but these countries showed a huge sensitivity towards the civil liberties, means any increase or decrease would have its significant impact on these country's growth.

Knutsen (2015) proposed an argument that in the long run democracies outperform or outgrow the autocracies. This is because autocrats impose restrictions on civil liberties to remain in power or to have hold in the office. These restrictions on freedoms result in the slow diffusion of economically relevant ideas and information which in turn leads to the slow adaptation of new technology and technological change. It happens because autocrats cannot distinguish between the economically relevant ideas and those that could hurt their survival in the office. He used large data set of 160 countries with time series going back to 1820 and had robust results in the support of his argument.

Czegledi (2014) interpreted the work investigated by (BenYishay & Betancourt 2010) and seocnds their work by saying that civil liberties are more important than the constraints on executive. He made three assumptions in this regard to establish his argument. First, higher level of freedom means government is not able to commit high level of expropriation. Second, institutions of freedom must be in line with culture, and fourth one is that enforcement of civil freedoms can be seen as enforcement of property rights. Proved his argument by using MSV models and argues that it not merely a libertarian argument that freedom of individual is an important determinant of development rather this conviction has supported by many empirical results. Further states that property rights first needs to be enforced and civil liberties are more important indicator in way that an unconstrained government can provide more property rights than a constrained one.

Czegledi (2013) build an argument based on two main assumptions. First, culture as an informal factor determine the enforcement cost of the property rights being more or less congenial towards the rent seeking activities of the government. While the second one is that income generated by the different property rights to the owner is expropriable to varying degrees. He used a cross-country correlation analysis to test his predictions over the period of 1972-2010 including 136 countries. Findings of the study suggest that pro market or less friendly attitudes will compel government to enforce and provide a large scope of rights. He defines the civil liberties in a framework in which there is no dividing lines between civil and property rights.

Florida (2002) in his book *The Rise of the Creative Class* defines creative class and human capital as an engine of the regional and national innovation and growth in a way that creative people are attracted towards the places which offer social amenities, diversity and tolerance towards the self-expression. Thus, this combination of factors makes creative people more productive, which in turn lead to the innovations and growth. To test his theory, Florida, Mellander and Stolarick (2008) used data set including 331 metropolitan areas in the United States for the period of 2000. And examined the relation of these occupational and educational measures of human capital and regional development. And how the distribution of these two measure is being affected by the potential features of the places, such as level of tolerance, social amenities and universities. They used regional wages and income as outcome variables and creative classs and human capital measures (labor force with the graduation degree) and many other potential variables as explanatory variables. They used structural equation models and path analysis to isolate the effects of the variables. Their findings suggested that human capital and creative class are two different measures of talent and are not substitute of each other, further suggested that these two have positive and singnificant impact on regional development through different channels: Creative class is related to enhance the productivity, and human capital affects through the channel of income. However, at the end, both

measures pool into the regional development. More interestingly, they found that universities attract both human capital and creative capital. Social amenities attract creative class but not to the human capital. Tolerance strongly associated with the distribution of skilled population more than universities and consumer services and it further correlates with regional development by attracting creative class and making regional resources more productive. The results were almost same when they tested the effects of technology, human capital, creative class, universities and tolerance on the regional development in the Canadian metropolitans (Florida, Mellander and Stolarick 2009).

Martin et al (2015) Combined the Porter's industrial cluster theory of traded and local clusters with the Florida's creative and routine workers theory, and made four categories, creative occupations in traded and local industries separately and routine occupations in traded and local industries. They investigated the impact of these four categories on regional economic performance by using correlation analysis and find that creative occupations in traded industries have strong relation with average wages, GDP per capita and innovation (measures of regional economic performance) than the creative occupations in local industries. More surprising is this that routine workers in both traded and local industries are negatively and significantly related to the variables of regional economic performance.

Researchers other than Florida have also examined the role of creative class as (e.g. Karasek, 2013) hypothesized the impact of creative class on the level of innovation in Polish regions and concludes by saying that regions with higher creativity are associated with higher level of innovation. Fairlie (2012) investigated the creative capital theory against unemployment rate and finds talent, technology and tolerance insignificant determinants of unemployment rate.

To conclude here, it is conceivable to state that variable like creative class, freedoms and tolerance along with other potential variables like FDI, R&D and quality of education directly and indirectly make a channel to foster the innovation and growth of an economy. Lacking in either of these factors would have its negative impact.

The model

A model is a simplified representation of the reality. It implies abstraction from the reality and includes the main features of the reality. It cannot always address the whole economic truth but an abstraction of the reality. A model is designed to study a phenomenon based on certain assumptions which has two main purposes, analysis and prediction (Koutsoyiannis, 2003). In this chapter econometric model, to carry out the empirical analysis, will be discussed in detail.

Hypothesis

1)

- H0: there is no significant relationship of civil liberties with innovation output.

H1: lesser civil liberties are negatively related to innovation.

