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FOREIGN DIRECT INVESTMENT IN PAKISTAN

Trends and Relationship with Technology Transfer

By **AYESHA SERFRAZ**

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AYESHA SERFRAZ



DEPARTMENT OF ECONOMICS
UNIVERSITY OF PUNJAB
LAHORE (PAKISTAN)

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A THESIS SUBMITTED TO
THE DEPARTMENT OF ECONOMICS
UNIVERSITY OF PUNJAB, LAHORE, IN PARTIAL
FULFILMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER OF PHILOSOPHY IN

ECONOMICS

By

AYESHA SERFRAZ



DEPARTMENT OF ECONOMICS
UNIVERSITY OF PUNJAB
LAHORE (PAKISTAN)

Abstract

This study is based upon examining an empirical relationship between Foreign Direct Investment (FDI) inflows and technology transfer in case of Pakistan. In addition, the study also highlights the trends of FDI inflows in various sectors. The model, which has been constructed uses time series data of 38 years starting from 1970 to 2008. All econometric tests have been applied using EVIEWS. The empirical findings indicate a strong positive relationship between FDI inflows and technology transfer. Moreover, it also leads to domestic innovation and R&D projects in the long run.

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AYESHA SERFRAZ

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Chapter 1

INTRODUCTION

Foreign direct investment (FDI) is the movement of capital across national frontiers in a manner that grants the investor control over the acquired asset. Thus it is distinct from portfolio investment which may cross borders, but does not offer such control. Firms which source FDI are known as 'multinational enterprises' (MNEs). In this case control is defined as owning 10% or greater of the ordinary shares of an incorporated firm, having 10% or more of the voting power for an unincorporated firm or development of a Greenfield branch plant that is a permanent establishment of the originating firm.

In the years after the Second World War global FDI was dominated by the United States, as much of the world recovered from the destruction wrought by the conflict. The U.S. accounted for around three-quarters of new FDI (including reinvested profits) between 1945 and 1960. Since that time FDI has spread to become a truly global phenomenon, no longer the exclusive preserve of OECD countries. FDI has grown in importance in the global economy with FDI stocks now constituting over 20% of global GDP.

There has been much debate on the importance of foreign direct investment (FDI) inflows for both developing and developed countries. Developing countries are faced with a shortage of capital and are in dire need of capital for the purpose of their development. On the other hand, investors in the developed countries find it profitable to invest their capital in developing countries. Therefore, there is a mutual benefit in the international capital movement. This type of process of integration and globalization has led to a fierce competition for inward FDI in developing countries. The extraordinary increase in FDI during the last two decades has affected the conventional relationships around the globe. In 2009, the increase in world FDI has almost surpassed \$ 5 trillion, (Pakistan economic survey 2008-09). According to analysts, the main reasons behind this trend are the awareness regarding benefits of FDI inflows at global level.

These factors have altered the destinations of FDI flows from technologically developed countries to developing countries having high expansion in growth rates. FDI reserves held by developing countries have observed a surprising increase in FDI inflows during the last two decades, which has lead to an increase in yearly growth rate of economies.

Conceptually foreign direct investment is international capital inflows in which a firm in one country creates or expands a subsidiary in another. It involves not only a transfer of resources but also the acquisition of control. That is, the subsidiary does not simply have a financial obligation to the parent company; it is part of the same organizational structure (Krugman and Obsfeld, 1997).

Therefore, FDI brings the most sought after necessary investment funds, highly developed manufacturing techniques, improved administrative skills, promotion and advertising proficiency, and universal associations.

BACKGROUND INFORMATION AND PURPOSE OF THE STUDY

This study aims at identifying the main trends of FDI in Pakistan. That is, which sector of Pakistan's economy is attracting the highest level of FDI and why? Moreover, its other objective is to find out whether an increase in FDI in Pakistan is marked with an increase in technology transfer or not? This has been tested by using time series data of Pakistan from 1970 to 2008 (Annual data).

FDI is very important from Pakistan's viewpoint, as large amounts of FDI are required to fill the resource gap. It is far and wide acknowledged that FDI produces economic benefits by providing capital, foreign exchange, technology, competition and provides attractive access to foreign markets. Moreover, given its delicate balance of payment position and vital need

heighten industrial production, Pakistan needs to extensively increase its resource mobilization. Unfortunately, in Pakistan, financial sector liberalization took a late start under the broader Structural Adjustment Programs (SAP) in early 1990s.

FDI consists of a package of technology, capital and market access, therefore Pakistan must concentrate on devising and implementing such policies, which could attract a heavy sum of FDI.

FDI inflows in Pakistan were not attractive in initial periods but with the passage of time FDI inflows kept on increasing. In 1980s the Government of Pakistan initiated market based liberalization programs, which were implemented in their best form in 1988. In 1990s further liberalization increased FDI towards different sectors of economy but in late 1990s, the political instability created a situation of uncertainty for foreign investors which led to a reduction in FDI.

ORGANIZATION OF THE STUDY

The study is organized into eight chapters. Chapters 2 and 3 present the historical trends of FDI inflows in Pakistan; which of the major sectors is getting the highest amount of FDI. It also studies the relationship between FDI inflows in Pakistan and the technology transfer. Chapter 2 provides an overview of FDI inflows in Pakistan during different decades along with the present scenario. Moreover, it highlights the trends of FDI inflows in major sectors of Pakistan's economy. Chapter 3 encompasses the study of relationship between FDI and technology transfer in the light of literature so far available on the subject and provides a proper conclusion after critically examining both the possible advantages and disadvantages for developing economies.

Econometric tools have been used to study the relationship between FDI inflows and technology transfer. This chapter also covers the hypotheses that

have been formulated, variables used along with their rationale and the tests to be applied to check the relevance of the formulated hypotheses. Chapter 5 explains the stationarity character of time series data by applying both econometric and graphical approaches.

Chapters 6 and 7 cover the cointegration between technology transfer which has taken place along with FDI inflows in Pakistan while Chapter 7 discusses the positive impact of technology transfer on local research and development resulting in innovations at domestic level. In both these chapters the cointegration between FDI and technology transfer and that leading to innovations etc. in Pakistan has been established by applying Johansen cointegration test and Vector error correction mechanism. Chapter 8, the last chapter, gives conclusion of the study.

Chapter 2

FDI INFLOWS DURING DIFFERENT DECADES

Before studying trends of FDI in Pakistan and the relationship between FDI and technology transfer, it is essential to review inflows of FDI during different decades and years. This not only enables to study ups and downs in economy but the reasons behind these fluctuations.

INITIAL SITUATION

Preference of foreign investors has always been towards those countries which assist them in terms of favorable policies for investment. The size of FDI inflows in Pakistan was not significant until 1991 due to unattractive environment for investment. When Pakistan came into being in 1947, it was faced with the fundamental issue of its survival. Initially, it took time to manage this problem and in 1950s, Pakistan started to concentrate upon the drivers of economic growth and how they can be introduced in the economy. Unfortunately, in 1950s Pakistan could not successfully tackle the problems that were giving rise to low growth.

In 1960s, when Ayub Khan took over, Pakistan experienced uneven but relatively high growth. But it could not successfully attract a high rate of FDI. The main reasons included weak education and scarcity of skilled labor. Moreover, in 1960s the distinct role of local sector in the provision of major services of banking, insurance, and commerce hindered the foreign investment in the country.

In early 1970s, Pakistan went for nationalization, which dispirited foreign investors. Also, the undue regulation of trade and commerce downcast

the foreign investors. But the nationalization program failed to provide most wanted results in terms of economic activity. Due to the breakdown of the nationalized organizations, the government softened its attitude towards foreign investment and steadily started allowing the foreign investment in the country.

In early 1980s, government gave more concentration to foreign investment and established Export Promotion Zones to smoothen the progress of the export oriented industries. At the end of 1980s, Pakistan tried to surmount the barriers which were restricting FDI, *e.g.* high public ownership, strict licensing and price controls by governments. This gave a free hand to the foreign investors and this kind of liberalization by the government resulted in high FDI inflows.

Therefore, initially Pakistan was not receiving a reasonable size of FDI may be due to Pakistan's own ignorance towards attracting foreign investment or may be other countries had some uncertainty factor as Pakistan was a newly born country with no proper industrial base and lack of required infrastructure and controversial industrial policies.

PRESENT SITUATION

In order to increase the level of foreign capital inflows, Pakistan has liberalized its trade and investment regime by relaxing governmental controls and offering a number of financial and trade incentives like tax concessions and tariff reductions. These steps resulted in increased FDI inflows into Pakistan from 1995-96 to 2005-06 at \$ 10.93 billion, making an average inflow of \$994 million annually. This was far below the required level of economy. However when Pakistan decided to become a nuclear power, it impelled many countries to impose economic sanctions that resulted in a sharp decline in FDI inflows.

