Productivity Driven Services Led Growth

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Job Market Paper

Abstract: Of forty-two countries identified by the World Bank as being low income in 1980, eleven have witnessed annual average growth rates of GDP per capita in excess of 2 percent during the period 1980-2004. Of these fast growing, low income countries, five of them have experienced GDP growth that is dominated by growth of value added in the service sector, rather than by growth in the industrial sector as typifies historical evidence on structural transformation from industrialized countries. This paper accounts for the rapid growth of the service sector in one of these countries, India. A sectoral growth accounting exercise for the period 1980-2003 shows that changes in total factor productivity (TFP) were significant in accounting for the service sector value added growth in India. Measured service sector TFP growth is much higher than measured TFP growth in agriculture and industry, and increased substantially following the inception of market based liberalization policies from 1991. A three sector neoclassical growth model is carefully calibrated to Indian data in which average rates of TFP growth by sector are the primary inputs. This model performs well in accounting for the evolution of value added shares and the growth rates of these shares of the three major sectors of economic activity over the period 1980-2003. The performance of the model improves significantly when the post 1991 increase in service sector TFP growth is accounted for. It is argued that liberalization policies adopted by India from 1991, and especially the deregulation and privatization of business and communications services, explain the improvement in service sector TFP, and hence the dominance of service sector activity in India's recent GDP growth.

JEL Codes: O14, O41, O53

Key Words: Structural transformation, Economic liberalization, TFP, India

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1 Introduction

An empirical comparison of the historical growth experiences of contemporary developed countries with the current growth experiences of some fast growing contemporary developing nations, reveals some significant differences in their growth patterns. For most industrialized nations, such as, the United Kingdom, France, United States, historical data show that at low levels of per capita income, the agricultural sector dominated the composition of output and employment. As these nations embarked on a path of rapid and sustained economic growth, resources were transferred from the agricultural sector to the manufacturing and service sectors. Only when the economy matured and reached the status of a high income nation, did the role of the service sector become more dominant. Today, for some low income, rapid growing industrializing nations, this process of sectoral reallocation of economic activity, also known as structural transformation, looks different. In these countries, even at low levels of per capita income, the service sector accounts for a significant amount of the economy's output as measured by its share in Gross Domestic Product (GDP). Moreover, in these economies the share of services in GDP has been increasing at a rapid rate, much greater than the corresponding growth rate witnessed by the service sector in the GDP of contemporary developed economies when they were at equivalent stages of development. In today's low income economies, the role of the service sector has become more prominent at relatively early stages of economic development. This paper accounts for the rapid growth of the service sector in one of today's low income, fast growing, developing economy, India, and investigates the factors driving this services led growth in the economy.

Figure 1 presents an empirical comparison of the current growth experience of India with the historical growth experience of the United States (U.S.). During the 1980-2003 period, the average annual growth rate of the total output of the Indian economy was 5.6 percent while the growth rate of the output of the service sector exceeded the aggregate growth rate at 7 percent. In other words, the service sector's share in GDP grew at an average annual rate of 1.3 percent for the 1980-2003 period. This growth rate is much higher than the corresponding growth rate witnessed by the U.S. economy, when the U.S. was at an equivalent stage of development. In the upper panel of Figure 1, the relative Indian/U.S.

GDP per capita during the 1980-2003 period is graphed against the services' share of output in Indian GDP. From this figure, it is evident that in 1980 when India's GDP per capita was 5.2 percent of the U.S. GDP per capita, the share of services in Indian GDP was about 38 percent. By 2002, Indian GDP per capita had grown to 7.2 percent of U.S. GDP per capita, at which date the share of services in Indian GDP was 49 percent. By 2003, Indian GDP per capita had increased to about 7.6 percent of U.S. GDP per capita, and the corresponding share of services accounted for 51 percent of Indian GDP.

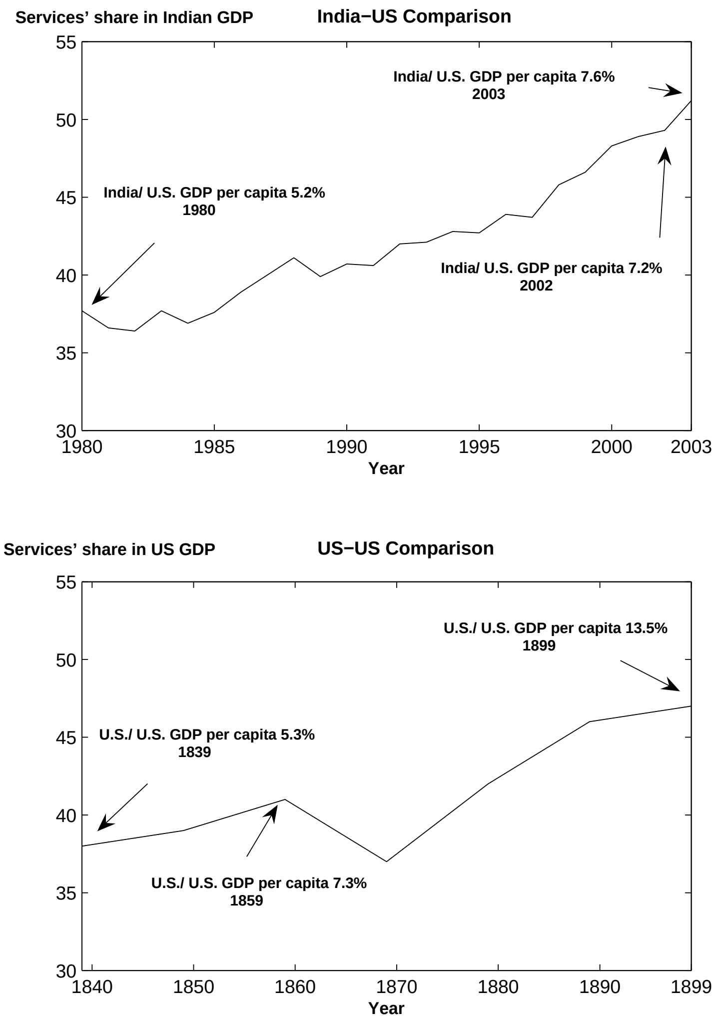

Figure 1:

A comparison of the Indian economy relative to the U.S. economy

The lower panel depicts how the share of services in U.S. GDP [1] evolved during the period 1839-1899. In 1839, the U.S. GDP per capita relative to its average 1980-2003 value was similar in magnitude to the 1980 Indian/U.S. GDP per capita ratio. In this year, the U.S. GDP per capita was 5.3 percent of its average 1980-2003 GDP per capita value, and services accounted for 38 percent of aggregate GDP. When U.S. had grown to 7.3 percent of its average 1980-2003 GDP per capita value, the output share of services was 41 percent. By 1899, U.S. GDP per capita had grown to 13.5 percent of its average 1980-2003 GDP per capita value, and the output share of services in GDP had risen only to about 47 percent. The share of services' output in U.S. GDP grew at an average rate of 0.36 percent during the 1839-1899 period. In comparison, the average annual growth rate of the output share of services in Indian GDP during the 1980-2003 period was one full percentage point higher than its U.S. counterpart, when the U.S. was at an equivalent stage of development.

The objective of this paper is to explain the rapid growth of value added in the service sector in India, and, to examine the factors driving this services led growth in the economy. A sectoral growth accounting exercise for the period 1980-2003 shows that changes in total factor productivity (TFP) were the largest source of service sector value added growth in India. Measured service sector TFP growth is also much higher than measured TFP growth in agriculture and industry, and increased substantially following the inception of market based liberalization policies from 1991. In contrast, measures of service sector productivity growth in the advanced economies are low, and the service sector is widely considered to be the 'unproductive' sector of the economy. However, in India's case, it is the service sector which is the most productive sector of the economy, as measured in terms of the growth rate of the total factor productivity in this sector.

In this paper, I develop a three sector neoclassical growth model to evaluate the quantitative performance of differential TFP growth across sectors in accounting for the structural transformation of India. In the model, agents are assumed to view consumption of agricultural, industrial and service sector goods as gross substitutes, but their preferences over goods are homothetic. The model displays 'unbalanced growth' in which the aggregate output, the aggregate consumption and the aggregate capital-labor ratio, grow at different rates.

[1] These data are obtained from Weiss and Gallman (1969).

A version of the model that is carefully calibrated to Indian data, and in which average rates of TFP growth by sector from India are the primary inputs, performs well in accounting for the evolution of value added shares of the three major sectors of economic activity over the period 1980-2003. It also accounts well for the growth rates of the GDP shares of all three major sectors of economic activity over this period - for the structural transformation of GDP. It cannot match the evolution of employment shares. The performance of the model improves significantly when the post 1991 increase in service sector TFP growth is accounted for. I find that the liberalization policies adopted by India from 1991, and especially the deregulation and privatization of business and communications services, explain the improvement in service sector TFP, and hence the dominance of service sector activity in India's recent GDP growth.

The rest of the paper is organized as follows: the next section conducts an empirical exercise to identify a broader set of low income, rapid growing, economies which exhibit the pattern of service sector driven growth. Section 3 discusses some empirical facts about the growth of sectoral output shares, sectoral employment shares and sectoral TFPs in the Indian economy. The growth accounting exercise is described in section 4. Sections 5, 6 and 7 discuss the model, the calibration procedure, and the results, respectively. The experiment conducted to assess the effect of increased TFP growth following economic liberalization in 1991 is described in section 8. In section 9, I discuss the different explanations offered to account for the rapid growth in the share of services' output in the Indian economy and present my argument here. The last section concludes.

2 Identifying Services led Growth

In this section, I conduct an empirical exercise to identify the set of low income, rapid growing, economies which exhibit the pattern of services led growth. A low income country is defined as a country with a level of GDP per capita less than 825 US $ in 1980[2]. Following this criterion, I identify 42 low income countries in 1980 and calculate their average growth

[2] In 2004, The World Bank defined a low income country as a country which had a level of Gross National Income per capita less than 825 US $.

rates of GDP per capita during the period 1980-2004. Table 9 in the appendix lists these countries in descending order of their growth rates, together with their respective GDP per capita in 1980. The average growth rate for the entire sample is 0.51 percent, owing to a large number of countries which witnessed negative growth rates during this time period. Amongst these countries, 17 countries experienced negative growth rates, while 11 countries grew at an average rate of 0-1 percent and 3 countries witnessed growth rates between 1-2 percent. My interest lies in choosing the rapid growing countries which witnessed average annual growth rates of GDP per capita in excess of 2 percent, which was the secular growth rate of the U.S. economy in the twentieth century[3]. The U.S. economy was the industrial leader throughout the twentieth century and hence the growth performance of the rapid growers is measured relative to the U.S. economy. I refer to these 11 countries as *Rapid Growers*. These countries include China, Thailand, Bhutan, India, Indonesia, Sri Lanka, Chad, Lesotho, Pakistan, Bangladesh and Nepal.

Next, I examine the performance of the three sectors, namely, agriculture, industry and services, in contributing to aggregate growth of output in these economies. It is well recognized that as an economy grows and witnesses structural transformation, growth proceeds at an uneven rate from sector to sector. Following Syrquin (1988), I examine the relation between aggregate and sectoral growth by differentiating with respect to time the definition of total output, $V = \sum V_i$ and expressing the result in growth terms:

$$g_V = \sum_i \rho_i g_{V_i}$$

where g_V and g_{V_i} are the growth rates of V and V_i, respectively, and the weights are sectoral output shares, $\rho_i = V_i/V$. The above equation expresses the contribution of each sector to aggregate GDP growth measured in terms of the average share of total GDP accounted by this sector, weighted by the growth rate of GDP in this sector.