2)

- H0: there is no significant relationship of creative class with innovation output.

H1: creative class is positively related to innovation.

To estimate the hypotheses a time series model over the period of 1982-2014 is constructed.

$$INNOVATION = \beta 1 + \beta 2CL + \beta 3PRIT + \beta 4CC + \beta 5ENROLI + \beta 6R\&D + \beta 7FDI + \varepsilon$$

Defining variables

Dependent variables

Innovation: Under current studies patent applications of residents and trademark applications residents are used as proxy for innovation output, though taking patents can be problematic as a proxy of innovation because not all the inventions are patented and patentable (Carney et al 2009). Still both are most reliable proxies. Both patents and trademarks are used interchangeably in the analysis as dependent variables. Data on these variables is taken from the World Bank development indicators. According to the definition of World Intellectual Property Rights Organization (WIPO) "intellectual property refers to the creation of mind, such as inventions; literary and artistic work; designs and symbols, names and images used in commerce". In addition, patents, copyrights and trademarks are used as laws to protect IP.

Explanatory variables

CL: Civil libertiesas it is stated earlier that civil liberties or freedoms are taken as enabling environment variable for innovation; which allows exploration and allows the generation and free flow of ideas. It enables an environment, which is diverse and tolerant towards the elf-expression of individualsat every level. As Knutsen (2015) stated that under dictators rule technological change gets slower due to the lesser civil liberties. To examine the hypothesis data on civil liberties is taken from the Freedom House which publishes the rankings of civil liberties on a scale from 0(greatest degree of freedom) to 7(smallest degree of freedom) for 195 countries from 1973-2016 based on a checklist of 15 civil liberties. For current study, it is taken as index of civil liberties from 1982 to 2014.

PRIT: Political rights indexanother control variable (named political rights index) is taken into consideration to examine, what is the impact of the quality of political institutions on innovation output following Varsakelis (2006). Data on this variable is taken from the Freedom House index, which publishes the ranking of political rights on scale from 0 (higher degree of political rights) to 7 (smaller degree of political rights). In other words, this could be stated as increase in the index of political rights means more autocratic the government is and decrease in the index means more democratic the government is.

CC: Creative class: creative class is defined by Florida (2002) as share of labor force engaged in creative and knowledge intensive occupations. Data on these occupations has been taken from the Labor Force Surveys of Pakistan from 1982-2014. Pakistan Bureau of Statistics defines occupations according to Pakistan Standard Classification of Occupations (PSCO), which further conforms to the International Standard Classification of Occupations (ISCO). Following major occupation groups are taken as Creative Class under current study, which includes all those occupation defined by Florida (2002):

1. Legislators, Senior Officials and Managers.
2. Professionals.
3. Technical and Associate Professionals.

Data on these occupations is taken as percentage distribution of employed persons 10years of age and above by major occupation groups. These occupation groups are taken as percentage sum of employed persons in all the industries and added together to form creative class. Creative class measures are tried to adjust according to the definition of Florida (2002). However, these occupations are still creativity intensive and knowledge based. As per the definitions of PSCO (2015) Managers, professional and associate professionals have skill level 4 and 3. Occupations at skill level 4 typically involve the task that require complex problem solving and, decision making and creativity. In addition, occupations at skill level 3 involve the performance of complex technical and procedural knowledge in a specialized field. Here it is important to state that Pakistan has a history in classification of occupations. First Pakistan standard classification of occupation (PSCO) was

developed in 1968, and then with little improvisations developed again in 1994 and in 2015, respectively. In current study from 1982-94 data on managers and on professionals was collected. And after that till 2014 data on managers, professionals and technicians and associate professionals was collected because before 1994, technicians and associate professionals were added in the group of professionals. Table1 illustrate the major occupational groups, which constitutes creative class and their skill level and description.

Table 1: Description of Creative Occupations

PSCO-2015 Major Groups	Skill Level	Description
Managers	3+4	Legislators, senior government officials, finance managers, human resource managers, policy and planning managers, health managers etc.
Professionals	4	Physicist and astronomers, chemist, biologist and environmental protection professionals, teachers, musicians singers and composers, journalists, film directors and actors, etc.
Technicians and Associate Professionals	3	Chemical and physical science technicians, civil, mechanical and chemical engineers, etc.

Source: Pakistan Standard Classification of Occupations (PSCO, 2015)

ENROLI: Enrollment index Literature suggest that tertiary or higher school enrolment is a potential factor affecting innovation output as a proxy of country's technology absorption capacity and supporting environment and infrastructure for innovation activity. As referred by the Ghazal et al(2015). In this study, enrolment is taken from the secondary vocational, arts and science colleges, professional colleges and universities. Enrolment is taken in absolute numbers and an index of enrolment is formed using principle components method. Data on this variable has been taken from Pakistan 50 years of statistics (various volumes).

