CHAPTER ONE

INTRODUCTION AND OVERVIEW OF THE COUNTRIES

1. Introduction

The saving rate of any country is an important indicator of economic development since the domestic saving rate is directly related with the investment rate and the lending capacity of the banking system. According to economic theory, in a closed economy, saving constitutes the only source of investment and the two must be equal by definition. Conventional wisdom says that in any economy, banking sector accumulates its funds mainly through the domestic saving. According to Wirvick (1986), domestic saving originates from three main sectors of the economy, namely government sector, corporate sector, and the household sector. He points out that the government sector, which consists of the central and local governments, accumulates funds for saving from its budget surplus. The corporate sector gets its saving from its own profit. The household sector's saving equals its income minus expenditure. He argues that the level of mobilization and utilization of domestic saving affects economic development for a country.

The rest of the chapter is organized as follows. In the next section, we present the significance of the study. The third section shows how our study is different from the previous studies. The fourth section presents an overview of the four countries that are used for the study. The fifth section discuses the methodologies used for the data analysis.

Chapter organization is given in the final section.

2. Significance and objectives of the study

There are numerous studies on saving behavior for developed countries. But the same is not true for developing countries. Policy makers have suffered from a dearth of knowledge regarding the nature of saving behavior in developing countries due to lack of research. Therefore, the research findings will increase the present knowledge about saving behavior of the south Asian countries.

The determinants of saving have been receiving attention of economists because of their significant impact on policymaking. The relationships between economic growth and saving, income inequality and saving, demographic factors and saving, and macroeconomic stability and saving have not been studied carefully for South Asia.

Saving is income that part of which is not spent, but put aside for future consumption. Investment is one of the vital factors for any country for economic development. The close relationship between saving rate and economic growth is explained by many economic growth models. The relationships between saving and investment, and saving and economic growth are highly debatable issues among economists. These issues have been subject of great interest and debate among economists for many years.

The relationship between saving and export is also one of the important issues.

South Asian countries are economically more integrated with the rest of the world now than two decades ago. However, South Asia's export as a percentage of gross domestic products (GDP) is still low compared to East Asian countries. Also, South Asian countries have low saving rates compared to many East Asian countries.

In this thesis, we do the following:

(1) Identify the determinants of savings for the South Asian countries.

(2) Measure the degree of international capital mobility for the South Asian countries and for the region.

(3) Examine whether higher saving rate is a primary determinant of economic growth rate for the South Asian countries.

(4) Examine whether the low share of trade in GDP is one of the reasons for the low saving rate in this region.

3. How the study differs from the previous studies

Our study differs from the other existing studies on saving in the following ways. We carry out a comprehensive study of saving behavior in four major South Asian countries. In this thesis, South Asian countries mean the major South Asian countries which are Bangladesh, India, Pakistan and Sri Lanka. We study the determinants of saving, relationships between saving and investment, between saving and economic growth, and between export and saving. Though economists have been studying the relationship

between saving and investment, they study either an individual country or cross-section of countries. We analyze saving behavior by using individual country data and panel data. The relationship between saving and export is an important issue for policy making. But the relationship has not been studied for South Asian countries. Thus, the study fills a gap in the literature that has not studied for South Asian countries. Previous studies have not used impulse response functions to examine the short-run dynamic responses between saving and GDP for South Asian countries. No previous study has used two error-correction models to study international capital mobility for an individual country for the South Asian region.

We use both Jansen (1996) and Johansen cointegration tests to study international capital mobility. For the South Asian countries, Ng-Perron (2001) and Im et al. (2003) unit root tests have not been used to test for stationarity for individual country and panel data, respectively. The Breusch-Godfrey test is more powerful than the Durbin-Watson statistics to test for serial correlation. The Breusch-Godfrey serial correlation test has not been used for the South Asian countries to test for serial correlation. We use the vector autoregressive and moving average processes with exogenous regressors (VARMAX procedure in SAS program) for the panel cointegration and causality for the South Asian countries and these have not been used before.

4. Overview of the four economies

This section gives an overview of the selected South Asian countries namely, Bangladesh, India, Pakistan and Sri Lanka. This will be useful in the thesis to analyze the behavior of saving in South Asian countries. Level of social development, economic structure, GDP, saving, and investment are briefly pointed out.

4.1. Bangladeshi economy

The People's Republic of Bangladesh is in the northeast of the Indian subcontinent. It has an area 147,570 sq km with a population about 140 million. When India was partitioned and the independent dominions of India and Pakistan were created in 1947 by the British government, present day Bangladesh was in the Pakistani territory. Before the independence, Bangladesh was called East Pakistan. Almost from the advent of independence of Pakistan in 1947, there were conflicts between East and West Pakistan. On March 26, 1971, after a war, people of the East Pakistan became an independent country. Unfortunately, Bangladesh has faced natural and political disasters since independence and these natural and political disasters have affected the economic progress.

Economic, social and political ideologies have periodically changed based on policy stances of political parties since the independence of Bangladesh. According to Khan et al. (2000), the Bangladeshi government initiated a policy of open economy and privatization in 1982. Economic and financial reforms accelerated in 1990. The

acceleration took place, after the implementation of the project which is called “five-year financial sector reform project (FSRP)”. Bangladesh Bank (2005) points out that the present government is committed to promote the market economy and to pursue policies for supporting and encouraging private investment and eliminating unproductive expenditures in the public sector.

4.1.1. Degree of social development

Despite its steady GDP growth rate from 1990 to 2004, Bangladesh has not achieved sufficient progress in the fields of health, education, and social welfare. According to the Bangladesh Bank (2004), poverty is one of the main problems in the country. Urban and rural poverty is increasing while income inequality is alarmingly increasing throughout the country. World Bank (2005) points out that nearly half of the population in Bangladesh are living in deprivation and with inadequate health facilities. Table 1.1 shows some key indicators of development of Bangladesh and some selected industrial countries.

According to the indicators such as malnutrition and maternal mortality rates, Bangladesh remains among the least developing countries in the world. Higher unemployment rate also makes it harder for the Bangladeshi government to achieve its goal such as reduction of poverty and income disparity. Though social development indicators paint gloomy picture, there has been a sharp fall in the rate of population growth in Bangladesh.

Table 1.1: Some key indicators of development for South Asian and other selected developed countries					
Country	Gini Index	Life Expectancy at Birth		Adult Literacy Rate	Average Annual Population Growth Rate
		Male	Female		
Australia	0.32	77	83	--	1.2
Japan	0.25	78	85	--	0.2
Singapore	0.43	76	80	93	1.9
Bangladesh	0.31	62	63	41	1.7
India	0.33	63	64	61	1.5
Pakistan	0.27	63	65	49	2.4
Sri Lanka	0.38	72	76	90	1.3
UK	0.34	75	80	--	1.2
USA	0.38	75	80	--	1.0

Source: World Bank (2005)

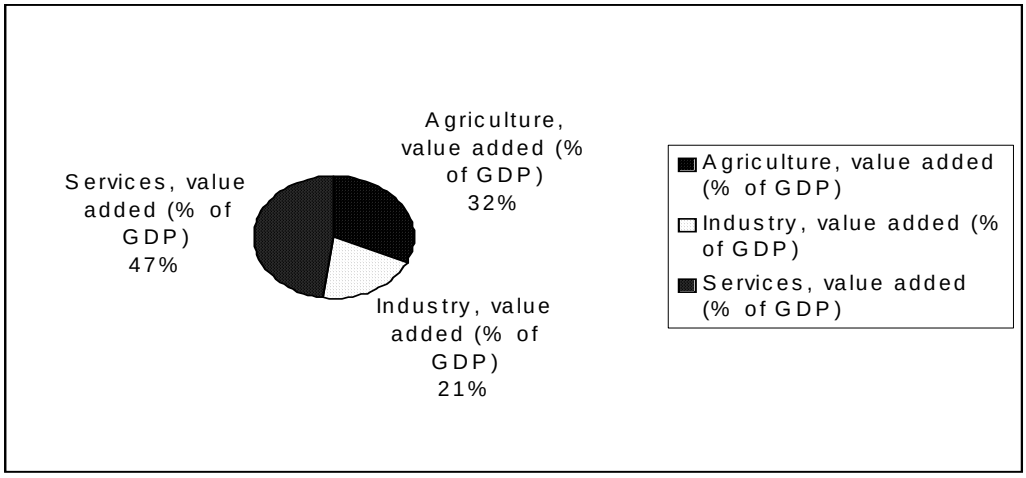
4.1.2. Economic structure

Bangladesh is an agricultural country. Major agricultural products are rice, jute, wheat, potato, pulses, tobacco, tea and sugarcane. In Bangladesh, about three-fifths of the

population is engaged in farming. Garment & apparel, jute, leather, and tea are the principal sources of foreign exchange. As most of the developing countries did after independence, Bangladesh had socialism as the economic ideology with a dominant role of the public sector. But, since the mid-eighties, Bangladesh has pursued economic reforms towards establishing a market economy with an emphasis on private sector oriented economic growth.

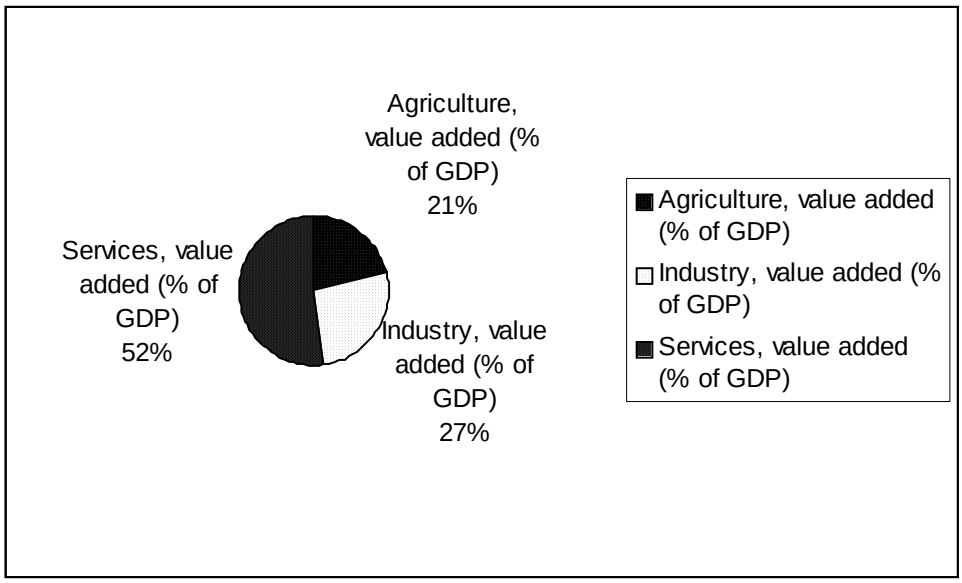
Economists often use a change in sectoral composition of GDP away from agricultural sector toward manufacturing and services sector as a measure of economic development. Figures 1.1 and 1.2 show that in Bangladesh, the sectoral composition of GDP has moved away from agricultural sector to manufacturing and service sectors. The agricultural sector's contribution to GDP has fallen from 32 percent in 1980 to 22 percent in 2004.

Figure 1.1: Sectoral composition of GDP at factor cost in 1980 for Bangladesh



Source: International Monetary Fund (2005)

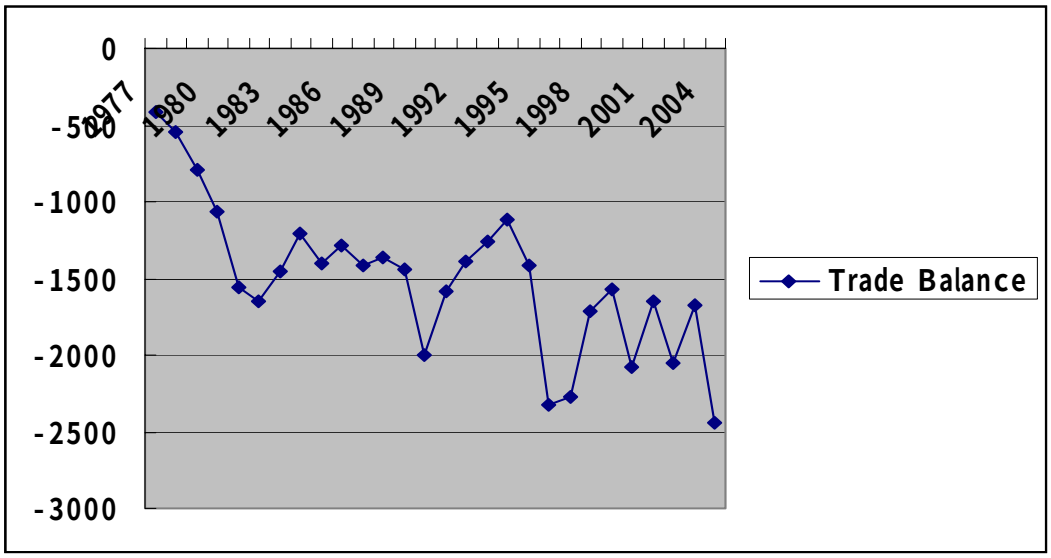
Figure 1.2: Sectoral composition of GDP at factor cost in 2004 for Bangladesh



Source: International Monetary Fund (2005)

According to Bank of Bangladesh (2003), the current account deficit was 2.5 percent of GDP in 2002. Figure 1.3 shows that the trade balance has become more negative since independence.

Figure 1.3: Balance of trade for Bangladesh, 1975-2005



Source: International Monetary Fund (2005)

Recently, the government has taken various steps to increase foreign exchange reserves. Some of the measures are punitive measures against illegal foreign exchange transactions, introduction of incentives to encourage overseas workers to send their remittances through official channels, closer monitoring of imports to discourage the practice of over invoicing, and encouragement of repatriation of export earnings.

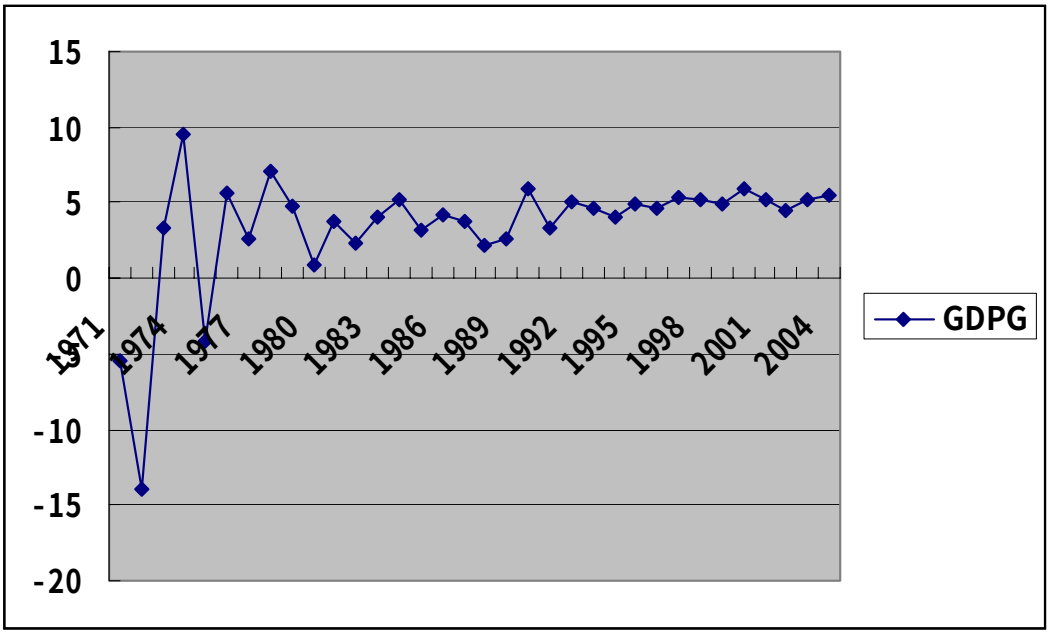
4.1.3. Gross domestic product

Unfortunately, in Bangladesh one of the major barriers to growth is frequent cyclones and floods. Also, inefficient state-owned enterprises, inadequate port facilities, a rapidly growing labor force that cannot be absorbed by the agricultural sector are impediments to economic development. It is a common knowledge that many development efforts in the developing countries have turned into exercises in futility because of the inefficiency and corruption among both politicians and bureaucrats. Bank of Bangladesh (2003) points out that though a number of measures have been taken to increase economic growth, the corruption of the public sector has set back the progress.

Figure 1.4 shows that except for 1971, 1972, and 1975 Bangladesh had a positive GDP growth rate since independence. GDP growth rate of Bangladesh was negative in 1975 because of the civil unrest and bad weather. The GDP growth rate increased after 1975. The average GDP growth rate was 3.7 percent until the late 1990s. According to the Bank of Bangladesh (2003), deteriorating external environment such as September 11,

2001, terrorist attack, slowed down the GDP growth in 2002. It was 3 percent in 2002. However, the GDP growth rate increased in 2003, due to a rise in both domestic and external demand.

Figure 1.4: GDP growth rate for Bangladesh, 1971-2005



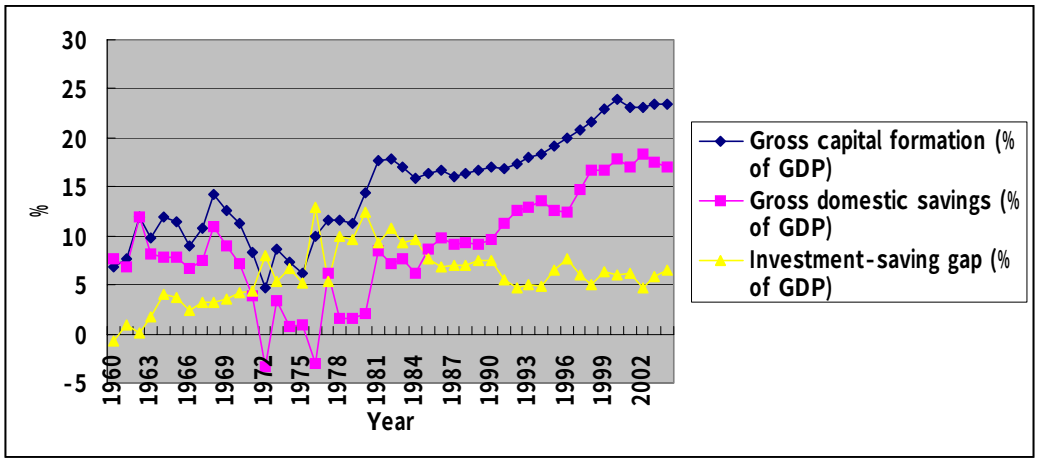
Source: Source: International Monetary Fund (2005)

Because of progress of the agricultural and the industrial sectors, the economy has maintained an upward trend of GDP growth rate, despite external economic and internal political pressures since 1990. Since 1990, Bangladesh has been having an average 5 percent GDP growth rate. The country has achieved considerable economic progress over the past few years. If Bangladesh is able to eliminate corruption and inefficiencies in the government sector, and improve economic governance, it could achieve a higher rate of growth.

4.1.4. Saving and investment

Bangladesh has had a low saving rate compared to other countries in the South Asian region since its independence. Figure 1.5 shows that there has not been a consistent increase in saving and investment rates for Bangladesh. However, in recent years, these rates have increased. The saving rate increased from 2.97% in 1976 to 18.38% in 2003. The figure shows that there was a steep decline of the saving rate during the period from 1970 to 1976. Bangladesh had an upward trend in the saving rate since 1979 although there have been considerable fluctuations around the trend. According to the Bank of Bangladesh (2001), remittances from expatriates and workers who are temporarily abroad have contributed to the growth in the saving rate in recent years. This is also the case for other countries in South Asia. According to the Bank of Bangladesh (2002), in recent years, the national saving rate has been much higher than the domestic saving rate because the balance in the current account has been positive.

Figure 1.5: Saving-investment gap for Bangladesh, 1960-2004



Source: World Bank (2006)

Since independence, public investment rate has been much less than private investment rate for Bangladesh. According to the Bank of Bangladesh (1990), investment was about 17 percent of GDP in which shares of public and private sectors were about 7 percent and 10.27 percent, respectively in the late 1980s. The investment rate has been increasing since the early 1990s and it rose to 23.4 percent of GDP in the early 2000. Out of the total investment, shares of public and private sector contributions were about 6 % and 17% respectively in 2003. Bank of Bangladesh (2001 and 2002) points out that because of the private sector-oriented reforms in Bangladesh, domestic investment and foreign direct investment have been increasing in the past decade.

The investment-saving gap was widening during the period from the early 1960s to the late 1980s. Since the early 1990s saving rate has been increasing and thus, the gap between saving and investment rates has reduced. Table 1.3 shows that Bangladesh's saving rate is low compared to that of East Asian and Latin American countries during the period from 1975 to 1985.

4.2. Indian economy

India's history begins not with its independence which was achieved in 1947, but more than 4500 years ago. When India became independent, present-day Pakistan and Bangladesh were within its territory. India has an area of 3,165,596 sq km and a population of about 1.07 billion. It has the second largest population in the world after China. When

India gained political freedom, the country was suffering from poverty and low standard of living. As a common feature for all the countries that gained independence after being colonized for a long period, agriculture was the principal industry at independence. According to Sankaran (1984), agriculture, forestry, and fishing accounted for 60 percent of the GDP and for a much larger proportion of employment. Manufacturing was dominated by the jute and cotton textile industries. The two industries accounted for about 10 percent of GDP. The great challenge that India faced after the independence was to eradicate poverty and to restructure the stagnant economy.

As many other developing countries in the South Asian region, India emphasized centrally planned economic policies for many years after independence. Soon after the independence, the government emphasized self-sufficiency rather than international trade and imposed strict controls on foreign exchange as well as on import and export. As Delong (2001) emphasizes, in 1991, India launched a series of economic reforms because of a foreign exchange crisis and the slowdown of economic growth. The economic reforms and restructuring programs consisted of liberalization of the exchange rate, foreign direct investment, and financial market. Also, the policy reforms included significant reductions in tariffs and other trade barriers, and significant adjustments in government monetary and fiscal policies. As a result of the policy reforms, the Indian economy is progressing well. India now has a higher GDP growth rate, lower inflation, and significant increase in

foreign direct investment and a growing middle class of 150-200 million which has disposable income for a comfortable life.

4.2.1. Degree of social development

Economic development is a multi-dimensional phenomenon. GDP growth, income inequality, level of education, level of nutrition, literacy rate, access to the health facility, and availability of housing are some of its important dimensions. According to Sankaran (1984), though India has increased its GDP growth rate, there is a wide socio-economic disparity.

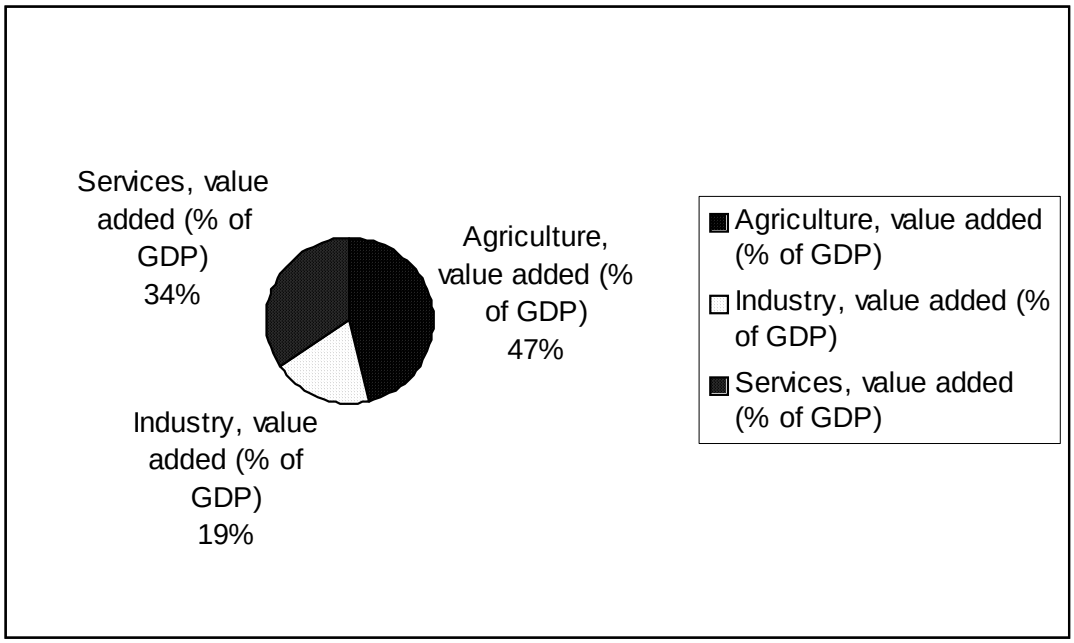
There is a widespread disparity in terms of economic development among the states in India. Though the economy is progressing well, the benefit of the rapid economic growth has not reached all parts of the country. Table 1.1 compares some key social development indicators of India with some developed countries.

Reserve Bank of India (2002 and 2003) opines that income distribution has not changed much even after the economic reforms in the early 1990s. Even now, the majority of the Indian people have low standard of living and many families live just above the subsistence level. According to the Reserve Bank of India (2005), a majority of the people who are above the poverty line, is still poor enough to qualify for poverty elimination programs.

4.2.2. Economic structure

At independence, the economy was dominated by agricultural activities. Agricultural value added as a percentage of GDP was more than 50. Figure 1.6 shows the sectoral composition of GDP in 1960. The figure shows that even after the fist decade of independence, the economy was heavily dependent on agricultural activities.

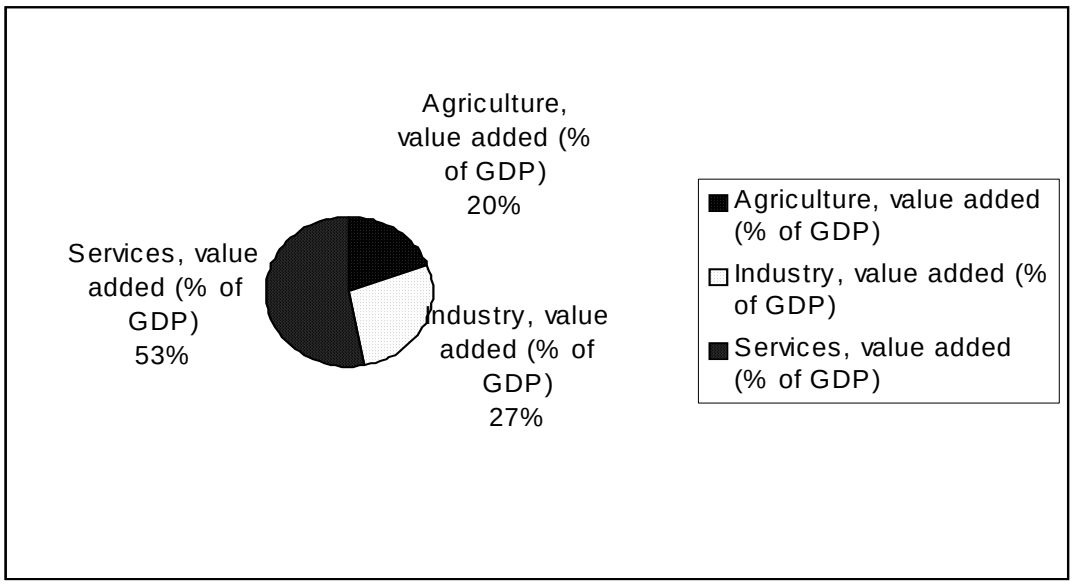
Figure 1.6: Sectoral composition of GDP at factor cost in 1960 for India



Source: International Monetary Fund (2005)

Until the late 1970s the economy was controlled heavily by the government. Beginning in the late 1980s, India has started to liberalize its economy. As a result of the economic reforms, agricultural sector's contribution to GDP has fallen and industry and service sectors' contribution to GDP has increased. Figure 1.7 shows the sectoral composition of GDP in 2004.

Figure 1.7: Sectoral composition of GDP at factor cost in 2004 for India

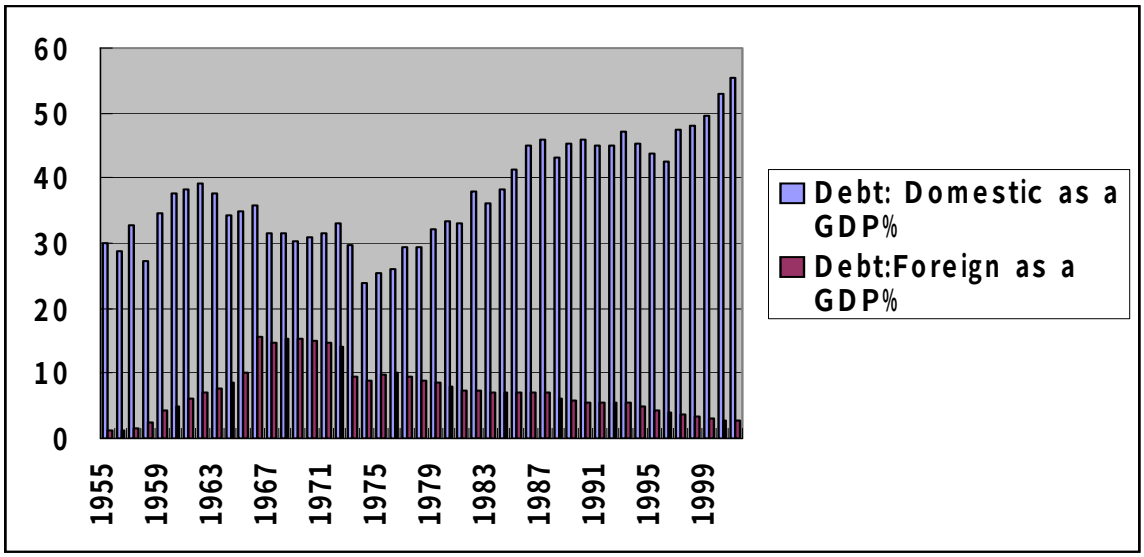


Source: International Monetary Fund (2005)

Compared to many other developing countries, India has not faced a persistent balance of trade problem. However, in the late 1980s, India was relying heavily on foreign borrowing to finance its development plans. Moreover, in the early 1990s, the world oil prices increased very sharply. As a result of the heavy foreign borrowing and high oil price, Indian government faced a severe balance of trade crisis.

The government embarked on a series of economic reforms to overcome the situation. Since then, foreign portfolio and direct investment flows have risen significantly and have contributed to healthy foreign currency reserves. Figure 1.8 shows the government domestic and foreign debt as a percentage of GDP.

Figure 1.8: Government debt as a percentage of GDP, 1955-2004



Source: International Monetary Fund (2005)

Most of the developing countries have the problem of existence of two separate economic systems within one country. This is called the dual economy problem. According to the Reserve Bank of India (2004), the Indian economy also has the so-called dual economy problem. In India, there is an informal or an unorganized, sector that is largely rural and it consists of farming, fishing, forestry, and cottage industries. The formal modern sector includes large-scale manufacturing and mining, major financial and commercial businesses, and telecommunications.

Although it has the dual economy problem, one should not overlook the progress India has achieved in the service sector especially in the field of information technology. India is one of the fine examples of how information technology (IT) would bring economic growth to a country. The government has recognized that IT can play a major

role as the enabler and accelerator of economic development. Reserve Bank of India (2003 and 2004) points that the economy is positively influenced by IT and software development sectors that has recently ridden the outsourcing boom. India has achieved a big niche in the international marketplace for IT products by using the low wages of its IT workers.

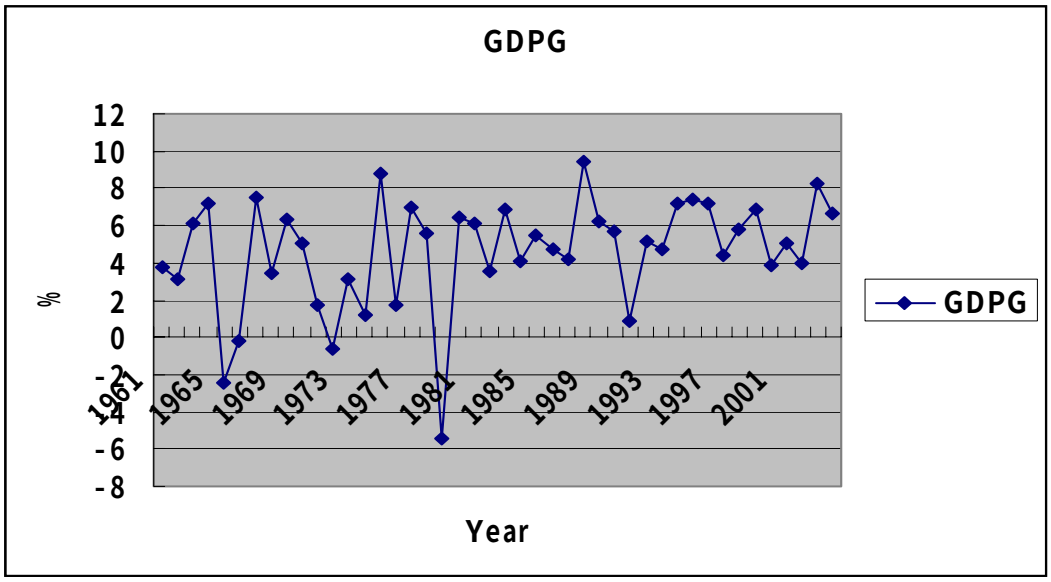
Reserve Bank of India (2005) points out that the U.S. has been the largest trading partner of India in the recent past. At present, textiles and ready-made garments, agricultural and related products, gems and jewelry, leather products, and chemicals are the main exports of India while aircraft and parts, advanced machinery, fertilizers, ferrous waste and scrap metal, and computer hardware are the main imports.

4.2.3. Gross domestic product

At independence, India had a lot of problems such as the war with Pakistan, lack of human resources, and poverty. However, now, India has a higher GDP growth rate than other countries in South Asia. Figure 1.9 indicates that during the 1950s, the average GDP growth rate was 4.5 percent. But after 1960, India's GDP growth rate fell dramatically. DeLong (2001) points out that many factors had contributed to the slowdown of the economy after the mid-1960s. DeLong argues that in India, structural deficiencies, such as the lack of institutional changes in agriculture and the inefficiency of the industrial sector, also contributed to economic stagnation during that period. In addition, wars with China in

1962 and with Pakistan in 1965 and 1971, respectively, currency devaluation in 1966, the first world oil crisis in 1973-74, and adverse weather conditions were also responsible for the low GDP growth rate. Figure 1.9 shows that the GDP growth rate was negative in 1979.

Figure 1.9: GDP growth rate for India, 1960-2005



Source: International Monetary Fund (2005)

The GDP growth rate increased in the 1980s. During 1980-1989, the economy performed better and GDP grew at an annual rate of 5.5 percent. During the period, Indian industry grew at an annual rate of 6.6 percent and agriculture at a rate of 3.6 percent. As DeLong (2001) explains, high rate of investment was a major factor for the GDP growth in the late 1980s. The balance of trade crisis of 1990 and the subsequent radical policy changes led to a temporary decline in the GDP growth rate, which fell from 6.9 percent in 1989 to 4.9 percent in 1990 and to 1.1 percent in 1991. However, since the 1990s, India

has been one of the fastest growing economies in the South Asian region and the world. This acceleration in the economic growth is mainly because of the policy changes that have been initiated since 1991.

4.2.4. Saving and investment

Over the past four decades, Indian saving rate has been consistently increasing though there are some fluctuations from year to year. The saving rate shows an upward trend from 1960 to 2004 although there are considerable fluctuations around the trend. The saving rate was about 10% of GDP in the early 1950s. It was about 17% in the early 1970s and it was about 25% in the late 1980s. According to the Reserve Bank of India (2005 and 2006), foreign remittances from Indian emigrants have increased since the late 1990s. Remittances from expatriates and others working abroad temporarily have contributed to the higher saving rate in the recent years. Wolf (2005) point outs the economic reforms which were initiated in the early 1990s have affected the saving rate in India. At present, the saving rate is about 30%.

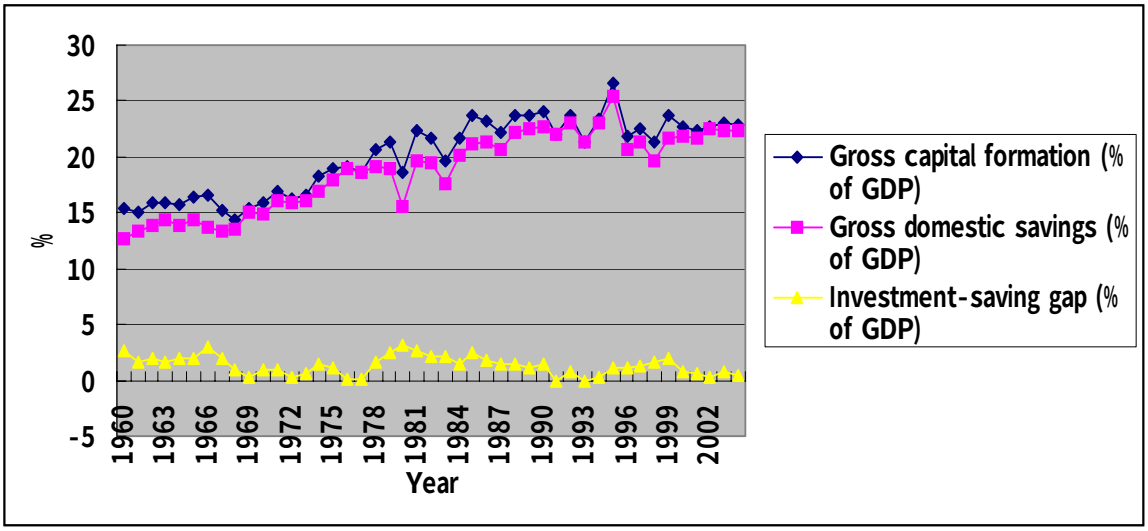
The main feature of Indian saving has been the dominant role of private saving during the period from 1960 to 2004. While the private saving rate has shown an increasing trend since 1960, public saving rate, which consists of saving by government administration, government departments and public enterprises, has shown a declining trend since the early 1980s (Athukorala and Sen 2003). The private saving rate increased

from about 8% in the early 1950s to 15% in the 1970s and to 25% in the late 1990s. The private saving rate has shown a much faster growth since the 1970s.

Table 1.2 shows that India's saving rate is the highest among the South Asian countries and it was much higher than many of the East Asian countries during the 1960s. By the mid 1990s, when most of the East Asian countries achieved high economic growth rates, Indian saving rate was lower than that of many East Asian countries. In Latin America, countries such as Venezuela and Peru had a high saving rate than that of India.

Since independence, the investment rate has shown an upward trend for India. However, Figure 1.10 shows that there are some fluctuations around the trend. The investment rate increased from 12% in the early 1960s to around 15% in the late 1970s and to 25% by mid-1990. It was around 23% in the early 2000. A narrow saving-investment gap has been one of the main features of the Indian economy.

Figure 1.10: Saving-investment gap for India, 1960-2004



Source: World Bank (2006)

Table 1.2: Average saving rate as a percentage of GDP for selected countries

South Asia	**1960-64**	**1965-69**	**1970-74**	**1975-79**	**1980-84**	**1985-89**	**1990-94**	**1995-99**	**2000-04**
Bangladesh	NA	NA	NA	1.5	1.9	2.9	12.0	14.6	17.5
India	14.3	15.0	17.4	20.8	19.3	20.8	22.4	21.7	22.1
Pakistan	10.5	11.8	8.7	7.3	7.9	9.6	15.4	14.8	14.2
Sri Lanka	11.9	10.4	13.5	13.8	13.7	11.6	14.8	17.3	15.8
East Asia									
China	33.2	33.0	33.5	32.6	34.3	35.2	39.7	42.1	43.6
Hong Kong	20.9	25.8	29.3	32.3	31.7	35.0	33.4	29.7	31.5
Indonesia	10.0	5.6	20.7	28.1	31.6	29.3	32.7	27.6	22.8
Korea	4.4	13.0	17.5	25.3	26.9	35.6	34.9	36.2	31.9
Malaysia	23.8	24.4	26.9	32.5	31.6	34.6	36.8	44.5	43.3
Singapore	4.3	14.9	24.0	33.2	42.7	41.0	45.4	51.1	45.8
Thailand	16.4	21.3	22.6	21.9	23.8	29.1	35.5	35.1	31.3
Latin America									
Argentina	22.1	23.7	23.7	30.6	23.5	21.2	16.9	17.1	22.0
Brazil	19.8	20.3	20.1	21.5	20.9	25.5	21.6	19.1	21.8
Chile	15.2	20.0	16.3	17.3	14.3	25.3	26.0	24.5	25.6
Costa Rica	14.4	13.0	14.6	16.1	22.9	23.7	15.9	16.6	18.3
El Salvador	12.4	11.0	14.3	18.8	8.2	5.7	2.8	4.5	1.3
Haiti	5.2	3.1	9.0	7.3	6.2	4.9	1.0	6.2	4.1
Jamaica	26.0	28.1	21.5	15.0	14.0	19.7	22.8	16.9	13.0
Mexico	16.1	18.2	18.1	20.3	27.1	23.6	18.9	23.5	19.2
Nicaragua	15.1	15.8	16.5	15.5	6.3	4.6	6.3	6.7	10.0
Paraguay	12.6	12.8	15.8	21.6	18.8	20.6	12.5	7.5	9.7
Peru	38.0	29.2	17.1	18.0	28.5	21.5	16.4	18.8	18.6
Uruguay	18.2	19.4	18.0	18.9	16.0	17.3	16.5	14.9	14.2
OECD Countries									
Canada	21.7	25.2	24.9	24.1	24.3	23.3	19.1	22.9	25.2
France	28.0	28.9	27.3	24.2	20.4	20.8	21.2	21.0	21.7
Italy	36.4	25.3	25.5	26.1	23.6	22.8	21.6	22.9	20.8
Japan	34.4	36.3	38.6	32.7	31.1	32.5	32.5	29.1	26.0
UK	18.1	20.0	19.9	20.3	18.7	18.1	15.8	16.6	14.0
United States	19.6	20.2	19.6	19.8	18.9	16.8	16.2	17.6	14.9

Source: World Bank (2006)

Figure 1.10 shows that except for 1991 and 1993, the investment rate has been higher than the domestic saving rate in India. The saving-investment gap has been consistently less than 3.5 as a percentage of GDP in India from 1960 to 2003.

