Shapley Value Decomposition of the Income Inequality and Productivity Growth of the Indian Economy

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In this paper we have examined the contribution of different sub-sectors to the overall inequality of the Indian economy over the last forty years. This has been achieved by Integrating the framework of Shapley Decomposition and the Frontier approach to Productivity analysis that decomposes the inequality indexes either by factor components or by sub populations. In line with the Shapley Decomposition the methodology can track the marginal change in Inequality that emanates from the productivity change and also from the different component of the productivity change. Thus, the methodology can estimate the how much of the inequality of the income is contributed from efficiency change, technology change and capital-labour ratio change. The methodology also enables us to find the contribution of each subsectors of the economy like for example the contribution of the primary, secondary and tertiary sector and the productivity of the three sub-sectors to the overall inequality of the economy. The methodology can also be employed to study the extent of inequality for different sub population (like for example the gender, race, caste) for the overall inequality of the society. In other words, the method enables us to deal with the influence of population sub group such as those defined by age, sex or race and the contribution of each of these sub-groups to overall inequality of the Indian economy. The framework proposed above also covers situation in which the contributions of the different components of the total income to the overall inequality of the economy is also examined. Thus, if we disaggregate the total income into several factor components like earning, property income and transfers, we wish to evaluate the contribution of each source to the aggregate inequality.

This is achieved because Shapley value of the player in coalitional game theory is the average of all the marginal contributions that this individual can make to all coalitions. Employing the same principal for the productivity analysis we have examined how the productivity and the different components of the productivity contributes to the overall growth of an economy.

We apply the methodology to analyze the relationship between inequality and productivity profile of growth both at the aggregate level and by the sectors. Using the frontier approach of the productivity

analysis we decompose the productivity growth of the labor into its different components and empirically analyze how each components affects the overall inequality of the economy.

We have applied this methodology to trace the Inequality of GDP and Productivity growth of the different states of India and for different sub-sectors of the economy. The analysis employs the real per capita net state domestic product (NSDP) of the 15 major Indian States for the period 1960-61 to 2008-2009 at the aggregate and sectoral levels. We have considered three different sectors viz., primary (agriculture and allied sector), Secondary and Tertiary Sector for the purpose of our analysis. The NSDP series has been measured at constant (1993-94) prices. Applying the methodology, we find the following result: In the year 1960 the Gini index of the distribution of GDP among the 15 states is 0.2849 and the contributions of sectors are as follows: 46,44 % for the Primary sector; 21,09% for the Secondary sector; 32,46% for the tertiary sector. This means that the overall inequality in 1960 in India would have been 46,44% lower if the GDP of the Primary sector would have been equally distributed across Indian States.

The methodology has been applied for the next 40 years and it was found that it is the Tertiary Sector that contributes most to the overall inequality of the economy. We also applied the method for the productivity of the economy and we have found that the contributions from sectoral productivity growth and contributions from employment shift across sectors is the principal cause for the increase in inequality for the states. While productivity growth in services and agriculture contributed significantly to the rise in the inequality of the economy; we find that the productivity growth in manufacturing and the contribution from technological growth has played a significant role in the fall in the inequality of the society.

Our study contributes to the field of inequality in the following ways: a) We have illustrated how the principles of general tools of cooperative game theory can be applied to develop a more generalized measure of inequality. The use of marginalized principle is the basis of our measure. b) We have integrated the inequality measure with the frontier approach to productivity analysis to understand the contribution of the different components of the productivity in the overall growth of inequality in the economy.