DETERMINANTS OF THE SHARE OF SERVICES IN NATIONAL INCOME: A PANEL DATA ANALYSIS

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AMRITA ROY

Centre for Economic Studies and Planning
School of Social Sciences
Jawaharlal Nehru University
New Delhi – 110067
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CENTRE FOR ECONOMIC STUDIES & PLANNING
SCHOOL OF SOCIAL SCIENCES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI-110067, INDIA

CERTIFICATE

Certified that the dissertation entitled "DETERMINANTS OF THE SHARE OF SERVICES IN NATIONAL INCOME: A PANEL DATA ANALYSIS" submitted by Amrita Roy in partial fulfillment for the award of the degree of Master of Philosophy (M. Phil.) of this University, is her original work and may be placed before the examiners for evaluation. This dissertation has not been submitted for the award of any other degree of this University or of any other University.

Pradipta Choudhury
Prof. Pradipta Choudhury
(Chairperson)

CHAIRPERSON
Centre for Economic Studies & Planning
SSS/JNU/New Delhi-110067

Subrata Guha
Dr. Subrata Guha
(Supervisor)

SUPERVISOR
CESP/SSS/JNU

Phone : 91-11-26717676, 26717557 Ext. 4421/26704421 Cable : JAYENU Fax : 91-11-26717586, 26197603

Contents

List of Tables

List of Figures

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CHAPTER 1

Introduction and Literature Review

1.1 Introduction

1.1.1 *The growing importance of the service sector in the world economy*

In the last few decades, services have emerged as the most important economic activity all over the world. The growing importance of the service sector in the economy is visible in terms of its share in total output and employment generation as well as in its fast-growing share in world transactions. Services account for almost two-thirds of total global output (World Bank 2002). In the developed nations services account for seventy percent of total production and employment generation. Correspondingly developing countries are also experiencing a rising share in services which constitutes fifty percent of economic activity in the developing countries. This has led to a world boom in services.

The growing importance of the service sector in the last three decades can be evaluated from five aspects:

a) Share of services in GDP

b) Growth in services

c) Contribution of services in employment generation

d) Export performance of service sector

e) Foreign direct investment in the service sector

a) Share of services in GDP

Over the last few decades the sectoral composition of output has undergone a structural shift all over the world. Over time countries in all income groups are shifting towards a service economy. In 1971 the service sector accounted for half of the share and even more of total GDP in the upper middle income and in high income countries. Countries in other income groups are following the same path. Table 1.1 shows the changes in the share of service sector output in GDP over the period for countries grouped by per capita income.

Table 1.1: Share of the service sector output in the economy, according to per capita income level, 1971 and 2003

Per Capita Income Group	Services share (%of GDP)	
	1971	2003
Low Income Countries ($825 or less)	37.42528	48.36224
Lower Middle Income Countries ($825 and $3,255)	37.16862	46.39864
Middle Income Countries ($825 and $10,065)	41.80254	52.84287
Upper Middle Income Countries ($3,256 and $10,065)	49.62382	61.6557
High-Income Countries ($10,066 or more)	55.67244	72.15459
World	53.41123	68.42043

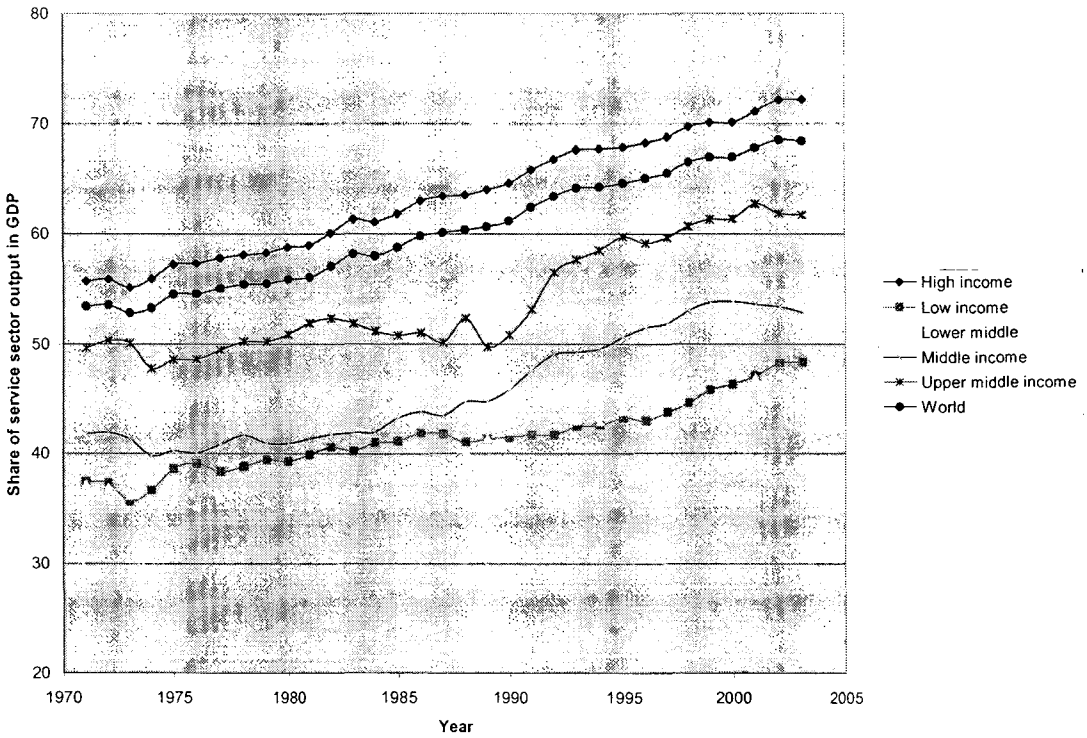
(2004 GNI per capita)

Source: World Bank, World Development Indicators 2005.

Note: World includes all 208 countries reported in World Development Indicators 2005.

Figure 1.1 shows the trend of the share of service sector output in GDP for different income groups of countries over the period 1971 to 2003. The graph shows that all the income groups have experienced a rising trend in the share of services over the period. At the same time the curves give a clear indication of higher share of service sector output in GDP with rising income. Except for the lower middle income group of countries, the curve for a higher income group of countries always lies above the curves for poorer income groups.

Figure 1.1 Share of service sector output in GDP in different income groups of countries over the period 1971 to 2003



Source: World Bank, World Development Indicators 2005.

b) Growth in services

Published data on the annual rates of growth of sectoral output in different countries show that there has been a considerable increase in the rate of growth of service sector output over time. According to World Development Indicators (2005), over the period 1990-2003 the service sector in the world economy had a much higher average annual percentage rate of growth of 3.2% compared to the other economic sectors. In the same period the average annual rate of growth was 2.3% in the industrial sector and 1.9% in the agricultural sector. It has been reported in World Development Indicators (2005) that among all the income group countries low income countries have experienced the highest rate of growth of service sector output in the last decade (1990-2003) and among regional groups of countries South Asia witnessed the highest rate of growth in this respect in that period. At the same time compared to 1980-90, the growth rate of service sector output

declined in the high income and lower middle income countries in 1990-2003 though still remaining well above zero.

Table 1.2: Rate of growth of service sector output in the economy, according to per capita income level, 1980-2003

Per Capita Income Group	Growth of service sector output	
	Average annual % growth	
	1980-1990	1990-2003
Low income ($825 or less)	5.1	5.9
Lower middle income ($825 and $3,255)	4.7	3.9
Middle income ($825 and $10,065)	3.1	3.5
Upper middle income ($3,256 and $10,065)	1.1	3
High Income ($10,066 or more)	3.4	3.1
World	3.4	3.2

(2004 GNI per capita)

Source: World Bank, World Development Indicators 2005.

Note: World includes all 208 countries reported in World Development Indicators 2005.

c) Contribution in employment generation

Today in most of the OECD countries the service sector accounts for three-quarters of all jobs and service sector employment still continues to grow. According to the OECD-Employment Outlook (2000), among the four service sub-sectors (producer services, distributive services, social services and personal services), employment growth was most rapid for the producer and social services sub-sectors over the second half of 1980s

and the1990s. The employment share for personal services also tended to increase a little while that for distributive services remained approximately unchanged.

This rising trend of employment share in the tertiary sector is visible in all regions. In all the regions the service sector accounts for a substantial proportion of total employment generated in the economy. Only in the Asian and African countries did the service sector account for less than 30% of total employment generated in the economy in 1990.

The World Employment Report (International Labour Organization, Geneva, 2004-05) looked into the trend in sectoral employment growth and productivity growth for various regions in the world over the period 1950 to 1990. The report shows that in all regions a considerable shift has been taking place from agriculture to non-agricultural sectors of the economy. The service sector attracted the major share of the increasing pool of labour. In terms of productivity growth, the service sector has been less important than the industrial sector for most countries.

Table 1.3: The sectoral distribution of employment according to region, 1950-1990

Sectoral Distribution of Employment			
Region	**Agriculture**	**Industry**	**Services**
World			
1950	67	15	18
1970	56	19	25
1990	49	20	31
Europe			
1950	40	32	28
1970	21	41	38
1990	12	36	52
North America			
1950	13	37	50
1970	5	32	63
1990	3	26	71
Oceania			

1950	32	31	37
1970	24	30	46
1990	20	22	58
East & South East Asia excluding China			
1950	71	11	18
1970	54	18	28
1990	44	20	35
Asia			
1950	82	7	11
1970	71	13	17
1990	62	17	21
Latin America and the Caribbean			
1950	54	19	27
1970	42	22	36
1990	25	24	51
Africa			
1950	83	6	11
1970	76	9	15
1990	63	11	26

Source: ILO, 2003, World Employment Report (2004-05)

d) Export performance of service sector

The world wide growth in the service sector has been accompanied by its rising share in world transactions. Trade in services is growing faster than in other areas and accounts for one-fifth of world transactions today. There has been a significant increase in the share of export of services world wide from 1980 to 1990 (i.e., from 17% to 20% of total trade) but after that this share of exports of services has become more or less stagnant and similar is the case for import share of services.

Table 1.4: Exports and Imports of services as a percentage of total trade

	World		Developed economies		Developing economies	
YEAR	Exports	Imports	Exports	Imports	Exports	Imports
1980	17.21	18.92	19.38	17.47	11.66	23.19
1985	18.43	19.24	19.72	18.25	14.92	22.65
1990	20.02	20.71	21.16	20.71	16.14	20.07
1995	19.63	20	20.82	20.53	17.05	18.77
2000	19.48	19.32	21.76	19.84	14.9	17.96
2004	19.79	19.47	22.6	20.52	14.42	16.95

Source: UNCTAD Handbook of Statistics 2005, online data base.

According to the World Bank (2005), compared to 1990, the share of transport services in total commercial service exports in 2003 was lower in all the income groups of countries. This is true for travel services also. The exports of this sub-sector as a share of total commercial exports was lower in 2003 compared to 1990; only the middle income countries had a slightly higher share in 2003. Among the other sub-sectors, insurance and financial services increased its share in total commercial service exports in the upper middle and high income countries. The share of exports of computer, information communications and other commercial services in total commercial service exports increased in all income groups of countries and the low income countries experienced the highest increase in this period. In the low income countries the computer, information, communication and other commercial services accounted for 62% of total commercial exports in 2003. Share of imports of this sub-sector in total commercial imports has also increased over this period in all the income groups. Similarly, in all the income groups of

countries the share of imports of insurance and financial services have increased in this period whereas all income groups have witnessed a declining share for transport services over this period. Thus according to the data provided by the World Bank (2005) regarding the export and import shares of the services sub-sectors in total commercial service transactions over the period 1990 to 2003, the insurance and financial services sub-sector and the computer, information and communications services sub-sector increased its share in total services transactions.

e) Foreign direct investment (FDI) in the service sector

FDI has grown over time in all the three economic sectors i.e., primary, secondary and tertiary sectors, but gradually the sectoral composition has shifted towards services. According to United Nations (2004), the global FDI stock in the service sector more than quadrupled during the period 1990-2002. As a result of more rapid growth in service sector than in the other sectors, services accounted for about 60% of global stock of inward FDI in 2002, compared to less than 50% a decade earlier. Inward and outward FDI, both flows and stock, in services grew in most countries as did the share of services in overall FDI flows and stock. According to United Nations (2004), most FDI in services has been domestic market seeking, in such traditional services as finance, tourism, trading and in industries that have only recently opened up to the private sector, such as electricity, water or telecommunications. The continuous process of liberalization and deregulation of key service industries has led to large inflows of FDI – with significant regional differences – into industries that were previously dominated by the state or domestic private sector firms.

1.2 *Growing importance of the service sector: The Case of India*

In the last two decades the service sector in India has followed the global trend. This is especially so when we consider the share of total output in the service sector. The emergence of India as one of the world's fastest growing economies in the 1990s can be attributed to a large extent to the rapid growth of its service sector.

a) Share of services in GDP: The sectoral composition of output in the Indian economy has undergone a structural shift over the years. From a primarily agro-based economy

during the 1970s, the service sector has emerged predominant in the Indian economy during the 1990s. Data shows that in the four decade period, 1950-1990, agriculture's share in GDP declined by about 25 percent points while industry and services gained equally. The share of industry has stabilized since 1990 and the entire subsequent decline in the share of agriculture has been picked up by the service sector which now contributes nearly sixty percent of total GDP.

If we look at the share of service sector in GDP at the disaggregated level, we will find an unequal distribution in terms of shares of different sub-sectors in total GDP. The most important services in terms of their shares in GDP in 1993-94 were trade (12%), community, social and personal services (12%), then financing, insurance, real estate and business services (11.5%). In 2003-04 contribution in GDP has increased for most of the services. In 2003-04, trade still remains the most important sector in terms of its contribution to GDP, its share having increased to 14.5 percent, according to National Accounts Statistics, 2005. Services which have lower shares in 2003-04 are railways, storage, real estate and ownership of dwellings.

b) Growth in services: The sectoral data on annual growth rate of output in the various issues of National Accounts Statistics, show that while over the period 1950 to 1980 the service sector in India had stable growth, a structural shift occurred in the 1980s when the annual growth rate of services exceeded six percent compared to four percent in the previous three decades. Growth rate of service sector accelerated in the 1990s and reached almost eight percent per annum.

Suresh Babu (2005) calculated the contribution of different sectors to GDP following the methodology adopted by Syrquin (1988). Contribution of each sector was calculated as the product of output share of a sector and the growth rate of that sector. He found that in the 1980s the primary and secondary sectors contributed more or less equally to over all growth in India and a higher contribution was made by the tertiary sector. In the 1990s the gap between the contribution made by the tertiary sector and the contributions made

by the other two sectors has widened. It has been found that sixty percent of overall growth in the 1990s has been accounted for by the tertiary sector.

The acceleration in the growth of services in the last two decades was not uniform across different sub-sectors. Some sub-sectors grew at much faster rate than their past average growth rates while some sub-sectors grew at the same past trend rate of growth. Gordon and Gupta (2004) have identified the fast growers and the trend growers among the sub-sectors in the 1990s using the past trend growth rates for the period 1980-2000. Comparing the actual and trend growth rates, the sub-sectors where growth accelerated in the 1990s were called the fast growers and the remaining activities which grew at a trend rate were called trend growers. Based on this criterion, Gordon and Gupta identified fast growers as business services (which include information technology), communication services, hotels and restaurants, community services and trade (distribution services). The trend growers included real estate, legal services, transport, storage, personal services and public administration and defence (PAD).

c) Contribution in employment generation: The structural transformation that India experienced in the last two decades in terms of sectoral composition of GDP is not visible in terms of sectoral composition of employment. Though there has been a phenomenal growth in the service sector output in India, this growth has not been accompanied by a corresponding high growth in employment in the 1990s. According to Institute of Applied Manpower Research, 2004 agriculture still is the most important sector in terms of share in total employment contributing more than 60 percent of total employment in 2001-2002. In contrast the share of service sector remained as low as 23 percent. In comparison to other countries also the share of service sector in total employment is very poor. In 1999-2000 services contributed more than 68 percent of total employment in high income countries, more than 30 percent in middle income countries (World Bank 2005) but little more than 22.5 percent in India (Institute of Applied Manpower Research, 2004). Thus there has been a disproportionate growth in tertiary sector in India as its share in employment has been less than half of its share in total output. Joshi (2004) shows that there has been a huge decline in the annual growth rate of total employment

from 2.04 in the period 1983-94 to 0.94 in the period 1994-2000. Only the secondary sector has been able to improve the growth rate in employment in this period whereas the other sectors have faced a setback.

d) Export performance: Reflecting the global trend, in India growth in the service sector has been followed by a substantial growth in international transactions in services. In fact, in the 1990s, India achieved one of the fastest growth rates in the world of service exports, which grew at over 17 percent per annum in the 1990s (the world average being 5.6 percent per annum). Service exports reached US $25 billion in 2002 and the share of India in global exports of services has exceeded one percent. At the same time, compared to merchandise exports, share of service exports as a proportion of GDP has been rising steadily from 1998-99 (Banga 2005).

Composition of India's exports of services shows large variation for different services in terms of their total export earnings as well as net export earnings. Average net export earnings for the period 1998-99 to 2002-03 was highest for software, which earned US $4 billion on average in that period. It was followed by travel (net earning US $0.92 billion), communication, construction and insurance whereas transport, financial and management sector had negative net average export earnings.

It has also been found that the composition of India's exports of services has changed over the years. In the period 1990-1995, travel was the most important sub sector in terms of total service exports, which accounted for more than 39 percent of total exports, but in the period 1996-2002 share of travel services in total exports has been reduced to 22.8 percent. In the last decade, communication, computers etc. were most important in this respect, accounting for more than 60 percent of total exports of services. The growth in exports of services has been most dramatic in software services.

In the last two decades, there has been a remarkable increase in FDI inflow into India. United Nations (2004) ranked India (4^{th}) amongst the top ten recipients of FDI inflows in the Asia and the Pacific. The service sector accounts for a large share in total FDI inflows

into India. The average inward FDI flows in services increased from 52 millions of dollars in 1990-1994 to 725 millions of dollars in 1995-1999. The share of services in the total FDI inflows has increased from 10.5 percent in the period 1990-94 to 28.3 percent in the period 1995-1999. Again the share of different services in FDI inflow varies significantly within the service sector. Within the service sector information and communication technology (ICT) industries are the largest recipients.

Thus looking into the growth pattern of the service sector in India, we can identify the following important points:

- India has undergone a structural change in the last two decades in terms of sectoral distribution of GDP, and the service sector has emerged as the most important sector in terms of contribution to the overall level and growth of GDP.
- Though the service sector is the most important sector in terms of output growth and share in total production, its performance in terms of employment generation is very poor.
- Performance of service sector in terms of foreign exchange earnings has also been very impressive, especially in the last decade.
- There has been a large variation in the growth pattern within the service sector for different activities. Some services have grown fast in terms of their share in GDP, in total exports and in FDI (e.g., software and telecommunication services). There are some sectors which have grown fast but have not been able to improve their share in international transactions (e.g., health and education) while, there are some other services that have witnessed a negative growth and also a negative share in international transactions (e.g., legal services).

