

Effect of FDI, R & D, and High-Tech Exports on Real Gross Domestic Product (GDP) of Pakistan and Canada over the Period of 1982-2011

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Abstract

Innovation is coming from new Knowledge, and new Technology. The author select these two countries because Canada has a very strong innovative economy, while Pakistan is not so strong. The study concludes that foreign direct investment, R&D, and High-tech exports have a positive impact on economic growth, and the results show a significant positive impact on GDP, in the case of Canada. While in Pakistan this influence is not significant due to some internal problems that Pakistan faces like a low rate of domestic investment, political instability, less investment in higher education. Therefore, the comparison can be useful in adapting Canada's innovation policy for Pakistan.

Keywords: Real GDP, FDI, R&D, High-Tech Exports, Innovation, Pakistan, Canada.

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Introduction

Innovation is the generation and application of new knowledge and technology in order to solve practical problem (i.e. improve productivity, create employment opportunity etc.). Innovation exists when there is generation of new knowledge and there is no innovation without new knowledge. Furthermore, technology in its purist form is knowledge. R&D, FDI, IPR, High-Tech. export etc. are the indicators of innovation.

The innovations may have positive, Negative as well as no impact on economic growth. If a country growth rate is high it doesn't mean it is just due to innovation. Even in micro level, in most of the cases innovation have no positive impact on growth rate because of the deficiency of good marketing, distribution and business networks and mismatch of the socio economic and institutional conditions According to Grossman and Helpman (1991) Most of the studies provide a positive relationship between innovation and economic growth. According to his views, innovation capacity and potential is a key factor behind differences in economic performance and wealth of different countries. Some economist like Rodriguez-pose and Crescenzi (2008) argued to look at the effect of innovation on economic growth, the social and institutional condition of an economy should be considered. Their study proved regional innovation capacity is the result of interaction between research, socio economic and institutional conditions. Wei and Liu (2006) studied the impact of innovation on economic growth in china and dyconcluded that there is a positive relationship between the two. Wu (2006, 2009) Empirical study also showed that there is a direct relationship between innovation and Economics growth. Kuo and Yong (2008) used cross-regional data and got significant results. Torun and Cicekci (2007) studied the impact of innovation on economic growth for Turkey, South korea, and Ireland and concluded that Innovation is a key contributor to economic growth for the countries. Wu (2010) measured innovation by patent statistics and studied both innovation, growth model and their link. The study used 31 Chinese regions for the period 1998-2007 and concluded that innovation has positive impact on economic growth of the country while R & D intensity has a positive impact on regional innovation. Heshmati and Löf (2006) used 931 Swedish firms but find no significant impact of R & D expenditure on firm growth. Kirchoff et al. (2002) also find no significant result regarding increased expenditures on R & D of Universities on economic growth for the region .Oliveira and Fortunato (2005) showed that physical investment has more important in increasing growth than R & D investment. Bottazzi et al. (2001) concluded that sales growth of Pharmaceutical firms is not determined by innovations. Almus and Nerlinger (1999) find that firm growth is influenced by its size and age and not by the innovative activities of firm. Folkeringa et al., (2004) find negative impact of innovation on firm growth due to the inability of firms to cover its innovation cost by increased sales and profit. Coad and Rao's (2006, 2007) find positive impact of innovative activities(R & D and Patents) only for fastest growing firms but negative impact for other firms as their costs of innovation were higher as compare to profit. Teece (1986) argued that there is not a solid reason on the basis of which we assume innovation will lead to higher revenue, market share and growth. He gives examples of many firms whose innovation were very important and also first to the market but still they could not able to maintain market share due to lack of "Complementary" assets like marketing, distribution and business networks.

In the present study, we will find the impact of FDI, R&D and high-tech. exports on Gross Domestic Product (GDP) of Pakistan (From South Asian Developing countries) and Canada (From North American Developed Country). The logic behind the selection of these two countries is that Canada has a very strong and innovative economy, while Pakistan is still on the pathway to development. Therefore, the comparison may be helpful in the adaptation of Canadian innovative policies for Pakistan.

To examine the impact of FDI, R&D, and high-tech exports on GDP growth, where FDI, R&D and high-tech exports are taken as independent variables, while GDP Growth as dependent variable, the study uses a time series data for the periods of 1982-2011.

Hypothesis of the study

H_0 : Innovation has a positive effect on economic growth.