4.3. Pakistani economy

Pakistan became an independent country in 1947. It has an area of about 796,000 sq. km with an estimated population of 152.1 million. Its population density is 197 persons per sq. km. Pakistan is the sixth most populous country in the world. Since its independence, Pakistan faced a number of challenges on the political and economic fronts. Pakistan is a politically unstable country. It has suffered from decades of internal political disputes and confrontations with the neighboring India. Monshipouri and Samuel (1995) point out that the three military leaders who governed Pakistan, implemented martial law to govern the country. Under these military regimes, the socio-economic development was low and problems such as poverty, income inequality, unemployment, and inflation were not attended to.

Pakistan followed import substitution policies until the late 1980s. Monshipouri and Samuel (1995) point out that import substitution policies that were pursued by the governments since independence were imprudent and led to a slowdown of economic growth in Pakistan in the 1990s. From 1990, the government has started to follow an open economy policy. State Bank of Pakistan (2002) points out that the government has been

implementing substantial macroeconomic reforms since 2000, after being advised by the International Monetary Fund (IMF). Since 2000, the government has begun to remove barriers to foreign trade and investment, reform the financial system, ease foreign exchange controls, and privatize state-owned enterprises.

4.3.1. Degree of social development

Partially due to the low growth rate, Pakistan has achieved very low progress in social and human development.

No more than 45.7 percent of adults are literate, and life expectancy is about 63 years. The population is growing at over 2.4 percent annually which is very close to average real GDP growth rate since independence. According to State Bank of Pakistan (2004), poverty and income inequality are the major problems.

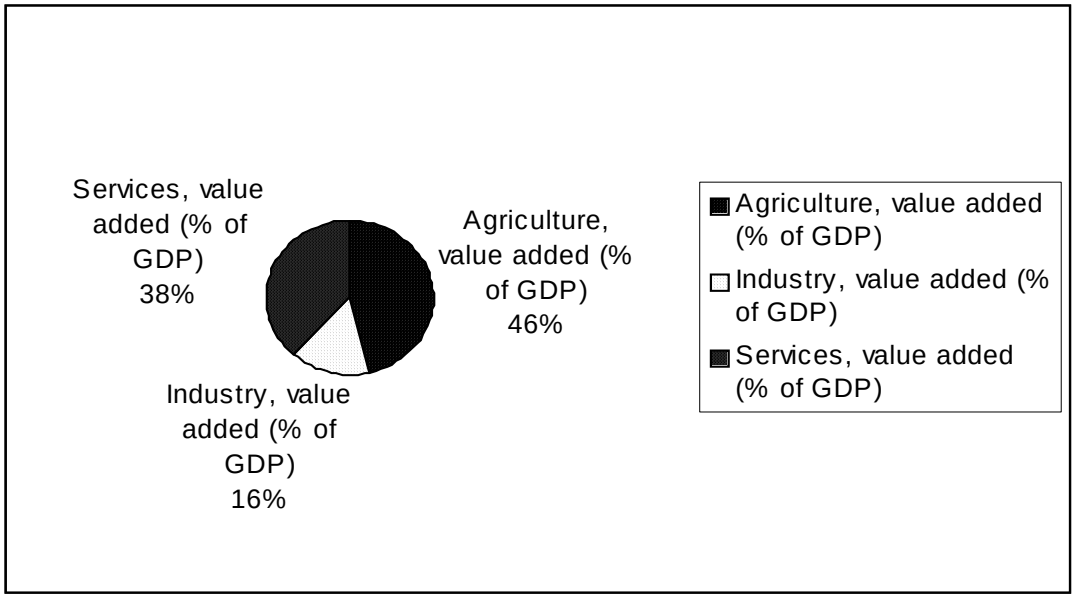
Table 1.1 compares some key social development indicators of Pakistan with that of some developed countries. In Pakistan, inadequate provision of social services such as health, education and high annual population growth rate have contributed to a persistence of poverty and income disparity.

4.3.2. Economic structure

At independence, agricultural activities accounted for 46 percent of GDP in Pakistan. Its principal natural resources are arable land, water, and extensive natural gas reserves. The most important agricultural crops are cotton, wheat, rice, sugarcane, fruits, and vegetables.

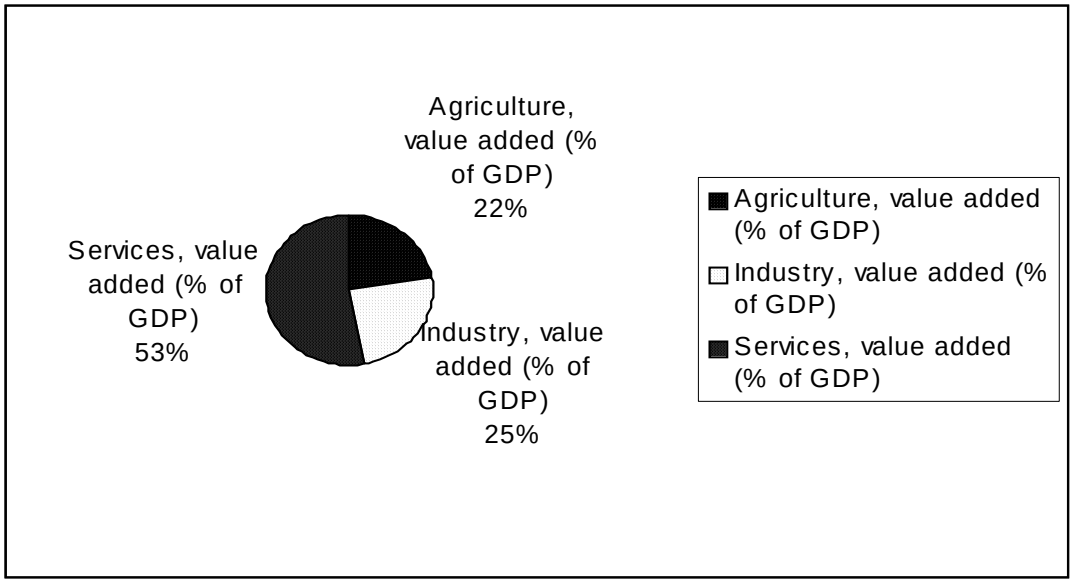
After the introduction of the open economy policy, the GDP growth rate has accelerated in the recent past. Also, Pakistan's industrial and service sectors are experiencing a rapid growth. At present, Pakistan receives its foreign exchange mainly from the textile industry.

Figure 1.11: Sectoral composition of GDP at factor cost in 1960 for Pakistan



Source: International Monetary Fund (2005)

Figure 1.12: Sectoral composition of GDP at factor cost in 2004 for Pakistan

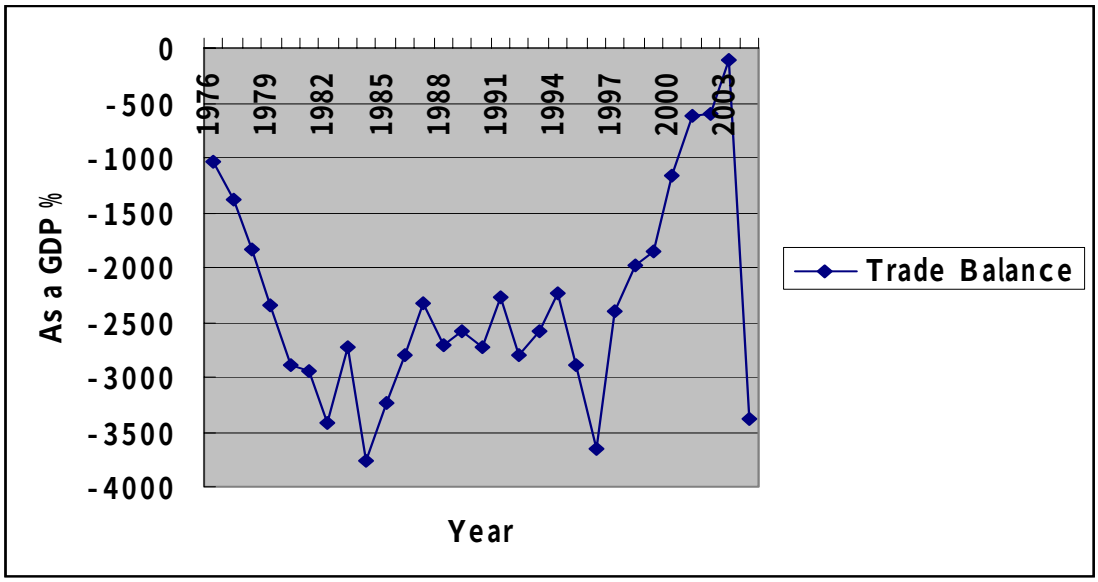


Source: International Monetary Fund (2005)

The textile industry is responsible for over 64 percent of the country's exports. Growth of non-agricultural sectors such as industry and service sectors has changed the structure of the economy, and at present, agricultural value added to GDP is one-fifth of GDP. Figures 1 and 2 show sectoral composition of GDP for Pakistan in 1960 and 2004, respectively.

The current account deficit is an important indicator for any country to gauge the pressure on a country's external sector. According to State Bank of Pakistan (2003 and 2004), a persistent current account deficit has led to a depreciation of the Pakistani rupee. Economic mismanagement and fiscally imprudent economic policies caused a large increase in the public debt and led to fall in the foreign currency reserves in the 1990s. Figure 1.13 shows the balance of trade in Pakistan.

Figure 1.13: Balance of trade for Pakistan, 1976-2004



Source: International Monetary Fund (2005)

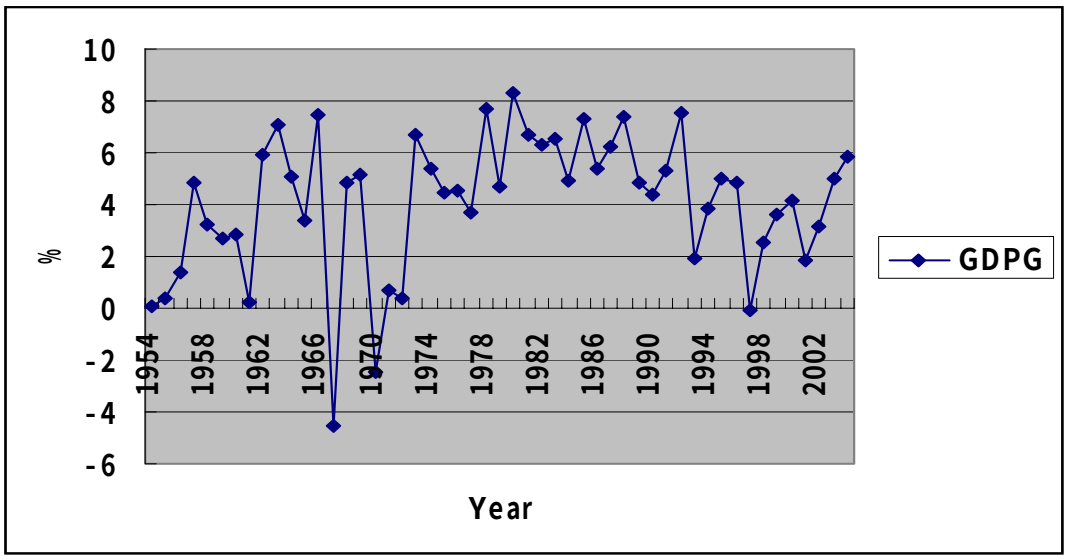
At the end of June 2001, the net present value of Pakistan's public external debt

was estimated to be about 260% of the value of exports of goods and services (State Bank of Pakistan, 2003). This is far in excess of the commonly accepted benchmarks for sustainability, which fall in the range of 150–200%. State Bank of Pakistan (2003) shows that in the recent years, FDI inflows have fallen, because of Pakistan's tense relationship with India. Fallen in FDI would put more pressure on the economy and would further deteriorate the balance of trade.

4.3.3. Gross domestic product

During first decade after independence, Pakistan made good economic progress because it had relatively peaceful social and political situations. The average annual GDP growth rate was about 3.5 percent until mid 1960s. Figure 1.14 shows that GDP growth rate was 6 percent per year during 1980-1990, but it decreased after 1997. State Bank of Pakistan (2000) argues that GDP growth rate fell after 1997 due to the financial crisis in Asia.

Figure 1.14: GDP growth rate for Pakistan, 1954-2004



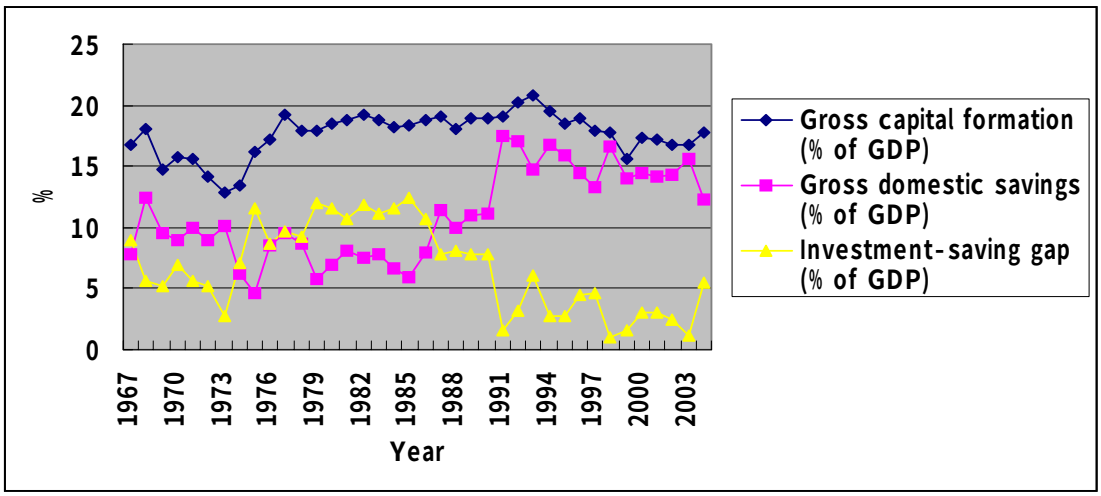
Source: Source: International Monetary Fund (2005)

According to the State Bank of Pakistan (2004), the government hopes to achieve a 8 percent GDP growth rate by the end of 2010.

4.3.4. Saving and investment

Pakistan's saving rate is about 12 %. This is one of the lowest in Asia for the period for 2000-2004. The saving rate showed a downward trend from 1967 to 1986. However, from 1987 to early 1990s, there was an upward trend in the saving rate. Once again, Pakistan's saving rate shows a downward trend from the mid-1990s. According to the State Bank of Pakistan (2004), the national saving rate in Pakistan has been lower than the domestic saving rate for most years because of the negative balance in the current account. The State Bank of Pakistan (2004) points out that private saving rate has been increasing while public saving rate had been declining during the period from 1960 to 2003.

Figure 1.15: Saving-investment gap for Pakistan, 1967-2004



Source: World Bank (2006)

Table 1.3 shows that Pakistan's saving rate is much lower than that of many East Asian

countries over the period from 1965 to 2004. For 1960-1964, Pakistan's saving rate was much higher than that of Singapore, Korea and Indonesia. From the late 1960s, Pakistan's saving rate has been lower than that of all East Asian countries. Among the four South Asian countries, Pakistan's saving rate is now only higher than that of Bangladesh. In Latin America, saving rates of all most all the countries have been consistently higher than that of Pakistan from 1960 to 2004, except for Haiti.

Pakistan has a relatively modest investment rate. There has not been a consistence increase in the investment rate for Pakistan. Investment rate in Pakistan decreased from the late 1960s to the early 1990s and then increased from the late 1990s. Figure 1.15 shows that the investment-saving gap has reduced during the period from 1967 to 2004. According to the State Bank of Pakistan (2004), the current investment rate is inadequate for both current and future needs of economic growth for Pakistan.

4.4. Sri Lankan economy

Sri Lanka is a small island with a population about 19.1 million and a landmass of 65,525 $km^{2.}$ It is located below India in the South Asian region. Sri Lanka is a democratic country. The island was known as Ceylon until 1972. It had been colonized by various Western nations for more than 500 years. Sri Lanka regained its independence in 1948. Until the late 1970s, Sri Lanka had a planned economic. Sri Lanka started its program of liberalization in the late 1970s. The government abolished the import substitution policy

and introduced export-oriented policy in 1978.

Unfortunately, since the early 1980s, Sri Lanka has experienced an ethnic conflict. This has led to a huge government budget deficit. Economic progress of the country has been badly affected by the war. As Lakshman (1997) indicates, if there were no civil war, Sri Lanka would likely be one of Asia's top economic performers.

4.4.1. Degree of social development

Although Sri Lanka has low economic growth, it has performed well in terms of social indicators. The government has been emphasizing social welfare in its economic development strategies since independence. As a result, it has achieved higher social development level compared to other developing countries.

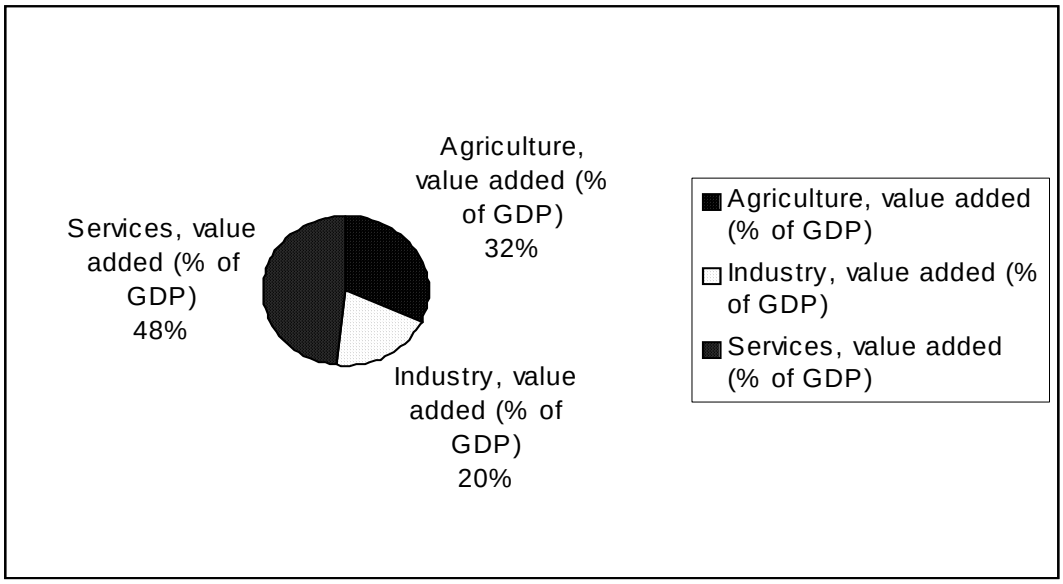
According to the Central Bank of Sri Lanka (2004), Sri Lanka had a literacy rate of 90%, a school enrolment ratio of 97%, and a life expectancy of 73.1 years in 2004. Most of these social indicators of development are much higher than those in other countries with similar per capita income levels as Sri Lanka. Table 1.1 shows some key indicators of social development of Sri Lanka and some selected industrial countries.

4.4.2. Economic structure

The economy was heavily dependent upon agricultural export during independence. According to Lakshman (1997), until the early 1980s agricultural sector accounted for almost 50% of the GDP. Primary agricultural products were tea, coffee, rubber and coconut.

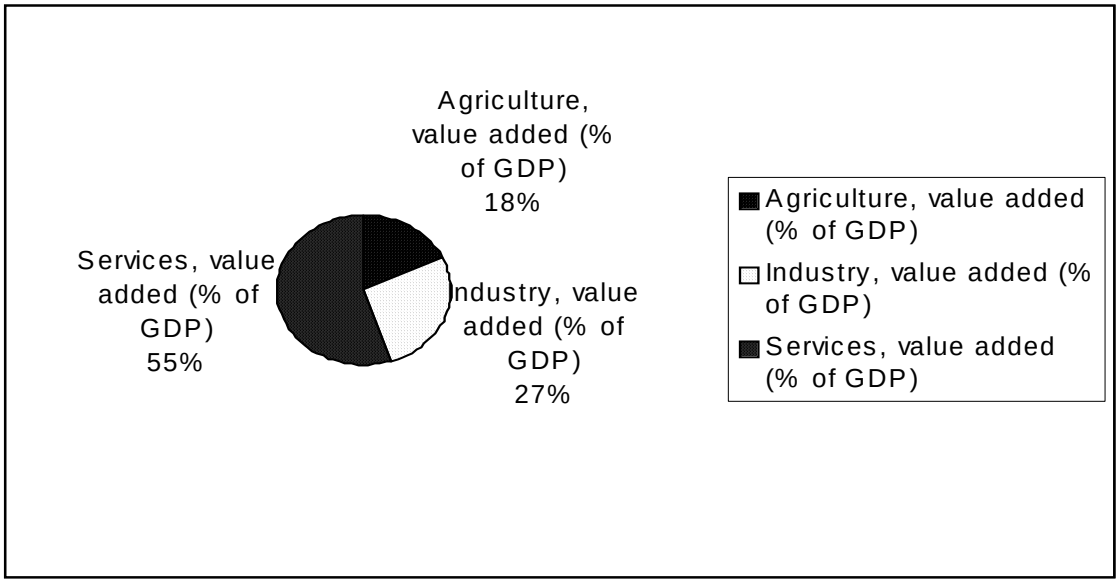
Tea, which is famous all over the world, is the main export crop and principal foreign exchange earner even today. Figure 1.16 shows the sectoral composition of GDP in 1960.

Figure 1.16: Sectoral composition of GDP at factor cost in 1960 for Sri Lanka



Source: International Monetary Fund (2005)

Figure 1.17: Sectoral composition of GDP at factor cost in 2004 for Sri Lanka

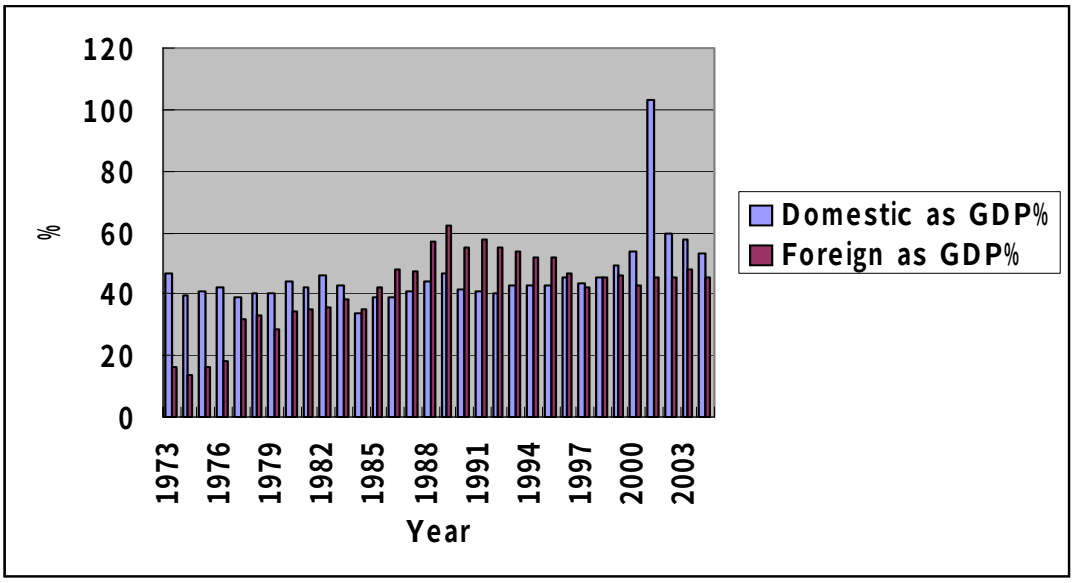


Source: International Monetary Fund (2005)

The government has undertaken measures to diversify the economic structure since the early 1980s. As a result, contribution of the agricultural sector to GDP has fallen during the past few years. Figure 1.17 shows the sectoral composition of GDP in 2004.

The existence of the dual economy has been one of the main problems since independence. The dual economy consists of a modern export oriented sector and a traditional subsistence sector. These two sectors have minimal interrelationships. The export oriented sector deals with plantations, transport, communication, banking, and garment and apparel. The traditional sector consists of peasant agriculture, small scale fishing, cottage industry, and informal service sector. According to the Central Bank of Sri Lanka (2004), at present, Sri Lanka's most dynamic sectors are textile and apparel, food and beverage, telecommunication, and insurance and banking, and food processing.

Figure 1.18: Government debt as a percentage of GDP for Sri Lanka, 1973-2004



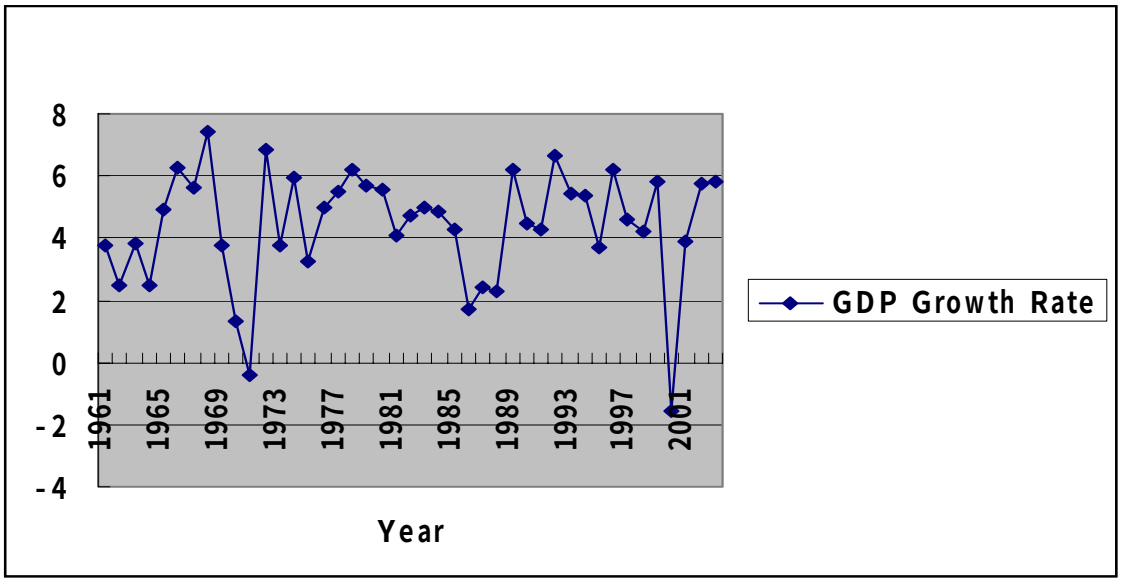
Source: International Monetary Fund (2005)

Sri Lanka has been having a persistent balance of trade problem. The country is dependent on large amounts of foreign aid and loans. Figure 1.18 shows the government domestic and foreign debt as a percentage of GDP. However, according to Central Bank of Sri Lanka (2004), most of the foreign loans are from bilateral agreements and thus, cost of the foreign loans is low.

4.4.3. Gross domestic product

Until late 1970s, the public sector contributed to GDP more than the private sector. Since 1977, the government has attempted to downsize and to privatize the public enterprises. As a consequence, the government's role as a producer has diminished since 1977. Though the ethnic conflict has affected the economy, Sri Lanka has been having a positive GDP growth rate since independence except for 1973 and 2001.

Figure 1.19: GDP growth rate for Sri Lanka, 1961-2004



Source: International Monetary Fund (2005)

Because of the sustained economic growth, coupled with average population growth of only 1.1%, has pushed Sri Lanka from the ranks of the poorest countries up to the middle income countries in the recent past. Figure 1.19 shows the GDP growth rate in Sri Lanka.

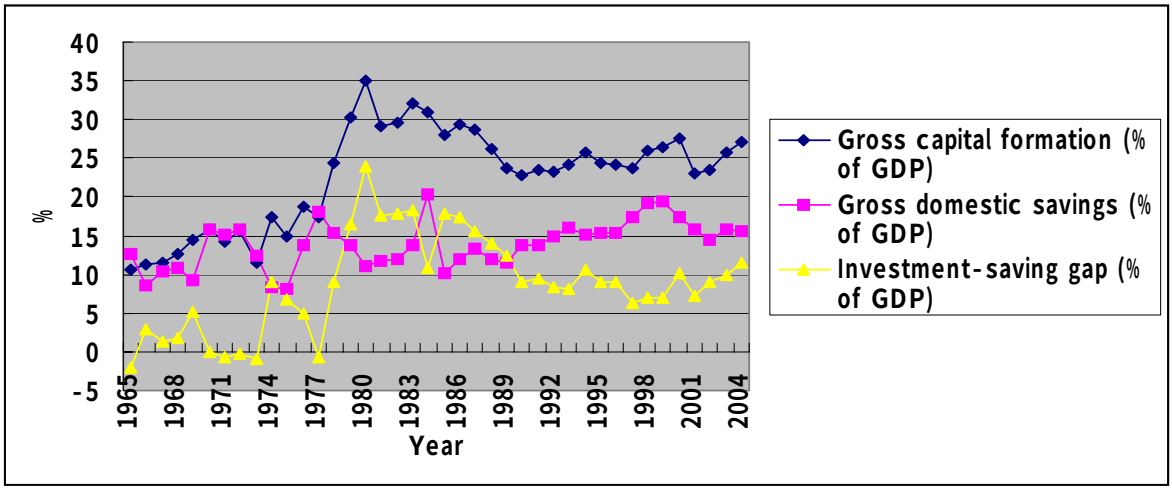
From 1950 to 1977, when Sri Lanka heavily relied on agricultural products, it had an annual GDP growth rate of 4.6 per cent. GDP grew at an average rate of 5.5% in the early 1990s. But in the late 1990s, due to a drought and ethnic violence GDP growth rate fell to 3.8%. In 2001, Sri Lanka for the second time in its history experienced a negative GDP growth rate of -1.4%, because of many reasons such as power shortage, severe budgetary problem, the global slowdown, and continuing civil conflict. However, economic growth recovered to 4.0% in 2003 and to 5.2% in 2004.

4.4.4. Saving and investment

Figure 1.20 shows the trends of domestic saving rate, investment rate and gap between saving and investment rates for Sri Lanka. Though there had been a decline in the size of the gap between saving and investment rates in the late 1990s, Sri Lanka has a much higher gap than other South Asian countries. Central Bank of Sri Lanka (2004) points out that the public sector's contribution to domestic saving was almost equal to zero or negative during the period from 1965 to 2003. Except for a few years from 1965 to 2003, the government consumption expenditure exceeded the government revenue.

Except for a few years, the national saving rate has been higher than the domestic saving rate, because of net private transfers from abroad has been positive for most of the years. Figure 1.20 shows that the investment-saving gap for Sri Lanka has reduced since the late 1980s. According to the Central Bank of Sri Lanka (2002), a proportion of the investment-saving gap is financed by private remittances from Sri Lankans who are living abroad. Private remittances have been increasing continuously since 1996. It increased from 5.5% of GDP in 1996 to 6.8% of GDP in 2002.

Figure 1.20: Saving-investment gap for Sri Lanka, 1965-2005



Source: World Bank (2006)

The average investment rate had been about 14% from 1965 to 1975. There was an upward trend during the period from 1965 to 1977. According to Lakshman (1997), from 1965 to 1977, state sponsored activities expanded in many sectors and the share of public investment averaged more than 40% percent of the total investment. The government that was elected in 1977 introduced economic reforms in the late 1970s. After

the economic reforms, the share of public investment gradually decreased. At present, the share of public investment is less than 25% of the total investment. Soon after the economic reforms, investment rate increased to 18%. This sharp increase was mainly because the private sector increased its contribution to gross capital formation. Because of the civil conflicts, investment rate has been showing a downward trend in Sri Lanka since the 1980s.

For the period from 1965 to 2003, the saving rate had been about 14% which was lower than that of many East Asian or OECD countries. In South Asia, saving rate of Sri Lanka is slightly higher than that of Pakistan and Bangladesh. Until 1964, the saving rate was higher than that of Singapore, Korea and Indonesia. Table 1.3 shows that in Latina America, most of the countries have a higher saving rate than Sri Lanka.

5. Data and methodologies

Data are from two sources for the study. The sources are the *World Development Indicators* of the World Bank and the *International Financial Statistics* of the International Monetary Fund. Time span is different for the countries because of non-availability of data. We use different time periods for the four countries based on data availability.

We study the unit root properties of the variables using Ng-Perron unit root tests. OLS and the fixed effects panel least squares (PLS) are used for regression analysis for individual and panel data, respectively. For cointegration tests between saving and

investment, we use both the error correction model that was used by Jansen (1996) and the Johansen cointegration tests. The Johansen cointegration tests are used to study the relationships between saving and GDP, and saving and export. For the individual country studies, if the variables are found to be cointegrated, we use the augmented Granger causality test. If the variables are not cointegrated, but stationary, the standard Granger causality tests are performed. We use the VARMAX procedure in the SAS program for the panel Granger causality tests. The impulse responses are studied by using Cholseky ordering. For the panel data, we use the panel cointegration test which is presented by Larsson et al. (2001).

6. Organization of the thesis

The reminder of the thesis is organized as follows. An overview of growth theories and methodologies for individual country studies are discussed in chapter two. Also, the chapter deals with methodologies for the panel study, panel regression, and causality and cointegration tests. In the third chapter, we present a brief literature review, the theoretical relationship and the empirical results on the determinants of saving. The literature on saving-investment, the theoretical relationship between saving and investment, and the empirical results are discussed in chapter four. The fifth chapter has the literature review and the empirical findings for the relationship between saving and economic growth. The sixth chapter presents the panel study for the South Asian countries. It includes the

empirical results of the relationships between saving and investment, and saving and economic growth. The determinants of saving rate for the panel study are discussed in this chapter. The seventh chapter presents the results of the relationship between saving and export for the individual and panel studies. It includes a brief literature review on the relationships between saving and export. The regression results of the two saving functions i.e. the Keynesian and the Maizels' for the four South Asian countries are presented. The conclusion and summary of the findings are given in chapter eight.

CHAPTER TWO

METHODOLOGIES FOR EMPIRICAL ANALYSIS

1. Introduction

In this chapter, we present an overview of selected economic theories and advanced econometric methodologies that are used in this thesis. Also, we discuss the data sources and time period of data for individual country and panel studies.

2. Econometric methodologies

This section provides a general description of the econometric methodologies. First, we describe the error correction models which are used to test for cointegration between variables. Methodologies for standard Granger causality and augmented Granger causality tests are explained in the next section. Finally, we discuss the method of the panel study.

2.1. The two error correction models for cointegration tests

We use two error correction models for individual country studies. These are the error correction model that was used by Jansen (1996) and the Johansen cointegration tests.

2.1.1. Error correction model by Jansen

According to Sinha and Sinha (2004), the error correction model which was used by Jansen has a number of advantages. The model shows both the short-run and the long-run relationships between saving and investment rates. Also, the model captures co-movement of saving and investment rates in response to shocks that hit the economy in the recent past.

The equation estimated by Jansen (1996) takes the following form.

$$\Delta IR = \alpha + \beta \Delta SR_t + \gamma (SR_{t-1} - IR_{t-1}) + \delta SR_{t-1} + \varepsilon_t \qquad (2.1)$$

IR and *SR* are investment and saving rates, respectively. Δ is the first difference of the variable and *t* stands for time. The coefficient β captures the Feldstein and Horioka (1980) type correlation between saving and investment rates and β measures the short-run relationship between saving and investment. According to Sinha and Sinha (2004), β is a measure of the extent to which shocks pass immediately through to investment in the current period. The error correction term γ captures the long-term relationship between saving and investment rates. The coefficient δ measures the capital mobility in terms of current account solvency constraint.

If γ is statistically significant, it means that saving and investment rates are cointegrated and there is no capital mobility. Conversely, if γ is statistically insignificant, it means that saving and investment rates are not cointegrated and thus, there is evidence of capital mobility. In case of capital immobility, we expect statistically significant values for β and γ, and statistically insignificant value for δ. The model helps to separate the short-run from the long-run dynamics of the relationship between saving and investment and relates the saving and investment relationship to the dynamics of the current account.

2.1.2. The Johansen cointegration tests

Next, we perform the VAR-based cointegration tests using the methodology developed by

Johansen (1991 and 1995). According to Baharumshah et al. (2003) and Schmidt (2001), the Johansen cointegration test helps to identify the long-run relationships between two or more variables and to avoid the risk of spurious regressions. The Johansen cointegration test is based on the maximum likelihood procedure and it provides a unified framework for testing of cointegrating relations in the context of vector autoregressive (VAR) error correction models. Schmidt (2001) and Sinha (1998) point out that the Johansen cointegration tests are more robust and it is easier to conduct than the residual-based cointegration tests proposed by Engle and Granger (1987). Schmidt points out that the Johansen framework is less sensitive to the choice of lags and is better suited to study the cointegration with small samples. The Johansen framework in VAR is given as follows.

Consider a VAR of order *p*:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t \qquad (2.2)$$

where y_t is a *k*-vector of non-stationary *I*(1) variables, x_t is a *d*-vector of deterministic variables, and ε_t is a vector of innovations. Now, we can rewrite this VAR as

$$\Delta y_t = \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \varepsilon_t \qquad (2.3)$$

where:

$$\Pi = \sum_{i-1}^{p} A_i - I, \text{ and } \Gamma_i = -\sum_{j=i+1}^{p} A_j \qquad (2.4)$$

The Granger representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exist k X r matrices α and β each with rank r such that $\Pi = \alpha\beta'$

and $\beta' y_t$ is $I(0)$. r is the number of cointegrating relations or the cointegrating rank and each column of β is the cointegrating vector. The elements of α are known as the adjustment parameters in the vector error correction (VEC) model. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π. Johansen (1995) suggests two tests statistics to determine the cointegration rank.

The first is known as the trace statistic. The trace statistic tests a null hypothesis of r cointegrating relations against an alternative of k cointegrating relations, where k is the number of endogenous variables, for r = 0 ,1 ,…..K-1. The trace statistic for the null hypothesis of r cointegrating relations is computed as:

$$LR_{tr}(r|k) = -T\sum_{i=r+1}^{k}\log(1-\lambda_i) \tag{2.5}$$

where λ_i is the i-th largest eigenvalue of the Π matrix in equation (2.4).

The second test statistic is the maximum eigenvalue test. The maximum eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative hypothesis of r+1 cointegrations. The eigenvalue statistic is computed as follows.

$$LR_{\max}(r|r+1) = -T\log(1-\lambda_{r+1}) \tag{2.6}$$

$$= LR_{tr}(r|k) - LR_{tr}(r+1|k) \quad \text{for } r = 0, 1, \ldots, k\text{-}1 \tag{2.7}$$

However, Johansen and Juselius (1990) argue that the trace test might lack power relative

to the maximum eigenvalue test. Also, they point out that the trace statistic and the maximum eigenvalue statistic may yield conflicting results in some cases. Thus, if any conflicting results are given by the two tests, the maximum eigenvalue test statistic will be preferred because of the power of the test.

3. Methodologies for Granger causality tests

The concept of Granger causality was first introduced by Granger (1969). Granger causality test has been employed to evaluate the forecasting power of one time series by another time series in empirical studies after the pioneering work by Granger. Granger points out that ordinarily, regressions study mere correlations and do not test the forecasting power of one time series by another time series. Y is said to “Granger-cause” X, if a scalar Y can help to forecast another scalar X. If Y causes X and X does not cause Y, it is said that unidirectional causality exists from Y to X. If Y does not cause X and X does not cause Y, then X and Y are statistically independent. If Y causes X and X causes Y, it is said that a feedback exists between X and Y.

Gujarati (1995) points out that the statement “X Granger causes Y” does not imply that Y is the result of X. Granger causality measures precedence and information content between two or more time series and does not by, itself, indicate causality in the more common use of the term.

3.1. Standard Granger causality tests

We use pair-wise Granger causality tests in a VAR setting. The bivariate regressions for causality are given as follows.