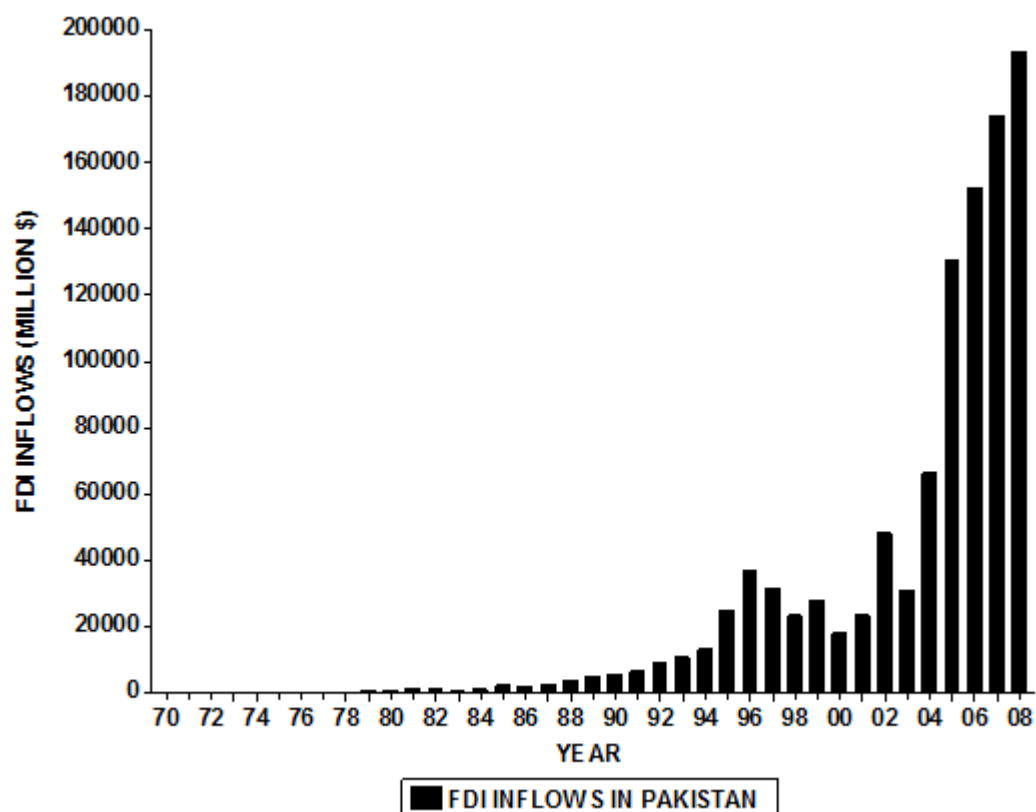
Over last one decade Pakistan has opened its economy through privatization and deregulation, which have increased foreign investor's

confidence in investing in Pakistan's economy. Also government of Pakistan is providing more facilities to foreign investors in the form of following steps:

- (i) There is freedom to bring, hold and take out foreign currency from Pakistan in any form.
- (ii) Government of Pakistan is providing Fiscal incentives to foreign investors in the form of tax exemptions, subsidies etc.
- (iii) Complete protection is provided to a foreign enterprise by the government.
- (iv) No foreign enterprise can be taken over by the government.
- (v) Foreign firms are acceptable to obtain a share of earned profit.
- (vi) Foreign and local investors are treated equally in terms of import and export of goods.

All the above-mentioned factors have led to an increase in FDI inflows towards different sectors of Pakistan. The pattern of FDI inflows over decades is reflected in Figure 1.

FIGURE 1
FDI Inflows over Decades



FDI INFLOWS TO MAJOR SECTORS OF ECONOMY — TRENDS

Going a step further in our analysis, we proceed to study the trends of FDI inflows to major sectors of Pakistan's economy, which are:

- (i) Agriculture
- (ii) Manufacturing
- (iii) Services

Sector wise distribution reflects two basic objectives behind investment being carried out. *Firstly*, it would reflect that which sector is being given more importance by the domestic government and *secondly*, it also reflects foreign investor's interest in a specific sector of the economy.

The sectoral study of the said three major sectors of Pakistan' economy with reference to receipt of FDI inflows reveals as under

Agriculture

Pakistan started off in 1947 as primarily an agricultural country, with eastern wing of the country producing hefty quantities of jute and jute-based products and western wing (especially Punjab and Sindh) producing great quantities of cotton and wheat.

In 1950s, the growth rate of agricultural sector was recorded as lowest, whereas the growth rates were highest during 1980s. This was chiefly due to the implementation of Structural Adjustment Programs (SAP) under the supervision of IMF. Moreover, two very important events took place in Pakistan's history; The Green Revolution and The Land Reforms. Green revolution took place in mid-1960s under the government of Ayub Khan. The technical package associated with it generated major changes in the economic, social and political structure of economy. Ironically, green revolution was implemented with the purpose of removing income disparities and increasing agriculture productivity, but at the same time it led to a further contribution in widening the income gap.

Although the major ingredients of green revolution including High Yield Variety Seeds (HYV), better quality pesticides and insecticides and technology were obtained through FDI inflows, but the poor management of government and biased ness towards big farmers made green revolution a failure, which extremely disappointed foreign investors. Other important

incidents that took place were the Land Reforms of 1959 and 1972, but even these reforms did not provide satisfactory results making foreign investors more cautious regarding investment in agriculture sector of Pakistan. Therefore, Pakistan's agricultural sector has never been of that much importance for foreign investors. Even after implementation of SAP, the situation did not improve. The growth rates were more or less same and FDI inflows also remained restrained because of political instability and lack of good governance, as it can be seen in Table 1.

TABLE 1

Performance of Agriculture Sector Before and After SAP

PRE-SAP PERIODS	(1959-1988)	AVERAGE ANNUAL GROWTH RATE = 4.6%
POST-SAP PERIODS	(1988-2005)	AVERAGE ANNUAL GROWTH RATE = 4.4%

Source: World Bank

In case of FDI inflows, agriculture sector has always been unlucky. Very meager amounts have always been allocated to agriculture sector. Even after implementation of SAP, FDI inflows in agriculture sector have not been satisfactory. It can be analyzed with the help of Figure 2.

FIGURE 2

FDI Inflows in Agriculture Sector of Pakistan (2001-2008) Million \$



Source: BOI, Pakistan

Presently Pakistan is facing insufficient inflow of FDI in agriculture. Many economists attribute this fall in FDI to terrorist activities and overall recession through which Pakistan's economy is passing.

Moreover, high food inflation also discouraged foreign investors to invest in agricultural sector. Besides regarding FDI inflows, agricultural sector of Pakistan was ignored both by the foreign investors and Government of Pakistan itself in the past, based on following main reasons:

- (i) Limited opportunities open for foreign exploitation in this sector.
- (ii) One of the most important reasons is the issue of child labor.

- (iii) Government has to choose between investments that lead to long-term benefits and short-term benefits. Therefore agriculture is mostly ignored.
- (iv) Agriculture sector is prey to uncertainties. That is, it depends on rain, weather conditions and other natural circumstances and any natural catastrophe can result in extreme losses.
- (v) Pakistan's government is involved in the process of development; this automatically results in biased ness in favour of other sectors at the cost of agriculture sector.

Hence, being agriculture based and a developing country, Pakistan should formulate such policies with respect to FDI that foreign investors find it profitable to invest in the agriculture sector; which is the main sector of economy and it employs the largest portion of population and it has the maximum potential of high growth rate if proper attention and investment is allocated towards this sector.

Manufacturing

After separation, the newly born state of Pakistan faced with the shortage of the human resources, institutions, and capital which could play a significant role in economic growth to top it all, Pakistan got involved in war with India in 1949. In order to overcome such difficult circumstances, the Pakistani officials started making efforts to lift the people out of misery and poverty and it was perceived that rapid industrialization would be the best alternative. But the first decade went through extreme political instability and rule by a tiny fraction of politicians and bureaucrats. Economic policies were by and large bent in a rough and ready mode, and commonly in shortest comeback to frequent problems.

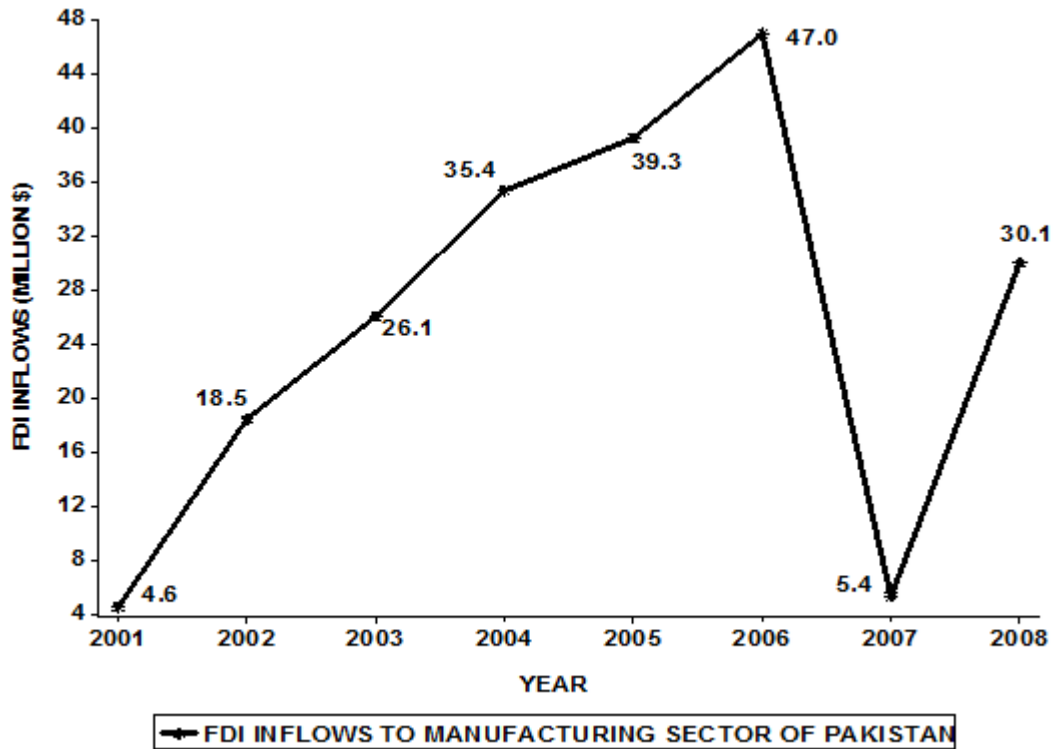
A more realistic economic policy framework emerged after the military's first direct take over in 1958. It was the first military government of Pakistan that was headed by Ayub Khan. His government took Reforms in both agriculture and manufacturing sectors. The reforms were mainly in the form of provision of subsidies and liberalization of economy. In 1960s, the country was considered a model for other developing countries. Rapid industrialization took place and foreigners found it profitable to invest in Pakistan's economy as they had been allowed 100 percent equity in all sectors. In addition to this, there was no distinction between foreign and domestic investment and foreign investors were also allowed to send home the profits earned on their investment. All these progressive steps encouraged FDI inflows in country and manufacturing sector kept on flourishing. However, rapid expansion of economy could not alleviate wide spread poverty, on the contrary it led to more unequal income distribution which resulted in regional disparity. As a result, in 1971, East Pakistan got separated and Pakistan, again experienced low growth rates in all sectors of economy.

In 1972, Zulfikar Ali Bhutto came to power as an elected representative. He nationalized several major industries. The nationalization of industries exerted bad impact on the development process of the economy and it discouraged FDI inflows. Later, in July 1977, Gen. Zia ul Haq denationalized much of industrial units which were nationalized by the Bhutto government. But comparatively 1970s was not a good decade for Pakistan and the economy went into recession.