1.2 Review of the Literature on the Development of the Service Sector

Among the three broad classes of economic activities i.e. agriculture, industrial and services activities, activities in the service sector account for the major share in GDP for most of the countries in the world. Given the growing importance of service sector in each and every aspect of the economy, starting from the output generation to employment generation, a large number of studies have tried to explain this phenomenon.

1.2.1 *Theories of structural change*

The explanations given for the expansion of services produced domestically emerge from the theories of structural change developed by Fisher (1939), Clark (1940), Chenery (1960) and Kuznets (1966). Empirical research on the features of modern economic growth started with comparing the long-run experiences of developed countries and then turned to cross-country comparisons of less developed countries for a given year or for a short period of time, depending on the availability of data. Analyzing the comparative experiences of the countries, these studies (Fisher (1939), Clark (1940), Chenery (1960), Kuznets (1966)) came to the conclusion that the process of development in every country displays common empirical structural regularities. These theories of structural change suggest that as the economy develops there is a necessary structural transformation in terms of a shift in production of commodities from agriculture to nonagricultural activities. In case of employment, a shift away from agriculture is also expected but with a lag, implying an initial drop in relative labour productivity in that sector. Part of the transfer of labour goes into industry but on an average the main beneficiary is the service sector.

The presence of universal factors, such as (a) common technological knowledge, (b) similar human wants, (c) access to the same markets for exports and imports and (d) the accumulation of capital and skills as the level of income increases, are perceived to be the basis for uniformities in the growth process at a broad level of analysis. At the same time existence of country specific factors and relative backwardness allows for variation in growth patterns at a lower level. However recent empirical studies on the share of the service sector in national output and employment (especially for underdeveloped

countries) appear at least partially to contradict the suggestion that the service sector tends to expand only after some development of industry.

Fisher (1935), Clark (1940), and Kuznets (1979) argued that low income elasticity of demand for food and high income elasticity of demand for services is the invariant structure of human wants. After a certain point of time demands for food and manufacturing goods become saturated and at that time rapid growth in final demand for services result in an increase the output share of services. Technological change and the shift in the pattern of life further enhance the demand for services. Technological change has led to the rise of modern industry and urbanization, in turn leading to the growing need for goods and services which were not essential in the countryside. These changes in demand patterns have characterized both the household and the government sectors. Thus with new technology, the demand for the products of industry and the service sector grows faster than demand for the products of the agricultural sector.

Kuznets (1979), considered the long-term growth experiences (the time period considered ranges from the late seventeenth century to the mid twentieth century) of thirteen developed countries—UK, US, France, Canada, Germany, Netherlands, Denmark, Norway, Sweden, Italy, Australia, Japan and U.S.S.R. He showed that in the course of modern economic growth with changes in socio-economic factors all (primary, secondary and tertiary) sectors undergo structural transformation in terms of their share in total output and in use of total productive resources. The rapidity of these shifts and their striking magnitude when cumulated over decades are the main distinctive features of modern economic growth. Kuznets finds a huge reduction in the share of the agricultural sector in total output and employment over the period. The industrial sector witnessed a substantial increase in its share of total output and employment but the increase in employment share was not as large as the relative rise in the sector's share in total product. On the other hand in most of the countries the absolute as well as the relative rise in the share of the services in total employment was significantly greater than the increase in its share in total product.

The study by Chenery and Syrquin (1975) is another important contribution in this pool of theories of structural change. They analysed the processes of changes in different dimensions of economic structure that generally accompany economic growth. For this purpose, along with looking at the transitions in the resource accumulation processes (investment, government revenue and education) and the demographic and distributional processes (labour allocation, urbanization, demographic transition and income distribution), they have also considered the resource allocation processes (structure of domestic demand, structure of production and the structure of trade). Their main focus was to analyse this whole set of integrated processes and their interactions in order to describe different dimensions of the overall structural transformation from a poor country to a rich one (defined in terms of per capita income). Thus as a part of their analysis they also looked at the behavior of the share of service sector output in GDP with the transition of an economy.

To perform a uniform analysis of these different dimensions of structural change they used the same statistical formulation for all of these development processes. The estimation equations they considered took the following forms:

$$X = \alpha + \beta_1 (logy) + \beta_2 (logy)^2 + \gamma_1 (log\, N) + \gamma_2 (log\, N)^2 + \sum \delta_j T_j \quad \text{(I)}$$

$$X = \alpha + \beta_1 (logy) + \beta_2 (logy)^2 + \gamma_1 (log\, N) + \gamma_2 (log\, N)^2 + \sum \delta_j T_j + \varepsilon F \quad \text{(II)}$$

$$X = \alpha_i + \beta_1 (logy) + \beta_2 (logy)^2 + \sum \delta_j T_j + \varepsilon F \quad \text{(III)}$$

where X is the dependent variable, Y is GNP per capita, N is population, F is net resource inflow (import minus exports of goods and non factor services) as a share of total GDP and T_j is time period (j = 1950-54, 1955-59, 1960-64 and 1965-69). $\beta_1, \beta_2, \gamma_1, \gamma_2, \delta_j$ and ε are the coefficients of the explanatory variables. α is the fixed intercept that appears in equation (I) and (II) and α_i in equation (III) is the country-specific dummy variable. They considered equation (I) and (II) as the basic-cross country regression and equation (III) as the average time-series regression.

Their analysis was based on the available statistical series gathered from 101 countries covering the period 1950-70.

All the explanatory variables in the regression results corresponding to the structure of production were significant. They found that seventy five to eighty percent of total structural change takes place within the range of $100 to $1000 per capita GNP (1964 $US) and this range is then chosen to represent the transition from a less developed to a developed country. Above the $300 level the value added in industry is normally found to exceed that in primary production. Employment shares in different sectors follow the same pattern as shares in total production but with a time lag. Moreover, once the level of $1500 per capita income is reached, the share of employment in the primary sector falls to 15 percent and the shares of industry and services increase and become very close to their shares of production. They concluded that, the rise in the share of industry in total output is the result of changes in the composition of domestic demand and trade and the composition and timing of industrialization is associated with different patterns of specialization.

They found that the results of all the regressions were quite similar in terms of the changes in structure of production as all the regression results showed an exogenous shift away from primary production to industry and services. Regarding the behavior of the share of service sector output in total output of that economy, they found that the relationship between the share of service sector and per capita GDP takes an 'inverted U' shape when the cross-country regression results are considered but when the average time series regression results are considered the relationship takes a 'U' shape. As the main focus of their study was to give an idea about the overall process of structural changes that accompany economic growth, they made no attempt to explain the reason behind the difference in the relationship between the share of service sector and per capita GDP in these two cases.

Syrquin (1988) using the simple regressions over the period 1950-83 from Deutsch and Syrquin (1986)[1] and Syrquin and Chenery (1986)[2] undertook a similar exercise to examine the pattern of structural change, assuming a different transition range ($300 to

[1] Deutsch, J. and Syrquin, M. (1986); 'Economic development and the structure of production', as cited in Syrquin, M. (1988); 'Patterns of Structural Change', In: Chenery, H. and Srinivasan, T. N. (eds.) Handbook of Development Economics, Volume1, Elsevier Science Publishers B.V., 1988.

[2] Syrquin, M. and Chenery, H. B. (1986); 'Patterns of Development: 1950 to 1983', World Bank, as cited in Syrquin, M. (1988); 'Patterns of Structural Change', In: Chenery, H. and Srinivasan, T. N. (eds.) Handbook of Development Economics, Volume1, Elsevier Science Publishers B.V., 1988.

$4000 per capita GNP in 1980 $US). He found that the pattern of sectoral shifts in employment reflects the lag in the movement of labour out of agriculture and correspondingly lower growth in labour productivity in this sector during the stages of transformation. The rise of employment in industry is much smaller than the decline in agriculture and consequently most of the shift is from agriculture to services.

Thus the literature, exploring the relationship between structural change and the process of economic development observed that there is a necessary structural transformation in terms of shift in production of commodities from primary to manufacturing activities.

1.2.2 *Studies relating to the service sector*

Along with the development of theories of structural change, a large number of studies have tried to explain the development characteristics of each of the three sectors – primary, secondary and tertiary – separately. In the last few decades, the service sector has expanded rapidly all over the world. The growing importance of service sector in the economy has attracted different researchers to explore this sector and the various issues associated with it. Researchers have chosen different regions, country groups or individual countries as well as different time periods to explore the behavior of the sector. Broadly there are two areas, the expansion in the share of output and the expansion in the share of employment in the service sector which have received most attention in research relating to the sector. The most important issues that have been considered by different studies under these broad heads are:

- Factors that have contributed to the rapid expansion of output of the service sector.
- The pattern of development of service sector output.
- The effect of growth in services on the growth rate of per capita income.
- The spill-over effects of services on manufacturing.
- Factors that have contributed to the rapid expansion of service sector employment in the developed countries.
- Sources of cross-country variation in the share of total employment in services within a relatively homogenous group of countries.

While conducting the research all the studies encountered a large number of difficulties starting from the question of the appropriate definition of service sector and its distinguishing features to the availability and the reliability of data for this sector. Many attempts have been made to define services. Banga (2005) noting the definitions of services proposed by Hill (1977) and Bhagwati (1984) tried to provide a clear concept of services. Banga (2005) notes that an early definition was proposed by Hill (1977). Hill (1977) focused on the non-storability feature of services and stressed the need for interaction of the user and the provider of the service. This was later criticized as being too restrictive since it considered only the case of contact services. Alternatively, Bhagwati (1984) divided services into two categories in terms of 'physical proximity.' First, services for which the physical proximity of the user and the provider is essential (e.g., hospital services, haircuts etc.). Second, services for which physical proximity is not essential (e.g., services provided through internet, communication services).

Banga (2005) notes that many studies adopt a broader and simpler definition of services. One such broad definition of services is: services form a diverse group of economic activities not directly associated with the manufacture of goods, mining or agriculture. The basic characteristics of services on which most of the classifications have been based are: non-transferability, non-storability and intangibility. But some services have elements of tangibility (e.g. a consultant's printed report), visibility (theatre), and storability (voice-mail). Second, most goods are intended to provide a service or function. Third, there are few pure goods or services: nearly all goods require non-factor services for their production, most services require physical assets and intermediate goods and, at the point of sale, most goods and services are simultaneously supplied -- airline travel requires aircraft and other equipments, and cars need to be marketed and distributed (United Nations (2004)).

These and other complications make it difficult to formulate a clear-cut definition of services. No commonly accepted definition exists. Analysis of services generally adopts a pragmatic approach by simply listing activities that they consider part of the service sector.

Many recent studies (Elfring (1989), for example), have analysed service sector under four broad categories: a) The producer services defined as activities whose output is purchased mainly by enterprises or, in other words, which are intermediate or auxiliary to the production process in other activities, b) The distributive services which involve the distribution of commodities and information and the transportation of persons, c) The personal services covering hotels, bars, and restaurants and miscellaneous personal services and d) The social services provided largely by government, non-profit organizations, private businesses and professions.

Thus there is no common norm for defining or classifying the service sector. Depending on their objectives different studies have put forward alternative definitions and classification schemes. The uniformity in composition of services is very important when we are using national income accounts for comparing the performance of the service sector in different countries.

The classification of service sector considered in our study corresponds to the International Standard Industrial Classification (ISIC) revision 3. Services corresponds to the ISIC divisions 50-99 and it broadly includes wholesale and retail trade; hotels and restaurants; transport, storage and communications; financial intermediation; real estate, renting and business activities; public administration and defence; education; health and social work; other community, social and personal service activities; private household with employed persons and extra-territorial organisations and bodies.

Again the unavailability of data regarding service sector output, employment and productivity for all countries has limited the scope of research in this sector. The reliability of the existing data has also come under question. Blades, Johnston and Marczewski (1974) in the report 'Service Activities in Developing Countries' examine the availability of basic data and the procedures used by developing countries for calculating the value added in service activities. The report concludes that the majority of developing countries are still at an early stage of statistical development. A number of

countries have carried out occasional surveys of some of the most important service activities, but very few have so far organized the regular enquiries which are needed for reliable estimates of the level of and the change in the services component of national income.

Regarding the factors responsible for the huge increase in the share of services in total output all over the world, most of the studies have come to the common conclusion that a shift in the structure of final demand from goods to services and technological change along with the accompanying shift in the pattern of life are the most important factors in explaining the increase in share of services.

One relatively recent study in this respect, for a small group of countries has been done by Gani and Clemes (2002). They have tested for the significance of the growth of real output, the growth of manufacturing sector, growth in exports, growth in imports and government spending which are supposed to have contributed to the rapid expansion of the service sector. The study was done for five ASEAN countries (Indonesia, Malaysia, Philippines, Singapore and Thailand) covering the period 1965 to 1994. Growth of real output, the growth of manufacturing sector, growth in exports, growth in imports and government spending were regressed on the growth of output of the service sector. As the data chosen was a combination of cross section and time series data, Generalised Least Square method was chosen to estimate the regression equation. In the regression results among the five variables chosen as the potential contributors to service sector expansion in the ASEAN economies, growth in real output, manufacturing output, imports and government spending were found to have strong influence on growth of services. All the estimated variables except growth in exports appeared with positive coefficients and were statistically significant at 1 percent level. Gani and Clemes suggest that economic growth through higher level of saving and investment creates opportunities for further economic expansion. The positive effect of manufacturing on services shows the strong inter-linkage between the two sectors and the strong favorable influence of imports suggests that imports are drawn into the high productivity service sector and may also reflect less distortionary policies.

A number of studies have also tried to capture the patterns of development of service sector output and employment for different countries as well as regions or groups of countries for different time periods. Fuchs (1969) analysed the level of service output and employment over the nineteenth century (1839 to 1899) for USA. The paper shows that over the course of the period the services' share of output measured in current prices increased from 38 to 48 percent. Significantly the increase in relative importance of the service sector occurred entirely between 1869 and 1899. The sector was dominated by three large industries i.e., distribution, transportation and public utilities, and housing which accounted for between two-thirds and three-fourths of service output in every year. Over this period the service sector's share of total labour force rose from 21 to 33 percent. Thus over this period the average output per worker in services was above the national average.

Singelmann J. (1978) analysed the transformation of employment in the three major industrialized capitalist regions: Western Europe, Northern America and Japan. The study was based on the data from 38 national censuses during the period 1920-70. The paper finds that the employment share of extractive industries declined in all countries over the period 1920-70. By 1970, these industries at most accounted for one-fifth of total employment and this proportion had dropped to below 10% in England, the US, Canada and Germany. In contrast to the decline of the extractive sector, transformative industries increased their labour force share between these periods in all the countries considered. By 1970 industrial sector accounted for one-third or more of the total labour force in all these countries. At the same time shares of employment in all the services (Distributive, Producer, Social and Personal services) have increased in these countries over that period but this expansion of employment share was due primarily to the growth of producer and social services. Distribution and personal services, in contrast, changed much less during that period. The paper also finds that though the transformation of employment in the three major industrialized countries in this period shows a shift towards industrial and tertiary sector from the extractive sector, the pattern of transformation is not same for all the countries. In some countries (e.g., European countries) employment structure shifted

from agriculture to industries and subsequently to tertiary sectors. Some countries (e.g., the US) witnessed a structural shift of employment from agriculture to both industry and service sectors simultaneously and others (e.g., Japan) have followed a completely different path where the decline in the share of agricultural sector has led directly to the expansion of services.

Schettkat and Yocarini (2003) summarizing the findings of Fisher (1935), Clark (1940), Fourastie (1949), Baumol (1967, 2001), and Fuchs (1968), concludes that the expansion of service industry employment in the developed countries is broadly the result of three factors: 1) a shift in the structure of final demand from goods to services; 2) changes in the domain of firm specialization reflecting outsourcing; 3) inter industry productivity differentials.

The first argument was proposed by Clark and Fisher by explaining that demand will shift to services because demand for manufacturing goods will be saturated and labour will subsequently move to the service sector. The low rate of productivity growth in services combined with a shift in demand for services have created the major shift of employment in services. But Schettkat and Yocarini (2003) noted that latter studies by Summers (1985), Baumol (2001) have questioned the finding that demand shifts are the major cause of expanding service employment. They have shown that the share of services in real output is constant i.e., when the share of services in overall output is expressed in international prices (PPPs), the positively sloping regression line turns horizontal. However, Appelbaum & Schettkat (1999) provide evidence that since the 1970s, the share of services in real output has been increasing in the highly industrialized countries.

According to the second argument, manufacturing firms are redefining their core business and contracting out service functions based on competitiveness of outside specialist suppliers as against in-house production. At the same time they are buying new inputs to give their products new characteristics for their customers, such as packages of insurance and finance for purchase. These led to the fall of employment in manufacturing industries

and stimulated the demand of service sector as the input of manufacturing industries. Greenhalgh and Gregory (2001) studied the input-output tables for 1979 and 1990 for UK and found evidence of outsourcing of services. According to the paper the input-output tables show that the rapid growth of intermediate services raised the share of gross output of services supplied to intermediate uses from just fewer than 30 to 40 percent. Coefficients also reveal that the biggest change in input purchases per unit of gross output was the rise in the intermediate use of services within the service sector. Russo and Schettkat (2001)[3] also came to the same conclusion that outsourcing from manufacturing to services took place but at a modest rate and outsourcing from services to services did increase substantially.

Blades, Johnston, Marczewski (1974) considered the service sector in developing countries and using the national accounts data for 66 developing countries in 1960s showed that the share of services in national income ranged from 20 to 70 percent, which was a fairly narrow range compared to that for the agricultural and manufacturing sectors. Within the service sector, trade was the most important single activity, followed by public administration, other services including education, health, personal and recreational services etc. Data for 56 developing countries show that on average the service sector accounted for 28 percent of total employment compared to 53 percent for agriculture. Other services including public administration, health and education accounted for 57 percent of total service employment in contrast commerce accounted for 29 percent, and transportation, storage and communications accounted for 14 percent of total employment in the service sector.

With respect to this structural transformation of industrial activities, the Indian case is very different from what has been proposed by the theories of structural change. Studies based on cross-country data on sectoral shares in GDP (Kuznets 1979, Chenery 1975) have found that as an economy moves from lower-income to middle- or higher-income

[3] Russo, G. and Schettkat, R. (2001); 'Structural economic dynamics: myth or reality? Structural Change and the final concept', In: Ten Raa, T./ Schettkat, R. (eds.) The Growth of Service Industries: The Paradox of Exploding Costs and Persistent Demand. Cheltenham: Edward Elgar, pp.132-166. As cited in Schettkat, R. and Yocarini L. (2003); 'The Shift to Services: A Review of the literature' IZA Discussion Paper No.964.

status, accordingly the share of industry and services increases. In case of India, though the size of India's service sector relative to GDP has reached closer to that of an upper middle income country, in terms of per capita income India still belongs to the low-income range. That is why many studies (Bhattacharya & Mitra 1990, Banga 2005) have argued that higher growth in the service sector in India is a unique case. According to Bhattacharya & Mitra (1990), the pattern of service sector growth in India appears to be different from the general pattern observed elsewhere in two major respects: one is that the service sector has become the predominant sector even before the economy could become a highly industrialized one and the other is that the share of services in national income is much larger than it's corresponding share in employment. They argued that all of services income in a developing country can not be attributed to the growth of real volume of services. Due to the increasing commercialization of production and consumption, at least a part of the measured increasing volume of services is the result of the increasing commercialization of services.