For each of the 11 Rapid Growers, I decompose the growth rate of aggregate GDP using growth rates of sectoral output and shares of the sectoral output in GDP. Following this decomposition, I identify those low income, fast growing, countries which have witnessed

[3]Following Kehoe and Prescott (2002); they calculate the average growth rate of output per working-age person in the U.S. economy to be 2 percent in the twentieth century.

service sector driven growth. Specifically, in these economies, the service sector has made the highest average contribution to aggregate growth during the 1980-2004 period. I classify them as *service sector* dominated countries. This set of countries includes India, Sri Lanka, Pakistan, Bangladesh and Nepal. Notably, all these countries have initiated economic and trade liberalization reforms. Amongst all these service sector led countries, India has witnessed the most rapid growth in GDP and in GDP per capita during the 1980-2004 period.

3 Sectoral Data Facts

During the 1980-2003 period, the real value added in agriculture, industry and services grew at an average annual rate of 3.1, 6.1 and 7 per cent, respectively. Figure 2 depicts the evolution of the shares of value added in agriculture, industry and services during the 1980-2003 period for India. Between 1980 and 2003, the share of value added in agriculture declined from 37 percent to about 21 percent, the share of industry increased from 24 to 27 percent, while the share of services grew from 37 percent to 52 percent. It is evident that the decline in agriculture's share of value added has been mirrored in an increase in services' share of value added, while industry's share of value added has increased only modestly over the time period. In terms of growth rates, the share of agriculture in GDP declined at an average annual rate of 2.4 percent over the 1980-2003 period. During the same period, the share of services in Indian GDP grew at 1.3 percent per year, while industry's share in GDP showed a small increase of 0.5 percent per year. This differential between the growth rates of shares of industrial and services' value added becomes sharper after 1991. For the 1991-2003 period, share of industry's value added grew at a meager rate of 0.04 percent per annum while the share of services' value added grew at a much higher rate of 1.95 percent per annum. The share of agriculture's value added was declining in both the sub periods - at an average annual rate of 1.48 percent during 1980-1990 and at 3.31 percent during the 1991-2003 period.

To gain further insight into the sources of growth in service sector value added, in the next section, I conduct a growth accounting of value added for each of the sectors - agriculture, industry and services, for the 1980-2003 period. This exercise involves decomposing

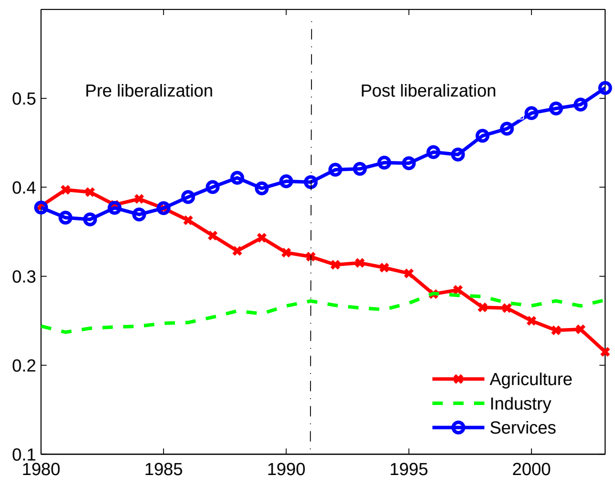

Figure 2:

Shares of Sectoral Output in GDP, 1980-2003

changes in value added into the portions due to changes in factor inputs and the portion due to the changes in efficiency with which these factors are used, measured as the total factor productivity (TFP) of a sector. To summarize, the results, which are recorded in the next section, indicate that changes in TFP are significant in accounting for value added growth in the service sector. Also, the growth of agricultural value added is largely accounted for by TFP growth. By contrast, the growth of industrial output is largely driven by the growth of factor inputs, primarily due to growth in capital. Additionally, I find that TFP growth rate in the service sector is the highest across the three sectors for the entire time period, primarily because it has grown at a very rapid rate after economic liberalization in 1991[4].

Figure 3 depicts the evolution of sectoral TFP from the initial time period, 1980, (the levels in all sectors have been normalized to unity) to 2003. It is evident from the graph that the service sector witnessed the fastest rate of TFP growth throughout the sample period. In addition, the rate of TFP growth in services increased after 1991. This is a striking result, since measures of service sector productivity growth in the advanced economies are low, and the service sector is widely considered to be the 'unproductive' sector of the economy. The argument is that, due to low productivity, the service sector witnesses faster growth of

[4]Gross output by sector would also be analyzed, but data is unavailable.

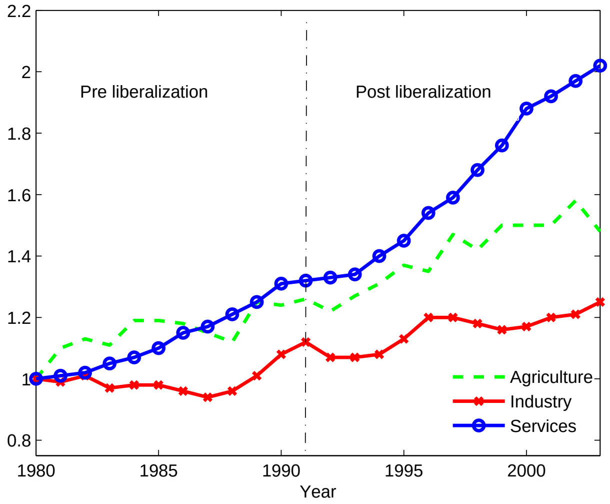

Figure 3:

Sectoral TFP Levels, 1980-2003

employment as compared to the industrial sector (Fisher (1935),Clark (1940)). However, in India's case it is the service sector which is the most productive sector of the economy, as measured in terms of the total factor productivity's contribution to value added.

While the value added data show significant growth in the share of services in aggregate output, the share of employment in this sector is still small. This observation of a high share of service output in aggregate output and low share of service employment in aggregate employment has been termed as 'jobless' growth in services (Bhattacharya and Sakthivel (2004), Banga (2006)). The trends in the share of employment in services and in the other two sectors are presented in figure 4.

The above figure reveals that sectoral reallocation of employment out of agriculture and into industry and services has been slow. Even by 2003, the share of employment in agriculture was still high, at 54 percent, whereas in industry and services, it was 18 and 28 percent, respectively. Clearly, the shares of sectoral employment have not kept pace with the shares of sectoral value added. Some authors have tried to rationalize the slow movement of labor from agriculture into industry and services in India. Panagariya (2006) discusses how the growth of unskilled labor in the organized sector has been very slow due to stringent labor regulations in that sector. He argues that the formal sector

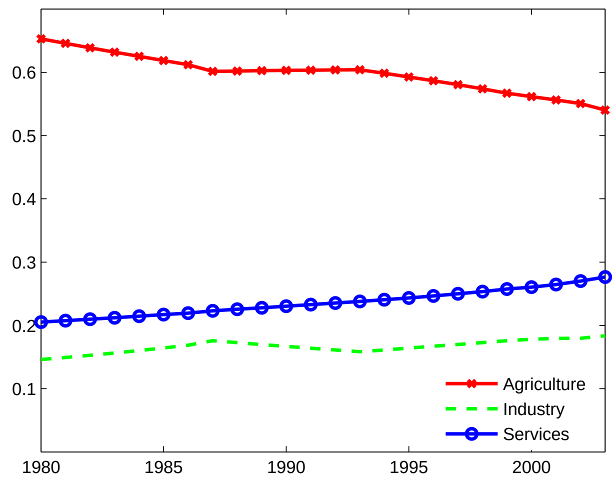

Figure 4:

Shares of Sectoral Employment, 1980-2003

in India has witnessed increasing wages, and has a lot of potential to absorb unskilled labor. In India, employment in the informal sector has been rising. However, since the wage differential between the non-agricultural informal sectors and the agricultural sector (which is predominantly informal in nature) is not very large, there does not exist a big enough incentive for labor to move out of agriculture and into industry and services. Moreover, inter-state migration has been extremely slow in India due to linguistic differences, lack of any social protections such as mutual insurance provided to members of the same sub-caste networks, making it dangerous to travel outside the reach of one's social network (Munshi and Rosenzweig (2004)). Additionally, Banerjee (2006) discusses how the lack of cheap urban housing and poor planning in urban areas has served as a barrier to migration. Since most of the industrial and service firms are located in the urban areas in India, the slow rural-urban migration has some merit in explaining the slow movement of labor across the sectors.

In sum, India's structural transformation is characterized by fast reallocation of value added shares but a much slower reallocation of employment, across the three sectors. In the following section, I conduct a formal accounting of the growth in each sector's value added.

4 Growth Accounting

4.1 Methodology

This section describes the model of value added by sector used in the growth accounting procedure. The methodology for constructing the factor shares is described in the following sub section. I follow the standard methodology of growth accounting which involves decomposing output growth into TFP growth, capital growth and labor growth.

The production function in each sector is assumed to be Cobb-Douglas with constant returns to scale. In particular, the function is described by

$$Y_{jt} = A_{jt} K_{jt}^{\nu_j} N_{jt}^{1-\nu_j} \qquad j \in \{industry, services\}$$

where ν_j and $1 - \nu_j$ represent the share of rental payments to capital and share of wage payments to labor in the total income of sector j, respectively. The agricultural production function has an additional input of land. The production function is accordingly modified as

$$Y_{at} = A_{at} K_{at}^{\nu_a} L_{at}^{\gamma_a} N_{at}^{1-\nu_a-\gamma_a}$$

The factor income shares in this sector are ν_a - capital income share, γ_a - share of rental income from land and $(1 - \nu_a - \gamma_a)$ - labor income share.

By differentiating the production function with respect to time, t, and dividing by Y_j, the growth rate of the total factor productivity growth in sector $j = \{a, i, s\}$ can be estimated as

$$\frac{dA_j/dt}{A_j} = \frac{dY_j/dt}{Y_j} - \nu_j \frac{dK_j/dt}{K_j} - (1 - \nu_j) \frac{dN_j/dt}{N_j} - \gamma_j \frac{dL_j/dt}{L_j} \tag{1}$$

In industry and services, the last term disappears since land is not a factor of production in these sectors.

4.2 Data

In order to conduct growth accounting, data are collected for the three sectors - agriculture, industry and services - for the 1980-2003 period.

Real GDP: Data for sectoral real GDP are taken from the *Business Beacon, Center for Monitoring Indian Economy (CMIE)*. Agriculture includes forestry, logging and fishing; Industry consists of manufacturing, mining, electricity, gas and water supply, and construction, while Services include trade, hotel, transport, communication, finance, insurance, real estate, business services and social and personal services. All data are measured in constant 1994 Indian Rupees.

Capital Stock: The capital stock series are constructed using the Perpetual Inventory Method (PIM), where investment is measured using the gross fixed capital formation series and a constant depreciation rate of 5 percent. In each of the sectors, the initial capital stock is the sectoral gross fixed capital stock in 1952. Using the PIM, the entire capital stock series for all sectors are constructed from 1952 to 2003. For this paper, I use the capital stock series for the 1980-2003 period. All sectoral capital stock data are measured in constant 1994 Indian Rupees and are obtained from the *Central Statistical Organization (CSO)* of India.

Employment: India does not report the number of labor hours worked in each sector. Hence, I measure employment as the number of people working in each sector. Sectoral employment numbers are calculated using the definition of employment on a current daily status (cds) basis [5]. These data are constructed with the help of annualized growth rates of sectoral employment reported by Gupta (2002). In particular, this report presents sectoral employment numbers for the years 1983, 1987-88, 1993-94, 1999-2000 and 2001-2002 as well as the average annual growth rates for the intermittent years. Using these growth rates, I construct sectoral employment series for the 1980-2003 period.

Land: An estimate of land used in the agricultural sector is needed. Data series on gross sown area are used for this purpose. Gross sown area is defined as the sum of area covered by all individual crops including the area sown under crops more than once during

[5] Details of the cds approach are provided in the data appendix.

a given year. It is also referred to as gross cropped area. These data are obtained from *Business Beacon, (CMIE)* from 1980 to 2001. For 2002 and 2003, gross sown area data have been taken from the Statistical Pocket Book, 2005 available from CSO, India[6].