H_1 : Innovation has a negative effect on economic growth.

Methodology

The study use country wise analysis and cross country comparison as methodology.

Data and variables

Data

The study will secondary data taken from:

1. World Bank site
2. Global Economy site
3. Different research papers/working papers

Variables

Real GDP growth rate (in %) as dependent variable, while FDI, R&D and high technological export as independent variables.

Data analysis and interpretation

The analysis is carrying out in two ways, i.e. country wise analysis & cross-country comparison

Country wise Analysis

Real GDP (in %), FDI, R&D (in % of GDP) and High-tech Exports (in % of Manufactured Exports) of Canada

Year	Economic growth: the rate of change of real GDP	FDI % of GDP	R&D % of GDP	High tech exports % of manufactured exports
1982	-2.86	0.03	...	
1983	2.72	0.6	...	
1984	5.81	1.37	...	
1985	4.78	0.38	...	
1986	2.42	0.77	...	
1987	4.25	1.93	...	
1988	4.97	1.22	...	10.79
1989	2.62	1.08	...	12.05
1990	0.19	1.3	...	13.76
1991	-2.09	0.48	...	15.91
1992	0.88	0.82	...	14.9
1993	2.34	0.84	...	13.94
1994	4.8	1.46	...	13.81
1995	2.81	1.58	...	14.99
1996	1.62	1.57	1.65	15.83
1997	4.23	1.81	1.66	15.55
1998	4.1	3.69	1.76	15.56
1999	5.53	3.75	1.80	14.95
2000	5.23	9.12	1.91	18.73
2001	1.78	3.87	2.09	16.65
2002	2.92	3.00	2.04	14.19
2003	1.88	0.83	2.04	13.73
2004	3.12	-0.07	2.07	12.09
2005	3.02	2.28	2.04	13.08
2006	2.82	4.72	2.00	13.34
2007	2.2	8.42	1.96	12.75
2008	0.69	4.14	1.86	13.6
2009	-2.77	1.78	1.92	16.26
2010	3.21	1.86	1.80	14.05
2011	2.53	2.35	...	13.43

(Source: Global Economy & World Bank)

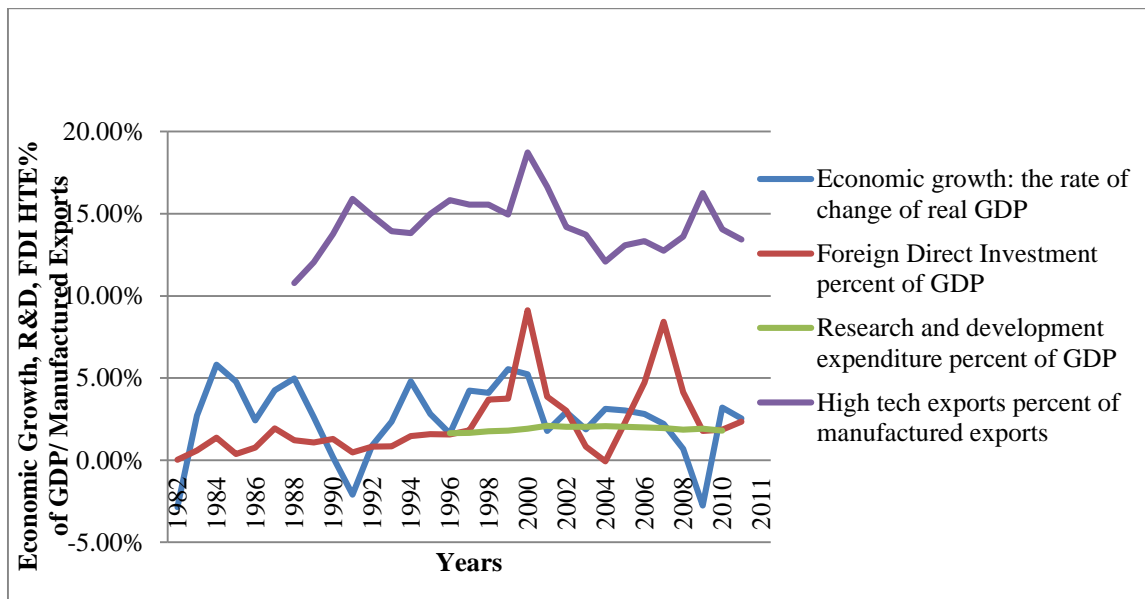


Figure 1 Impact of FDI, R&D and High-Tech Exports on GDP Of Canada

According to the above data & Graph, Canada, experience three recessions in its economy i.e. 1981-1982, 1990-1991, and finally 2008-2009 because of rise in world oil prices, saving & debt crises and financial crises respectively. During these recession periods the real GDP goes to negative numbers, but soon after every recession the economy attain its position.