In present decade, manufacturing sector is experiencing unevenness in FDI inflows are shown in Figure 3.

FIGURE 3

FDI Inflows to Manufacturing Sector of Pakistan (2001-2008) Million \$



Source: BOI, Pakistan

In late 1980s, structural adjustment programs (SAP) were introduced by IMF and World Bank. The main rationale behind implementation of SAP was that the developing countries ought to trade and exchange goods and build up their own sectors of export promotion and import substitution.

Pakistan launched SAP in 1988 under the tutelage of IMF and World Bank. According to Liberalization and SAPs – Unit 21, the thirteen years of military rule had ruined the economy. Whereas, the democratic regime was confronted with low GDP growth rates, high external debts, low exports, low industrial production and deteriorating forex reserves.

Taken as a whole economic state was awfully horrific and the democratic government had no alternative other than to approach IMF and World Bank for financial assistance. The industrial reforms implemented under SAP were based on exclusion of protection to industrial sector and price controls over goods, but the results were not according to the expectations. The increase in FDI inflows had become very temperate, signifying that foreign investors did not get attracted by the liberalization programs. This proves that simply opening up of the economy is not sufficient for attracting higher sums of FDI; a proficient infrastructure in addition to social and political stability is also vital. Unfortunately Pakistan is deficient on this front.

In 2000, the government made many noteworthy macroeconomic reforms:

- (i) Privatizing Pakistan's state owned enterprises
- (ii) Reforming the banking sector
- (iii) Giving attention towards increasing forex reserve
- (iv) Scrutiny of piracy of intellectual property
- (v) Assurance to fighting terror

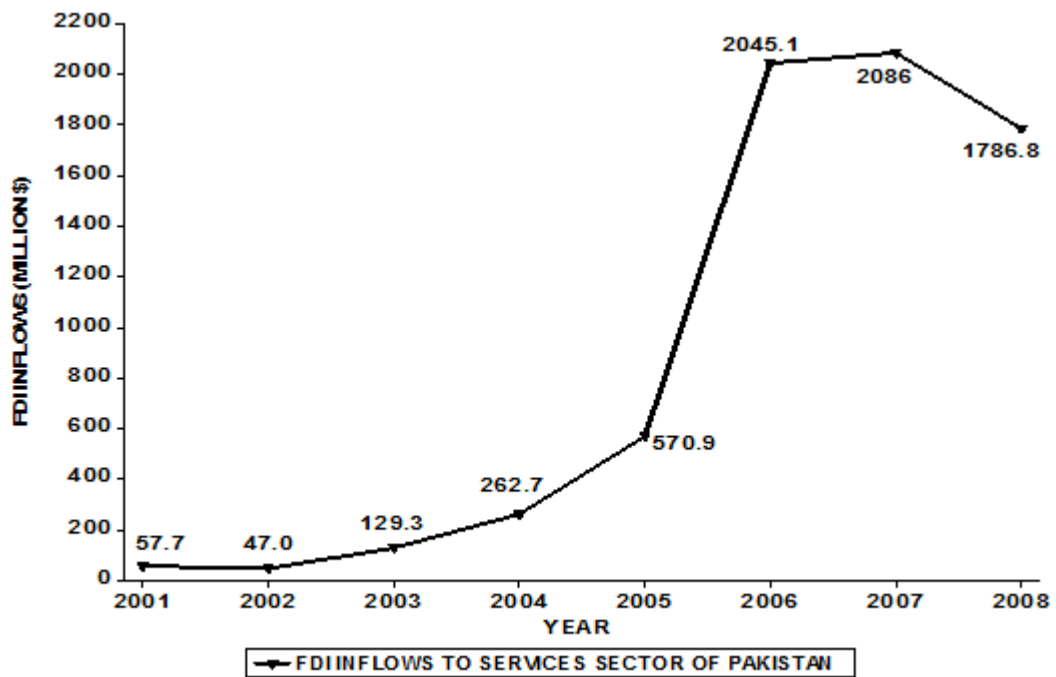
As a result of these measures, many sanctions predominantly forced by US were lifted. Pakistan's economic scenario began to enlarge appreciably owing to extraordinary inflows of FDI at the end of 2001 and the same trend continued till 2009. This trend is anticipated to prolong through a long period of time, which might result in Pakistan entering the list of industrially, developed countries.

Services

In the recent years this sector, particularly construction, communications, telecommunications and financial business witnessed unprecedented growth due to heavy inflow of FDI which placed Pakistan as third (the first two being India and china) fastest growing economy, with an annual growth rate of 6%. This can be seen with the help of Figure 4.

FIGURE 4

FDI Inflows to Services Sector of Pakistan (2001-2008) Million \$



Source: BOI, Pakistan

According to Economic Survey of Pakistan (2007-08), the services sector has surpassed the growth target of 7.1 percent and grew by 8.2 percent in 2007-08 as against the actual achievement of 7.6 percent last year. And this growth rate is due to high share of this sector in net FDI flows. In particular, liberalization and privatization policies assisted the finance, and communication sub-sectors got hold of foremost fraction of the mounting FDI

inflows in the country. State bank of Pakistan estimated that the share of FDI in services sector has exceeded than in non-service sectors consistently for the last three years. As a result services sector has become the most important sector of economy and government is paying special attention towards its expansion.

After having a brief overview of each sector individually, it can be easily concluded that the pattern and trend of FDI inflows in Pakistan have undergone a visible and explicit change.

Initially the main sector of economy was agriculture in terms of its contribution to GDP and provision of employment opportunities. Now this sector contributes only 22% in GDP but still it is the largest sector in terms of employment opportunities. Unfortunately, agriculture has never been an attractive sector for foreign investors, although depending on this sector many agro-based industries have been established, but there is negligible direct inflow of FDI in agriculture sector. Rather agro-based industries which include fertilizer industry, sugar industry and the primary industry of Pakistan; the textile industry attracted a huge amount of FDI inflows. Therefore depending on agriculture sector, Pakistan has now developed a proper industrial base and established an appropriate manufacturing sector, which has enabled Pakistan to be ranked as a third country, developing at a fast pace.

The manufacturing sector includes food, beverages, tobacco, textiles, sugar, paper and pulp, leather and rubber products, chemical and petrochemicals, mining and quarrying, oil and gas explorations, pharmaceuticals, cement. All these sub sectors are attracting a huge sum of FDI.

At present, Pakistan is self-sufficient in food and has a reasonably well manufacturing sector which contributes a handsome amount to GDP but the most important feature of Pakistan's economy is that it has developed services sector which makes a notable contribution towards GDP. Services sector

includes wholesale and retail trade, transport, storage and communication, finance and insurance, public administration and defense services, community, social and personal services.

After liberalization and privatization, this sector has become the centre of attraction for foreign investors. Pakistan's economic managers and policy makers have also realized the importance of the growing services sector in the country. It is the most important sector of Pakistan's economy because it attracts a very high sum of FDI; it stimulates employment, adds most to the GDP and is an important driver of economic growth. The sector wise FDI inflows are shown in Table 2.

TABLE 2

Group Wise Net Inflows of Foreign Direct Investment (\$ Million)

FDI Inflows by Economic Group (Jul-February)	2007-08	2008-09	% Change
Textiles	20.5	27.6	34.7
Chemicals & Petro-Chemicals	67.5	63.6	-5.8
Petroleum Refining	56.1	74.0	31.9
Oil & Gas Explorations	418.2	483.1	15.5
Cement	86.0	30.9	-64.1
Transport Equipment (Automobiles)	67.0	58.5	-12.7
Power	39.3	79.8	103.4
Trade	123.9	121.5	-2.0
Communications	828.1	790.7	-4.5
Financial Business	714.8	647.2	-9.5
Personal Services	68.0	63.2	-7.1
Others	299.7	354.3	18.2
All Groups	2789.1	2794.4	0.2

Source: External Sector of Pakistan, Ministry of Finance.

Chapter 3

FOREIGN DIRECT INVESTMENT AND TECHNOLOGY TRANSFER

The Relationship

Most analysts have the same opinion that FDI, like other private flows, encourages technological advancement, because Investors bring innovative apparatus and expertise, initiate more efficient techniques of production, promotes technological spread out to nationwide businesses in the course of replication, employment revenue, and the supply of superior quality of inputs for production.

It has been observed that an increase in FDI does not always produce an instantaneous boost in technology flows to the recipient country as the relationship between FDI and technology transfer is multifaceted, because of the gap between the actual investment and the payments for the technology. In developing countries, fee payments for developed technology generally reach their climax only three to four years after the initial investment has taken place.

According to many economists, FDI is less probable to go to countries that have undersized potential markets, comprise a small number of trained or well educated workers, have a dilemma of widespread corruption or are defenseless to social and civil disturbance, or contain very narrow reserves of natural resources of money-making concern. Numerous of these factors pertain to the poorest developing countries making it complicated for them to be a focus for private investment.

A survey of foreign investment trends conducted by United Nations Conference on Trade and Development (UNCTAD) proposes that the unending

globalization of world economy will continue which will lead to further mergers, joint ventures and other equity and non -equity types of inter-company agreements as FDI keeps on increasing. Business reformation in developed countries, intended at improving competence and advancement, is expected to continue, giving rise to efficiency-seeking investment.

REVIEW OF LITERATURE

The probable task that foreign investment could play in supporting countries to accomplish the objective of augmented income, employment and output has been recognized at present, all across the world. More or less every country is occupied in autonomously liberalizing their foreign investment regimes with a vision to ease smooth flow of investment to their respective territories.

Regarding the impact of FDI inflows, its relation with technology transfer and impact on overall growth, economists have presented different views.

In addition to the direct capital financing supplies, FDI can be a source of valuable technology and know-how while fostering linkages with local firms, which can help jumpstart an economy. Based on these arguments, industrialized and developing countries have offered incentives to encourage foreign direct investments in their economies (Alfaro, 2003).

Recent international strategy research has shown that in the context of FDI, multinational companies often send expatriates to their overseas operations to transfer knowledge, contributing to FDI performance (Lyles and Salk, 1996).

Whereas Rodel (2008) is of the view that technology transfer and knowledge spillovers often can be expected from FDI in developing countries.