Gordon and Gupta (2004) estimated the importance of 'splintering'[4] in case of Indian services by measuring the increase in input usage of services in other sectors through changes in input-output coefficients. Using the input-output matrices for the years 1979-80, 1989-90 and 1993-94, they have shown that the use of service sector outputs as inputs in industry increased by 40 percent between 1979-80 and 1993-94. The study found that final consumption of services grew at a rate similar to services output in the 1990s, whereas in the 1980s final consumption of services grew at a slower rate than services output. But they could not find any indication of such huge increase in final demand of services which can explain the rapid growth of services in India in the 1990s.

Bhattacharya and Mitra (1990) estimated the effects of income from commodity output and other factors like urbanization, population growth and commercialization on the services income in India. The function they considered was: $Y(t) = a + bX(t) + cT$. Here variable Y (income in the service sector) at time t is a linear function of variable X

[4] Splintering of industrial activity is the outsourcing of services that were once produced in house. It may result from the technical and structural changes in the economy.

(income from commodity output) at time t and a time trend, T. The time trend T is assumed to represent the combined partial effect of all other variables except that of commodity output. To avoid the problem of multicollinearity, Bhattacharya and Mitra estimated the function in first difference form i.e., $dY = b\ dX + c$, where $dY = Y(t) - Y(t-1)$, $dX = X(t) - X(t-1)$ and c represents the coefficient of the trend variables. They estimated the equation for different services sub-sectors for two different time periods: 1950-51 to 1968-69 and 1969-70 to 1986-87. They found that except in the case of the trade group, commodity output has a very poor relationship with services income. The intercept term is significant in all equations except in the case of public administration in the period 1969-70 to 1986-87. Based on this analysis they concluded that, in general, the growth rate of services income in India is independent of the commodity sector income and if we distinguish between exogenous and induced (caused by commodity growth) components of services growth then it appears that the exogenous component has far outweighed the induced component.

Thus, they concluded that demand as represented by commodity output, can explain only a minor proportion of growth of services income (by broad group of services activities) in India and there are strong exogenous factors which are governing the growth of services income.

A similar exercise to explain the growth of services in Indian economy has been done by Chakravarty (2005) who carries out an analysis for different states in India. Following the boom in services in most of the states in India, Chakravarty (2005), has tried to explain this situation for two periods, the initial phase of liberalization from 1980 to 1992-93 and the later phase of liberalization from 1993-94 to 2002-03. She did a closed-economy demand side analysis which is based on the simple assumption that the demand for services in a closed economy is a function of the outputs generated in the commodity producing sectors of agriculture and industry. In this analysis, output of the service sector in a state was expressed as the function of the output of the state's own agricultural sector, output of the state's own industrial sector and the output of the commodity producing sector for the rest of the Indian economy.

Chakravarty found that while service sector growth since 1980 is a common experience in all the states, the nature and the determinants are not exactly the same. The output of the state's industrial sector turned out to be the most important factor in explaining service sector growth in different states. Again, except for the service sector there was not any significant change in the growth performances in the other two sectors in the later reform period, when compared to the early reform era of the eighties. Thus Chakravarty's findings for the 1980s and the 1990s are different from that of Bhattacharya and Mitra (1990) for the four decades 1950s to 1980s.

There were significant policy changes in India beginning in the 1980s especially relating to deregulation, liberalization of FDI and privatization of government-owned services. Important policy changes undertaken by the government for different services or for other sectors (e.g., deregulation, privatization, and opening up to FDI) may be very important in explaining the rapid growth of that sector. Greater openness leads to enhanced competition both at domestic and foreign level and may also generate greater scope to take advantage of scale effects and imported technology. Thus it was expected that policy changes were likely to be a factor behind the growth in the service sector, which registered an upward trend in the 1980s and accelerated in the 1990s. Gordon and Gupta (2004) attempted to incorporate liberalization in an analysis of the growth in service-sector activity. To quantify the contribution of different factors in the growth of the different service activities they empirically tested for the significance of different factors in explaining growth. The annual growth in the i-th service sector in the year t was regressed on the growth rate of the commodity-producing sector, growth rate of the external trade volume of goods, the growth of exports in services and the dummy variables for the years 1980s and 1990s (to capture the influence of reform). They first estimated separate regression equations using time series data for the period 1951-2000 to explain growth in different service activities. Service activities were grouped as Business services, Communication, Financial services, Community services, Hotel-Restaurant, Distribution, Transport, Public Administration and Defence and Personal services. To capture the influence of reforms a dummy variable for the 1990s was used, as reforms in

the service sector were mostly carried out in the 1990s. After controlling for other effects, a significant coefficient for this dummy was meant to indicate that there is an unexplained part of growth which could possibly be attributed to reforms.
Another approach taken was to use panel data for different service activities, where the observations were averaged over five year periods. Instead of a general dummy for the 1990s, Gordon and Gupta used a dummy variable which assigns a value 1 to activities which were liberalized in the periods 1980 and 1990 otherwise zero. In panel data regression the time period considered was 1970-2000 and the observations were averaged over 1970s, 1981-85, 1986-1990, 1991-1995 and 1996-2000. In this case a dummy variable accounting for the fact whether reforms were carried out in each segment of services was also included along with the other explanatory factors.

They found that factors such as high income-elasticity of demand and increased input usage by other sectors have played an important part in evaluating services growth. The paper also found that along with the demand side factors and the growth of service exports, liberalization (representing by the dummy variables for 1980s and 1990s) has played an important role in accelerating the growth of services. Regression results show that for all sub-sectors growing at above trend rates in the 1990s, the dummy for the 1990s is positive and highly significant, where as the dummy for the 1990s is not significant in explaining the growth in most of the activities which grew at trend rates in the 1990s. The dummy for the 1980s was significant for business, financial and community services. Results corresponding to the second approach of panel data exercise for different service activities show that the dummy variable for reform measures in each activity is the most significant variable.

Thus, they concluded that the service activities which went through the liberalization process in India over the period of 1980 to 1990 were the fast growing sectors and the acceleration of growth of services over that period is due to the reform.
The paper however does not make any attempt to isolate the effects on growth of service sector of reforms from other exogenous events which might have occurred in the 1990s nor does it distinguish between different types of reforms or take into account the extent

or intensity of reforms. For example, the effect of technological advances on the growth process in the 1990s cannot be distinguished from the effects of policy changes. Service activity can also be stimulated by technological advances. New products or activities may emerge as a result of technological breakthroughs- such advances are likely to be particularly relevant in the case of the information technology (IT) sector (e.g., the internet), telecommunication (e.g. cellular phone services) and to some extent in the case of financial services (e.g. credit cards, ATM).

Thus there is a large literature which has contributed in different ways in explaining the expansion of service sector. Reviewing the findings of all the papers discussed above, we can summarize the factors responsible for the increase in the share of service sector output in total output generated in an economy.

1.3 Factors Responsible for the Expansion of the Service Sector

1.3.1 *Introduction*

Regarding the factors responsible for the huge increase in the share of services in total output all over the world, it has been a common consensus among the studies that a large number of factors are associated with this rising share of service sector output in total output generated in the economy. These factors range from the changing nature of human wants to policy changes domestically and world wide. The proposed factors include the shift in the structure of final demand from goods to services which may come from domestic consumers with high income elasticity of demand for services or from foreign consumers with a growing demand for the country's service exports; the contracting out of services which were formerly produced in-house within commodity-producing firm; technological change which leads to growth in the intermediate demand for services as inputs in the production of commodities or the emergence of new products in service activities. Recently the deregulation and the increasing opening up of this sector to international trade and investment have further accelerated the process of expansion in this sector.

1.3.2 *High income elasticity of demand for final product services*

The high income elasticity of demand for services is considered to be the most important factor behind the huge expansion of the service sector, especially in developed countries. This means that given the relative price of services the quantity of services absorbed increases compared to goods as the real income increases. Hence, the final demand for services increases more than commodities as income increases. This is especially so for services such as leisure activities, high quality health care services, higher education or other services such as travel, that can contribute to an improved quality of life (Wolfl (2005)). The importance of this factor as an explanation for the increasing share of services have been cited by most of the studies dealing with structural changes in economies (Fisher (1935), Clark (1940), Chenery (1960), Kuznets (1966)) and the evolution of the service sector (Gordon and Gupta (2004), Banga (2005), Wolfl (2005)).

Chenery and Syrquin (1975) empirically tested for the significance of income represented by log per capita GNP, for the period 1950-1970 for 101 countries, in explaining the share of output of different sectors in the economy and finds it statistically significant and positively related with the share of the service sector. Similarly Gani and Clemes (2002) finds the growth of real output (GDP) as a significant determinant of the growth of service sector for five ASEAN countries over the period 1965 to 1994.

1.3.3 *Changes in demographic pattern*

Given the income elasticity of demand for services, changing demographic patterns have been considered another important factor in raising the demand for final product services. Wolfl (2005) argued that the declining birth rate and higher life expectancy in the industrialized countries are resulting in a rapidly aging population, so that demand for certain goods and services (e.g. primary schooling) are declining and demand for others (e.g. health and personal services) are rising in these countries.

1.3.4 *Urbanization and the increasing demand for services*

The technological changes that have accounted for the rise of modern industry and urbanization have also changed the basic needs of people. Increasing urbanization results in a rising demand for services which are not essential in the countryside (e.g., housing, personal transportation, and the like). These changes in demand patterns have characterized both the household and the government sector. Kuznets (1979) and Bhattacharya & Mitra (1990) have emphasized the direct role of urbanization in increasing the demand for services and the share of output in the service sector.

1.3.5 *Government expenditure*

Defence of the country, the maintenance of law and order, the administration of justice, the collection of tax revenues, the administration of welfare measures, the planning and regulation of economic activity, often the building and maintenance of communications and transport infrastructure – these are basic functions of governments and the product of the government sector is mostly in the form of services rather than tangible goods. The size of the government sector can therefore be a crucial determinant of the size of the

service sector in an economy and a rise in the share of the government sector in GDP might explain a rise in the share of the service sector. Gani and Clemes (2002) find that the growth of government spending has a significant positive relationship with the growth of the service sector output.

1.3.6 *Demonstration effects*

We know that people have a tendency to follow the lifestyles of their better-off neighbors, a phenomenon often described as 'keeping up with the Joneses.' Thus the demonstration effect of household consumption patterns in developed countries on household consumption patterns in developing countries is another factor which might result in a higher share of services in private consumption expenditure in the latter countries. This factor is likely to have a strong impact on the economy with the increasing degree of openness in developing economies which is a part of the processes of liberalization and globalization. In other words, with increasing exposure of developing economies to the world market we can expect that the share of output in the service sector is going to increase due to demonstration effects, especially for the developing countries.

1.3.7 *Population*

Chenery and Syrquin (1975) considered a country's population to be another important determinant of the share of output of different sectors in the economy. The extent to which economies of scale can be realized depends on the economic size of the domestic market and in many cases population is a better representation of market size than total GNP. For example, for commodities with income elasticity greater than one, an increase in income has a greater effect than the increase in population where as the opposite is true for commodities with income elasticity of demand less than one.

1.3.8 *Interaction between industrial and service sectors*

Increasing interaction between the industrial and the service sectors is another factor responsible for the expansion of the service sector. The interaction between the agricultural sector and service sector is also growing with the modernization of the

agricultural sector and the increasing integration of the global economy but the linkage between these two sectors is not as strong as it is for the industrial and the service sectors. Using the input-output data of different sectors for the Indian economy Sastry et al (2001) noted that in 1993-94, to produce one unit of agricultural output it required 0.048 units of inputs from the service sector. In contrast to that in that year to produce one unit of industrial output it required 0.213 units of input from the service sector.

It has been found that the use of services in the industrial sector has increased at a considerable rate in the last two decades (Greenhalgh and Gregory (2001), Gordon and Gupta (2004)). Pilot and Wolfl (2005) cite the example of car production in this respect. The production of a car needs market research, technical research and development, human resource management and business consulting or in other words it requires a large number of service activities. In recent years the introduction of packages for debt financing of car purchases which may be provided by the car producer or indirectly via subcontracting, has further added to this link between industrial and service activities.

Wolfl (2003, 2005) notes that the service sector is increasingly involved in the production of intermediate inputs. This is especially so for the case of business related services, such as financial intermediation, transport and storage and post and telecommunication services, and also to a smaller extent for wholesale and retail trade. These (Wolfl (2003, 2005)) OECD studies conclude that on an average across OECD countries, about 45 percent of gross output produced by these service industries is used as intermediate inputs by other industries. More than half of all transport and communication services, for instance are used as intermediate inputs. Again it has been found that in the mid-1990s, services accounted directly or indirectly for about 22% of manufacturing production (total value added). This is the average across OECD countries for which input-output tables were available. The importance of the contribution of services in manufacturing has increased substantially since 1970s – it has, in fact, doubled in certain OECD countries, notably Japan, France and Australia.

The past two decades have also seen an increasing trend towards the outsourcing of business related services, such as research and development, financing or logistics. Technical and structural changes within different sectors have made it more efficient to contract out services that were previously produced in-house. This type of outsourcing has been termed as "splintering". Services have been contracted to existing specialized providers or are provided by a newly created firm that can provide services at lower cost or higher quality. This type of outsourcing has resulted in an increase in net input demand for services from the industrial sector as well as within the service sector. Referring to Fixer and Siegel (1999), Wolfl (2003) argues that in a world of free entry and exit in output and input markets, outsourcing of service functions to specialized service providers will enable final goods providers to produce at lower costs.

A large number of studies have considered the increasing interaction between the industrial and the service sector as an important factor to explain the expansion of the service sector. Bhattacharya and Mitra (1990) and Gordon and Gupta (2004) tested for the significance of this factor (represented by the growth of commodity producing sector) in explaining the growth of the service sector in case of India where as Gani & Clemes (2002) have done the same (in this case the variable considered was the growth of the manufacturing sector) for ASEAN countries. All of these studies find this factor significant.

This rise in interaction between the industrial and the service sector may be attributable to the course of technological change in industry and services. This in turn might be partly attributable to processes of structural change within industrial and service sectors ushered in by policy changes. For example, liberalization of policies with respect to foreign investment may lead to greater use of foreign technologies. Structural changes in the economy brought about through changes in policy might affect the degree of interaction between industry and services in other ways as well. For example, the liberalization of trade policies may lead to an increase in the degree of competition in the economy which could lead to increases in spending by industry on advertising, customer care services etc.

An increase in the variety of products could lead to a rise in retail or wholesale trade services.

1.3.9 *Trade in services*

Traditionally, most services have been non-tradable across economies because they require buyers and sellers to be in the same place at the same time. For example, a haircut is impossible to deliver across a distance. Many services, however, do not require physical proximity, but their production has usually taken place where producers and users are in close proximity because of technical constraints, habits or customs. These services centre on the exchange, storage, processing and retrieval of information, broadly defined. Now information and communication technologies i.e. ICTs, are dramatically changing the tradability of this information-centered set of services, in several ways (United Nations (2004)). For example all kinds of information can be stored by digitization and the instantaneous exchange of digitized information and voice communication between people situated in different countries has enhanced the tradability of services.

In addition customs and traditions are being broken as people are induced to use electronic media to acquire services they had previously only accessed by direct contact. In business sphere, services traditionally obtained in-house by firms are now being externalized, and consultation between service providers and customers are starting to take place at a distance because face-to-face interaction is not always deemed necessary. The tradability-of-services revolution is visible in the Balance of Payments data of countries (United Nations (2004). The development of these new technologies along with the processes of liberalization and globalization has led to increased tradability of services and in turn to increased trade in services.

This increasing volume of trade in services is likely to have a positive impact on the share of output in service sector in the economy. Gordon and Gupta (2004), for example, found the growth of exports in services to be a significant variable for explaining growth in service activity in India.

As noted above, both the increasing interaction between the industrial and the service sectors and the increasing volume of trade in services are largely the result of technological and policy changes taking place in economies. In the following subsections we discuss further the role of technological change and changes in government policy in determining the relative size of the service sector in the economy.

1.3.10 *Technological change*

Wolfl (2005) argued that innovation has to play an important role in long-run productivity growth. According to Wolfl, when we consider long-term growth, knowledge capital is even more important in contrast to physical capital as it is characterized by its non-decreasing returns. Innovation may take the form of process innovation or product innovation to improve the performance of a firm, as process innovation may reduce production costs and product innovation may help to increase the market share of that firm by opening up new markets for its products.

Regarding the determinants of success in service sector, OECD case studies of some of the international service firms show that along with factors which are internal to a firm (e.g., the organisation of work), external factors such as opening up of markets and innovation have played a crucial role in their success. According to these firms (FedEX, Southwest Airlines, eBay and Jet Blue), innovations either in terms of products or process have helped their firms by differentiating them from others. For example, FedEx developed a model for overnight package delivery and Southwest Airlines developed a business model for passengers at low cost. Many of these firms have pioneered in introducing information and communication technologies and developing applications, e.g., airline reservations without physical sales points (OECD 2005).

However, Wolfl (2005) points out that the service sector is less knowledge-based compared to the manufacturing sector. This fact is also reflected in the R&D intensity of service industries. Based on the OECD ANBERD data 2003, Wolfl (2005) shows that the R&D intensity of service production, as measured by the share of business R&D expenditure (BERD) in value added of the services sector is very low in the OECD

countries compared to the intensity to the manufacturing sector. In 2001 the share of BERD in total value added of service sector was about 0.4% on average across OECD countries in contrast in manufacturing sector it was about 7% in that year.

1.3.11 *Changes in policy environment*

1.3.11.1 *Policy changes related to deregulation of services*

Historically services have been highly regulated, partly due to market failure in the provision of some services (health, education and social services) and also due to the domestic influence of special interest groups as a result of which many firms have been able to restrict the entry of foreign competition. Transportation and communication services, trade and business services are prominent examples of such regulated services. These regulations may be in the form of (a) state control of business enterprises, (b) legal and administrative barriers to enterprises (e.g. licensing), (c) restrictions on trade and investment, (d) competition policies etc.