FDI shows a mixed-trend in its values. According to the figure in 1982 when FDI is 0.03% the real GDP growth rate is negative -2.68, this negative GDP due to rise in the oil prices. The FDI shows Positive smooth growth in GDP until 1991; due to second recession, both FDI and GDP decreased. In 2000, FDI reached to its maximum level of 9.12% of GDP and real GDP goes to 5.23 present, while in 2004, FDI was seemed to reduce to -0.07.

The R&D investment in Canada shows smooth increase from 1996-2006. From 2004, onward R&D shows decreasing value but still shows a consistency in its values showing a positive impact on real GDP.

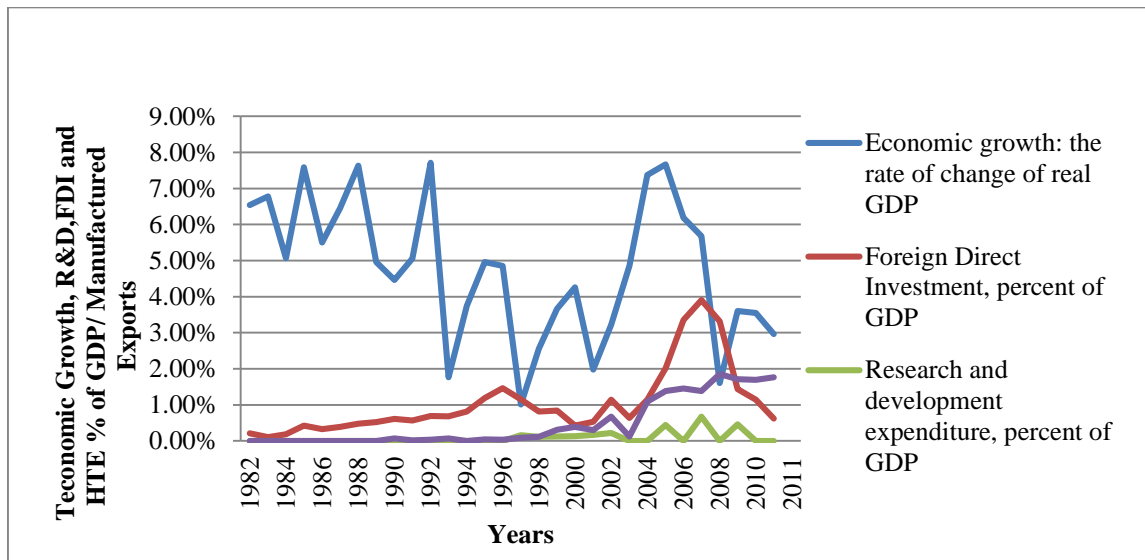
In high-tech, exports of Canada are strongly appreciable. Starting after the first recession of 1980-1981, Canada high-tech exports show an increasing trend, however soon due to second recession the percent of export decrease. In 2000, this percentage reached to its peak with 18.73%. After 2000 onward, data shows a mixed-trend in its values, but seems good to start recovery after every recession, showing a positive impact on GDP.

Table: 2 Real GDP (in %), FDI, R&D (in % of GDP) and High-tech Exports (in % of Manufactured Exports) of Pakistan

year	Economic growth: the rate of change of real GDP	Foreign Direct Investment, percent of GDP	Research and development expenditure, percent of GDP	High technology exports
1982	6.54	0.21	...	...
1983	6.78	0.1	...	...
1984	5.07	0.18	...	...
1985	7.59	0.42	...	...
1986	5.5	0.33	...	...
1987	6.45	0.39	...	...
1988	7.63	0.48	...	...
1989	4.96	0.52	...	...
1990	4.46	0.61	...	0.07
1991	5.06	0.57	...	0.02
1992	7.71	0.69	...	0.03
1993	1.76	0.68	...	0.07
1994	3.74	0.81	...	...
1995	4.96	1.19	...	0.04
1996	4.85	1.46	...	0.03
1997	1.01	1.15	0.16	0.09
1998	2.55	0.81	0.11	0.11
1999	3.66	0.84	0.12	0.31
2000	4.26	0.42	0.13	0.39
2001	1.98	0.53	0.17	0.30
2002	3.22	1.14	0.22	0.67
2003	4.85	0.64	...	0.12
2004	7.37	1.14	...	1.09
2005	7.67	2.01	0.44	1.38
2006	6.18	3.35	...	1.45
2007	5.68	3.9	0.67	1.38
2008	1.6	3.32	...	1.85
2009	3.6	1.44	0.46	1.71
2010	3.55	1.14	...	1.69
2011	2.96	0.62	...	1.76