Spillovers are indirect effects of FDI, and can be defined as circumstances where FDI improves the technology or productivity of domestic firms. Spillover effects can have both vertical and horizontal impacts on host economies. Vertical spillovers refer to inter-industry impacts. Whereas horizontal spillovers are those benefits to local enterprises at an intra-industrial level.

The empirical economic literature is progressively leading towards holding the view that international trade and FDI provide means by which technologies can be spread internationally (Acharya and Keller, 2007) and show how the extent of international technology transfer activities can explain cross-country differences in per capita incomes.

Foreign direct investment added considerably to the transfer of new technologies and thus to the modernization and reorientation of the organization of the economies. The main mass of technology transfer took place either through foreign direct investments (FDI) mainly through multinationals (MNCs) or through technological agreements (for instance, licensing and joint ventures). Mergers and acquisitions have played a major role in this direction. Acquisitions have been used by foreign and domestic firms as a tool for strengthening their position in domestic or international markets (Korres and Iosifides, 2002).

Subbarao (2008) writes that technology is an important ingredient of the development mix and an important aspect of the international economic and the technological gap. While technological backwardness and a slow pace of technological progress generally characterize the developing countries, the advanced countries boast of rich stock of technology and fast technological progress.

Technology transfer is the term used to describe the processes by which technological knowledge moves within or between organizations. International technology transfer refers to the way in which this occurs between countries. Transfer of technology from the developed to the developing countries, there is a necessary measure to speed up the pace of the economic development and modernization process in the low developing countries (LDCs). Indeed, *transfer of technology to developing countries is a major area of concern in the discussions on the establishment of a New International Economic Order (NIEO). It is given so much importance that there is a talk of building a New International Technological Order (NITO) as an integral part of the NIEO.*

How does the level of FDI saturation speak about technology transfer, both directly (to the own affiliate) and indirectly (to the other firms in the local economy)?

Damijan, Majcen, Knell, Rojec (2002) using a large panel of data from eight economies, have a number of relevant findings. One of the most expected results is that FDI represents an important channel of technology transfer in the Czech Republic, Estonia, Poland, Romania and Slovenia.

In addition to positive views, many economists hold negative viewpoint. In a recent survey of the literature, Hanson (2001) argues that evidence that FDI generates positive spillovers for host countries is weak.

Whereas Voinea (2003) is of the view that new foreign technology is costly. To deal with FDI, domestic firms would have to acquire foreign technology, at the same time with restructuring their activities; and restructuring implies hard budget constraints. Given the high supplementary costs, and the lack of ample financial intermediation means (credit restrictions in economies with a recent history of high inflation), local companies simply cannot come up with the money to cover expenses, whereas foreign owned

companies get hold of financing either intra-firm, or from foreign capital markets, causing an income gap and widespread poverty.

Moreover, Rodrik (1999), in a summary of the evidence, comments, “today’s policy literature is filled with extravagant claims about positive spillovers from FDI, [but] the hard evidence is sobering.”

In addition to this, Multinational entry may also hurt local firms. First, foreign firms may hire talent away from local firms, thereby creating a “brain drain”. Second, foreign firms, which often pay higher wages, may raise wages for all firms in competitive labor markets (Aitken, Harrison and Lipsey 1996).

Advantages of FDI inflows for Developing Economies

To attain sustainable economic growth, one of the key concerns for developing countries is to acquire satisfactory foreign capital to escape from the vicious circle of low savings and low economic growth (Hayami and Godo, 2005).

Hymper as quoted in Parry (1997) affirms that foreign investment involves not only the simple transfer of capital but also technology and superior management. This thought is pursued up by Blomstrom and Kokko (1997) who make clear that the spillovers from FDI to host countries may occur through three channels: knowledge shifts with skilled labor, technology transfer, and effective resource allocation due to competition.

Based on above-mentioned ideas of economists, FDI is very important for developing economies:

1. Through foreign direct investment (FDI), recipient countries cannot merely attain essential capital, but in addition acquire technology, organization and advertising talents. For this reason,

several intellectuals and policy-makers focus on the impact of FDI on the productivity of domestic firms.

2. The technology transfer generates healthy competition between the locally manufactured products and the goods produced by the foreign firms which in turn forces the local manufactures to adopt new methodology, resulting not only in the improved quality and increased production of goods but also helps the consumers to have the goods at competitive lesser prices.
3. Foreign Direct Investment (FDI) in developing countries is one of the foremost outdoor foundations of financial support to fulfill resources gap. FDI is and can play a fundamental role in the economic growth of developing countries. FDI can add appreciably in the human resources development, capital formation, and managerial and administrative talents of the people in the country.
4. For a developing country, attracting an inflow of FDI strengthens the connection to world trade networks, provides benefits from the globalization advantages and finances its development path.
5. Typically, foreign firms encompass superior productivity than local ones, given that the foreign possession prompts managers to utilize foreign knowledge, foreign machinery and such foreign techniques lead to domestic innovation.

Disadvantages of FDI inflows for Developing Economies

According to Yousaf, Hussain and Ahmad (2008), the Negative impacts take place with competition over scanty resources and deficient talented manpower, due to deliberate intentions by the members of Multinational

Corporations (MNCs) or the high technological gap between local and foreign firms. There are also additional costs related with inflow of FDI such as restrictive business practices by foreign firms, profit repatriation and forgone tax in the case of tax holidays. The net welfare effects also differed by the nature of FDI motives behind internal transactions, and host countries government policies.

Moreover, Javorcik (2004) proves that in developing countries there is no evidence of spillovers from FDI into sectors, which supply intermediate inputs. He also indicates that domestic firms' productivity benefits are associated with joint ventures but not with fully owned foreign projects.

In addition to this, according to Voinea (2003) new technologies are more likely to be transferred through FDI when the foreign affiliate operates in a pro-competitive environment. When the environment is anti-competitive, like in the case of developing countries, there are perverse incentives to gain monopoly rents not through innovation, but through market power inducements.

All the above discussion leads to following disadvantages of FDI and technology transfer through it:

1. On a sub-national rank, FDI generally focuses on the most prosperous part of the country, where returns are expected to be higher. Besides the investors can come across an improved infrastructure for the use of better techniques of production and easier logistical ease of access from abroad. This leads to not only income disparities but also regional inequalities.
2. Most developing countries are labor abundant, whereas FDI brings new technology in country, which replaces labor and results in unemployment.

3. MNCs established in host countries not only implement their own techniques of production, but also take the earned profit back home and most inappropriate function of MNCs is that they strongly interfere in the working of the economy, affecting the tradition, law and culture of recipient country.
4. The most pinching factor regarding FDI inflows are the law introduced under Intellectual Property Rights (IPRs). Under this law, no country can imitate the Technology developed by innovating nation. Every country has to buy that technology, whereas developing countries do not possess enough capital or forex, due to which they are facing a serious problem regarding introduction of the new technology.
5. Debt crises are a striking result of FDI because the foreign firms take the profit away and introduce such a technology which is not suitable for developing countries which results in external aid, currency crises, bank crashes and political instability.

At the world level, attainment of new technology has become extremely important for developing countries as their development and growth rests on rapid industrialization, which in turn is dependent on new technology and foreign assistance. Supplies of technology transfer, are dependent on many important multilateral and bilateral agreements, such as the Agreement on Trade-Related Intellectual Property Rights (TRIPS or IPRs) of the World Trade Organization (WTO) and the United Nations Framework principle on regional conditions, as well as in regional and bilateral agreements. Technology transfer problems at this stage are inclined to be limited to explaining the set of laws of the fixture in which shifts occur, and setting up wide-ranging agreement to bear with technology transfer to developing countries. These kinds of accords are likely to be articulated in negotiations of international agreements, instead of

dealing with their individual concerns, or else with particulars in relation to the transfer of technology to various domestic industries.

Guidelines taken up by developed countries for motivating the movement of technologies to developing countries are in addition becoming more and more appropriate. This is due to the international policies on trade and environmental matters, which frequently entail such countries to provide inducements for the transfer of technologies to developing countries. Moreover, as pointed out above, technology transfer is a major goal of numerous official development assistance or aid policies.

In this framework, quite a few developed countries furnish motivations in favour of their companies and organizations to transfer technologies to developing countries. Such incentives comprise investing and instruction, plus entering partnerships between companies and organizations in developing countries, and possible sources of technologies. Nonetheless, there is an unending debate on the subject of the success of current procedures. Several analysts pointed out that on the one hand motivations are discriminatory and while on the other, these have hidden conditionalities though on the face of it such programs are centrally associated with technology transfers.

In the context of the policies of developing countries themselves, it is far and wide acknowledged that their rationale ought to be to make the most of the gains from technology transfer while avoiding to the maximum hidden unfavorable conditionalities. Nonetheless, the latest international policy on trade; such as those adopted by the WTO, emerges to be unsure in this regard.

Chapter 4

ECONOMETRIC MODEL BUILDING

In this chapter, econometric model has been constructed to examine the relation between FDI inflows in Pakistan and technology transfer.

The model, which has been, constructed uses time series data of 38 years starting from 1970 to 2008. Data has been collected from various publications and versions of World Bank and Pakistan Economic survey respectively.

FORMULATION OF HYPOTHESES

The importance of FDI inflows for Pakistan has been explained in much detail in previous chapters. It has also been discussed that foreign direct investment also brings technology into the country. This discussion leads to development of the first hypothesis:

H₁ FDI stimulates technology transfer and technology intensive goods.

On the other hand, it has also been discussed in the literature review that the foreign technology transfer also leads to domestic innovation and most of the economists have consensus in this regard. But is this the case in Pakistan? To check this, another hypothesis is formulated as:

H₂ FDI can directly stimulate local innovation and increases local R&D.

VARIABLES TO BE USED AND RATIONALE

It is necessary to specify the variables, which have been used, and the rationale behind using these variables. These variables include:

1. Foreign direct investment
2. Technology measure
3. Per capita GDP
4. Civil liberty index (CL)
5. Property rights index (PR)
6. Innovation measure

The model can be expressed in the form of equation as

$$FDI = f(\text{technology, per capita GDP, CL, PR, innovation})^1$$

The measure of technology transfer considered is merchandise imports because a rise in merchandise imports is associated with new technological products, therefore an increase in technology-intensive imports lead to high inflow of high-tech products, like pharmaceutical goods, chemicals, aerospace, computer services, information, and office and telecommunication equipment (Park and Lippoldt, 2008).