These measures could in some cases also have a negative impact on the supply of services. Nicoletti (2001) argued that the regulations in any sector should be considered while discussing the expansion of that sector as it may restrict the firm or business operation to enter the industry. For example, the legal and the administrative requirements for businesses represent fixed costs that can be a major hindrance for starting new venture especially in competitive service industries, such as road freight, retail distribution and communication services. As these industries consist of a large number of small and medium-sized firms the existence of such costly administrative procedures, such as multiple and complicated licensing systems, may constitute barriers to entry, affecting the number of start-ups and the survival rate of the new firms. Restrictions on trade and investment as well as restrictions on the size of enterprises may create hindrance in the expansion of different industries by limiting markets and access to capital resources and by restricting the utilization of economies of scale.

Several important services, such as health, education and social services are often provided in a non-market environment, although with considerable variation across

countries. The absence of market or a price mechanism for these services implies that it is difficult for the providers of these services to gauge the demand for these services. This is sometimes reinforced by the absence of competition between providers and by the reliance on public funding. As a result of this environment, producers may have difficulties in responding adequately to evolving user's needs, such as growing demand for long-term health care. Suitable policy measures, which could be explored in several public services. For example, opening of the market to private providers and the introduction of user choice. While such measures may not be suitable for all public services especially when equity objectives are considered (OECD (2005)).

Nicoletti (2001) notes that in the past two decades, many service markets have been extensively liberalized and regulation of services, even where it remained necessary, has often been overhauled. However, initial conditions differed a lot across countries, and the pace and extent of regulatory reforms also differed widely. Widespread reforms have, for example, considerably loosed the tightness of regulation throughout OECD countries.

1.3.11.2 *Policy changes related to FDI*

Investment has to play a very important role in the expansion of services as it has a direct impact on production, productivity and an indirect impact on innovation. Benefits can also stem from the increased competition, lower prices and better quality of services thus creating supply as well as more demand for services.

There are some economic factors which have created pressures for the developing countries to restrict the entry of foreign investment in their domestic economy. Among these, the infant industry argument is the most important.

While FDI in services remains more restricted than in the industrial sector, both developed and developing countries have taken steps to open up their service industries. In fact, starting from a higher level of restrictions, developing countries may have liberalized their service industries at an even more rapid pace than developed countries over the past decade. It has also been found that even relatively open and mature

economies such as the United States have been restrictive in not allowing FDI in media and air transportation while low and middle income economies on average are more protected than high income economies in distribution industries (United Nations (2004)).

In the last two decades, there has been a substantial increase in the use of services as the intermediate inputs. This has accentuated the need for efficient provision of key services. At the same time advances in information and communication technologies have facilitated trade in services. New technology has made it easier to digitize information and send it across the world at negligible cost. This has allowed services to be split into components, each of which can be located in countries which can provide them with more efficiency or at lower cost. As a result IT-enabled services are increasingly globalizing.

This situation becomes clearer when we see that the sectoral mix of FDI has shifted towards services and the sectoral composition of services FDI is also changing, reflecting in particular a surge in flows into activities previously closed to FDI. Many service industries have until recently been relatively closed to foreign entry and once the liberalization of FDI policies in service industries started around the mid-1980s and gathered momentum during the 1990s, services FDI surged. According to the United Nations 2004, world's stock of inward FDI in services quadrupled between 1990 and 2002, from an estimated $950 billion to over $4 trillion (based on 61 countries accounting for over four-fifths of the world's stock of FDI). On average, services accounted for two-thirds of total FDI inflows (and about 70% of outflows) during 2001-2002. Among individual countries, the share of services in total FDI varies considerably. For example, in the early 2000s, it ranged from 30 percent or less of the inward FDI stock in Bangladesh, Sweden and Venezuela to over 80% in Denmark, Luxemburg, Switzerland, Hong-Kong and Latvia.

Over the last two decades all the countries continued to liberalize their FDI policies in an effort to improve the environment to attract more FDI in all sectors. Various incentives were given to the investors to attract FDI in services over this period. These included

fiscal concessions (reduction in tax level), introduction of new investment policies and investment guides to give the private sector opportunities to participate in different areas which were previously closed to them, shortening the processing time for investment proposals and the establishment of free economic zones.

Similarly, countries and regions through integration and co-operation have taken several steps to work towards further liberalization of service sector both for investment and trade. For example, the ASEAN Framework Agreement on Services, signed on 15th December 1995, aimed at eliminating restrictions on trade in services in the region and improving the efficiency and competitiveness of ASEAN service suppliers (United Nations 2004).

Table 1.5: Examples of policy changes related to FDI in the service sector (2003-04)

Developed Countries	**Policy Changes**
Canada	Allows foreign banks or interests to own up to 20% of an individual bank (double the previous limit). Permitted foreign ownership share in media companies rose from 20% to 33% by 2004.
Switzerland	Aims to complete opening to investors of the last-mile telecoms network, which is fully owned by Swisscom.
African Countries	
Ethiopia	Amended investment law to allow the private sector to participate in all areas except electric power development and distribution, postal service delivery and air transport using over 20 seater planes, which are solely reserved for the government.

Madagascar	Undertaken a number of operations for privatisation including airlines, Northern Railways Company, Southern Railway, telecommunications services.
Asian Countries	
China	Opened its finance and travel industries to foreign companies, the establishments of educational institutions were allowed for joint operation by foreign and domestic investors or institutions.
Saudi Arabia	Opened up more industries to FDI, including electricity gas transmission and pipeline services. Restrictions in FDI in some telecom industries such as internet and e-mail service provision and data and message transmission services were removed.

Source: World Investment Report 2004.

Thus this shift in FDI inflow towards services is likely to have a strong impact on the share of services in total GDP for all the countries which have experienced this type of FDI inflow in services.

According to the report of the meeting of the OECD countries at the ministerial level, 2005, deregulation and the emergence of competitive pressure that has occurred over the last few decades have been very important in the growth process of services. Regulatory reforms with a reduction in international barriers to trade and investment in services as well as growing scope for competition and international cross-border trade due to technological change and the growing tradability of services have opened up service markets that were previously sheltered from competition. The growth of competition in

service sector is important for another reason; it fosters the growth and new entry of firms that are particularly innovative and successful in meeting consumer demand.

Gordon and Gupta (2003) have taken into account the importance of policy changes to explain the expansion of the service sector. Gordon and Gupta (2003) empirically tested for the significance of the factor in case of India by introducing dummy variables for the 1980s and the 1990s (the period when most of the policy reforms were undertaken in service sector in India). In the regression results dummy variables became significant.

1.4. Objectives of the Study

The above review of literature indicates that there are a large number of issues associated with the expansion of the service sector. These include the validity of theories relating structural change and economic development, the possible reasons for the rapid global expansion of the service sector in recent decades and its emergence as the most important sector of economic activity in many countries, the impact of this sectoral transformation pattern on the overall growth process and productivity of economies, the employment implications related to this and finally, the sustainability of this process of rapid expansion of the service sector in various economies.

In this study we will concentrate on one major issue – the factors behind the emergence of the service sector as the most important economic activity almost all over the world. We analyse panel data on a large set of countries over the period 1971 to 2003 to look at the factors which can explain the share of service sector output in the GDP of an economy.

From the very beginning the theories of structural change tried to establish that the transition of an economy from a traditional to a developed one is the result of interrelated changes in the economic structure which are prerequisites for continued increase in income and welfare of an economy. This required set of structural change includes the accumulation of physical and human capital, the transformation of demand, structure of production and trade patterns and also transformation in demographic and distributional patterns.

Proponents of these theories of structural change have tried to put forward statistical evidence on the uniformity in the process of transformation in economic structures. The study by Chenery and Syrquin (1975) is a significant attempt in this respect. It initiates an integrated approach to analyse all the major interrelated structural transformations that generally accompany the transition of a traditional economy to a developed economy.

Chenery and Syrquin's econometric analysis is based on data from 101 countries for the period 1950 to 1970.

The starting point of our study is the analysis by Chenery and Syrquin (1975). Though the Chenery and Syrquin (1975) study attempts to provide a uniform description of all the major interrelated structural transformations accompanying growth, we have focused on the expansion process of only one important sector that is the service sector. Our study is based on the data from 65 countries for the last three decades (1971-2003) that is the time period just after the time period considered by them. Thus we can see our study as an extension of the analysis by Chenery and Syrquin in this respect.

Although our main objective is to look at the determinants of the share of service sector output in total GDP, our study is different from that by Chenery and Syrquin in the sense that, we have tried to find the impact of additional factors such as the level of government expenditure in an economy and the degree of openness of an economy to trade and investment.

Relatively recent contributions to the literature (e.g. Gordon and Gupta (2004)) have claimed that policy changes related to liberalization and globalization are important factors explaining the rapid expansion of the service sector in the last two decades in India. In the last two decades, a large number of other countries have also undertaken policy changes related to trade and investment and increasingly opened up their economy in the international market. We have in our analysis tried to determine the importance of this process of global integration and policy changes adopted by different countries in determining the share of total output in the service sector.

Finding out the impact of policy changes related to liberalization and globalization is also important in the sense that it will help us to shed some light on the debate over the long-run sustainability of the growth of the service sector in India (Joshi (2004), Suresh Babu (2005), DVS Sastry et all (2003)). Gordon and Gupta (2004) concluded that the acceleration of growth in the service sector in India in the 1990s was due to fast growth

in those service sub-sectors which were opened up for foreign investment, external trade or private ownership and "there is considerable scope for further rapid growth in the Indian service sector".

The question that may arise in the context of the findings of Gordon and Gupta (2004) is whether this high growth rate of Indian services is sustainable even after the end of policy changes related to the process of liberalization and globalization. For example, if we find that the phenomenon of world-wide expansion of service sector over time is unrelated to the policy changes associated with the process of liberalization and globalization then it would be difficult to conclude that the growth of the Indian services sector is going to slow down significantly after the process of economic reforms comes to an end.

The state of technology has always played an important role in determining the production as well as the consumption pattern of an economy. Over the last few decades some important technological breakthroughs have taken place which has affected both the supply and demand for services and it must be noted that these technological changes may possibly provide an alternative explanation for the growing importance of the service sector in the world economy. Thus another objective of our study is to find out the role of technological development independent of the policy changes associated with globalisation in determining the relative size of service sector output in the economy.

CHAPTER 2
Specification and Data

2.1 The Initial Model

Chenery and Syrquin (1975) analyzed the interrelated changes in the structure of the whole economy in the process of economic development (these have been discussed in section 1.2.1 in the previous chapter). Here we consider only one aspect of these development processes – the transition towards services with changing income status.

Based on the analysis by Chenery and Syrquin (1975) our empirical exercise is aimed at finding out the significant factors responsible for the expansion of the share of services in national income. However, our analysis also tries to account for factors which were not considered by Chenery and Syrquin but might have been important, especially in the period subsequent to that considered by Chenery and Syrquin. The statistical analysis is designed in such a way that we can explore other subsidiary objectives.

1. We can compare our findings with the findings by Chenery and Syrquin (1975) related to this structural transformation and check whether the process of structural change has changed over the last three decades (1971-2003) after the period (1950-1970) of their analysis.

2. We have also tried to study the impact of globalization and technological change as other two important exogenous factors in explaining the relative size of service sector in total output of the economy. We have discussed the importance of these two variables in detail in section 1.3.10 and 1.3.11 in the previous chapter.

The basic specification of the model used is:

$$s_{it} = \alpha + \gamma' w_i + \lambda' z_t + \beta' x_{it} + u_{it}$$

$$i = 1, 2, \ldots\ldots, N.$$

$$t = 1, 2, \ldots\ldots\ldots, T.$$

with the value of i denoting the country and the value of t denoting the year corresponding to a particular observation. The i subscript, therefore denotes the cross section dimension and t denotes the time series dimension. α is a scalar, β is K X 1 vector of coefficients of K explanatory variables and x_{it} is the vector of observations on K explanatory variables for the country i in year t.

That is the share of service sector in national income (s_{it}) is a function of a vector of variables (x_{it}) which vary with both country and time, a vector of variables (w_i) which vary only with country and a vector of variables (z_t) which vary with time only. α, β, γ and λ are the vectors of coefficients of these variables, which are constant over time and across countries.

u_{it} is the residual component or the unexplained part of the variation of s_{it}.

2.1.1 *Individual country specific effects (w_i)*

There may be a lot of variables which vary with countries but are time-invariant that may affect the sectoral distribution of national income. For example, certain aspects of the socio-political environment of a country may be historically specific to that country and remain invariant over time. These may influence social objectives and thus government policies, which may, in turn, influence the sectoral distribution of national income. The value of w_i is supposed to represent the effect of all these unobserved influences on the share of the service sector in the i^{th} country.

2.1.2 *Time specific effects (z_t)*

Like individual country specific factors there are other explanatory factors which may be the same for all countries at any given point in time but may vary over time for all countries. These may have a considerable impact on the share of service sector in national income. For example, one can assume that all countries have access to a common pool of technologies at any point in time and as new technologies enter this pool they affect the supply and demand of different services and in turn their share in national income in the same way in all countries. The value of z_t represents the effect of all such factors on the share of the service sector in all countries in year t.

2.1.3 *Variables that vary both with country and time (x_{it})*

The literature suggests a number of factors that vary both with country and time and affect the share of service sector in national income.

The factors which influence the share of service sector output in total GDP may be usefully classified into two kinds: demand side factors and supply side factors. Demand for services may be final demand for services (which may be for domestic consumption and for foreign consumption) or intermediate demand for services. The latter is demand from production units, both from within the service sector and from outside it. Like demand for services for final consumption, demand for intermediate use may also come from domestic as well as foreign production units. Same is true for supply of services.

The demand side factors which may influence the total demand for services include factors which affect demand for final product services like per capita income, the size and age structure of the population, the degree of urbanization, the structure and organization of the non-service sector in the economy (especially the share of the industrial sector in GDP), the state of technology in the non-service sector and the demand for service exports. On the other hand, the major supply side factors which may influence the total supply of services include the state of technology in the service sector, government expenditure for the provision of government services and the supply of service imports. Government policies are also important determining factors. We should note that the structure and organization of the non-service sector, the state of technology in the economy and the extent of trade in services may be significantly influenced by the economy's degree of openness to trade and investment.

Thus we may write a basic linear regression equation relating the share of services in national income to its determinants as follows:

$$s_{it} = a_1.w_1 + a_2.w_2 + ...+ a_N.w_N + \gamma_1 (cgdp)_{it} + \gamma_2 (dmp)_{it} + \gamma_3 (urb)_{it} + \gamma_4 (pop)_{it} + \gamma_5 (cg)_{it} + \gamma_6 (iy)_{it} + \gamma_7 (xs)_{it} + \gamma_8 (ms)_{it} + \gamma_9 (openk)_{it} + \gamma_{10} (fdigdp)_{it} + \beta_1 . z_1 + \beta_2 . z_2 + ... + \beta_T . z_T + u_{it}$$

where, s = Share of service sector output in total GDP.

$cgdp$ = GDP per capita.

dmp = The ratio of aging population[5] to total population.

urb = Percentage of total population living in urban areas.

pop = Population (in millions).

cg = Share of government expenditure in total GDP.

iy = Share of industrial sector output in total GDP.

xs = Share of service sector exports in total trade.

ms = Share of service sector imports in total trade

$openk$ = Ratio of sum of imports and exports to GDP (Trade openness index).

$fdigdp$ = Foreign direct investment inflow as a percentage of GDP.

w_j = dummy variable representing country-specific effect for j^{th} country ($w_j = 1$, if $j = i$ and $w_j = 0$, otherwise; $j = 1,2, \ldots, N$).

z_r = dummy variable representing time-specific effect for r^{th} year ($z_r = 1$, if $r = t$ and $z_r = 0$, otherwise; $r = 1,2, \ldots, T$).

u = Error component.

In the above equation dummies which account for the time-specific effects are assumed to capture the impact of the state of technology. As it is difficult to find a variable which can represent the state of technology we can assume that the impact of this variable is captured by the time specific effects and the degree of openness of the economy, the former represents the access to technology independent of the degree of openness of the economy. Similarly the effect of the organization and structure of the non-service sector maybe assumed to be largely captured in the share of the industrial sector in GDP but also by the variables representing openness.

[5] people aged above 60/65 years

2.2 Description of Data

To perform the statistical analyses and to find out the important variables to explain the share of service sector in national income we have used data for the different variables mentioned above from a maximum of 65 countries over the period 1971 to 2003. The sample of 65 countries has been listed in the appendix (in Table1). Panel data has been used to take care both of the cross-section and the time series element at the same time. We have chosen this time period for our analysis because continuous data for a sufficiently large number of countries are available for this period. Alternatively, as our study can be viewed as an extension of Chenery and Syrquin (1975) analysis with respect to the service sector we choose to restrict our study for the three decades just after the period considered by them.

Estimations have been done for two periods i.e., first for the period 1971 to 2003 using data from 59 countries and second for the period 1980 to 2003 using data from 65 countries. As continuous data for some of these variables (share of export of services in total trade and the share of import of services in total trade) are not available for this whole period of 1971-2003, when these variables are included in the regression analysis, we have considered the shorter time period 1980-2003 using data from 65 countries. A relatively large number of countries (65 countries) have continuous data for those variables when the shorter span of time is considered (1980-2003) compared to the longer period (1971-2003). Thus here the choice of countries has been totally based on the availability of data.

The country sets that have been included here are a good combination of some developed (17 countries) and some developing countries or underdeveloped countries (48 countries). Among these 65 countries 20 countries belong to the high income group, 12 countries in the upper middle income group, 15 countries in the middle income group and 18 countries in the low income group (classification of countries in different income groups are as per the World Bank 2004). Thus a heterogeneous groups of countries have been

included here which allows for considerable variation in the values of the variables included. [6]

All the exercises that we have done here are based on balanced panel data i.e., all the countries are observed over the entire sample period. Thus total number of observations in each case is equal to the number of countries included multiplied by total number of years considered for each country.[7]

The prime advantage of using panel data for estimation is that it allows us to explore a wide range of variables that would not have been possible if we considered only cross section data or only time series data for estimation. Countries are heterogeneous and there are variables which vary with both country and time and there are a lot of other variables which are country-invariant or time-invariant (these variables have been discussed earlier). It is difficult to include all of these variables in the estimation equation. Omission of these variables may lead to bias in the resulting estimates. By using panel data we are able to control for these time-invariant and country-invariant variables. This is the main advantage of estimates using panel data over other estimates. At the same time estimation using panel data is more informative, gives more variability, more degrees of freedom and more efficiency.[8]

2.2.1. *Dependent and explanatory variables*

It has already been mentioned before that a large number of variables have been suggested by the literature. Variables which are most important in explaining the share of service sector output in total output of the economy have been listed above in the form of

[6] When we have considered the period 1971 to 2003, we have used data from 17 developed countries and 42 developing or underdeveloped countries.

[7] For Senegal data for export and import share of services in total trade were not available for the year 2003 and data of the year 2002 have been entered in that cell. Similarly for South Africa data is missing for the year 1980 for these two variables and in that case data of the year 1981 have been entered in place of those missing values.