Factor Income Shares: I follow Gollin (2002) and calculate factor shares by adjusting for income of the self employed. For the 1980-2003 period, CSO reports factor incomes from different sub sectors which comprise of Compensation of Employees (COE) and Operating Surplus (OS). In each sub sector, the COE and OS are further divided into two components, one part accruing from the organized sector and the second part as originating in the unorganized sector. I consider OS of the unorganized sector as Operating Surplus of private unincorporated enterprises (OSPUE). Then, using the second adjustment method followed by Gollin,[7] I compute labor income shares for different sub sectors. Using the share of each sub sector's output in the output of the agricultural, industrial and service sectors' as weights, I construct weighted labor shares for these three sectors. The share of capital income in the industrial and service sectors are deduced as residuals.

The share of rental income from land in agricultural income is taken to be 0.2 (average over the period 1980-1999) as reported by Sivasubramonian (2004). Consequently, the labor and capital shares are rescaled to sum to 1 minus the share of land.

I also conduct a sensitivity analysis of the growth accounting results by using two alternate sets of factor shares. The first set consists of sectoral labor shares computed using the Global Trade Analysis Project (GTAP) data, and is reported by Terry Roe. The second set assigns the customary value of one-third as the share of capital income and treats the residual as the share of labor income in the industrial and service sectors. For the agricultural sector, the capital income and labor income shares of one-third and two-thirds, are rescaled so that they sum to 1 minus the share of land, where the share of land is taken as 0.2.

[6] Note that this is incomplete - land is also used for cattle and large animals etc. but no estimates of these data are available. Not accounting for these in land estimates probably overestimates TFP growth in agriculture.

[7] Labor income share= Compensation of Employees/(Compensation of Employees+Operating Surplus of Incorporated Enterprise+Consumption of Fixed Capital)

4.3 Results

Table 1 reports the decomposition of average annual growth in real value added due to change in capital, labor, land and TFP in each sector. These results have been obtained using 'baseline' factor shares, calibrated from the CSO data. I refer to these results as 'baseline' results.

For the agricultural sector, the labor income share is 0.58, the share of land is 0.2 and the share of capital is determined residually as 0.22. The contribution of each factor is measured as the product of the factor share with the growth rate of the factor. During the 1980-2003 period, agricultural real value added grew at an average annual rate of 3.06 percent. The contributions of capital, labor and TFP were 19, 24 and 56 percent, respectively. Land made a negligible contribution of 1 percent during the entire period. In the pre liberalization period 1980-1990, real value added was growing at 4.23 percent, of which TFP growth accounted for 52 percent. After TFP, the contribution of labor was next largest at 29 percent, followed by capital which accounted for about 16 percent. Land made a small contribution of 3 percent. In the post liberalization period, growth in real value added decreased to about 2.02 percent and the contribution of TFP increased to account for 66 percent of real value added growth. Capital and labor accounted for 26 and 13 percent of growth, respectively, whereas the contribution of land was small and negative at -4 percent.

Table 1: Growth Accounting - Baseline results

	Agriculture	**Industry**	**Services**
Factor share			
capital	0.22	0.55	0.44
labor	0.58	0.45	0.56
land	0.2		
Decomposition of average annual changes in real value added (%)			
Entire period 1980-2003			
Growth in real value added	3.06	6.14	6.95
due to capital	0.58	3.77	1.92
	(19.0)	(61.4)	(27.6)
due to labor	0.73	1.40	1.92
	(23.7)	(22.8)	(27.6)
due to land	0.03		

Table 1: (continued)

	Agriculture	Industry	Services
	(1.1)		
due to TFP	1.73	0.98	3.11
	(56.3)	(15.9)	(44.8)
Pre liberalization 1980-1990			
Growth in real value added	4.23	6.75	6.53
due to capital	0.68	4.08	1.49
	(16.0)	(60.5)	(22.9)
due to labor	1.22	1.93	2.31
	(28.8)	(28.6)	(35.3)
due to land	0.14		
	(3.4)		
due to TFP	2.19	0.74	2.73
	(51.8)	(10.9)	(41.8)
Post liberalization 1991-2003			
Growth in real value added	2.02	5.52	7.44
due to capital	0.52	3.51	2.26
	(25.9)	(63.6)	(30.3)
due to labor	0.26	1.05	1.58
	(12.7)	(19.0)	(21.3)
due to land	-0.09		
	(-4.4)		
due to TFP	1.33	0.96	3.60
	(65.9)	(17.3)	(48.4)

The number in parenthesis is the % contribution of the factor to real value added growth.

With respect to the industrial sector, the calibrated capital and labor shares are 0.55 and 0.45, respectively. Real value added in industry grew at 6.14 percent during the entire 1980-2003 period. The contribution of capital was the largest at 61 percent while that of labor was about 23 percent. TFP in industry made a relatively small contribution of 16 percent during this period. In the pre liberalization period, real value added was growing at 6.75 percent, of which capital made a significant contribution of 61 percent. The contribution made by labor was 29 percent, followed by TFP which accounted for a relatively small proportion, 11 percent. In the post liberalization period 1991-2003, growth of industrial real value added slowed down to 5.52 percent. Again, the contribution of capital was largest, accounting for about 64 percent of growth in real value added, followed by labor which made a contribution of 19 percent. In this period, the contribution of TFP increased to account for about 17 percent of real value added growth in this sector.

For the service sector, the shares of capital and labor income are calculated to be 0.44 and 0.56, respectively. During the 1980-2003 period, real value added grew at 6.95 percent, of which TFP accounted for 45 percent, followed by capital and labor which each accounted for about 28 percent of services' value added growth, respectively. In the pre liberalization period, real value added grew at 6.53 percent. The contributions of capital and labor were 23 and 35 percent, respectively, while that of TFP was about 42 percent. In the post liberalization period, service sector real value added grew at 7.44 percent. The contribution of capital increased to 30 percent while the contribution of labor decreased to about 21 percent in this period. TFP's contribution increased and TFP growth alone, in this period accounted for 48 percent of real value added growth.

Bosworth, Collins and Virmani (2007) conduct sectoral growth accounting for the Indian economy and find similar sectoral TFP growth rates for the 1980-2004 period. Their estimates of TFP growth rates in agriculture, industry and services are 1.1, 1, and 2.9 percent respectively. They do not calibrate factor shares but assume a capital share of 0.4 in industry and services. For agriculture, the factor shares are 0.5, 0.25, and 0.25 for labor, capital and land respectively. They have another factor input - education in each sector. In spite of this additional input, my estimates of TFP growth rates are similar to their numbers, suggesting that education has not played a very significant role in contributing to the growth of sectoral real value added.

From Table 1 one observes that the service sector in India has witnessed very rapid TFP growth which exceeds TFP growth in the agricultural and industrial sectors for the 1980-2003 period, primarily because of the high growth it experienced in the 1991-2003 period. This is a striking result because, in contrast, measures of services' TFP growth are low in advanced economies, especially when compared to the TFP growth in the industrial sector in the data from most countries. Echevarria (1997) reports sectoral TFP growth rates for fourteen OECD countries for the 1970-85 period. In all countries, measured TFP growth in services is lower than the corresponding growth rate in industry.

In the Indian case, the finding of high TFP growth in services does not depend on the values of factor shares. I report results using two other sets of factor shares in the appendix. Table 7 reports the results using the GTAP computed sectoral factor shares and table 8 presents the results using capital share values of one-third in the sectors. These results validate the finding that amongst the three sectors, TFP growth is highest in the service sector for the entire sample period, especially due to the high growth observed in the post liberalization period.

5 Model

5.1 Technology

I develop a three sector, dynamic general equilibrium model in which an infinitely lived representative household owns all land, labor and capital and is endowed with one unit of productive time. Therefore, the model is set up in terms of per capita quantities. Time is discrete and is indexed by $t = 0, 1, ...\infty$.

There are three sectors in the economy, agriculture, industry and services. In each sector, the production function exhibits constant returns to scale and is assumed to be Cobb-Douglas in form. The agricultural good is produced using capital k_a, land l_a, and labor n_a as inputs; the industrial good and the service good are produced using capital and labor, (k_i, n_i), (k_s, n_s), respectively. θ and γ are the shares of capital and land in agricultural output, α and ϕ are the capital shares in industrial and services' output, respectively. Labor shares are deduced as residuals.

The firms in each sector are assumed to behave competitively. They rent capital, labor and land from the representative agent at rates, r_k, w and R_l, respectively. In the agricultural sector, the firm solves

$$\max_{k_{at}, n_{at}, l_{at}} \{y_{at} - r_{kt}k_{at} - w_t n_{at} - R_{lt} l_{at}\}$$

subject to

$$y_{at} = b_{at} k_{at}^{\theta} l_{at}^{\gamma} n_{at}^{1-\theta-\gamma}, \quad \theta + \gamma \in (0, 1) \tag{2}$$

In the industrial sector, the firm solves

$$\max_{k_{it},n_{it}}\{y_{it} - r_{kt}k_{it} - w_t n_{it}\}$$

subject to

$$y_{it} = b_{it}k_{it}^{\alpha}n_{it}^{1-\alpha}, \quad \alpha \in (0,1) \tag{3}$$

In the services sector, the firm solves

$$\max_{k_{st},n_{st}}\{y_{st} - r_{kt}k_{st} - w_t n_{st}\}$$

subject to

$$y_{st} = b_{st}k_{st}^{\phi}n_{st}^{1-\phi}, \quad \phi \in (0,1) \tag{4}$$

where b_{jt} is the TFP level in sector $j = a, i, s$.

There are three market clearing conditions for produced goods:

$$c_{at} = y_{at} \tag{5}$$

$$c_{it} + k_{t+1} - (1-\delta)k_t = y_{it} \tag{6}$$

$$c_{st} = y_{st} \tag{7}$$

The market clearing conditions for agricultural and service goods imply that output produced in these sectors is consumed. The industrial good can either be consumed or it can be used for investment, where $\delta > 0$ is the constant rate of depreciation.

There are also three market clearing conditions for primary inputs:

$$\begin{aligned} k_{at} + k_{it} + k_{st} &= k_t \\ n_{at} + n_{it} + n_{st} &= 1 \\ l_{at} &= 1 \end{aligned}$$

where labor supply per capita and l_{at}, the supply of land per capita, are each normalized to unity[8].

[8] In the data, stock of agricultural land is virtually fixed, and increases by less than 4 percent over the twenty-three year time interval. In comparison, agricultural capital grows by 82 percent and labor grows by more than 100 percent.

The industrial good is assumed to be the numeraire and its price is normalized to unity at all dates. Then let $\{r_{kt}, R_{lt}, w_t, p_{at}, p_{st},\}$ denote the rental prices for capital and land, the wage rate, the price of the agricultural good, and the price of the service good, at date t, respectively.

5.2 Preferences

There is an infinitely-lived representative household endowed with one unit of time in each period. The lifetime utility function for the household is given by

$$\sum_{t=0}^{\infty} \beta^t U(c_{at}, c_{it}, c_{st})$$

where c_j is the consumption of good j $(j = a, i, s)$ in period t and β is the discount factor. The per period utility function is given by

$$U(c_{at}, c_{it}, c_{st}) = ln(\omega_a c_{at}^{\epsilon} + \omega_i c_{it}^{\epsilon} + \omega_s c_{st}^{\epsilon})^{(1/\epsilon)}$$

with $\epsilon < 1$ and $\sum \omega_{j=a,i,s} = 1$. Thus, the elasticity of substitution between c_a, c_i and c_s is given by $\frac{1}{1-\epsilon}$.