To ensure that the empirical analysis picks up the relationship between FDI and technology transfer, it is necessary to control variables that may also influence technology transfer. The control variables include property rights (PR) in general, per capita GDP and civil liberty (CL): PR and CL are in the form of an index. Whereas, capital formation (CF) in Pakistan has been taken as a measure of innovation.

¹ Data source of each variable has been mentioned in the Annex.

MODEL SPECIFICATION

Using above variables and hypotheses, following model can be specified:

For Hypothesis 1

Technology transfer = $f(\text{FDI, control variables})$

For Hypothesis 2

Innovation = $f(\text{FDI, technology transfer, control variables})$

TESTS TO BE APPLIED

Time series data is furnished with the problem of non-stationarity i.e. it does not converge to a central or mean value. If OLS regression is applied to time series data without making it stationary, the results would have the problem of spurious regression i.e. the estimates are not reliable. To remove this problem, data is made stationary by taking differences. Moreover, time-series data characteristically contains a trend, which must be removed before undertaking any estimation. The traditional detrending procedure separates the trend from the cyclical component of the series. This procedure is appropriate for trend stationary (TS) time-series. However, many macroeconomic time-series are difference stationary (DS).

DS type time-series may become stationary and application of OLS technique may also give proper estimates but this kind of estimation provides only a short run relationship between the variables to be estimated. On the other hand, if ordinary least squares (OLS) estimation techniques are applied to non-differenced DS type sequences, resulting error terms are serially correlated. This renders any subsequent hypothesis tests unreliable. The actual determination of whether a variable is TS or DS is based upon the results of unit root tests.

Numerous unit root tests have been presented in economic literature; the most common test, and the one we utilize, is the Augmented Dickey-Fuller test. If one can reject the null hypothesis that a series possesses a unit root, then the series is TS, or integrated of order zero $I(0)$. If one cannot reject the null of a unit root, then the series is DS. Subsequent unit root tests on differenced DS series determine the form in which the data may be used in regressions. The most common occurrence is that first differences of DS series are stationary; in this case the series is said to be integrated of order one $I(1)$ and no further differencing of the data or unit root testing is required.

When multiple individual time-series variables are found to be integrated of order one, an additional test is required to determine whether long-term relationships exist among the variables. Cointegration tests indicate the presence of such stable long-term relationships. After applying cointegration test, Error correction model or VAR models are applied to remove shortcomings, if any, in the cointegration test. Therefore, following three econometric tests have been applied on the data:

1. PHILLIPS-PERRON (PP) TEST FOR STATIONARITY
2. AUGMENTED DICKEY-FULLER TEST FOR STATIONARITY
3. JOHANSEN COINTEGRATION TEST
4. VAR OR VECTOR AUTOREGRESSIVE MODEL

All these tests have been applied using econometric software EVIEWS 5.0.

Chapter 5

STATIONARITY OF DATA SERIES

MATHEMATICAL APPROACH

The stationarity status of time series can be checked with the help of unit root test by applying Phillips-Perron (PP) test and Augmented Dickey-Fuller (ADF) test statistic. The results are summarized in Table 3 and Table 4 respectively.

TABLE 3

PHILLIPS-PERRON (PP) TEST STATISTIC

<u>VARIABLES</u>	<u>AT LEVEL</u>			<u>AT FIRST DIFFERENCE</u>			
INCLUDES IN EQUATION	INTERCEPT	TREND AND INTERCEPT	NONE	INTERCEPT	TREND AND INTERCEPT	NONE	<u>ORDER OF INTEGRATION</u>
LFDI	-0.34***	-6.82*	2.19***	-15.84*	-15.37*	-10.77*	I(1)
LGDP	-1.52**	-2.84***	-5.24*	-7.04*	-7.23*	-5.09*	I(1)
LINNO	-1.51***	-1.89***	0.82***	-4.84**	-4.80**	-4.82*	I(1)
LTECH	-7.35*	-8.33*	0.97***	-5.20**	-5.53**	-5.21*	I(1)
PR	-1.93***	-2.09***	0.25***	-7.33*	-7.23*	-7.31*	I(1)
CL	-2.58***	-2.52***	-0.09***	-9.42*	-9.80*	-9.70*	I(1)

*Significant at 1 % level of significance

**Significant at 5 % level of significance

*** Not significant

TABLE 4
ADF Test Statistic

<u>VARIABLES</u>	<u>AT LEVEL</u>			<u>AT FIRST DIFFERENCE</u>			
INCLUDES IN EQUATION	INTERCEPT	TREND AND INTERCEPT	NONE	INTERCEPT	TREND AND INTERCEPT	NONE	<u>ORDER OF INTEGRATION</u>
LFDI	-0.96***	0.96***	0.87***	-8.68*	-8.68*	-12.64*	I(1)
LGDP	-1.39**	-1.38***	-4.24**	-7.30**	-7.30*	-0.63***	I(1)
LINNO	-1.17***	-1.17***	0.90***	-4.89**	-4.89*	-4.89*	I(1)
LTECH	-4.23**	0.68***	0.68***	-5.54*	-4.89*	-4.89*	I(1)
PR	-1.96***	-1.90***	0.10***	-7.30*	-7.30*	-7.39*	I(1)
CL	-4.14**	-0.29***	-0.29***	-5.71*	-5.71*	-5.87*	I(1)

*Significant at 1 % level of significance

**Significant at 5 % level of significance

*** Not significant

The abbreviations are as follows:-

LFDI = LOG of FDI series

LGDP = LOG of GDP series

LINNO = LOG of CF series

LTECH = LOG of TECH series

The rationale behind taking log of above-mentioned series is to make the model SEMI LOG model. Because SEMI LOG models provide a good estimate of change in a variable over a specific period of time

(GUJRATI)

GRAPHICAL APPROACH

The results can also be seen and analyzed graphically. Figure 5 shows the graph of log of FDI over years.

FIGURE 5

Graph of LFDI Series

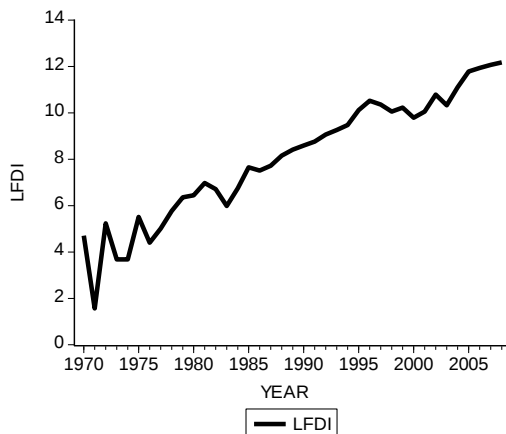
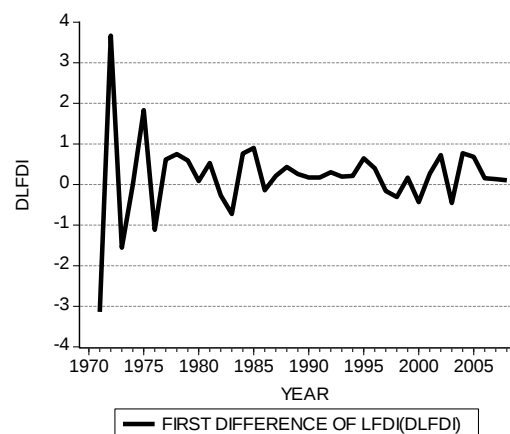


FIGURE 6

Graph of Stationary LFDI Series



The graph clearly determines a trend; an upward trend. But when taking its first difference plots the series, it becomes clear from the zero line that the series is stationary and the data moves around its mean value.

FIGURE 7

Graph of LGDP Series

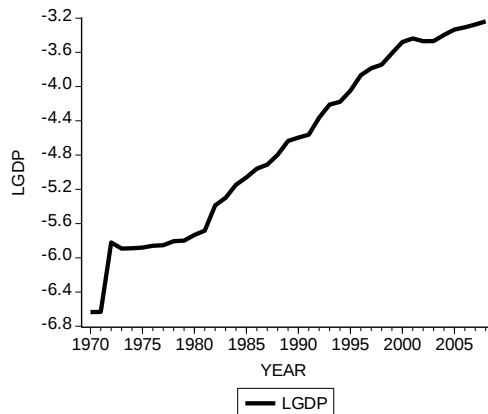


FIGURE 8

Graph of Stationary LGDP Series

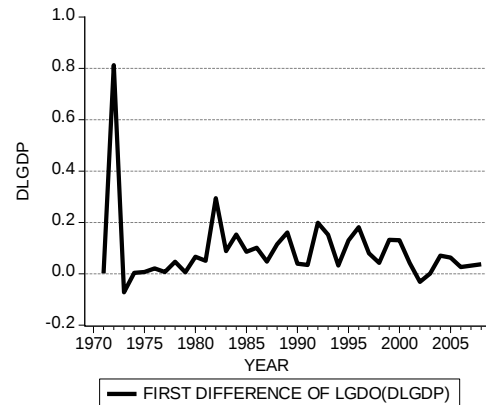


Figure 7 shows that the series of LGDP is not stationary at level and is show an upward trend, whereas Figure 8 shows the graph of LGDP at first difference of series. The figure shows that at first difference, the series is stationary and it moves around a mean value shown by the zero line. This series is without trend and it is stationary.