[8] The advantages of using panel data compared to cross-section or time series data have been explained in detail in Baltagi (2003), pp.5-9.

an equation. But all of these variables that have been discussed above do not appear in our main statistical analysis (explained in the following sections) as many of these variables are associated with each other and it is difficult to differentiate their individual impacts. As for example, by including per capita income as an independent variable we can take into account the effect of changing income on the final demand for services as well as the intermediate demand for services. As rising income implies increase in industrial output which in turn creates the intermediate demand for services (as industrial sector is the main source of intermediate demand for services). Similarly, changes in life-style and the degree of urbanization are associated with the income level. Thus inclusion of all of these variables may further aggravate the problem of multicollinearity.

Alternatively, proportion of population aged above 60/65 can be a significant factor for the developed countries (as it is suggested by the literature) where life expectancy is high and health services account for a larger share in GDP compared to the developing countries where life-expectancy is relatively low and thus smaller expenditure on health services (which in turn is also a reason for low life-expectancy in the developing countries). Thus if we consider aging population as an independent variable then we may get a spurious positive correlation.

In our analysis the dependent variable is the share of service sector in total GDP (*s*). Services here correspond to ISIC divisions 50-99. All the data related to the share of service sector that have been used here are taken from the World Bank's World Development Indicators 2005.

The explanatory variable per capita GDP (*cgdp*) is defined in real terms (aggregated using purchasing power parities, measured in $ at current prices). As the sample of countries considered in the analysis is a combination of developed and developing countries, values of *cgdp* vary considerably among countries. Malawi had the lowest per capita GDP ($832.81 in 2003) in the sample of countries and United States had the highest *cgdp* ($37313.3 in 2003) in the sample in 2003.

Another explanatory variable is total population (*pop*), which is counted in 1000s (thousands). The total population has a large variance in the sample of countries as total population in India was 1049700 thousands in 2003 whereas in that year total population in Barbados was only 277.26 thousands.

Share of government spending in real GDP per capita (*cg*) is another explanatory variable that has been included here. In our sample of countries the share of government expenditure in total GDP was maximum in Lesotho (51.61%) in 2003 and that expenditure was minimum in Nigeria (4.23%) in that year.

Another explanatory variable that has been included in the study is a measure of the extent of openness to international trade (*openk*). It is calculated as exports plus imports divided by real GDP per capita. The values of *openk* vary considerably over time and across countries in the sample. In terms of values of openness index, in 2003, Malaysia was the most open country within the sample (value of openness index for Malaysia was 208.03 in 2003) and Argentina was the most closed economy within the sample (value of openness index for Argentina was 20.8 in 2003).

Yearly data on all the above mentioned four variables for all the countries that we have considered are available in the Penn World Table 6.2. (PWT 6.2) web page[9].

Data on the shares of exports and imports of services in total trade (for the period 1980-2003) are available in the UNCTAD (Handbook of Statistics 2005, webpage) on-line data base[10]. The shares of exports and imports of services in total trade also vary considerably among countries. Service exports accounted for 82.4 percent of total trade in Gambia in 2003 while its share in Venezuela was only 3.13 percent in that year; in 2003 the share of service imports in total trade was maximum in Gabon (52.79%) and minimum in Lesotho (7.87%).

[9] http://pwt.econ.upenn.edu/php_site/pwt62//pwt62_form.php
[10] http://stats.unctad.org/handbook/ReportFolders/ReportFolders.aspx

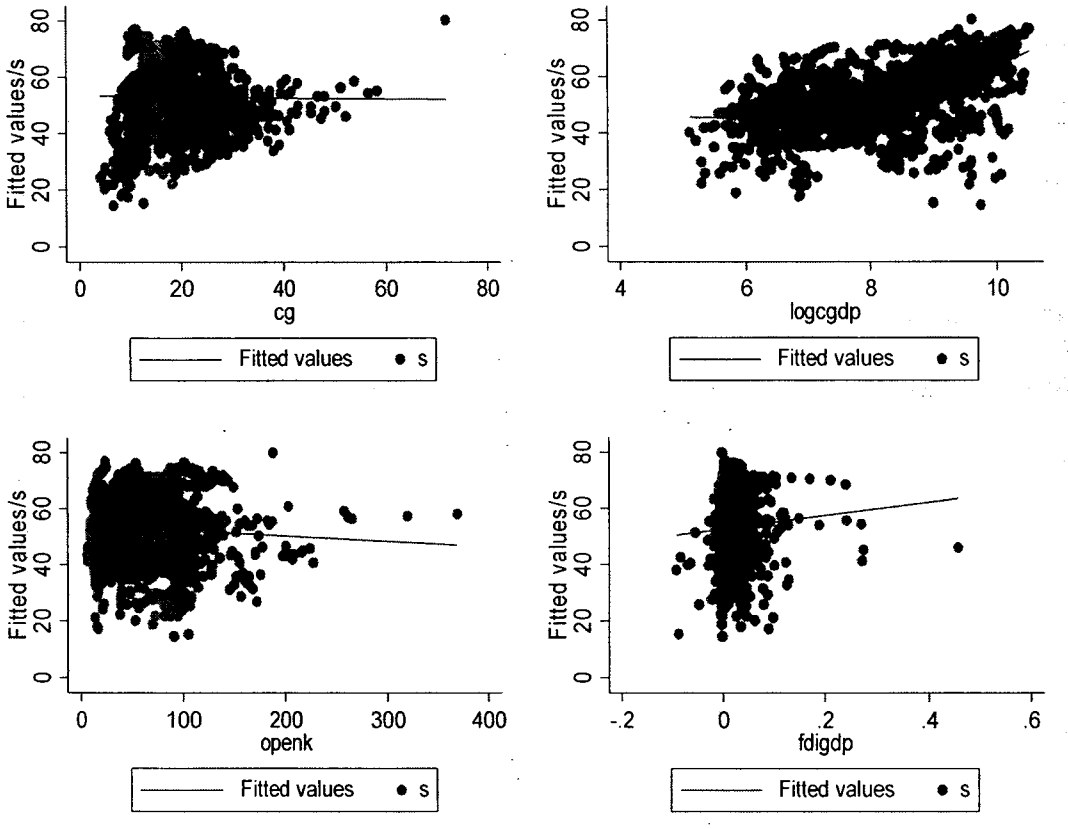
FDI inflow as a share of GDP (*fdigdp*) has been included as another explanatory variable. Inflows of FDI in the reporting country comprise capital provided (either directly or through other related enterprises) by a foreign direct investor to an enterprise resident in the economy (called FDI enterprise). Data on FDI inflow (for the period 1970-2003) is available in UNCTAD FDI data base.[11] Data on FDI inflow is reported in million current US dollars. Here the explanatory variable *fdigdp* has been calculated by dividing FDI inflow of the host country in a year by GDP of that year.[12] In 2003 the share of FDI inflow in GDP was highest in Jamaica (1.99%) and lowest in Lesotho (-0.06%).

[11] http://stats.unctad.org/FDI/TableViewer/download.aspx
FDI has three components: equity capital, reinvested earnings and intra-company loans. FDI flows are recorded on a net basis (capital account credits less debits between direct investors and their foreign affiliates) in a particular year.

[12] Here data on GDP in million current US dollars have been adapted from World Bank's World Development Indicators 2006.

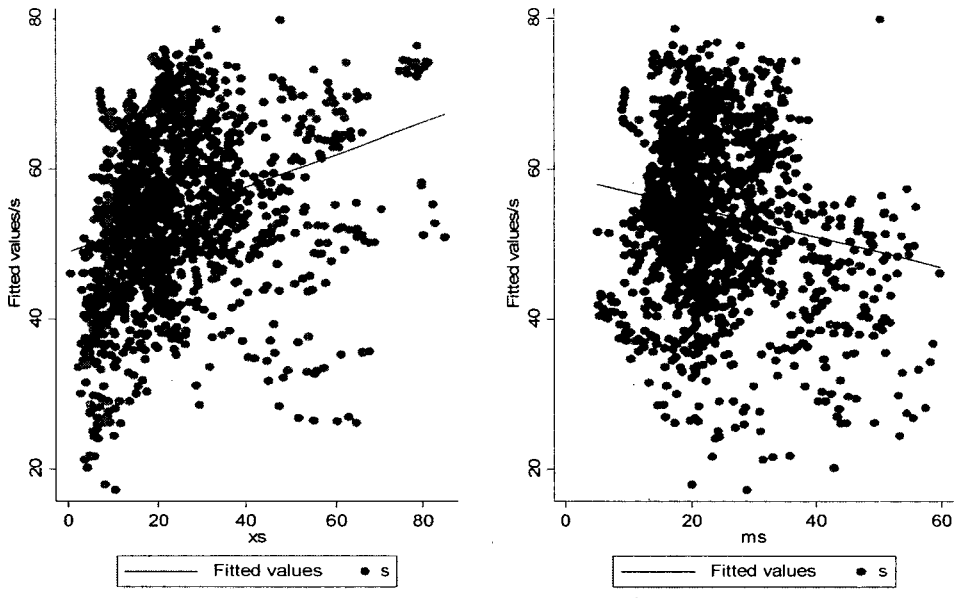
The graphs in figures 2.1 and 2.2 show the predicted values for the share of service sector output in GDP based on the simple linear regressions of that dependent variable on the independent variables used later in multiple regression analysis.[13]

Figure 2.1: Regression fit of *cg*, *logcgdp*, *openk* and *fdigdp*



[13] The first curve shows the predicted values for *s* where *s* is regressed on log values of *cgdp* and its square values.

Figure 2.2: Regression fit of export and import shares of service sector in total trade



The regression fit graphs in Figure 2.1 and 2.2 show that the variable *logcgdp* is in a U-shaped relationship with *s,* in contrast *fdigdp* and *xs* indicate a positive relationship with *s,* whereas the other variables *cg*, *openk* and *ms* indicate a negative relationship with that variable. However, except *cg* and *openk* all the variables are significant in the above regression fits.

2.3 Estimation Procedure

Having decided on the dependent and the explanatory variables to be included, we now move to the estimation of the regression equations. Here we can begin our discussion by considering the form of the average time series regression equation (that is the equation (III) explained in section 1.2.1 in the previous chapter) estimated by Chenery and Syrquin (1975) in explaining the share of service sector output in country GDP over the period

1950 to 1970. Using the same notations which we have used in our analysis we get the average time series regression equation estimated by Chenery and Syrquin as:

$s = \alpha_i + \gamma_1 (logcgdp) + \gamma_2 (logcgdp)^2 + \sum \rho_j T_j + \varepsilon .F + u$ ..... (A)

Here, the dependent variable s is the share of service sector output in GDP. The right hand side variables are the explanatory variables. *logcgdp* is the natural log value of real GDP per capita, F is the net resource inflow (imports minus exports of goods and non factor services) as a share of total GDP, T_j is the time period where j = 1950-54, 1955-59, 1960-64 and 1964-69 and u is the error component. γ_1, γ_2, ρ and ε are the coefficients of the explanatory variables. α_i is the country-specific dummy variable.

Chenery and Syrquin considered the log values of per capita income and the size of population (instead of absolute values of these variables) in their estimation as they found evidence of the existence of nonlinearities in the relationships analysed. Referring to the UN study (1963) and the Chenery and Tylor (1963), Chenery and Syrquin (1975) argued that in the study of patterns of development, empirical results have suggested the existence of nonlinearities in the relationships analyzed even after transforming all or part of the data into logarithms. This is true on the theoretical level as well because the shares of any aggregate have an upper bound of unity and is bounded from below by zero. Chenery and Syrquin had found the coefficient of the quadratic terms to be significantly different from 0. This nonlinearity is taken into account in our study by taking a log quadratic formulation similar to Chenery and Syrquin analysis.

The basic panel data models that have been used in our analysis are:

Equation (1)

$s_{it} = \alpha_i + \beta_t + \gamma_1 (logcgdp)_{it} + \gamma_2 (logcgdp_{it})^2 + \lambda_1 (logpop)_{it} + \lambda_2 (logpop_{it})^2 + \delta(cg)_{it} + \zeta (openk)_{it} + \psi (fdigdp)_{it} + u_{it}$

i(country)=1,2,3,.....N

t(year)=1,2,3,.....T.

Equation (2)

$s_{it} = \alpha_i + \beta_t + \gamma_1 (logcgdp)_{it} + \gamma_2 (logcgdp_{it})^2 + \delta (cg)_{it} + \zeta (openk)_{it} + \psi (fdigdp)_{it} + u_{it}$

i(country)=1,2,3,.....N

t(year)=1,2,3,.....T

Equation (3)

$s_{it} = \alpha_i + \beta_t + \gamma_1 (logcgdp)_{it} + \gamma_2 (logcgdp_{it})^2 + \delta (cg)_{it} + \eta (xs)_{it} + \kappa (ms)_{it} + u_{it}$

i(country)=1,2,3,.....N

t(year)=1,2,3,.....T

In our analysis, s, the dependent variable is the share of service sector output in GDP. The right hand side variables are the explanatory variables mentioned above. *logcgdp* is the natural log values of real per capita GDP, *logpop* is the natural log value of total population, *cg* is the percentage share of government expenditure in GDP, *openk* is a measure of international trade openness, *fdigdp* is the percentage share of FDI inflow in GDP, *xs* is the share of exports of services in total trade and *ms* is the share of imports of services in total trade. γ_1, γ_2, λ_1, λ_2, δ, ζ, ψ, η , κ are the coefficients of the explanatory variables (which vary both with country and year) to be estimated. α_i and β_t are the country-specific and year-specific dummy variables respectively. Country-specific dummies are included to capture the variation of the dependent variable due to the unobservable country-specific characteristics. Similarly year dummies account for the unobservable time-specific effects.

Here equation (1) is the same as the average time series regression equation adopted in Chenery and Syrquin (1975) i.e., equation (A). The only difference is that instead of net resource inflow (import minus export of goods and non-factor services) as a share of total GDP, we have included *fdigdp* as the relevant explanatory variable and have included in addition the variables *cg* and *openk*. At the same time we have included the variable population as they did in their basic cross section regression equation (explained in section 1.2.1 in the previous chapter).

Similarly, equation (2) is the same as the regression equation (1). The difference is that we have dropped the variable population from this equation. In the analysis by Chenery and Syrquin (1975), the population variable was dropped from equation (A). The reason behind dropping the population variable from the time series analysis was that the growth of population is in the form of a uniform change over time and this uniform change is indistinguishable from a time trend but here the population variable has been dropped also to reduce the problem of multicollinearity with other variables besides the time dummies.

Equation (3) is a modified version of equation (2). Here in this equation we have included other explanatory factors (*xs* and *ms*), dropping *openk* and *fdigdp* from equation (2). In all the three equations a large number of country specific and year specific dummy variables have been included and inclusion of many explanatory variables along with these dummy variables may aggravate the problem of multicollinearity. Thus as the main purpose of equation (3) is to test for the importance of other two explanatory variables in this respect which were not considered in Chenery and Syrquin (1975) analysis, we have dropped *openk* and *fdigdp* (to reduce the problem of multicollinearity) from equation (3). Also these two variables (*openk* and *fdigdp)* were not significant in equation (1) and (2). Again as *cg* was found to be a significant variable in both (1) and (2), we retained that variable in equation (3).

Equation (1) and equation (2) have been estimated using a balanced sample of 59 countries as data were available for each of the countries on all the variables for the whole period of 1971 to 2003. The total number of observations used for estimating equation (1) and equation (2) was 1947. To estimate Equation (3), a balanced sample of 65 countries was considered over the period 1980 to 2003. Choice of countries and the time period considered was entirely based on the availability of the data.[14]

[14] As continuous data on *xs* and *ms* for most countries are not available for the 1970s, Equation (3) is estimated for 1980-2003.

Equation (1), (2) and (3) can be estimated in several ways by making different assumptions regarding the components of the error term and their correlation with the explanatory variables. The simplest among all these estimation procedures is to ignore the country and time specific fixed effects and run OLS (this is the method of pooled regression). But we cannot ignore the possibility of existence of time-specific and country-specific effects. These unobservable time and country specific effects can be incorporated as fixed effects (in a fixed effect model) or can be included as random effects in the error term (in a random effect model).

While running a random effect model we have to make some strict assumptions which are not required in case of a fixed effect model. In case of a random effect model along with other assumptions we have to assume that the unobservable country or time specific effects are uncorrelated with the explanatory variables but this assumption is not required for a fixed effect model. A fixed effect model generates consistent estimates even in the presence of correlation between the unobservable fixed effects and the explanatory variables. Thus we have chosen a fixed effect model because the assumptions required are relatively less strict.

There are several strategies using which we can estimate a fixed effect model. We can include all the dummy variables in the regression equation. This is the method of fixed effects (FE) least squares also known as least squares dummy variables (LSDV). Instead of including dummies for countries the within effects model uses the deviation from group means for the dependent and the independent variables. Alternatively, we can use the between effect model which uses the group means of the dependent and the independent variables to run the regression and we can also use the first differences of the variables to replace the variables themselves in the regression equation (the first difference (FD) model). Since the dummy variables are of interest we have focused on the least squares dummy variable model. To estimate the equations we have used the least square dummy variable (LSDV) model, dropping one country dummy (dummy

variable of the country Venezuela)[15] and one year dummy (dummy variable of the year 2003) to avoid the problem of perfect multicollinearity.

We have tested for the joint significance of the country-specific and the year-specific dummies, i.e., $\alpha_1 = \alpha_2 = \alpha_3 = \ldots\ldots\ldots = \alpha_{N-1} = 0$ and $\beta_1 = \beta_2 = \beta_3 = \ldots\ldots\ldots\ldots = \beta_{T-1} = 0$, by performing an F-test.[16] The F-test compares the pooled regression and the two-way country and time effect model. Here the F-statistics of 71.20, 80.04 and 67.60 (calculated using regression equations (1), (2) and (3) respectively) reject the null hypothesis that the parameters of the country and year specific dummies are zero, at one percent level of significance. Thus the F-tests support the inclusion of the country and time specific fixed effects in the regression.

F-test for fixed effects corresponding to Equation (1)
F(90, 1852) = 71.20
Prob > F = 0.0000

F-test for fixed effects corresponding to Equation (2)
F(90, 1851) = 80.04
Prob > F = 0.0000

F-test for fixed effects corresponding to Equation (3)
F(87, 1467) = 67.60
Prob > F = 0.0000

The standard fixed effect model assumes that the regression disturbances are homoskedastic with the same variance across time and units. This assumption is likely to be invalid as the cross-sectional units (countries) are of varying size and as a result may exhibit different variation. When the disturbances are heteroskedastic, on running an OLS

[15] As here we have dropped one country dummy and one year dummy just to avoid the problem of perfect multicollinearity, the country and year dummies that have been dropped here have been chosen arbitrarily.
[16] This is a simple Chow test with the restricted residual sums of squares (RRRS) being that of OLS on the pooled model and the unrestricted residual sums of squares (URSS) being that of the LSDV regression. These have been explained in detail in Baltagi (2003), pp. 14.

regression we get regression coefficients which are consistent but not efficient (since OLS standard errors are minimum when the residuals are independent and identically distributed). Also, the standard errors of these estimates will be biased unless we compute robust standard errors correcting for the possible presence of heteroskedasticity. The use of a White heteroskedasticity consistent covariance estimator together with Ordinary Least Squares estimation in fixed effects models can yield standard errors robust to unequal variance along the predicted line.