The parameter, ϵ, plays an important role in generating structural change in models with differential TFP growth across sectors. Specifically, if consumption goods are complements, then, in the presence of differential TFP growth across sectors, resources are transferred to the sector experiencing the lowest TFP growth. But if consumption goods are substitutes, then resources are allocated to the sector witnessing highest TFP growth. The underlying reasoning is that the sector witnessing highest TFP growth also experiences the most rapid decline in the price of the good that it produces. If the goods are substitutes, the household increases its share of consumption expenditure on this relatively cheap good, and reduces the share of expenditure on the other goods. The household then demands more of the cheap good and reduces the demand for the relatively expensive good. As a result, when the two goods are substitutes, labor shifts into the sector where TFP growth is the highest. The converse is true when goods are complements. Since the growth accounting results reveal TFP growth to be largest in the service sector for India, and the data show that the output and employment of this sector have grown, I assume ϵ is < 1 and therefore assume that the three goods are substitutes in consumption.

The representative household faces the following maximization problem in each period

$$max \sum_{t=0}^{\infty} \beta^t U(c_{at}, c_{it}, c_{st})$$

subject to

$$p_{at}c_{at} + c_{it} + p_{st}c_{st} + k_{t+1} - (1-\delta)k_t = r_{kt}k_t + w_t + R_{lt} \quad \forall \;\; t = 0, 1, ..\infty$$

with k_0 given.

5.3 Competitive Equilibrium

Given k_0, an equilibrium is defined as a sequence of prices $\{r_{kt}, R_{lt}, w_t, p_{at}, p_{st}\}_{t=0}^{\infty}$ and allocations $\{k_{at+1}, k_{it+1}, k_{st+1}, n_{at}, n_{it}, n_{st}, c_{at}, c_{it}, c_{st}, l_{at}\}_{t=0}^{\infty}$ such that

1. Given prices, the sequence $\{c_{at}, c_{it}, c_{st}, n_{at}, n_{it}, n_{st}, k_{t+1}\}_{t=0}^{\infty}$ solves the household's maximization problem;

2. Given prices, the sequence $\{k_{at}, k_{it}, k_{st}, n_{at}, n_{it}, n_{st}, l_{at}\}_{t=0}^{\infty}$ solves the firms' maximization problem;

3. The markets for primary inputs and final goods clear.

The numerical appendix describes in detail how an equilibrium is computed for this economy.

5.4 Model of Unbalanced Growth with Structural Change

The model is characterized by existence of an aggregate unbalanced growth path consistent with structural change.

The process of structural change has been studied by previous authors using two classes of models. The first class of models uses non-homotheticities in preferences and neutral technological change across sectors. The underlying premise is that if income elasticities of demand are not unitary, then as economies grow richer, reallocation of resources across sectors will take place. Examples of these models are Echevarria (1997) and Kongsamut, Rebelo and Xie (2001). The second class of models emphasizes that differential productivity growth across sectors can generate structural transformation even with homothetic preferences. This is done by assuming that the elasticity of substitution between goods is different from unity and authors like Baumol (1967) and Ngai and Pissarides (2007) use this class of models. Yet others, like Rogerson (2007), use a hybrid of both classes of models: uneven technological change across sectors coupled with non-homothetic preferences. Rogerson states that while uneven technological change can generate reallocation across industry and services, non-homothetic preferences are required to enable the reallocation of resources out of agriculture.

In this paper, I use homothetic preferences with the assumption that the goods of three sectors are substitutes in consumption, and assume differential productivity growth across sectors, as measured by the growth rate of TFP derived in the growth accounting. It is important to note that in India's case, the high income elasticity of demand for services is empirically implausible[9].

The model characterizes the transitional dynamics of an economy. Here, unbalanced growth exists because of the assumption of different values of factor shares in the sectors and presence of a fixed factor (land) in one sector (agriculture). The equations of motion for the state variable (k) and the control variable (c) of the aggregate economy are [10]

$$\frac{k_{t+1}}{k_t} = \frac{b_{it}k_t^{\alpha-1}}{\hat{\lambda}^{\alpha}}\left[1 - \frac{x_{at}c_t}{X_t y_t}\frac{1-\theta-\gamma}{1-\alpha}\Omega_1 - \frac{x_{st}c_t}{X_t y_t}\Omega_2\right] - \frac{c_t}{X_t k_t} + (1-\delta) \tag{8}$$

$$\frac{c_{t+1}}{c_t} = \beta\left(1 + \alpha b_{it+1}k_{t+1}^{\alpha-1}\hat{\lambda}^{\alpha-1} - \delta\right) \tag{9}$$

where

$$\hat{\lambda} = \left[\frac{\theta}{1-\theta-\gamma}\frac{1-\alpha}{\alpha}n_{at} + n_{it} + \frac{\phi}{1-\phi}\frac{1-\alpha}{\alpha}n_{st}\right]$$

$$\Omega_1 = \left[\frac{1-\alpha}{1-\theta-\gamma}n_{at} + n_{it} + \frac{1-\alpha}{1-\phi}n_{st}\right]$$

$$\Omega_2 = \left[\frac{1-\phi}{1-\theta-\gamma}n_{at} + \frac{1-\phi}{1-\alpha}n_{it} + n_{st}\right]$$

[9] I elaborate on this point in section 9.

[10] These are formally derived in the numerical appendix.

In this economy, unbalanced growth is characterized by the aggregate output, the aggregate consumption and the aggregate capital-labor ratio, growing at different rates. Notably, if the values of factor shares were the same across the sectors, and no fixed factor is used in production in agriculture, then this model exhibits a balanced growth path. The equations of motion for the state variable (k) and the control variable (c) of the aggregate economy will accordingly, be

$$\frac{k_{t+1}}{k_t} = b_{it} k_t^{\alpha-1} - \frac{c_t}{k_t} + (1-\delta)$$

$$\frac{c_{t+1}}{c_t} = \beta \left(1 + \alpha b_{it+1} k_{t+1}^{\alpha-1} - \delta\right)$$

In this economy, then, the aggregate capital-labor ratio, the aggregate consumption and the aggregate output, all will grow at the rate of labor augmenting technological progress in the manufacturing sector. This is the case discussed in Ngai and Pissarides (2007) where there exists a saddlepath equilibrium and stationary solutions for the aggregate consumption and the aggregate capital-labor ratio.

6 Calibration

6.1 Methodology

I now assess whether this model can replicate the sectoral transformation witnessed by the Indian economy between 1980-2003. In particular, I evaluate the performance of the model in matching the quantitative changes in sectoral output and sectoral employment shares observed in the data. I also report the average annual growth rates of sectoral output and sectoral employment shares implied by the model and compare them with their data counterparts.

Each period in the model is assumed to be one year. The computational experiment conducted is as follows. For each sector, I use the calibrated factor income shares and sectoral TFP growth rates from the baseline growth accounting exercise. The subjective discount factor, β, is taken as 0.98 and the depreciation rate is set at 5 percent in each period. The remaining parameters - TFP levels in the initial period - b_{a0}, b_{i0}, b_{s0}; the weight on the agricultural and industrial good in the utility function - $\omega_a, \omega_i,$; and the parameter dictating the elasticity of substitution between the three goods - ϵ, are calibrated in the following manner.

Assuming the initial period to be 1980 ($t = 0$), I compute the equilibrium trajectory of the model in each period and calibrate these six parameters to minimize the sum of squared differences between the data and the model with respect to six targets in the initial period. These six targets are - the share of output in agriculture, the share of output in services, the share of employment in agriculture, the share of employment in services, the share of consumption expenditure on services and the relative price of the service good, all in 1980. Specifically, if $\hat{y}_{a0}, \hat{y}_{s0}, \hat{n}_{a0}, \hat{n}_{s0}, \hat{CS}_0, \hat{p}_{s0}$ are the model's prediction for the six targets and $y_{a0}, y_{s0}, n_{a0}, n_{s0}, CS_0, p_{s0}$ are the actual observations in the data, then I solve the following problem:

$$\begin{aligned}\{b_{a0}, b_{i0}, b_{s0}, \omega_a, \omega_i, \epsilon\} = arg \min_{\{x,y,z\}} \sum \{&(\hat{y}_{a0} - y_{a0})^2 + (\hat{y}_{s0} - y_{s0})^2 + (\hat{n}_{a0} - n_{a0})^2 \\ &+(\hat{n}_{s0} - n_{s0})^2 + (\hat{CS}_0 - CS_0)^2 + (\hat{p}_{s0} - p_{s0})^2\}\end{aligned} \tag{10}$$

The parameter values are presented in table 2. The numerical algorithm used to compute the equilibrium trajectory is described in the appendix of this paper.

6.2 Data for Calibration

As mentioned above, to assist in the calibration of some parameters, I need data on private final consumption expenditure as well as relative prices of service goods. *CMIE* reports disaggregated data for private final consumption expenditures. To construct sectoral consumption expenditure, I group the disaggregated final consumption expenditures under the three sectors, following Echevarria (1997)[11]. Since the industrial good is assumed to be the numeraire in the model, relative prices for the service goods are got by dividing the GDP deflator series for services with that of industry.

[11] Details of the classification methodology are provided in the data appendix.

Table 2: Calibrated parameters

Parameters	Description	Values
θ	capital share in agriculture	0.22
γ	land share in agriculture	0.2
α	capital share in industry	0.55
ϕ	capital share in services	0.44
b_{a0}	initial TFP level in agriculture	3.9
b_{i0}	initial TFP level in industry	1.1
b_{s0}	initial TFP level in services	1.9
g_{at}	growth rate of TFP in agriculture	0.0173
g_{it}	growth rate of TFP in industry	0.0098
g_{st}	growth rate of TFP in services	0.0311
β	discount factor	0.98
δ	depreciation rate	0.05
ω_a	weight on agricultural good	0.44
ω_i	weight on industrial good	0.19
ω_s	weight on service good	0.37
$1/(1-\epsilon)$	elasticity of substitution	4.3

7 Results

The trends in sectoral output shares implied by the model and those observed in the data are presented in Figure 6. In the agricultural sector, the model tracks the data closely and can capture the declining share of agricultural output in GDP over the whole sample period. With respect to industry, the model captures the increasing trend of output share in this sector, although it over predicts the output share by a small amount in each time period. For the service sector, the model tracks the data very closely for the entire period, although it underpredicts the output share by a small amount in the last few years.

Sectoral employment share trends are displayed in Figure 7. The model has difficulty in matching the levels of sectoral employment shares for the entire period. The model implies that the shares of sectoral output and shares of sectoral employment are similar in magnitude[12], but, in the Indian case, one observes a huge divergence in their corresponding values. In the data, one observes a declining share of agricultural employment, although at a

[12]See Numerical Appendix, section on 'Solving the Model'.

very slow pace. The model can capture the declining share of employment in this sector, but it implies a faster movement of labor out from this sector when compared to the trend seen in the data. With respect to industrial and service sectors employment shares, the model cannot match the magnitude of the employment shares over the entire period, although it captures the trend of increasing employment shares in both these sectors.

To gain further insight into the performance of the model, I also calculate the average annual growth rates of the shares of output and employment in each of the three sectors for the given time period. The growth rates implied by the model and those calculated from the data are displayed in table 3. The model implies that the share of agricultural output declined at an average annual rate of -2.1 percent. The calculated growth rate from the data is about -2.4 percent; the model can account for about 86 percent of the decline observed in the data. With respect to the share of industrial output, the model implies a growth of 0.4 percent, which is very close to the growth of 0.5 percent seen in the data and therefore, the model can account for about 80 percent of the growth in the share of industrial output seen in the data. For the service sector, the model indicates that the share of this sector in total output increases at an average annual rate of 1.2 percent. This share grows at an average annual rate of 1.3 percent in the data, and therefore the model can account for about 88 percent of the growth in the service sector output share in the data. With respect to employment shares, the model predicts the share of agriculture declines at an average annual rate of 2.1 percent, whereas, in the data, the movement of labor is much slower at 0.82 percent. For the industrial sector, the data implies that the share of employment grows at a rate of 1 percent, while the model suggests the growth rate to be 0.4 percent. With respect to the service sector, the growth rate of the share of employment is about 1.3 percent in the data and the model comes very close to matching this growth, implying a growth rate of 1.2 percent.