FIGURE 9

Graph of LINNO Series

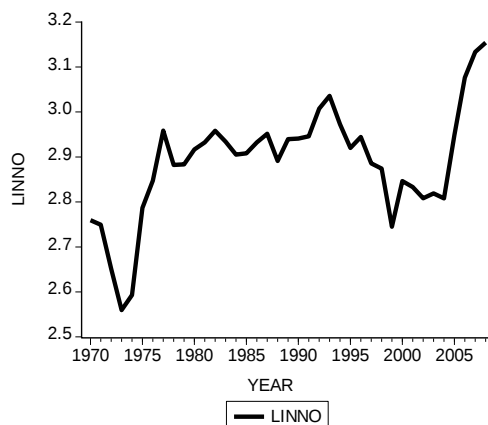
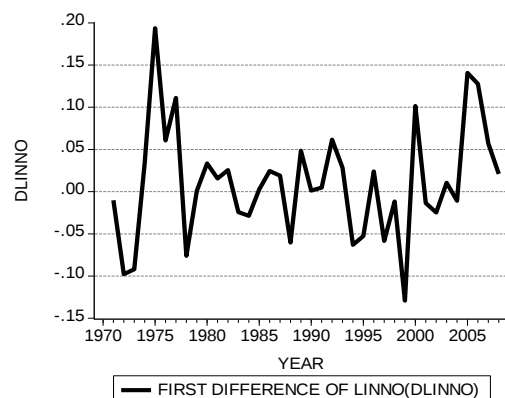


FIGURE 10

Graph of Stationary LINNO Series



The measure of innovation has been taken gross capital formation in Pakistan (CF). The series is not stationary when plotted at level. It shows an upward trend. When the first difference of series is taken and plotted it shows

movement along its mean value as the zero grid line shows. Therefore, the series become stationary at first difference.

The other series also determine the same trend, *i.e.* they become stationary at first difference as shown by following diagrams.

FIGURE 11

Graph of LTECH Series

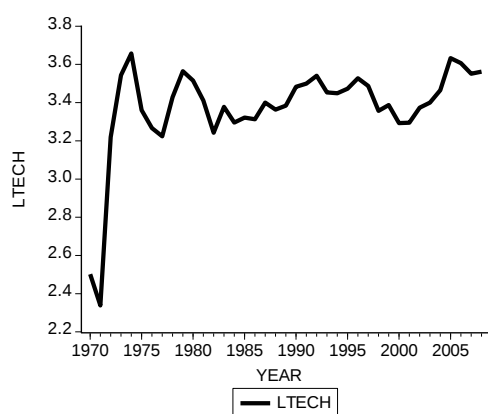


FIGURE 12

Graph of Stationary LTECH Series

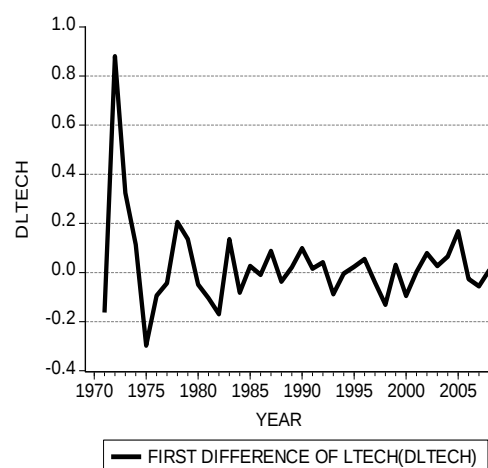


FIGURE 13

Graph of PR Series

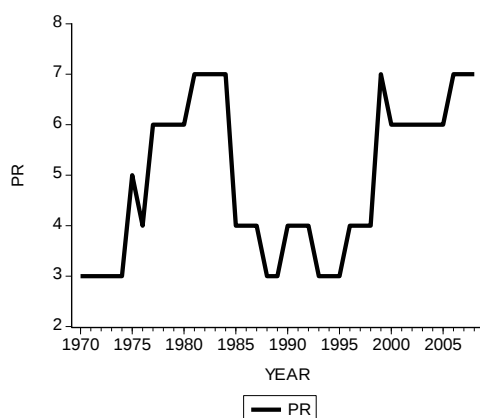


FIGURE 14

Graph of Stationary PR Series

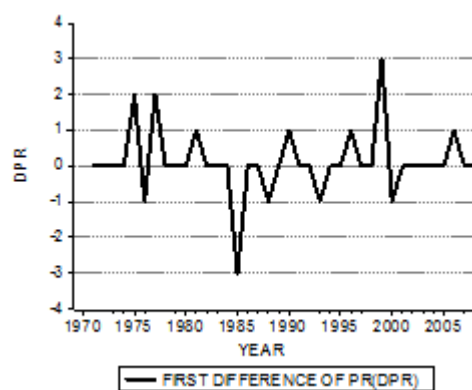


FIGURE 15

Graph of CL Series

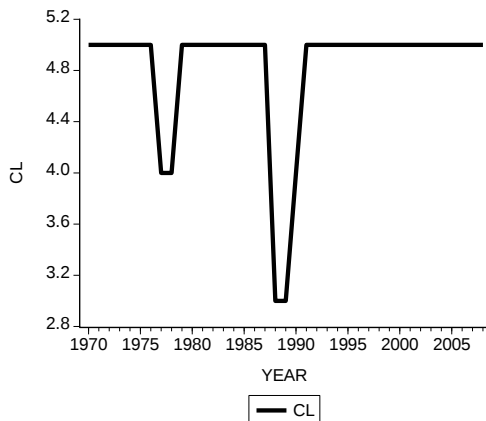
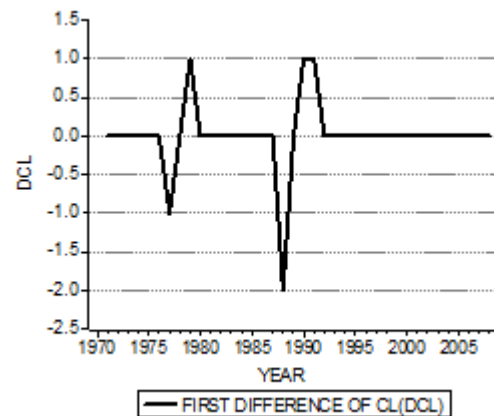


FIGURE 16

Graph of Stationary CL Series



All the figures show that at level the series has a trend and this trend makes all the series non-stationary. But when plotted at their first difference, the series move up and down along a mean value shown by the zero grid line. In case of CL, Figure 15 may be taken as a stationary series by some readers, but it can be clearly seen that the series is showing a downward movement after a specific value. But to be stationary, the series must move both up and down along the mean value as it is shown in Figure 16.

The above discussion leads to a simple conclusion that all the series are non-stationary at level, *i.e.* they show a specific trend. But all the series become stationary at first difference. Except LGDP, all other series are stationary at 1 percent level of significance. ADF test statistic and graphical result show the same result.

Now the next step is to apply cointegration test. Although OLS model can also be applied but in case of differenced series, OLS estimates give a short run relation. But the main purpose of study is to find the long run relation based on the two hypotheses that have been constructed on the basis of the literature review. Therefore, to find a stable and long run relation, cointegration test has

to be applied on the stationary series. This would be explained in the coming chapters.

Chapter 6

CO INTEGRATION BETWEEN FDI INFLOWS AND TECHNOLOGY TRANSFER

As the first hypothesis states that:

H₁ FDI stimulates technology transfer and technology intensive goods.

And based on the above hypothesis, the model to be estimated becomes:

Technology transfer = f (FDI, control variables)

I.e. technology transfer in Pakistan is a function of FDI inflows and the control variables. Now the results of estimated model are shown in the next section.

JOHANSEN COINTEGRATION TEST

For application of Johansen co integration test, the necessary condition is that all series must have same order of integration, which has been verified in the previous chapter. The test is applied using the assumption of intercept and trend and then calculation of VAR. Moreover, the lag length chosen for estimation of the model is 11. The results are shown in Table 5.

The null hypothesis is rejected at $r = 0$. It could not be rejected after $r = 0$. Consequently it can be concluded that there is only one cointegrating relationship among the variables, specified in the model. Eigen values show the relative importance of the linear combination of the variables.

TABLE 5
Johansen Test for Cointegration

MAXIMUM EIGEN VALUE TEST			
H_0	H_a	TEST STATISTIC	95% CRITICAL VALUE
$r = 0$	$R = 1$	74.73299*	33.87687
$r = 1$	$R = 2$	22.18299	27.58434
$r = 2$	$R = 3$	10.90009	21.13162
$r = 3$	$R = 4$	3.403824	14.26460
$r = 4$	$R = 5$	1.083858	3.841466
TRACE TEST			
H_0	H_a	TEST STATISTIC	95% CRITICAL VALUE
$r = 0$	$R \geq 1$	112.3007*	69.81880
$r = 1$	$R \geq 2$	37.57076	47.85613
$r = 2$	$R \geq 3$	15.38778	29.79707
$r = 3$	$R \geq 4$	4.487681	15.49471
$r = 4$	$R \geq 5$	1.083858	3.841466

NOTE: Max-eigen value test indicates 1 cointegrating eqn(s) at the 0.05 levels.

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level.

*Denotes the rejection of the hypothesis at the 0.05 level.

VECTOR ERROR CORRECTION MECHANISM

The second step in the cointegration involves constructing an error correction model. And the best model for constructing an error correction model is vector Autoregressive Model. According to the theory of cointegration, if all variables are I (1) and there exists an error correction

mechanism, then the linear combination of the I(1) variables is always stationary (Saeed, 2001). In this case, following linear relationship exists:

$$TECH = \beta_0 + \beta_1 FDI + \beta_2 GDP + \beta_3 CL + \beta_4 PR + vt$$

Where vt is random error term, which must be white noise for the estimates to be proper and correct. Therefore, VAR model is applied after the application of cointegration test.

The results are shown in Table 6.