There is another problem which plagues panel data models and that is the existence of serial correlation in the disturbance terms. For the OLS estimates to be efficient we need the error terms to be uncorrelated. This is another restrictive assumption for economic relationships, where an unobserved shock in a period will affect the behavioral relationship for at least the next few periods. Ignoring serial correlation when it is present results in consistent but inefficient estimates of the regression coefficients and biased standard errors.[17] In panel data we usually worry that there is a unit specific effect in the error term. To address this problem of autocorrelation we consider each unit a "cluster" and allow a covariance structure where the error terms are correlated within clusters, but uncorrelated across clusters. With this specification we can also address the problem of heteroskedaticity.

In order to make correct inferences from the model we have considered the robust standard errors which take into account possible heteroskedasticity and serial correlation in the residuals.

[17] Issues related to heteroskedasticity and autocorrelation in panel data models have been discussed in detail in Baltagi (2003), chapter 5.

CHAPTER 3
Estimation with Panel Data: Results

3.1 Estimation Results

Estimation results corresponding to equations (1), (2) and (3) are given in Table 3.1, Table 3.2 and Table 3.3 respectively.

Regression results corresponding to equation (1) show that only per capita GDP and government expenditure are the explanatory variables which are significant. Government expenditure (*cg*) is significant at 1 percent level of significance and the coefficient of this variable appears with a positive sign. The other significant factor i.e., log per capita GDP (*logcgdp*) is significant at 5 percent level of significance and the coefficient of this variable appears with a negative sign. Square of log per capita GDP (*logcgdpsq*) is significant at 10 per cent level of significance and it enters with a positive sign. All the other explanatory variables i.e., *logpop*, *logpopsq*, *openk* and *fdigdp* are not statistically significant. Among the dummy variables 23 year-specific dummies and 18 country-specific dummy variables are significant at 5% level of significance. The values of the coefficients of the year-specific dummy variables show a rising trend.

While running these regressions we encounter the problem of multicollinearity[18]. In estimating these fixed effect models, along with estimating the coefficients of independent variables, coefficients of additional [(N-1) + (T-1)] 58 + 32 = 90 dummy variables have to be estimated and so many dummies may aggravate the problem of multicollinearity among the regressors.[19] For these reasons to counter the problem of multicollinearity associated with the inclusion of all the country-specific and year-specific dummy variables we estimated equation (1) by first dropping the country

[18] Multicollinearity in these estimates have been tested by the Variance Inflation Factor (VIF). VIF is used to measure the possible collinearity of the explanatory variables. To find VIF of an explanatory variable, that variable is regressed on the remaining explanatory variables and the R^2 of that regression equation is used in the formula $\{1/(1 - R^2)\}$ to get VIF of that variable. There is no specific cut off value of VIF but as a general practice it is taken as 10 and in stricter cases this cut off point is taken to be 4. That is when VIF is greater than 10 then we say that here multicollinearity is problematic and it should be taken into account.

[19] Explained in Baltagi (2003), pp.13.

dummies, then the year dummies and finally both country and year dummies and tested for multicollinearity in all the three cases. In terms of the signs of the coefficients of the variables (except for *fdigdp*) results of all the regressions were same (even after dropping the dummy variables) but after dropping the country-specific dummies none of the variables were significant only *logcgdpsq* and *openk* were significant at 10 percent level of significance. These estimates have not been reported here.

Table 3.1 Regression results corresponding to Equation (1)

Dependent Varible (*s*)	**No. of Observations (1947)**
Independent Variables	**Equation (1)**
constant	**246.7146*** **(3.02)**
logcgdp	**-16.83**** **(-2.16)**
logcgdpsq[20]	**0.917***** **(-1.90)**
logpop	**-17.6** **(-1.20)**
logpopsq[21]	**0.602** **(-0.75)**
cg	**.380*** **(-3.29)**
openk	**0.013** **(-0.88)**

[20] *logcgdpsq* is the square of the log value of per capita GDP. This is same as $(logcgdp)^2$ which has been included in the regression equations.

[21] *logpopsq* is the square term of the log value of total population. This is same as $(logpop)^2$ which has been included in the regression equations.

fdigdp	**-17.41** **(-1.96)**
R-squared	**0.8635**

* implies significant at 1 percent level of significance, ** implies significant at 5 percent level of significance, *** implies significant at 10 percent level of significance. Values in the parentheses are the corresponding t values. Coefficients of the dummy variables representing time-specific effects have been reported in Table 4 in the Appendix. Coefficients of country dummies have not been reported.

Testing for multicollinearity revealed that even after dropping the dummy variables multicollinearity still remained in all the regression equations. Even the pooled regression encounters the problem of multicollinearity. To solve the problem of multicollinearity we also did the first difference transformation of the variables and then ran the regression (FD model) but the problem of multicollinearity remained significant. Then we performed the within effect transformation (by demeaning the variables) and ran the regression (WE model) but still the problem persisted. Though the problem of multicollinearity reduced slightly after these transformations but the problem remained significant. These results have not been reported here.

To trace the roots of the problem of multicollinearity we considered closely the variance inflation factors of the included explanatory variables. The variables *logpop* and the squared variables *logpopsq* and *logcgdpsq* are highly collinear with other variables. Thus in equation (2) we have dropped *logpop* and *logpopsq* and have run the fixed effect model. Chenery and Syrquin (1975) have argued that in time series analysis any uniform change such as the growth of population is indistinguishable from a time trend and accordingly the variable population was dropped from their time series analysis. If we follow the same logic here then dropping population in equation (2) should not lead to any problem of misspecification of the regression equation. However, the coefficients of the time dummies have now to be interpreted as including the effect of the change in population over time. Though the main reason of multicollinearity was the inclusion of

square terms, *logcgdpsq* has not been omitted in equation (2) as dropping the square term may result in a misspecification of the equation.[22]

In the formulation by Chenery and Syrquin (1975) the reason given for the quadratic form of the regression is that since the dependent variable is a fraction of total GDP, its value is bounded from below and above. Thus it can not go on increasing and exceed one nor can it go on decreasing and fall below zero. Here to take into account the bounds on the dependent variable, we also did the logit transformation[23] of the dependent variable and ran the regression in equation (2) using the transformed variable. The result tells that even with logit transformation and restricting the dependent variable to lie between 0 and 1, the square term (*logcgdpsq*) is statistically significant. Thus this result further strengthens the quadratic formulation of the model.

It has been seen in all the regression results that throughout the whole analysis multicollinearity prevails as a problem and the inclusion of the square term (*logcgdpsq*) is one reason for that along with the inclusion of many dummy variables. Thus in some cases (e.g., estimating equation (2) by pooled regression and dropping *logcgdpsq* and also in case of estimating equation (2) while dropping the country dummies and *logcgdpsq*) dropping the square term we can get rid of the problem of multicollinearity. Even though the problem of multicollinearity can be eliminated by dropping the square terms we have used the quadratic form of the regression equation as dropping this term will lead to misspecification of equation as it is quite clear from the regression results of equation (2) with logit transformation. Regression result with logit transformation related to equation (2) is given in the appendix (Table 2).

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[22] It has been specified in Chenery and Syrquin (1975) that the greatest danger of multicollinearity is not in the low t ratios it some times produces but in the misspecification it leads to when important variables with high standard errors are omitted from the regression.

[23] Logit transformation of the dependent variable:

$y = f(x) = e^{\alpha+\beta x} / (1+ e^{\alpha+\beta x})$

$\Rightarrow e^{\alpha+\beta x}(y-1) = -y$

$\Rightarrow e^{\alpha+\beta x} = y / (1-y)$

$\Rightarrow \alpha+\beta x = log[\, y / (1-y)]$; here $\alpha+\beta x$ is the right hand side part of Equation (2) and y is the dependent variable.

Regression results corresponding to equation (2) are reported in Table 3.2 below. Regression results corresponding to equation (2) show that *logcgdp*, *logcgdpsq* and *cg* are highly significant and after dropping population terms the results have not changed much compared to equation (1). The coefficients of *cg*, *openk* and *fdigdp* have remained more or less unchanged. The coefficients of *logcgdp* and *logcgdpsq* have become relatively stronger than equation (1). Here in regression equation (2) *openk* and *fdigdp* continue to be insignificant at 5 per cent level although *fdigdp* is significant at 10 percent level of significance. *logcgdp*, *logcgdpsq* and *cg* are significant at 1 percent level of significance. Like equation (1), in equation (2) the coefficients of *logcgdp* and *logcgdpsq* appear with opposite signs, the coefficient of *logcgdp* being negative and the coefficient of *logcgdpsq* positive. *cg* like in all the other cases is positively related with the percentage share of service sector in GDP. Among the dummy variables 18 year-specific and 45 country specific dummy variables were significant. Regression result of equation (2) also shows a rising trend in the time-specific dummy variables.

In equation (2) population terms were dropped to get rid of the problem of multicollinearity but in regression equation (2), though the problem of multicollinearity has been reduced but it could not be eliminated by dropping the population terms. As in the case of regression equation (1), we estimated regression equation (2), dropping just year-specific dummy variables, just country-specific dummy variables and both year and country dummies (pooled regression). Results do not change much (both in terms of the signs of the coefficients and in terms of significance of the variables) when we drop only the year-specific dummy variables but after dropping the country-specific dummy variables and both results change considerably in terms of significance of the variables as all the variables (except *logcgdpsq*) become insignificant in the later two cases. These estimates have not been reported here. Regression equations estimated dropping these dummy variables are also not free from multicollinearity. Though the problem of multicollinearity was reduced in each case compared to regression equation (2) it could not be eliminated.

Table 3.2: Regression results corresponding to Equation (2)

Dependent Varible (*s*)	No. of Observations (1947)
Independent Variables	**Equation (2)**
constant	**128.3*** **(4.91)**
logcgdp	**-20.19*** **(-3.79)**
logcgdpsq	**1.26*** **(4.06)**
cg	**0.403*** **(3.65)**
openk	**0.0135** **(0.88)**
fdigdp	**-17.94***** **(-1.90)**
R-squared	**0.8609**

* implies significant at 1 percent level of significance, ** implies significant at 5 percent level of significance, *** implies significant at 10 percent level of significance. Values in the parentheses are the corresponding t values. Coefficients of the dummy variables representing time-specific effects have been reported in Table 4 in the Appendix. Coefficients of country dummies have not been reported.

Now we turn to regression equation (3). Chenery-Syrquin (1975) in their time series analysis included only two explanatory variables (along with country and time dummies) – GNP per capita and the net resource inflow (imports minus exports of goods and non factor services) as a share of total GDP. In equations (1) and (2), we replaced these two variables with GDP per capita and FDI inflow as a percentage of GDP. Now in equation

(3) along with per capita GDP we have included two other explanatory variables, *xs* (percentage share of exports of services in total trade) and *ms* (percentage share of imports of services in total trade), which were not considered in the Chenery and Syrquin's analysis. This is to check for the significance of these additional explanatory variables and to test whether the results for per capita income and share of government expenditure in GDP change with the inclusion of other explanatory variables. Thus with these additional variables we can also test for the robustness of the previously included explanatory variables. Regression results corresponding to equation (3) have been reported in Table 3.3 below.

Table 3.3 Regression results corresponding to Equation (3)

Dependent Varible (*s*)	**No. of Observations (1560)**
Independent Variables	**Equation (3)**
constant	**152.0108*** **(4.04)**
logcgdp	**-26.01803*** **(-3.31)**
logcgdpsq	**1.572766*** **(3.56)**
cg	**.3829361*** **(4.98)**
xs	**.1060749**** **(2.23)**
ms	**-.1593492***** **(-1.76)**
R-squared	**0.8965**

* implies significant at 1 percent level of significance, ** implies significant at 5 percent level of significance, *** implies significant at 10 percent level of significance. Values in the parentheses are the corresponding t values. Coefficients of the dummy variables representing time-specific effects have been reported in Table 4 in the Appendix. Coefficients of country dummies have not been reported.

Regression results corresponding to equation (3) show that in terms of statistical significance of the variables, results have not changed much compared to the regression equation (2). Here also we find that *logcgdp*, *logcgdpsq* and *cg* are highly significant. Here *xs* is significant at 5 percent level of significance but *ms* is significant only at 10 percent level of significance. *logcgdp*, *logcgdpsq* and *cg* are significant at 1 percent level of significance and the coefficients of these variables hold the same sign as in all the previous regression equations. In this regression result we find 10 year-specific dummy variables and 47 country specific dummy variables as significant. Similar rising trend is noticed in the time-specific dummy variables.

In all the regression equations government expenditure establishes a strong positive relationship with the percentage share of service sector output in total GDP. Similarly *logcgdp* and *logcgdpsq* have opposite signs in all the regressions establishing a "U"-shaped relationship between per capita GDP and the share of service sector output in total GDP. Among the additional variables the coefficient of *xs* (the share of exports of services in total trade) appears with a positive sign whereas the coefficient of *ms* (the share of imports of services in total trade) appears with a negative sign. Thus as expected increasing share of service sector exports in total trade has a considerable impact in increasing the share of service sector output in GDP.

Like in the case of the above two regression equations, in case of regression equation (3) as well we estimated the regression equation by dropping the year dummies, dropping the country dummies and dropping both the country and the year dummies. Like previous two equations in equation (3) also we see that results do not change much after dropping the year-specific dummy variables compared to the regression result of the original equation but in terms of the significance of the variables result changes considerably

when we drop the country-specific dummy variables and both year-specific and country-specific dummies as except *xs* and *ms* all the other variables become insignificant in the later two cases. These results have not been reported here. Here also the problem of multicollinearity persists.

Multicollinearity refers to a situation where the explanatory variables are linearly dependent. Due to the existence of this relationship among the explanatory variables, it becomes difficult to differentiate their separate effects on the explained variable. If the relationships among some or all explanatory variables of a regression model is a perfect or exact linear relationship (i.e., perfect multicollinearity), the regression coefficients of the explanatory variables are indeterminate and their standard errors are infinite. On the other hand if multicollinearity is less than perfect (i.e., some or all explanatory variables of a regression model are not an exact linear combination of other explanatory variables), the regression coefficients, although determinate, posses large standard errors, thereby making the t values smaller. Therefore in such cases one tends to accept the null hypothesis that the relevant true population value is zero. This is the only effect of multicollinearity that, it is hard to get coefficient estimates with small standard errors. But, since multicollinearity violates no regression assumptions, even if multicollinearity is very high, the OLS estimators still retain the property of BLUE.

Multicollinearity is essentially a sample (regression) phenomenon in the sense that even if the explanatory variables are not linearly related in the population, they may be so related in the particular sample considered. General practice is that when multicollinearity is detected in a regression model, we drop one of the collinear variables. But in dropping a variable from the model we may be committing a specification bias or specification error.

It has been said that multicollinearity is not necessarily bad. Multicollinearity is essentially a data deficiency problem and some times we have no choice over the data we have available for empirical analysis. As Johnston (1984) notes, multicollinearity may not pose a serious problem when R^2 is high and regression coefficients are individually

significant as revealed by their t values. This can arise if individual coefficients happen to be numerically well in excess of the true value, so that the effect still shows up in spite of the inflated standard errors and the true value itself is so large that even an estimate on the downside still shows up as significant.

In our analysis multicollinearity persists in all the regressions and in spite of the existence of multicollinearity we find that *logcgdp*, *logcgdpsq*, *cg* and *xs* have been highly significant in the regressions. It has also been found that some of the variables which were not statistically significant (like *openk* and *fdigdp*) have low variance inflationary factor (VIF) and in contrast to that *cg* which also has low VIF is significant. Thus we can say that multicollinearity is not a serious problem in our analysis as in our estimated regression equations the value of R^2 is always above 0.85 and most of the variables with high VIFs are individually significant. In other words we can say that the regression results in the presence of multicollinearity in the data set further verifies the importance of these explanatory variables in explaining our dependent variable (as most of the variables are significant even in the presence of multicollinearity in the data set).

CHAPTER 4

Analysis and Concluding Remarks

4.1 Nature of estimated relationships between dependent and explanatory variables

4.1.1 Per capita GDP (logcgdp and logcgdpsq)

The variable per capita GDP has been included in this analysis to capture the effect of income in raising the share of service sector output in total GDP. It has been suggested in the literature that the income elasticity of demand for services is greater than one and final demand for services increases more than commodities as income increases. Thus it could be expected that *logcgdp* (i.e., the log values of per capita GDP) could have a positive relation with the share of service sector output in total GDP. That is demand for services will increase more than proportionately with per capita income (due to higher income elasticity of demand for services) and thus the share of service sector output would increase in total GDP. In addition we can expect a higher share of the service sector in GDP to be associated with per capita income also because of the expansion of industrial sector with rise in per capita income. The share of industrial sector and per capita income are highly positively correlated (this is clear from the partial relation curve shown in Figure 4.2). Demand for industrial products could be expected to rise with rise in per capita income and because industrial products use more of service inputs, intermediate demand for services will also rise.

In the analysis the regression results corresponding to equations (1), (2) and (3) show that the variables *logcgdp* and *logcgdpsq*[24] are statistically significant in all the estimated equations implying that per capita GDP has been a significant determinant of the expansion of the service sector.

[24] *logcgdpsq* is significant only at 10 per cent level of significance in equation (1).