R&D: Research and development Research and development has emerged as an important factor effecting growth which enhances the stock of knowledge and works as an input for innovation. In the current study, it is used as a proxy of internal finance input for innovation, as referred by Ghazal et al (2015). Due to the lack of availability of data on R&D and on expenditures on higher education, government expenditures on education (percent of GDP) are used as proxy R&D expenditures. Data on this variable is taken from the website of United nations Educational, Science and cultural Organization (UNESCO).

FDI: Foreign direct investment foreign direct investment is taken as a finance coming from the other countries, which brings modern technology with it. It has been considered as an important channel for technology and knowledge transfer and spillovers (Cavascepeda & Lippoldt, 2010). Furthermore, these spillovers benefit locally owned enterprises. Data on this variable is taken from the website of United Nations Conference on Trade and Development. FDI is taken as in million dollars at current price.

Data Limitations

The lack of availability of data, particularly in case of developing country like Pakistan, on measures of innovation and other potential variables like R&D (expenditures on education are used as R&D proxy), most importantly in case of time series analysis, has made this analysis tough. This situation did not allow constructing a complete model predicting as national system of innovation, still an effort has been made to shed light on the issue from this standpoint. Which I believe a very basic to enhance a country's competitiveness. Main proxy measures of innovation such as trademark

and patents have some missing values and measure of creative also has missing values for the years of 1988, 1989, 1994, 1995, 1998, 2000, 2002, 2004 and 2011 which have been generated with help of linear interpolation using EVIEWS software. So, it is feared that with this much sensitive data empirical tests could be opposite to the proposed hypothesis.

Empirical estimation

In first section of this chapter, econometric methodology is discussed keeping in view the nature of the data. Descriptive statistics and graphical representation of data is also made in the same section. In second and third sections, empirical results are presented and discussed briefly. In fourth section, concluding remarks are also presented.

Methodology

Model of the current study includes patent and trademark applications of residents as dependent variables (used interchangeably as proxy of innovation). These variables are discrete in nature, which takes nonnegative integer values. Applying conventional OLS on such models is inappropriate and leads to bias results. Main problem of using OLS is that it reads dependent variable as a continuous one and leads to biased and inconsistent estimates. According to Gujarati and Porter (2009), a phenomenon such as number of patents received by a firm in a given year or number of articles published by a professor in a year is known as, or called, a count data or rare event data and these are an example of Poisson probability process. Poisson probability distribution is suitable for such count dependent variables. Poisson distribution density is as follows

$$Pr = (Y = y) = \frac{e^{-\mu}\mu^{y}}{y!} \quad y = 0{,}1\ 2\ \ldots \qquad (1)$$

Where, y is count variable and μ is the intensity or rate parameter. According to Cameron and Trivedi (1999) Poisson regression model is derived from the Poisson distribution by parameterizing the relationship between mean (μ) and explanatory variables (x).

$$\mu = \exp(x\beta) \qquad (2)$$

However, there is a restriction or a property of Poisson distribution that is; mean variance equality. This is also known as property of *equidispersion.*

$$E(Y) = \mu \qquad (3)$$

$$Var = \mu \qquad (4)$$

This property of the Poisson is often violated because in most of the cases variance often exceeds the mean. Cameron et al (1999) suggested a statistical test for over dispersion is required after running a Poisson regression. This can be computed by obtaining fitted values of $\mu = \exp(x\beta)$ and running a simple auxiliary OLS regression (without constant) and for a time series model it is suggested to test for the zero correlation between the current and lagged residuals. If there is over dispersion and serial correlation in the model then Poisson regression is inappropriate. To tackle this problem and to relax this property of Poisson, many researches and economists (e.g. Cameron et al 1999) have proposed an alternative approach called negative binomial distribution. Negative binomial is a generalization of the Poisson distribution, which relaxes the property of equality of mean and variance. One form of negative binomial distribution is as follows:

$$P(Y = y \mid x) = \frac{\Gamma(\theta + y)}{\Gamma(y+1)\Gamma(\theta)} r^{y}(1-r)^{\theta} \quad y = 0{,}1{,}2{,}3\ \ldots, \qquad (5)$$

Where $r = \frac{\lambda}{\lambda+\theta}$ (6)

In negative binomial conditional mean function is same as in the Poisson distribution.

$$E[y|x] = \mu = \exp(x\beta) \qquad (7)$$

$$Var[y\ |x\ ] = \mu\,(1 + \alpha\,\mu\,) > \lambda \qquad (8)$$

Negative binomial has an extra parameter $\alpha = 1/\theta$ which shows if $\alpha > 0$ means variance exceeds the mean.

Empirical Results and Discussion: when patents are dependent

In this section, empirical investigation is carried out following suggestion made in the previous section. Since, in current study times series data over the period of 1982-2014 is used to isolate impact of civil liberties and creative class on innovation. Therefore, using STATA software first Poisson model is estimated and then checked for the over dispersion and serial correlation and then negative binomial is used. In the table below result are presented and discussed in detail.