TABLE 6
Estimates of VAR Model

Cointegrating Eq.	CointEq1
LTECH (−1)	1.000000
LGDP (−1)	0.283985
	(0.05092)
	[5.57710]*
LFDI (−1)	-0.131006
	(0.02061)
	[-6.35783]*
CL (−1)	-0.064318
	(0.02514)
	[-2.55845]**
PR (−1)	0.024746
	(0.00817)
	[3.02945]*
C	−0.819986

Standard errors in () & t-statistics in []

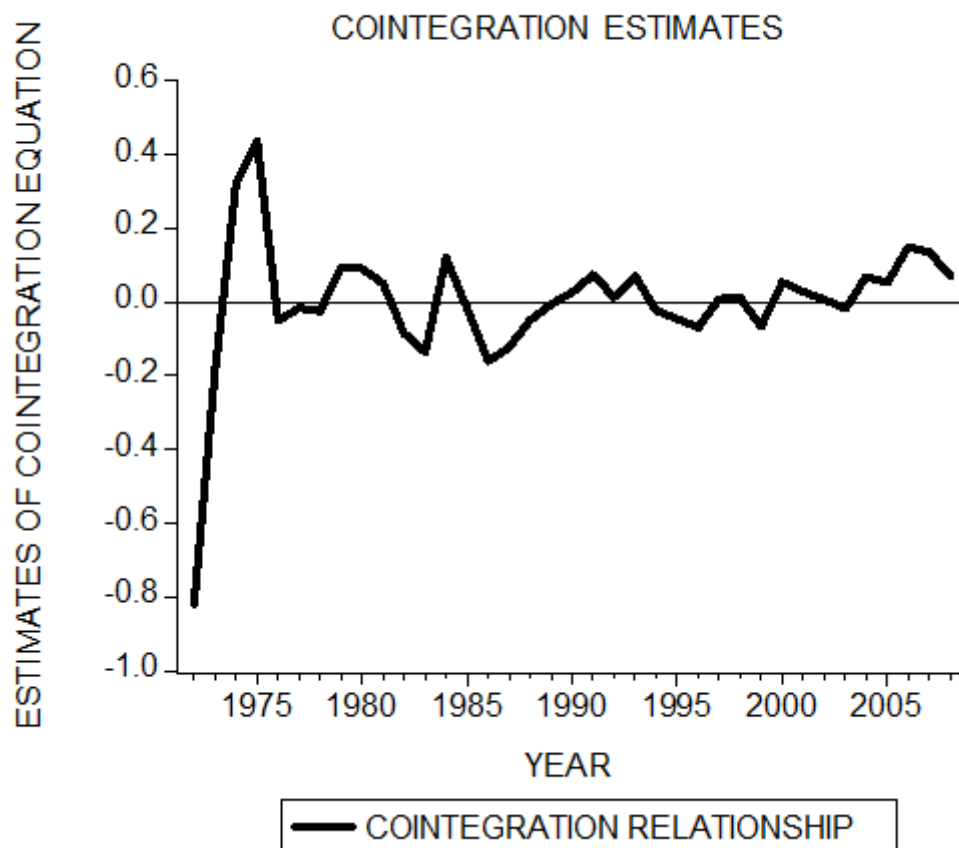
Significant at 1% and ** significant at 5%.

TABLE 6 (CONT ON PAGE 42)

Error Correction:	D (LTECH)	D (LGDP)	D (LFDI)	D (CL)	D (PR)
CointEq1	-0.851035	-0.552245	-1.328389	0.223006	1.009393
	(0.10615)	(0.08862)	(0.67557)	(0.56469)	(1.10875)
	[-8.01724]	[-6.23158]	[-1.96633]	[0.39491]	[0.91039]
D (LTECH (-1))	0.526435	0.071598	1.101011	-0.017760	0.387489
	(0.12030)	(0.10043)	(0.76560)	(0.63995)	(1.25651)
	[4.37614]	[0.71292]	[1.43810]	[-0.02775]	[0.30838]
D (LGDP (-1))	-0.186406	-0.141806	-2.086807	0.202092	0.027451
	(0.18290)	(0.15269)	(1.16402)	(0.97298)	(1.91041)
	[-1.01917]	[-0.92869]	[-1.79276]	[0.20770]	[0.01437]
D (LFDI (-1))	-0.052078	-0.055938	-0.436469	0.025174	-0.246435
	(0.02151)	(0.01796)	(0.13692)	(0.11445)	(0.22471)
	[-2.42071]	[-3.11449]	[-3.18782]	[0.21997]	[-1.09667]
D (CL (-1))	-0.040438	-0.006019	-0.167710	0.119186	-0.035535
	(0.03438)	(0.02870)	(0.21878)	(0.18288)	(0.35907)
	[-1.17631]	[-0.20972]	[-0.76655]	[0.65172]	[-0.09896]
D (PR (-1))	0.017432	0.018897	-0.047001	0.050348	-0.204354
	(0.01683)	(0.01405)	(0.10708)	(0.08951)	(0.17574)
	[1.03607]	[1.34531]	[-0.43893]	[0.56251]	[-1.16281]
C	0.043529	0.111671	0.536794	-0.028294	0.165766
	(0.02037)	(0.01701)	(0.12966)	(0.10838)	(0.21280)
	[2.13658]	[6.56552]	[4.13999]	[-0.26106]	[0.77897]
R-squared	0.771765	0.736532	0.551376	0.044832	0.122410
Adj. R-squared	0.726119	0.683839	0.461651	-0.146201	-0.053108
Sum sq. residues	0.270015	0.188195	10.93659	7.641342	29.45857
S.E. equation	0.094871	0.079203	0.603782	0.504689	0.990935
F-statistic	16.90729	13.97765	6.145187	0.234683	0.697420
Log likelihood	38.52292	45.20135	-29.95286	-23.31985	-48.28396
Akaike AIC	-1.703942	-2.064938	1.997452	1.638911	2.988322
Schwarz SC	-1.399174	-1.760170	2.302220	1.943679	3.293091
Mean dependent	0.033060	0.091740	0.286652	0.000000	0.108108
S.D. dependent	0.181281	0.140861	0.822903	0.471405	0.965625
Determinant resid covariance (dof adj.)			2.57E-06		
Determinant resid covariance			9.02E-07		
Log likelihood			-5.010024		
Akaike information criterion			2.432974		
Schwarz criterion			4.174507		

The results of VAR model show that all variables are significant in LONG RUN, where GDP and PR have a negative relation. Whereas, the short run relation is shown by differenced equation where all variable have been estimated by taking their difference and D denotes these coefficients. In SHORT RUN, all variables are significant except CL and PR where FDI and GDP have a negative relationship with technology. The coefficient of technology is also significant which means that FDI inflows lead to technology transfer in Pakistan. The equilibrium path of coefficients can be shown in the Figure 17.

FIGURE 17
Cointegration Estimates



The above calculations show that the FDI inflows in Pakistan have significant relationship with technology transfer, both in short-run and long run. Moreover, all other variable are also significant in the long run.

It means that there exists a stable long run relation between technology transfer and FDI, and that FDI inflows bring technology in Pakistan.

It has also been demonstrated with the help of co integration graph. The estimates of Johansen co integration have been plotted and the graph shows that the values converge to their equilibrium value. Also the assumption of stationarity has also been verified. The linear combination formed above is stationary as the values move along the equilibrium values shown by zero grid line. This leads to the conclusion that Hypothesis 1 cannot be rejected *i.e.*, FDI inflows in Pakistan are furnished with technology transfer.

Chapter 7

COINTEGRATION BETWEEN FDI INFLOWS, INNOVATION AND TECHNOLOGY TRANSFER

The second hypothesis states that:

H2 FDI can directly stimulate local innovation and increases local R&D.

And based on the above hypothesis, the model to be estimated becomes

Innovation = f (FDI, technology transfer, control variables)

It means that technology transfer through FDI inflows lead towards domestic innovation and research and development based on new techniques and technology brought by the foreign investors? Does it really happen in Pakistan? The next sections of this chapter provide an empirical answer to this hypothesis.

JOHANSEN COINTEGRATION TEST

Like the case of previous hypothesis, the test is applied after satisfying the necessary condition of same order of integration and in this case too the model is using the assumption of intercept and trend and then calculation of VAR. moreover, the lag length chosen for estimation of the model is 11. The results are shown in Table 7. The test result of this hypothesis is same until now, *i.e.* both trace test and maximum Eigen value test give only one co integrating equation and show a long run relation between variables.

TABLE 7
Johansen Test for Cointegration

MAXIMUM EIGEN VALUE TEST			
H_0	H_a	TEST STATISTIC	95% CRITICAL VALUE
$R = 0$	$R = 1$	80.48614*	40.07757
$R = 1$	$R = 2$	30.51499	33.87687
$R = 2$	$R = 3$	20.34623	27.58434
$R = 3$	$R = 4$	7.838842	21.13162
$R = 4$	$R = 5$	3.721829	14.26460
$R = 5$	$R = 6$	1.486737	3.841466
TRACE TEST			
H_0	H_a	TEST STATISTIC	95% CRITICAL VALUE
$R = 0$	$R \geq 1$	144.3948*	95.75366
$R = 1$	$R \geq 2$	63.90864	69.81889
$R = 2$	$R \geq 3$	33.39364	47.85613
$R = 3$	$R \geq 4$	13.04741	29.79707
$R = 4$	$R \geq 5$	5.208566	15.49471
$R = 5$	$R \geq 6$	1.486737	3.841416

NOTE: Max-eigen value test indicates 1 cointegrating eqn (s) at the 0.05 level.

Race test indicates 1 cointegrating eqn (s) at the 0.05 level.

*Denotes the rejection of the hypothesis at the 0.05 level.

VECTOR ERROR CORRECTION MECHANISM

As before the next step is the construction of an error correction model, *i.e.* the VAR model will be applied. In this case, following linear relationship is formed on the basis of hypothesis 2:

$$\text{INNO} = \beta_0 + \beta_1 \text{FDI} + \beta_2 \text{TECH} + \beta_3 \text{GDP} + \beta_4 \text{PR} + \beta_5 \text{CL} + vt$$

The VAR model makes adjustment for possible error in the data and it gives both short run and long run relationship among variables to be tested. The results are shown in Table 7.

TABLE 8

Estimates of VAR Model

Cointegrating Eq.	CointEq1
LINNO (–1)	1.000000
LTECH (–1)	–73.61119
	(5.13858)
	[–14.3252]*
LGDP (–1)	–21.21571
	(3.61466)
	[–5.86935]*
LFDI (–1)	9.853319*
	(1.51898)
	[6.48679]*
PR (–1)	–2.008443
	(0.55809)
	[–3.59878]*
CL (–1)	4.811682
	(1.71115)
	[2.81196]**
C	54.87340

Standard errors in () and t-statistics in []

*Means significant at 1% level and ** shows significance at 5% level.