(Source: Global Economy & World Bank)

Countrywise comparison of FDI, R&D and HTE on Growth in Pakistan



According to table and figure 3.2 Pakistan's real GDP growth shows increase stating from 6.54% in 1982 and reach to 7.59% in 1985. After 1985, Pakistan real GDP decrease to 4.46 but soon after economy shows an increasing trend and the GDP reached to its maximum level of 7.71 % in 1992. In 1998 after becoming seventh atomic country, due to large financial constraints from developed nations, GDP of Pakistan reached to its lowest level of 1.01%. The data shows that soon Pakistan re-attain its previous high position in 2004 and 2005, when FDI and R&D reached to its high position and consequently affect GDP to reach to 7.65%.

FDI has a great positive impact on developed country, however in case of developing countries its impact on growth is not much appreciable due to low domestic investment. In case of Pakistan, low FDI lead to slow increase in GDP. This increase in FDI continue up to 1998 but after restriction imposed from developed country side and government instability, the % of FDI again reached to the level of 1989 FDI. After Musharraf taking over the government and due to some flexible policies for foreign investors, the FDI reach to its maximum level of 3.9% in 2007. After attaining the maximum position of 3.9 % in 2007, Pakistan again faces a decrease in FDI stock merely 1.44% in 2009 and 2010 decreased to 1.14 % and 0.62 % in 2011. This decrease was mainly due to political instability, war against terrorism and corruption (Rehman U.R. 2013 Determents of FDI).

Pakistan has limited R&D base and innovation capabilities. According to the above diagram the R&D in Pakistan, get developed in period of Musharraf when investment in higher education is increased. The percentage of R&D in Pakistan reached to its maximum level of 0.67 % in 2007 showing positive impact on growth of the economy. However, this percentage is still very low in comparison to the other countries. The low levels of patents in Pakistan indicate a limited level of R&D taking in Pakistan due to lack of development of its innovation capabilities (Khattak & Baseer, 2012).

Pakistan has an agricultural based economy and export mostly agricultural raw material. However, Pakistan also exports high-tech commodities. The percentage of high-tech export in Pakistan is very low but showing a continuous and consistent increase up to 1.85 % of maximum in 2008. The table and figure show that high-tech exports have a positive impact on growth of the economy.

Cross Country Comparison

In the subsequent sections, data has been selected for cross-country comparison to analyze and interpret the results for both countries according to each indicator.

Table 3 Real GDP (in %) of Pakistan & Canada

Year	Economic growth: the rate of change of real GDP of Canada	Economic growth: the rate of change of real GDP of Pakistan
1982	-2.86	6.54
1983	2.72	6.78
1984	5.81	5.07
1985	4.78	7.59
1986	2.42	5.5
1987	4.25	6.45
1988	4.97	7.63
1989	2.62	4.96
1990	0.19	4.46
1991	-2.09	5.06
1992	0.88	7.71
1993	2.34	1.76
1994	4.8	3.74
1995	2.81	4.96
1996	1.62	4.85
1997	4.23	1.01
1998	4.1	2.55
1999	5.53	3.66
2000	5.23	4.26
2001	1.78	1.98
2002	2.92	3.22
2003	1.88	4.85
2004	3.12	7.37
2005	3.02	7.67
2006	2.82	6.18
2007	2.2	5.68
2008	0.69	1.6
2009	-2.77	3.6

2010	3.21	3.55
2011	2.53	2.96

Source: Global Economy & World Bank)