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + ... + \alpha_j y_{t-j} + \beta_1 x_{t-1} + ... + \beta_j x_{-j} + \varepsilon_t \quad (2.8)$$

$$x_t = \alpha'_0 + \alpha'_1 x_{t-1} + ... + \alpha'_j x_{t-j} + \beta'_1 y_{t-1} + ... + \beta'_j y_{-j} + \mu_t \quad (2.9)$$

The null hypothesis is that *x* does not Granger-cause *y* in the first regression. In the second regression the null hypothesis is that *y* does not Granger-cause *x.* The *F-statistic* is used to test for the joint significance of each of the other lagged endogenous variables in the equations. The null hypothesis for the *F-statistic* is given as follows.

$$\beta_1 = \beta_2 = ... = \beta_j = 0 \quad (2.10)$$

Claus et al. (2001) argue that empirical test for the Granger causality is sensitive to the choice of lag length. Thus, bivariate Granger causality tests are conducted by using different lag lengths in order to ensure that the results are not affected by the choice of the lag lengths.

.2. Augmented Granger causality tests

If the variables are cointegrated, the standard Granger causality tests are not valid. When the variables are found to be cointegrated, we can proceed with the error correction model for the causality testing. According to Sinha (1998), the test gives more robust results than the standard Granger causality test. The equations for the augmented Granger causality test

are as follows.

$$\Delta x_t = a_0 + a_1 z_{t-1} + \sum_{i=1}^{g} c_i \Delta x_{t-i} + \sum_{j=1}^{h} d_j \Delta y_{t-j} + \varepsilon_t \tag{2.11}$$

$$\Delta y_t = a_0' + a_1 z_{t-1}' + \sum_{i=1}^{g} c_i \Delta x_{t-i}' + \sum_{j=1}^{h} d_j \Delta y_{t-j}' + v_t \tag{2.12}$$

(2.20) and (2.21) are restricted regressions. In (2.11) and (2.12), z_{t-1} and z_{t-1}' are the lagged error terms. Δ is the first difference of the variable. The two lagged error terms are the result of the following cointegrating equations, i.e. (2.13) and (2.14), respectively.

$$y_t = g_0 + g_1 x_t + z_t \tag{2.13}$$

$$x_t = h_0 + h_1 y_t + z_t' \tag{2.14}$$

The two restricted regressions are given as follows.

$$\Delta x_t = a_0 + \sum_{i=1}^{g} c_i \Delta x_{t-i} + \varepsilon_t \tag{2.15}$$

$$\Delta y_t = a_0' + \sum_{j=1}^{h} d_j \Delta y_{t-j} + v_t \tag{2.16}$$

The *F-statistic* for the causality test is calculated as follows.

$$F = (n-k-1)\frac{(ESSR - ESSU)}{q(ESSU)} \tag{2.17}$$

In (2.17), *ESSR* is the error sum of squares in the restricted regression. *ESSU* is the error sum of squares in the unrestricted regressions. The number of degrees of freedom of the regression is denoted by (*n-k-1*). The number of parameter restrictions is denoted by *q.* The *F-statistic* is distributed as *F (q, n-k-1)*. The null hypothesis in the error correction model is one of non-causality.

4. Methodologies for the panel study

We use the fixed effects panel least squares (PLS) method. Let us assume Y and X are dependent and independent variables of a cross-section of countries, respectively. Also, assume that we have a balanced panel where the number of observation on each cross-section unit is the same. Then, the panel regression model is given as follows.

Y_{it} = value of the dependent variable for cross section country i at time t

Where $i = 1,\ldots,n$ and $t = 1,\ldots,t$

X_{it}^{j} = value of the jth explanatory variable for country i at time t. There are K explanatory variables indexed by $j = 1,\ldots,K$..

Then, the way of organizing the panel data is given as follows.

$$Y_i = \begin{bmatrix} Y_{i1} \\ Y_{i2} \\ \vdots \\ Y_{iT} \end{bmatrix}, \quad X_i = \begin{bmatrix} X_{i1}^1 & X_{i1}^2 & X_{i1}^3 \\ X_{i2}^1 & X_{i2}^2 & X_{i2}^3 \\ \vdots & \vdots & \vdots \\ X_{iT}^1 & X_{iT}^2 & X_{iT}^3 \end{bmatrix} \text{ and } \varepsilon_i = \begin{bmatrix} \varepsilon_{i1} \\ \varepsilon_{i2} \\ \vdots \\ \varepsilon_{iT} \end{bmatrix} \tag{2.18}$$

where ε_{it} denotes the error term for the ith country at time t. Hence, the data take the following form in the E-Views.

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}, \quad X = \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} \text{ and } \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix} \tag{2.19}$$

where Y is nT X 1, X is nT X K, and ε is nT X 1. Therefore, the standard liner model is given as follows.

$$Y = X\beta + \varepsilon \tag{2.20}$$

Where $\beta = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_K \end{bmatrix}$ (2.21)

4.1. The process of the panel cointegration test

We use the panel cointegration test which is described in Larsson et al. (2001). Larsson et al. present a maximum-likelihood-based panel test for the cointegrating rank in heterogeneous panels. They modify the Johansen trace test procedure for the panel cointegration tests. They propose a standardized LR-bar test based on the mean of the individual rank trace statistic of Johansen (1995).

Also, for the panel cointegration tests, we use the vector autoregressive and moving average processes with exogenous regressors (VARMAX). Brocklebank and Dickey (2003) point out that the time series are both contemporaneously correlated to each other and to each other's past values. According to them, the VARMAX procedure can model both types of the correlations. Further, they suggest that the VARMAX model is more powerful for panel studies. The VARMAX model is defined in terms of the orders of the autoregressive or moving-average process or both. The general form of the vector

autoregressive and moving average processes with exogenous regressors is given as follows.

$$Y_t = \delta + \sum_{i=1}^{p} \phi_i Y_{t-i} + \sum_{1=0}^{s} \Theta_i^n X_{t-i} + \varepsilon_t - \sum_{i=1}^{q} \Theta_i \varepsilon_{t-i} \tag{2.22}$$

Where the output variable of interest, i.e. Y_t = (Y_{1t},...Y_{kt}), can be influenced by other input variables, X_t = (X_{1t},...X_{rt}), which are determined outside the system. Y_t is considered the dependent, response, or endogenous variable, and the variable X_t is referred to as the independent, or exogenous variable. ε_t is equal to $\varepsilon_t = (\varepsilon_{1t,}...,\varepsilon_{kt})$ and it is the vector for white noise processes.

4.2. Panel causality for the major South Asian countries

We use the VARMAX procedure for the panel Granger causality tests. We conduct the panel Granger causality test between saving and GDP, and saving rate and investment rate. Bivariate Granger causality test is used and the model is given as follows. Let us assume that Y_t is arranged and divided into subgroups of Y_{1t} and Y_{2t} with dimensions of k_1 and k_2, respectively. k and Y are equal to $k = k_1 + k_2$ and $Y_1 = (Y_{1t}{}', Y_{2t}{}')'$, respectively. The white noise process is equal to $\varepsilon_t = (\varepsilon_{1t}', \varepsilon_{2t}')'$. Then, the VARMAX($p$) model with partitioned coefficients $\Phi_{ij}(B)$ for $i, j = 1,2$ can be expressed as follows

$$\Phi(B)Y_t = \begin{bmatrix} \Phi_{11}(B) & \Phi_{12}(B) \\ \Phi_{21}(B) & \Phi_{22}(B) \end{bmatrix} \begin{bmatrix} Y_{1t} \\ Y_{2t} \end{bmatrix} = \delta + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{2.23}$$

Thus, the bivariate regressions are given as follows.

$$Y_t = \alpha + \Phi Y_{t-1} + B_0 X_t + B_1 X_{t-1} + \varepsilon_t \tag{2.24}$$

$$X_t = \alpha + \Phi X_{t-1} + B_0 Y_t + B_1 Y_{t-1} + \varepsilon_t \qquad (2.25)$$

The null hypothesis is that there is no Granger causality from x to y. The chi-square statistics are used to test for the joint significance of the variables. The null hypothesis for the test is given as follows.

$$\beta_1 = \beta_2 = ... = \beta_j = 0 \qquad (2.26)$$

5. The Phillips-Hansen fully modified procedure

We test the Maizels' hypothesis for the four South Asian countries. If the variables are cointegrated and there is only one cointegrating vector, we use the Phillips-Hansen fully modified procedure to estimate the saving function(s) for individual country study.

The Phillips-Hansen fully modified OLS procedure is given by

$$y_t = \beta_0 + \beta_1' x_t + u_t, \quad t=1,2,\ldots.n \qquad (2.27)$$

where y_t is first difference variable. x_t is a k x 1 vector of first difference regressors which are not cointegrated among themselves. The Phillips-Hansen fully modified procedure assumes that x_t has the first difference stationary process.

$\Delta x_t = \mu + v_t$, t= 2, 3, ….n where μ is a k x 1 vector of drift parameters, v_t is a k x1 vector of $I(0)$ variables. $\xi_t = (u_t, v_t')'$ is strictly stationary with zero mean and a finite positive definite covariance matrix, Σ.

6. Unit root tests

In our individual country studies, we use four unit root tests, recently developed by Ng and Perron (2001), to examine the properties of the time series. For the panel study, Im et al. (2003, hereafter IPS) unit root test is used. We briefly explain the procedures for individual and panel unit root tests in the following section.

6.1. The Ng and Perron unit root tests

Ng and Perron unit root tests are calculated using generalized least squares (GLS). According to Corray and Sinha (2005), Ng-perron tests have a better power for small samples than widely-used Dickey-Fuller (DF) and Phillips-Perron (PP) unit root tests. Ng and Perron (2001) constructed four test statistics and they use the GLS detrended data to test for unit roots. The GLS-detrended M statistics are defined as follows:

$$MZ_{\alpha}^{d} = (T^{-1}\tilde{\pi}_{t}^{2} - f_{0})/2k \tag{2.28}$$

$$MSB^{d} = (k/f_{0})^{1/2} \tag{2.29}$$

$$MZ_{t}^{d} = MZ_{\alpha}^{d} \times MSB^{d} \tag{2.30}$$

and

$$MPT_{t}^{d} = \begin{cases} \left(\bar{c}^{2}k - \bar{c}T^{-1}\tilde{\pi}_{t}^{2}\right)/f_{0} & if \quad x_{t} = \{1\} \\ \left(\bar{c}^{2}k + (1-\bar{c})T^{-1}\tilde{\pi}_{t}^{2}\right)/f_{0} & if \quad x_{t} = \{1,t\} \end{cases} \tag{2.31}$$

where c = -7 if x_t = {1} and c = -13.5 if x_t = {1, t}. k is defined as $k = \sum_{t=2}^{T}(\bar{\pi}_{t-1})^{2}/T^{2}$. f_0 is the zero frequency spectrum term and $\tilde{\pi}_t$ is the generalized least squares (GLS) de-trended value of the variable.

6.2. The IPS unit root test

According to Kim et al. (2005), panel unit root tests are more powerful than unit root tests which are based on individual time series. This is because IPS test permits heterogeneity of the autoregressive unit root among the panel. Hence, IPS test studies the panel unit root with heterogeneity dynamics, fixed effect and individual trend for the countries.

We begin our unit root analysis by explaining the panel unit root process of the IPS. We follow Im et al. (1996) and Kim et al. (2005). Let us assume the following AR (1) process for our panel data

$$Y_{it} = P_i Y_{it-1} + X_{it}\delta_i + \varepsilon_{it} \qquad (2.32)$$

where i = 1, 2 ,…,N cross-section units over the periods. T=1,2,…, T_i . X_{it} is the exogenous variable and X_{it} indicates any fixed effects or individual trends, P_i is the autoregressive coefficient which tests the panel unit roots. In the IPS panel unit root tests, P_i is different across countries in the panel because IPS test for unit root with individual unit root processes. Thus, the basic equation for the panel unit root tests for IPS is given as follows.

$$\Delta Y_{it} = \alpha Y_{it-1} + \sum_{i=1}^{p_i} \beta_{ij} \Delta Y_{it-j} + X'_{it}\delta + \varepsilon_{it} \qquad (2.33)$$

The null hypothesis for the IPS test is given as follows.

$H_0 : \alpha_i = 0,$ for all *i.* Thus, the alternative hypothesis is given as follows.

$$H_1 : \begin{cases} \alpha_i = 0 & , i = 1,2,....., N_1 \\ \alpha_i < 0 & , i = N+1, N+2,..., N \end{cases}$$

The ADF type *t*-statistics of the IPS test is given by,

$$\bar{t}_{NT} = \frac{1}{N}\sum_{i}^{N} t_{iT}(P_i) \qquad (2.34)$$

where $t_{iT}(P_i)$ denotes the ADF *t*-statistic of country *i* based on the country specific ADF regression, as in equation (2.34). The IPS test has modified the standard *t*-bar statistics and the modified *t*-bar statistics is given as follows.

$$\bar{t} = \frac{\sqrt{N}\left\{i - 1/N\sum_{i=1}^{N} E\left[t_{iT}(P_i,0) : \beta_i = 0\right]\right\}}{\sqrt{1/N\sum_{i=1}^{N} Var\left[t_{iT}(P_i,0) : \beta_i = 0\right]}} \qquad (2.35)$$

According to Kim et al., the *t*-bar statistics have standard normal distribution as N and $T \Rightarrow \infty$, and $N/T \Rightarrow k$, are finite positive coefficients.

7. Data and sources of data

We use two data sources. The two sources are the *World Development Indicators* of the World Bank (WDI) and the *International Financial Statistics* of the International Monetary Fund (IMF). Time span is different for the four countries based on data availability. Data on variables for different studies are obtained as follows.

Data on gross domestic saving, government saving, GDP, the rate of inflation, dependency ratio, interest rate, level of per capita income, and, borrowing constraint are from the WDI. Foreign saving data are taken from the IMF. Data on the GDP deflator are from IMF.

The saving rates are calculated by using data from WDI. Investment rates are

calculated by using data from the IMF. Gross domestic saving, investment and GDP are deflated by using the GDP deflator. Data on the GDP deflator are from IMF. Foreign saving and Investment rate tare taken from the IMF. Also, data on foreign exchange rates are from IMF. Annual data on export are from WDI. Foreign exchange rates are obtained from IMF.

CHAPTER THREE

DETERMINANTS OF SAVING FOR MAJOR SOUTH ASIAN COUNTRIES

I. Introduction

The literature on the determinants of saving is extensive. There are two groups of studies on this issue. One group of studies uses data for an individual country. The second group of studies uses either panel or cross-country data. First, this chapter reviews studies on these two strands. Second, we discuss the model for the determinants of saving. The possible determinants of saving are given in the next section. The empirical results on the determinants of saving are given in the fourth section of the chapter.

2. Individual country studies on the determinants of saving

Empirical studies on determinants of saving for individual countries can be divided into three subgroups. The first group examines the determinants for developing countries. The second group studies the determinants for the developed countries. The third group uses data from both developed and developing countries and compares the results.

2.1. Empirical studies on the determinants of saving for developing countries

India has been having a higher saving rate than many other countries in the region and the saving rate of India has an increasing trend. Athukorala and Sen (2003) examine the determinants of private saving in India. They argue that the cross-country studies have fundamental limitations. As pointed out by Athukorala and Sen, cross country regression

studies are based on the assumption of homogeneity of the countries. However, there is a vast difference between countries with respect to the nature and quality of data and this leads to misleading results.

The independent variables for the Athukorala and Sen study are as follows: growth rate of real per capita gross national disposable income (GNDI), growth rate of population, nominal interest rate on bank deposits, real wealth, real per capita GNDI, the rate of inflation, terms of trade[1], public saving as ratio of GNDI, bank density[2], and remittances by Indian expatriates as a percentage of GNDI. Real wealth is proxied by the ratio of money stocks to GNDI. The dependent variable is the private saving rate. It is defined as the ratio of household plus corporate saving to GNDI. They use annual data for 1954-1998. They test for the time series properties of the data using the ADF test. They use the general to specific modeling procedure since the unit root results show that there are stationary and non-stationary variables in the model. They also use lagged dependent and independent variables in the study.

The coefficient on the growth rate of real per capita income has a positive sign and it is statistically significant as a determinant of the private saving rate in India. The coefficient on real per capita income has a positive sign and it is statistically significant.

[1] The terms of trade equals PX/PM, where PX and PM are the prices of export and import, respectively in domestic currency.

[2] The bank density equals population divided by number of bank branches.

They argue that the absolute income is an important determinant of the potential to save at least in the initial stage of development in developing countries. Interestingly, the bank density is a statistically significant variable. The coefficient on the terms of trade has a negative sign and it is statistically significant. They argue that this is because households and corporate sectors in India seem to consider terms of trade deterioration as a permanent shock and attempt to smooth their consumption. The results show that the coefficient on the government fiscal policy has a negative sign and it is statistically significant. Athukorala and Sen argue that the public saving displaces Indian private saving. Though the coefficient on the ratio of remittances by Indian expatriates on abroad has a negative value, it is not statistically significant. The inflation rate has a positive effect on private saving in India. The coefficient on the growth of population and wealth are not statistically significant. The study is a comprehensive in-depth analysis of determinants of saving in India. In the study, they use conventional measurements of determinants of saving as well as some interesting indicators such as bank density.

Karunarathne and Abeysinghe (2005) study the relationship between mandatory pension saving and voluntary household saving for Sri Lanka. They point out that the relationship between pension policies and household saving is an unresolved issue. This is a hotly debated issue in the saving literature. According to the life-cycle theory, mandatory pension saving crowds out household saving and thus, aggregate saving. Saving behavior

of households in developing countries is affected by three factors. The three factors are uncertainty of the future income, limited financial facilities, and inflation. They argue that the households in developing countries accumulate their assets mainly through smoothing their consumption during their working life. Therefore, households in these countries react strongly if they are asked to increase the mandatory saving contribution. An individual who has a mandatory pension scheme has less private saving than an individual who is not covered by a mandatory pension scheme.

Karunarathne and Abeysinghe use the life-cycle hypothesis to formulate their model. Annual data from 1960 to 2002 are from the Central Bank and department of Employees' Provident Fund of Sri Lanka. The variables are total private saving (*TPSR*), households' non-pension saving (*NEPFSR*), mandatory saving (*EPFSR*), real per capita disposable income *(PCYd*), average real deposit rate (*RDR*), inflation rate (*INF*), money stock as a ratio of nominal GDP *(M2R*), and commercial bank credit to private sector as a ratio of nominal GDP (*CPSR*). They use the employees' provident fund (*EPF*) to measure mandatory saving and total private saving minus EPF saving as a proxy for households' non-pension saving. Commercial bank credit to the private sector as a ratio of nominal GDP is used to measure financial development. Money stock as a ratio of nominal GDP is used to capture the effect of disposable income and wealth on non-pension saving. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to examine the

unit roots. Both tests show that *INF* and *RDR* are stationary in their levels and all other variables are stationary in their first differences. They use the following two linear regressions:

$$NEPFSR_t = \beta_0 + \beta_1 EPFSR_t + \beta_2 PCYd_t + \beta_3 M2R_t + \beta_4 CPSR_t + \varepsilon_t \qquad (3.1)$$

and

$$TPSR_t = \beta_0 + \beta_1 NEPFSR_t + \beta_2 EPFSR_t + \beta_3 PCYd_t + \beta_4 M2R_t + \beta_5 CPSR_t + \varepsilon_t \qquad (3.2)$$

Karunarathne and Abeysinghe point out that if *I*(1) variables are cointegrated, one can mix *I*(0) and *I*(1) variables in a linear regression to form an *I*(0) linear combination. The Johansen procedure is used for cointegration. The vector error correction model for cointegration is given as follows.

$$\Delta y_t = \alpha\beta' y_{t-1} + \Gamma \Delta y_{t-1} + \phi x_t + \mu + \varepsilon_t \qquad (3.3)$$

where adjustment coefficient vector is $\alpha = (\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5)$ and normalized cointegrating vector is $\beta = (1, \beta_2, \beta_3, \beta_4, \beta_5, \beta)'$

The results show that there is cointegration among the *I*(1) variables. For (3.1), all explanatory variables are significant at the 5% level except mandatory saving. The results of (3.2) suggest that the real per capita disposable income, average real deposit rate, inflation rate, money stock as a ratio of nominal GDP, and commercial bank credit to private sector as a ratio of nominal GDP are statistically significant at the 5% level. They find that the total private saving is not affected by mandatory saving.

They have used the employees' provident fund (*EPF*) as a proxy measure for mandatory saving and it is one of the explanatory variables in (3.2). In (3.2), total private saving is the dependent variable. Nevertheless, total private saving includes mandatory saving and thus, the results might be misleading. *EPF* is available mostly for private sector employees in Sri Lanka. However, in Sri Lanka, there is a large government sector and all government servants are covered by the government pension schemes. Therefore, it is important to examine the effect of government pension on non-pension saving. Also, we are not sure whether they use nominal variables in the model because they have not mentioned anything about using real variables.

The pecking-order hypothesis states that firms more prefer to use its own saving for financing their new investment projects than external credit sources such as bank loans. Thus, the hypothesis states that the firms should accumulate funds for their potential investment. Mahakud (2002) examines the determinants of corporate saving in India. The corporate saving rate in India is low compared to OECD countries. According to Mahakud, if India wants to increase its gross domestic saving, corporate sector should also increase its saving rate.

He suggests that tax policy, depreciation policy, dividend policy, prevailing interest rate, size of the firm, age of the firm and investment opportunities are the major determinants of the corporate saving. The corporate tax rate is higher in India than OECD

countries. Even so, the effective tax rate is more or less same or lower than developed countries. This is mainly due to the various tax concessions such as tax holidays, investment allowances, development rebate, liberal depreciation allowances, various incentives and export promotion activities. The depreciation rate of the corporate sector is considerably higher in India. He suggests that the low corporate saving in India can not be attributed to the prevailing taxation or the depreciation system since the corporate sector is given tax incentives and the corporate sector has high depreciation rate. The main objective of Mahakud (2002) is to analyze the reasons for poor performance of the corporate saving in India.

He uses data for 1984-2000. The period of study is divided into three sub-periods. The first sub-period is from 1984 to 1991. During this period, India did not have liberalized trade policy. The second sub-period is 1991-2000. India had liberalized its trade policy for this period. The third sub-period of study is 1984-2000. The sample data consists of 300 firms. He uses both fixed and random effects panel least squares procedures. In the brief literature review, he identifies various determinants of corporate saving. These determinists are the growth rate of corporate profit after tax (PAT), fixed and inventory investment (INV), external sources of funds (ES), cost of borrowings (CB), cost of equity (CE), corporate tax rate (CTAX), inflation rate (IR) and the growth rate of sales (GR).

The results show that the explanatory variables, PAT, CB, CE, ES, and CTAX are

statistically significant for 1984-2000. The explanatory variables GR, IN, and IR are not statistically significant for the period. During the pre-liberalization period, the major statistically significant determinants of corporate saving are PAT, CB, CE and CTAX. Although ES is statistically significant for 1984-2000, it is not significant during the pre-liberalization period. He argues that this is because of the less developed capital market during the pre-liberalization period. Also, IR is not a significant variable during the pre-liberalization period due to less fluctuation of the sales during the period. The results show that the PAT, ES, CB, CE, CTAX, GR are statistically significant determinants of the corporate saving for 1991-2001 for India.

He suggests the following policy measures to increase saving of the corporate sector in India. Bank loans should be given at a low interest rate with reasonable conditions to the corporate sector. The government should decrease the corporate tax rate. The dividend policy of the corporate sector should be restructured. Finally, financial institutions should charge a low interest rate when they issue funds for replacement of capital and modernization of the corporate sector.

2.2. Empirical studies on the determinants of saving for developed countries

The precautionary motives of saving are important. If households' earnings are uncertain, they make an extra effort to accumulate wealth early in their life to protect against fluctuations in the future income. Starr-McCluer (1996) analyzes the relationship

between health and precautionary saving in the USA. Her argument is that if the government or private social welfare and security programs increase the social precautions in an economy, saving would decline among households of all ages and income levels.

She examines whether health insurance is a determinant of the low income households' saving in the USA. She argues that the standard life-cycle hypothesis fails to explain certain irregularities in saving and consumption behavior of households. She empirically examines the relationship between saving and precautionary motives by using health insurance as a measure of precautionary motives. She uses data from the 1989 *Survey of Consumer Finances* (SCF)[3]. The SCF survey has 3,143 samples. It includes 866 observations that represent the high-wealth households. The Gibbs sampling technique is used to fix the missing values. Liquid assets, financial assets, and net worth are used as the measurement of households' saving[4]. She uses the Ordinary Least Squares (OLS).

She finds that insured households have a higher level of wealth or saving than households without health insurance coverage regardless of how saving is measured. Hence, the findings do not suggest that the households who are facing greater health risk save more than the other households. She finds that saving and health insurance are related for reasons that have nothing to do with uncertainty and precautionary motives. Thus, the

[3] The Federal Reserve Board and several other government agencies sponsor the Survey of Consumer Finances (SCF).

[4] Liquid assets refer to assets that can be readily converted into cash. Financial assets refer to assets such as stocks, bonds, and mutual funds. Net worth is the total wealth of the households.

households who are particularly risk averse are keen on purchasing health insurance.

The study shows that the insured households differ considerably from uninsured households in terms of their income, age, education and work status. Although uninsured households face a greater uncertainty in health costs than insured households, they do not have any incentive or motivation to save more or hold more assets. But the above results do not suggest that the precautionary motives are not important for studying the household saving behavior. The variable, health insurance, which is chosen for the study, is difficult to isolate from other influences such as the individual's outlook on the risk, and the availability of insurance coverage. If the households' decision of purchasing a health insurance is affected by the other influencing factor(s), the results would not reflect the true relationship between saving and precautionary motives. For example, if a significant number of households in the sample work full-time for medium to large-scale enterprises, insurance coverage rate may be high among them since most of these enterprises provide insurance coverage, free of cost or at a low cost, for their employees. The findings of the study give important insights into saving behavior.

Lee and Kwack (2005) study the determinants of saving in South Korea. They examine the effects of income growth, uncertainty, and demographic factors on domestic saving. They point out that the relationships between economic growth and saving, income uncertainty and saving, and demographic factors and saving are ambiguous. Annual data

from 1975 to 2002 are used. Data are from the National Statistical Office of Korea and the Bank of Korea. In Korea, the number of older people as a percentage of total population has increased in the recent years. Thus, they suggest that it is important to study the relationship between saving rate and age structure in Korea. The study is based on the life-cycle hypothesis. The life-cycle hypothesis is more suitable for explaining individual saving behavior than national saving behavior because national saving includes government saving and foreign saving.

They use three regression models. The first model is as follows.

$$s = \alpha_{1j} + \alpha_2 L + \alpha_3 g + \alpha_4 \bar{g} + \alpha_5 V + \alpha_6 H + \alpha_7 BL + \alpha_8 s_g + \alpha_9 s_f \qquad (3.4)$$

Where s, s_g, and s_f are domestic saving, government saving, and foreign saving rates, respectively. BL is the duration of remaining life time. BL is calculated as life expectancy minus the mean age of total population. L is the life expectancy. g is the growth rate of real GDP per capita minus the growth rate of total population in the current period. $\bar{g}$ is the 3-year moving average growth rate of real per capita GDP minus the growth rate of total population in the current period. V is the variance of the GDP output growth rate around the 3-year moving average growth rate. H is the ratio of the housing stock to GDP at the beginning of the period. The GDP deflator is used to deflate nominal data.

The second model takes the following form:

$$s = \beta_1 + \beta_2 g + \beta_3 \bar{g} + \beta_4 Odep + \beta_5 Ydep + \beta_6 s_g + \beta_7 s_f \qquad (3.5)$$

Where *Ydep* is the young dependency ratio and *Odep* is the old dependency ratio.

The third model combines some variables in (3.4) and (3.5) and is as follows:

$$s = \alpha_{1j} + \alpha_3 g + \alpha_4 \overline{g} + \alpha_5 V + \alpha_6 H + \alpha_7 Odep + \alpha_8 Ydep + \alpha_9 s_g + \alpha_{10} s_f \qquad (3.6)$$

For each equation, a dummy variable is added to capture the effect of the Asian financial crisis and the dummy takes a value one for 1998 and zero otherwise. The results show that all the variables are statistically significant at the 5% level except *g* and BL in (3.4). The sign of the government saving is positive and the sign of the foreign saving is negative. According to the results, government saving does not crowd out private saving and foreign saving crowds out domestic saving in Korea. The results of (3.5) show that *g is* statistically insignificant and all the other variables are statistically significant. Also, the sign of the government saving is positive and the sign of the foreign saving is negative in equation (3.5). In (3.6), all variables are statistically significant, except *V* and *H*. In (3.6), there are eight explanatory variables and only 28 observations. This reduces the power of the regression results. Also, they have not studied the unit root properties of the variables.

Luo (1998) examines the saving behavior of small investors in Taiwan. He uses the 1988 survey of family income and expenditure in Taiwan. Unfortunately, no reasonable definition is given for 'small investors' by the author. The primary objective of the study is to analyze the saving behavior of small investors who live in the urban areas. According to

Luo, small investors in urban areas had experienced a rapid change during the period of Taiwan's industrial revolution.

He argues that small investors have a higher return for their investment and save a higher percentage of their income than households who are primarily engaged in activities that yield wages and salaries. He uses the OLS method. The dependent variable is the saving rate of small investors. The independent variables are disposable income, size of the household, and age of the head of the household. The results show that the coefficient for age of the head of the household is positive, and it is statistically significant. The size of the household is one of the most important factors affecting saving behavior for Taiwan and it has a negative influence on saving. This results show that the pecking order hypothesis is true for Taiwan.

Jappelli and Pagano (1998) examine the determinants of saving in Italy. They study the determinants of saving at macro level as well as at micro level. Long-run macro and micro data are used. They use the Granger-causality test to examine the causal relationship between economic growth and saving rate in Italy.

In their study, the growth rate is computed as the rate of change of net national income. Government saving is defined as the public sector budget surplus net of investments outlays. Private saving is measured as national saving minus government saving. The saving rate was high during 1960s and 1970s in Italy. The saving rate began to

fall in the late 1990s because of the following reasons: fluctuations in productivity growth, pervasive borrowing constraints, imperfection of insurance markets, liberalization of financial markets, restructuring of the generous social security system, tax pressures, public debt, changes of the age structure and changes in the Italian households' tastes.

They use individual household income data to identify which population group has been responsible for the decline in the saving rate during 1970-1990. The groups are defined as follows: Children less than 18 years old, people older than 60, younger people, head of households, permanent income earners and self-employed. Significantly, the results show that all the demographic groups are responsible for the decline of the aggregate saving rate. However, they find that the younger age groups are more responsible for the decline of the aggregate saving rate than the other groups. The Granger-causality test rejects the null hypothesis that the GDP growth rate does not Granger-cause the growth rate of saving rate for Italy.

Shiba (1979) analyzes the personal saving function of urban households in Japan during the 1970s. Since the end of the World War II, the Japanese economy had experienced rapid economic growth, and the required level of capital accumulation was given by domestic saving rather than foreign direct investment or foreign loans. The urban workers' personal saving rate rose steadily and reached a much higher level than the other OECD countries in the 1970s. Shiba argues that the rise in the saving rate of urban worker

households until 1970 can be explained by the conventional saving behavior as there was no structural change in the saving behavior during this period. The saving rate of the urban worker households after the 1970s is a puzzle because the saving rate did not fall even though inflation rate was high during that time. According to Shiba, many studies found that the saving rate was positively correlated with the inflation rate for Japan in the 1970s. He poses the following question: does a conventional saving function explain the Japanese urban workers' saving behavior? If not, what would help to explain the remarkable rise of the personal saving rate in Japan in the 1970s?

Economists have used two hypotheses to explain the Japanese urban workers' saving behavior in the 1970s. The two hypotheses are the permanent income and the life–cycle hypotheses. The researchers who use the life–cycle hypothesis to study the saving behavior of the urban workers assume that the urban workers would reach a normal saving rate around 13%. This is because in the prewar period, 13% was the highest saving rate in Japan. But the saving rate kept rising beyond that level.

Researchers who used the Freidman's permanent income hypothesis explained that the urban workers kept on increasing their personal saving due to the temporary income, which they received from the well-known two annual bonus payments in Japan. But Shiba argues that in Japan, the bonus income is fully institutionalized and workers expect bonus as an intrinsic part of their income. Therefore, the permanent income hypothesis is not

appropriate to explain the urban workers' saving behavior in Japan.

Shiba argues that the saving behavior of urban worker households reflect some endogenous socio-economic motivations. He uses the Bayesian shift test to test the parameter shifts for two sample periods. The sample periods are from 1966 to 1970 and from 1971 to 1975. The Bayesian test of parameter shifts indicates a structural change in the saving behavior of the urban workers in the 1970s. Shiba points out that there were three important factors, which influenced the high saving rate of urban workers in the 1970s. These are the purchase of one's own dwelling, preparation for children's college education and marriage expenses and preparations for living after retirement.

There are many reasons why households save and these reasons may vary from one society to another. Horioka and Watanabe (1997) also study the motives for households' saving for Japan. Horioka and Watanabe use micro economic data. According to them, there are three basic purposes for why they analyze the motives for household saving in Japan. First, this would help to know about the saving behavior of the households and explain the different saving rates among different group of households in the past, present and future. Second, they study the determinants of households saving for Japan. Finally, they analyze which hypothesis i.e. life-cycle hypothesis, precautionary motive, or bequest motive is the most applicable one for Japanese society.

Horioka and Watanabe use ten motives for saving which are as follows: retirement,

illness, education, marriage, acquisition of house, acquisition of consumer durables, leisure, tax, independent business, peace of mind, and bequest. These motives are classified into two groups. The first group represents the precautionary motives and the second group represents the bequest motives. They calculate the contribution to net saving from each group. Net saving is defined as the difference between saving and dis-saving. The data are from the *Survey on Financial Asset Choice of Household* which was conducted by the Institute for Post and Telecommunications. The survey was conducted in 1994.

They find that among the precautionary motives, illness, health and retirement greatly contribute to the net saving. They argue that the life-cycle hypothesis is more relevant than the permanent income hypothesis to explain household saving behavior in Japan. The bequest motive is not so important. This is a comprehensive analysis about the saving motives for Japan.

2.3. Studies on comparison of determinants of saving using developing and developed countries

Baharumshah et al. (2003) empirically analyze the factors which affect the saving behavior in the fast growing economies of Singapore, South Korea, Malaysia, Thailand and the Philippines. Aslo, they study the causality between saving and its determinants for these countries. They use annual data from the *International Financial Statistics* of the International Monetary Fund and *World Development Indicators* of the World Bank for

1970-1998. Gross national saving is the dependent variable. They use the country's net current account balance as a measure of foreign saving. The independent variables are gross national product, interest rate and the dependency ratio. Except for the interest rate, all the other variables are in their logarithmic forms. The ADF and PP tests are used to test for the unit root. The Johansen and Juselius (1990) maximum likelihood procedure is used for cointegration tests. The Engle and Granger (1987) procedure is used for Granger causality test.

Both the ADF and PP unit root tests fail to reject the null hypothesis of a unit root for all the variables in their levels except for the gross national saving of the Philippines. All other variables are found to be integrated of order one at the 5% level. They find that Singapore, South Korea, Malaysia and Thailand have a common set of determinants of saving. The Granger causality tests show that the first difference of saving does not Granger cause first difference of economic growth for these countries. The results show that FDI displaces domestic saving for Malaysia and Singapore but not for South Korea and Thailand.

Morisset and Revoredo (1995) analyze whether education has an effect on the saving rate. They examine the effects of the primary, secondary, and tertiary education. They argue that the relationship between education and saving is negative in the initial stage of a person's life. This is because in the early stage, cost of education is higher than

the later stage of a person's life. In the long-run, the relationship between education and saving rate is a positive one. This is because education leads to high income, thereby leading to increased saving. Morisset and Revoredo examine the relationship between education and saving in the short-term and in the long-term.

They use annual data for 1960-1990 for 74 countries. In order to capture the different levels of economic development as well as regional characteristics, they employ subsets of industrialized, less developed, European, Asian, and Latin American countries. In addition to the level of education, they use two other explanatory variables, namely, growth rate and dependency ratio. The dependency ratio is defined as the percentage of the population less than 15 years and older than 65 years to total population. The dependent variable is the saving rate. Data on dependency ratio, GDP and saving are from the *World Development Indicators* and data on education are from Nehru et al. (1993). In order to capture the long-term trend of explanatory variables, the annual data are expressed as five-year average. For the panel data, they use the two-stage least squares techniques.

Their major findings are as follows. In the short-run, education has a negative effect on the saving rate for all countries. However, in the long-run, education has a positive effect on the saving rate for all countries except for Latin American countries. They argue that this can be explained by the poor quality of education in Latin American countries. For all countries, the effects of primary and secondary education on saving are positive and

statistically significant. For developing countries, the relationship between university education and saving rate is not statistically significant. The tertiary education has a positive effect on saving only for industrial countries.

3. Determinants of saving using either cross-country or panel data

Masson et al. (1998) empirically test the private saving behavior by using data from industrial countries and developing countries. In the study, they examine a broad set of possible determinants of private saving. The major objectives of the study are to examine several empirical issues, which have not been resolved conclusively, for instance, the effects of real interest rates, demographic factors, and per capita income on private saving.

According to them, some of the explanatory variables of private saving in the literature seem to explain persistent country differences. Other determinants are subject to year-to-year fluctuations. Therefore, they employ both time-series and cross-sectional data to study the determinants of private saving. The sample consists of 21 industrial countries and 40 developing countries. Data are from the *World Economic Outlook (WEO)* of the International Monetary Fund.

The dependent variable is the private saving as a percentage of GDP. To calculate the private saving, they first calculate national saving as domestic investment plus the current account surplus. Second, they calculate private saving as national saving minus the central government fiscal surplus and the central government expenditure on capital goods.

The independent variables are government budget surplus as a percentage of GDP, government current expenditure as a percentage of GDP, government investment as a percentage of GDP, growth rate of GDP, real interest rate, wealth as a percentage of GDP, inflation rate, changes in the terms of trade, GDP per capita in purchasing power parity terms, current account balance as a percentage of GDP, and the dependency ratio. Also, they use explanatory variables to study how government policies affect private saving.

They argue that the government budget deficits resulting from lower tax or higher government spending have effects on private saving. For example, increased government spending has a negative effect on private saving since it lowers the resource available to the private sector and the magnitude of the effect depends on whether government spending is productive or not. The Ricardian equivalence hypothesis suggests that private agents may offset any decrease in public saving by an equal increase in their saving. Empirical studies on the relationship between saving and economic growth have shown mixed results. One group of studies shows that there is a positive correlation between saving and economic growth. This is supported by the life-cycle hypothesis which shows that saving would fall during a period of slow economic growth. The other group of studies shows that there is no relationship between saving and economic growth. If workers are not myopic and expect that their income will grow in the future, aggregate saving would not fall.

They point out that the relationship between the interest rate and the saving rate is ambiguous. Financial liberalization affects the relationship between the saving rate and the domestic interest rate. Financial deregulation makes domestic saving more responsive to foreign interest rate. According to them, in developing countries, a rise in per capita income leads to a higher saving rate since at the subsistence level of income, saving is relatively low and increased income increases the potential to save. Also, they examine the relationship between the terms of trade and saving.

In the panel data estimation, they use both combined panel of industrial and developing countries and separate panels for industrial and developing countries. Similarly, in the cross-sectional estimation, they conduct estimations separately for industrial and developing countries and also for the combined sample. In the panel data estimation, they use ordinary least squares method and the Durbin-Watson statistic shows that there is evidence of serial correlation problem. Thus, they use the auto-regressive procedure.

The results for both industrial and developing countries indicate that the demographic variable (dependency ratio) is an important determinant of the private saving rate. It has a negative effect on private saving. The GDP growth rate is statistically significant and it has a positive relationship with the private saving in most cases. But, they do not test for the causal relationship between these two variables. They find that the per capita income has a positive effect on the private saving for the developing countries.

However, the per capita income has a negative effect on the private saving for the developed countries. Real interest rate is statistically significant only for developed countries and it has a positive relationship with the private saving. Changes in the terms of trade have a statistically significant positive effect on the saving for developed countries, but not for developing countries. Finally, the study indicates that the government's fiscal policies have a significant impact on the private saving for both developed and developing countries. This result is valid irrespective of the estimation techniques which are used.

The results of Masson et al. show that determinants of saving are different for developed and developing countries. Also, the same determinant can have a different effect on private saving for developed and developing countries. The study provides ample evidence that the countries' heterogeneity has an enormous impact on the determinants of saving.

Leff (1969) analyzes the relationship between demographic factors and saving using cross-country and time series data. According to him, a high dependency ratio ultimately lowers the savings rate in the long-run. He explains the logic of an inverse relationship between the dependency ratio and the saving rate as follows. In any society, children and elderly people consume more and contribute less to family income. Also, children and elderly people make less contribution to the country's GDP than other age group. Hence, the high ratio of dependents to the labor force in a country may reduce the

households' potential for saving. He argues that there is a link between the dependency ratio and the government saving. If tax is levied out of discretionary income, the high dependency ratio will reduce the government tax income since the government has to reduce the tax burden and increase social welfare expenditure for providing better living standards for the elderly people. According to him, there is no obvious reason why the dependency ratio would affect the corporate saving.