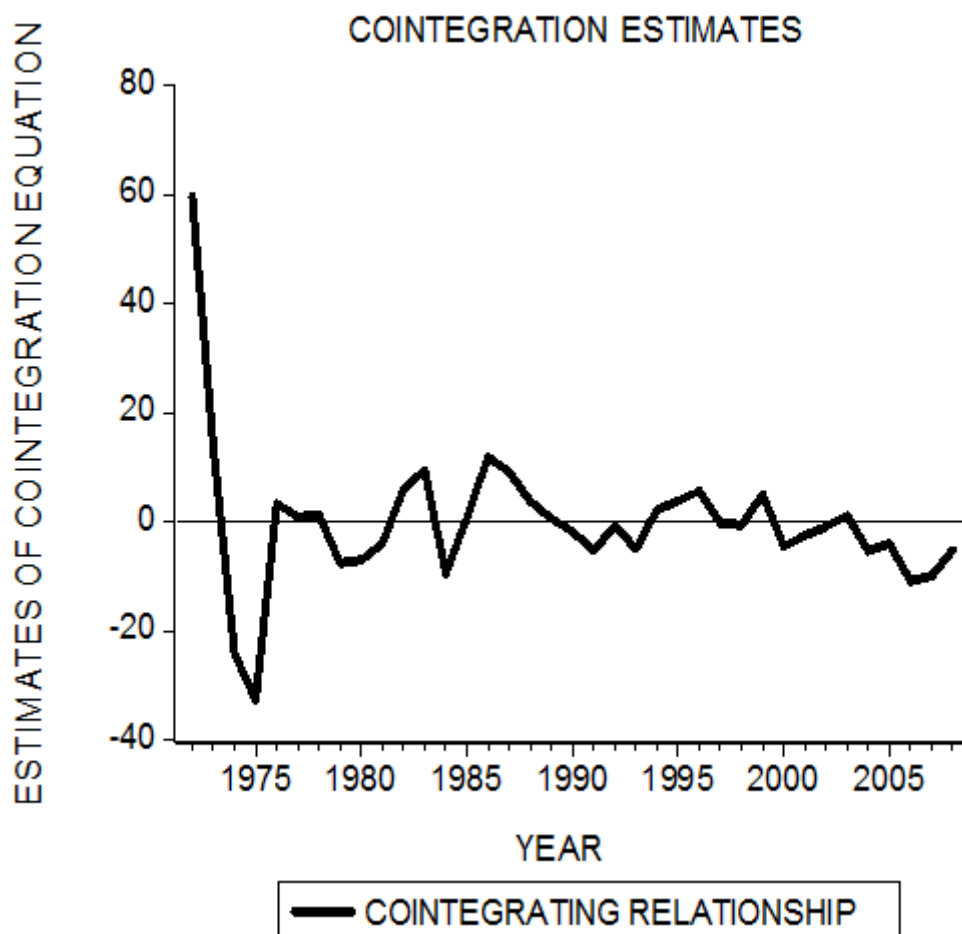
TABLE 8 (CONT ON PAGE 48)

Error Correction:	D (LINNO)	D (LTECH)	D (LGDP)	D (LFDI)	D (PR)	D (CL)
CointEq1	– 0.002524	0.011752	0.007397	0.018545	–0.011143	–0.003887
	(0.00095)	(0.00146)	(0.00123)	(0.00940)	(0.01525)	(0.00781)
	[–2.66249]	[8.03424]	[6.03617]	[1.97331]	[–0.73055]	[–0.49796]
D (LINNO (–1))	0.082328	0.310518	–0.155007	0.993900	2.769058	–1.121065
	(0.17887)	(0.27600)	(0.23124)	(1.77330)	(2.87806)	(1.47294)
	[0.46025]	[1.12505]	[–0.67034]	[0.56048]	[0.96213]	[–0.76111]
D (LTECH (–1))	– 0.017871	0.602504	0.040429	1.330601	1.031992	–0.277224
	(0.08857)	(0.13666)	(0.11449)	(0.87802)	(1.42503)	(0.72930)
	[–0.20178]	[4.40881]	[0.35311]	[1.51545]	[0.72419]	[–0.38012]
D (LGDP (–1))	– 0.087370	–0.186840	–0.142545	–2.078490	–0.020010	0.210206
	(0.11906)	(0.18372)	(0.15392)	(1.18036)	(1.91572)	(0.98043)
	[–0.73381]	[–1.01701]	[–0.92612]	[–1.76090]	[–0.01045]	[0.21440]
D (LFDI (–1))	0.006165	–0.059497	–0.053953	–0.458412	–0.293434	0.046224
	(0.01434)	(0.02213)	(0.01854)	(0.14218)	(0.23076)	(0.11810)
	[0.42983]	[–2.68853]	[–2.90999]	[–3.22407]	[–1.27157]	[0.39140]
D (PR (–1))	– 0.003228	0.018866	0.019704	–0.044674	–0.204410	0.049511
	(0.01095)	(0.01690)	(0.01416)	(0.10858)	(0.17623)	(0.09019)
	[–0.29473]	[1.11632]	[1.39160]	[–0.41143]	[–1.15991]	[0.54896]
D (CL (–1))	0.004702	–0.045343	–0.004746	–0.181651	–0.069422	0.133554
	(0.02248)	(0.03469)	(0.02906)	(0.22286)	(0.36171)	(0.18512)
	[0.20918]	[–1.30718]	[–0.16330]	[–0.81508]	[–0.19193]	[0.72146]
C	0.017674	0.039595	0.113706	0.523601	0.133177	–0.014443
	(0.01344)	(0.02074)	(0.01738)	(0.13326)	(0.21628)	(0.11069)
	[1.31481]	[1.90902]	[6.54352]	[3.92917]	[0.61576]	[–0.13049]
R-squared	0.340904	0.777659	0.741522	0.554589	0.147931	0.063576
Adj. R-squared	0.181811	0.723991	0.679131	0.447077	–0.057741	–0.162458
Sum sq. residues	0.110482	0.263042	0.184631	10.85825	28.60190	7.491393
S.E. equation	0.061723	0.095239	0.079791	0.611901	0.993112	0.508256
F-statistic	2.142804	14.49007	11.88506	5.158354	0.719255	0.281268
Log likelihood	55.05503	39.00694	45.55512	–29.81986	–47.73799	–22.95321
Akaike AIC	– 2.543515	–1.676051	–2.030006	2.044317	3.012865	1.673146
Schwarz SC	– 2.195209	–1.327744	–1.681700	2.392623	3.361171	2.021453
Mean dependent	0.010946	0.033060	0.091740	0.286652	0.108108	0.000000
S.D. dependent	0.068237	0.181281	0.140861	0.822903	0.965625	0.471405
Determinant resid covariance (dof adj.)			8.76E-09			
Determinant resid covariance			2.03E-09			
Log likelihood			55.26569			
Akaike information criterion			–0.068416			
Schwarz criterion			2.282654			

According to the results, in LONG RUN, all variables are significant whereas FDI and CL have negative impact on domestic innovation. On the other hand, in SHORT RUN where variables are estimated on their differenced value shown by D, domestic innovation, technology transfer and FDI inflows are significant and all of them have a positive impact on domestic innovation in Pakistan. Whereas, CL and PR are both insignificant and negative. The equilibrium values of estimated coefficients are shown in Figure 18.

FIGURE 18

Cointegration Estimates



The estimations/ results of this study lead to conclude that there exists a long run equilibrium relation between domestic innovation, FDI inflows and technology transfer. This means that FDI inflows bring technology in transfer and this new and modern technology leads to domestic research and development resulting in innovations at domestic level.

Moreover, the model is a good estimate as the linear combination also becomes stationary as shown by the cointegration graph, where values of estimated coefficients converge to equilibrium value. This leads to final conclusion that there is no evidence to reject hypothesis 2:

H₂ FDI can directly stimulate local innovation and increases local R&D.

Chapter 8

CONCLUSION OF THE STUDY

The present study basically identifies the trends of FDI inflows in Pakistan and the relationship of FDI with technology transfer.

Regarding trends of FDI inflows in Pakistan, the present decade has experienced a huge change. Not only FDI inflows have increased manifold in present era but their sectoral distribution has also changed. Pakistan started of as an agricultural country, but at present services sector is relatively the most important sector of the economy as it attracts highest flows of foreign investment and it contributes the most toward GDP. On the contrary, the share of agriculture has dropped significantly and it is the most unattractive sector for foreign investors. The other main sector of the economy, the manufacturing sector, is showing a reasonable but not satisfactory performance. But government's attention towards this sector as well as foreign investment is making this sector better and more productive with the passage of time.

The other part of the study is based on empirical relationship between FDI inflows and technology transfer. The advantages and disadvantages of FDI inflows with reference to technology transfer have been examined in the light of the current literature available on the subject. It has been found that technology transfer as a result of FDI inflows, in addition to multilateral and bilateral agreements, is also dependent on international agreements like trade related intellectual property rights (TRIPs) or IPRs of the World Trade Organization and the United Nations. Consequently the recipient developing countries had to undertake internal legislations with reference to TRIPs, which has its implications on technology transfer. It has been noticed that quite a few developed countries have shown a great interest towards transferring FDI along with technology package. At the same time many analysts have pointed out that

their motives are discriminatory and, according to their view, recipient countries are required to take extra measures to avoid hidden unfavorable conditionalities at the time of negotiations for receiving FDI.

In order to reach definite conclusion that FDI inflows are associated with technology transfer, two hypotheses were developed: (H₁) FDI stimulates technology transfer and technology intensive goods and (H₂) FDI can directly stimulate local innovation and increase local R& D and to empirically test these hypotheses six variables have been used which are mentioned in Chapter 4. Using those variables three econometric tests have been applied: ADF unit root test, Johansen cointegration test and VAR model. The empirical findings show that both hypotheses are correct and in both long run and short run. There is a strong relationship between FDI inflows, technology transfer and innovation. Thus, it can be safely concluded that Pakistan is no exception and it receives technology with FDI inflows, which lead to domestic innovation and R&D projects in the long run, and therefore FDI inflows along with the technology package are beneficial for the economic development of Pakistan.

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ANNEXURE

UNITS AND SOURCES OF DATA

1. FDI is in Rs. million. (Source: World Development Indicators)
2. Merchandise imports (TECH) and innovation (CF) are in percentage of per capita GDP. (Source: OECD statistics)
3. GDP per capital is in the form of Rs million. (Source: World Development Indicators)
4. PR and CL are in the form of indexes. (Source: World Development Indicators)

The World Development Indicators (WDI) gives data in Dollars, which has been converted into rupees by multiplying the annual data of each year in dollars with annual average exchange rate of the same year.

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