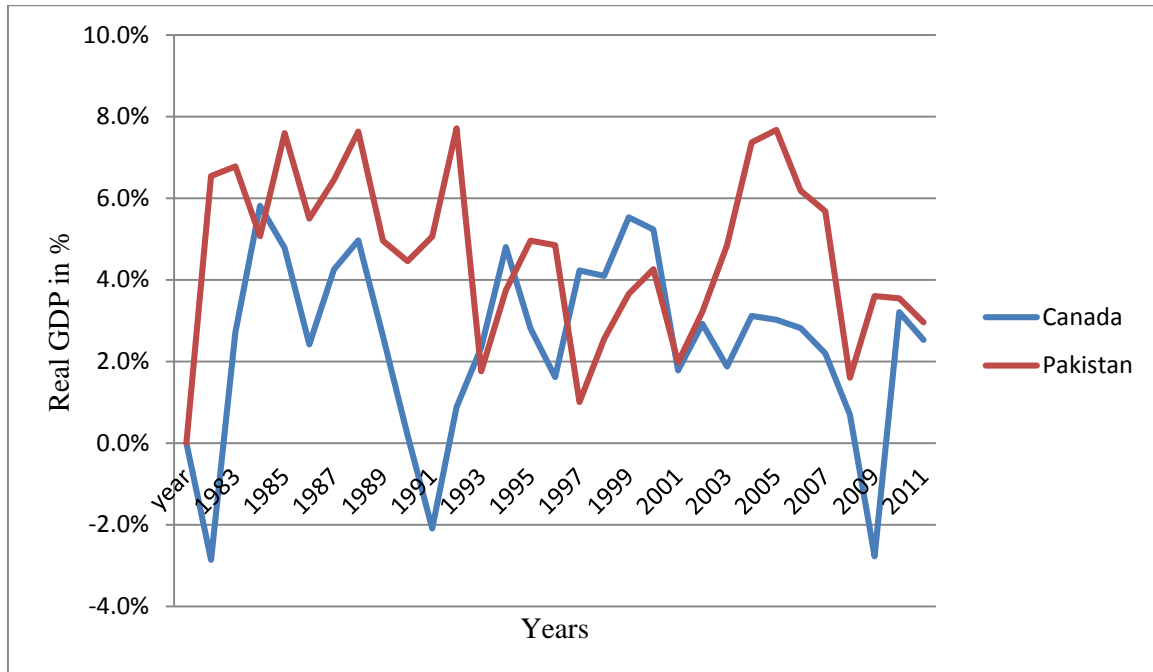


Figure: 3 Cross country comparison of real GDP in Pakistan & Canada

According to the above diagram, Canada from the very first year shows negative GDP because of recession in world due to oil prices. However, from onward till 1985 both country shows increase in its real GDP. In 1986 the GDP of both countries decrease. Soon both countries recover showing increase in real GDP, but again due to 2nd recession in Canada its GDP goes to negative figure, while in case of Pakistan the GDP rise continuously and reached to 7.71% of its maximum level in 1992. From 1992 onward both countries showed mix-trend in it real GDP growth, growth in real GDP of Pakistan is almost 40% more than that of Canada. The reason behind this is that Canada experienced three great recession due to which its growth rate is low than Pakistan. The GDP growth does not means that the economy of Pakistan is better than that of Canada, because there are so many other factors which determines the growth of an economy

Table 4 FDI (in %) of GDP of Pakistan and Canada

Year	Foreign Direct Investment percent of GDP of Canada	Foreign Direct Investment, percent of GDP of Pakistan
1982	0.03	0.21
1983	0.6	0.1
1984	1.37	0.18
1985	0.38	0.42
1986	0.77	0.33
1987	1.93	0.39
1988	1.22	0.48
1989	1.08	0.52
1990	1.3	0.61
1991	0.48	0.57
1992	0.82	0.69
1993	0.84	0.68
1994	1.46	0.81
1995	1.58	1.19
1996	1.57	1.46
1997	1.81	1.15
1998	3.69	0.81
1999	3.75	0.84
2000	9.12	0.42
2001	3.87	0.53
2002	3	1.14
2003	0.83	0.64
2004	-0.07	1.14
2005	2.28	2.01
2006	4.72	3.35
2007	8.42	3.9
2008	4.14	3.32
2009	1.78	1.44
2010	1.86	1.14
2011	2.35	0.62

(Source: Global Economy & World Bank)