8 Effect of Liberalization

The growth accounting results indicate that there was a rapid increase in service sector TFP in the post liberalization period in India. Table 4 reproduces the pre and post liberalization sectoral TFP growth rates obtained from the growth accounting exercise. These

Table 3: Average annual growth rates (%), 1980-2003

Variable	**Data**	**Model**
Share of output in agriculture	-2.4	-2.1
Share of output in industry	0.5	0.4
Share of output in services	1.3	1.2
Share of employment in agriculture	-0.8	-2.1
Share of employment in industry	1.0	0.4
Share of employment in services	1.3	1.2

results show that there was a rapid increase in services' TFP from 2.73 percent in the pre liberalization period to 3.6 percent in the post liberalization period. In the agricultural sector, TFP growth slowed from 2.19 percent during 1980-1990 to 1.33 percent in the 1991-2003 period. Industrial TFP growth increased by a small amount from 0.74 percent in the pre liberalization period to 0.96 percent in the post liberalization period.

Table 4: Pre and post liberalization TFP growth rates

TFP growth rate (%)	Agriculture	Industry	Services
Pre liberalization 1980-1990	2.19	0.74	2.73
Post liberalization 1991-2003	1.33	0.96	3.6

In order to assess the importance of the changes in TFP growth rates that occur following the economic liberalization in 1991, I ask the following: What would be the level and the growth rate of each sector's share in aggregate output and aggregate employment in the 1991-2003 period if TFP growth rate had not changed after 1991? To start with, I simulate the model by assuming that the average annual growth rate of sectoral TFPs for the 1980-2003 period is equal to the pre liberalization (1980-1990) average annual growth rate. Then, I compare this economy with the one in which, I take into account the higher TFP growth rates observed in post liberalization era. Thus, I simulate the model by using the average pre liberalization sectoral TFP growth rates for the 1980-1990 period, and the average post liberalization sectoral TFP growth rates for the 1991-2003 period.

Figures 8 depict the time paths of sectoral output shares under the two scenarios and compare these with the trends observed in the data. The results are also presented in terms of average annual growth rates in table 5. In the simulation in which I use the pre liberalization

TFP growth rates, the share of output in agriculture declines at a rate of -0.9 percent during 1991-2003. This rate is lower than -3.3 percent, which is the growth rate implied by the model when I use the post liberalization TFP growth rate, and also the growth rate seen in the data.

Table 5: Average annual growth rates during 1991-2003

	Data	Model using pre liberalization TFPs	Model using post liberalization TFPs
Share of output in agriculture	-3.3	-0.9	-3.3
Share of output in industry	0.0	0.1	0.0
Share of output in services	2.0	0.6	2.1

With regard to the trend in the share of industrial output, there is not much difference between the time paths implied by the model, in both simulations. In fact, the model implies a small positive growth in the share of industrial output of 0.1 percent in the first simulation. This occurs at the expense of lower growth in the share of output in the service sector.

In the absence of the TFP growth rate increase after liberalization, the share of service sector output increases at a rate of 0.6 percent. The corresponding growth in service sector output share when I allow for TFP growth rate to increase following liberalization, is about 2 percent in the model as well as in the data. Without the increase in TFP following liberalization, the model can account for only 32 percent of the growth in the share of service sector output. This low growth in the output share of services stems from the fact that resource reallocation from agriculture to services is slower, compared to the scenario in which TFP growth rises after liberalization. This is because, in the absence of the change in TFP growth rates following liberalization, the differential in TFP growth rates which is the principal factor guiding the relative price difference between the agricultural good and the service good becomes less potent in generating the movement of resources from agriculture to services. Consequently, the differential between the price of the service good and the price of the agricultural good becomes smaller and hence, the household is less willing to substitute into consuming the service good.

9 Explaining the Rapid Growth of Share of Services in Indian GDP

A number of explanations have tried to account for the rapid growth of the service sector share in Indian GDP after liberalization. In this section, I discuss each of the arguments and also present mine. I argue that the liberalization policies adopted by India from 1991, and especially the deregulation and privatization of business and communications services, explain the improvement in service sector TFP, and hence the dominance of service sector activity in India's GDP growth.

Splintering

One 'supply side explanation' discusses the role of splintering. Splintering involves switching to a more service-input intensive method of organizing production, which can arise as a result of increasing specialization as the economy matures. Gordon and Gupta (2004) use input-output coefficients for the 1989/1990-1993/94 period to measure the usage of services by agriculture and industry in the early 1990s. They find that splintering could have added only about one fourth of one percentage point to annual services' value added growth during the early 1990s. Following an identical methodology, Singh (2006) uses input-output coefficients from the 1998-1999 data and finds that splintering makes no contribution to services' value added growth during the entire 1990-2000 period.

Demand

The 'demand side explanation' argues that an increase in the share of services' output in GDP is due to rapid growth of final demand for services, resulting from a high income elasticity of demand for services. Gordon and Gupta (2004) find that this argument has little merit in the Indian case. They argue that prior to the 1990s, final consumption of services was growing at a lower rate than output of services and, after 1990, the two grew at roughly equivalent rates. Hence, the income elasticity argument could only hold if there was a behavioral change in the 1990s and there is no *a*prior reason to expect this to have occurred. Moreover, they reason that, if the demand side explanation was true, the price of services relative to the overall price level in the economy should have increased. The Indian data reveal that this ratio actually decreased after 1991. Additionally, recent work by Falvey and Gemmell (1996) has tended to reject the income-elastic demand for services overall but confirm a wide range of income elasticity estimates (above and below unity) across different types of services.

TFP

The above explanations have little merit in explaining rapid service sector growth in India. Moreover, the growth accounting results show that changes in TFP were crucial for driving growth in the service sector, especially after liberalization. The question is whether and which of the liberalization reforms of 1991 were the mechanisms which resulted in productivity growth in the service sector? The economic liberalization of 1991 involved a myriad of policy changes. Some of the important policy reforms included tariff reductions, reduction in export controls, removal of quotas, entry of foreign direct investment (FDI) in some sectors and deregulation and privatization in the service and industrial sectors. Which of these policy changes, if any, can best explain the rapid growth of service sector productivity and service sector output in India?

Trade liberalization

Major policy changes carried out within the ambit of trade liberalization involved tariff reductions, reduction in export controls, repeal of quotas and removal of import licensing. Prior to 1991, India had very high tariff rates, with the aim of turning quota rents into tariff revenues. Pre liberalization, about 439 items were subject to export controls, but this number was brought down to about 296 in 1992 (Panagariya (2004)).

Although much progress was made in liberalizing the trade regime in India, India remained a relatively closed economy during much of the 1990s. Rodrik and Subramanian (2004) use a gravity model and conclude that India became a 'normal' trader only by 2000 (for the 1980-1999 period the coefficient of openness on India was negative and significant), as compared to China, for which trade was significant during the entire 1980-2000 period. The World Bank Report (2004) reports that the average tariff rate in India (inclusive of customs duties and other general and selective protective levies) in 2002-03 was still high, at 35 percent. With respect to exports of services, there is no refutation of the fact that, as a share of service sector GDP, these exports grew following trade liberalization. However, by 2003, service sector exports were about 8 percent of services' GDP, and about 4 percent of aggregate GDP. Given how small these numbers are, an export-led growth hypothesis of service sector growth is difficult to support.

FDI in services

Gordon and Gupta (2004) and Singh (2006) discuss the role of FDI in the service sector, particularly its growth in the telecommunication sector after liberalization. The channel through which FDI and foreign technology spills over to domestic firms deserves some merit as an explanation of enhancing productivity growth in this sector. However, while it is true, that services in general and telecommunications in particular have been attracting a large share of FDI, the share of FDI inflow in service sector GDP has been very small. The Handbook of Industrial Policy and Statistics 2003-05 reports the values of FDI inflows in various sub sectors of the economy. Table 6 reproduces these values for the sub sectors in services and also reports the values of service sector GDP for the 1991-2003 period. During 1991-2002, the cumulative share of service sector FDI inflows in service sector GDP is 0.3 percent and falls to 0.2 percent by 2003. The small share of FDI inflows in the service sector seems unlikely to account for the magnitudes of productivity and output growth in the Indian service sector.

Education

Since services are assumed to be relatively skill intensive, one could argue that education has a big role to play in driving growth in this sector. Bosworth et al. (2007) conduct growth accounting for each of the three sectors (agriculture, industry and services) for the

Table 6: FDI and GDP in Indian Services

	1991-2002	2003
FDI inflows:	Rs. Million cumulative	Rs. Million
Telecommunications	98,994.43	7,272.59
Financial and Non Financial Services	65,938.62	13,903.59
Consultancy Services	4,354.96	2,480.26
Hotel & Tourism	6,276.92	2,594.21
Trading	11,982.54	831.46
Total FDI in Services	187,547.47	27,082.11
Total GDP in Services	66,368,910	11,434,480
Share of FDI/GDP in Services	0.3%	0.2%

Indian economy between 1960 and 2004. In each sector, output is produced by capital, labor and, human capital measured as education. For the 1980-2004 period, they report that TFP in services grows at an average annual rate of 3 percent, similar to what I find. Their results indicate that the average annual growth of education as a factor of production in the service sector is small at 0.4 percent and accounts for 14 percent of services' output growth, suggesting that education alone could not be the driving force of productivity and output gains in this sector.

Deregulation and Privatization

Prior to liberalization, the service sector had been subject to heavy government intervention. There was a conspicuous dominance of the public sector in the key sectors of insurance, banking and telecommunications.

Following liberalization, there was an active deregulation of some sectors, and entry of private firms was allowed in the service sector. Prior to 1991, insurance was a state monopoly. In 1999, the Indian Parliament passed the Insurance Regulatory and Development Authority (IRDA) Bill, which established an Insurance Regulatory and Development Authority and permitted private sector participation in the insurance sector. Similarly, the banking sector was opened up to allow private banks to operate, following the recommendations of the Narasimhan Committee in 1991-92. Another sector which witnessed massive growth in its

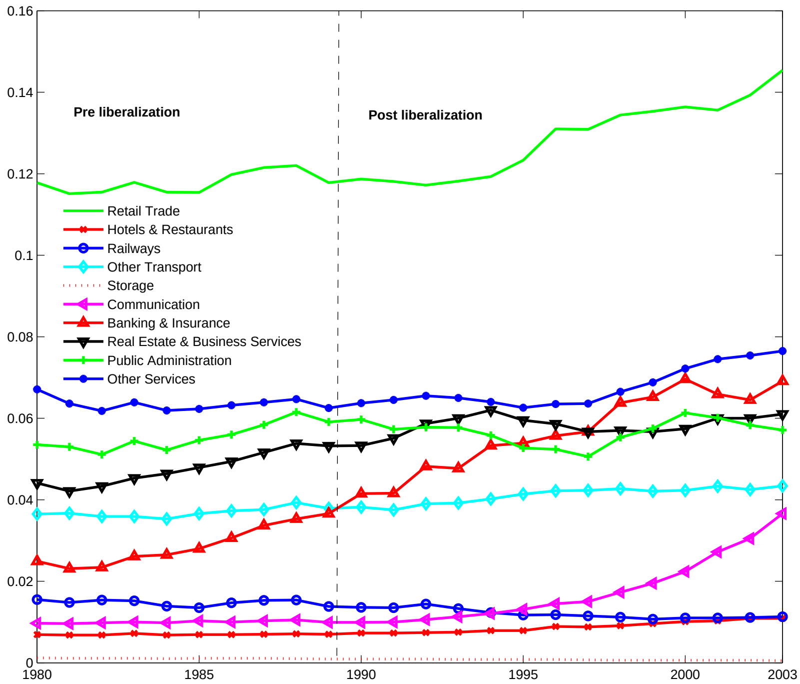

Figure 5:

Share of Output of Services Subsectors in Aggregate GDP

output was telecommunications. Until early 1990s, this sector was a state monopoly but with the creation of the National Telecommunications Policy in 1994, the doors were opened to provide for cellular, as well as basic and value-added, telephone services by the private sector. The Handbook of Industrial Policy and Statistics 2003-2005 lists that in 2003, the share of public sector investment in commodity producing enterprises as 60.36 percent, while the corresponding share in enterprises rendering services was much less, at 35.6 percent.