Table 2: Poisson: Dependent Variable: PATENTS

Variables	Coefficients	Standard Errors	P –values
CL	-0.0005116	0.0776608	0.995
PRIT	0.0563371	0.0294617	0.056
CC	0.0227642	0.0056407	0.000
ENROLLI	0.8760388	0.0544678	0.000
EDUEXP	-0.2207712	0.1117329	0.048
FDI	0.0001085	0.0000224	0.000
C	3.193982	0.4633643	0.000
Pseudo R^2 = 0.7448			
Deviance goodness of fit = 122.035			0.0000
Pearson goodness of fit = 121.9368			0.0000

First Poisson regression is estimated when patents are dependent variable keeping in view the discrete nature of the dependent variable and further checked for the presence or absence of dispersion or to check whether the *equidisperison* property of Poisson holds or not. As it shown in table 2, almost all the coefficients are significant at 95% confidence interval except the CL (civil liberties). Before going for further interpretations of coefficients, it is necessary to look at the goodness fit of the model. Goodness of fit statistics is given in the bottom of the table 2; both Pearson and Deviance statistics are highly significant and suggesting that in this condition Poisson estimates are not appropriate. In other words, goodness of fit stats are showing that mean variance equality does not prevail. As it is said earlier that model being estimated under current study is a time series model so, a test of serial correlation is also carried out by regressing residuals on its lagged values, results shows the presence of serial correlation. Thus, Poisson estimates are not reliable and Negative Binomial regression is better to use in this situation as suggested by the Cameron et al (1999).

Table 3: Negative Binomial: Dependent Variable: PATENTS

Variables	Coefficients	Robust Std.Err	P-Values	Marginal Effects	P-Values
CL	-0.0219778	0.0684639	0.748	-1.366244	0.748
PRIT	.00916144	0.045567	0.044	5.695179	0.051
CC	0.0155161	0.0084679	0.067	.9645503	0.068
ENROLLI	0.900115	0.103359	0.000	55.95534	0.000
EDUEXP	-0.2335793	0.1693383	0.168	-14.52038	0.162
FDI	0.0001242	0.0000536	0.020	0.0077233	0.027
C	3.213393	0.5145597	0.000		
Lnalpha	-3.199759				

Alpha	0.040772				
No. of Obs = 33 Wald statistics = 329.20					0.0000
McFadden's R^2 0.219 McFadden's Adj R^2: 0.171					

Negative Binomial is estimated because there is *overdispersion* and serial correlation is presented in the model as it is explained earlier that a restriction imposed by the Poisson is equality of its mean and variance. In this current study, this restriction of Poisson is violated as the alpha stats and Wald statistics shows.

Negative binomial has its mean μ similar to Poisson but its conditional variance is$\mu = (1 + \alpha\mu)$ when α = 0, then negative binomial distribution is same as Poisson. If, greater the alpha greater the dispersion. As it shown in the bottom of the table 3, that alpha is ".040772" which shows that choice of using negative binomial is appropriate. Probability of α = 0 is also rejected by the Wald statistics.

Here, it important to state that Robust Standard errors are used to counter the problem of auto or serial-correlation. In the bottom of the table 3, McFadden pseudo R2 shows goodness of the fit of the model. McFadden which is being calculated as $R^2 = 1 - \frac{\ln(Mfull)}{\ln(Mintercept)}$ where ln(Mfull) shows the log likelihood of the full estimated model and ln(Mintercept) shows the log likelihood of the intercept model without covariates. Interpretation of McFadden r-square cannot be carried out as ordinary least square and its value cannot tend to be as big as of conventional OLS R^2. Values between "0.2 to 0.4" show an excellent fit of the model (McFadden, 1978).

Average marginal effects [dy/dx] are calculated to interpret the results in a way like conventional linear regression. There are two main variables of interest in this study; one is CL (civil liberties) and the other is CC (creative class). Expected relationship of civil liberties with innovation was negative because an increase in the index of civil liberties means lesser civil liberties. Therefore, lesser civil liberties would lead to decrease in the innovation output in way that lesser civil liberties would restrict the generation and free flow of diverse ideas. In response to it, innovation output would decrease because; above all innovation demands a diverse market of ideas.

In table 3, it can be seen; though CL (civil liberties) is merely insignificant but still carries a negative sign which predicts the negative relationship between patents (proxy of innovation output) and civil liberties. It means that with a unit decrease in the provision of civil liberties (an increase in the Freedom House index of civil liberties),on average patents applications are predicted to decrease by -1.37 units, holding other variables constant.