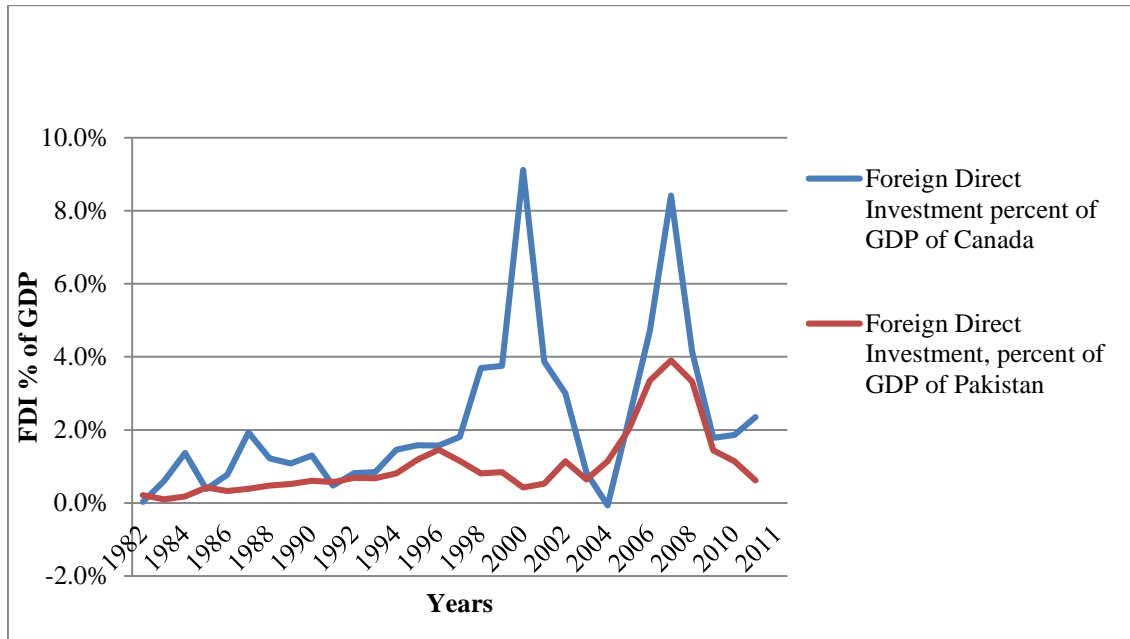


Figure: 4 Cross country comparison of FDI % of GDP in Pakistan and Canada

FDI is an important indicator of economic growth in the host country. In the above, diagram it is clear that from the start both countries experience the increasing inflow of FDI until 1991 when Canada face a recession. FDI inflow in Pakistan shows still an increasing trend but after 1998, the inflow of FDI decrease till 2001 and then followed by a mixed-trend values shown in figure & finally FDI reach to 3.9% of maximum level. The Canadian economy after starting recovery reached to 9.12 % of GDP of maximum level in 2004. In 2004 Canada face a negative inflow of FDI as - 0.07% of GDP but in the next year shows positive figures in FDI followed by mixed trend in FDI. Both the country shows a positive impact of FDI inflow on GDP Growth.

Table: 5 R&D (in %) of GDP of Pakistan and Canada

Year	Research and development expenditure percent of GDP of Canada	Research and development expenditure, percent of GDP of Pakistan
1982
1983
1984
1985
1986
1987
1988
1989
1990

1991	...	...
1992	...	...
1993	...	...
1994	...	...
1995	...	...
1996	1.65	...
1997	1.66	0.16
1998	1.76	0.11
1999	1.8	0.12
2000	1.91	0.13
2001	2.09	0.17
2002	2.04	0.22
2003	2.04	...
2004	2.07	...
2005	2.04	0.44
2006	2.0	...
2007	1.96	0.67
2008	1.86	...
2009	1.92	0.46
2010	1.8	...
2011	...	...

