Nexus between Economic Growth and the Economic Structure in Indian Economy: An Empirical Analysis

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Abstract: *India's economic base was gradually shifted from agricultural-based to industrial and service –based country for the last 30 years. The purpose of this study was to investigate the effect of those structural changes on economic structures. In order to estimate the relationship between economic growth and economic structure a log –linear model is used which is estimated using Newey-West methodology. For the result, an incremental employment in agricultural sector yielded a negative effect on the Indian economy. Also, an increase in employment in service sector was better than industrial sector in supporting economic growth. Thus, the government should give priority to service-based economy even though agricultural sector is the backbone of Indian economy.*

JEL Classification: C13, C22, H11

Keywords: Newey-West methodology, Structural Changes, log-linear model, Unit root, Berlett Kernel procedure

1. Introduction

India is, as everyone knows, agriculture-based country for a long time. With flourish nature, agriculture is first choice for sustainable living. But the question is "Is India appropriate for being agricultural-based country?" It is true that Indian people did agriculture because they can do it best relative to other economic base or they just have no potentials to do anything else. However, economic structure in India was dramatically changes for the last 30 years.

Economic development has historically been associated with structural changes in the national economies. It has, in fact, most often, been defined as a process combining economic growth with changing share of different sectors in the national product and labour force. The most common structural changes that have been observed historically have followed a sequence of shift from agriculture to industry and then to services. Thus, an underdeveloped economy is characterised by a predominant share of agriculture; with development the share of industry increases and that of agriculture declines, and subsequently after reaching a reasonably high level of development, the services sector increases in importance, becoming a major component of the economy. This pattern has not only been observed historically, but also holds across the countries with different levels of development. Structural shifts and changing sectoral shares are found to hold both for the national product and the work-force [1].

Prior to the global financial crisis, the Indian economy overall was growing at nearly double digit rates. The transition from the "Hindu" rate of 3% per annum to 9.7% in 2007 has been widely studied and publicized. The growth transition has been accompanied by rising fractions of employment and value added in the services sector. The mirror image is the contraction of the agricultural sector. Manufacturing has maintained a surprisingly steady share of employment (~13%) and value added (~20%). Meanwhile, manufacturing and services have been the main drivers of labour productivity growth. Similar trends are observed in total factor productivity growth across sectors. Thus, manufacturing has been an important driver of overall productivity growth, though services have played the dominant role [2].

Recent years have witnessed a growing optimism about the potential for Indian economic growth. In part, this is fuelled by the example of strong sustained growth in China, raising the obvious question of why India cannot do as well. However, the optimism also reflects the fact that India's growth has accelerated over the past two decades. And while its growth rate remains well below that of China, this favourable performance contrasts with the slowing of growth in other regions. It has also enabled the emergence of a significant middle class in India [3].

2. Structural Changes in Indian Economy

Everything that grows also changes its structure. Just as a growing tree constantly changes the shape, size, and configuration of its branches, a growing economy changes the proportions and interrelations among its basic sectors—**agriculture, industry,** and **services** and between other sectors—rural and urban, public and private, domestic- and export-oriented. Are there common patterns in how growing economies change? Which changes should be promoted and which should be discouraged?

One way to look at the structure of an economy is to compare the shares of its three main sectors—agriculture, industry, and services—in the country's total output and employment. Initially, agriculture is a developing economy's most important sector. But as income per capita rises, agriculture loses its primacy, giving way first to a rise in the industrial sector, then to a rise in the service sector.

These two consecutive shifts are called industrialization and post-industrialization (or "deindustrialization"). All growing economies are likely to go through these stages, which can be explained by structural changes in consumer demand and in the relative labour productivity of the three main economic sectors.

As people's incomes increase, their demand for food—the main product of agriculture—reaches its natural limit, and they begin to demand relatively more industrial goods. At the same time, because of new farm techniques and machinery, labour productivity increases faster in agriculture than in industry, making agricultural products relatively less expensive and further diminishing their share in gross domestic product (GDP).

The same trend in relative labour productivity also diminishes the need for agricultural workers, while employment opportunities in industry grow. As a result industrial output takes over a larger share of GDP than agriculture and employment in industry becomes predominant.

As incomes continue to rise, people's needs become less "material" and they begin to demand more services—in health, education, entertainment, and many other areas. Meanwhile, labour productivity in services does not grow as fast as it does in agriculture and industry because most service jobs cannot be filled by machines. This makes services more expensive relative to agricultural and industrial goods, further increasing the share of services in GDP. The lower mechanization of services also explains why employment in the service sector continues to grow while employment in agriculture and industry declines because of technological progress that increases labour productivity and eliminates jobs. Eventually the service sector replaces the industrial sector as the leading sector of the economy.