It is important to note, since CL is insignificant but political rights index (PRIT) is significant and shows a positive impact on the patents applications which means that with a decrease in political rights (an increase in the political rights index) patents applications are (on average) predicted to increase by 5.7 units. However, the correlation of CL and PRIT is 0.35 which show a positive association of both variables, though it is a lower degree of association but as suggested by Isham et al(1997) that theoretically it is inappropriate to interpret both civil liberties and political rights in a conventional citrus-paribus way. Since both variables move together, changing civil liberties without change in political rights is theoretically irrelevant. Therefore, negative impact of civil liberties (-1.37) is being offset by the positive impact of political rights (5.7) and the net effect is (4.3) units. Which means that with one unit decrease (increase in Freedom House index of political rights) in political rights on average patents are predicted to have 5.7 units, but -1.37 units would be the cost of decreased civil liberties. In this way, results seem consistent with Knutsen (2015) argument that in autocracies technological change is slow because of the lesser civil liberties. Moreover, Wald test shows that both civil liberties and political rights index jointly have predictive power and are

significantly different from zero. It also strengthens the phenomenon that both variables move together.

Second main variable of interest is Creative Class (CC), anticipated relationship of creative class with innovation output (proxied by patents applications) was positive in a way that innovation takes place with generation of creative ideas and their implementation in a productive way. Therefore, creative class is an engine to generate creative ideas, and by implementing those ideas enhances the innovation activity in the country. It can be observed in the table 3 that relationship between patents and CC is positive, and has significant impact with a significant p-value (0.067). Moreover, it is as it was hypothesized; a unit increase in Creative Class would lead to increase in the patents by 0.97 units, holding other variables constant. These results are consistent with those of Martin et al (2015) in which they stated that creative class in traded industry positively correlates with patents as proxy of innovation output. The relationship is further in line with (Florida, 2002) that creative class works as an engine to innovation.

One of the highest impacts on innovation output (patents) is seen through ENROLLI. Enrollment index (secondary vocational, arts and science colleges, professional colleges and universities) has its significant impact on patents or innovation output with a significant p-value (0.000) which means that a unit increase in the enrollment index would lead to increase in the patents around 56 units, citrus paribus. Here, it is important to note that the enrollment index includes enrollment not only at tertiary level, but also at college level (vocational, professional and science colleges). It is because (in current study) enrollment is used as a proxy of supporting environment and infrastructure for innovation activity in an economy. Therefore, it is plausible to take enrollment from both colleges and university level because not all students reach to the university level, a lot more leave after graduation and become a part of the labor force. Hence, it is necessary to enhance quality of education and infrastructure at both secondary and tertiary levels. Otherwise, following Ghazal et al (2015), tertiary enrollment is insignificant in case of developing countries including Pakistan.

Due to non-availability of data on R&D in Pakistan, education expenditures (EDUEXP) as percentage of GDP are used as a proxy of innovation input variable based on the rationale that in Pakistan a large chunk of education expenditures out of total expenditures is being spent on tertiary education. A positive relationship between education expenditures and patents was expected but results are contrary to the anticipation: EDUEXP is insignificant with p-value (0.168) and parameter has a negative sign (-15). This means that a unit increase in education expenditures, on average, patents are predicted to decrease by 15 units holding other variables constant. Either it is so, because of the week proxy of R&D, or it is because in Pakistan expenditures on education have always been less than two percent. However, still considering EDUEXP as proxy of research and development these results are consistent with Ghazal et al (2015), implying that in developing countries most of the research is being carried out at government level and at university level which have less impact on patent applications.

Foreign direct investment (FDI), another variable of innovation input is significant at p value (0.020) and has positive relation with the patents. It shows that with a unit increase in FDI, on average, patents are predicted to have 0.008 units. Despite of the positive significant relationship, the impact is very small. However, as suggested by Ghazal et al (2015), by making a fertile environment to attract the foreign investment this small impact can be increased.

Empirical results and discussions

When Trademarks are dependent

Table 4: Poisson Dependent Variable: TRADEMARKS

Variables	Coefficients	Satandard Errors	P-Values
CL	0.1291283	0.0084002	0.000
PRIT	0.0155488	0.0030268	0.000
CC	0.0314792	0.0005691	0.000
ENROLLI	1.125396	0.0052846	0.000
EDUEXP	-0.1194679	0.0110049	0.000
FDI	-0.0000183	2.37e-06	0.000
C	6.970712	0.0486072	0.000
Pseudo R^2 = 0.9764			
Deviance goodness of fit = 2291.973			0.0000
Pearson goodness of fit = 2394.285			0.0000

The Poisson results on trademarks in table 4 are bit different from those of patents as for as the significance and relationship of covariates is concerned. All variables are significant with p-value (0.000) and positively related with the trademark applications except EDUEXP and FDI. Daviance and Pearson goodness of fit results are suggesting that the Poisson distribution is inappropriate. Here again residuals are being regressed on its lagged values to check the serial correaltion among the residuals and from the test of the serial correaltion it is seen that residuals are serialy correlated. Hence, it is plausible to go for the Negative Binomial regression model.