(Source: Global Economy & World Bank)

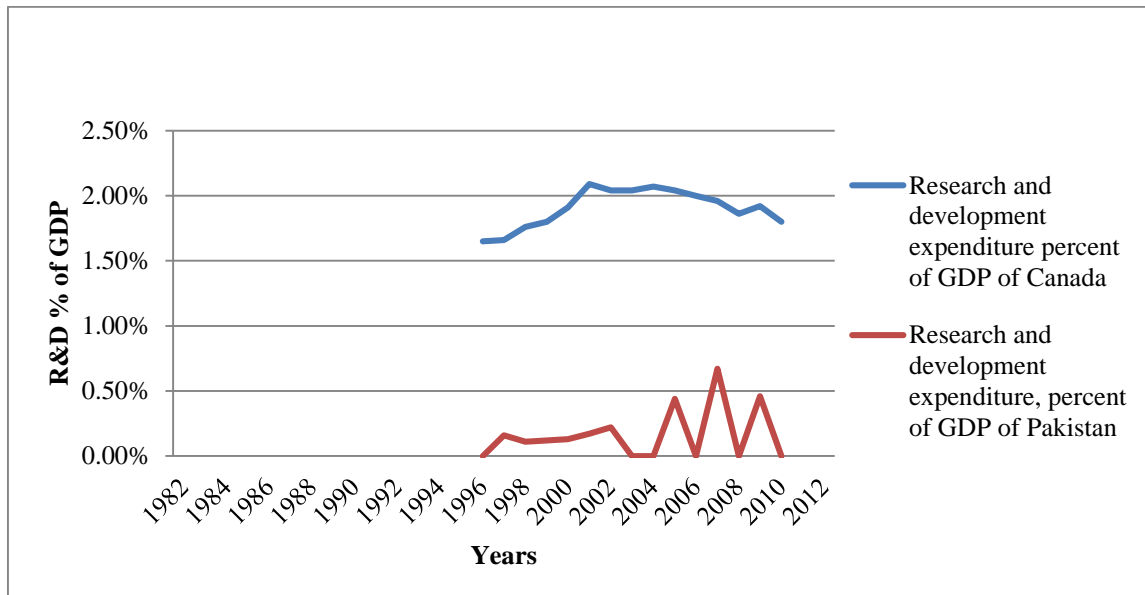


Figure 5 Cross country comparison of R&D % of GDP in Pakistan and Canada

According to the above table, the data of R&D in percent of GDP shows an increasing trend for both countries. For Canada, the R&D percent of GDP reached to 2.09% of

maximum level in 2001 and then followed by mixed trend in subsequent years. In Pakistan in 1998 R&D of GDP decrease to 0.11 % compare to 0.16% in the last year, however data shows a positive trend from 1999-2007 and reached to maximum level of 0.67%. The trend of data from 2007 onward shows decrease in R&D. From the above table it is clear that the percent of R&D of Canada is for the more than of percent of R&D in Pakistan, which provide a strong proof of the development of Canada and underdevelopment of Pakistan. Pakistan needs to invest more in research and development.

Table 6 High Tech Exports (in %) of Manufactured Exports of Pakistan and Canada

Year	High tech exports percent of manufactured exports of Canada	High technology exports % of Manufactured Exports of Pakistan
1982	...	...
1983	...	...
1984	...	...
1985	...	...
1986	...	...
1987	...	...
1988	10.79	...
1989	12.05	...
1990	13.76	0.07
1991	15.91	0.02
1992	14.9	0.03
1993	13.94	0.07
1994	13.81	...
1995	14.99	0.04
1996	15.83	0.03
1997	15.55	0.09
1998	15.56	0.11
1999	14.95	0.31
2000	18.73	0.39
2001	16.65	0.3
2002	14.19	0.67
2003	13.73	0.121
2004	12.09	1.09
2005	13.08	1.38
2006	13.34	1.45
2007	12.75	1.38
2008	13.6	1.85
2009	16.26	1.71
2010	14.05	1.69
2011	13.43	1.76

(Source: Global Economy & World Bank)