In his study, the dependent variable is the country's aggregate saving rate (*S/Y*). The independent variables are the level of per capita income (*g*), annual average growth rate for the preceding five years, percentage of population aged 14 or less (D_1), percentage of population aged 65 or older (D_2), and D_3, which is the sum of D_1 and D_2. First, Leff tests with the D_1 and D_2 separately and then with D_1 and D_2 together i.e., D_3. He also estimates the model separately for developing countries and less developed countries. He uses log-linear least squares regression using data for 47 less developed countries and 20 developed countries. Data are from the Statistics and Reports Division of the Agency for International Development.

The results show that the dependency ratio is statistically significant for developed and developing countries. The independent variable D_1, D_2, and D_3 are statistically significant for both developed and developing countries. But the results show that the separate independent variables i.e. D_1 and D_2 are more statistically significant than the

combined dependent variable i.e. D_3. The results suggest that it is possible for developing countries to achieve a high saving rate by reducing the birth rate since in less developed countries, the birth rate is higher than in developed countries.

Sociopolitical instability has increased in the recent past. Gupta and Venieris (1986) study income distribution and sociopolitical instability as the determinants of saving by using a cross-sectional data. Their main objective is to examine the consequences of income distribution and sociopolitical instability (SPI) on aggregate saving.

This is a cross sectional study and the sample consists of 49 non-communist countries. Data on saving, GDP and the GDP deflators are from the *World Development Indicators*. SPI data are from Taylor and Hudson (1972). They define saving as households forgone consumption. The households use the forgone consumption to purchase assets such as precious metals and stones, foreign currencies, local currencies, and investment. The forgone consumption can be divided into two main categories. These are recorded saving and unrecorded saving. The recorded saving is defined as investment which is financed by domestic sources i.e. investment minus net capital inflows. The unrecorded saving is defined as assets such as precious metals and stones, foreign currencies, and hoarding of local currency. But investment is not included in the unrecorded saving.

They assume that the unrecorded saving is risk less and has much less sensitiveness

to SPI than recorded saving. The recorded saving is highly sensitive to SPI since an increase in SPI increases the perceived risk and lowers the expected value of future income on saving. They measure the SPI for each country separately by using riots, demonstrations, irregular transfers of governments, and number of deaths due to political violence. The dependent variable is the gross domestic saving. The independent variables are SPI, gross GDP received by the population percentile, and the change in GDP. The population is divided into three groups, namely, upper income, middle income and low income based on GDP received by the population percentile. To recognize the influence of SPI on different income groups, they study the relationship between SPI and income group and measure differences in the marginal propensity to save (MPS) among the three different income groups.

They find that an increase in SPI would cause households at all income levels to decrease the recorded saving. The upper income group is more vulnerable to the SPI than the middle income and the lower income groups. In other words, an increase in SPI would reduce MPS more in upper income groups than the low and middle income groups. This is mainly due to the fact that the upper income group has more opportunities to use their forgone consumption in unrecorded saving such as foreign currencies and foreign investment. The results show that the middle income group has a higher MPS than the upper and low income groups. Hence, they argue that any redistribution of income from

the upper and middle to lower income groups would not increase saving rate. On the other hand, if the middle income group gets more income, saving rate would increase.

Schmidt-Hebbel and Serven (2000) examine the relationship between income distribution and the aggregate saving rate. Their primary objective is to test the relationship between saving and income inequality by using different saving specifications. They use alternative income inequality measures. They conduct estimations jointly and separately for industrialized and developing countries. Annual data are from the World Bank's *Macroeconomic and Social Database* for 1965-1994. They use the income distribution data from Deininger and Squire (1996). If there is any missing observation, they use the average value to fix the problem. They employ a panel data set of five years' average for industrial and developing countries. They use ordinarily least square (OLS) and generalized method of moments (GMM). The GMM is used to estimate because they find multicolinearity among the explanatory variables.

They use alternative saving measures. These are gross national saving and its ratio to gross national product (GNP) and GDP. Saving is the dependent variable. Four conventional indicators of income distribution are used to measure income inequality. These are the Gini coefficient, the income share of the richest 20% and poorest 40% of the population, and the income share of the middle income group.

The results of the cross-country study show that the relationship between saving

rate and income distribution is negative for the whole sample regardless of the measures of saving and inequality that are used. However, the relationship is positive for the industrial countries and negative for the developing countries, though in the both cases, the dependent variable is not statistically significant. They find similar results with alternative model specifications. They argue that the relationship between saving rate and income inequality in the sub-set of samples i.e. developing and industrial countries, is statistically not significant due to the problems in the time series data and the heterogeneity of the countries. The results of the panel study show that there is no statistically significant relationship between saving rate and income inequity. Hence, they conclude that the effect of income inequality on aggregate saving is ambiguous.

Edwards (1995) studies the determinants of saving and discusses why saving rates differ across countries. Most researchers do not distinguish between private and government saving and assume that the government saving is exogenous. He argues that the government saving is not exogenous but is determined by various factors such as the country's economic situation, and political strategies. Hence, he examines the determinants of both private saving and public saving. The relationship between the real interest rate and the saving rate depends on the relative strengths of the substitution and wealth effects. The effect is different across countries.

He uses data from 36 countries. The sample consists of 11 industrialized and 25

less developed countries. The explanatory variables are the dependency ratio, the rate of growth of per capita GDP, the ratio of old and young population, development of capital market, borrowing constrains, urban population, inflation, violence and political instability, government saving, current account balance, and the ratio of social security expenditure to total government expenditure. The dependent variables are the ratios of private saving to GDP and government saving to GDP. He uses panel data for 1983-1992. Data are from the *World Development Indicators* and the *International Financial Statistics*. Data on political instability are taken from Edwards and Tabellini (1994). He examines the determinants of saving separately for industrial countries and developing countries.

The results show that the coefficient on the age dependency ratio is negative. The coefficients on urban population, government saving, and social security have negative signs and are statistically significant. This suggests that social security system reduces the private saving rate both in the developed and the developing countries. The GDP growth rate is statistically significant. The coefficient on the GDP growth rate has a positive sign for both industrialized and developing countries. The development of the financial market is statistically significant. This shows that the countries with an advanced financial system will tend to have higher private saving. The coefficients on borrowing constraints and real interest rate are found to be positive and statistically significant. Political instability and inflation are statistically insignificant.

The coefficient on the current account balance is positive and is statistically significant. The results show that the foreign saving displaces domestic saving since the coefficients on foreign saving have a negative sign for both developed and developing countries. He finds that political instability, economic growth rate, and current account balance are statistically significant determinants of government saving. Demographic variables, social security expenditure and the development of financial sector are not statistically significant variables for government saving.

4. The model for the determinants of saving

The model is adapted from Edwards (1995). The model is in the tradition of the life-cycle hypothesis and a number of other models that have focused on intertemporal optimization. Consider a rational individual living for an infinitely period of time. The individual is assumed to maximize the present value of his or her life time subject to a number of budget constraints. This can be expressed as follows:

$$\max \int_0^\infty E\{U(c_t g_t)e^{-pt}dt\} \qquad (3.7)$$

subject to:

$$\int_0^\infty c_t e^{-rt}dt \le W, \qquad (3.8)$$

$$W = \int_0^\infty y_t(1-\tau_t)e^{-rt}dt, \qquad (3.9)$$

$$S_t = [y_t(1-\tau_t) - p_t c_t], \qquad (3.10)$$

$$-k \le S_t \le y_t(1-\tau_t) \qquad (3.11)$$

E denotes the individual's expectation and U is the utility function of the individual. The utility function is assumed to be concave. p is the rate of time preference and r is the interest rate. Private and public goods consumptions in period t are denoted by c and g, respectively. For simplification, supplies of c and g are assumed to be exogenous. Total wealth and the tax rate in the period are denoted by W and τ_t, respectively. $y_t(1-\tau)$ is the net income or the disposable income of the individual. S_t stands for saving. Saving is defined as net income minus private goods consumption based on the rate of time preference. If saving is negative in a given period, the individual has to borrow. Thus, the third and final restriction shows that in any given period, saving ought to be less than the net income of the individual and borrowing cannot exceed k.

As income tends to fluctuate over the course of an individual's lifetime, he or she will use saving and borrowing to smooth consumption through time. Individuals have smooth consumption over their lifetimes, and as a result, they are net savers during years which thy have high income to secure funds for hard times and dis-savers during years which they have low income.

Despite its simplicity, the model can be used to study several empirical and theoretical issues of saving behavior that have not been resolved conclusively. The main unresolved issues of saving behavior that can be explained by using the model are as follows.

4.1. Possible impact of fiscal policy

Empirical results on private saving crowding out government saving show that the Ricardian equivalence hypothesis is ambiguous. The model presented above implies that changes in either g or τ can have different effects on the household saving behavior. The model suggests that both present and future tax rates have effects on household saving. Also, the model is able to capture important implication of social security programs. The life-cycle hypothesis implies that the presence of government-run social security systems leads to a decrease in individuals' saving because social security programs reduce the uncertainty of individuals in their retirement.

4.2. Does income growth raise saving?

Modigliani (1966) argues that a higher economic growth rate would, with unchanged saving rates by age groups, increase aggregate saving because it would increase the aggregate income of workers. In other words, when the economy is growing, workers' saving will increase more than that of retired and old people. Hence, aggregate saving will increase. However, there are arguments in the opposite direction as well. Tobin (1967) argues that if workers are certain that their income will grow in the future, workers will consume more today and save less. Therefore, aggregate saving will decrease.

4.3. The role of inflation in determining saving

The effects of inflation on saving behavior have been studied extensively. However, results

in the earlier studies are mixed. In the above model, the impact of inflation on saving is through its role in determining the real interest rate. In other words, inflation could have an effect on saving through its impact on real wealth. In the saving literature, there are two strands of arguments. First, higher inflation tends to lead to a higher nominal interest rate and hence, leads to higher disposable income and household saving. Also, Athukorala and Sen (2003) argue that saving rises with inflation. They argue that if households seek to maintain a target level of wealth or liquid assets, inflation will lead to an increase in aggregate saving. Households increase their saving because if inflation increases, nominal value of liquid assets or wealth will decrease. This leads to an increase in saving because the households try to maintain a target level of real wealth. Second, higher inflation decreases saving by increasing the uncertainty about future price levels and thus, consumers tend to consume more.

4.4. Demographic variables as determinants of saving

The life-cycle hypothesis highlights the importance of age structure of the population. The impact of demographic variable for the above model is mainly based on aggregation across households in a country. The life-cycle hypothesis argues that economic growth makes the middle-age workers richer than young and retired people who do not have a steady income source. Furthermore, the life-cycle hypothesis argues that when the economy is flourishing, middle-aged workers save more than young workers and old people dis-save. Therefore,

economic growth with unchanged saving rate of workers leads to an increase in the aggregate saving. Empirical results on the relationship between dependency ratio and saving rate are often ambiguous. Having more children may increase the household's desire to leave a larger bequest for the children. Therefore, a higher dependency ratio may lead to a higher saving rate. Conversely, having more children may increase the living expenses of the household such as expenditure on education and health, and may decrease the household's potential to save. In that case, the higher dependency ratio would decrease aggregate saving.

4.5. Does a higher real interest rate lead to higher saving?

The relationship between the interest rate and the saving rate depends on substitution and income effects. A higher interest rate increases the present price of consumption relative to the future price of consumption i.e. the substitution effect, and therefore, leads to an increase in saving. If a person is a net lender, his or her lifetime income will increase and thus he or she will consume more than what he or she will save i.e. the income effect. At the aggregate level, a higher interest rate leads to an increase in saving only if the substitution effect is stronger than the income effect. If the income effect is stronger than the substitution effect, saving will decrease.

4.6. Borrowing constraint

The borrowing constraint is a very crucial variable in developing countries. The model

assumes that the individual can borrow without any difficulty which is unlikely in many developing countries or for low income workers. Also, the relationship between the borrowing constraint and saving is affected by the depth of the financial market. Though one can assume that the tendency to dis-save depends on the ability to borrow, empirical studies on the relationship between the borrowing constraint and saving show mixed results.

Though the above model is appropriate for studying important possible determinants of saving, the model has some limitations. The model is not able to capture variables such as households' heterogeneity and foreign saving. Hence, in addition to the above variables, few other explanatory variables are used for the empirical analysis.

4.7. The effects of the terms of trade on saving

The possible relationship between the terms of trade and saving is an important issue. The terms of trade can be defined as the ratio of the export price index to the import price index. According to the Harberger-Laursen-Metzler hypothesis, a deterioration in the terms of trade decreases domestic saving and an improvement in terms of trade leads to an increase in saving. A deterioration in the terms of trade means a fall in prices of domestically produced goods relative to that of foreign goods. A fall in the prices of domestically produced goods leads to a decrease in real income of households and thus, saving. According to Masson, Bayoumi, and Samiei (1998), changes in the terms of trade can

either increase or decrease saving depending on whether the changes are transitory or permanent. In view of the above, a separate variable for the terms of trade is included in our model.

4.8. Foreign saving

In an open economy, households can use foreign borrowing to smooth consumption. This implies that foreign saving affects domestic saving. Masson, Bayoumi, and Samiei (1998) point out that foreign saving is a potential exogenous variable for determining domestic saving in developing countries. Baharumshah et al. (2003) indicate that there are two broad views on how foreign saving affects domestic saving. One view is that foreign saving adds to the overall availability of funds without substituting for domestic saving. The second view is that foreign saving substitutes domestic saving and thus, reduces domestic saving. Whether foreign saving reduces domestic saving or not is ultimately an empirical issue.

4.9. Income distribution

The relationship between income inequality and saving has been receiving attention in both theoretical and empirical studies. According to Schmidt-Hebbel et al. (2000), there are two broad views on how income inequality may affect domestic saving. First, the recent political-economy literature postulates a negative relationship between the two variables. Second, most of the empirical literature on the relationship between income disparity and saving based on cross-section data finds a positive relationship between the two variables.

4.10. Level of per capita GDP

Athukorala and Sen (2003) argue that absence of a link between current income and current saving is a limitation of the life-cycle hypothesis. One can not ignore the link especially in developing countries such as India. Households in developing countries are not always forward looking and do not take their saving decision based on lifetime income or wealth. These households may take their saving decisions based on current income rather than on future income because it is impossible for them to set aside resources now in order to provide funds for consumption later. Majority of the people living in South Asia are low income earners. According to Leff (1969), the literature on determinants of saving shows that the level of per capita affects saving rate in developing countries. Hence, the level of per capita income is included in our empirical model.

4.11. The possible explanatory variables

The above discussion and the literature review suggest a number of factors that may influence saving rate. Hence, the saving function for the determinants of saving is specified as follows.

$$SR_t = \beta_O + \beta_1 SPB_t + \beta_2 GDP_t + \beta_3 INF_t + \beta_4 DPR_t + \beta_5 RIR_t + \beta_6 TOT_t + \beta_7 FSA_t + \beta_8 IDP_t + \beta_9 LPY_t + \beta_{10} BC_t + \varepsilon_t \qquad (3.12)$$

SR is the saving rate of the country in period t. The saving rate is defined as the ratio of gross domestic saving to GDP. SPB is the government saving rate. The government saving

rate is defined as the ratio of government budget deficit or surplus to GDP. The coefficient is expected to be negative because we assume that government saving will crowd out private saving. The saving literature shows that if the coefficient is significantly different from -1, increases in government saving, will crowed out private saving. *GDP* is the gross domestic product. As suggested by the life-cycle model, the coefficient of *GDP* growth rate is assumed to be positive. *INF* is the inflation rate. Following Edwards (1995), this variable is used to capture the macroeconomic stability as well. Its coefficient is expected to be negative. *DPR* is the dependency ratio. The dependency ratio is defined as the ratio of population younger than 15 years old plus population over 65 years as a percentage of working age population. According to the life-cycle model, the coefficient should be negative. *RIR* is the real interest rate. The sign of the coefficient is expected to be positive. *TOT* is the terms of trade. Terms of trade is defined as the index of prices of export goods divided by the index of prices of import goods in domestic currency. Its coefficient is expected to be positive. *FSA* is the foreign saving. Foreign direct investment is a broad measure of foreign saving. If foreign saving displaces domestic private saving, the coefficient would be positive. *IDP* measures income inequality. Income share held by the highest ten percent of the total population is the proxy for income inequality and its coefficient is expected to be positive. *LPY* is the growth rate of per capita GDP. The coefficient is expected to be positive. *BC* is the borrowing constraint. The coefficient is

proxied by domestic credit of the banking sector as a percentage of GDP. The coefficient is used to study the depth of the financial system. The relationship between the borrowing constraint and saving is expected to be negative. ε is the error term or the disturbance term.

We prefer to use ratios rather than absolute values. By using ratios, instead of levels, comparisons between countries can be made without using appropriate exchange rates. We use data for different time periods for the four countries based on the availability of data.

5. Determinants of saving rate for Bangladesh

We wish to estimate the saving function as in equation (3.12). However, in practice, it is not easy to find data for some variables for a sufficient length of time. Annual data from 1973 to 2004 are used for Bangladesh. Therefore, equation number (3.12) is modified by excluding some variables based on the data availability.

5.1. Empirical results of the determinants of saving rate for Bangladesh

The saving function for Bangladesh is given as follows.

$$SR_t = \beta_0 + \beta_1 BC_t + \beta_2 DPR_t + \beta_3 FSA_t + \beta_4 GDP_t + \beta_5 INF_t + \beta_6 LPY_t + \beta_7 RIR_t + \varepsilon_t \qquad (3.13)$$

In the above saving funtion, all variables are in growth rate forms. The results of the Ng-perron unit root tests in levels and first differences are given in Tables 3.1 and 3.2, respectively. The unit root results show that *BC, FSA, INF* and *RIR* are stationary in their

levels. *DPR, GDP, LPY* and *SR* are stationery in their first differences.

Figure 3.1: The normality test for residuals for Bangladesh

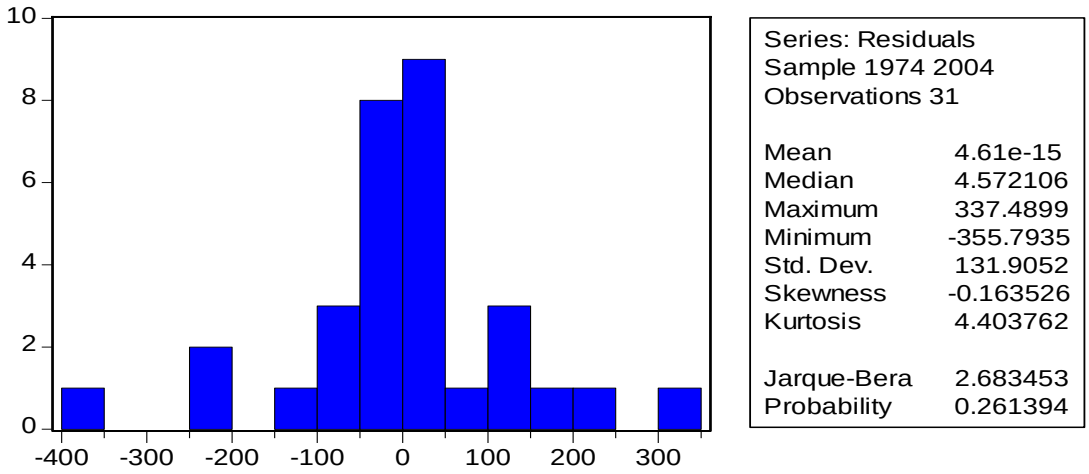


Table 3.1: Results of the Ng-Perron tests for unit root in levels for Bangladesh

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	-15.0982	-8.1000	-2.7475	-1.9800	0.1820	0.2330	1.6231	3.1700
*DPR	-5.2701	-17.3000	-1.5752	-2.9100	0.2989	0.1680	17.1017	5.4800
*FSA	-15.3315	-8.1000	-2.7687	-1.9800	0.1806	0.2330	1.5980	3.1700
*GDP	-0.8231	-8.1000	-0.6107	-1.9800	0.7419	0.2330	27.6069	3.1700
*INF	-15.4690	-8.1000	-2.7810	-1.9800	0.1798	0.2330	1.5844	3.1700
*LPY	-11.2715	-17.3000	-2.3732	-2.9100	0.2106	0.1680	8.0883	5.4800
*RIR	-14.6873	-8.1000	-2.7094	-1.9800	0.1845	0.2330	1.6700	3.1700
*SR	-1.7949	-8.1000	-0.9356	-1.9800	0.5213	0.2330	13.4805	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Table 3.2: Results of the Ng-Perron tests for unit root in first differences for Bangladesh

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	-9.0159	-8.1000	-2.08152	-1.9800	0.1282	0.2330	1.289	3.1700
*DPR	-19.6261	-17.3000	-5.5520	-2.9100	0.0816	0.1680	3.8266	5.4800
*FSA	-12.655	-8.1000	-2.4954	-1.9800	0.1972	0.2330	2.0128	3.1700
*GDP	-10.0867	-8.1000	-1.48329	-1.9800	0.2730	0.2330	2.1565	3.1700
*INF	-23.8128	-8.1000	-3.4503	-1.9800	0.14489	0.2330	1.0296	3.1700
*LPY	9.0971	-8.1000	-2.6013	-1.9800	0.1942	0.2330	1.937	3.1700
*RIR	-9.2491	-8.1000	-1.3529	-1.9800	0.0166	0.2330	1.9883	3.1700
*SR	-19.0237	-17.3000	-3.7092	-2.9100	0.0928	0.1680	3.6356	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Table 3.3: Correlation matrix of the variables for Bangladesh

Variable	BC	DPR	FSA	GDP	INF	LPY	RIR
BC	1.00	-0.07	-0.21	0.27	0.14	0.43	-0.07
DPR	-0.07	1.00	-0.04	0.05	0.14	-0.02	-0.01
FSA	-0.21	-0.04	1.00	0.12	-0.10	0.05	0.17
GDP	0.27	0.05	0.12	1.00	-0.25	0.83	-0.09
INF	0.14	0.14	-0.10	-0.25	1.00	-0.24	0.01
LPY	0.43	-0.02	0.05	0.83	-0.24	1.00	-0.06
RIR	-0.07	-0.01	0.17	-0.09	0.01	-0.06	1.00

Note: All variables are in growth rate forms.

We estimate equation (3.13) by using the first difference of the growth rate variables because all the variables are stationary in their first differences at the 5% level. Table 3.3 gives the correlation matrix of the explanatory variables. The table shows that there is a multicollinearity problem between *GDP* and *LPY* and thus, we drop *LPY* from the equation.

Table 3.4 reports the results of the ordinary least square (OLS) and autoregressive procedure (AR). The first column in Table 3.4 reports the results from OLS and the second column reports the results from AR(1) procedure. We use AR(1) procedure because there is evidence of serial correlation in the OLS estimation as shown by the p-value of the Breusch-Godfrey statistics. The high Durbin-Watson statistic, which is close to 3, also indicates serial correlation.

The Jarque-Bera statistic in Figure 3.1 shows that AR(1) estimations does not have the problem of non-normality. The *F-statistic* is statistically significant at the 1% level. This shows that the overall fit of the estimated equation is good for the AR (1) procedure.

Table 3.4: Regression results of the determinants of the saving rate for Bangladesh

Variable	OLS Estimation	Corrected for serial correlation: The AR(1) method
Constant term	0.1804 (0.0063)	3.1917 (0.2065)
Borrowing constraint	-1.7076 (-1.4342)	0.0310 (0.0374)
Dependency ratio	-81.3843 (-0.3614)	-41.6710 (-0.3216)
Foreign saving	0.0234 (0.3573)	0.0437 (0.6944)
***GDP growth rate	45.2852 (5.7730)	36.6810 (3.1106)
Real interest rate	-0.0936 (-0.7519)	-0.0934 (-0.7362)
**Rate of inflation	-0.0759 (-1.0215)	-0.0936 (-1.9959)
AR(1)	--	-0.6142 (-3.2414)
R-squared	0.6603	0.7753
Adjusted R-squared	0.5754	0.7038
F-statistic	7.7764	10.8444
Durbin-Watson stat	2.9289	2.3872
BD	0.0172	0.0831

Notes: The dependent variable is the growth rate of gross domestic saving rate.

The t-ratios are given in parentheses. BD is the p-value of the Breusch-Godfrey serial correlation test.

*Critical value for the t-ratio at the 10% level of significance= 1.303

**Critical value for the t-ratio at the 5% level of significance=1.684

***Critical value for the t-ratio at the 1% level of significance=2.021

The results show that for Bangladesh, GDP growth rate and growth rate of inflation are statistically significant at the 1% and 5% levels, respectively. Both coefficients have the expected signs. Thus, the GDP growth rate has a positive effect on the

growth rate of gross domestic saving rate for Bangladesh as predicted by the life-cycle hypothesis. The growth rate of inflation has a negative effect on the growth rate of gross domestic saving rate.

6. Determinants of saving rate for India

Annual data from 1965 to 2004 are used for India. The saving function for India is given as follows.

$$SR_t = \beta_0 + \beta_1 BC_t + \beta_2 DPR_t + \beta_3 FSA_t + \beta_4 GDP_t + \beta_5 INF_t + \beta_6 LPY_t + \beta_7 RIR_t + \beta_8 SPB_t + \varepsilon_t \quad (3.14)$$

In the above model, all variables are in growth rate forms. For most of the period, India had a government dis-saving and thus, logarithms cannot be taken. Table 3.5 gives the correlation matrix of the explanatory variables and it shows that there is a multicollinearity problem between GDP and LPY. Hence, we drop LPY.

6.1. Empirical results of the determinants of saving rate for India

Table 3.6 shows the results of the unit root tests in levels of the variables. Table 3.7 shows the results of the unit roots in first differences of the variables. The Ng-Perron unit root tests show that all the variables have unit roots in their levels except for *FSA* and *INF* for India. However, there are no unit roots in their first differences at the 5% significance level for all the variables. The Ng-Perron unit root tests suggest that *BC, DPR, FSA, GDP, INF, LPY, RIR, SPB* and *SR,* follow an *I*(1) process and thus, the OLS model is estimated with the first differences of all the growth rate variables .

The Jarque-Bera statistic in Figure 3.2 shows that OLS estimation does not have the problem of non-normality. The Durbin-Watson statistic shows that there is no serial correlation. The p-value of the Breusch-Godfrey serial correlation test also confirms that the OLS results of India do not have the serial correlation problem.

The results of the OLS estimation are given in Table 3.8. *F-statistic* is greater than the *F-critical* value and it shows that the overall fit of the OLS estimation is statistically significant at the 5% level.

Table 3.5: Correlation matrix of the variables for India

Variable	BC	DPR	FSA	GDP	INF	LPY	RIR	SPB
BC	1.00	-0.04	-0.02	-0.30	-0.11	-0.22	0.25	0.15
DPR	-0.04	1.00	0.10	0.01	0.00	-0.04	0.06	0.01
FSA	-0.02	0.10	1.00	0.02	0.19	-0.10	0.20	-0.10
GDP	-0.30	0.01	0.02	1.00	-0.33	0.87	-0.12	0.01
INF	-0.11	0.00	0.19	-0.33	1.00	-0.35	0.14	-0.17
LPY	-0.22	-0.04	-0.10	0.87	-0.35	1.00	-0.10	0.05
RIR	0.25	0.06	0.20	-0.12	0.14	-0.10	1.00	-0.19
SPB	0.15	0.01	-0.10	0.01	-0.17	0.05	-0.19	1.00

Note: All variables are in growth rate forms.

Table 3.6: Results of the Ng-Perron tests for unit root in levels for India

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	31.8619	-8.1000	6.2936	-1.9800	0.1975	0.2330	25.7057	3.1700
*DPR	-9.4260	-8.1000	-0.7312	-1.9800	0.0776	0.2330	6.3456	3.1700
*FSA	-19.1713	-8.1000	-3.0501	-1.9800	0.1591	0.2330	1.4414	3.1700
*GDP	-4.2382	-8.1000	-1.3418	-1.9800	0.3166	0.2330	5.9371	3.1700
*INF	-1339.22	-8.1000	-25.8725	-1.9800	0.01932	0.2330	0.0206	3.1700
*LPY	-11.6328	-8.1000	-1.1662	-1.9800	0.1003	0.2330	2.7217	3.1700
*RIR	-19.3185	-8.1000	-3.0698	-1.9800	0.1589	0.2330	1.4038	3.1700
*SPB	-18.499	-8.1000	-2.1979	-1.9800	0.11881	0.2330	3.9521	3.1700
*SR	-17.0204	-8.1000	-1.8941	-1.9800	0.3113	0.2330	4.5545	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

The results show that the GDP growth rate does not affect the growth rate of saving rate for India as posited by the life-cycle hypothesis. Hence, in India, people are not so concerned about the GDP growth rate when they make saving decisions.

Table 3.7: Results of the Ng-Perron tests for unit root in first differences for India

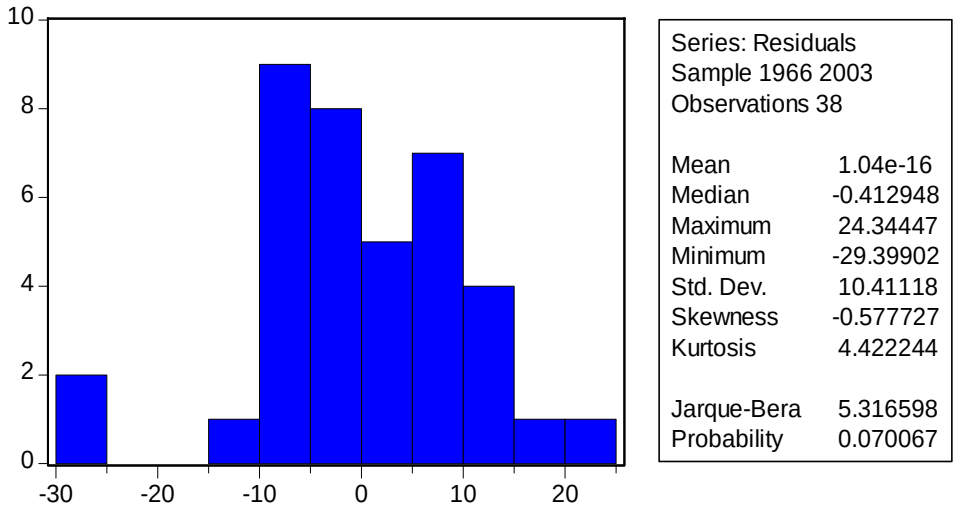
Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	-12.8349	-8.1000	-8.7979	-1.9800	0.09452	0.2330	2.6443	3.1700
*DPR	-11.8117	-8.1000	-0.9565	-1.9800	0.0809	0.2330	2.0852	3.1700
*FSA	-39.4048	-8.1000	-4.4261	-1.9800	0.11232	0.2330	0.6569	3.1700
*GDP	-18.2799	-8.100	-3.0230	-1.9800	0.1654	0.2330	4.9864	3.1700
*INF	-14.0024	-8.1000	-2.6282	-1.9800	0.1877	0.2330	1.8175	3.1700
*LPY	-22.3970	-8.1000	-1.4427	-1.9800	0.0644	0.2330	5.7561	3.1700
*RIR	-41.5160	-8.1000	-4.5491	-1.9800	0.1096	0.2330	0.6093	3.1700
*SPB	-12.6147	-8.1000	-2.9234	-1.9800	0.1532	0.2330	3.4834	3.1700
*SR	-16.5749	-8.1000	-1.9767	-1.9800	0.1193	0.2330	4.3014	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Figure 3.2: The normality test for residuals for India



Although the growth rates of borrowing constraint, the dependency ratio, the rate of inflation, and the government saving are statistically insignificant, the coefficients have the expected signs.

Table 3.8: Regression results of the determinants of the saving rate for India

Variable	OLS Estimation
Constant term	-0.11602 (-0.0539)
Borrowing constraint	0.13686 (0.51930)
Dependency ratio	-5.0475 (-0.2261)
Foreign saving	0.01382 (0.9746)
GDP growth rate	-0.1888 (-0.3863)
Government saving rate	-0.07836 (-1.0218)
***Real interest rate	0.06124 (3.5951)
Rate of inflation	-0.0073 (-0.6084)
R-squared	0.4253
Adjusted R-squared	0.2912
F-statistic	3.1714
Durbin-Watson stat	2.0278
BD	0.2088

Notes: The dependent variable is the growth rate of gross domestic saving rate.

The t-ratios are given in parentheses. BD is the p-value of the Breusch-Godfrey serial correlation test.

*Critical value for the t-ratio at the 10% level of significance= 1.303

**Critical value for the t-ratio at the 5% level of significance=1.684

***Critical value for the t-ratio at the 1% level of significance=2.423

The growth of real interest rate is statistically significant at 1% level and the coefficient has the expected sign. At the aggregate level, a higher interest rate leads to an increase in the saving rate. Thus, the results suggest that the substitution effect is higher than the income effect in India.

7. Determinants of saving rate for Pakistan

Annual data from 1965 to 2004 are used for Pakistan. Based on availability of data, equation (3.12) is modified by excluding some variables. The saving function for Pakistan is as follows.

$$SR_t = \beta_0 + \beta_1 BC_t + \beta_2 DPR_t + \beta_3 FSA_t + \beta_4 GDP_t + \beta_5 INF_t + \beta_6 LPY_t + \beta_7 RIR_t + \beta_8 SPB_t + \varepsilon_t \quad (3.15)$$

In the above model, all variables are in growth rate forms.

7.1. Empirical results of the determinants of saving rate for Pakistan

Unit root properties of the variables are examined by using the Ng-Perron unit root tests. Tables 3.9 and 3.10 give the results of unit root tests in levels and in first differences of the variables, respectively. The results of the Ng-Perron unit root tests show that all variables are stationary in their levels, because the null hypothesis of non-stationarity is rejected at the 5% level except for *DPR* and *SPB*. *DPR*, and *SPB* are found to be *I*(1) for Pakistan. Hence, we take the first differences of the growth rate of the variables for the OLS. Table 3.11 shows the correlation matrix for the variables. Because of the multicolinerity between GDP and LPY we drop LPY from the equation.

The p-value of the Breusch-Godfrey serial correlation test shows that the OLS results of Pakistan have the problem of serial correlation. Figure 3.3 shows that the residuals have no problem of non-normality for the AR(1) estimation. The regression results of OLS and AR(1) are given in Table 3.12. *F-statistic* is greater than the *F-critical* value at the 5% level for the AR(1) estimation.

Table 3.9: Results of the Ng-Perron tests for unit root in levels for Pakistan

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	-19.0985	-8.1000	-2.8951	-1.9800	0.1516	0.2330	1.9604	3.1700
DPR	-3.7361	-17.3000	-1.2486	-2.9100	0.3342	0.1680	22.6940	5.4800
*FSA	-14.1941	-8.1000	-2.6631	-1.9800	0.1876	0.2330	1.7295	3.1700
*GDP	-19.1269	-8.1000	-3.0761	-1.9800	0.1608	0.2330	1.3394	3.1700
*INF	-48.4120	-8.1000	-4.9071	-1.9800	0.10136	0.2330	0.5392	3.1700
*LPY	-10.7004	-8.1000	-2.2511	-1.9800	0.2104	0.2330	2.5292	3.1700
*RIR	-16.4663	-8.1000	-2.8691	-1.9800	0.1742	0.2330	1.4888	3.1700
SPB	-0.3184	-17.3000	-0.3906	-2.9100	1.2269	0.1680	274.926	5.4800
*SR	-43.1296	-17.3000	-4.6435	-2.9100	0.1077	0.1680	0.5689	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Table 3.10: Results of the Ng-Perron tests for unit root in first differences for Pakistan

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	-10.0816	-8.1000	-2.1684	-1.9800	0.0640	0.2330	2.108	3.1700
DPR	-23.6542	-17.3000	-3.3922	-2.9100	0.1434	0.1680	4.1305	5.4800
*FSA	-42.4592	-8.1000	-4.6060	-1.9800	0.1085	0.2330	0.5812	3.1700
*GDP	-21.5926	-8.100	-3.2815	-1.9800	0.15197	0.2330	4.2457	3.1700
*INF	-37.4820	-8.1000	-4.3291	-1.9800	0.1155	0.2330	0.6537	3.1700
*LPY	-13.5551	-8.1000	-2.3321	-1.9800	0.0746	0.2330	2.8913	3.1700
*RIR	-16.9794	-8.1000	-2.9137	-1.9800	0.1716	0.2330	1.4429	3.1700
SPB	-376.090	-17.3000	-13.7104	-2.9100	0.0365	0.1680	0.2474	5.4800
*SR	-44.6183	-17.3000	-4.7232	-2.9100	0.1059	0.1680	2.0428	5.4800

Notes: Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

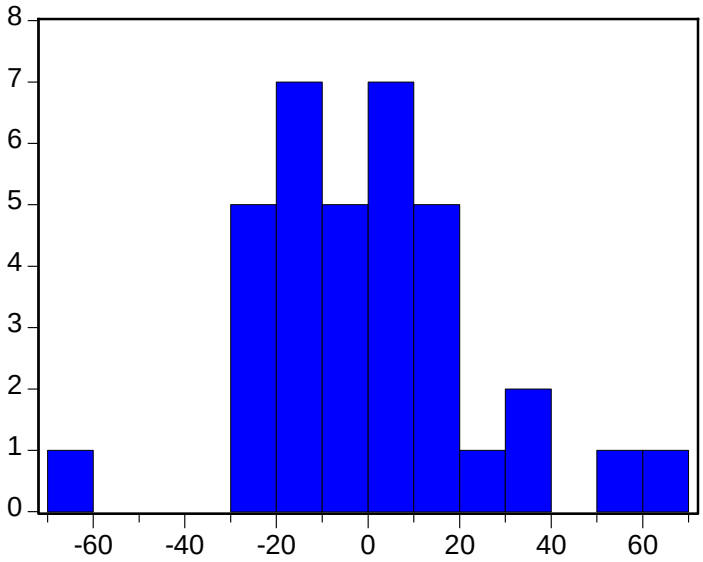
* Indicates no trend

Table 3.11: Correlation matrix of the variables for Pakistan

Variable	BC	DPR	FSA	GDP	INF	LPY	RIR
BC	1.00	0.13	0.39	0.02	-0.40	-0.07	-0.06
DPR	0.13	1.00	0.00	0.13	0.00	0.08	0.10
FSA	0.39	0.00	1.00	-0.22	-0.12	-0.14	0.00
GDP	0.02	0.13	-0.22	1.00	-0.26	0.87	0.18
INF	-0.40	0.00	-0.12	-0.26	1.00	0.38	0.35
LPY	-0.07	0.08	-0.14	0.87	0.38	1.00	0.19
RIR	-0.06	0.10	0.00	0.18	0.35	0.19	1.00

Note: All variables are in growth rate forms.

Figure 3.3: The normality test for residuals for Pakistan



Series: Residuals
Sample 1967 2004
Observations 35

Mean	3.29e-11
Median	-0.284557
Maximum	60.00285
Minimum	-64.98237
Std. Dev.	23.81588
Skewness	0.166920
Kurtosis	4.028059
Jarque-Bera	1.703851
Probability	0.426593

Results show that although *SBP, RIR, INF* have the expected signs, they are statistically insignificant for Pakistan. The growth rate of the borrowing constraint and the growth rate of the foreign saving are statistically significant at the 5% level. The coefficient on the growth rate of the foreign saving is negative. This result suggests that increased foreign saving crowds out the growth rate of domestic saving rate in Pakistan. The coefficient on the growth rate of the borrowing constraint is positive. This shows that financial development has a positive effect on the growth rate of the domestic saving rate for Pakistan.

Table 3.12: Regression results of the determinants of the saving rate for Pakistan

Variable	OLS Estimation	Corrected for serial correlation: The AR(1) method
Constant term	-0.6643 (-0.1240)	-0.1936 (-0.0462)
**Borrowing constraint	0.5890 (1.0001)	0.7627 (2.2622)
Dependency ratio	-5.6204 (-0.1945)	-2.9412 (-0.1326)
**Foreign Saving	-0.01584 (-1.2834)	-0.01636 (-1.9607)
GDP growth rate	0.0521 (0.0276)	-0.3923 (-0.2001)
Real Interest rate	0.60756 (0.4152)	0.5253 (0.4415)
Government saving rate	0.0004 (0.0025)	-0.0004 (-0.1078)
Rate of inflation	0.0117 (0.2282)	-0.0003 (-0.0055)
AR(1)	--	-0.31948 (-2.8045)
R-squared	0.4387	0.4181
Adjusted R-squared	-0.0557	0.50243
F-statistic	1.0608	4.0408
Durbin-Watson stat	2.553	2.2580
DB	0.0060	0.8001

Notes: The dependent variable is the growth rate of gross domestic saving rate.

The t-ratios are given in parentheses. DB indicates the p-value of the Breusch-Godfrey serial correlation test.

*Critical value for the t-ratio at the 10% level of significance= 1.303

**Critical value for the t-ratio at the 5% level of significance=1.684

***Critical value for the t-ratio at the 1% level of significance=2.423

8. Determinants of saving rate for Sri Lanka

Annual data from 1965 to 2004 are used for Sri Lanka. The equation is given as follows.

$$SR_t = \beta_0 + \beta_1 BC_t + \beta_2 DPR_t + \beta_3 FSA_t + \beta_4 GDP_t + \beta_5 INF_t + \beta_6 LPY_t + \beta_7 RIR_t + \beta_8 SPB_t + \varepsilon_t \quad (3.16)$$

In the above equation, all variables are in growth rate forms. For most of the period, Sri Lanka had government dis-saving and *INF* was negative for some years.