Figure 5 shows how the shares of the services sub sectors in aggregate GDP grew for the 1980-2003 period. Clearly, the telecommunication, and the banking and insurance sectors have witnessed rapid growth after liberalization [13]. The growth in the share of the telecommunication sector is particularly notable. In this sector, massive deregulation as well as technological progress occurred and may have promoted the rapid growth of output

[13]The growth in banking and insurance started during late 1980s as some deregulation took place then, although major reform followed after liberalization in 1991.

in a short span of time. Information technology, as a sub sector of activity, is a part of business services. Further disaggregated data are not available to see how this sector grew but Singh and Srinivasan (2004) report that the share of this sector in GDP was about 1 percent in late 1990s. Even though this sector, in itself, may not account for a large share of Indian GDP, its large spillover effects to the other sectors has enabled much growth in the telecommunication, the banking and the insurance sectors.

I conclude that deregulation, privatization and quite possibly - technological progress promoted the growth of output in the service sector during the 1991-2003 period.

10 Conclusion

This paper accounts for the rapid growth of the service sector in one of today's low income, rapid growing countries, India. The motivation for studying the Indian economy, as a representative of low income, fast growing, service sector driven economies, results from an empirical exercise. Of forty-two countries identified by the World Bank as being low income in 1980, eleven have witnessed average annual growth rates of GDP per capita in excess of 2 percent for the 1980-2004 period. Of these fast growing, low income countries, I find that five of them have experienced GDP growth that is dominated by growth of value added in the service sector, rather than by growth in the industrial sector as typifies historical evidence on structural transformation from industrialized countries. This group consists of a set of South Asian economies, namely, Bangladesh, India, Nepal, Pakistan and Sri Lanka. Of these, India had witnessed highest growth in GDP and in GDP per capita over the whole time period.

In the first part of this paper, I discuss the trends of sectoral output shares, sectoral employment shares and sectoral TFPs observed in the Indian data and, conduct a sectoral growth accounting exercise for India during the period 1980-2003. The results from this exercise show that changes in total factor productivity (TFP) were the largest source of service sector value added growth in India. For the same period, measured service sector TFP growth was also much higher than measured TFP growth in agriculture and industry, and increased substantially following the inception of market based liberalization policies from 1991.

In the second part of this paper, I develop a three sector, neoclassical growth model to evaluate the quantitative performance of differential TFP growth across sectors in accounting for the structural transformation of India. In the model, agents are assumed to view consumption of agricultural, industrial and service sector goods as gross substitutes, but their preferences over goods are homothetic. For the period 1980-2003, the model is calibrated to Indian data in which average rates of TFP growth by sector from India are the primary inputs. This model performs well in accounting for the evolution of value added shares of the three major sectors of economic activity over the period 1980-2003. It also accounts well for the growth rates of the GDP shares of all three major sectors of economic activity over this period - for the structural transformation of GDP. However, the model cannot match the evolution of employment shares, primarily because of the large differences between the shares of sectoral value added and the shares of sectoral employment observed in the Indian data.

I conduct an experiment to highlight the importance of the post 1991 increase in service sector TFP. The performance of the model improves significantly when the post 1991 increase in service sector TFP growth is accounted for. I argue that the increase in service sector TFP is a result of the liberalization policies adopted by India. The economic liberalization that India initiated in 1991, involved a myriad of policy changes consisting of tariff reductions, reduction in export controls, removal of quotas, entry of FDI in some sectors, and deregulation and privatization in the service and industrial sectors. Among all these reforms, I find that the deregulation and privatization of business and communications services explain the rapid growth in service sector TFP, and hence the dominance of service sector activity in India's GDP growth.

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Data Appendix

1. Classification according to current daily status approach (cds): The activity pattern of people particularly in the unorganized sector is such that a person might be pursuing more than one activity during a week and sometimes even during a day. In the current daily status, upto two activity statuses were assigned to a person on each day of the reference week. The unit of classification was thus half day in the cds. In assigning the activity status on a day, a person was considered working for the entire day if he had worked 4 hours or more during the day. If he had worked one hour or more but less than 4 hours, he was considered working (employed) for half day and seeking/available for work (unemployed) or not available for work (not in labor force) for the other half day depending on whether he was seeking /available for work or not. On the other hand, if a person was not engaged in any work even for one hour but was seeking or available for work for 4 hours or more, he was considered unemployed for the entire day. If he was available for work for less than 4 hours only, he was considered unemployed for half day and not in labor force for the other half of the day. A person who neither had any work to do nor was available for work even for half of the day was considered not in labor force for the entire day and was assigned one or two non-economic activity status codes. The aggregate of person days classified under the different activity categories for all the seven days gave the distribution of person days by activity category during an average week over the survey period of one year.

2. Expenditure on agriculture goods includes food, beverages, pan & intoxicant, tobacco & its products. Expenditure on industry includes clothing & footwear, gross rent, fuel & power, furniture and household, personal transport equipment and operation of personal transport equipment. Expenditure on services includes other services in furniture etc., medical care & health services, equipment, recreation, education & cultural services, miscellaneous goods & services, hotels & restaurants, & transport & communication minus the sum of personal transport equipment and operation of personal transport equipment.

11 Numerical Appendix

11.1 Solving the Model

Firms

At time t, using the firms' first order conditions and the assumption that capital and labor are completely mobile across sectors, one gets [14]

$$r_{kt} = p_{at}\theta b_{at}k_{at}^{\theta-1}n_{at}^{-\gamma} = \alpha b_{it}k_{it}^{\alpha-1} = p_{st}\phi b_{st}k_{st}^{\phi-1}$$

$$w_t = p_{at}(1-\theta-\gamma)b_{at}k_{at}^{\theta}n_{at}^{-\gamma} = (1-\alpha)b_{it}k_{it}^{\alpha} = p_{st}(1-\phi)b_{st}k_{st}^{\phi}$$

$$R_{lt} = p_{at}\gamma b_{at}k_{at}^{\theta}n_{at}^{1-\gamma}$$

Since $\frac{w_t}{r_{kt}}$ is equal across the three sectors, one obtains the following relation

$$\frac{w_t}{r_{kt}} = \frac{1-\theta-\gamma}{\theta}k_{at} = \frac{1-\alpha}{\alpha}k_{it} = \frac{1-\phi}{\phi}k_{st} \tag{11}$$

which implies

$$k_{at} = \frac{\theta}{1-\theta-\gamma}\frac{1-\alpha}{\alpha}k_{it} \tag{12}$$

$$k_{st} = \frac{\phi}{1-\phi}\frac{1-\alpha}{\alpha}k_{it} \tag{13}$$

The equality of the marginal product of capital across sectors implies

$$p_{st} = \frac{\alpha}{\phi}\frac{b_{it}}{b_{st}}\frac{k_{it}^{\alpha-1}}{k_{st}^{\phi-1}}$$

which can be further simplified, after substituting value of k_{st} from above, into

$$p_{st} = \left(\frac{\alpha}{\phi}\right)^{\phi}\left(\frac{1-\phi}{1-\alpha}\right)^{\phi-1}\frac{b_{it}}{b_{st}}k_{it}^{\alpha-\phi} \tag{14}$$

Also, from the equality of the marginal product of capital, one gets

$$p_{at} = \frac{\alpha}{\theta}\frac{b_{it}}{b_{at}}\frac{k_{it}^{\alpha-1}}{k_{at}^{\theta-1}}n_{at}^{\gamma}$$

which can be further simplified, after substituting value of k_{at} from above, into

$$p_{at} = \left(\frac{\alpha}{\theta}\right)^{\theta}\left(\frac{1-\theta-\gamma}{1-\alpha}\right)^{\theta-1}\frac{b_{it}}{b_{at}}k_{it}^{\alpha-\theta}n_{at}^{\gamma} \tag{15}$$

[14] Here k_j is the capital-labor ratio in sector $j = \{a, i, s\}$.

Household

At time t, the household's intra-temporal optimization between c_{at}, c_{st} and c_{it} imply

$$c_{at} = \left(\frac{\omega_i p_{at}}{\omega_a}\right)^{\left(\frac{1}{\epsilon-1}\right)} c_{it} \tag{16}$$

$$c_{st} = \left(\frac{\omega_i p_{st}}{\omega_s}\right)^{\left(\frac{1}{\epsilon-1}\right)} c_{it} \tag{17}$$

$$c_{st} = \left(\frac{\omega_a p_{st}}{\omega_s p_{at}}\right)^{\left(\frac{1}{\epsilon-1}\right)} c_{at} \tag{18}$$

And the inter-temporal Euler equation is

$$\left(\frac{c_{it+1}}{c_{it}}\right)^{\epsilon-1} \frac{C_t}{C_{t+1}} = \frac{1}{\beta(1 + r_{kt+1} - \delta)}$$

where C_t is defined for convenience as $(\omega_a c_{at}^{\epsilon} + \omega_i c_{it}^{\epsilon} + \omega_s c_{st}^{\epsilon})$.

At any time t, the inter-temporal Euler equation, the intra-temporal optimization equation between c_{st} and c_{at} and the resource constraint of the industrial sector are used to solve for three endogenous variables k_{it+1}, n_{at} and n_{it}. Once these are determined, n_{st} is determined as $n_{st} = 1 - n_{at} - n_{it}$, k_{at}, k_{st} are determined from equations (12) and (13), p_{at}, p_{st} are obtained from equations (15) and (14), y_{at}, y_{it}, y_{st} are determined from equations of the production functions, c_{at}, c_{st} are known from the resource constraints and c_{it} is known from the household's intra-temporal optimization condition between c_{at} and c_{it}.

In this economy, output shares are functions of employment shares. Define A as output share in agriculture, I as output share in industry and S as output share in services. Then, using equations (2), (3), (4), (12), (13), (14), and (15), one obtains

$$A = \frac{p_a y_a}{p_a y_a + y_i + p_s y_s} = \frac{\left(\frac{1-\alpha}{1-\theta-\gamma}\right) n_a}{\left(\frac{1-\alpha}{1-\theta-\gamma} - \frac{1-\alpha}{1-\phi}\right) n_a + \left(\frac{\alpha-\phi}{1-\phi}\right) n_i + \left(\frac{1-\alpha}{1-\phi}\right)}$$

$$I = \frac{y_i}{p_a y_a + y_i + p_s y_s} = \frac{n_i}{\left(\frac{1-\alpha}{1-\theta-\gamma} - \frac{1-\alpha}{1-\phi}\right) n_a + \left(\frac{\alpha-\phi}{1-\phi}\right) n_i + \left(\frac{1-\alpha}{1-\phi}\right)}$$

$$S = \frac{p_s y_s}{p_a y_a + y_i + p_s y_s} = \frac{\left(\frac{1-\alpha}{1-\phi}\right) 1 - n_a - n_i}{\left(\frac{1-\alpha}{1-\theta-\gamma} - \frac{1-\alpha}{1-\phi}\right) n_a + \left(\frac{\alpha-\phi}{1-\phi}\right) n_i + \left(\frac{1-\alpha}{1-\phi}\right)}$$

11.2 Model Properties: Unbalanced Growth and Structural Change

The aggregate capital-labor ratio can be expressed as

$$k_t = k_{at}n_{at} + k_{it}n_{it} + k_{st}n_{st}$$

Since $k_{at} = \frac{\theta}{1-\theta-\gamma}\frac{1-\alpha}{\alpha}k_{it} = \lambda_a k_{it}$ and $k_{st} = \frac{\phi}{1-\phi}\frac{1-\alpha}{\alpha}k_{it} = \lambda_s k_{it}$, the aggregate capital-labor ratio can be re-written as

$$k_t = \hat{\lambda}k_{it} \quad \forall \;\; t = 1....\infty \tag{19}$$

where $\hat{\lambda} = \frac{\theta}{1-\theta-\gamma}\frac{1-\alpha}{\alpha}n_{at} + n_{it} + \frac{\phi}{1-\phi}\frac{1-\alpha}{\alpha}n_{st}$