Most high-income countries today are post industrializing—becoming less reliant on industry-while most low-income countries are industrializing- becoming more reliant on industry. But even in countries that are still industrializing, the service sector is growing relative to the rest of the economy. By the mid1990s services accounted for almost two-thirds of world GDP, up from about half in the 1980s.
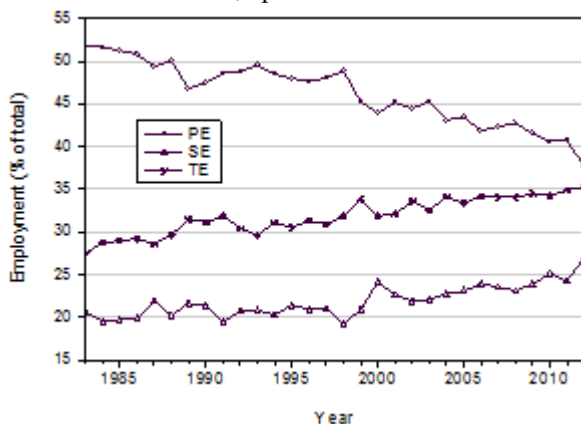

Figure 1: Changes in the Economic Structure of Indian Economy
Source: Author

According to the figure 1, employment in primary started decreasing since 1980s while employment in industry and service began increasing. It represented the structural change from agricultural-based country to be more industrialized and serviced. In 1983, 52 % of employment was in primary while 21% and 27% were in secondary and tertiary sector, respectively. In 2012, structure was totally changed. Proportion of employment in primary sector decreased to 38 % while increased to 27% and 35 % in secondary sector and tertiary sector, respectively. However, the majority of employment was still in primary sector i.e., agricultural sector. Rice, Wheat, Oilseeds, rubber, was industrial or economic crop in India. But the poor in India were, by majority, farmer due to unstable price. For winning election, government would very much like to intervene crop product by price floor or price ceiling. With the problem of inefficient administration and corruption, the policy was failed.

Besides the revenue used to promote agriculture market, India has accepted the way of international economic interdependent by encouraging investment and secondary sector. Many institutions were established aimed at managing and operating a flow of funds from multi-enterprise. Additionally, service sector was dramatically increasing, for example, financial sector (Banking), tourism (hotel and restaurant), and telecommunication. The study of ADB (2013) found that services sector plays a major role to India's economic growth. Thus, policies should be issued in supporting this sector. However, secondary sector i.e., industrial sector is the main source of national prosperity, especially, the developed countries. Newly Industrialized Country (NIC) like India should not reject this kind of strategy also.

3. Objectives

The purpose of this study was twofold:
1. Firstly, to investigate the effects of changing economic structure in three kinds of pace including agricultural-based economy, industrial-based economy, and service-based economy on economic performance.
2. Secondly, to examine the link between structural change and growth in the Indian economy.

4. Review of Related Literature

Cortuk, D., etal. (2013) examined the link between structural change and growth in India. It constructs indices of structural change, and performs a panel data analysis using data for India's 16 major states. It finds that there is one-way positive impact from structural change to growth for the period 2000-2006[4].

The study of Virmani(2004) found that since independence trend growth of Gross domestic product (GDP) and Net domestic product (NDP) has gone through one complete cycle (growth cycle) with a trough in 1971-72 and a peak in 1994-95. The trend started at around 4.8% per annum in 1951-2 and is currently around the same level. The trends in growth of NDP per capita and NDP per worker were almost identical [5].

The study of Fuad M. Kreishan(2010) recommended that economic policies related to demand management would not have an important effect in reducing unemployment rate. Accordingly implementation of economic policies oriented to structural change and reform in the labour market would be more appropriate by policy makers in Jordan[6].

This study of Fan.,S. Etal.(2003), develops a new analytical framework to account for sources of rapid economic growth in China. The traditional Solow approach is expanded to include another source of economic growth—structural change. Their study show that structural change has contributed to growth significantly by reallocating resources from low-productivity sectors to high-productivity sectors [7].

5. Data and Methodology

5.1 Data

For the analysis we used the annual growth rates of GDP are calculated by using the time series data of GDP at constant prices from 1983 to 2012. The economic structures of Indian Economy are represented by the % share of employment on primary (Primary sector includes the Agriculture and allied activities), secondary (Secondary sector includes the Mining, manufacture, electricity, gas, water, etc. And construction) and tertiary (Tertiary sector includes the Trade, Hotels, transport, storage and communication) sectors out of total employment in both public and private sectors. The time series of employment for the year 1984, 1985, 1986, 1988, 2007, 2009 and 2011 are missing which are interpolated using trend model. The data on real GDP and different sectors employment levels for the period are taken from various issues of Hand book of Statistics on Indian Economy published by RBI. The main objective of using real variable is to eliminate and offset the inflationary effects from the variable. The following variables are considered for the present study:
GDP= Annual growth rates of GDP
PE= Percentage share of employment in primary sector.
SE= Percentage share of employment in secondary sector.
TE= Percentage share of employment in Tertiary sector.