8.1. Empirical results of the determinants of saving rate for Sri Lanka

We start our analysis by examining the order of integration of the variables. The results of the Ng-Perron tests in levels and first differences of the variables are in Tables 3.13 and 3.14, respectively. The results of the Ng-Perron unit root tests show that *DPR, FSA, GDP, INF, LPY, RIR,* and *SBP* are stationary in their levels because the null hypothesis of non-stationarity can be rejected at the 5% level.

However, the results show that *DPR,* and *SR* are *I*(1) for Sri Lanka because the null hypothesis of non-stationarity cannot be rejected at the 5% level of significance unless the first differences are taken. Therefore, we use the first differences of the growth rate of the variables for the OLS.

Table 3.13: Results of the Ng-Perron tests for unit root in levels for Sri Lanka

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	-19.4793	-8.1000	-3.1206	-1.9800	0.1602	0.2330	1.2586	3.1700
DPR	-0.6592	-17.3000	-0.3604	-2.9100	0.5468	0.1680	63.0478	5.4800
*FSA	-29.9713	-8.1000	-3.8706	-1.9800	0.1291	0.2330	0.8192	3.1700
*GDP	-18.1785	-8.1000	-2.9768	-1.9800	0.1638	0.2330	1.4853	3.1700
*INF	-19.1454	-8.1000	-3.0784	-1.9800	0.1608	0.2330	1.3354	3.1700
*LPY	-19.1237	-8.1000	-3.0616	-1.9800	0.1601	0.2330	1.3905	3.1700
*RIR	-19.4091	-8.1000	-3.1013	-1.9800	0.1598	0.2330	1.3120	3.1700
*SPB	-17.7573	-8.1000	-2.9782	-1.9800	0.1677	0.2330	1.3853	3.1700
*SR	-1.0291	-8.1000	-0.7135	-1.9800	0.6934	0.2330	23.6292	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Table 3.14: Results of the Ng-Perron tests for unit root in first differences for Sri Lanka

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values	Test statistics	Critical values
*BC	-14.758	-8.1000	-2.7163	-1.9800	0.1841	0.2330	1.6606	3.1700
DPR	-22.8514	-17.3000	-3.1677	-2.9100	0.0409	0.1680	3.1179	5.4800
*FSA	-10.0059	-8.1000	-2.1007	-1.9800	.0935	0.2330	1.4084	3.1700
*GDP	-12.9941	-8.100	-2.5303	-1.9800	0.1947	0.2330	1.9572	3.1700
*INF	-12.7100	-8.1000	-2.5035	-1.9800	0.1970	0.2330	1.9950	3.1700
*LPY	-12.9276	-8.1000	-2.5365	-1.9800	0.1962	0.2330	1.9180	3.1700
*RIR	-50.8854	-8.1000	-5.0347	-1.9800	0.0989	0.2330	0.5050	3.1700
*SPB	-32.8750	-8.1000	-4.0531	-1.9800	0.1233	0.2330	0.7489	3.1700
*SR	-20.4569	-8.1000	-3.1978	-1.9800	0.1563	0.2330	1.1989	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Table 3.15 gives the correlation matrix of the explanatory variables. As is the case for Bangladesh and India, there is evidence of multicollinearity between *GDP* and *LPY* in the OLS regression results for Sri Lanka. Hence, we drop *LPY*. The OLS regression results are given in Table 3.16. The Jarque-Bera normality test of statistic is in Figure 3.4 and it shows that OLS residuals do not have the problem of non-normality.

Table 3.15: Correlation matrix of the variables for Sri Lanka

Variable	BC	DPR	FSA	GDP	INF	RIR	SPB	LPY
BC	1.00	-0.01	-0.02	0.03	0.03	0.04	-0.12	0.11
DPR	-0.01	1.00	0.02	-0.10	0.06	-0.03	-0.04	-0.05
FSA	-0.02	0.02	1.00	-0.05	0.14	0.03	-0.26	0.23
GDP	0.03	-0.10	-0.05	1.00	-0.21	-0.03	0.11	0.89
INF	0.03	0.06	0.14	-0.21	1.00	0.16	-0.14	-0.14
RIR	0.04	-0.03	0.03	-0.03	0.16	1.00	-0.36	0.07
SPB	-0.12	-0.04	-0.26	0.11	-0.14	-0.36	1.00	-0.30
LPY	0.11	-0.05	0.23	0.89	-0.14	0.07	-0.30	1.00

Note: All variables are in growth rate form

Figure 3.4: The normality test for residuals for Sri Lanka

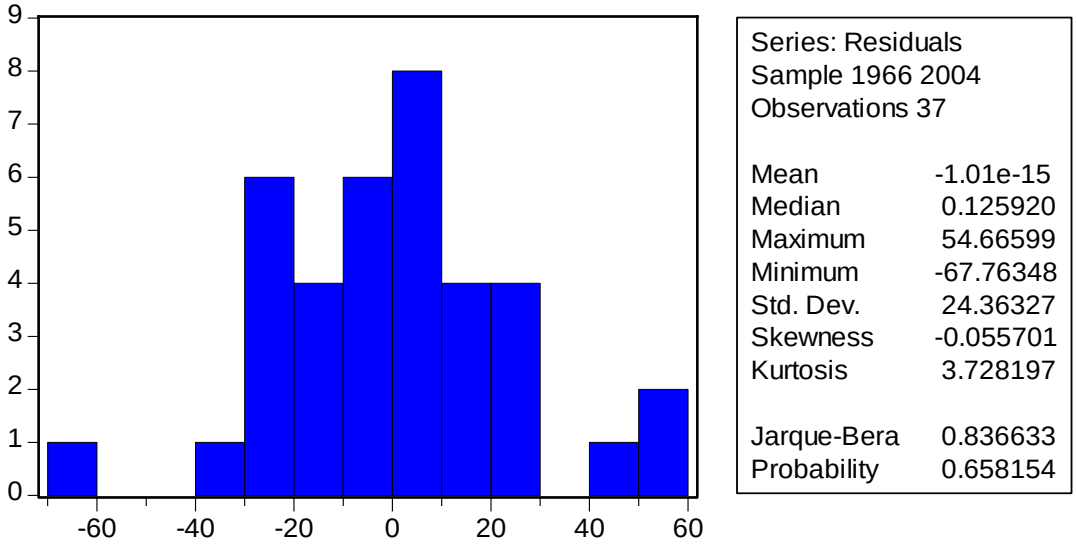


Table 3.16: Regression results of the determinants of the saving rate for Sri Lanka

Variable	OLS Estimation
Constant term	3.5255 (0.7719)
Borrowing constraint	-0.0091 (-0.0924)
Dependency ratio	27.1952 (1.71592)
***Foreign saving	0.0099 (3.5430)
GDP growth rate	0.0863 (0.0501)
Government saving rate	-0.0010 (-0.0117)
**Real interest rate	0.0627 (2.0894)
Rate of inflation	0.0270 (1.7919)
R-squared	0.5037
Adjusted R-squared	0.3839
F-statistic	4.2048
Durbin-Watson stat	2.2162
BD	0.7290

Notes: The dependent variable is the growth rate of gross domestic saving rate.

The t-ratios are given in parentheses. BD is the p-value of the Breusch-Godfrey serial correlation test.

*Critical value for the t-ratio at the 10% level of significance= 1.303

**Critical value for the t-ratio at the 5% level of significance=1.684

***Critical value for the t-ratio at the 1% level of significance=2.423

The Durbin-Watson statistic shows that there is no evidence of serial correlation. The p-value of the Breusch-Godfrey serial correlation test also shows that there is no serial correlation. *F-statistic* for the regression is significant at the 5% significance level. The

OLS estimation is in Table 3.16. The results show that *BC* and *GDP* have the expected signs but are statistically insignificant for Sri Lanka. The results show that *DPR, FSA, RIR* and *INF* are statistically significant. *DPR, RIR* and *INF* are statistically significant at the 5% level and *FSA* is statistically significant at the 1% level. Even though *DPR* is statistically significant as a determinant of growth rate of the saving rate, the sign of the coefficient is not negative as expected.

The growth rate of foreign saving rate has a positive sign. This suggests that growth rate of the foreign saving rate does not crowd out growth rate of the domestic saving in Sri Lanka. The growth rate of the real interest rate has a positive sign. This implies that the substitution effect is higher than the income effect for Sri Lanka as is the case for India. The growth rate of the inflation rate has a negative effect on growth rate of the saving rate in Sri Lanka as expected.

CHAPTER FOUR

THE RELATIONSHIP BETWEEN SAVING AND INVESTMENT

1. Introduction

The degree of capital mobility and the long-run relationship between domestic saving and investment have various policy implications for a county. Analysis of the relationship between saving and investment in the South Asian countries can improve understanding of capital mobility in the region. In a closed economy, saving constitutes the only source of investment and the two must be equal by definition.

Most Asian countries have removed the government controls on capital accounts and have liberalized their capital accounts in the late 1970s. Also, countries in the South Asian region have begun to liberalize their economies since early 1980s. If capital mobility has increased in the South Asian region, there would be no strong relationship between domestic saving and investment. If there is the capital mobility in the South Asian countries, an increase in saving in any one country should add funds to either the region or the world capital market. Thus, an increase in one county's saving would be shared among other countries with favorable investment opportunities in the region.

The rest of the chapter is organized as follows. In section two, we discuss literature on the relationship between saving and investment. In section three, the model for the relationship between saving and investment and capital mobility is described. In

section four, we discuss empirical results of the relationship between saving and investment.

2. Literature on the relationship between saving and investment

Economists have studied extensively the relationship between saving and investment for developed countries but the same is not true for developing countries. Feldstein and Horioka (1980) initiate the idea that high correlation between saving rate and investment rate would mean international capital immobility. Feldstein and Horioka find that there is a strong correlation between the saving and investment rates for OECD countries. Since the capital market is supposed to be integrated between the OECD countries their result is called the “Feldstein and Horioka puzzle”.

2.1. Cross section studies

Feldstein and Horioka (1980) look at the relationship between domestic saving and investment. It is a well established fact that most of the OECD countries have liberalized their financial markets. Thus, capital is freely mobile among OECD countries. When there is the international capital mobility, a country can finance its investment needs by using foreign capital inflows. Feldstein and Horioka find that capital is immobile in the OECD countries.

Feldstein and Horioka examine whether domestic saving remains in the same country to be invested or not for OECD countries. They argue that it is necessary to

empirically examine the relationship between saving and investment to decide on an optimal saving's policy and measure the tax incidence. They measure capital mobility using high correlation between domestic saving and domestic investment. According to them, if there is perfect international capital mobility, there should not be a high correlation between domestic saving and domestic investment. Equally, if incremental saving is invested within the country itself, the investment rate of the country should be very sensitive to the domestic saving rate.

They point out a number of issues relating to international capital flows. They suggest that the government should stimulate saving only if the additional saving gives sufficient benefits to the nation. According to them, in a closed economy the benefit of additional saving can be measured by the returns on the pre-tax domestic marginal product of capital since ultimately the nation as a whole receives both the after-tax yield and the tax revenue. On the other hand, in a perfectly financially liberalized market, the incremental saving can either replace the foreign saving or leave the home country.

Therefore, the benefits from additional domestic savings in a financially liberalized market can be measured only in terms of after-tax yields. When there is international capital mobility, tax incidence or burden can be shifted to domestic labor and foreign capital owners. But, in a closed economy, the tax burden is borne by the owners of capital and the possibility to shift the burden is limited. In a perfectly financially

liberalized economy, both short term and long term portfolio capital is mobile. This will continue until the domestic net-of-tax return on capital is equal to the foreign net-of-tax return on capital. However, the short term portfolio investment is more mobile than the long term capital. Feldstein and Horioka point out that the investors consider not only the rate of return on capital, but also many other factors before investing in a foreign country. These factors include the risks of investing in different countries, predictable changes of the tax rates both in host and in domestic countries, and the saving rate of the both countries. Nevertheless, Feldstein and Horioka argue that, in reality, even though investors are well informed about the investment opportunities in foreign countries, they are unable to freely move capital from one country to another since there are official restrictions and institutional rigidities in most countries.

They use annual data for 21 OECD countries for 1960-1974. However, five OECD countries are excluded from the sample because these five countries use different methods for calculating national income. The variables are the ratio of gross domestic investment to GDP and the ratio of gross domestic saving to GDP. Their model is given by

$$(I/Y)_i = \alpha + \beta(S/Y)_i \qquad (4.1)$$

where $(I/Y)_i$ is the investment rate and $(S/Y)_i$ is the saving rate. α is the constant term. β would be close to one if there is no capital mobility. It would be close to zero if there is perfect capital mobility.

The results using 16 OECD countries show that there is a significant relationship between saving and investment. Hence, Feldstein and Horioka suggest that most of the incremental saving is reinvested in the country itself and international capital mobility is less than expected. They conclude that the strong relationship between saving and investment may be due to some exogenous variables. Thus, they use the growth rate of population and the openness of the economy as exogenous variables. Openness is measured in two ways. The first measure is the sum of export and import as a percentage of GDP. The second openness measure is the size of the economy. They use size of the economy to measure openness because they argue that a large economy is more self-contained than a small economy. The explanatory variables, growth rate of population and the share of trade are not statistically significant. Though the openness is statistically significant, it has a negative value.

Kasuga (2003) studies the saving and investment relationship for developing countries. He indicates that the decisions of both savings and investment are affected by financial net worth which is a measure of the overall financial position. The domestic investment out of domestic saving depends on incremental net worth. The net worth depends on the level of financial development of the country. Therefore, he suggests that the relationship between saving and investment can be explained by the financial structure of the country.

Kasuga uses data for 23 OECD countries and 79 developing countries. He examines OECD and developing countries separately. Data are from the *World Development Indicators* of the World Bank. His analysis can be divided into two parts. First, he estimates the relationship between saving and investment using the same equation which is used by Feldstein and Horioka (1980). Second, he studies the relationship between saving and investment using the following equation.

$$(I/Y)_i = \alpha + \alpha_D D_i + \beta(S/Y)_i + \beta_D D_i (S/Y)_i + \varepsilon_i \qquad (4.2)$$

where $(I/Y)_i$ is the investment rate and $(S/Y)_i$ is the saving rate. α is the constant term. The dummy variable, D_i, is equal to one if the country has a developed financial market and equal to zero if it does not.

The regression coefficient of saving on investment for OECD countries is found to be higher than for developing countries. He uses several indexes for financial development and estimates the saving-investment relationship. Based on the indexes, the 120 countries are divided into different samples. First, he employs the ratio of equity to GDP as a measure of stock market. The sub-samples are as follows. The first sub-sample is the top 20 countries which have the most developed financial market based on the equity to GDP index. The second sub-sample is the top 30 countries which have a developed financial market according to the equity ratio. The top 20 countries, which have developed financial markets, includes 11 developing countries and the top 30 countries that have developed

financial markets, includes 17 developing countries. The results show that the regression coefficient on saving is larger for the top 20 country sample than the top 30 country sample.

He also studies and compares the results of the saving-investment relationship across different financial systems. The study finds that the countries, which have a developed stock market system, have a higher regression coefficient on saving than the countries which does not have a developed stock market. The dummy variable, which indicates the level of financial market development, is statistically significant. Thus, the level of financial development is a determinant of the saving-investment relationship.

2.2. Time series studies

After the Feldstein and Horioka study, two groups of study have emerged. One group of studies revisits the Feldstein and Horioka puzzle using a long sample period or dividing the sample period into two based on the date of change in the exchange rate system. These studies replicate the Feldstein and Horioka puzzle simulating exogenous and endogenous shocks to saving and investment. The second group of studies re-examine the Feldstein and Horioka puzzle by using alternative hypotheses such as intertemporal budget constraints, and the level of financial market development.

Narayan (2005) examines the relationship between saving and investment for Japan. He points out that there are limitations associated with panel data and cross-sectional data

such as the problem of heterogeneity. Hence, he analyzes the relationship between saving and investment using time series data for one country, which is Japan. In addition to the conventional unit root tests, like ADF and PP unit root tests, he uses the Zivot and Andrews (ZA), and the Lumsdaine and Papell (LP) unit root tests. He tests for structural breaks in the data. The structural breaks capture the short-run and the long-run effects of government policies on saving and investment. He uses the bounds testing approach to test for cointegration between saving and investment. The critical values for the bounds testing approach i.e. *F-statistic*, is calculated specific to the sample size. The bounds test can be used for testing for cointegration irrespective of whether the variables in the model are integrated of order zero, i.e. *I*(0) or integrated of order one, i.e. *I*(1). Narayan (2005) applies the bootstrap approach for the causality tests since the bootstrap approach produces more robust critical values. The lag length for the analysis is selected by using the "t-sig" approach[5] since the t-sig approach has better properties than information-based methods, such as the Akaike information criterion. The error correction cointegration model is as follows,

$$\Delta y_t = \beta_0 + \pi_{yy} y_{t-1} + \pi_{yx} x_{t-1} + \sum_{i=1}^{p} \vartheta_i \Delta y_{t-1} + \sum_{j=0}^{q} \phi_j{}' \Delta x_{t-j} + \theta w_t + \mu_t \qquad (4.3)$$

where π_{yy} and π_{yx} are long-run multipliers. β_0 is the drift and w_t is a vector of exogenous components. Δx_{t-j} and Δy_{t-i} are used to capture the short-run dynamics of

[5] This approach is suggested by Hall (1994).

the model. μ_t is the error term.

ADF and the PP unit root tests indicate that the saving and investment rates in Japan are integrated of $I(1)$. He uses ZA and LP tests to measure the impact of one structural break and two structural breaks, respectively. But both ZA and LP tests also indicate that saving and investment are integrated of $I(1)$. Thus, he concludes that policies, which are implemented by the Japanese authorities to boost investment and saving, have permanent effects. The bounds test for cointegration finds that the investment rate and the saving rate are not cointegrated for Japan from 1960 to 1999, when investment is the dependent variable in the model. Hence, he argues that the Feldstein and Horioka puzzle is not a puzzle in the case of Japan because the result is contrary to the Feldstein and Horioka's findings.

Many econometric studies have approached international capital mobility by using either direct or indirect measurements of capital mobility. Kant (2005) analyzes capital mobility among advanced countries. There are many ways to approach the question of international capital mobility indirectly.

First, international capital mobility has been examined using the relationship between saving and investment. These studies show mixed results. Some studies find that the saving-investment correlations to be stronger in the short-run than in the long-run. Some other studies find the opposite results.

Second, international capital mobility has been analyzed by using rates of return on capital among countries. These studies make an assumption which is that if no barriers exist for international capital mobility, rate of return on capital will not differ among countries. Third, capital mobility has been examined in the literature by using covered and uncovered interest parity condition (IPC[6]). The uncovered interest parity condition is more difficult to test than the covered interest parity since data on expected rate of return on all currencies are not easy to obtain. Studies on covered interest parity condition show mixed results (Taylor (1989), and Popper (1993)). Some studies find that only short-term financial capital is mobile. Other studies find that long-term financial capital is as mobile as short-term financial capital.

Kant's study is different because the paper empirically measures international capital mobility by using capital inflows and outflows. It also measures the determinants of the US capital outflows. The analysis is based on the Mundell-Fleming model. Quarterly data are used for the US. The quarterly data on stocks, investment abroad, and foreign investment in the US are from the *Survey of Current Business*[7]. Data on total private

---

[6] IPC describes the equilibrium of interest rates and exchange rates in an economy. The main idea of the IPC is that if a country's interest rate is relatively low compared to other countries, then that country's currency will tend to appreciate. Conversely, if the country's interest rate is relatively high, then that country's currency will tend to depreciate.

[7] The U.S. Department of Commerce's Bureau of Economic Analysis publishes the *Survey of Current Business*.

financial wealth are from the *Balance Sheets for the US Economy*.[8]

Data on spot exchange rates, foreign interest rates, and gold prices are obtained from both International Financial Statistics and the Federal Reserve web site. Globalization index data are obtained from various issues of the World Bank's World Development Report. Data on investment for Australia, Canada, Japan, and Western Europe are combined to yield total US assets. The total US investment in Australia, Japan and Western Europe are measured by using direct long-term capital flows, portfolio investment, and bank loans. Dicky-Fuller and Phillips–Perron unit root tests are used. Durbin-Wu-Hausman test is used to examine whether any endogenous elements in the model create a bias for the OLS estimators.

The results show that real interest rates of Canada, Germany, Japan and UK are not affected US investment in these countries. When each component of the total investment is measured separately, only bank loans and portfolio investment are affected by the real interest rate of the countries. Real money supply in the US, expected gold price, real interest rate in the US, and globalization index are found to be significant determinants of capital outflows for the US. He concludes that countries can have independent monetary policies with capital mobility. In addition, he finds that short term capital is more mobile than long term capital.

---

[8] The *Balance Sheets for the U.S.* Economy are published by the Board of Governors of the Federal Reserve System.

Kant's study shows that there can be a close relationship between domestic saving and investment simultaneously with international capital mobility. The study shows that the long-term capital flows are not affected by the government monetary policy. Thus, the governments can have their own policy targets without being too concerned about the effects of international capital mobility.

Most of the countries have experienced the process of financial market deregulation for over the past two decades. When financial markets are liberalized and integrated, an increase in saving in one country should add funds to the world capital. This available world capital then can be shared among countries, which have favorable investment opportunities.

Hussein (1998) revisits the Feldstein-Horioka puzzle by using data from 23 OECD countries. He uses annual data from the *World Development Indicators* for 1960-93. Hussein points out that there are number of drawbacks of the equation, which was used by Feldstein and Horioka. Feldstein and Horioka argue that if a country has perfect capital mobility, β_1 is equal to one in the following equation.

$$\frac{I}{Y_t} = \beta_0 + \beta_1 \frac{S}{Y_t} + \varepsilon_t \qquad (4.4)$$

Where *I/Y* is the investment rate as a percentage of GDP and *S/Y* is the saving rate as a percentage of GDP. Time is denoted by *t*. Hussein points out that if a country has offsetting capital inflows and outflows, then also the value of β_1 should be equal to one. Another

weakness of Feldstein and Horioka's cross-section approach is that the long term average of saving and investment rates may produce a long-run relationship even when no actual relationship exists. He argues that the high correlation between saving and investment can occur due to a number of macroeconomic factors. For example, government policies on current account targets would produce a strong correlation between these two variables. An economic shock that creates co-movements in saving and investment could also affect the relationship between saving and investment. For instance, a technological shock would increase investment as capital becomes more productive. Also, this leads to an increase in saving because wages of the workers would increase because of increased profit of the firms from low cost of production. Also, he points out that a high positive correlation between saving and investment occurs naturally within a quantitatively restricted equilibrium model.

He uses the dynamic ordinary least square method (DOLS). The equation is as follows.

$$(I/Y)_t = \alpha + \beta(S/Y)_t + A(L)\Delta(S/Y)_{t-k} + B(L)\Delta(S/Y)_{t+k} + A(L)\Delta(I/Y)_{t-k} + u_t \quad (4.5)$$

Where *A(L)* is the polynomial lag operator, *B(L)* is the polynomial lead operator, and *k* is either the number of lags or leads. *S/Y* and *I/Y* are saving and investment rates, respectively. He includes lag and lead variables because these variables solve the problem of endogeneity between saving and investment. He points out that the inclusion of a lagged

first difference investment variable would correct for the impact of the remaining autocorrelation of the residual term. Statistical significance is tested by using the Wald test. Stationarity of the data is checked by using ADF and PP unit root tests.

Results show that the variables are stationary in their first differences, they are i.e. $I(1)$. In order to study the impact of the financial deregulation on saving and investment relationship, he examines the long-run relationship betweens saving and investment over two periods. The two periods are from 1960 to 1993 and 1970 to 1993. The results show that there is no cointegration between saving and investment rates for Austria and the UK for 1970-1993 and Ireland for the period 1960-1993. When the endogeneity of saving is taken into account, the parameter β in the cointegration relation between saving and investment is far from unity for 18 countries out of 23. Hence, he concludes that capital is highly mobile in most countries over the last three decades.

Schmidt (2001) examines the relationship between saving and investment rates for the following five countries: the United States, the United Kingdom, Canada, France, and Japan. He points out that if there is a close relationship between saving and investment, a shock to one variable may produce an adjustment in the other variable. He mentions that several models have been used in the previous studies on the relationship between saving and investment. First, some studies use the same model as the one used by Feldstein and Horioka. Second, some studies use the following model.

$$\Delta\left(\frac{I}{Y}\right)_t = \alpha_0 + \alpha_1\left[\left(\frac{S}{Y}\right)_{t-1} - \left(\frac{I}{Y}\right)_{t-1}\right] + \eta_t \tag{4.6}$$

Schmidt argues that first and second models have an error specification problem because they ignore the dynamic adjustment process that would maintain the long-run relationship between saving and investment.

Thus, he uses the following model to correct the specification error.

$$\Delta\left(\frac{I}{Y}\right)_t = \delta_0 + \delta_1\Delta\left(\frac{S}{Y}\right)_t + \delta_2\left[\left(\frac{S}{Y}\right)_{t-1} - \left(\frac{I}{Y}\right)_{t-1}\right] + \delta_3\left(\frac{S}{Y}\right)_{t-1} + \eta_t \tag{4.7}$$

The model includes a lagged differenced saving term to capture the short-run dynamics and the additional lagged saving rate captures the long-run dynamics. He uses the Johansen maximum likelihood methodology (MLE) to estimate the parameters of the vector error-correction (VEC) model. The MLE approach includes both the long-run and short-run responses to the relationship between saving and investment. Schmidt's *k*-order VAR model can be presented as follows,

$$\Delta X_t = \mu + \sum_{i=1}^{k-1}\Gamma_i\Delta X_{t-1} + \Pi X_{t-k} + \varepsilon_t \tag{4.8}$$

Where, X_t is a vector of $I(1)$ variable at time t. The $\Gamma_i\Delta X_{t-1}$ terms account for the stationary variation related to the past history of the variables, and Π is the matrix for cointegrating relationship between variables.

Furthermore, he examines variance decompositions for saving and investment. The deviations away from the long-run equilibrium of two variables i.e. saving and

investment rates, need some short-run adjustment to reach the equilibrium. The adjustment to reach the equilibrium requires either saving rate to rise or investment rate to fall and/or both. He uses ADF and PP unit root tests. The Akaike information criterion and the Schwarz Bayesian criterion are employed for selecting the lag length. He uses quarterly data from the *OECD Quarterly National Accounts*. Gross private domestic investment is measured by gross fixed capital formation plus net addition to stock. Gross private saving is calculated by adding net lending abroad to GDP and subtracting private and government final consumption.

He finds that the saving and investment rates are stationary in their first differences. Saving and investment are found to be cointegrated for all four countries. Results of the variance decomposition find that domestic investment is largely determined by factors other than domestic saving. However, the results show that saving policies are likely to affect investment rate in France and Canada more than in the United States, the United Kingdom, and Japan. He finds that the short-run responses of investment for saving are not very large. The significant policy implication is the impact of saving policies to stimulate economic growth in the short-run may not be strong.

Sinha (2002) studies the relationship between saving and investment. The data are from the *International Financial Statistics*. Selection of the countries and time period are dictated by the data availability. Gross domestic saving is calculated by subtracting

government and private consumption from GDP. Saving rate and investment rate are defined as percentages of GDP. Investment is measured using gross fixed capital formation. He uses gross fixed capital formation because gross fixed capital formation does not include the inventory component. He uses the ADF and PP tests to test for unit roots and the Johansen tests for cointegration. To study the causality between saving and investment, Sinha uses Granger causality test. The growth rates of saving and investment are computed by using first difference of the logarithms of the variables. He also takes into account the effects of structural breaks. The vector error correction model is as follows.

$$\Delta y_t = a_{oy} + a_{1y} t - \Pi_y z_{t-1} + \sum_{i=1}^{p-1} \Gamma_{iy} \Delta z_{t-i} + \Psi_y w_t + e_t, t = 1,2,...,n \qquad (4.9)$$

where $z_t = (y_t', x_t')'$, y_t is an m_y x 1 vector of endogenous variables $I(1)$ variables, x_t and m_x x 1 vector of exogenous $I(1)$ variables.

He finds that only Japan and Thailand show a long-run relationship between saving and investment. But when structural breaks are taken into account, saving and investment have long-run relationships for Myanmar and Thailand. Based on the Granger causality tests using structural breaks into account, he finds that there is a causality running from the growth rate of saving to the growth rate of investment for Malaysia, Singapore, Sri Lanka and Thailand. The reverse causality holds only for Hong Kong, Malaysia and Singapore.

Sinha and Sinha (2004) study the relationship between saving and investment for 123 countries. They use data from the *Penn World Table*. They use the general class of

error correction model which gives both short and long-run relationships between variables. Basic saving is used as a measure of saving. Basic saving is defined as GDP minus total consumption expenditure of both government and private sectors. Investment is measured using gross fixed capital formation (GFCF). They use the ordinary least square method to estimate the vector error correction model for the countries for which there is no serial correlation problem. Autoregressive procedure (AR) is used for the countries that have the serial correlation. The general class of error correction model is as follows.

$$\Delta IR_t = \alpha + \beta \Delta SR_t + \gamma (SR_{t-1} - IR_{t-1}) \delta SR_{t-1} + \varepsilon_t \qquad (4.10)$$

where SR and IR are saving and investment rates, respectively. Δ stands for the first difference.

The results show that there are statistically significant long-run relationships between saving rate and investment rate for 41 countries. They find that the capital is mobile for only 16 countries. These 16 countries include 13 developing countries and only three developed countries. They find that for 84 countries there are short-run relationships between saving and investment rates.

Sinha and Sinha (1998) study the long-run relationship between saving and investmen for 10 Latin American countries. They use annual data and time periods are different for the countries. Investment is measured by using gross fixed capital formation. Gross domestic saving and investment are expressed as percentages of GDP. All data are

from the *International Financial Statistics* of the International Monetary Fund.

They use the ADF and PP unit root tests. The Johansen tests for cointegration are used. For all countries, except for Dominican Republic both variables are found to be $I(1)$. For Dominican Republic, saving and investment rates are integrated of order zero. The results show that there is a long-run relationship between saving and investment rates for Ecuador, Honduras, Jamaica, and Panama. For the four countries, there is one cointegrating vector between growth rate of saving and GDP. The cointegrating vector is found to be positive. They find that there is capital mobility for Colombia, El Salvador, Guatemala, Mexico and Venezuela.

Schneider (1999) studies saving-investment correlation and capital mobility in developing countries. In his study, he pays special attention to measure capital mobility in India. The effectiveness of various government stabilization policies, outcome of monetary policies, and effects of expansionary fiscal policies depend on the degree of international financial integration. The degree of crowding out of private investment due to the expansionary fiscal policy of the government also depends on the relationship between domestic and international financial markets. Capital mobility has increased in recent years due to the financial reforms and the opening up of the capital accounts to private capital inflows and outflows in many developing countries.

We can use two approaches to study international capital mobility. The first

approach is called the quantity approach. This approach examines whether domestic investment needs are financed by local supply of capital, or by the global supply of capital. Economists who use this approach suggest that if there is international capital mobility, there should not be a strong relationship between domestic saving and investment rates. The second approach is called the price approach. Economists who use this approach examine whether rates of return on capital are equalized or not between countries. Schneider also uses the quantity approach to study the international capital mobility among 60 developing countries for 1970-1997. Data are from the *World Development Indicators* and *International Financial Statistics*.

The basic model of the paper is based on the Feldstein and Horioka (1980) study. He uses annual time series data. His study is different from the previous studies because he examines the saving and investment relationship based on an inter-temporal approach to the current account. He uses the current account balance to measure international capital mobility because if investment increases above its permanent value, there will be a higher current account deficit. The reason for this is that new investment projects can be partially financed with an increase in foreign borrowing, generating a higher current account deficit. He uses India as a case study to analyze why saving and investment are lower for developing countries than for developed countries. Thus, he uses unrecorded capital flows. He argues that unrecorded capital inflows affect the relationship between saving and

investment. Unrecorded capital inflows are measured by using non-market foreign borrowings. The short-run and the long-run dynamics of the saving and investment relationship of the developing countries are analyzed by using an error correction model. The model is as follows,

$$\Delta I / Y_t = \alpha_{ECM} + \beta_{ECM} \Delta S / Y_t + \gamma_{ECM} (S / Y_{t-1} - I / Y_{t-1}) + \delta_{ECM} S / Y_{t-1} + \varepsilon_t \qquad (4.11)$$

In the above model t is time, β_{ECM} is a summary statistic of the dynamic properties of the economy. The error term is ε. The error correction term $S/Y_{t-1} - I/Y_{t-1}$ captures the long-run relationship between saving and investment. The ADF and PP unit root tests are used. The OLS method is used to estimate the coefficients of the model. If there is evidence of serial correlation problem, he uses the autoregressive method. In his study, he uses a benchmark to measure international capital mobility. If the correlation coefficient is below 0.6 for a country, there is no capital mobility for that particular country. When the correlation coefficient is over 0.6, there is capital mobility for that country.

The results of the ADF unit root tests show that data for many developing countries are non-stationary in their levels. The results show that the variables are $I(1)$ for most countries. The cointegration test shows that the saving and investment rates are cointegrated for India. Also, for India, the current account is non-stationary. For India, saving-investment correlation for the post-liberalized period is much lower than for the pre-liberalized period. The hypothesis that non-market capital flows may lower the

saving-investment correlation coefficient is rejected for India. All the countries in the sample except Algeria, Indonesia, and Ghana show a positive long-run correlation between saving and investment rates. Significantly, the results show that there is no international capital mobility for China. The results show that only for some countries, a stationary current account is associated with the low correlation between saving and investment rates.

Cooray and Sinha (forthcoming) study the relationship between saving and investment for African countries. African countries have a lower saving and investment rates. Cooray and Sinha point out that since the publication of the Feldstein-Horioka's (1980) paper, studies on saving-investment relationship have taken three basic strands. The first group of studies empirically tests the relationship between saving and investment using the methodology of Feldstein-Horioka. The second group of studies tests the relationship by using data on rates of return on capital. The third group of studies tests international capital mobility by examining endogenous policy responses. Their study belongs to the first group. They define the saving rate (*SR*) as GDP minus private and government consumption divided by the GDP. Cooray and Sinha use gross fixed capital formation as a measure of investment. The investment rate (*IR*) is defined as gross fixed capital formation divided by the GDP.

They use annual data on saving and investment rates for 20 African countries. Data are from the *International Financial Statistics*. The time span is different for different

countries based on data availability. The study is different from the previous studies on the relationship between saving and investment for African countries in three ways. First, Cooray and Sinha use data for a much longer time period. Second, they use the Ng-Perron tests which have not been used to test for unit root of saving and investment rates for African countries. Third, they use both the Johansen (1998) and fractional cointegration procedures to test for cointegration. For fractional cointegration tests, they use the Geweke and Porter-Hudak (1983) semi-parametric test. The general form of the least squares regression for the Geweke and Porter-Hudak semi-parametric test is as follows.

$$\ln(I(\omega_j)) = \theta + \lambda \ln(4\sin^2(\omega_j / 2)) + u_j ; j = 1,...,J \qquad (4.12)$$

Where θ is the constant term. $\omega_j = 2\pi_j / T(j = 1,...,T-1), J = f(T^{\mu})$ where J is an increasing function of T. T is the number of observation. $I(\omega_j)$ is the periodogram of the time series at frequency ω_j.

Either the Phillips-Hansen fully modified procedure or the OLS method is used to estimate the Feldstein-Horioka's saving function. The Phillips-Hansen fully modified procedure is used if the variables are cointegrated and there is only one cointegrating vector. Saving and investment rates are found to be cointegrated for Rwanda and South Africa when the Johansen test for cointegration is used. The fractional cointegration tests indicate that saving and investment rates are fractionally cointegrated for Algeria, Burundi, Egypt, Morocco, Niger, Rwanda, Senegal, South Africa, Swaziland, Tanzania, Tunisia and

Zimbabwe. The regression results show that there is a high correlation between saving and investment rates for Ethiopia, Niger and Senegal.

Cooray (2002) examines the degree to which financial deregulation has contributed international capital mobility in Sri Lanka. Sri Lanka deregulated its financial market in the late 1970s. She uses three models to study international capital mobility. The first is the same model as used by Feldstein-Horioka (1980). The second is the model tested by Sachs (1981) to study the saving-investment relationship. Sachs uses the following regression.

$$(CA/Y)_t = \alpha + \beta(I/Y)_t \tag{4.13}$$

where Y and I are GDP and gross domestic investment, respectively. CA stands for current account.

The third is the model used by Shibata and Shintani (1998). Their model is given by

$$\Delta C_t = (1-\lambda)e_t + \lambda \Delta X_t \tag{4.14}$$

where Δ and C stand for the first difference and private consumption, respectively. X_t is country's net output and it is defined as GDP minus gross domestic investment and government consumption.

Annual data are from the Central Bank of Sri Lanka for 1959-1998. She divides the sample period into two sub-periods. The first sub-period is from 1959 to 1976. During

this period, the exchange rate was fixed. The second sub-period is from 1978 to 1998. Sri Lanka had a floating exchange rate system during this period. She finds evidence of international capital mobility for Sri Lanka. All the three models that are used show that the degree of capital mobility is higher in the post-financial deregulation period, that is, 1978-1998, than the period prior to financial deregulation.

2.3. Panel studies

Kim et al. (2005) examine the saving-investment relationship for 11 Asian countries using panel data. Most of the Asian countries controlled foreign investment or foreign capital inflows and exchange rates until the 1980s. However, from the late 1980s, these countries have gradually removed legal barriers on capital inflows and outflows and adopted the free floating exchange rate system. The removal of barriers on movement of capital account has increased international capital mobility for Asian countries. Kim et al. compare the results of the saving-investment relationship before and after the 1980s.

They argue that the main problem with time series data is that they may be nonstationary. Nonstationary time series data may give spurious regression results. Although one can check for stationarity by using unit root tests, the tests have the problem of low power. There are two approaches to resolve the problem of low power. Increasing the length of data is one. However, it is very difficult to increase the number of observations because most of the countries do not have the data for a longer time period.

On the other hand, if data for a very long time period are used, it may capture unwanted regime-shifts. The other approach to solve the problem of low power is the panel data approach. They use saving and investment rates as percentages of GDP. Data are from the *International Financial Statistics* for 1960-1998. They employ "between-group" and "within group" means panel cointegration methods. The fully modified ordinary least square method (FMOLS) and the dynamic ordinary least square method (DOLS) are used for the regression.

They use two unit root tests. The Levin and Lin (1992) test (LL). The test can be used to test panel unit root with heterogeneous dynamics, fixed effects and individual-specific determinant trend. The Im et al. (2003) test (IPS) can be used to test the heterogeneity of the autoregressive unit root in the panel data. Heterogeneity across countries is the most common problem associated with the panel data approaches. They tackle the heterogeneity problem of the panel data by using cointegration tests which are developed by Pedroni (1995). This approach is very powerful because it incorporates all kinds of cross-country and time-series heterogeneities that are very common in panel data. The regression equation is as follows.

$$IR_{it} = \alpha_i + \delta_t + \beta_i SR_{it} + \varepsilon_{it} \qquad i = 1,2,3,.....,n \qquad t = 1,2,3,.....,T \qquad (4.15)$$

Where *IR* is the investment rate and *SR* is the saving rate. The fixed effect of the model is represented by α_i. δ_i is the individual deterministic trend. β_i is the heterogeneous slope

coefficient.

The results of both LL and IPS tests show that saving and investment rates are stationary in their first differences. The results of “between group test” and “within-group test” show that saving rate and investment rate are cointegrated. For the entire period, 1960-1998, FMOLS estimate of the saving-investment coefficient is 0.54 and DOLS estimate of the saving-investment coefficient is 0.62. FMOLS estimates of the saving-investment coefficients for 1960-1979 and 1980-1998 are 0.58 and 0.39, respectively. The saving-investment coefficients of DOLS are 0.76 and 0.42 for 1960-1979 and 1980-1998, respectively. Thus, they conclude that capital mobility has been increasing in the Asian countries since 1980s.

They argue that it is not wise to rely excessively on foreign capital inflows because of the possibility of abrupt reversal of foreign capital inflows. However, this possibility is high only for short-term portfolio investment. But, it is lower for foreign direct investment and foreign bank loans.

Ho (2002) examines the relationship between saving and investment for 20 OECD countries. Data are for 1961-97 from the *OECD Annual National Accounts*. He points out that there is a debate on the national accounts data of Luxembourg. The national accounts data of Luxembourg are outliers. The results would vary based on whether data from Luxembourg are included or not. In the recent past, many studies have examined the

Luxembourg effect in the context of the relationship between saving and investment. He studies the Luxembourg effect by using DOLS and the FMOLS. For the DOLS panel cointegration, he uses the following equation.

$$y_{it} = \alpha_i + \beta x_{it} + \delta_1(L)(y_{it} - \alpha_i - \beta x_{it}) + \delta_2(L)\Delta x_{it} + \delta_3(L^{-1})\Delta x_{it} + v_{it} \qquad (4.16)$$

where x and y denote the saving and investment rates respectively.