The resource constraint in the industrial sector can be expressed as

$$b_{it}k_{it}^{\alpha}n_{it} = c_{it} + k_{t+1} - (1-\delta)k_t$$

Using equation (19), the above can be re-written as

$$\frac{k_{t+1}}{k_t} = \frac{b_{it}n_{it}k_t^{\alpha-1}}{\hat{\lambda}^{\alpha}} - \frac{c_{it}}{k_t} + (1-\delta) \tag{20}$$

Now, consider the aggregate per capita consumption expenditure, c

$$c_t = p_{at}c_{at} + c_{it} + p_{st}c_{st}$$

Dividing through by c_{it}, this can be expressed as

$$c_t = c_{it}X_t$$

where $X_t = x_{at} + x_{st} + 1$, $x_{at} = \frac{p_{at}c_{at}}{c_{it}}$ and $x_{st} = \frac{p_{st}c_{st}}{c_{it}}$

Similarly, the aggregate per capita output y_t is

$$y_t = p_{at}y_{at} + y_{it} + p_{st}y_{st} \tag{21}$$

Using the expressions for p_{at} from (15), p_{st} from (14), the equations for the production functions, and equations (12), (13) imply after some algebraic simplification

$$y_t = b_{it}k_{it}^{\alpha}\left[\frac{1-\alpha}{1-\theta-\gamma}n_{at} + n_{it} + \frac{1-\alpha}{1-\phi}n_{st}\right]$$

which can be expressed as

$$y_t = b_{it} k_{it}^{\alpha} \Omega_1 \tag{22}$$

where $\Omega_1 = \left[\frac{1-\alpha}{1-\theta-\gamma} n_{at} + n_{it} + \frac{1-\alpha}{1-\phi} n_{st}\right]$

Now $p_{at} c_{at} = x_{at} c_{it} = \frac{x_{at} c_t}{X_t}$. Using equation (15) and the resource constraint for the agriculture good, one can derive the following expression for n_{at}

$$n_{at} = \frac{x_{at} c_t}{X_t b_{it} k_{it}^{\alpha}} \frac{1-\theta-\gamma}{1-\alpha}$$

Using (22), the above can be written as

$$n_{at} = \frac{x_{at} c_t}{X_t y_t} \frac{1-\theta-\gamma}{1-\alpha} \Omega_1$$

In a similar manner, one can derive the expression for n_{st} as

$$n_{st} = \frac{x_{st} c_t}{X_t y_t} \Omega_2$$

where $\Omega_2 = \left[\frac{1-\phi}{1-\theta-\gamma} n_{at} + \frac{1-\phi}{1-\alpha} n_{it} + n_{st}\right]$

Then $n_{it} = 1 - n_{at} - n_{st}$ can be expressed as

$$n_{it} = 1 - \frac{x_{at} c_t}{X_t y_t} \frac{1-\theta-\gamma}{1-\alpha} \Omega_1 - \frac{x_{st} c_t}{X_t y_t} \Omega_2$$

Therefore, equation (20) can be expressed as

$$\frac{k_{t+1}}{k_t} = \frac{b_{it} k_t^{\alpha-1}}{\hat{\lambda^{\alpha}}} \left[1 - \frac{x_{at} c_t}{X_t y_t} \frac{1-\theta-\gamma}{1-\alpha} \Omega_1 - \frac{x_{st} c_t}{X_t y_t} \Omega_2\right] - \frac{c_t}{X_t k_t} + (1-\delta) \tag{23}$$

Next, consider the utility function

$$U(c_{at}, c_{it}, c_{st}) = ln(\omega_a c_{at}^{\epsilon} + \omega_i c_{it}^{\epsilon} + \omega_s c_{st}^{\epsilon})^{(1/\epsilon)}$$

Define $\psi_t(\cdot) = (\omega_a c_{at}^{\epsilon} + \omega_i c_{it}^{\epsilon} + \omega_s c_{st}^{\epsilon})^{(1/\epsilon)}$

The Euler equation implies

$$u_{it} = u_{it+1} \beta (1 + r_{kt+1} - \delta) \tag{24}$$

[15] Now

$$u_{it} = \frac{1}{\psi_t(\cdot)}\psi_{it}$$

$$\psi_{it} = \omega_i(\frac{\psi_t}{c_{it}})^{(1-\epsilon)} \tag{25}$$

[16] $\psi_t(\cdot)$ is homegenous of degree one. Then, using the Euler's theorem one can express

$$\psi_t(\cdot) = \psi_{at}c_{at} + \psi_{it}c_{it} + \psi_{st}c_{st}$$

Note that

$$\frac{u_{at}}{u_{it}} = \frac{\psi_{at}}{\psi_{it}} = p_{at}$$

This implies $\psi_{at} = p_{at}\psi_{it}$. Similarly $\psi_{st} = p_{st}\psi_{it}$. Therefore $\psi_t = (p_{at}c_{at} + c_{it} + p_{st}c_{st})\psi_{it}$ or $\psi_t = c_t\psi_{it}$. Using this in equation (25), one gets $\psi_{it} = \omega_i(\frac{c_t\psi_{it}}{c_{it}})^{(1-\epsilon)}$. But $c_t = c_{it}X_t$ which implies $\psi_{it} = {\omega_i}^{1/\epsilon}X_t^{\frac{1-\epsilon}{\epsilon}}$.

Hence, equation (24) can be written as

$$\frac{1}{c_t} = \frac{1}{c_{t+1}}\beta(1 + r_{kt+1} - \delta)$$

Using $r_{kt+1} = \alpha b_{it+1}k_{it+1}^{\alpha-1}$, one arrives at

$$\frac{c_{t+1}}{c_t} = \beta\left(1 + \alpha b_{it+1}k_{t+1}^{\alpha-1}\hat{\lambda}^{\alpha-1} - \delta_t\right) \tag{26}$$

Equations (23) and (26) are the equations of the state and control variables of the aggregate economy. From these equations, one can infer that the aggregate capital-labor ratio, the aggregate consumption and the aggregate output all grow at different rates. This is because of the assumption of different sectoral factor shares and presence of a fixed input, land, in agriculture. If one relaxes these assumptions, i.e - assumes same values of factor shares and absence of land, then balanced growth exists in this economy. This is the case discussed in Ngai and Pissarides (2007) where there exists a saddlepath equilibrium and stationary solutions for the aggregate consumption and the aggregate capital-labor ratio. In their framework, the aggregate capital-labor ratio, the aggregate consumption and the aggregate output, all grow at the rate of labor augmenting technological progress in the manufacturing sector.

[15] u_{it} is the time t marginal utility of consumption with respect to the industrial good.

[16] ψ_{it} is the time t derivate of $\psi_t(\cdot)$ with respect to the industrial good.

12 Numerical Algorithm

This section describes the numerical algorithm used to simulate the model. The model is simulated for $T = 50$ periods [17]. The solution technique involves solving three equations, the inter-temporal Euler equation, the intra-temporal optimization equations between c_{st} and c_{at} and the resource constraint of the industrial sector, for t=1 to T-1 periods.

$$\left(\frac{c_{it+1}(b_{at+1}, b_{it+1}, k_{it+1}, n_{at+1})}{c_{it}(b_{at}, b_{it}, k_{it}, n_{at})}\right)^{\epsilon-1} \frac{C_t(b_{at}, b_{it}, b_{st}, k_{it}, n_{at}, n_{it})}{C_{t+1}(b_{at+1}, b_{it+1}, b_{st+1}, k_{it+1}, n_{at+1}, n_{it+1})} = \frac{1}{\beta(1 + r_{kt+1}(k_{it+1}) - \delta)}$$

$$c_{st}(b_{st}, k_{it}, n_{at}, n_{it}) = \left(\frac{\omega_a}{\omega_s}\right)^{\left(\frac{1}{\epsilon-1}\right)} c_{at}(b_{at}, k_{it}, n_{at}) \left(\frac{p_{st}(b_{it}, b_{st}, k_{it})}{p_{at}(b_{at}, b_{it}, k_{it}, n_{at})}\right)^{\left(\frac{1}{\epsilon-1}\right)}$$

$$c_{it}(b_{at}, b_{it}, k_{it}, n_{at}) + k_{t+1}(k_{it+1}, n_{at+1}, n_{it+1}) - (1-\delta)k_t(k_{it}, n_{at}, n_{it}) = y_{it}(b_{it}, k_{it}, n_{it})$$

The objective is to determine the time paths of k_i[18], n_a and n_i, using the system of equations specified above. To initialize the algorithm, I guess a path for k_i, n_a and n_i, i.e. $\{k_{it}\}_{t=1}^{T}, \{n_{at}\}_{t=1}^{T}, \{n_{it}\}_{t=1}^{T}$. At any time t, the endogenous variables are: k_{it+1}, n_{at} and n_{it}, given k_t and exogenous paths of sectoral TFPs. Then, I use the solutions of the above equations to update the time t values of the vectors: $\{k_i\}$, $\{n_a\}$ and $\{n_i\}$. This process is carried out for $t = 1, \ldots, T-1$ and in the end I get the updated time paths. I compare these vectors with those of the starting guesses and check if the difference between the two is smaller than a defined threshold value. If the difference exceeds the threshold, the guess is replaced by the new paths. This process is repeated until the error becomes smaller than the threshold criterion.

[17] I report results obtained by simulating the model for 50 periods, but these results are similar to those obtained when the model is simulated for 100 periods.

[18] k_i is the capital-labor ratio in industry.

Table 7: Growth Accounting - GTAP factor shares

	Agriculture	Industry	Services
Factor share			
capital	0.21	0.61	0.5
labor	0.41	0.39	0.5
land	0.38		
Decomposition of average annual changes in real value added (%)			
Entire period 1980-2003			
Growth in real value added	3.06	6.14	6.95
due to capital	0.55	4.18	2.18
	(18.1)	(68.0)	(31.3)
due to labor	0.51	1.20	1.72
	(16.8)	(19.5)	(24.7)
due to land	0.06		
	(2.0)		
due to TFP	1.93	0.76	3.05
	(63.1)	(12.4)	(43.9)
Pre liberalization 1980-1990			
Growth in real value added	4.23	6.75	6.53
due to capital	0.65	4.52	1.70
	(15.3)	(67.0)	(26.0)
due to labor	0.86	1.67	2.06
	(20.4)	(24.7)	(31.5)
due to land	0.27		
	(6.5)		
due to TFP	2.45	0.56	2.77
	(57.9)	(8.3)	(42.5)
Post liberalization 1991-2003			
Growth in real value added	2.02	5.52	7.44
due to capital	0.51	3.90	2.56
	(25.2)	(70.6)	(34.4)
due to labor	0.18	0.90	1.41
	(8.9)	(16.3)	(19.0)
due to land	-0.17		
	(-8.5)		
due to TFP	1.50	0.72	3.47
	(74.4)	(13.1)	(46.6)

The number in parenthesis is the % contribution of the factor to real value added growth.