5.1.1. Empirical Model
Log-linear model was the main tool in analyzing. The coefficient of regressor in log-linear model was normalized as elasticity. Then, it was economic growth elasticity of an increase in employment in each sector. With time series data of the percentage of employment in agricultural, industrial, and service sector to total employment from 1983 – 2012, stationary test should be implemented firstly before running simple regression. There are three models as written;

$$Log(GDP) = \alpha + \beta \log(PE) \qquad (1)$$

where Log(GDP) stands for log of growth rate of GDP, log(PE) stands for log of the proportion of employment in agricultural sector to total employment, and stands for economic growth elasticity of an increase in agricultural employment.

$$Log(GDP) = \alpha + \beta \log(SE) \qquad (2)$$

where Log(GDP) stands for log of growth rate of GDP, log(SE) stands for log of the proportion of employment in industrial sector to total employment, and stands for economic growth elasticity of an increase in industrial employment.

$$Log(GDP) = \alpha + \beta \log(TE) \qquad (3)$$

where Log(GDP) stands for log of growth rate of GDP, log(TE) stands for log of the proportion of employment in service sector to total employment, and stands for economic growth elasticity of an increase in service employment.

Unit root test for time series data

For estimating whether there is a long term equilibrium relationship between income (GDP) and economic structures, recent studies have used time series analysis of these variables. However, time series analysis poses a number of methodological issues. The regression method can only be used if the time series data are stationary. Stationary in the time series refers to a condition whether the time series has a constant mean and constant variance. Thus, in finding the relationship between the GDP and economic structures, the stationary condition of the time series is essential. The following two stationarity tests were used in order to test the time series properties:
1. The Augmented Dickey Fuller (ADF) Test
2. The Phillips-Perron (P-P) Test

5.3.1. Augmented Dickey Fuller (ADF) Test[8]
It considers an Autoregressive process of order one i,e., AR(1) process.

$$Y_t = \mu + \rho Y_{t-1} + \varepsilon_t \qquad (4)$$

where μ and ρ are parameters and ε_t is assumed to be white noise (White noise here refers to those error terms which are not only unautocorrelated but also are independent) Y_t is a stationary series if $-1 < \rho < 1$. If $\rho = 1$, Y_t is non-stationary series (a random walk with drift). For testing the hypothesis of Unit root, the null hypothesis (Ho) is set as Ho : $\rho = 0$, against $H_1: \rho < 1$ The test is carried out by estimating an equation with Y_{t-1} subtracted from both sides from equation (5.2.1) as follows:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \varepsilon_t \qquad (5)$$

where $\gamma = \rho - 1$ and then the null hypothesis and alternative hypothesis becomes
Ho : $\gamma = 0$ against $H_1 : \gamma < 0$

Under the null hypothesis of unit root, the t- test for the estimated γ does not follow the conventional t -distribution. Because of this, on the basis of Monte Carlo Simulations both Dickey and Fuller tabulated the critical values known as tau (τ) statistic. So, the test is also known as tau test. This tau (τ) statistic is generally negative. In order to capture the higher order correlation both Dickey and Fuller added lagged differences terms of the dependent variables Y_t to the

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right hand side of the regression and thus obtained the following regression equation:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \delta 1 Y_{t-2} + \delta 2 Y_{t-3} + \ldots\ldots\ldots + \delta p Y_{t-p} + 1 + \varepsilon_t \quad (6)$$

This augmented specification is then used to test the null hypothesis, $H_0: \gamma = 0$ against $H_1: \gamma < 0$, in the regression. An important result obtained by Fuller was that the asymptotic distribution of t- statistic on γ is independent of the number of lagged first differences included in the ADF regression. A high negative value of Dickey Fuller statistic (τ-statistic) indicates the rejection of the null hypothesis of stationary of the series.

5.3.2. Phillips-Perron(P-P) Test [9]
Phillips and Perron(1988) propose a non-parametric method of controlling for higher order serial correlation in a series. The test regression for the Phillips -Perron test for AR (1) process is as follows:

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \varepsilon_t \quad (7)$$

while the ADF test corrects the higher order serial correlation by adding lagged differenced terms on the right hand side of the regression, whereas P-P test makes a correction to t - statistic of the β coefficient from the AR(1) regression to account for the serial correlation in ε_t. The correction is non-parametric since they used an estimate of the spectrum of it at frequency zero that is robust to heteroscedasticity and autocorrelation of known form. Most of the econometric software uses the Newey-West heteroscedasticity and autocorrelation consistent estimate:

$$w^2 = \gamma_0 + 2 \sum_{j=1}^{q} \left\{ 1 - \frac{j}{q+1} \right\} \gamma_j \;;$$

$$\gamma_j = \frac{1}{T} \sum_{t=j+1}^{T} \left(\hat{\epsilon}_t \hat{\epsilon}_{t-j} \right)$$

where q is the truncation lag. The P-P test statistic is computed as

$$tpp = \frac{t_b \sqrt{\gamma_0}}{w} - \frac{(w_2 - \gamma_0) T s_b}{2 w \sigma}$$

where t_b and s_b are the t- distribution and standard error of the regression. The asymptotic distribution of the P-P test statistic is same as ADF test statistic. Similarly, the P-P test critical values are also generally negative and hence the null hypothesis of unit root is rejected, if the calculated P-P statistic is a high negative value.

6. Econometric Results

6.1. Unit root test for Time Series Data

For stationary test, employment in primary sector was stationary at the first difference level by 1% significance level. Similarly, Employment in secondary sector and Employment in tertiary sector was stationary at first difference by 1% significance level. The growth rate of GDP was also stationary at the first difference level by 1% significance level.

Table 1: Unit root test for time series data

Variables		ADF	
		c	ct
GDP	level	-4.2379*	-4.4321*
	1st diff	-4.8827*	-7.1027*
PPE	level	-0.1313	-2.9587
	1st diff	-6.6384*	-6.5920*
PSE	level	-0.9814	-3.6597**
	1st diff	-5.7480*	-5.8538*
PTE	level	-0.9949	-4.9367*
	1st diff	-4.3561*	-4.3481*
		P-P	
GDP	level	-4.1663*	-4.8322*
	1st diff	-10.6805*	-10.6781*
PPE	level	1.0436	-2.9587
	1st diff	-8.2734*	-10.1657*
PSE	level	-0.6214	-3.6700**
	1st diff	-9.1460*	-16.9058*
PTE	level	-1.5129	-4.9322*
	1st diff	-14.4839*	-14.0981*

Source: Author's estimation

*, ** and *** indicates 1%, 5% and 10% level of significance

Note: c and ct denotes constant and constant and trend which is included in model while testing unit root.

Firstly, let us analysis the relationship between growth of the economy and employment in primary sector. The result suggested that an increase in employment in primary (agricultural) sector by 1 % can create a decrease in growth of GDP by 6.197%. R^2 was 91.22%. The result was statistically significant.

Secondly, let us analysis the relationship between growth of the economy and employment in secondary sector. The result suggested that an increase in employment in secondary (industrial) sector by 1 % can create an increase in growth of GDP by 5.4163%. R^2 was 70.96% which show the strong relationship. The result was statistically significant.

Table 2: Estimated log linear model of (1), (2) and (3) using Neway-West & HAC estimator.

a)Relationship between growth rate and primary sector employment
$Log(GDP) = 33.770 - 6.197 * PE + e_t$
(22.44*) (-15.70*)
$R^2 = 0.9122$ Adj-$R^2 = 0.9091$ D.W.=1.23
Log likelihood for GDP=-288.053
b) Relationship between growth rate and secondary sector employment
$Log(GDP) = -6.6689 + 5.4163 * SE + e_t$
(-2.738**) (6.919*)
$R^2 = 0.7096$ Adj-$R^2 = 0.699$ D.W.=1.17
Log likelihood for GDP = -306.003
c) Relationship between growth rate and tertiary sector employment
$Log(GDP) = -15.4178 + 7.358 * TE + e_t$
(-7.807*) (12.79*)
$R^2 = 0.89$ Adj-$R^2 = 0.865$ D.W.=1.36
Log likelihood for GDP = -293.93

Source: Author's estimation using gretl.

Thirdly, let us analysis the relationship between growth of the economy and employment in tertiary sector. The result suggested that an increase in employment in tertiary (service) sector by 1 % can create an increase in growth of GDP by 7.358 %. R^2 was 87%. The result was statistically significant.

7. Conclusion

With the reliable econometric method and data availability in the sense of time series, any increase in employment in primary sector in India yields a negative effect on economy. However, an increase in other sectors viz; secondary and tertiary sectors, positively affects economic performance. Especially service sector can give better positive effect on the growth of GDP of the country than that of the industrial sector.

8. Policy Suggestions

1) Government should cut any programs that supports an expand in agricultural sector, especially market intervention, for example, rice pledging which can create an artificial incentive for people to be a new farmer so as to get the benefit from the program.
2) India should reform to be service-based country like many developed countries. Service sector requires high quality of labour. Then, an improvement in education and health system should be policy priority.
3) Industrial sector also yields the positive effects to economy but its effect is statistically significant but smaller than that of service sector. However, infrastructure and political stability are together important factors in supporting this sector.

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