Table 5: Negative Binomial: Dependent Variable: TRADEMARKS

Variables	Coefficients	Robust Std.Err	P-Values	Marginal Effects	P-Values
CL	0.1393662	0.0298515	0.000	887.3818	0.000
PRIT	-0.0111653	0.0260068	0.668	-71.09216	0.668
CC	0.033201	0.0050839	0.000	211.3995	0.000
ENROLLI	1.103566	0.0486515	0.000	7026.702	0.000
EDUEXP	-0.1993443	0.1041554	0.056	-1269.278	0.059
FDI	-0.0000105	0.0000177	0.555	-0.0666944	0.556
C	7.223651	0.2972541	0.000		
Lnalpha	-4.332458				
Alpha	0.0131352				
No. of Obs 33 Wald statistics 0.0042232					0.0000
McFadden's R^2: 0.197 McFadden's Adj R^2: 0.172					

Negative binomial is used as discussed earlier that overdispersion and serial correlation is presented in the model and distribution is not a Poisson distribution because property of equidisperiosn (mean and variance should be equal) is violated, as it is shown in the bottom of the

table 5 that $\alpha \neq 0$ and significance of Wald statistics is suggesting that the choice of negative binomial is appropriate.

The results of trademarks are significantly different form the those when patent applications (residents) as proxy of innovation were dependent variable (see table 5). This time CL (civil liberties) are positively related to the trademarks and significant with p-value (0.000). It means that a unit decrease in CL (increase in the index of civil liberties means lesser civil liberties) trademarks, on average, are predicted to increase by 887.4 units holding other variables constant. Political rights index is now insignificant but has negative sign with parameter which is contrary to that of when patents are dependent. If we ignore the insignificance of political rights index, that means with a unit decrease in political rights (increase in the political rights index of freedom house) trademark applications (residents) are on average predicted to decrease by 71 units. Here again the interpretation complication araises which is being dicsussed above that theoretically it irrelevant to interpret both civil liberties and political rights separately or in a conventional citrus-paribus way. Here possitve impact of civi liberties (887) is being offset by the negative impact of political rights (-71) and the net or joint impact of both civil liberties and political rights is 816 units.

CC (creative class) has significant positive relation with trademarks with highly significant p-value (0.000). It reads, with a unit increase in creative class, on average trademarks are predicted to increase by 211.3 units, citrus paribus. It again strengthens the theory that creative class drives innovation(Florida, 2002).

A surprising feature of these results is that here EDUEXP (education expenditures as percent of GPD) turned significant with negative impact on trademarks applications. Which means that with a unit increase in education expenditures, on average trademark applications are predicted to decrease by 1269.2 units. It can be interpreted in way that expenditures on education are less than two percent and most of the research is conducted at university level which has minimal impact on patent applications. Considering education expenditures as a proxy of research and development expenditures, these results are consistent with those of (Ghazal et al 2015), predicting that education expenditures are not R&D oriented in Pakistan. It is important to that education expenditures have negative association with both Trademarks and Patents applications suggesting that it will offset the impact of Enrollment index. Therefore, It plausible to state that education system in Pakistan is not supporting human capital to innovate.

FDI (foreign direct investment) turned insignificant with negative coefficient, these results are inconsistent with that of Ghazal et al (2015) in case of Pakistan. A possible reason to this is that lower inflows of FDI in Pakistan.

ENROLLI (enrollment index) is positively and significantly related to the trademarks applications and has a highest impact on the trademark applications with coefficient value of 7026.1. It means that, with a unit increase in enrollment index trademark applications are predicted to increase by 7026.1 units.

Conclusion and policy recommendations

Innovation amongst other factors is considered a very important ingredient to foster the growth and economic development. It has become crucial for developing countries to catch up the technologically advanced countries. Pakistan, being a developing country, is struggling to double the pace of innovation. Global innovation index (GII 2016) ranked Pakistan at 119 out 128 countries. It shows less innovativeness of the country and poses towards the seriousness of the problem. Therefore, current study was carried out in case of Pakistan to understand the factors hindering innovation activity in the country.

This study, very precisely, was an attempt to probe the direct impact of civil liberties and creative class on innovation. Two hypotheses were constructed; one was lesser civil liberties

negatively relates to the innovation output and second was creative class positively relates to innovation output. Rationale behind the hypotheses was a long history of dictatorships (even the democratic regimes) with lesser civil liberties has negatively affected the creative culture in the country. This in turn resulted into the less productive creative class and lower innovations and inventions. To test the hypotheses, time series model over the period of 1982-2014 was developed and investigated empirically, using negative binomial approach. Negative binomial approach was used because conventional regression methods are inappropriate for model with a count dependent variable. Innovation output was proxied by patent and trademark applications of residents of Pakistan.