The equation to test for cointegration using the FMOLS method is as follows:

$$\hat{\beta}_{FM} = \left[\sum_{i=1}^{N}\left(\sum_{t=1}^{T}(x_{it} - \bar{x}_i)\hat{y}_{it} - T\hat{\Delta}_{\varepsilon U}\right)\right]\left[\sum_{i=1}^{N}\sum_{T=1}^{T}(x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)\right]^{-1} \qquad (4.17)$$

Kwiatkowski et al. (1992, hereafter KPSS) panel unit root test is used. He simulates the critical values for the unit root test based on the sample size to avoid the small sample bias. The results of the KPSS panel unit root tests show that saving and investment rates are $I(1)$ variables. The results of the FMOLS tests show that the investment and saving rates are cointegrated. But, the results of the DOLS show that there is no cointegration between saving and investment rates. The inclusion of Luxembourg does not affect the cointegration results.

Krol (1996) examines the relationship between saving and investment for OECD countries using panel data. He finds that the saving and investment correlation to be much lower than those commonly found in the literature.

Jansen (2000) argues that the low estimate of saving and investment correlation that is found by Krol is not related to the panel estimation, but is largely due to the

inclusion data from Luxembourg in the sample. Jansen points out that Luxembourg national accounts data are not used by many researchers who examine the relationship between saving and investment for OECD countries because Luxembourg's large international banking sector makes national accounts data less reliable than national account data of other OECD countries. He replicates the panel regression with the same equation, which is used by Krol. The panel regression is as follows:

$$IR(i,t) = a + c(i) + d(t) + \beta SR(i,t) + e(i,t), \qquad (4.18)$$

where *IR* is the investment rate. *SR* is the saving rate. The disturbance term is represented by e. The indices *i* and *t* denote country and time, respectively.

He uses gross investment, gross saving and gross GDP monthly data from *the OECD National Accounts* for 1960-1994. He uses seven sub-samples. Each sample is different from the other based on the number of countries or the time period. The point estimates for β are close to the values obtained by Krol when Luxembourg is included. When Luxembourg is excluded, the values of the β in equation (4.18) increase in every sub-sample. Hence, he concludes that Krol gets the low correlation between saving and investment rates due to the inclusion of Luxembourg but not due to the panel estimation technique.

Jansen's study is not much different from that of Krol. Jansen argues that the inclusion of Luxembourg in the sample creates biased results for the relationship between

saving and investment. However, some of the recent studies using advanced econometric techniques point out that the inclusion of Luxembourg does not affect the final results.

Rocha (2000) examines the relationship between saving and investment in developing countries using panel data. Many developing countries have adopted the flexible exchange rate system and liberalized their financial markets in the early 1980s. In order to capture the effects of financial liberalization on capital mobility in developing countries, separate regressions are estimated for 1960-1974 and 1975-1996. Capital mobility of 36 developing countries is studied using annual data for 1960-1996.

Feldstein and Horioka and many others have found that capital immobility in their studies because they find a high correlation between saving and investment. She indicates that there are three basic reasons why saving and investment rates could be correlated even if capital is mobile in reality. First, saving and investment could be correlated when an exogenous variable affects both saving and investment. Second, sometimes the high correlation between saving and investment can be attributed to the government's current account targets. Third, the country size can also affect the saving and investment correlation. When a country is large enough to affect the world interest rate, an increase in national saving would reduce the world interest rate and thus, increase domestic saving.

She uses a least square dummy variable (LSDV) model which is as follows:

$$y_{it} = \alpha_o + \alpha_i + \gamma_t + \beta' x_{it} + \varepsilon_{it} \qquad (4.19)$$

where y_{it} equals $I(_{i,t})/Y(_{i,t})$. x_{it} equals $S(_{i,t})/Y(_{i,t})$. (I / Y) is the ratio of gross domestic investment to gross national product (GNP). (S / Y) is the ratio of national saving to GNP. i is a country index. t is a time index. The model has a constant term, a_i to remove fixed differences between countries. Rocha uses the value of β of 0.6 following Murphy (1984) as the benchmark to see whether the correlation between saving and investment is high or not. The estimated slope coefficient, β, is 0.36 for the whole period, that is, for 1960-1996. The β values are 0.9925 and 0.3104 for 1960-1974 and 1975-1996, respectively. Thus, Rocha finds that there is international capital mobility for the developing countries.

Banerjee and Zanghieri (2003) study the relationship between saving and investment for 14 European countries using both panel and time series data. Their sample of countries only includes the European Union Countries (EVC) because these countries are much more likely to be homogeneous in terms of saving and investment.

To check for unit roots and cointegration in the time series data they use the ADF test and the Johansen test, respectively. They use three panel unit root tests namely, Levin and Lin (LL), Im et al. (IPS), and Maddala and Wu (MW). The Pedroni panel cointegration tests are used. The panel cointegration regression is as follows.

$$y_{it} = \alpha_i + \delta_i t + z_{it}{}' \beta_i + e_{it}, i = 1,2,.....T, \qquad (4.20)$$

where $\beta_i = (\beta_{1i}, \beta_{2i}, ...\beta_{ki})'$ is the k- dimensional cointegration vector with the coefficient on y_{it} normalized to one and $z_{it} = (z_{1t}, z_{2t}, ..., z_{kt})$ is the vector for the right hand side

variables. *e* is the error term.

The data are from the European Commission's *Annual Macroeconomic Database* of the Directorate General for Economic and Financial Affairs (AMECO). They use annual data from 1960 to 2000. Banerjee and Zanghieri use nine variables for their study. STY is the total saving rate. It is defined as private and public saving as a percentage of GDP. ITY is total investment rate. It is defined as private and public investment as a percentage of GDP. SGY is the government saving as a percentage of GDP. SPY is the private saving as a percentage of GDP. IGY and IPY are government investment and private investment as percentages of GDP, respectively. Current account balance (CA) is defined as the difference between STY and ITY. GGAP and PGAP are the saving gaps of the government and private sectors, respectively. GGAP is the difference between SGY and IGY. PGAP is defined as the difference between SPY and IPY.

The results of country-by-country analysis find that total saving rate is stationary in its first difference, for all countries except for Portugal and Finland. Total investment rate is also stationary in its first difference for all countries except Portugal and Span. Current account is first-difference stationary for all countries except Germany, Greece, Italy, Portugal, Spain, and the United Kingdom. Most of other variables like SPY, IPY, and PGAP. are stationary in their first difference for most countries. The results of the LM panel unit root test find that the total saving rate is stationary in its level. However, the

other panel unit root tests show that total saving rate is stationary in its first difference. On the other hand, only the results of the LL unit root test shows that total investment rate is stationary in its first deference. The other panel unit root tests show that total investment rate is stationary in its level.For the other variables like SPY, IPY, PGAP, and GGAP show that different panel unit root tests give different results.

The country by country study rejects the null hypothesis of no cointegration between the total saving rate and total investment rate for 7 countries out of the 14 countries tested. It is found that there is no cointegration between IPY and SPY for 5 out of the 13 countries. The panel tests show that the total saving rate and the total investment rate are cointegrated. The IPY and SPY are found to be not cointegrated. Also, there is no cointegration between SGY and IGY for individual countries and the panel. The study shows that the results of the unit root test as well as the cointegration tests depend on the test that is used.

3. Model for the relationship between saving and investment and capital mobility

The fundamental insight for the model for saving and investment relationship is taken from Schneider (1999) and Claus et al. (2001). The familiar open economy's national income and balance of payment identities are used to establish the theoretical relationship between saving and investment and capital mobility.

In an open economy, GDP is given as follows:

$$GDP = C+I+ G+(X-M) \quad (4.21)$$

where C and G are household consumption and government consumption, respectively. I is investment. X and M are exports and imports, respectively.

Let us assume that the trade balance is in a surplus, i.e. exports exceed imports, and the country's net credit position with the rest of the world is a positive number which is denoted by B. Then, the country earns a world interest rate r for the claims. Thus, gross national product (GNP) is GDP plus the net factor income from the rest of the world. The country's GNP is given as follows.

$$GNP = Y= C + I + G + (X-M) + rB \quad (4.22)$$

If we rearrange (4.22), we can show that the current account is equal to the difference between saving and investment of the country. (4.23) shows the relationship between saving and investment and current account balance or international capital flows into the country.

$$CA= (X-M) + rB = (Y-C-G)-I= S-I \quad (4.23)$$

In (4.23), S is the gross national saving and S is defined as $S=Y-C-G$ Also, S is equal to the sum of private saving and government saving. If the economy is closed to international capital movements, total domestic saving is equal to total domestic investment. In contrast, if the country is open to international capital movements, total domestic saving does not equal total domestic investment. If, for a country, domestic saving exceeds domestic

investment, the country will have a current account surplus and will accumulate net foreign factor income from the world.

4. Empirical analysis of the relationship between saving and investment

Two error correction models are employed to examine the relationship between saving and investment in the South Asian region. We employ two models to check the robustness of the findings and to compare the results of the two methods. First, we use the error correction model that was used by Jansen (1996). Second, we test for the long-run relationship between the two variables using the Johansen cointegration tests.

4.1. Results of the error correction model by Jansen

We analyze the dynamics of national saving and investment relationships to determine the degree of international capital mobility by using the error correction model in equation (2.1) in chapter two.

We use annual data. Data for Pakistan and Sri Lanka are for 1960 to 2004. The data for India and Bangladesh are for 1965-2004 and 1973-2004, respectively. AR(1) procedure is used for Pakistan because the Breusch-Godfrey serial correlation test shows that the OLS results of Pakistan have the problem of serial correlation. Although the error correction model can be estimated without considering the order of integration of the variables, time series properties of saving and investment rates are studied before analyzing the relationship between saving and investment because we also use the

Johansen cointegration tests for the same variables. The results of the Ng-Perron tests in levels and first differences of the investment rates are in Tables 4.1 and 4.3, respectively. Tables 4.2 and 4.4 show the results of the Ng-Perron tests in levels and first differences of the saving rates, respectively.

Table 4.1: Results of the Ng-Perron tests for unit roots for investment rates in levels for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
Bangladesh	-8.2973	-17.3000	-2.0351	-2.9100	0.2453	0.1680	10.9874	5.4800
India	-6.8192	-17.3000	-1.839	-2.9100	0.2697	0.1680	13.3692	5.4800
Pakistan	-17.2024	-17.3000	-2.8217	-2.9100	0.1875	0.1680	5.61417	5.4800
Sri Lanka	-7.6489	-17.3000	-1.9407	-2.9100	0.2537	0.1680	11.9479	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% level.

Table 4.2: Results of the Ng-Perron tests for unit roots for saving rates in levels for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
Bangladesh	-10.0787	-17.300	-2.2405	-2.9100	0.2223	0.1680	9.0608	5.4800
India	-14.844	-17.300	-2.6898	-2.9100	0.1812	0.1680	6.3406	5.4800
Pakistan	-9.1132	-17.300	-2.0837	-2.9100	0.2286	0.1680	10.1963	5.4800
Sri Lanka	-35.6972	-17.300	-4.2240	-2.9100	0.11833	0.1680	2.5570	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% level.

The results of the Ng-Perron tests show that both saving and investment rates are

integrated order one i.e. $I(1)$ at the 5% level for Bangladesh, India and Pakistan. The results show that the null hypothesis of containing a unit root is rejected for saving rate in its level for Sri Lanka.

Table 4.3: Results of the Ng-Perron tests for unit roots for investment rates in first differences for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
*Bangladesh	-10.0951	-8.1000	-2.1453	-1.9800	0.0527	0.2330	1.2397	3.1700
*India	-21.413	-13.800	-3.2214	-2.5800	0.1504	0.1740	1.3188	1.7800
*Pakistan	-12.837	-8.1000	-2.5261	-1.9800	0.1968	0.2331	1.9373	3.1700
*Sri Lanka	-21.7307	-8.1000	-3.2446	-1.9800	0.1493	0.2331	1.3052	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% level.

*Indicates no trend

Table 4.4: Results of the Ng-Perron tests for unit roots for saving rates in first differences for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
*Bangladesh	-10.8047	-8.1000	-2.8211	-1.9800	0.2176	0.2330	3.0806	3.1700
*India	-15.8756	-8.1000	-2.8154	-1.9800	0.1773	0.2330	1.5510	3.1700
*Pakistan	-9.66295	-8.1000	-2.82112	-1.9800	0.2033	0.2330	3.0912	3.1700
*Sri Lanka	-20.4738	-8.1000	-3.1964	-1.9800	0.1561	0.2330	1.2076	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% level.

*Indicates no trend

Table 4.5 shows the results of the error correction model. The OLS test results

show that there is a serial correlation problem for Pakistan. Thus, we use the AR(1) procedure for Pakistan. The test results show that the long-run saving and investment rates' coefficient i.e γ is statistically significant for India at the 5% level of significance and 10% level of significance for Sri Lanka.

Table 4.5: Results of the error correction model

Country	α	β	γ	δ	R^2	DW	BD	JB
Bangladesh	0.1583 (0.1406)	0.1924 (2.1067)	-0.0672 (-0.4271)	-0.0105 (-0.2550)	0.40	2.34	0.95	3.77
India	-0.8544 (-1.4743)	0.3695 (5.8482)	0.3603 (4.4650)	0.0479 (1.6274)	0.54	1.84	0.18	2.22
*Pakistan	9.9278 (1.1970)	0.0557 (0.6081)	0.5407 (1.109)	-0.6371 (-1.2269)	0.26	1.77	0.16	0.93
Sri Lanka	1.5908 (0.6754)	-0.0781 (-0.4433)	0.1145 (1.5777)	-0.0418 (-0.2592)	0.07	1.61	0.44	2.18

Notes: The first four rows show the estimated coefficients of the error correction model. The model is as follows: $\Delta IR = \alpha + \beta \Delta SR_t + \gamma(SR_{t-1} - IR_{t-1}) + \delta SR_{t-1} + \varepsilon_t$. Values in parentheses are the *t-statistic*. DW stands for the Durbin-Watson statistics. BD stands for the p-value of the Breusch-Godfrey serial correlation test. JB stands for the Jarque-Bera test statistic at the 5% level.

* The results are for the AR (1) procedure.

The statistically significant values for $SR_{t-1} - IR_{t-1}$ for India and Sri Lanka show that there is a long-run relationship between saving and investment for these countries. This implies that the intertemporal budget constraint is obeyed for India and Sri Lanka. The coefficient β which shows the short-run relationship between saving rate and investment rate, is statistically significant at the 5% level for both Bangladesh and India. Judging by the Feldstein and Horioka criterion, the statistically significant values for ΔSR_t implies that there is international capital mobility for India and Bangladesh.

The short-run relationship between saving and investment rates is not statistically significant for Pakistan and Sri Lanka. According to Sinha and Sinha (2004), and Levy (1999), the statistically significant value for SR_{t-1} indicates that the current account does not converge to a constant in the long-run and thus, implies that there is capital mobility. The coefficient of SR_{t-1} is statistically significant at the 10% level only for India and thus, there is evidence of international capital mobility for India.

4.2. Results of the Johansen cointegration tests for saving and investment rates

Next, we perform the VAR-based cointegration tests using the methodology developed by Johansen (1991 and 1995). Sinha (2002) points out that in Johansen cointegration tests, the time series are required to be $I(1)$. The unit root results show that both saving and investment rates are integrated of order one for all countries except Sri Lanka. Thus, the cointegration tests are performed for India, Pakistan and Bangladesh.

Table 4.6: Results of cointegration tests between saving and investment rates for Bangladesh, India and Pakistan

Country	Trace tests		Maximum eigenvalue tests	
	Test statistic	Critical value	Test statistic	Critical value
Bangladesh	14.2991	15.4947	14.1647	14.2646
India	15.3066	15.4947	12.9725	14.2646
Pakistan	9.8525	15.4947	9.3816	14.2646

Notes: The null hypothesis for both the tests is r=0.

Critical values are at the 5% significance level.

The unit root results show that we can not proceed with the Johansen cointegration test for Sri Lanka. The results of the trace tests and maximum eigenvalue tests are given in Table

4.6.

Neither the maximum eigenvalue nor the trace tests rejects the null hypothesis of no cointegration at the 5% level for all the three countries. The failure to reject the null hypothesis of $r = 0$ means that saving and investment rates are not cointegrated and there is no long-run relationship between saving rates and investment rates for the three South Asian countries. According to the Feldstein and Horioka interpretation, the results could be seen as evidence of high international capital mobility for Bangladesh, India and Pakistan.

5. Granger causality between saving and investment rates

Baharumshah et al. (2003) and Sinha (1998) point out that cointegration does not imply causality. According to Gujarati (1995), Granger causality is a technique for studying whether one time series is useful in forecasting another time series.

Claus et al. (2001) argue that the empirical test for the Granger causality is sensitive to the choice of lag length. Thus, bivariate Granger causality tests are conducted by using different lag lengths in order to ensure that the results are not affected by the choice of lag length. Sinha (1998) suggests that when the variables are cointegrated or they are stationary, the causality test can be conducted. In our case, saving rate and investment rate are not cointegrated for all countries. However, saving rate and investment rate are stationary in their first differences for all countries and thus, we use first differences of saving rate and investment rate for the causality test.

The results of the causality test for saving rate and investment rate for Bangladesh, India, Pakistan and Sri Lanka are given in Tables 4.7 to 4.10. DSR and DIR stand for the first differences of the saving rate and the investment rate, respectively.

Table 4.7: Granger causality tests for the first differences of saving and investment rates for Bangladesh

Null hypothesis	1 lag		2 lags		3 lags		4 lags	
	F-Statistic	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value
DIR does not Granger cause DSR	16.0352	0.0004	7.4319	0.0031	6.8668	0.0021	3.6751	0.0234
DSR does not Granger cause DIR	2.06129	0.16257	0.7805	0.4695	5.0908	0.0084	1.9398	0.0474

Table 4.8: Granger causality tests for the first differences of saving and investment rates for India

Null hypothesis	1 lag		2 lags		3 lags		4 lags	
	F-Statistic	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value
DIR does not Granger cause DSR	0.7002	0.4084	0.1195	0.8878	0.7315	0.5416	0.5248	0.7184
DSR does not Granger cause DIR	1.4361	0.2388	0.1122	0.8942	0.5455	0.6551	0.3115	0.8676

Table 4.9: Granger causality tests for the first differences of saving and investment rates for Pakistan

Null hypothesis	1 lag		2 lags		3 lags		4 lags	
	F-Statistic	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value
DIR does not Granger cause DSR	0.7810	0.38212	1.5868	0.2182	1.1569	0.3404	1.1771	0.3401
DSR does not Granger cause DIR	2.72625	0.10654	0.3751	0.6892	0.3971	0.7559	0.22851	0.9203

Table 4.9: Granger causality tests for the first differences of saving and investment rates for Sri Lanka

Null hypothesis	1 lag		2 lags		3 lags		4 lags	
	F-Statistic	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value	*F-Statistic*	p-value
DIR does not Granger cause DSR	1.0799	0.3050	0.3010	0.7419	0.3903	0.7608	0.3011	0.8744
DSR does not Granger cause DIR	0.1256	0.7249	0.6954	0.5053	0.8509	0.4758	2.3927	0.0719

The results of the causality tests between the first differences of saving and investment rates show that we reject the null hypothesis that investment rate does not Granger cause saving rate for Bangladesh for any lag level. The reverse causality does not hold for 1 and 2 lags, but there is reverse causality if we select lag of 3 or 4. Hence, the results show that feedback exists between the first differences of saving rate and investment rate for lag of 3 and 4 for Bangladesh.

We find that no evidence of Granger causality in either direction between the first differences of saving rate and investment rate for India, Pakistan and Sri Lanka. Hence, the results indicate that the first differences of saving and investment rates are statistically independent for India, Pakistan and Sri Lanka. Also, bivariate Granger causality tests show that the results are not sensitive to the choice of lag length for India, Pakistan and Sri Lanka. This may be due to the fact that we do not have disaggregated data on saving, for example, data on household saving, corporate saving and public saving.

6. Impulse response functions of saving and investment rates for the major South Asian countries

Elder (2003) points out that shock to one variable not only directly affects that variable, but also the shock transmits to all other endogenous variables, which are in the model, through the dynamic structure of the VAR. An impulse response function creates a shock to one variable and captures how the shock affects all other endogenous variables in the VAR. According to Pesaran and Shin (1998), an orthogonal set of innovations does not depend on the VAR ordering. We estimate the impulse responses from an innovation to either saving rate or investment rate by using Cholseky ordering.

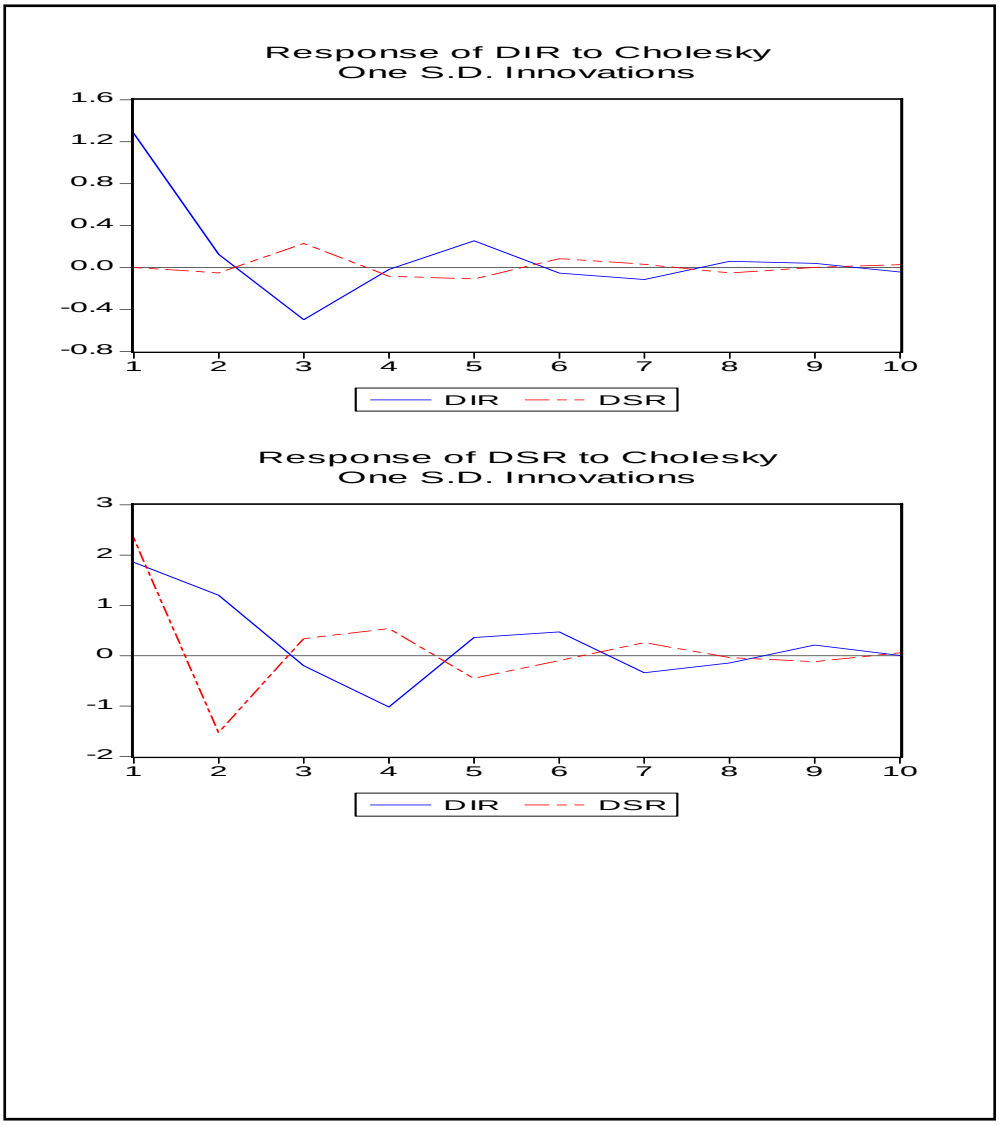
According to Sinha (2002) and Claus et al. (2001), we can use the impulse response functions to study the short-run dynamic responses between saving and investment. A shock to saving is expected to reduce interest rate and thus, increase investment. On the other hand, a shock to investment is expected to increase the interest rate and thus, increase saving.

We employ the first differences of SR and IR in the VAR setting to study the impulse response functions for the South Asian countries. For impulse response functions, DSR and DIR are the first differences of saving and investment rates, respectively. The impulse response functions are studied with one standard deviation innovation.

6.1. Impulse response functions for Bangladesh

Figure 4.1 plots the impulse response functions for Bangladesh. For Bangladesh, a shock to either DIR or DSR has hardy any effect on the other variable. However, the effect of the shock for both variables lasts for a long period.

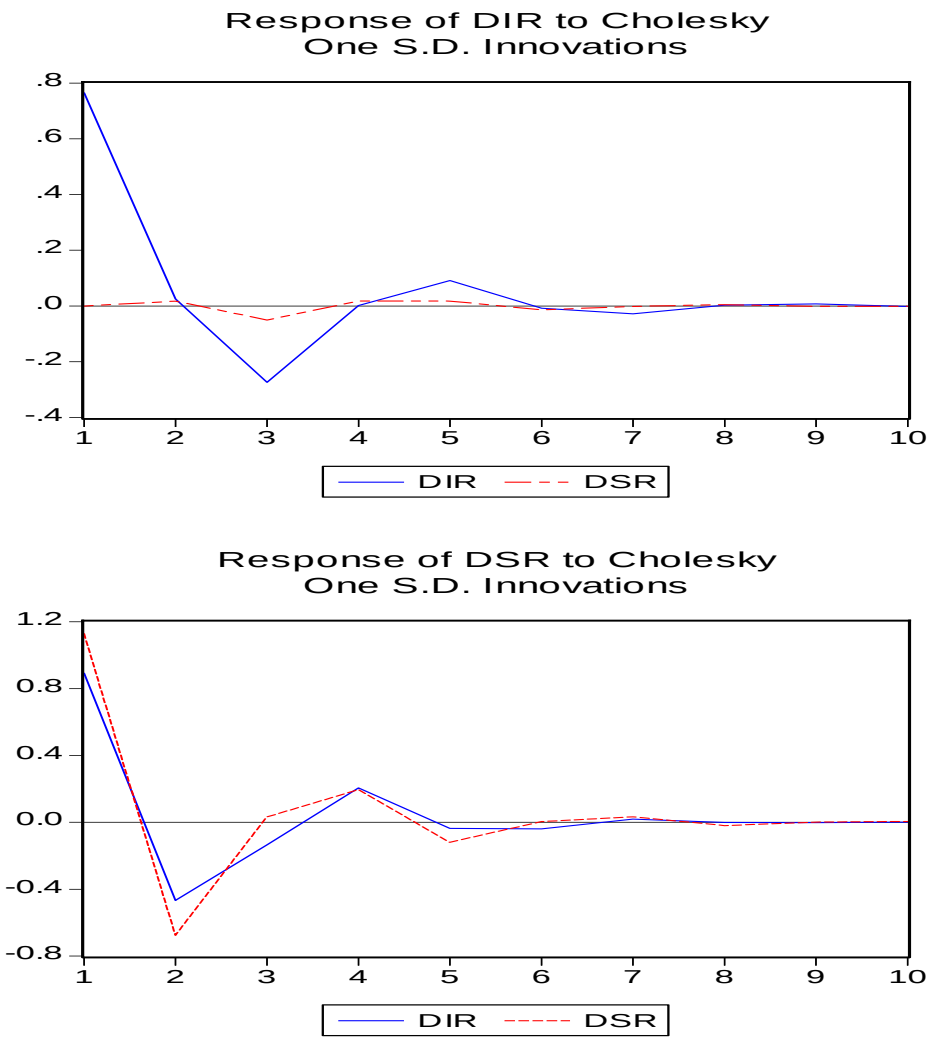
Figure 4.1: Impulse response functions of saving and investment rates for Bangladesh



6.2. Impulse response functions for India

Figure 4.2 shows the impulse response functions of DIR and DSR for India. A shock to DSR does not have much effect on DIR. However, a shock to DIR has an effect on DSR. For India, shocks to DIR and to DSR are hardly noticeable after seven years.

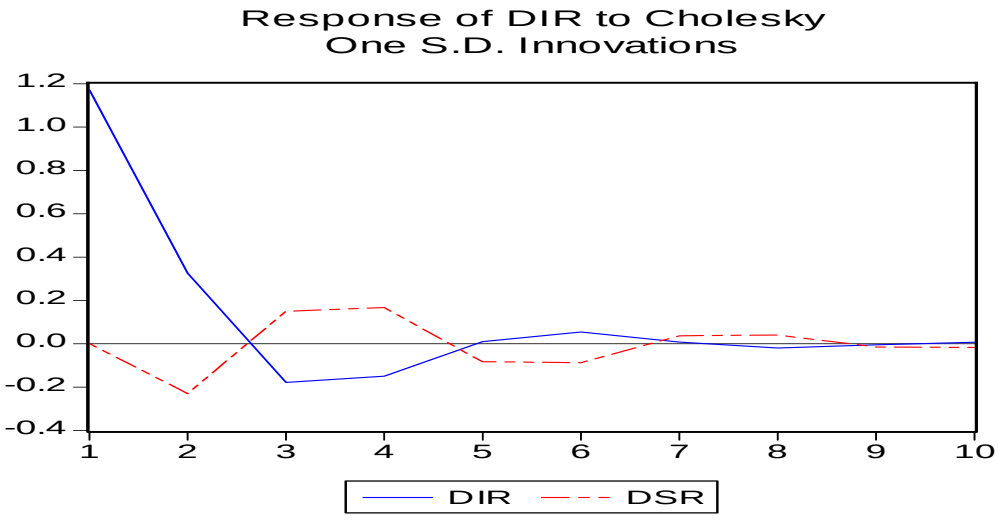
Figure 4.2: Impulse response functions of saving and investment rates for India

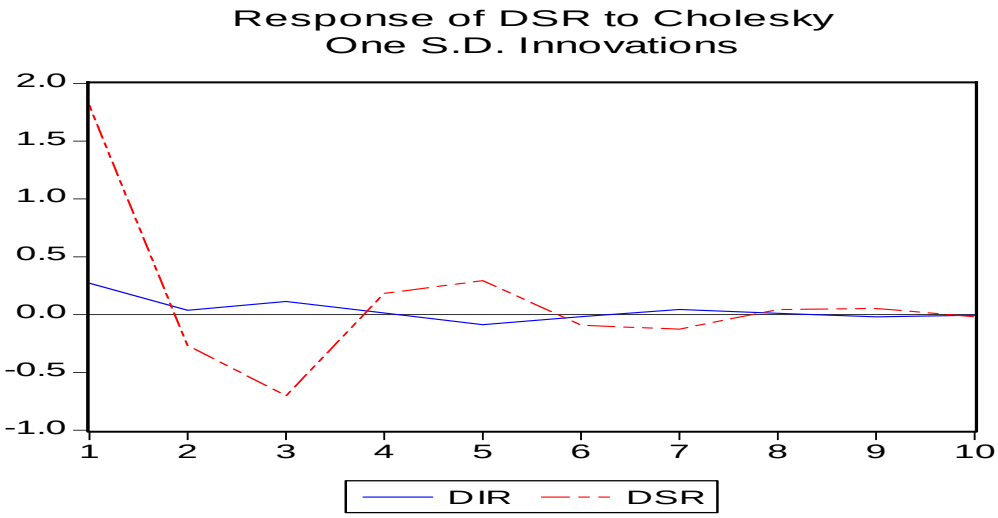


6.3. Impulse response functions for Pakistan

Figure 4.3 plots the impulse response functions of DIR and DSR for Pakistan. The results are as same as those for Bangladesh. A shock to DIR has not much effect on DSR. Also, the shock to DSR does not increase DIR as expected.

Figure 4.3: Impulse response functions of saving and investment rates for Pakistan

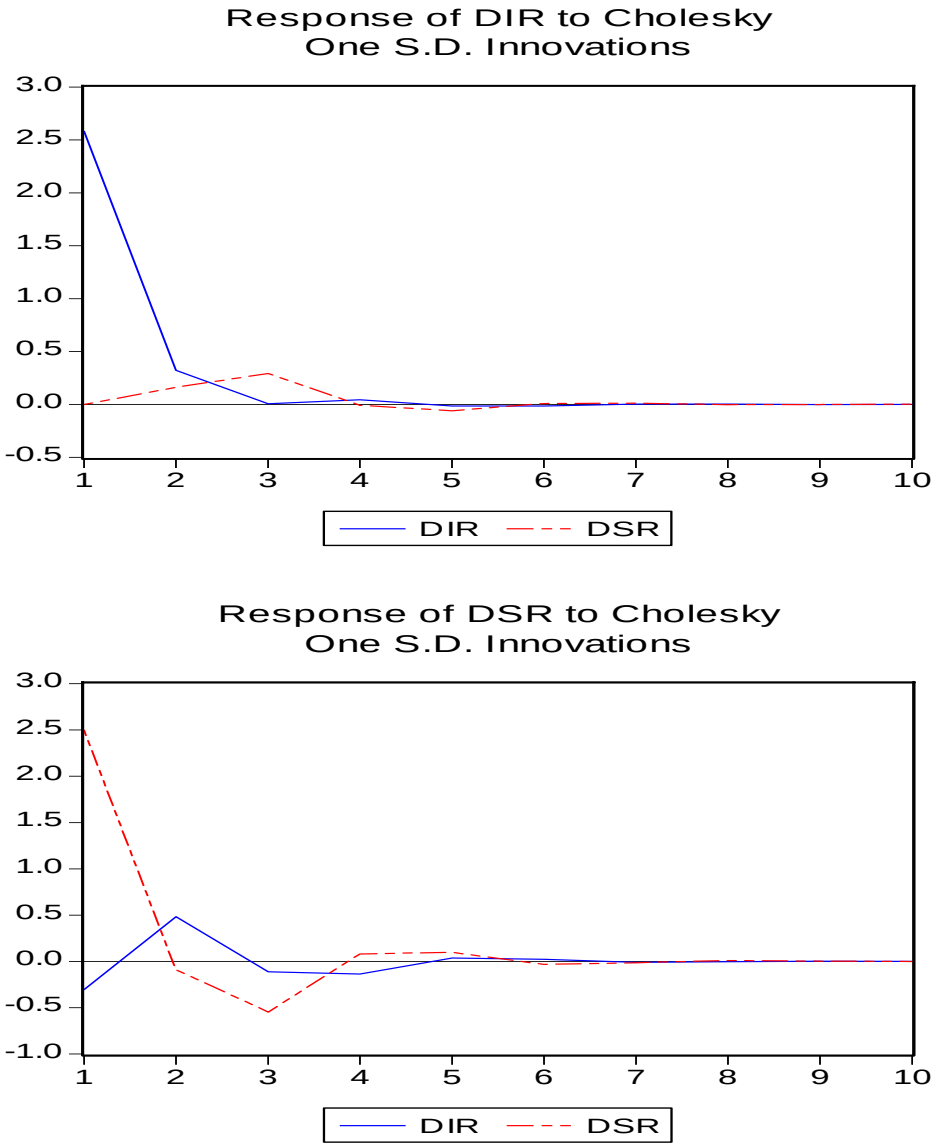




6.4. Impulse response functions for Sri Lanka

Impulse response functions of saving and investment rates for Sri Lanka are in Figure 4.4. For Sri Lanka, the responses to both shocks are expected. A shock to DIR has the effect of increasing DSR and a shock to DSR has the effect of increasing DIR. However, the shocks die out after seven years as is the case for India.

Figure 4.4: Impulse response functions of saving and investment rates for Sri Lanka



Understanding capital mobility is important for analyzing a wide range of issues such as the country's optimal saving rate and the incidence of tax changes. If there is a strong relationship between saving and investment, policy makers can alter investment through the introduction of policies that alter domestic saving. In contrast, if a high percentage of country's domestic investment is financed by foreign capital inflows, the government has to take policy measures to ensure macroeconomic stability of the country. Overall, we find that there is evidence of capital mobility for the four South Asian countries. Thus, South Asian countries have to implement policies to ensure macroeconomic stability.

CHAPTER FIVE

THE RELATIONSHIP BETWEEN SAVING AND ECONOMIC GROWTH

1. Introduction

Economists have studied the relationship between saving and economic growth using individual country and panel data for more than two decades. The policies which foster domestic saving are important for economic growth. Also, growth theories show that that saving contributes to higher economic growth. Solow type growth models also argue that saving precedes and causes economic growth.

On the other hand, the permanent income hypothesis and the life-cycle hypothesis argue that causality runs from economic growth to saving. Most neoclassical growth models show that if there is a decrease in saving, economic growth will decrease. Therefore, policy makers take measures to stimulate domestic saving.

The reminder of the chapter is organized as follows. First, we present a brief review of the literature on the relationship between saving and economic growth. Second, long-run relationship between saving and economic growth are discussed. In the third section, we show the results of augmented Granger causality tests. Impulse response functions for saving rate and GDP growth rate are given in section four.

2. Empirical studies on the relationship between saving and economic growth

Economists have studied the relationship between saving and economic growth using individual country, cross-country and panel data. Studies find mixed results about the relationship between the two variables. Some studies find that an increase in domestic saving increases economic growth. Some other studies find that the two variables are statistically independent.

2.1. Time-series and cross-country studies

Alguacil et al. (2004) examine the relationship between saving and economic growth for Mexico. They use the Granger non-causality test proposed by Toda and Yamamoto (1995). In an open economy, domestic saving can be financed either by domestic or by foreign saving or/and both. Therefore, they also examine the effect of foreign direct investment (FDI) on domestic saving. Out of three main types of foreign capital inflows, i.e. FDI, portfolio investment and foreign bank loans, FDI is more sensitive to economic growth because FDI is more permanent than the other two. Moreover, FDI transfers technological know-how to developing countries. Therefore, the effect of FDI on economic growth is grater than other forms of foreign capital inflows.

A country can invest more than it saves by acquiring international capital from the rest of the world. If the country acquires foreign capital to finance its investment, the current account balance will be in deficit. This relationship can be shown as follows.

$$I_t \equiv S_t - CA_t \tag{5.1}$$

where, I_t and S_t are domestic investment and saving, respectively. CA_t is the current account balance. They use annual data for 1970-2000. Data on saving and growth are from *World Development Indicators* and data on FDI inflows to Mexico are from the *International Financial Statistics*. They use the following vector autoregressive model (VAR).

$$x_t = \mu + \beta t + \Phi_1 x_{t-1} + ... + \Phi_S x_{t-S} + u_t \qquad t = 1,\ldots\ldots, T \tag{5.2}$$

Where $x_t = (S_t', Y_t', FDI_t')$, and $\Phi(i = 1,....,s)$ are all matrices of coefficients and u is the error term. S is gross domestic saving. Y and FDI stand for GDP and FDI inflows, respectively. The Toda and Yamamoto test does not need the pre-testing for unit roots. However, they test for unit roots using the ADF and PP tests. The unit root tests show that S, Y and FDI are integrated of order one.

They find that saving and GDP are cointegrated for Mexico. The results show that there is strong evidence of a causality running from domestic saving to GDP. There is also the reverse causality. The causality runs from *FDI* to GDP. The multivariate causality tests find that saving and *FDI* jointly Granger cause GDP. There is a one-way causality running from saving to foreign direct investment. They argue that the uni-directional causality shows the increasing confidence of foreign investors when domestic saving is rising. They find that if foreign direct investment variable is excluded, results are affected. Therefore,

the omitted *FDI* variable may give misleading results of the true causality between saving and growth.

Sinha and Sinha (1998) study the causal relationship between saving rate and economic growth for Mexico using annual data from 1960 to 1996. Data on saving are from Ortiz (1997). Real GDP data are from International Monetary Fund. The variables are public saving (PUBSAV), private saving (PVSAV) and GDP. All variables are transformed into logarithmic forms and growth rates are calculated by using the first difference of the logarithmic variables. ADF and multivariate cointegration tests are used to test for unit roots and cointegration, respectively. They use multivariate Granger causality tests and Johansen framework for cointegration tests. The vector error correction model is given by

$$\Delta y_t = \alpha_{oy} + a_{1y} t - \prod_y z_{t-1} + \sum_{i-1}^{p-1} \Gamma_{iy} \Delta z_{t-i} + \Psi_y w_t + e_{t,} t = 1,2,.....,n \qquad (5.3)$$

where $z_t = (y_t', x_t')', y_t$ is an m_y x 1 vector of endogenous variables *I*(1) and w_t is *q x* 1 vector of exogenous/deterministic variables *I*(0) variables.

The logarithms of PVSAV and GDP are found to be stationary in their first difference. PUBSAV is stationary in its level and it is excluded from the cointegration tests. The results of cointegration tests find that there is a long-term relationship between private saving and economic growth in Mexico. Causality tests show that there is a causality running from growth of GDP to both private saving and public saving. There is no reverse causality running from either PVSAV or PUBSAV to growth of GDP in Mexico.

Alguacil et al. (2003) examine the relationship between saving and economic growth for Spain. The Solow growth model and the endogenous growth model find that higher saving precedes and causes economic growth. In contrast, the model of consumption with habit formation[9] predicts that income growth can lead to a higher saving rate at least in the short-run.