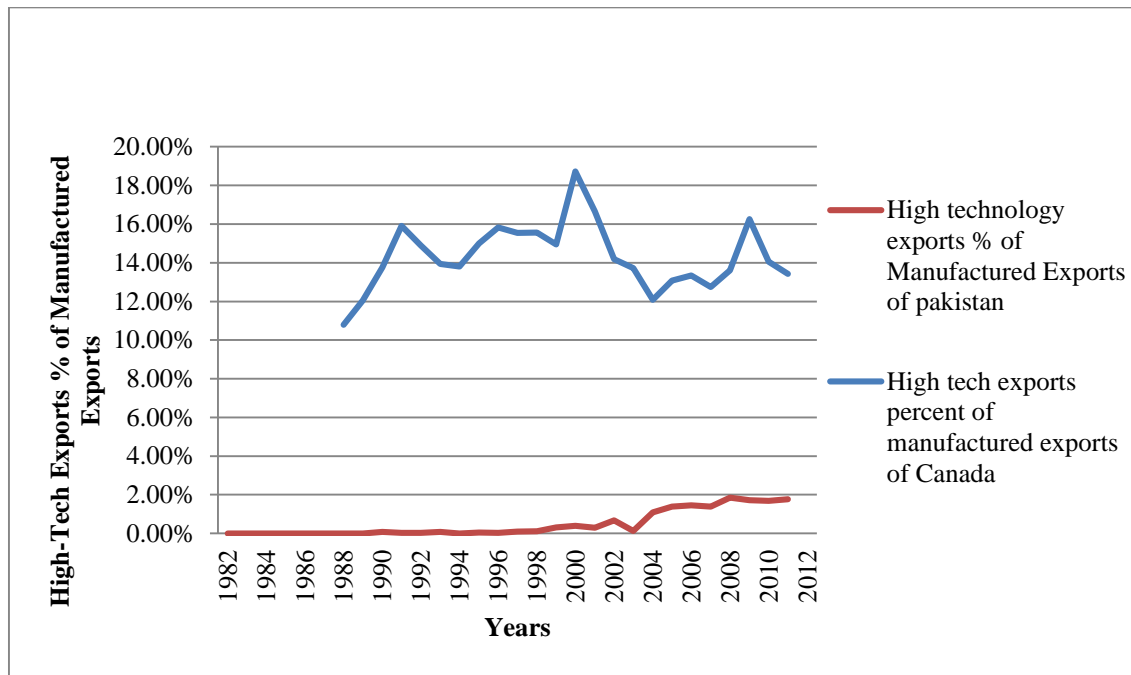


Figure 6 Cross country comparison R&D % of GDP in Pakistan and Canada

According to table and figure 3.10, the available data shows mixed-trend for both countries in high-tech export. For Canada, the export increase from 10.79% to 15.91%, from 1988 to 1991 respectively. From 1992-1994 the export shows decreasing trend, followed by the strong increase in export take it to 18.73% of highest level in 2000. In Pakistan in 1991, the export decreased to 0.02% compare to 0.07 % last year, followed by a mixed-trend in the subsequent years and reached to its maximum level of 1.85% in 2008 due to export promotion strategies. From the data, it is clear that Canada is strongly better than Pakistan in high-tech export. However, both show a positive impact on GDP.

Conclusion

In this study, we examine the impact of innovation on economic growth over the period of 1982-2011. The study is conducted for two countries, namely Pakistan and Canada using country wise analysis and cross-country comparison taking real GDP growth rate as dependent and FDI, R&D and high technological export as independent variables. The study conclude that the FDI, R&D and high-tech export has a positive impact on economic growth, especially in case of Canada the results shows significantly positive impact on GDP, while in Pakistan this impact is not significant because of some internal problems faced by Pakistan like low rat of domestic investment, political instabilities, less investment in higher education. However, the data shows that the real GDP of Pakistan is higher than that of Canada. The growth in only real GDP does not mean that Pakistan is more developed than Canada; rather there are some other factors also which significantly contribute in the development of a country like equal income distribution, gender equality, political stability, justice and the like.

Limitations of the study

There were many constraints we faced during the study, the most prominent of which was data availability. As the developing countries do not maintain their data updated, our indicators of interest are bound in data availability.

Policy implications

Based on the analysis & conclusion above, the researcher gives the following recommendations for the policy makers.

1- Development and adoption of such policy measures that create investment in friendly environment especially for foreign firms to accelerate economic growth in the country.

2- FDI should be included as an essential part in addition to export promotion strategy.

3- The policy makers should encourage improved domestic investment to accelerate growth rather than relying on Foreign Direct investment (FDI) only.

4- Strategy should be adopted to improve high-tech, export, rather than export raw and primary goods.

5- As Pakistan is populous country and have deprived educational system, therefore, fundamental attempt should be taken to attract FDI in this sector.

6- According to the study, Canada government should do more focus on FDI.

7- As in Pakistan, the major setback against FDI is political instability, so serious measures in the following area should be taken that will positively affect FDI.

8- It is imperative to overcome the energy crises like electricity and gas load shedding to eliminate the negative impact on an economic growth of Pakistan.

9- Finally, the government should provide appropriate funding of R&D performed in the public sector, especially in the higher education sector.

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