Obtained empirics suggested explicitly that civil liberties index is not significantly related to patents application but have negative association. However, index of civil liberties positively and significantly related to trademark applications (proxy of innovation output). Creative class turned out to be positive and significant factor affecting innovation output. The estimates of civil liberties and political rights index implicitly indicate that there would be a cost of restricting civil liberties in terms of less innovation activity, it affects either directly (negatively) or by making creative class less productive. This is because, above all, innovation requires a diverse market of ideas but, by restricting civil liberties, generation and free flow of ideas would decrease. It, in the end, leads to decrease in innovativeness of the country (Knutsen 2015).The creative class is positively associated with innovation output. However, its impact is very small and that can be interpreted because of lesser tolerance and encouragement towards the new ideas, expressions and un-conventional perspectives, because creativity thrives in an open and diverse environment. As argued by Florida et al (2008), values such as tolerance and openness to diversity and self-expression nurture creativity and are associated with innovation and entrepreneurial behavior. Furthermore, FDI was found significant but with little effect on innovation output. However, it can be attracted by providing a congenial ground in terms of strong intellectual property rights protection and political stability (Falvey et al., 2004).

Another important result is school enrollment's positive significant association with innovation output (with both patent and trademark applications). In present study, school enrolment (secondary, vocational and tertiary level) used as a presence of supportive infrastructure to innovation activity and technology absorption capacity in the country. However, tertiary education alone seems failed to translate it into an innovation output, as Ghazale et al(2015) reports the insignificant and negative association of tertiary enrolment with patent applications in case of developing countries, including Pakistan. Moreover, negative impact of education expenditures as percentage of GDP (Proxy of R&D) on innovation output (Trademark and Patent applications) suggests the same that there is a need to revisit the policy. A specific policy should initiate to improve the situation by revisiting the education expenditures allocation pattern: A large chunk of expenditures should also be made on primary education as it is considered to be a nursery for the higher education institutes. As a result, higher institutes, with better-grown nursery, would be able to make resources more productive and provide better skilled human capital to the business market. Alongside, a policy to increase the quality of education is needed, both in terms of text and teaching practices as suggested by Mayehew et al(2012); with some appropriate teaching practice innovation is something that can be nurtured at college by encouraging students to construct and defend their arguments.

References

1. Acemoglu, D., & Robinson, J. A. (2012). Why Nations Fail. New York: Crown Business.
2. Ahmed, H., & Mahmud, M. (2011). What Determines Innovation in Manufacturing Sector? Evidence from Pakistan. The Pakistan Development Review, 50, NO. 4 Part II, 365-376.
3. Albaladejo, H. R. (1969). QEH Working Paper Series – QEHWPS40.
4. Benyishay, A., & Betancourt, R. R. (2010). Civil Liberties and Economic Development. Journal of Institutional Economics, 6(3), 281-304.

5. Bound, E., Gerhard, U., Hoelscher, M., & Mildenberger, G. (2015). A Methodological Framework for Measuring Social Innovation. Methods of Innovation Research, 40 NO 3, 48-78.

6. Cameron, A. C., & Trivedi, P. K. (1999). Essentials of Count Data Regression: online available at http://cameron.econ.ucdavis.edu/research/CTE01preprint.pdf.

7. Carney, R. W., & Zheng, L. Y. (2009). Institutional (Dis)incentive to Innovate: An Explanation for Singapore's Innovation Gap. Journal of East Asian Studies, 9, NO. 2, 291-319.

8. Cavascepeda, R. H., & Lippoldt, D. C. (2010). The Strnght of IPR Protection: Policy Complements. The WIPO Journal, 2(1).

9. Czegledi, P. (2014). Why are Civil Liberties More Important than Executive Constraints in Economic Development? A Property Right Approach. Sociey and Economy, 36(1), 37-38.

10. Czegledi, P. (2013). Civil liberties and Economic Development: The Role of Culutre in Property Rights. 17 Annual Conference of the International Society for New Institutional Economics.

11. Dimock, M. (1986). Creativity. Public Administration review, 46, no.1, 3-7.

12. Edquist, C. (1997). System of Innovation, Technologies, Institutions and Organizations. Pinter Publishers/Cassell Academic, London, UK.

13. Edquist, C. (2008). Identification of Policy Problems in System of Innovation through Diagnostic Analysis. Prime-Latin America Conference. Mexico: Prime.

14. Fairlie, Z. (2012). Economic Development Strategy: The Creative Capital Theory. Major Themes in Economics, Spring 2012.

15. Falvey, R., Foster, N., & Greenaway, D. (2004). Intellectual Property Rights and Economic Growth. Research Paper series: Internationalization of Economic Policy: The University of Nottingham, 12.

16. Fatah, F. A., Othman, N., & Abdullah, S. (2012). Economic Growth, Political Freedom and Human Development: China Indonesia and Malaysia. International Journal of Business and social Science, 3 No. 1.

17. Florida , R., Mellander, C., & Stolarick, K. (2008). Inside the Black Box of Regional Development: Human Capital, The Creative Class and Tolerance. Journal of Economic Geography, 8, no. 5, 615-649.

18. Florida, R. (2002). The Rise of the Creative Class. New York: Basic Books.

19. Florida, R., Mellander, C., & Stolarick, K. (2009). Talent, Technology and Tolerance in Canadian Regional Development.