Gross domestic saving is calculated by subtracting final consumption expenditure of both household and government consumption from GDP. Total saving is defined as private saving plus government saving. Data on GDP, saving, and GDP deflator are from OECD national accounts and *World Development Indicators*. Inward foreign direct investment data are from the Bank of Spain. Annual data are for 1970-1999.

Their vector autoregressive (VAR) model is as follows.

$$X_i = \alpha + \beta t + \phi_1 X_{t-1} + ... + \phi_s X_{t-s} + u_t \qquad t = 1, \ldots\ldots, T \tag{5.4}$$

In the above model, X_t is equal $X_t = (S'_{it}, Y'_t, FDI'_t)$ and, $S_i = S_T, S_H$. t represents a deterministic time trend. $\phi_j\,(j = 1,...,s)$ is a matrix of coefficients. S and Y are gross domestic saving and GDP, respectively. *FDI* stands for foreign direct investment. White noise error term is represented by *u.* The lag length is decided by using the Akaike information criterion (AIC) and the Hanna-Quinn criterion (HQC). They use Toda and Yamamoto (1995) Granger non-causality tests.

[9] The model of habit formation predicts that the individual's consumption is not affected immediately by an unexpected income growth.

They find that there is evidence of a causality running from domestic saving to GDP. But, there is no reverse causality. FDI Granger causes GDP. But, there is no reverser causality. The results of the Multivariate Granger causality tests show that there is a Granger causality running from *FDI* and *S* to *GDP*. Thus, the results show the importance of FDI to stimulate economic growth for Spain.

Mohan (2006) examines the relationship between saving and economic growth. He studies how the relationship affects economies with different income levels. He tries to determine whether the level of GDP has an effect on the direction of causality between saving and economic growth. He uses data for 25 countries. The variables are gross domestic saving (GDS) and GDP. GDS is defined as GDP minus government consumption and private consumption. The logarithms of the two variables are taken. He uses first differences of the logarithms of GDS and GDP to test for Granger causality. Thus, growth rate of the variables are used.

Annual data from 1960 to 2001 are from the *World Development Indicators*. The sample is divided into four subsets. The subsets are low-income, low-middle-income, upper-middle-income, and high-income countries. Each subset has five countries. ADF and the Johansen cointegration tests are used for unit root and cointegration tests, respectively. If the variables are found to be cointegrated, he uses the vector error correction (VEC) model to test for causality. Otherwise, vector auto-regression (VAR) model is used to test

for causality.

Results of the ADF unit root tests indicate that logarithms of GDS and GDP are integrated of order one for 22 countries. For Egypt, Malaysia, and the USA, at least one of the variables is stationary in its level and thus, these countries are excluded from the Johansen cointegration tests. He finds that growth rate of GDP Granger causes growth rate of saving for 13 countries. There is a reverse causality for 5 countries among the 13 countries. Further, there is a unidirectional causality, which is from the growth rate of saving to the growth rate of GDP, for Indonesia and Singapore.

He finds that the level of GDP affects the direction of causality between saving and economic growth. For the high-income countries, the causality runs from the growth rate of saving to the GDP growth rate. For the upper-middle-income countries, there is a bi-directional causality. The causality runs from the growth rate of GDP to the growth rate of saving for the low-middle-income countries. Finally, he finds mixed results for the direction of causality for low-income countries.

Andersson (1999) test for the causality between saving and growth in the long-run and in the short-run. He uses annual data for real GDP and real gross saving for three countries. Data are for 1950-1997, 1952-1996, and 1950-1996 for USA, UK, and Sweden, respectively. These three countries are chosen because of two reasons. First, there are dissimilar trends of the saving rates for these countries after the Second World War.

Second, Andersson wants to compare the results of large and small open economies.

Gross saving is equal to fixed capital formation plus net exports. Data for the US are from the NIPA[10] table. Data for UK and Sweden are from the *OECD national accounts* and Swedish Central Bank, respectively. The logarithms of the variables are used. Thus, the first difference of the variables gives the growth rate. The results show that for the US, there is no cointegration between saving rate and GDP growth. Thus, the long-run Granger-causality is not performed for the US. For the UK and Sweden, the variables are cointegrated. Also, there is evidence of long-run Granger-causality between saving and GDP. The long-run causality for UK runs from GDP growth to saving rate. Also, there is the reverse causality. For Sweden, the causality runs from GDP growth to saving rate. There is no evidence of the reverse causality.

The short-run causality between saving rate and GDP growth runs in both directions for the US and the UK, even though no long-run causality is found for the US. For Sweden there is no statistically significant short-run causality in either direction between saving rate and GDP growth.

[10] National Income and Product Accounts Tables (NIPA) are published by Bureau of Economic Analysis. It is an agency of the U.S. Department of Commerce.

2.2. Panel studies

Konya (2004) studies the Granger causality between saving rate and growth rate for 84 countries. He uses annual data for 1961-2000. The 84 countries are divided into three groups on the basis of their per capita GDP in 1995. The first group is the high-income countries which had at least US $ 10,000 per capita GDP. The second group is the medium-income countries which had per capita GDP from US $ 10, 000 to 1000. The third group is the low income countries which had less than US $ 1000 per capita GDP. Granger causality between saving and growth rate is examined with a new panel data approach based on the seemingly unrelated regressions (SUR) and Wald tests. According to him, the SUR method is more efficient than the OLS method only if three are contemporaneous correlations across countries. He uses the SUR instead of the OLS because there are contemporaneous correlations across the countries. Also, he uses country specific bootstrap critical values for the analysis. He argues that there are two advantages of this approach. First, the SUR does not require a joint hypothesis for all panel countries. Therefore, with the SUR, it is possible to perform Granger causality test on each individual country separately. Second, we can proceed with the Granger causality without testing for unit roots or cointegration. His equations for Granger causality tests are as follows.

$$Y_{i,t} = \alpha_{1,i} + \sum_{l=1}^{mly_i} \beta_{1,i,l} Y_{i,t-l} + \sum_{l=1}^{mlx_i} \gamma_{1,i,l} X_{i,t-l} + \varepsilon_{1,i,t} \qquad (5.5)$$

$$X_{i,t} = \alpha_{2,i} + \sum_{l=1}^{mly_i} \beta_{2,i,l} \; Y_{i,t-l} + \sum_{l=1}^{mlx_i} \gamma_{2,i,l} X_{i,t-l} + \varepsilon_{2,i,t} \qquad (5.6)$$

Index *i* refers to the country, *t* to the time, *l* to the lag and, *mly* and *mix* are the longest lags in the model. ε is the error tem. Akaike information criterion and Schwartz criterion are used for deciding the number of lags.

He finds that there are statistically significant high correlations between saving rate and growth rate for 38 countries. Results of the Granger causality tests show that only five countries have a causality runinng from saving rate to growth rate. These countries are Austria, Ireland, the Netherlands, Trinidad, and Tobago and Burundi. Out of these five countries, only Austria has a reverse causality. There is a one-way causality runinng from growth rate to saving rate in Finland, France, Japan, Sweden, Switzerland, Saudi Arabia, and Niger. The study presents a new approach to measure the Granger causality. The approach does not require for pre-testing for unit roots. Konya's results for some countries are different from the results of Andersson (1999) and Sinha and Sinha (1998).

3. Empirical results of the Johansen cointegration test between saving and GDP

The cointegration analysis helps to identify the long-run relationship between saving and GDP for the South Asian countries. We use data for 1960 to 2004 for India, Pakistan and Sri Lanka. For Bangladesh, the data are for 1973 to 2004.

We study the unit root properties of gross domestic saving and GDP for the four countries before proceeding with the Johansen cointegration test. The results of the

Ng-Perron unit root tests are given in Tables 5.1 to 5.4. The results show that we cannot reject the null hypothesis of a unit root for saving in level for all four countries. Also, Ng-Perron tests show that GDP is non-stationary in its level for all the countries. Both saving and GDP are found to be $I(1)$ for the four countries. Thus, we proceed with the Johansen cointegration test. The results of the trace tests and the maximum eigenvalue tests are given in Table 5.5. Table 5.6 shows the normalized coefficients of GDP and saving for the four countries.

The trace tests show that GDP and saving are cointegrated for all four countries. These results show that there is one cointegrating vector. The maximum Eigenvalue also reject the null hypothesis of no cointegration at the 5% level for all countries. The tests confirm that there is a one cointegrating vector for all the countries. Therefore, neither the maximum eigenvalue nor the trace tests has contradictory results at the 5% level for all the countries.

Table 5.1: Results of the Ng-Perron tests for unit roots for saving in levels for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
Bangladesh	-2.9938	-17.300	-0.9928	-2.9100	0.3316	0.1680	24.8396	5.4800
India	-1.0277	-17.300	-0.4231	-2.9100	0.4117	0.1680	40.1266	5.4800
Pakistan	-3.0424	-17.300	-0.9352	-2.9100	0.3074	0.1680	23.2470	5.4800
Sri Lanka	-7.5182	-17.300	-1.8349	-2.9100	0.2441	0.1680	12.3352	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

Table 5.2: Results of the Ng-Perron tests for unit roots for GDP in levels for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
Bangladesh	1.7417	-8.1000	0.9508	-1.9800	0.5459	0.2330	28.4237	3.1700
India	-8.7905	-8.1000	-1.7167	-1.9800	0.1953	0.2330	4.1238	3.1700
Pakistan	-0.6783	-8.1000	-0.2509	-1.9800	0.3699	0.2330	12.2769	3.1700
Sri Lanka	-6.3351	-8.1000	-2.8482	-1.9800	0.6744	0.2330	11.5361	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

Table 5.3: Results of the Ng-Perron tests for unit roots for saving in first differences for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
*Bangladesh	-8.5530	-8.1000	-2.0640	-1.9800	0.2413	0.2330	2.8793	3.1700
India	-21.8349	-17.300	-3.2524	-2.9100	0.1490	0.1680	4.4843	5.4800
*Pakistan	-21.2669	-8.1000	-3.2023	-1.9800	0.1506	0.2330	1.3547	3.1700
*Sri Lanka	-22.072	-8.1000	-3.3127	-1.9800	0.1501	0.2330	1.1422	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

*Indicates no trend.

Table 5.4: Results of the Ng-Perron tests for unit roots for GDP in first differences for South Asian countries

Country	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value	Test statistic	Critical Value
Bangladesh	-34.2456	-17.3000	-3.9773	-2.9100	0.1161	0.1680	3.5277	5.4800
India	-20.1868	-17.3000	-3.0587	-2.9100	0.1515	0.1680	5.2201	5.4800
Pakistan	-166.357	-17.3000	-9.0816	-2.9100	0.0546	0.1680	0.6630	5.4800
Sri Lanka	-21.7862	-17.3000	-3.2016	-2.9100	0.1470	0.1680	4.7724	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

Table 5.5: Results of the Johansen cointegration tests between saving and gross domestic product

The null hypothesis for both the tests is r=0				
Country	Trace tests		Maximum Eigenvalue tests	
	Test statistics	Critical values	Test statistics	Critical value
Bangladesh	31.41183	15.49471	27.62072	14.26460
India	25.67373	15.49471	22.12938	14.26460
Pakistan	15.53972	15.49471	15.47860	14.26460
Sri Lanka	19.39613	15.49471	19.39465	14.26460
The null hypothesis for both the tests is r<=1				
Country	Trace tests		Maximum Eigenvalue tests	
	Test statistics	Critical values	Test statistics	Critical value
Bangladesh	3.791106	3.841466	3.791106	3.841466
India	3.544352	3.841466	3.544352	3.841466
Pakistan	0.061126	3.841466	0.061126	3.841466
Sri Lanka	0.001489	3.841466	0.001489	3.841466

Note: All critical values are at the 5% significance level.

Table 5.6: Long-run cointegrating coefficients

Country	Gross domestic product	Saving
Bangladesh	1.000000	-0.896339
India	1.000000	-0.025561
Pakistan	1.000000	-4.033274
Sri Lanka	1.000000	-6.395794

Note: The coefficients are normalized on gross domestic product.

Table 5.6 shows that there is a long-run positive relationship between saving and GDP for all the South Asian countries. The results of the Johansen cointegration test show that the relationship between saving and GDP is as expected by the theory for South Asian countries.

4. Causality test between saving and economic growth for the four South Asian countries

Results of the Johansen cointegration test show that saving and GDP are found to be cointegrated for the South Asian countries. Our results are in line with many other empirical studies. Many empirical studies have found that there is a long-run relationship between saving and economic growth. Even though the two variables are cointegrated, it does not imply causality. We examine the short-run and long-run relationships between saving and economic growth to understand the saving behavior of the South Asian countries.

Sinha (1998) argues that if the variables are cointegrated, the standard Granger causality tests are not valid. When the variables are cointegrated, we can use an error correction model for the causality testing. The model gives more robust results than the standard Granger causality test. Thus, we use the error correction model or the augmented Granger causality test to study the causality between saving and economic growth.

4.1. Results of the augmented Granger causality test for saving and GDP for the four countries

The results of the augmented Granger causality between saving and GDP are given in Table 5.7. The results are for two lags. The results are not sensitive to lags. Thus, we report the results of two lags only. The results of the causality test show that we cannot

accept the null hypothesis that saving does not Granger cause GDP for all the countries except Sri Lanka. Saving and GDP are statistically independent for Sri Lanka.

Table 5.7: Results of the augmented Granger causality test for saving and GDP

Country	Saving does not Granger cause GDP		GDP does not Granger cause saving	
	F-calculated	F-critical	F-calculated	F-critical
Bangladesh	6.40	3.35	0.38	3.35
India	4.22	3.23	1.20	3.23
Pakistan	5.30	3.23	2.11	3.23
Sri Lanka	0.11	3.23	2.18	3.23

However, there is no evidence of reverser causality for any country because we fail to reject the null hypothesis that GDP does not Granger cause saving. Hence, the results show that feedback does not exist between saving and GDP for the South Asian countries. The results suggest that an increase in saving has an effect on GDP for Bangladesh, India, and Pakistan.

5. Impulse response functions for saving rate and economic growth

We study the impulse response functions for the South Asian countries to trace out the dynamic inter-relationship between saving rate and GDP growth rate. The theory predicts that an increase in saving will lead to higher GDP growth rate. In contrast, the life-cycle hypothesis predicts that an increase in GDP growth rate increases aggregate saving rate because higher GDP growth rate increases the lifetime resources of younger-age groups relative to older-age groups. We follow Claus et al. (2001) and study the impulse response

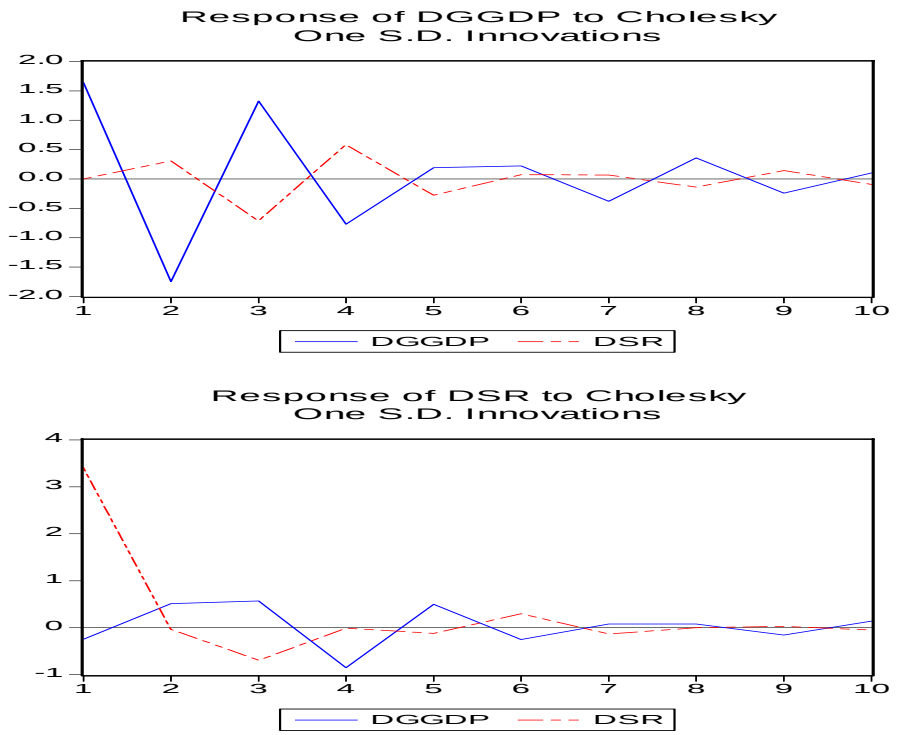
functions of saving rate and GDP growth rate to understand the short-run dynamics of the two variables.

We use first differences of SR and GDP growth rate in the VAR setting. In the impulse response function, DSR and DGGDP are the first differences of saving rates and GDP growth rates, respectively. Data are from 1960 to 2004 for all the countries except Bangladesh. For Bangladesh, the data are for 1973-2004. The impulse response functions are estimated with one standard deviation innovation and by using Cholseky ordering.

5.1. Impulse response functions for saving rate and GDP growth rate for Bangladesh

Figure 5.1 plots the impulse response functions for Bangladesh. A shock to DGDP increases DSR as is predicted by the life-cycle hypothesis. Also, a shock to DSR increases

Figure 5.1: Impulse response functions for saving rate and GDP growth rate for Bangladesh

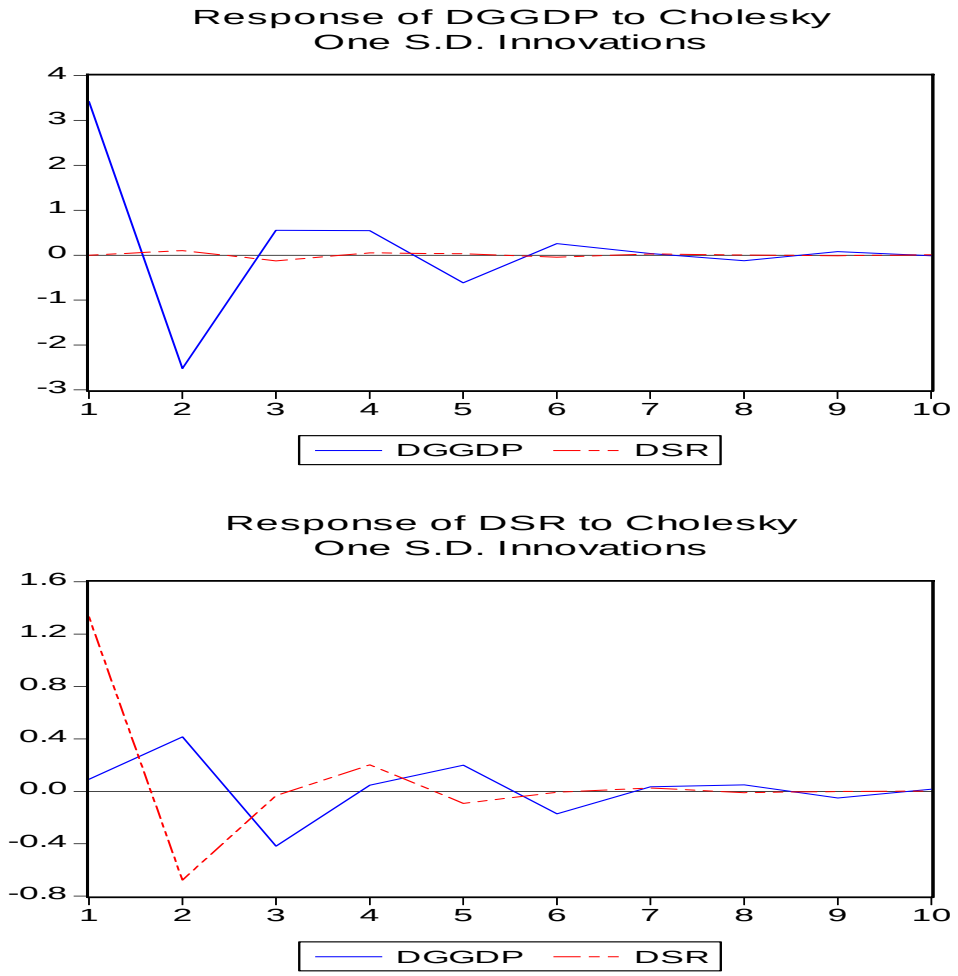


DGGDP during the first few years. The results show that a higher saving rate leads to a higher economic growth rate and a higher economic growth rate produces even a higher saving rate. It takes a fairly long time for DSR and DGGDP to return to the equilibrium levels after the shocks for Bangladesh.

5.2. Impulse response functions for saving rate and GDP growth rate for India

Figure 5.2 plots the impulse response functions of DSR and DGGDP for India. A shock to DGGDP has the effect of increasing DSR. The effect of the shock to DSR has the expected effect of increasing DGGDP.

Figure 5.2: Impulse response functions for saving rate and GDP growth rate for India

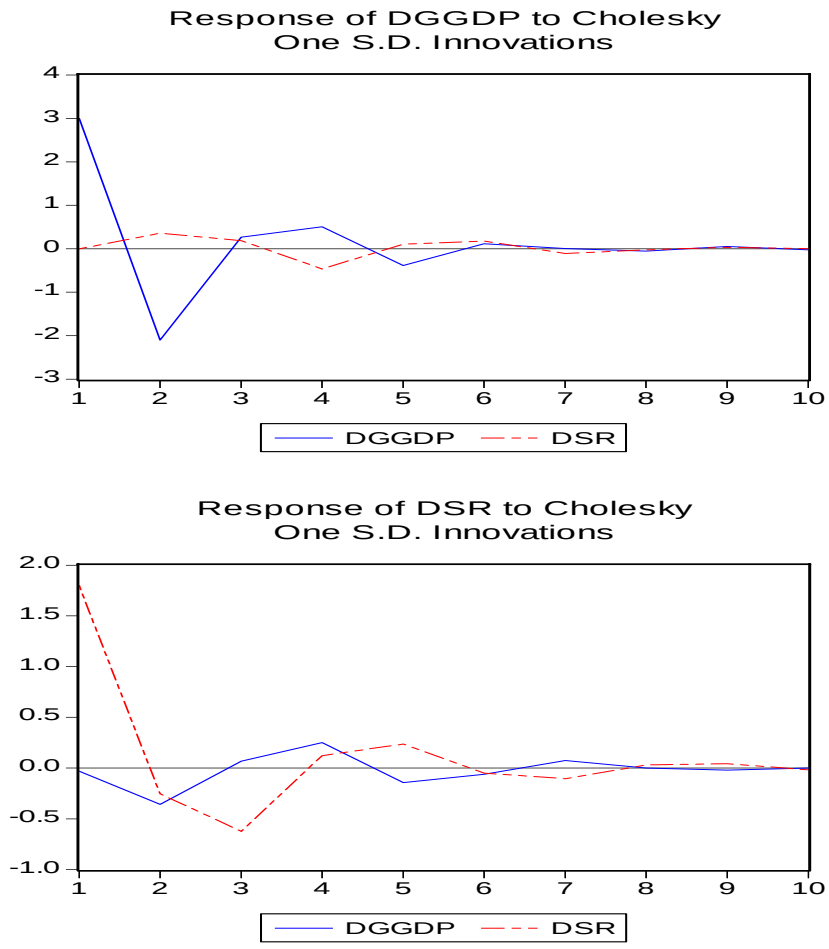


As is the case for Bangladesh, the responses to both shocks remain for a fairly long time for India. The results indicate that a higher GDP growth rate leads to a higher saving rate and a higher saving rate produces even a higher economic growth rate for India.

5.3. Impulse response functions for saving rate and GDP growth rate for Pakistan

Figure 5.3 shows the impulse response functions of DSR and DGDP for Pakistan. A shock to DGGDP does increase DSR as is expected. However, a shock to DSR does not increase DGGDP as is expected. A shock to DGGDP returns to the equilibrium level faster than that of DSR for Pakistan.

Figure 5.3: Impulse response functions for saving rate and GDP growth rate for Pakistan

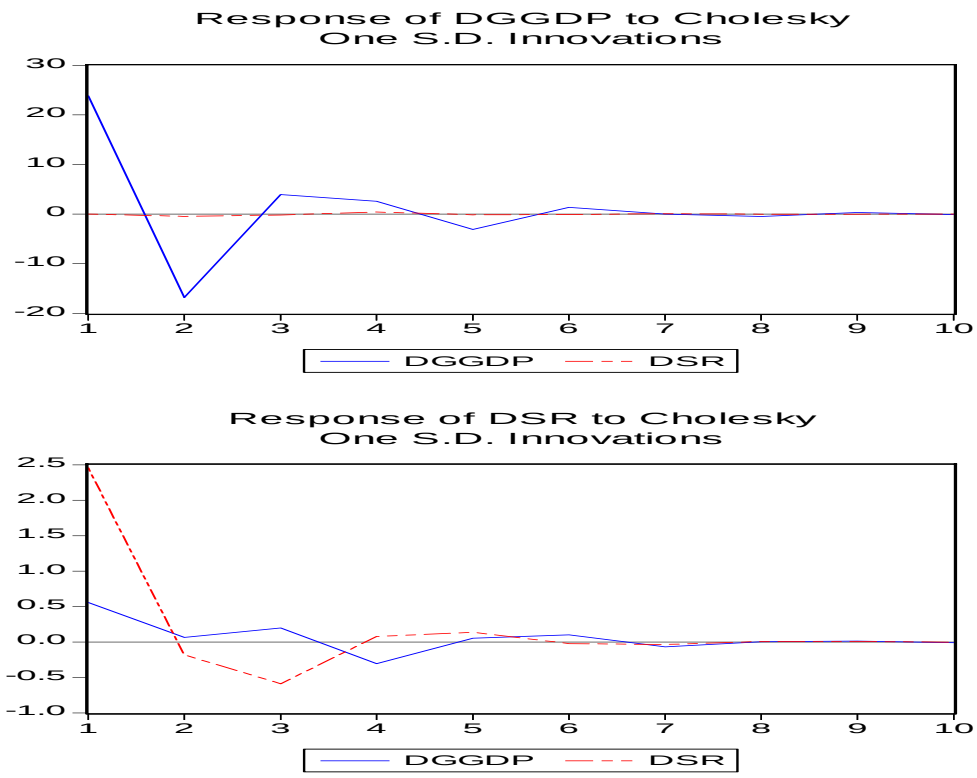


The results show that a higher GDP growth rate leads to a higher saving rate for Pakistan. But, a higher saving rate does not produce a higher economic growth rate for Pakistan as is predicted by the theory.

5.4. Impulse response functions for saving rate and GDP growth rate for Sri Lanka

Figure 5.4 shows the impulse response function for Sri Lanka. The responses to both shocks are hardly noticeable. This means that a higher saving rate and a higher economic growth rate do not affect each other. A higher GDP growth rate does not lead to a higher saving rate. Also, a higher saving rate does not produce a higher economic growth rate for Sri Lanka as is expected by the theory.

Figure 5.4: Impulse response functions for saving rate and GDP growth rate for Sri Lanka



CHAPTER SIX

PANEL STUDY FOR THE MAJOR SOUTH ASIAN COUNTRIES

1. Introduction

Asia is composed of many dynamic emerging economies. Among the Asian countries, all South Asian countries are developing countries. Johnston and Dinardo (1997) and Kim et al. (2005) point out that there are two advantages of the panel study. First, the panel study takes care of the problem of bias that is caused by the heterogeneity in a cross-sectional study. The heterogeneity arises from the differences of the countries. Second, panel data studies often have very large number of observations.

2. Results of the IPS unit root tests and the panel regression

We use the fixed effects panel least squares (PLS) method. Before estimating the fixed effects panel least squares (PLS), we study the time-series properties of the data. We use IPS unit root test. Annual data for 1973-2004 are used for the panel study. Thus, we use a balanced panel. All variables are in growth rate forms. Before studying the panel unit root properties, we test for the trend term of the variables. The results of the trend test show that dependency ratio has a time trend and thus, we include the time trend for the dependency ratio for the IPS unit root test.

The results of the IPS unit root test are in Table 6.1. A p-value which is less than 0.05 indicates that the null hypothesis of the panel unit root can be rejected at the 5% level.

The results show that the IPS unit root tests reject the null of a unit root for all the variables at the 5% level.

Table 6.1: Result of the IPS tests for panel unit root in levels

Panel Variable	IPS test statistic	p-value
Borrowing Constraint	-4.6987	0.0000
*Dependency ratio	-4.8349	0.0000
Foreign saving	-16.9120	0.0000
GDP	-4.60964	0.0000
Rate of inflation	-6.7080	0.0000
Level of per capita income	-4.0780	0.0000
Real interest rate	-5.7171	0.0000
Saving rate	-8.9206	0.0000

Notes: The null hypothesis is that the variable has a unit root.

All variables are in their growth rate forms.

* Indicates individual time trend

Table 6.2: Correlation matrix for the panel

Variable	BC	DPR	FSA	GDP	INF	LPY	RIR
BC	1.00	-0.11	-0.06	0.04	-0.05	0.09	0.04
DPR	-0.11	1.00	0.00	0.20	-0.05	-0.04	0.04
FSA	-0.06	0.00	1.00	0.08	-0.01	0.32	0.02
GDP	0.04	0.20	0.08	1.00	-0.16	0.84	-0.01
INF	-0.05	-0.05	-0.01	-0.16	1.00	-0.13	0.00
LPY	0.09	-0.04	0.32	0.84	-0.13	1.00	-0.05
RIR	0.04	0.04	0.02	-0.01	0.00	-0.05	1.00

Note: All variables are in their growth rate forms.

Since all variables are $I(0)$, we estimate the fixed effect panel least squares in the levels of the variables. Table 6.2 gives the correlation matrix of the explanatory variables. As is the case for individual country analysis, we do not include the level of per capita income for the panel regression because of the problem of multicollinearity.

Table 6.3: Fixed effect panel regression results of the determinants of the growth rate of saving rate for the South Asian countries

Explanatory variable	Coefficient	*t-statistic*	p-value
Constant	-15.5929	-0.9008	0.3695
Borrowing Constraint	0.2593	0.9045	0.3675
Dependency ratio	-1.7394	-0.2222	0.8246
Foreign saving	0.0028	0.1315	0.8956
GDP	5.9758	2.2643	0.0254
Rate of inflation	-0.0890	-2.6828	0.0083
Real interest rate	0.0290	0.5357	0.5932
Durbin-Watson stat	2.4370		
R-squared	0.4234		
Adjusted R-squared	0.4795		
F-statistic	3.8156		

Notes: All variables are in their growth rate forms.

All critical values are at the 5% significance level.

Although the growth rate of foreign saving is statistically insignificant, the results of the PLS show that it does not crowd out the growth rate of domestic saving since the coefficient on the growth rate of foreign saving is positive. Also, the results show that growth rate of dependency ratio reduces the growth rate of domestic saving rate as is expected by the theory. The growth rate of dependency ratio is statistically insignificant. The growth rate of borrowing constraint and the growth rate of real interest rate have a positive effect on the growth rate of domestic saving rate as is expected by the theory. But the coefficients on these two variables are also statistically insignificant.

The coefficients on the growth rate of rate of inflation and the GDP growth rate

are statistically significant. The growth rate of inflation has a negative effect on the growth rate of saving rate in the South Asian countries as is expected. This implies that macroeconomic stability affects the saving behavior of the South Asian countries. GDP growth rate has a positive effect on the growth rate of saving rate in the South Asian countries as is expected by the life-cycle hypothesis.

3. Panel cointegration between saving and GDP, and between saving and investment rates

We study two long-run relationships for South Asian countries by using the panel cointegration methodology. First, we study the long-run relationship between gross domestic saving and GDP. Second, we study the long-run relationship between saving rate and investment rate. We calculate the US $ value for saving and GDP. Data from 1973 to 2004 are used for each country and thus, we have a balanced panel. We study the properties of panel data before proceeding with the cointegration tests.

We use the IPS panel unit root test. We begin our unit root analysis by studying the time trends of the panel variables. The results of the trend tests show that saving and investment have a trend in their levels. GDP and gross domestic saving have no trend in their level and first differences.

Table 6.4: Result of the IPS tests for panel unit root in levels

Panel Variable	IPS test statistic	p-value
GDP	-0.9290	0.1764
Gross domestic saving	-3.518	0.7052
*Saving rate	-1.2570	0.1044
*Investment rate	-1.4966	0.0673

Notes: The null hypothesis is that the variable has a unit root.

* Indicates individual time trend

Hence, we conduct the IPS panel unit root tests with individual time trends for saving and investment rates in their levels. The results of the unit root tests in their levels and first differences are given in Tables 6.4 and 6.5, respectively.

Table 6.5: Result of the IPS tests for panel unit root in first differences

Panel Variable	IPS test statistic	p-value
GDP	-8.9445	0.0000
Gross domestic saving	-10.8314	0.0000
Saving rate	-11.0182	0.0000
Investment rate	-7.4232	0.0000

Note: The null hypothesis is that the variable has a unit root.

The results of the IPS tests show that we can not reject the null hypothesis of a unit root for all the variables in their levels. However, GDP, gross domestic saving, saving rate and investment rate are found to be stationary in their first differences. Since all variables are integrated of order one, we can proceed with the panel cointegration tests.

We use the panel cointegration test which is presented by Larsson et al. (2001).

Larsson et al. propose a maximum-likelihood-based panel test for the cointegrating rank in heterogeneous panels. Also, for the panel cointegration tests, we use the vector autoregressive and moving average processes with exogenous regressors (VARMAX).

3.1. Results of the panel cointegration tests

When we use the VARMAX procedure, lag orders can be either specified or automatically determined. We use the Hannan-Quinn criterion (HQC) for automatically determining the lag order. The results of the panel cointegration between gross domestic saving and GDP are given in Table 6.7. Table 6.8 gives the results of the panel cointegration between saving and investment rates.

Table 6.7: Results of the panel cointegration test between gross domestic saving and GDP

Cointegration Rank Test Using Trace					
The null hypothesis is r=0			The null hypothesis is r<=1		
Eigenvalue	Test statistic	Critical value	Eigenvalue	Test statistic	Critical value
0.1837	26.2180	15.4947	0.0228	2.6776	3.8415

Note: Critical values are at the 5% significance level.

Table 6.8: Results of the panel cointegration test between saving rate and investment rate

Cointegration Rank Test Using Trace					
The null hypothesis is r=0			The null hypothesis is r<=1		
Eigenvalue	Test statistic	Critical value	Eigenvalue	Test statistic	Critical value
0.0851	11.2100	12.2100	0.0000	0.0020	4.14

Note: Critical values are at the 5% significance level.

Table 6.9: Long-run panel cointegrating coefficient

Gross domestic product	Gross domestic saving
1.000000	-4.1779

Note: The coefficients are normalized on gross domestic product.

The results of the panel cointegration show that the trace test rejects the null hypothesis of no cointegration between gross domestic saving and GDP at the 5% level. Further, the results show that there is a one cointegrating vector for the panel. Table 6.9 shows that there is a long-run positive relationship between saving and GDP for the South Asian countries as is expected by the theory.

The trace test does not reject the null hypothesis of no cointegration at the 5% level for the panel cointegration between saving and investment rates. Failure to reject the null hypothesis of $r = 0$ means that saving and investment rates are not cointegrated for South Asian countries. Thus, there is no long-run relationship between saving rate and investment rate for South Asian countries. According to the Feldstein and Horioka interpretation, the results shows that there is evidence of high international capital mobility in the South Asian countries.

4. Panel causality for the major South Asian countries

We use the VARMAX procedure for the panel Granger causality tests. We study the panel Granger causality test between saving and GDP, and saving rate and investment rate. We

find that saving rate and investment rate are not cointegrated for the South Asian countries. However, the two panel data variables are stationary in their first differences and thus, we test for the causality between saving rate and investment rate in their first differences. The panel data result shows that the trace test rejects the null hypothesis of no cointegration between saving and GDP at the 5% level. Thus, we test for panel causality between gross domestic saving and GDP in their levels. Table 6.10 shows the results of the panel causality tests between saving and investment rates. The results of the panel causality between GDP and saving are given in Table 6.11. DIR and DSR stand for the first differences of investment rate and saving rate, respectively.

Table 6.10: Results of the panel causality between the first difference of saving and investment rates

Null hypothesis	1 lag		2 lags		3 lags		4 lags	
	Chi-Square	p-value	Chi-Square	p-value	Chi-Square	p-value	Chi-Square	p-value
DIR does not Granger cause DSR	1.24	0.2661	1.12	0.2900	1.06	0.3031	2.10	0.1476
DSR does not Granger cause DIR	4.24	0.0395	4.50	0.0340	3.84	0.0501	3.12	0.0774

Table 6.11: Results of the panel causality between saving and GDP

Null hypothesis	1 lags		2 lags		3 lags		4 lags	
	Chi-Square	p-value	Chi-Square	p-value	Chi-Square	p-value	Chi-Square	p-value
Saving does not Granger cause GDP	6.48	.012	7.06	.000	2.47	0.006	3.55	.009
GDP does not Granger cause Saving	9.95	0.002	3.90	.022	4.61	0.004	3.66	.007

The results of the panel causality test between the first difference of saving rate and investment rate show that we cannot reject the null hypothesis that the growth rate of investment rate does not Granger cause the growth rate of saving rate for the South Asian countries for any lag level. The results show that there is the reverse causality for 1 and 2 lags. However, the reverse causality does not hold for 3 and 4 lags. Panel causality tests between the first difference of saving and investment rates show that the results are sensitive to the choice of lag length for the South Asian countries.

The results of the panel causality test between saving and GDP show that we cannot accept the null hypothesis that saving does not Granger cause GDP for the South Asian countries. Also, there is the reverse causality because we reject the null hypothesis that GDP does not Granger cause saving. Thus, the results show that the feedback exists between saving and GDP in the South Asian countries. Also, panel Granger causality tests show that the results are not sensitive to the choice of lag length for saving and GDP for South Asia.

CHAPTER SEVEN

THE RELATIONSHIP BETWEEN SAVING AND EXPORT FOR MAJOR SOUTH ASIAN COUNTRIES

1. Introduction

The relationship between saving and export is one of the important issues for policy making. South Asian countries have undertaken economic reforms to restructure their export structures. Mayer and Wood (2001) find that South Asia's exports are dominated by labor-intensive manufacturing goods. South Asian export industries have more unskilled labor than other regions in Asia. World Bank (2005) points out that South Asian countries' share of world trade remained low until 2000. South Asian countries still have one of the world's highest levels of average tariffs in the world. However, South Asian countries have begun to liberalize their trade since in the early 1990s.

We review the literature on saving and export in the first section. We discuss the model for the analysis of saving and export in the second section. We summarize the empirical findings for country and panel studies in the fourth section.

2. Literature on saving and export

The relationship between saving and export is one of the least analyzed relationships in the literature on saving. Maizels (1968) is the first economist to argue that saving and export would be correlated more to each other than saving and non-export part of GDP for less

developed countries. This is called the Maizels' hypothesis. Maizels studies the relationship between saving and export for primary goods exporting less developed countries. Primary exports include unprocessed agricultural products, minerals and fish products. He uses annual data from 11 member nations of the "Overseas Sterling Area" for 1950-1960. He finds a statistically significant correlation between saving and export for these countries.

Lee (1971) studies the Maizels' hypothesis using data for a longer period. His sample includes 20 developing countries and 8 developed countries. Annual data are from the United Nations *Yearbook of National Account Statistics*. Export affects saving because of three reasons. First, the propensity to save is higher in the export sector than elsewhere. Second, government saving depends heavily on taxes on foreign trade. Third, a sustained growth in export could result in a rise of the marginal saving propensities in other sectors. Lee uses the following two equations to study the Maizels' hypothesis.

$$S_t = a + b(Y_t) + u_t \tag{7.1}$$

$$S_t = d + e(Y_t - X_t) + f(X_t) + u_t \tag{7.2}$$

Where, S and Y stand for gross domestic saving and GDP, respectively. X is the value of export. ($Y_t - X_t$) denotes the non-export part of GDP. According to the Maizels' hypothesis, equation (7.2) would have a larger $\overline{R}^2$ value for each country than equation (7.1). Also, the regression coefficient for export (X_t) would be statistically significant and

larger than that of non-export part of GDP. He estimates the above two equations by using levels and first differences of the variables.

The results show that the $\overline{R}^2$ is higher for (7.2) than for (7.1) for all the countries except Israel. Export is not significant only for Israel, Greece, and South Korea. The results are not dramatically different between levels and first differences of the variables. The results show that Maizels' hypothesis is valid not only for the developing countries but also for the developed countries.

Sinha (1999) examines the Maizels' hypothesis for 17 African countries. He uses annual data from the *International Financial Statistics*. Following previous studies, Sinha estimates (7.1) and (7.2). Based on the unit root results, he tests for cointegration for 12 countries and 8 countries for (7.1) and (7.2), respectively. If the variables are found to be cointegrated, he uses the Phillips-Hansen fully modified OLS. The Phillips-Hansen fully modified OLS is used for Kenya and Tunisia for (7.1). It is also used for Egypt, Kenya and Tunisia for (7.2). If the variables are found to be $I(1)$ but not cointegrated, then he uses the OLS method. If the OLS estimations have a serial correlation problem, then AR(1) is used. If at least one variable is $I(2)$, the equation is estimated in the second difference of the variables by using either OLS or AR(1).