Table 4.1 Income elasticity of demand for services

logcgdp	Income elasticity of demand
6	.92
7	.96
8	.99
9	1.04
10	1.08
11	1.11
12	1.13

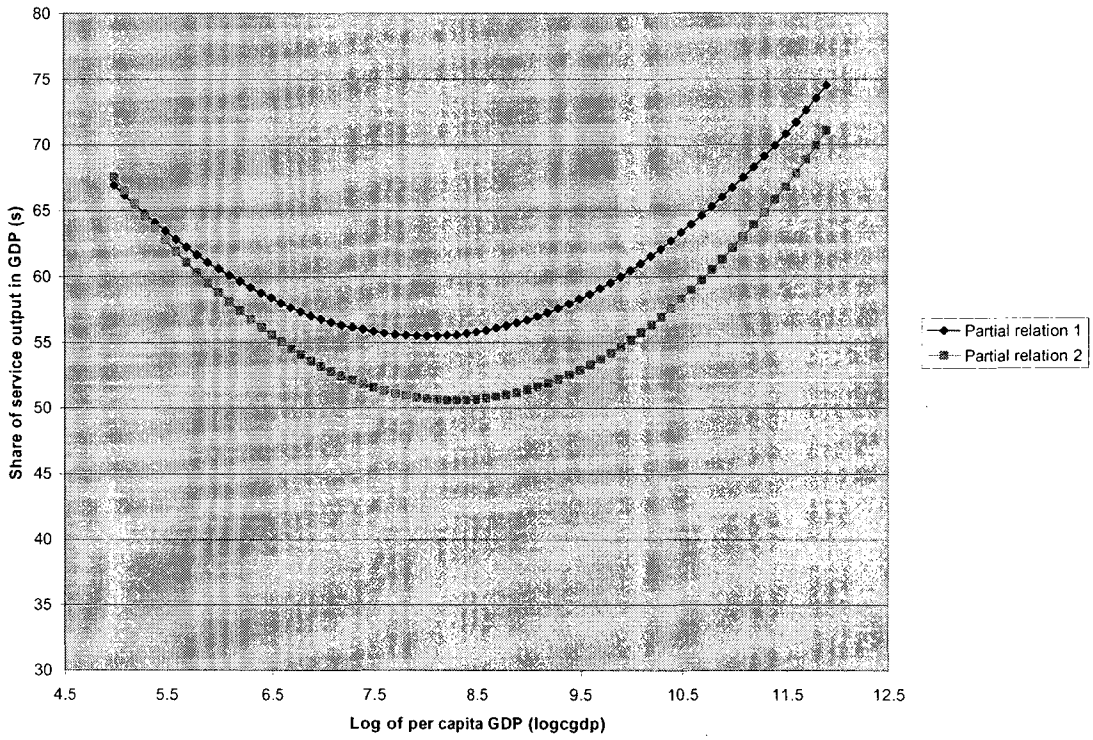
Table 4.1 reports the income elasticity of demand for services[25] for different levels of per capita income. These values of income elasticity of demand for services are calculated using the regression results corresponding to equation (2) (reported in Table 3.2). These values show that the income elasticity of demand for services increases considerably with the increase in per capita income.

At the same time the estimated coefficients of *logcgdp* and *logcgdpsq* suggest that the relation between the share of service sector output in GDP and per capita GDP is not monotonic. That is as per capita GDP increases the share of service sector in GDP does not increase monotonically but the relation takes a "U" shape. The regression results suggest that other things remaining constant as per capita income increases the share of service sector output in GDP first falls and then increases. This partial relation between the share of service sector output in GDP (s) and per capita GDP (*logcgdp*) has been shown below in Figure 4.1.

[25] Income elasticity of demand for services = $((\delta s/\delta logcgdp)^* 1/\boldsymbol{s}) + 1$ where $\boldsymbol{s}$ are the estimated values of s (share of service sector output in GDP) for different levels of per capita GDP, holding other variables fixed at their average values. If *cgdp* is per capita income and z is per capita output in the service sector then income elasticity of demand for services is $(\delta z/\delta cgdp)(cgdp/z) = ((\delta s/\delta logcgdp)^* 1/\boldsymbol{s}) + 1$.

Figure 4.1 gives a graphical description of the partial relation between s and per capita GDP. Here along the x-axis we measure the log values of per capita GDP and along the y-axis we measure s (the share of service sector output in total GDP). The graph shows the estimated effect of log per capita GDP on s when all other explanatory variables are kept constant (thus it depicts a partial relation).[26]

Figure 4.1 Share of service sector output in GDP (%) against log per capita GDP (partial relation)



Partial relation 1 is the relationship drawn from the estimated equation (2) in Table 3.2 and partial relation 2 is the relationship drawn from the estimated equation (3) in Table 3.3.

Thus Figure 4.1 gives a clear picture of the relation between the share of service sector output in GDP and the per capita GDP where the relationship takes a "U" shape. In order to explain this "U" shaped relationship it is necessary to consider the other two sectors

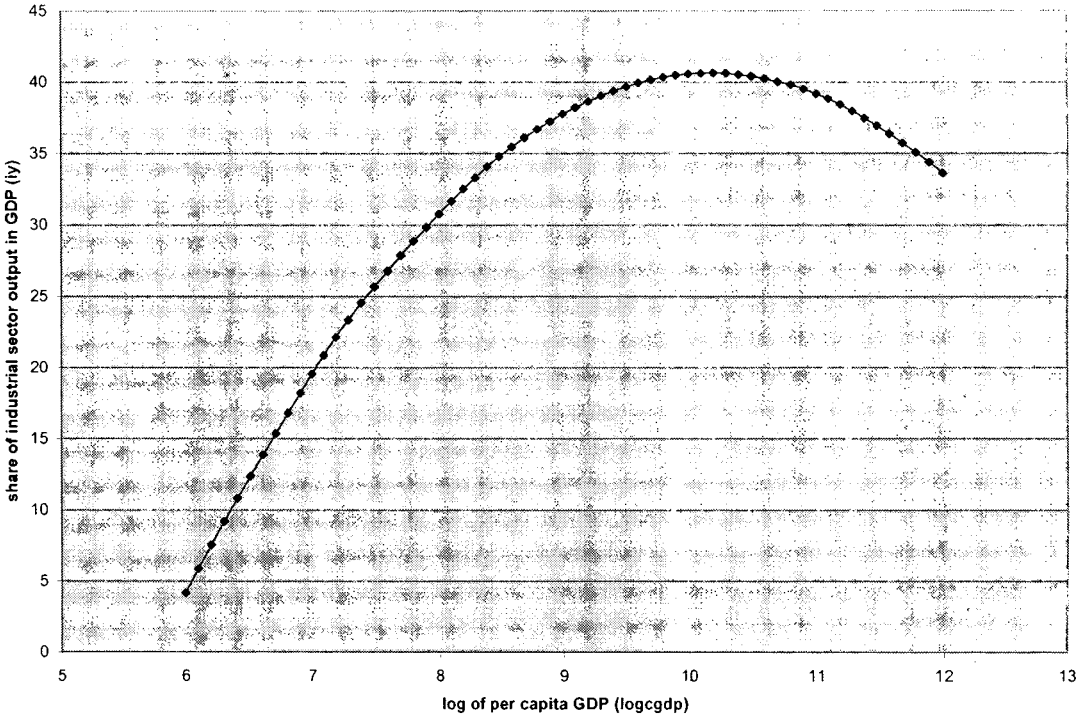
[26] These graphs are drawn corresponding to the estimated equation (2) and equation (3), reported in Table 3.2 and Table 3.3 respectively. To calculate the partial relation all other explanatory variables (except *logcgdp* and *logcgdpsq*) were held constant at their respective average values over all the countries and all the years considered.

i.e., the primary sector and the industrial sector. It has been established by many studies that as the economy moves from low income to high income status the share of primary sector output in GDP falls drastically and the other two sectors fill the place of this reduced share of primary sector in GDP.

Figure 4.2 shows the partial relation between the share of industrial sector output in GDP[27] and per capita GDP. This partial relation curve has been drawn using the regression result of basic equation (2) after replacing the dependent variable *s* by the share of industrial sector output in GDP (*iy*). Result of this estimation is given in the appendix (Table 3). The partial relation curve of the share of industrial sector output shows that there exists a clear "inverted U" shaped relationship between these two variables. The curve first rises with the increase in per capita income and when the economy reaches a very high level of per capita income then the share of the industrial sector starts to fall.

[27] Data related to the share of industrial sector that have been used here are taken from the World Bank's World Development Indicators 2005.

Figure 4.2 Share of industrial sector output in GDP (%) against log per capita GDP (partial relation)

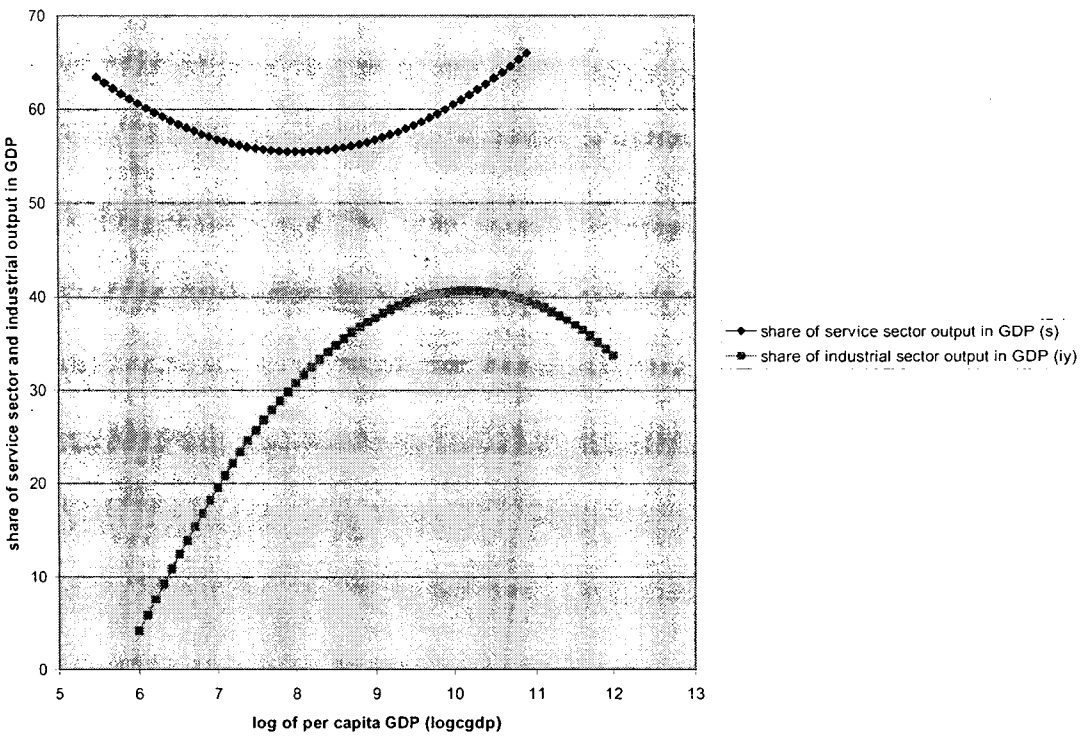


Thus we can see that as an economy moves from low-income to high-income status, its production structure undergoes transitional shifts. When economies have low-income status, the primary and the tertiary sectors account for most of GDP and the secondary (industrial) sector is the most underdeveloped among the three sectors. In the initial phase of economic growth as per capita income increases the share of the industrial sector tends to increase and that of the service sector to decrease. The high share of the service sector output in GDP at low levels of per capita income does not imply high levels of demand for services but is probably the result of supply side factors. At low levels of per capita income the primary and the secondary (industrial) sectors can not absorb the total amount of resources and the excess resources are shifted towards services. The service (tertiary) sector therefore acts as the residual sector. The growth of the industrial sector initially sucks in resources from both agriculture and services and therefore the share of the service sector in total output is negatively associated with levels of per capita income.

The positive relation between per capita income and the share of the service sector in GDP at sufficiently high levels of per capita income is the result of demand side factors. Many of the products of the service sector can be considered luxury goods and when per capita income becomes sufficiently large, the final demand for services increases more rapidly than income, increasing the share of the service sector in GDP. At the same time with industrialization the intermediate demand for services increases and the income effect (resulting through the higher income elasticity of demand for services) combined with the linkage effect (which is the result of industrialization) raises the percentage share of service sector output in GDP.

Figure 4.3 combines figures 4.1 and 4.2 to display together the graphs for the partial relations of the share of service sector output and the share of industrial sector output with per capita.

Figure 4.3 Shares of industrial sector output and service sector output in GDP (%) against log per capita GDP (partial relation)



These two partial relation curves (i.e., the partial relation curve of the share of service sector output and the partial relation curve of the share of industrial sector output) take two opposite shapes. Note that the partial relation curve of the share of the service sector output in GDP takes the positive turn before the partial relation curve of the industrial sector takes the negative turn. Three clear phases can therefore be distinguished. As per capita income initially increases the share of the industrial sector in GDP rises but the share of the service sector falls. Subsequently there is a middle range of per capita income in which the shares of both the service sector and the industrial sector increase. Finally at sufficiently high levels of per capita income the share of industrial sector in GDP falls but the share of the service sector rises.

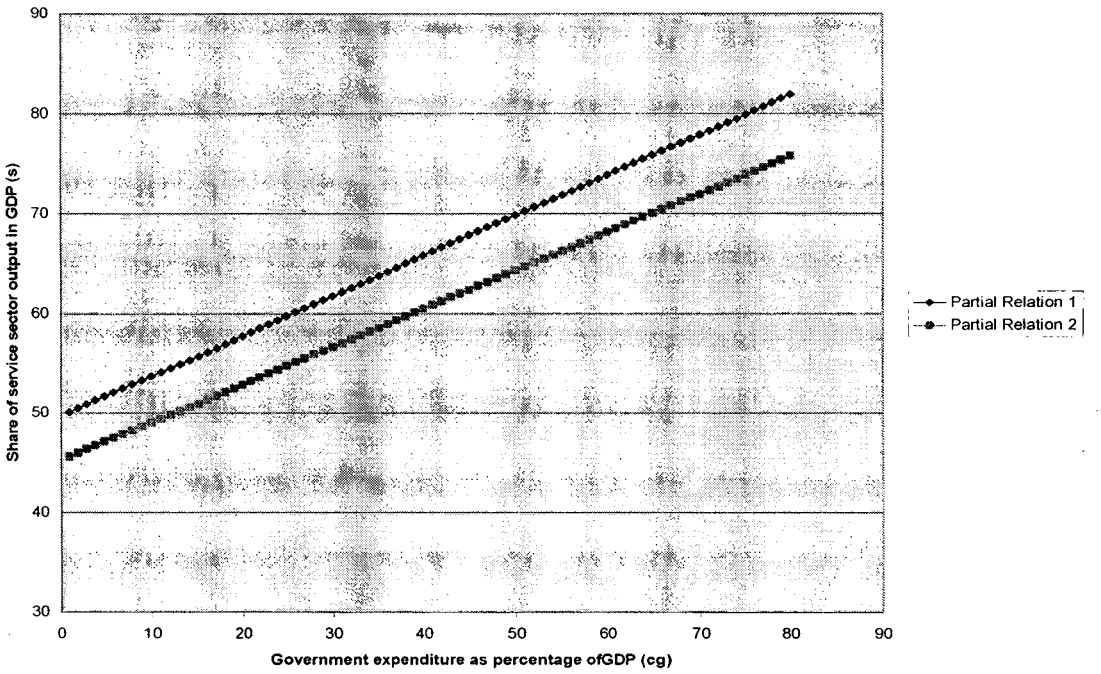
4.1.2 Government expenditure (cg)

The share of government expenditure in GDP has been another important factor in explaining the share of the service sector in GDP. This variable was statistically significant in all the regression equations considered and in all the cases it was significant at one percent level of significance. The coefficients of this variable take positive values in all the regression equations considered. The values of the estimated coefficients of *cg* in the regression equations lie between .38 to .4 (reported in Table 3.1, Table 3.2 and Table 3.3), implying that with one unit increase in *cg,* the share of service sector output in GDP increases in average by .4 percent, other things held constant. The partial relation between *cg* and the dependent variable *s* is shown graphically below in Figure 4.4.

In Figure 4.4 the horizontal axis measures government expenditure as a proportion of GDP and the vertical axis measures the share of service sector output in GDP. The graph shows the partial relation between the two in the sense that it depicts the relation between the two variables when other variables are held constant at their average values for the sample. Partial relation 1 is the relationship calculated using the estimates of regression equation (2) reported in Table 3.2 and partial relation 2 is the relationship calculated using the estimates of regression equation (3) reported in Table 3.3.

As the products of government sector are mostly in the form of services, higher ratios of government spending to GDP are associated with higher shares of the service sector in GDP.

Figure 4.4 Share of service sector output in GDP (%) against government expenditure as a percentage of GDP (partial relation)

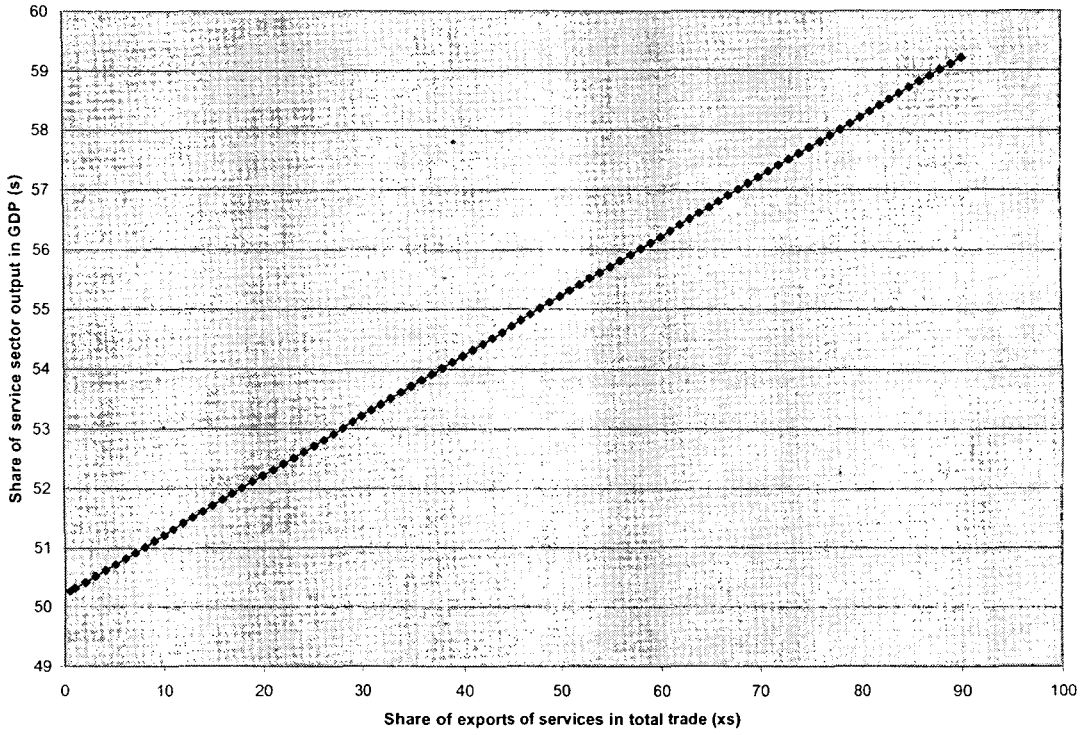


4.1.3 Share of exports of services in total trade (xs)

The third important determinant of the expansion of service sector output as a proportion of GDP is the share of exports of service sector output in total trade. In estimated regression equation (3) the variable was found to have the expected positive coefficient and to be significant at five percent level of significance (see Table 3.3). The value of the estimated coefficient of *xs* of equation (3) is .106 (reported in Table 3.3) which implies that with one unit increase in the share of exports of services in total trade, the share of service sector output in GDP increases by .1 percent, other things held constant.