Table 8: Growth Accounting - Capital share of one-third

	Agriculture	Industry	Services
Factor share			
capital	0.24	0.3	0.3
labor	0.56	0.7	0.7
land	0.2		
Decomposition of average annual changes in real value added (%)			
Entire period 1980-2003			
Growth in real value added	3.06	6.14	6.95
due to capital	0.63	2.07	1.31
	(20.7)	(33.7)	(18.8)
due to labor	0.70	2.19	2.39
	(22.9)	(35.7)	(34.5)
due to land	0.03		
	(1.1)		
due to TFP	1.69	1.88	3.25
	(55.3)	(30.6)	(46.8)
Pre liberalization 1980-1990			
Growth in real value added	4.23	6.75	6.53
due to capital	0.74	2.25	1.02
	(17.5)	(33.3)	(15.6)
due to labor	1.18	3.00	2.88
	(27.8)	(44.4)	(44.1)
due to land	0.14		
	(3.4)		
due to TFP	2.17	1.50	2.63
	(51.2)	(22.2)	(40.3)
Post liberalization 1991-2003			
Growth in real value added	2.02	5.52	7.44
due to capital	0.58	1.93	1.55
	(28.7)	(35.0)	(20.8)
due to labor	0.25	1.65	1.98
	(12.2)	(29.9)	(26.6)
due to land	-0.09		
	(-4.4)		
due to TFP	1.28	1.94	3.92
	(63.5)	(35.2)	(52.6)

The number in parenthesis is the % contribution of the factor to real value added growth.

Table 9: Growth Rates of GDP per capita in Low Income Countries

Countries	1980 **GDP per capita less than** 825 **constant** 2000 **U.S.$**	**Average annual growth rate (%) of GDP per capita 1980-2004**
Rapid Growers: growth rate greater than 2%		
China	186.44	8.51
Thailand	804.48	4.58
Bhutan	263.65	4.12
India	222.05	3.76
Indonesia	396.63	3.50
Sri Lanka	441.86	3.29
Chad	147.26	2.34
Lesotho	309.65	2.34
Pakistan	327.43	2.31
Bangladesh	240.51	2.16
Nepal	140.08	2.11
Countries with growth rate greater than 1% but less than 2%		
Sudan	274.22	1.93
Mozambique	179.01	1.80
Burkina Faso	191.69	1.08
Countries with growth rate greater than 0% but less than 1%		
Kiribati	435.41	0.84
Mauritania	361.8	0.79
Guyana	819.41	0.79
Ghana	233.56	0.74
Senegal	405.53	0.53
Benin	292.44	0.47
Mali	220.22	0.302
Solomon Islands	597.09	0.26
Cameroon	638.19	0.15
Papua New Guinea	582.54	0.15
Gambia	327.21	0.12
Countries with growth rate less than 0%		
Kenya	435.24	-0.08
Malawi	161.7	-0.23
Guinea-Bissau	144.44	-0.23
Nigeria	425.32	-0.24

Table 9: (continued)

Countries	1980 **GDP per capita less than** 825 **constant** 2000 **U.S.$**	**Average annual growth rate (%) of GDP per capita 1980-2004**
Comoros	404.63	-0.29
Rwanda	280.35	-0.48
Burundi	126.36	-0.78
Zimbabwe	598.68	-1.12
Zambia	450.51	-1.21
Central African Republic	313.57	-1.37
Togo	346.28	-1.45
Madagascar	341.81	-1.66
Niger	245.5	-1.87
Haiti	802.62	-2.57
Sierra Leone	310.4	-2.82
Congo, Dem. Rep.	251.12	-4.29
Liberia	744.48	-7.02
All Countries: Average annual growth rate 0.51%		

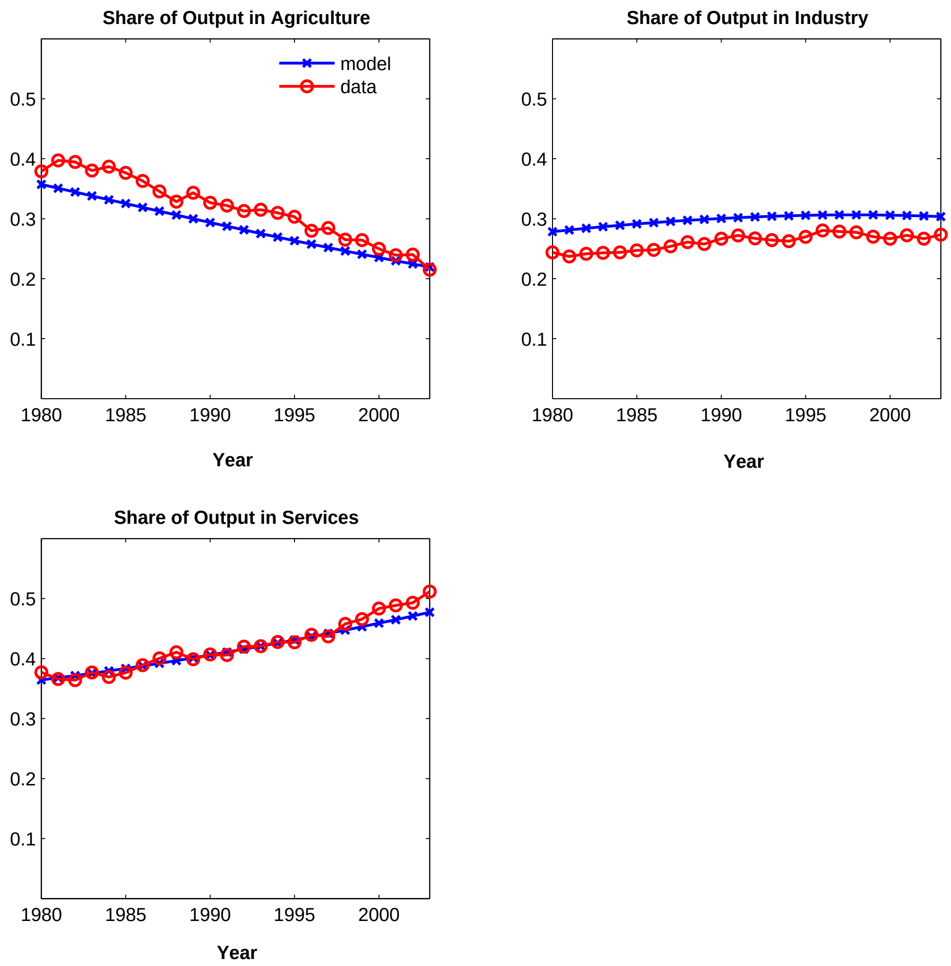

Figure 6:

Shares of Sectoral Output, 1980-2003

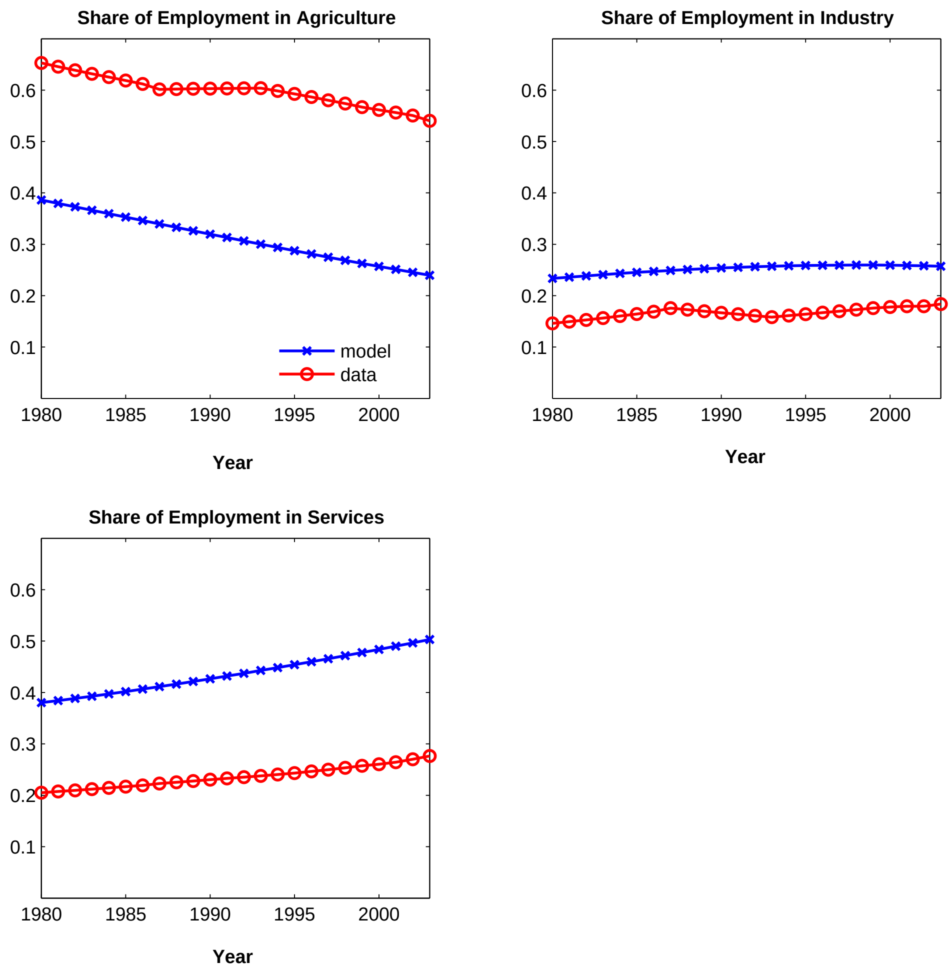

Figure 7:

Shares of Sectoral Employment, 1980-2003

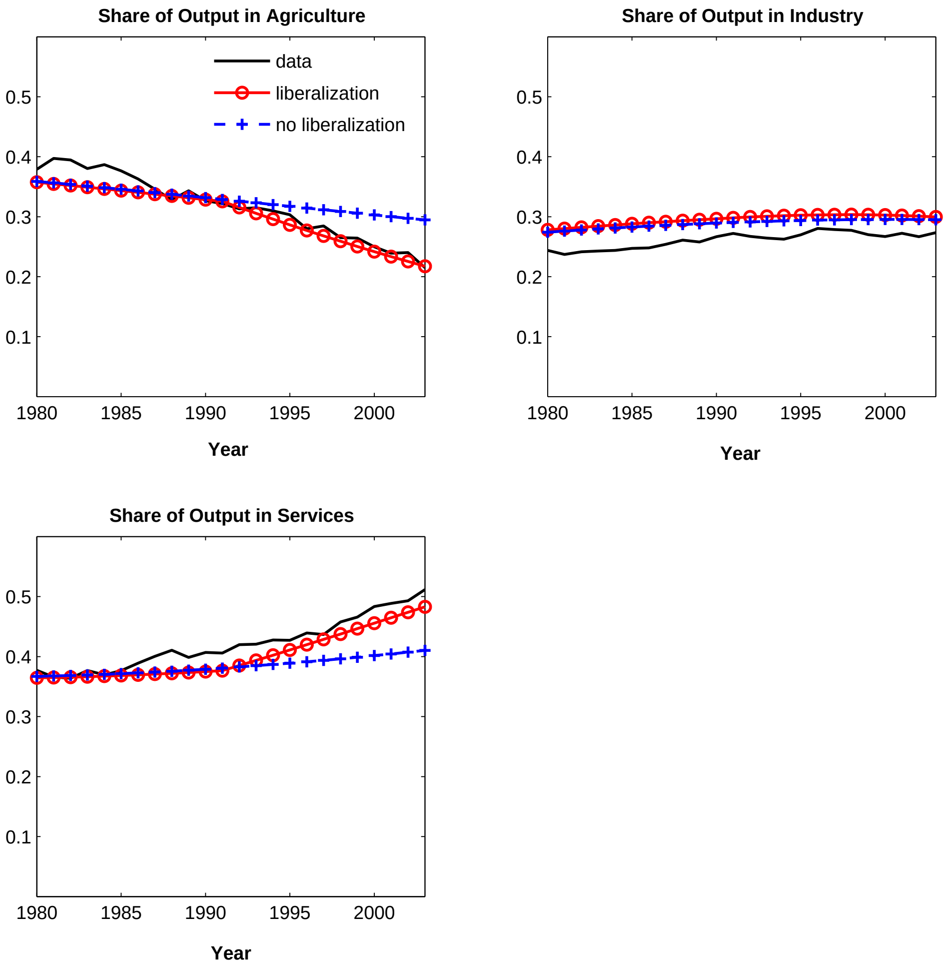

Figure 8:

Effect of Liberalization - Shares of Sectoral Output