20. Ghazal, R., & Zulkhirbri, M. (2015). Determinants of innovation outputs in developing countries: Evidence from panel data negative binomial approach. Journal of Economic Studies, 42, no.2, 237-260.

21. Ghulam Rasool Lakhan, S. A. (2015). The Economic Effects of Democracy in Pakistan: An Empirical Analysis. Inrernational Research Journal of Social Sciences, 4 (3), 14-18.

22. Gujarati, D. N., & Porter, D. C. (2009). Basic Econometrics Fifth Edition. McGraw-Hill/Irwin.

23. Hayek, F.A. (1960). Constitution of Liberty. The University of Chicago.

24. Index, G.I. (2016). Global innvoation index. Retrieved from https://www.Global innovationindex.org/home

25. Isham, J., Kaufmann, D., & Pritchett, L. H. (1997). Civil Liberties, Democarcy and the Performance of Governmnet Projects. The World Bank Economic Review, 11, no. 3, 219-242.

26. Janjua, P. Z., & Samad, G. (2007) Intellectual Property Rights and Economic Growth: The Middle Income Developing Countries. The Pakistan Development Review, 46: Part II , 711-722, Winter 2007.

27. Karasek, A. (2013). Human Capital, The Creative Class and Innovation in Polish Regions. Management, Knowledge and Learning International Conference. Zadar, Croatia.

28. KEA, E. C. (2009). The Impact of Culture on Creativity.

29. Khan, J., & Khattak, N. R. (2014). The Significance of Research and Development for Economic Growth: The Case of Pakistan. Munich Personal RePEe Archive.

30. Knutsen, C. H. (2015, August). Why Democracies Outgrow Autocracies in the Long Run: Civil Liberties, Information Flows and Technological Change. KYKLOS, 68 NO. 3, 357-384.

31. Koutsoyiannis., A. (2003). Modern Microeconomics: Secont edittion. Macmillan Education UK.

32. Lilach Sagiv, Sharon Arieli, Jacob Goldenberg & Ayalla Goldschmidt. (2009). Structure and freedom in creativity: The interplay between externaly imposed structure and cognitive style. Journal of Organizational Behaviour.

33. Martin, R., Florida, R., Pogue, M., & Mellander, C. (2015). Creativity, Clusters and Competitive Advantages of the Cities. Competitiveness Review, 25 NO. 5, 482-496.

34. Mayhew, M.J., Simonoff, J.S., Baumol, W. J., Wiesenfeld, B.M., & Klein, M.W. (2012). Eploring Innovative Entrepreneurship and its ties to Higher Educational Experiences. Research in Higher Education, 58, NO. 8, 831-859.

35. McFadden, D. (1978). Quantitative Methods for Analysing Travel Behaviour of Individuals: Some Recent Developments Online Available at https://eml.berkeley.edu/~mcfadden/iatbr00.html.

36. OECD. (2005). Oslo Manual: Guidlines For Collecting and Interpreting Inovation Data, third edition. OECD and EUROSTAT.

37. OECD. (2012). Innovation for Development. OECD.

38. Parzefall, Marjo-Riitta, Seeck, Hannele and Leppänen, Anneli. (2008). Employee Innovativeness in Organizations: A Review of the Antecedents. Finnish Journal of Business Economics, 2, 165-182.

39. Qazi Abdul Subhan, T. M. (2014). Innovation and Economic Development, A Case of Small and Medium Eterprise in Pakistan. Pakistan Economic and Social Review, 52, NO. 3 , 159-174.

40. Ridley, M. (2010). The Rational Optimist: How Prosperity Evolves. HarperCollins Publishers.

41. Sledzik, K. (2013). Schumptere's View on Innovation and Etrepreneurship. SSRN Ectronic Journal.

42. Sternberg, R. J. (2006). The Nature of Creativity. Creativity Research Journal, 18, NO. 1, 87-98.

43. Varsakelis, N. C. (2006). Education, political institutions and innovation activity: A cross-country empirical investigation. Research Policy, 35, 1083-1090.

44. Zemplinerova, A., & Hromadkova, E. (2012). Determinants of Firm's Innovation. Prague Eocomic papers, 4.

45. Zouhaier, H., & karim, K. M. (2012). Democracy Investment and Economic Growth. International Journal of Economics and Financial Issues, 2, no.3, 233-240.

Data Sources

1. Patent and trademark applications of residents of Pakistan, Source: http://www.worldbank.org/

2. Political rights index and Civil liberties index. Source: https://freedomhouse.org/

3. Creative class, Source: Labor Force Surveys (http://www.pbs.gov.pk/)

4. Government Expenditures on Education (% GDP), Source: http://data.uis.unesco.org/Index.aspx

5. Foreign Direct investment, Source: http://unctadstat.unctad.org/EN/Index.html

6. Enrollment, Source: Pakistan 50 years of Statistics (various Volumes).