The graphical representation of the partial relation between the share of service sector output in GDP and the share of exports of services in total trade has been shown in Figure 4.5. This graph is drawn using the estimates of equation (3) (reported in Table 3.3). In this figure, the horizontal axis measures *xs* and the vertical axis measures *s*. As in the previous graphs, the partial relation between these two variables explains the relationship between *xs* and *s* when other variables are held constant at their average values for the sample. In Figure 4.5 the partial relation curve shows that with the increase in the share of exports of services in total trade, percentage share of service sector output increases monotonically.

Figure 4.5 Share of service sector output in GDP (%) against the share of exports of services in total trade (%) (Partial relation)



Traditionally the cross border transactions in services had been limited due to the nature of service sector output and the close proximity required between buyers and the sellers. Thus the service sector traditionally accounted for a minimal share of total trade. In recent years the information and communication technologies (ICTs) have dramatically changed the nature of tradability of services across countries and thus the last two

decades have seen a considerable increase in the share of trade in services in total trade (these issues have been discussed in detail while discussing the possible determinants of the share of service sector output in GDP in section 1.3, chapter1). This rising share of exports of services in total trade has been a significant determinant of the expansion of service sector output expressed in terms of its share in GDP. This rising share of exports of services implies increasing foreign demand for services but this itself may have been largely a result of technological changes in the service sector.

4.1.4 Other explanatory variables

The other explanatory variables considered in the whole regression analysis i.e., *openk*, *fdigdp* and *ms* were not statistically significant. Even if we consider a ten percent level of significance only in the estimation result corresponding to equation (2), reported in Table 3.2, we do find *fdigdp* to be statistically significant. Though statistically insignificant, the estimated coefficients of *openk* in equation (1) and equation (2), enters with a positive sign as expected. On the other hand the estimated coefficients of *fdigdp* in equation (1) and equation (2) appear with negative signs. In the analysis *openk* and *fdigdp* were included to capture the impact of globalization and policy changes related to deregulation of services in the economy on the share of service sector output in GDP. The estimation results suggest that these two variables did not have a significant impact on the share of service sector output in GDP. The expansion of service sector output expressed in terms of its share in GDP during the period 1971–2003 does not appear to be the result of policy changes related to processes of liberalization and globalization.

In estimated equation (3) the share of imports of services in total trade (*ms*) has a negative coefficient and is only significant at ten percent level of significance (reported in Table 3.3). This negative relation between *ms* and *s* reflects the fact that imports of services from other countries may substitute for domestically produced services in satisfying a portion of domestic demand for services. The reduced demand for domestic services reduces the share of service sector output in GDP.

4.2 Concluding Remarks

The conclusion that we can draw from the whole analysis is that there are several factors behind the expansion of service sector output as a share of GDP. Given the constraints on availability of data, among all the explanatory variables suggested in the literature we included some of the variables. At the same time most of the impacts of many other variables (which were not included) are captured through the indirect impact of per capita GDP. The factors included in the analysis were per capita GDP, population size, government expenditure (as a share of GDP), the share of exports of services in total trade, the share of imports of services in total trade, trade openness index and the ratio of FDI inflows to GDP.

Among the included explanatory variables, per capita GDP, government expenditure and share of export of services as a proportion of total trade were found to be significant in our results.

Our analysis suggests that per capita income has been a very important variable in determining the share of service sector output in GDP over the last three decades. Our findings regarding the significance of per capita GDP as an explanatory variable is consistent with the findings of Chenery and Syrquin (1975). At the same time, it has also been noted that the U-shaped relationship found by Chenery and Syrquin for their average time series analysis is still significant in a subsequent time period which probably indicates the robustness of this relationship.

Government expenditure was the other important explanatory variable in our analysis as it was highly significant in all the estimated equations we considered. This variable was not included in Chenery and Syrquin analysis as an explanatory variable but our results suggest that government expenditure is clearly an important variable in determining the share of service sector output. In this context we should mention that Gani and Clemes (2002) study also included government expenditure as an explanatory variable to estimate the growth of services. They also found this variable to have a strong influence on growth

of services. Thus we can not deny the importance of this variable in the expansion of service sector.

Another significant explanatory variable that comes out of our analysis is the export share of service sector in total trade. As expected this variable bears a positive significant relationship with the dependent variable in our analysis. In the literature the increase in the share of service sector output in total trade has been perceived to be the outcome of increased tradability of services resulting from technological improvement and increasing opening up of that sector in the world economy. Thus the significance of the share of service sector exports in total trade or in other words the increase in tradability of services might indicate the importance of technological development and access to new markets in influencing the share of service sector output in total output of the economy.

Another supply side factor which we should consider here is innovation or technological improvements over time. There is not any specific variable which can quantify the impact of innovation or technological change on the dependent variable. Many studies (e.g., Chenery and Syrquin(1975)) have tried to capture the impact of this variable through the time trend. The year dummies which have been included here in the analysis serve the purpose.

In all the estimation results most of the year-specific dummies (estimated year dummies for all the years 1971-1993, 1972-1990 and 1980-1990 are significant at 5% level of significance in equation (1), (2) and (3) respectively and the dummy variable for the year 2002 is significant in all the equations) are significant. The values of the coefficients of all the year dummies display a consistent increase over time in all the regression results (estimates of the year dummies for all the regression equations are given in the appendix (in Table 4)). To run the regressions the dummy variable corresponding to year 2003 was dropped (to avoid the problem of perfect multicollinearity) in all the regressions reported above. Estimated coefficients of all the significant time dummies (except dummy variable for the year 2002 in all the equations and dummy variable for the year 1999 in equation (2)) appear with negative signs implying that in all the previous years the share

of service sector output in GDP was less compared to year 2003. As it is expected that technological improvements or innovations occur with the passage of time, thus technological improvements or innovations create an external shift of the estimated equations over time. Coefficients of the year dummies show such upward shifts of these regression equations with every year.

The analysis by Chenery and Syrquin (1975) assumed that in all countries there are shifts in the structural relationships over time that is independent of income changes within countries. To test for the existence of time trends dummy variables corresponding to five-year periods were included in their analysis and their results indicated the existence of a time trend. Thus, our analysis for the period 1971 – 2003 as well as that by Chenery and Syrquin for the period 1950 – 1970 confirms the existence of a time trend and thus the shift of the structural relations over time. If instead of the year dummies we include decadal dummies in our analysis, (dummy variables for the periods 1971-1980, 1981-1990 and 1991-2003) the estimates of the decadal dummies show a clear shift of the functions over the decades (reported in the appendix, Table 5).

The question that may arise in this respect is whether we can differentiate the impact of technological change from that of scale variable (note that the variable population size was dropped from equation (2) and equation (3) due to high VIFs for population terms) by looking at the estimates of time dummies. Or in other words it may be argued that the estimated coefficients of time dummies in equations (2) and (3) actually represent the effect of growth of population. It may be the case that the problem of multicollinearity associated with the variable population might have resulted in insignificant estimates of the coefficients of population terms in estimated equation (1). In equation (1), VIFs for all the time dummies are less than 10 except for dummy variables for the years 1971, 1972, 1973 and 1974 (VIFs for these time dummies lies between 10-13) and 23 estimated time dummies (i.e. time dummies for all the years from 1971 to 1992 and time dummy for the year 2002) were significant at 5% level of significance (reported in the appendix, Table 4). Thus multicollinearity was not a major problem for these time dummies. Thus even in the presence of population as an explanatory variable in equation (1), the time

trend is significant and has same sign as it is in the other two equations (where population terms were dropped). Thus we can argue that time trend in our analysis is not actually showing the effect of growth in population (increasing economies of scale).

fdigdp and *openk* are the other two variables that we considered in our analysis but these variables were found to be insignificant in our regression results. The variables *fdigdp* and *openk* are the measures of openness in investment and trade but these variables do not distinguish between the opening up of the service sector and the opening up of the rest of the economy as these are the measures of openness for the whole economy. One might expect the policy changes related to opening up of investment specific to the service sector to have a more direct and therefore greater impact on the share of national output generated by the service sector. While the general degree of openness of the economy may not be significant, there may be some reason to believe that the significance of the share of exports in total trade implies that the greater the degree of openness to trade in the service sector compared to that in the rest of the economy, the greater would be the share of service sector output (especially since share of imports in total trade does not seem to have a significant effect).

Data related to country specific FDI inflow in service sector over time are not available thus we could not calculate the impact of the index of openness in investment specific to service sector. Running regression in equation (2) by substituting *openk* by the ratio of the sum of exports and imports of services to GDP (as we can take it as a measure of openness to trade specific to service sector) we found that the latter variable was also not significant. Thus our results suggest that over the last three decades the expansion of service sector in terms of its rising share in GDP is a world wide phenomenon independent of increasing opening up of the economy for trade and investment.

This conclusion is however on the basis of the assumption that the two variables, *fdigdp* and *openk*, were able to capture the major part of the impact of the process of liberalization and globalization.

Now coming to the question of sustainability of high growth rate of India's service sector after the end of the process of policy changes related to economic reforms, we can say that the phenomenon of growth of service sector is a world-wide phenomenon which appears to be independent of the process of globalization of the economy. The insignificance of the estimated coefficients of the measures of openness of the economy and the presence of a significant positive time trend from the mid-twentieth century in the estimated regressions for the share of service sector output suggest that it is the technological developments independent of processes of global integration, which are responsible for global increases in service sector output which are unrelated to changes in income status of economies. Thus our results suggest that there is no reason to assume that the growth of Indian services is going to stagnate after the end of the process of policy changes related to economic reforms.

Finally we can say that, as the literature suggests our study also finds a number of factors (i.e., per capita income, government spending, export share of service sector in total trade and external shock such as technological development) influencing the share of service sector in total output of the economy. Broadly comparing our results to those obtained by Chenery and Syrquin thirty years ago we can say that our analysis confirms the continued importance of their findings even for a later time period. The U-shaped relationship between the share of service sector output in GDP and per capita income that they found in their average time series analysis is still valid even in current period. Our finding is also consistent with the finding of Chenery and Syrquin with respect to time trend as both the results have found indication of positive time trend. At the same time, our analysis focuses on some additional points of interest. These are the importance of the size of the government sector in determining the share of service sector output and the probable unimportance of the general process of globalization.

APPENDIX

Table 1: List of countries

Countries considered for the period 1971 to 2003		*Countries considered for the period 1980 to 2003*
Country		**Country**
1. Algeria		1. Algeria
2. Argentina		2. Argentina
3. Australia		3. Australia
4. Austria		4. Austria
5. Barbados		5. Bangladesh
6. Bolivia		6. Barbados
7. Brazil		7. Bolivia
8. Chad		8. Brazil
9. Chile		9. Chad
10. Colombia		10. Chile
11. Costa Rica		11. Colombia
12. Denmark		12. Costa Rica
13. Dominican Republic		13. Denmark
14. Ecuador		14. Dominican Republic
15. Egypt		15. Ecuador
16. Finland		16. Egypt
17. France		17. Finland
18. Gabon		18. France
19. Gambia, The		19. Gabon
20. Germany		20. Gambia
21. Ghana		21. Germany
22. Greece		22. Ghana
23. Guatemala		23. Greece
24. Honduras		24. Guatemala
25. India		25. Honduras
26. Ireland		26. India
27. Italy		27. Ireland
28. Jamaica		28. Italy
29. Japan		29. Jamaica
30. Kenya		30. Japan
31. Kuwait		31. Jordan
32. Madagascar		32. Kenya
33. Malawi		33. Kuwait
34. Malaysia		34. Lesotho
35. Mali		35. Madagascar
36. Mexico		36. Malawi
37. Morocco		37. Malaysia
38. Netherlands		38. Mali
39. Nicaragua		39. Mexico
40. Nigeria		40. Morocco
41. Norway		41. Mozambique

42. Pakistan		42. Nepal
43. Papua New Guinea		43. Netherlands
44. Philippines		44. Nicaragua
45. Portugal		45. Nigeria
46. Saudi Arabia		46. Norway
47. Senegal		47. Pakistan
48. South Africa		48. Panama
49. Spain		49. Papua New Guinea
50. Sri Lanka		50. Philippines
51. Sweden		51. Portugal
52. Thailand		52. Saudi Arabia
53. Togo		53. Senegal
54. Tunisia		54. South Africa
55. Turkey		55. Spain
56. United Kingdom		56. Sri Lanka
57. United States		57. Sweden
58. Uruguay		58. Thailand
59. Venezuela		59. Togo
		60. Tunisia
		61. Turkey
		62. United Kingdom
		63. United States
		64. Uruguay
		65. Venezuela

Table 2: Regressing the share of service sector output in GDP (*s*) after logit transformation of the dependent variable: (Results)

Dependent Varible (*s*)	**No. of Observations**
	1947
Independent Variables	**Equation (2)**
constant	.132713** (2.17)
logcgdp	-.9095703* (-3.87)
logcgdpsq	.0563688* (4.13)
cg	.0175804* (3.62)
openk	.0005763 (0.87)
fdigdp	-.7752953 *** (-1.93)
R-squared	0.4752

*implies significant at 1 percent level of significance, ** implies significant at 5 percent level of significance, *** implies significant at 10 percent level of significance. Values in the parentheses are the corresponding t values. Estimates of the country and year dummies have not been reported here.

Table 3: Regressing the share of industrial sector output in GDP (*iy*) on the explanatory variables: (Results)

Dependent Varible (*iy*)	No. of Observations
	1947
Independent Variables	**Equation (2.a)**
constant	-173.2717* (-6.33)
logcgdp	42.657* (7.72)
logcgdpsq	-2.096757* (-7.03)
cg	-.209523 (-1.51)
openk	.0131864 (0.82)
fdigdp	7.687481 (1.01)
R-squared	0.8838

*implies significant at 1 percent level of significance, ** implies significant at 5 percent level of significance, *** implies significant at 10 percent level of significance. Values in the parentheses are the corresponding t values. Estimates of the country and year dummies have not been reported here. Equation (2.a) summarizes the estimation result when *iy* is regressed on the independent variables using data for 59 countries over the period 1971 to 2003.

Table 4: Estimates of year dummies corresponding to equation (1), (2) and (3)

Dependent Variable	No. of Observations	No. of Observations	No. of Observations
s	1947	1947	1560
	Equation (1)	Equation (2)	Equation (3)
Year dummies			
t1	-13.30161** (-2.27)	-5.651655 (-1.55)	----------
t2	-13.35202** (-2.36)	-5.972732*** (-1.71)	----------
t3	-13.15093** (-2.42)	-6.072727*** (-1.82)	----------
t4	-14.70227* (-2.93)	-8.020615 * (-2.51)	----------
t5	-13.22087* (-2.71)	-6.841933** (-2.25)	----------
t6	-12.56993* (-2.73)	-6.517447** (-2.28)	----------
t7	-11.88492* (-2.72)	-6.152276** (-2.33)	----------
t8	-10.85427** (-2.63)	-5.422344** (-2.18)	----------
t9	-11.55742* (-2.98)	-6.490082 * (-2.90)	----------
t10	-10.62958* (-3.02)	-5.926496* (-2.88)	-6.410742* (-2.92)
t11	-9.31495* (-2.83)	-4.912965** (-2.54)	-5.407573 ** (-2.63)
t12	-8.246189** (-2.57)	-4.060095** (-2.28)	-4.551336** (-2.30)
t13	-8.275245* (-2.67)	-4.287802** (-2.53)	-4.576572** (-2.39)
t14	-8.349504* (-2.79)	-4.597835* (-2.89)	-4.461559** (-2.46)
t15	-7.541219** (-2.60)	-4.003755 ** (-2.65)	-4.016119** (-2.29)
t16	-6.395496** (-2.32)	-3.048608** (-2.19)	-2.937482*** (-1.76)

t17	-5.97007** (-2.28)	-2.830072** (-2.13)	-3.060827** (-2.00)
t18	-5.461077** (-2.20)	-2.555437** (-2.09)	-2.821274*** (-1.89)
t19	-5.367417** (-2.36)	-2.705474** (-2.29)	-2.950579** (-2.03)
t20	-5.100447** (-2.61)	-2.712008** (-2.50)	-2.751313** (-2.14)
t21	-3.797294** (-2.03)	-1.489443 (-1.58)	-1.507315 (-1.33)
t22	-3.356979** (-2.02)	-1.290589 (-1.46)	-1.393209 (-1.33)
t23	-2.67558*** (-1.75)	-0.7885122 (-0.97)	-0.7801375 (-0.77)
t24	-1.949183 (-1.36)	-0.2605143 (-0.32)	-0.3612101 (-0.35)
t25	-1.963536 (-1.54)	-0.4686637 (-0.62)	-0.4702976 (-0.52)
t26	-1.890921 (-1.65)	-0.6157075 (-0.91)	-0.584554 (-0.76)
t27	-1.129266 (-1.18)	-0.0387344 (-0.07)	-0.1579981 (-0.24)
t28	.2861355 (0.28)	1.23895*** (-1.77)	0.8771721 (-1.26)
t29	.614869 (0.71)	1.39263 ** (-2.03)	0.804984 (-1.17)
t30	.0138013 (0.02)	0.5428416 (-0.85)	0.0996097 (-0.17)
t31	.4744378 (0.90)	.8471715*** (-1.78)	0.6333888 (-1.36)
t32	.778316* (2.03)	.9956393 * (-2.74)	.8176553** (-2.35)

*implies significant at 1 percent level of significance, ** implies significant at 5 percent level of significance, *** implies significant at 10 percent level of significance. Values in the parentheses are the corresponding t values. "--------" means that these explanatory variables have not been included in this regression equation.

Table 5: Estimates of decadal dummies corresponding to equation (2) and equation (3)

Dependent Varible (*s*)	No. of Observations (1947)	No. of Observations (1560)
Independent Variables	**Equation (2)**	**Equation (3)**
constant	114.3489* (5.59)	108.5707* (3.26)
logcgdp	-19.19281* (-3.85)	-20.17889* (-2.69)
logcgdpsq	1.289313* (4.17)	1.436124* (3.30)
cg	.4040993* (3.64)	.3882014* (4.73)
openk	.0090705 (0.64)	-------
fdigdp	-11.07156 (-1.08)	-------
xs	-------	.1280847 * (2.77)
ms	-------	-.1758862** (-2.07)
TD1	-1.583485 (-1.67)	-------
TD2	3.08945* (4.21)	2.184124* (3.30)
R-squared	0.8545	0.8921

*implies significant at 1 percent level of significance, ** implies significant at 5 percent level of significance, *** implies significant at 10 percent level of significance. Values in the parentheses are the corresponding t values. "--------"means that these explanatory variables have not been included in this regression equation. *TD1* is the decadal dummy for the decade 1970s i.e., *TD1* is equal to 1 if year considered lies between 1971 to 1980 otherwise it is 0 and *TD2* is the decadal dummy for the decade 1990s i.e., *TD2* is equal to 1 if year considered lies between 1991 to 2003, otherwise it takes value 0.

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