The results for (7.2) show that the coefficient for export is statistically significant at the 5% level for 12 countries. The non-export part of GDP is statistically significant at

the 5% level for 9 countries. Overall, the results support the Maizels' hypothesis for African countries.

Sergi (2003) tests the two saving functions i.e. the Keynesian and the Maizels' for Slovakia. His study is different from the other studies in two ways. First he uses quarterly data for 1993-2001. Second, the Maizels' hypothesis has not been tested for any of the new market economies of Central Europe. Data are from the National Bank of Slovakia. Ordinary least-squares and the Johansen cointegration tests are used. He uses the logarithms of the variables. The ADF unit root test is used.

The Keynesian saving function is:

$$\ln S_t = \alpha_0 + \alpha_1 \ln Y_t + \varepsilon_t \qquad (7.3)$$

where S_t is saving and Y_t is income.

The Maizels' saving function is:

$$\ln S_t = \beta_0 + \beta_1 \ln X_t + \beta_2 \ln(Y - X)_t + \mu_t \qquad (7.4)$$

Where X_t and $(Y - X)_t$ are export and non-export part of GDP.

All the variables are found to be $I(1)$. The results of the cointegration tests show that saving and export have a long term relationship. There is one cointegrating vector and the two variables have a positive relationship. The $\overline{R}^2$ is higher for (7.4) than for (7.3). The marginal propensity to save out of export is higher than the marginal propensity to save out non-export part of GDP for Slovakia. Thus, he finds that the Maizels' hypothesis

is valid for Slovakia.

Laumas (1982) uses equations (7.1) and (7.2) to examine the Maizels' hypothesis for 40 countries. Data are from the United Nations' *Year-book of National Accounts and Statistics.* He divides the sample into four subsets. These are primary exporting less developed countries, primary exporting developed countries, non-primary exporting less developed countries, and non-primary exporting developed countries. He finds that the marginal propensity to save out of export is higher than the marginal propensity to save out non-export part of GDP for 23 countries. Most of these countries are primary exporting developed and less developed countries. But for 10 countries, the coefficient for export has a lower value than the coefficient for non-export part of GDP. Most of these countries are non-primary exporting developed countries. Thus, the results are inconclusive.

3. Data and methodology to test for the relationship between saving and export

We analyze the relationship between saving and exports by using country and panel data. For Bangladesh and India, we use annual data for 1975-2004 and 1960-2004, respectively. For Pakistan and Sri Lanka, the annual data are for 1967-2004 and 1965-2004, respectively. Annual data for 1973-2004 are used for the panel study. The time periods are selected based on availability of data. Thus, we use a balanced panel. Real variables are used for both individual country and panel studies. The US $ is used as the common currency for the panel study.

Following previous studies, we estimate equations (7.1) and (7.2) to test Maizels' hypothesis. We define the variables as follows. Gross domestic saving (S) is defined as GDP (Y) minus government consumption and private consumption. Non-export part of GDP is defined as GDP minus export. First, we study the time trend and the unit root properties of the variables. Next, we carry out regression and cointegration tests. Ng-Perron and IPS tests are used for individual country and panel studies, respectively. For the panel study, we estimate the two saving functions by using the panel least squares (PLS).

For the individual countries, if the variables are $I(1)$, we conduct cointegration tests. VAR-based cointegration tests using the methodology developed by Johansen (1991 and 1995) are used for the individual countries. If the variables are cointegrated, we use the Phillips-Hansen fully modified procedure to estimate the saving function(s). If the variables are not cointegrated but are found to be $I(1)$, we use the OLS method to estimate the saving function(s). If at least one variable is found to be $I(2)$, we use the OLS method with the second differences of the variables. If there is evidence of serial correlation, we use AR(1) procedure for the individual country.

According to Sinha (1996), the Phillips-Hansen fully modified procedure has a number of advantages. The method corrects for both endogeneity in data and asymptotic bias in estimates. Also, it eliminates the serial correlation problem. Two conditions need to

be fulfilled for the Phillips-Hansen fully modified procedure to be used. First, there should be only one cointegrating vector. Second, the independent variables should not be cointegrated among themselves.

4. The empirical results for the individual countries

The results of the Ng-Perron unit root tests of the variables in their levels for the four countries are in Tables 7.1 to 7.4. Tables 7.5 to 7.8 show the results of the Ng-Perron unit root tests of the variables in their first differences for the four countries. Table 7.9 show the results of the Ng-Perron unit root tests of exports in its second difference for Bangladesh.

Table 7.1: Results of the Ng-Perron tests for unit root in levels for Bangladesh

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
$^{*}X$	-17.2078	-17.3000	-2.7670	-2.9100	0.1608	0.1680	6.2592	5.4800
$(Y_t - X_t)$	-61.5176	-17.3000	-5.3979	-2.9100	0.0878	0.1680	2.1437	5.4800
S	4.1904	-17.3000	-1.2206	-2.9100	0.2913	0.1680	19.5219	5.4800
Y	-16.5879	-17.3000	-2.9104	-2.9100	0.1486	0.1680	5.9219	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

[*] Indicates no trend

The results show that S_t is $I(1)$ at the 5% level for all countries. We find that Y_t is $I(1)$ at the 5% level for Bangladesh, India and Pakistan. Y_t is stationary in its level for Sri Lanka. Except for Pakistan, non-export part of GDP is stationary in its level for all countries.

$(Y_t - X_t)$ is stationary in its first difference for Pakistan. X_t has a unit root for Bangladesh, Pakistan and Sri Lanka in its level. X_t is stationary in its first difference for Pakistan and Sri Lanka. X_t is stationary in its second difference for Bangladesh.

Table 7.2: Results of the Ng-Perron tests for unit root in levels for India

Variable	MZ_α^d		MZ_t^d		MSB^d		MP_t^d	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
X	-24.4054	-17.3000	-3.6617	-2.9100	0.1772	0.1680	4.8780	5.4800
$(Y_t - X_t)$	-25.4245	-17.3000	-3.4943	-2.9100	0.0155	0.1680	1.3354	5.4800
S	-1.0277	-17.300	-0.4231	-2.9100	0.4117	0.1680	40.1266	5.4800
Y	-8.7905	-8.1000	-1.7167	-1.9800	0.1953	0.2330	4.1238	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

Table 7.3: Results of the Ng-Perron tests for unit root in levels for Pakistan

Variable	MZ_α^d		MZ_t^d		MSB^d		MP_t^d	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
X	-4.0992	-17.3000	-1.3333	-2.9100	0.3253	0.1680	21.1534	5.4800
$^*(Y_t - X_t)$	6.2665	-8.1000	3.6903	-1.9800	0.5889	0.2330	53.4053	3.1700
S	-4.5262	-17.300	-1.2681	-2.9100	0.2802	0.1680	18.3919	5.4800
Y	0.3919	-8.1000	0.1830	-1.9800	0.4670	0.2330	18.6657	3.1700

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Table 7.4: Results of the Ng-Perron tests for unit root in levels for Sri Lanka

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
X	-3.9026	-17.3000	-1.1328	-2.9100	0.2903	0.1680	20.1958	5.4800
$(Y_t - X_t)$	-23.0702	-17.3000	-3.9171	-2.9100	1.2987	0.1680	2.6543	5.4800
S	-8.0678	-17.300	-1.9396	-2.9100	0.2404	0.1680	11.4867	5.4800
Y	-69.1817	-17.300	-5.78257	-2.9100	0.0836	0.1680	1.7444	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

Table 7.5: Results of the Ng-Perron tests for unit root in first differences for Bangladesh

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
X	-2.5495	-17.3000	-1.0031	-2.9100	0.3934	0.1680	31.1707	5.4800
$(Y_t - X_t)$	-6.2774	-17.3000	-1.6381	-2.9100	0.2610	0.1680	4.3195	5.4800
$^{*}S$	-8.9079	-8.1000	-2.0933	-1.9800	0.2350	0.2330	2.8154	3.1700
Y	-19.1941	-17.3000	-3.9532	-2.9100	0.0124	0.1680	3.6123	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

[*] Indicates no trend

Table 7.6: Results of the Ng-Perron tests for unit root in first differences for India

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
X	-22.908	-17.3000	-4.4326	-2.9100	0.0433	0.1680	3.7958	5.4800
$(Y_t - X_t)$	-26.2340.	-17.3000	-3.9670	-2.9100	.0861	0.1680	3..5430	5.4800
S	-21.8349	-17.300	-3.2524	-2.9100	0.1490	0.1680	4.4843	5.4800
Y	-20.1868	-17.3000	-3.0587	-2.9100	0.1515	0.1680	5.2201	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

Table 7.7: Results of the Ng-Perron tests for unit root in first differences for Pakistan

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
$^{*}X$	-18.2056	-8.1000	-3.0140	-1.9800	0.1656	0.2330	1.3568	3.1700
$^{*}(Y_t - X_t)$	-68.4669	-17.3000	-5.7638	-2.9100	0.0842	0.1680	1.7090	5.4800
$^{*}S$	-17.1983	-8.1000	-2.8907	-1.9800	0.1681	0.2330	1.5767	3.1700
Y	-424.836	-17.3000	-14.5350	-2.9100	0.03421	0.1680	0.2899	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

[*] Indicates no trend

Table 7.8: Results of the Ng-Perron tests for unit root in first differences for Sri Lanka

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
X	-35.6621	-17.3000	-4.2086	-2.9100	0.1180	0.1680	2.6325	5.4800
$(Y_t - X_t)$	-44.870	-17.3000	-4.7295	-2.9100	0.1054	0.1680	2.0671	5.4800
*S	-17.7680	-8.1000	-2.9642	-1.9800	0.1668	0.2330	1.4388	3.1700
Y	-19.414	-17.3000	-3.0689	-2.9100	0.1581	0.1680	4.9746	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

Table 7.9: Result of the Ng-Perron tests for unit root in second difference for non-export for Bangladesh

Variable	MZ_{α}^{d}		MZ_{t}^{d}		MSB^{d}		MP_{t}^{d}	
	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value	Test statistic	Critical value
*X	-70.8359	-17.3000	-5.9323	-2.9100	0.0838	0.1680	1.3672	5.4800

Notes: The null hypothesis of the Ng-Perron test is that the variable has a unit root.

All critical values are at the 5% significance level.

* Indicates no trend

According to the results of the Ng-Perron tests for the four countries, we can proceed with the Johansen cointegration tests for saving function (7.1) for Bangladesh, India, and Pakistan. Also, based on the unit root results, the Johansen cointegration tests are

conducted for saving function (7.2) for Pakistan. The results of the Johansen cointegration tests for saving functions (7.1) and (7.2) are in Tables 10 and 11, respectively. The cointegration results show that both the maximum eigenvalue and the trace tests reject the null hypothesis of no cointegration at the 5% level for Bangladesh, India, and Pakistan. There is one cointegrating vector for India and Pakistan for saving function (7.1).

There are two cointegrating vectors for saving function (7.1) for Bangladesh. Neither the maximum eigenvalue nor the trace tests rejects the null hypothesis of no cointegration at the 5% level for saving function (7.2) for Pakistan. Thus, we can apply the Phillips-Hansen fully modified OLS procedure for saving function (7.1) for India and Pakistan. For all other cases, we can not proceed with the Phillips-Hansen fully modified OLS procedure. Thus, we use either the OLS method or the AR(1) procedure.

Table 7.10: Results of the Johansen cointegration tests for saving function (7.1)

The null hypothesis for both the tests is r=0				
Country	Trace tests		Maximum Eigenvalue tests	
	Test statistic	Critical value	Test statistic	Critical value
Bangladesh	58.2680	15.4947	48.9528	4.2646
India	25.6737	15.4947	22.1294	14.2646
Pakistan	17.0411	15.4947	15.7547	14.2646
The null hypothesis for both the tests is r<=1				
Country	Trace tests		Maximum Eigenvalue tests	
	Test statistic	Critical value	Test statistic	Critical value
Bangladesh	9.3153	3.8415	9.31526	3.8415
India	3.5444	3.8415	3.5444	3.8415
Pakistan	1.2863	3.8415	1.2867	3.8415

Note: All critical values are at the 5% significance level.

Table 7.11: Results of the Johansen cointegration test for saving function (7.2)

The null hypothesis for both the tests is r=0				
Country	Trace tests		Maximum Eigenvalue tests	
	Test statistic	Critical value	Test statistic	Critical value
Pakistan	28.4467	29.7970	20.0168	21.1316
The null hypothesis for both the tests is r<=1				
Country	Trace tests		Maximum Eigenvalue tests	
	Test statistic	Critical value	Test statistic	Critical value
Pakistan	0.1831	8.4299	7.2829	14.2646

Note: All critical values are at the 5% significance level.

Table 7.12: Results of the regressions for saving functions

Country	Saving function (7.1)			Saving function (7.2)			
	Y	$\overline{R}^2$	BD	X	$(Y_t - X_t)$	$\overline{R}^2$	BD
Bangladesh	0.6487[AR] (1.2538)	0.22	0.18	0.9279 (1.4437)	0.1638[AR] (0.2763)	0.24	0.06
India	.2349 [PH] (12.3949)	*NA*	*NA*	0.2265 (1.4045)	0.2821 (1.8314)	0.06	0.75
Pakistan	1.76E+08[PH] (90.4734)	*NA*	*NA*	0.6335 (2.6732)	-0.4367 (-3.8405)	0.35	0.41
Sri Lanka	0.2785 (2.1772)	0.09	0.43	0.1590 (1.0968)	0.5489 (2.6460)	0.13	0.34

Notes: Saving function (7.1) is $S_t = a_o + a_1 Y_t + e_t$

Saving function (7.2) is $S_t = b_o + b_1(Y_t - X_t) + b_2 X_t + u_t$

[AR] denotes that the saving function is estimated by using the AR(I) procedure

[PH] denotes that the saving function is estimated by using the Phillips-Hansen procedure

The t-ratios are given in parentheses.

BD is the p-value for the *F-statistic* of the Breusch-Godfrey serial correlation test.

All critical values are at the 5% significance level.

We estimate the saving function (7.1) in the first differences of the variables for Bangladesh and Sri Lanka. Saving function (7.2) is estimated in the first differences of the variables for India, Pakistan and Sri Lanka. We use second differences of the variables for saving function (7.2) for Bangladesh. The results of the regressions for saving functions (7.1) and (7.2) are in Table 12.

Since we use different type of estimation procedures, it is difficult to compare the results. Also, $\overline{R}^2$ is not given in the Phillips-Hansen procedure. For Bangladesh and Sri Lanka, $\overline{R}^2$ is higher for (7.1) than for saving function (7.2). The estimation for saving function (7.1) show that GDP is statistically significant for India, Pakistan and Sri Lanka. For saving function (7.2), export is statistically significant at the 5% level only for Pakistan. Non-export part of GDP is statistically significant at the 5% level for Pakistan and Sri Lanka. Thus, the results show that in South Asia, the Maizels' hypothesis that the export promotes saving more than the non-export part of GDP is valid only for Pakistan.

5. The empirical results for the panel study for the major South Asian countries

We examine the Maizels' hypothesis for the South Asian countries using a balanced panel. First, we test for the trend of the variables. We find that the export, non-export part of GDP, and GDP have a time trend in their levels and first differences at the 5% level. There is no trend for gross domestic saving in its level and first difference.

The results of the IPS unit root tests in levels and first differences are in Tables 7.13 and 7.14, respectively. The tests fail to reject the null of a unit root for all the variables in their levels at the 5% level. However, all variables are found to be $I(1)$ at the 5% level. Thus, we estimate saving functions (7.1) and (7.2) with the first differences of the variables using the PLS method. The results of the regressions are in Table 7.15.

Table 7.13: Results of the IPS tests for panel unit root in levels

Panel Variable	IPS test statistic	P-value
$^{*}X$	5.9988	1.0000
$^{*}(Y_t - X_t)$	3.3835	0.9996
S	-0.7358	0.2309
$^{*}Y$	6.2843	1.0000

Notes: The null hypothesis is that the variable has a unit root.

All variables are in constant US $.

[*] Indicates an individual time trend

Table 7.14: Results of the IPS tests for panel unit root in first differences

Panel Variable	IPS test statistic	P-value
$^{*}X$	-3.6686	0.0001
$^{*}(Y_t - X_t)$	-3.2370	0.0006
S	-11.9479	0.0000
$^{*}Y$	-2.3126	0.0104

Notes: The null hypothesis is that the variable has a unit root.

All variables are in constant US $.

[*] Indicates an individual time trend

Table 7.15: Results of the fixed effects panel least squares for saving functions

[D] Saving function (7.1)			[D] Saving function (7.2)			
Y	$\overline{R}^2$	DW	X	$(Y_t - X_t)$	$\overline{R}^2$	DW
0.66739 (4.2895)	0.1668	2.2502	0.9161 (3.5290)	0.5178 (2.5976)	0.2810	2.3293

Notes: Saving function (1) is $S_t = a_o + a_1 Y_t + e_t$.

Saving function (2) is $S_t = b_o + b_1(Y_t - X_t) + b_2 X_t + U_t$.

The t-ratios are given in parentheses.

DB is the Durbin-Watson statistic.

[D] denotes the saving function is estimated with the first differences of the variables.

All variables are in constant US $.

All critical values are at the 5% significance level.

The Durbin-Watson statistic test finds that there is no evidence of serial correlation for the results of the fixed effects panel least squares for saving functions (7.1) and (7.2). The results show that the $\overline{R}^2$ is higher for saving function (7.1) than for saving function (7.2) for South Asia. The results for saving function (7.1) show that GDP is statistically significant at the 5% level. The results for saving function (7.2) show that export is statistically significant at the 5% level. Non-export part of GDP is statistically significant at the 5% level. Thus, the Maizels' hypothesis is valid for South Asia.

CHAPTER EIGHT

SUMMARY AND CONCLUSIONS

In this chapter we provide a summary of the results and give some policy recommendations. In this thesis, we examine the determinants of saving rate, and long-run and short-run relationships between saving and GDP for Bangladesh, India, Pakistan, and Sri Lanka. Also, we study the short-run and long-run relationships between saving and investment rates for the four countries. The Maizels' hypothesis that exports promote saving more than non-export part of GDP is also tested.

Table 8.1: Determinants of saving for the South Asian countries

Explanatory Variable	Bangladesh	India	Pakistan	Sri Lanka	Panel Study
Borrowing constraint	No	No	Yes	No	No
Dependency ratio	No	No	No	Yes	No
Foreign Saving	No	No	Yes	Yes	No
GDP growth rate	Yes	No	No	No	Yes
Real Interest rate	No	Yes	No	Yes	No
Government saving rate	No	No	No	No	No
Rate of inflation	Yes	No	No	Yes	Yes

Notes: All variables are in their growth rate forms

"Yes" means that the variables are statistically significant at the 5% level.

"No" means that the variables are not statistically significant at the 5% level.

We use individual country and balanced panel data for the South Asian countries. Table 8.1

shows that the growth rate of government saving is not a determinant of the growth rate of saving rate for any individual country and for the panel. Growth rate of dependency ratio is a determinant of the growth rate of saving rate only for Sri Lanka. The growth rate of borrowing constraint is not a determinant of the growth rate of saving rate for Bangladesh, India and Sri Lanka. The growth rate of foreign saving is a determinant of the growth rate of saving rate only for Pakistan and Sri Lanka. The GDP growth rate is a determinant of the growth rate of saving rate for Bangladesh and for the panel. The growth rate of real interest rate is a determinant of the growth rate of saving rate only for India and Sri Lanka. The growth rate of rate of inflation is a determinant of the growth rate of saving rate for the panel. Also, it is a determinant of the growth rate of saving rate for Bangladesh and Sri Lanka.

Table 8.2 shows that there is no cointegration between saving and investment rates for the countries individually and for the panel. Thus, we conclude that there is no long-run relationship between saving rate and investment rate for the South Asian countries. Thus, it is very difficult for policy makers to alter investment through the introduction of policies that alter domestic saving for South Asian countries.

The integration of financial markets into the world capital market is important for economic growth in the South Asian countries. This would increase the access to foreign capital and leads to the transfer of technology and know-how through foreign direct

investment. If there is a strong relationship between domestic saving and investment rates, the country's economy is not vulnerable to unexpected shifts in international capital flows. South Asian countries are vulnerable to unexpected shifts in international capital inflows and outflows because saving and investment rates are found to be not cointegrated. Since domestic investment is financed also by foreign capital inflows in these countries, the governments have to take policy measures to ensure macroeconomic stability of the countries.

Table 8.2: Summary of the Johansen cointegration test results

Variables	Bangladesh	India	Pakistan	Sri Lanka	Panel Study
Saving and GDP	Yes	Yes	Yes	Yes	Yes
Saving rate and investment rate	No	No	No	Not Applicable	No

Notes: "Yes" means that the variables are cointegrated

"No" means that the variables are not are cointegrated

Table 8.3: Summary of the Granger causality results

Hypothesis	Bangladesh	India	Pakistan	Sri Lanka	Panel Study
GDP Granger causes Saving	No	No	No	No	Yes
Saving Granger causes GDP	Yes	Yes	Yes	No	Yes
Saving rate Granger causes investment rate	Yes	No	No	No	Yes
Investment rate Granger causes saving rate	Yes	No	No	No	No

Note: "Yes" means that there is Granger causality.

"No" means that there is no Granger causality.

Table 8.2 shows that saving and GDP are cointegrated for the South Asian

countries. There is a positive long-run relationship between saving and GDP for all the South Asian countries. Saving contributes to GDP in the long-run for South Asian countries.

The direction of causal link and cointergration between saving and economic growth, saving and investment are important for policy makers for developed or developing countries. Both short-run and long-run relationships between saving and economic growth have important policy implications especially for developing countries. World Bank (1993) points out that in East Asia, there has been a “virtuous circle” from higher economic growth to higher saving and to higher economic growth. In Solow-type growth models, higher saving leads to higher economic growth until the economy reaches a steady-state. Our result supports the Solow’s model that saving precedes and causes economic growth for the South Asian countries. Hence, we strongly recommend policies which increase the sum of domestic saving and capital inflow. Considering the previous conclusion concerning difficulty of increasing investment through increase in domestic saving, as an initial impetus for the virtuous circle, the role of capital inflow is very important. The summary of the results of causality tests between saving and investment, and GDP growth rate and saving rate is given in Table 8.3. The Granger causality tests show that saving and investment rates are statistically independent for India, Pakistan and Sri Lanka. However, the panel study shows that the saving rate Granger causes the

investment rate. For Bangladesh, there is a causality running from the saving rate to the investment rate and there is a reverse causality.

We find that saving and GDP are statistically independent for Sri Lanka. Panel study shows that there is a causality running from saving to GDP and there is a reverse causality. For Bangladesh, India, and Pakistan, saving Granger causes GDP. The summary of the short-run dynamic responses of saving and investment, and GDP growth rate and saving rate is given in Table 8.4.

Table 8.4: Summary of the short-run dynamic responses of the variables

Impulse Response	Bangladesh	India	Pakistan	Sri Lanka
A shock to saving rate has an effect on investment rate	No	No	No	Yes
A shock to investment rate has an effect on saving rate	No	yes	No	Yes
A shock to GDP growth rate has an effect on saving rate	Yes	Yes	Yes	No
A shock to saving rate has an effect on GDP growth rate	Yes	Yes	No	No

Note: “Yes” means that a shock to one variable has an effect on the other variable.
“No” means that a shock to one variable has no effect on the other variable.

We find that a higher GDP growth rate leads to a higher saving rate for Bangladesh and India in the short-run. A higher saving rate produces a higher economic growth only for Bangladesh and India. A shock to saving is expected to reduce interest rate and thus, increase investment only for Sri Lanka. A shock to investment is expected to increase the interest rate and thus, increase saving for India and Sri Lanka.

The results of the panel and individual country studies are mixed for the Maizels' hypothesis that export promotes saving more than non-export part of GDP. The marginal propensity to save out of export is higher than the marginal propensity to save out non-export part of GDP only for Pakistan. However, the panel study shows that Maizels' hypothesis is valid for South Asian countries. The low share of trade in GDP is one of the reasons for the low saving rate of South Asia. Thus, we recommend South Asian countries to strengthen their links with the global economy through trade and investment to achieve a higher economic growth rate. We suggest that South Asian countries undertake economic reforms to change their export structures and increase international trade as a share of GDP.

References

Alguacil, M.T., Cuadros, A., Orts V., (2004), “Does saving really matter for growth? Mexico (1970-2000)”, *Journal of International Development*, vol. 16, no. 2, pp. 281-90.

Andersson, B., (1999), “On the causality between saving and growth: Long-run and short-run” *Working Paper Series*, no 1999:18, Uppsala University, Department of Economics, Sweden. (http://www.nek.uu.se/pdf/1999wp18.pdf)

Athukorala, P., and Sen, K., (2003), “The determinants of private savings in India”, *World Development*, vol. 32, no. 3, pp. 491-503.

Baharumshah, Z. A., Thanoon, M. A., and Rashid, S., (2003), “Saving dynamics in the Asian countries”, *Journal of Asian Economics*, vol. 13, no. 6, pp. 827-845.

Bahmani-Oskooee, M., and Chakrabarti, A., (2005), "Openness, size, and saving-investment correlations", *Economic Systems*, vol. 29, no. 3, pp. 283-293.

Banerjee, A., and Zanghieri, P., (2003), “A new look at the Feldstein-Horioka puzzle using an integrated panel”, *Working Paper,* Centre D'études Prospectives et D'informations Internationales (CEPII), no. 2003-22, France.

Bangladesh Bank, (1990), *Annual Report 1989-1990*, Bangladesh Bank, Dhaka.

Bangladesh Bank, (2001), *Annual Report 2000-2001*, Bangladesh Bank, Dhaka.

Bangladesh Bank, (2002), *Annual Report 2001-2002*, Bangladesh Bank, Dhaka.

Barro, R.J. and Sala-i-Martin, (1995), *Economic Growth*, McGraw-Hill, UK.

Central Bank of Sri Lanka, (2002), *Annual Report 2001*, Central Bank of Sri Lanka, Colombo.

Central Bank of Sri Lanka, (2003), *Annual Report 2002*, Central Bank of Sri Lanka, Colombo.

Central Bank of Sri Lanka, (2004), *Annual Report 2003*, Central Bank of Sri Lanka, Colombo.

Claus, I., Haugh, D., Scobie, G., and Tornquist, J., (2001),"Saving and growth in an open economy", New Zealand Treasury, *Treasury Working Paper Series*, vol. 01, no. 32, Wellington, New Zealand.(http://www.treasury.govt.nz)

Coakley, J., Kulasi, F., and Smith, R., (1998), "The Feldstein-Horioka puzzle and capital mobility: A review", *International Journal of Finance and Economics*, vol. 3, no. 2, pp. 169-188.

Cooray, A., (2002), "Capital mobility: Evidence from Sri Lanka", *Asian Development Review*, vol. 19, no. 2, pp. 104-120.

Cooray, A., and Sinha, D., (forthcoming), "The Feldstein-Horioka model re-visited for African countries", *Applied Economics.*

Deininger, K., and Squire, L., (1996), "A new data set measuring income inequality", *World Bank Economic Review,* vol. 10, pp. 565-591.

Edwards, S., (1996), "Why savings rates so different across countries? An international comparative analysis", *NBER Working Paper,* no. 5097, National Bureau of Economic Research, Cambridge.

Edwards, S., and Tabellini, G., (1994), "Political instability, political weakness and inflation: An empirical analysis", *NBER Working Paper*, no. 3721, National Bureau of Economic Research.

Elder, J. (2003). "An impulse-response function for a vector autoregression with multivariate GARCH-in-mean", *Economics Letters*, vol. 79, no.1, pp. 21-26.

Engle, R. F., and Granger, C.W. J., (1987), "Co-integration and error correction: Representation, estimation, and testing", *Econometrica*, vol. 55, no. 2, pp. 251-76.

Feldstein, M., and Horioka, C., (1980), "Domestic saving and international capital flows", *The Economic Journal*, vol. 90, no. 358, pp. 314-329.

Geweke, J., and Porter-Hudak, S., (1983), "The estimation and application of long memory time series models", *Journal of Time Series*, vol. 4, no. 4, pp. 221-238.

Granger, C. W. J., (1969), “Investigating causal relations by econometric models and cross-spectral methods,” *Econometrica*, vol. 37, no. 3, pp. 424–438.

Gujarati, D. N., (1995). *Basic Econometrics*, 3rd Edition, McGraw-Hill, New York.

Gupta, D. K., and Venieris, Y. P., (1986), “Income distribution and sociopolitical instability as determinants of savings: A Cross-sectional model”, *The Journal of Political Economy*, vol. 94, no. 4, pp. 873-883.

Hall, A. R., (1994), “Testing for unit root in time series with pretest data based model selection", *Journal of Business and Economic Statistics*, vol. 12, no. 4, pp. 461-470.

Hayami Y., (2001), *Development Economics*, 2nd Edition, Oxford University Press, London.

Ho, T., (2002), “The Feldstein–Horioka puzzle revisited”, *Journal of International Money and Finance*, vol. 21, no. 4, pp. 555-564.

Horioka, C. Y., and Watanabe, W., (1997), “Why do people save? A micro-analysis of motives for household saving in Japan”, *The Economic Journal*, vol. 107, no. 442, pp. 537-552.

Hussein, K. A., (1998), “International capital mobility in OECD countries: The Feldstein-Horioka ‘puzzle’ revisited”, *Economic Letters*, vol. 59, no. 2, pp. 237-242.

Im, K. S., Pesaran, M. H., and Shin, Y. C., (2003), “Testing for unit roots in heterogeneous panels,” *Journal of Econometrics*, vol. 115, no. 1, pp. 53–74.

International Monetary fund (2006), International Financial Statistics Online Service, International Monetary fund.

Jansen, W. J., (2000), “International capital mobility: Evidence from panel data”, *Journal of International Money and Finance*, vol.19, no. 4, pp. 507-511.

Jansen, W. J., (1996), “Estimating saving–investment correlations: Evidence for OECD countries based on an error correction model”, *Journal of International Money and Finance*, vol. 15, no. 5, pp. 749–781.

Jappelli, T., and Pagano, M., (1998), “The determinants of savings: lessons from Italy”, *CSEF Working Paper,* Centre for Studies in Economics and Finance (CSEF), University of Salerno. (http://ideas.repec.org/p/sef/csefwp/01.html)

Johansen, S., (1991). “Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models,” *Econometrica*, vol. 59, no.6, pp. 1551–1580.

Johansen, S., (1995),*Likelihood-based Inference in Cointegrated Vector Autoregressive Models*, Oxford University Press, Oxford.

Johansen, S., and Juselius, K., (1990). “Maximum likelihood estimation and inferences on cointegration—with applications to the demand for money,” *Oxford Bulletin of Economics and Statistics*, vol. 52, no. 2, pp. 169–210.

Johnston, J., and Dinardo, J., (1997), *Econometric Methods*, 4th Edition, McGraw-Hill Companies, Inc., Singapore.

Kant, C., (2005), “Capital mobility among advanced countries” *Journal of Policy Modeling*, vol.27, no.9, pp. 1067-81.

Karunarathne, W., and Abeysinghe, T., (2005),” Does mandatory pension savings crowd out private savings? The experience of Sri Lanka”, *Journal of Asian Economics*, vol. 16, no. 5, pp. 830-846.

Kasuga, H., (2003), “Saving-investment correlations in developing countries”, *Economics Letters*, vol. 83 no. 3, pp. 371-376.

Kim, H., Oh, K., and Jeong, C., (2005), “Panel cointegration results on international capital mobility in Asian economies”, *Journal of International Money and Finance*, vol. 24, no.1, pp. 71-82.

Konya, L., (2004), “Saving and growth: Granger causality analysis with bootstrapping on panels of countries”, *Discussion Paper*, La Trobe University, School of Business, no. A04.02, Australia.

Krol, R., (1996), “International capital mobility: Evidence from panel data”, *Journal of International Money and Finance*, vol. 15, no.3, pp. 79-113.

Kwack, S. Y., and Lee, Y. S., (2005), "What determines saving rates in Korea? The role of demography", *Journal of Asian Economics*, vol. 16, no. 5, pp. 861-873.

Lakshman, W.D. (ed.), (1997), *Dilemmas of Development: Fifty Years of Economic Change in Sri Lanka*, Sri Lanka Association of Economists, Colombo.

Larsson, R., Johan L., and Mickael L., (2001), "Likelihood-based cointegration tests in heterogeneous Panels", *Econometric Journal*, vol. 4, no. 1, pp.109-142.

Laumas, S. P., (1982) "Exports and the propensity to save", *Economic Development and Cultural Change*, vol. 30, no. 4, pp. 831-841.

Lee, J. K., (1971), "Exports and the propensity to save in L.D.C.s", *The Economic Journal*, vol. 81, no. 322, pp. 341-351.

Leff, N.H., (1969)., "A dependency rates and savings rates", *American Economic Review*, vol. 59, no. 5, pp. 886-896.

Levin, A., and Lin, C.F., (1992), "Unit root tests in panel data: Asymptotic and finite sample properties", *UCSD Discussion Paper 92–23*, University of California, San Diego.

Levy, D., (2000), "Investment-saving co-movement and capital mobility: Evidence from century long U.S. time series," *Review of Economic Dynamics*, vol. 3, no.1, pp. 100–136. (http://econwpa.wustl.edu/eprints/if/papers/0505/0505006.abs)

Luo, J. L., (1988), "The savings behavior of small investors: A case study of Taiwan", *Economic Development and Cultural change*, vol. 46, no. 4, pp. 771-788.

Maizels, A., (1968), *Exports and Economic Growth of Developing Countries*, Cambridge University Press, Cambridge.

Manhakud, J., (2002), "Determinants of corporate savings in India: A panel data analysis", *Capital Market Conference 2002*, Indian Institute of Technology, India (http://utiicm.com/jitendramahakud^37.pdf).

Mankiw, N. G., (2002), *Macroeconomics*, 5th Edition, Worth Publishers, New York.

Masson, R. P., Bayoumi, T., and Samiei, H., (1998), “International evidence on the determinants of private saving”, *The World Bank Economic Review*, vol. 12, no. 3, pp. 483-501.

Mayer, J., and Wood, A., (2001), “South Asia’s export structure in a comparative perspective”, *Oxford Development Studies*, vol. 29, no. 1, pp. 5-29.

McCluer, M., (1996), “Health insurance and precautionary savings”, *The American Economic Review*, vol.86, no. 1, pp. 285-295.

Modigliani, F., (1966), "The life-cycle hypothesis of saving, the demand for wealth, and the supply of capital”, *Social Research*, vol.33, no. 2, pp.160-217.

Mohan, R., (2006), “Causal relationship between savings and economic growth in countries with different income levels”, *Economics Bulletin*, vol. 5, no. 3, pp. 1-12.

Morisset, J., and Revoredo, C., (1995), “Savings and education: A life-Cycle model applied to a panel of 74 countries”, *The World Bank Policy Research Paper,* no.1504, World Bank.

Murphy, R.G., (1984), “Capital mobility and the relationship between saving and investment in OECD countries”, *Journal of International Money and Finance*, vol. 3, no. 3, pp. 327-342.

Narayan, P. K., (2005), “The relationship between saving and investment for Japan”, *Japan and the World Economy*, vol. 17, no. 3, pp. 293-309.

Nehru, V., Swanson, E., and Dubey, A. (1993), “A new database on human capital stock: source, methodology, and results”, *Policy Research Paper*, no.1124, World Bank.

Ng, S., and Perron, P., (2001),”Lag length selection and the construction of unit root tests with good size and power”, *Econometrica*, vol. 69, no. 6, pp. 1519-1554.

Ortiz, G., (1997), “Documnetos: descurso del Dr. Guillermo Ortiz Martinez, secretario de hacienda credito publico”, en la presentacion del programa nacional de financiamiento del desarrollo 1997-2000. *Informe Hacendario*, vol. 5, pp. 41-53.

Pedroni, P., (1999), “Critical values for cointegration tests in heterogeneous panels with multiple regressors”, *Oxford Bulletin of Economics and Statistics*, vol. 61, no. 4, pp. 653–670.

Pesaran, H. H., and Shin, Y., (1998), “Generalized impulse response analysis in linear multivariate models,” *Economics Letters*, vol. 58, no. 1, pp. 17-29.

Popper, H., (1993), “Long-term covered interest parity: Evidence from currency swaps”, *Journal of International Money Finance*, vol. 12, no. 4, pp. 439–448.

Reserve Bank of India (1995), *Annual Report 1994*, Reserve Bank of India, India.

Reserve Bank of India (1996), *Annual Report 1995*, Reserve Bank of India, India.

Reserve Bank of India (2005), *Annual Report 1994*, Reserve Bank of India, India.

Reserve Bank of India (2006), *Annual Report 1994*, Reserve Bank of India, India.

Rocha, F., (2000),”Capital mobility in developing countries: Evidence from panel data”, *Seminar Paper*, The Latin American and Caribbean Economic Association (LACEA), Rio de Janeiro, Brazil. (http://www.lacea.org/meeting2000/FabianaRocha.pdf)

Romer, P. M. (1990), “Endogenous technological change”, *Journal of Political Economy*, vol. 98, no. 5, pp. 71-102.

Romer, P. M., (1986), “Increasing returns and long run growth”, *Journal of Political Economy*, vol. 94, no. 5, pp. 1002-1037.

Sachs, D. J., (1981), “The current account and macroeconomic adjustment in the 1970s”, *Brookings Papers on Economic Activity*, vol. 1, no.1, pp. 201-68.

Schmidt, M. B., (2001), “Saving and investment: Some international perspectives”, *Southern Economic Journal*, vol. 68, no. 2, pp. 446-456.

Schmidt-Hebbel, K., and Serven, L., (2000), “Does income inequality raise aggregate Savings?”, *Journal of Development Economics*, vol. 61, no. 2, pp. 417-446.

Schmidt-Hebbel, K., Serven, L., and Loayza, N.,(2000), “What drives private saving across the world ?” , *Review of Economics and Statistics*, vol. 82, no. 2, pp. 165-181.

Schneider, B., (1999), “Saving-investment correlations and capital mobility in developing countries with special reference to India”, *Working Paper,* Indian Council for Research on International Economic Relations, no.48, New Delhi, India.

Sergi B. S., (2003), “Testing the saving functions of Keynes and Maizels: A case study for Slovakia”, *Eastern European Economics*, vol. 41, no. 3, pp. 60-69.

Shiba, T., (1979), “The personal savings function of urban worker households in Japan”, *The Review of Economics and Statistics*, vol. 61, no. 2, 1979, pp. 206-213.

Shibata, A., and Shintani, M., (1988), “Capital mobility in the World economy: An alternative test”, *Journal of International Money and Finance*, vol. 17, no. 5, pp. 741-56.

Sinha, D., (1998), “Saving and economic growth in Thailand”, *Philippine Review of Economics and Business*, vol. 35, no. 2, pp. 177-86.

Sinha, D., (1999), “Do exports promote savings in African countries?”, *Economia Internazionale*, vol. 52, pp. 383-395.

Sinha, D., (2002), “Saving-investment relationships for Japan and other Asian countries”, *Japan and the World Economy*, vol. 14, no.1, pp.1-23.

Sinha, D., and Sinha, T., (1998), “Cart before the horse? The saving-growth nexus in Mexico”, *Economics Letters*, vol. 61, no. 1, pp. 43-47.

Sinha, D., and Sinha, T.,(1998), “An exploration of the long-run relationship between saving and investment in the developing economies: A tale of Latin American countries”, *Journal of Post Keynesian Economics*, vol. 20, no. 3, pp. 435-443.

Sinha, T., and Sinha, D., (2004), “The mother of all puzzles would not go away”, *Economics Letters*, vol. 82, no. 2, pp. 259-267.

Starr-McCluer, M., (1996), “Health insurance and precautionary savings”, *The American Economic Review*, vol. 86, no. 1, pp 285-295.

State Bank of Pakistan (2003), *Annual Report 2002-2003*, State Bank of Pakistan, Karachi.

State Bank of Pakistan (2004), *Annual Report 2003-2004*, State Bank of Pakistan, Karachi.

Taylor, C. L., and Hudson, M. C., (1972), *World Handbook of Political and Social Indicators*, 2nd Edition, New Haven, Yale University.

Taylor, M. P., (1989), "Covered interest arbitrage and market turbulence", *Economic Journal*, vol. 99, no. 396, pp. 376–391.

Tobin, J., (1967), "The Life-cycle Saving and Balanced Growth", In William Fellner., *Ten Economic Studies in the Tradition of Irving Fisher*, John Wiley and Sons, New York. pp. 231-56.

Toda, H.Y., and Yamamoto, T., 1995, "Statistical inference in vector autoregressions with possibly integrated processes", *Journal of Econometrics,* vol. 66, no. 1, pp. 225-250.

Wirvick, D., (1986), "Mobilisation of private savings", *Savings and Development Quarterly Review*, no. 3, pp. 112-134.

Wolf, M., (2005). "Promoting India's inexorable ascent", *Financial Times*. http://www.ft.com/home/asia

World Bank (2005), Global Economic Prospects: Trade, Regionalism, and Development, The World Bank, Washington.

World Bank (2006), World Development Indicators Online, World Bank.

World Bank, (1993), The East Asian Miracle: Economic Growth and Public Policy, Oxford University Press, New York.