An Input-Output Approach to Forecasting Gross Domestic Output and Employment Intensities by Sectors

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Abstract: The purpose of this paper is to integrate two commonly known input-output models of Leontief and Stone for employment analysis. Although assumptions of Leontief model are somewhat different from Stone’s model, the empirical analysis can be conducted ignoring the difference between competitive and noncompetitive imports in the initial stage. The Leontief model is used to make predictions of gross domestic output on the basis of predicted imports and final demand by sectors. The predicted output is used to derive employment by sectors for a target year and this in turn is used in Stone’s input-output framework for the analysis of total labour intensity by sectors. The approach on the estimates of labour intensity by sectors is illustrated using Japan’s input-output data.

Introduction

The purpose of this paper is to combine two common input-output models 3) for predicting gross domestic output, and employment intensities per unit of final demand in each of the sectors of the economy. The use of input-output model for employment analysis requires data on domestic input coefficients matrix. Domestic coefficients matrix will be more likely to change than technology matrix yielding change in employment intensity by sectors. The changes in domestic matrix could be induced through changes in product mix, and substitution of domestic for imported commodities although it could be the case that technology matrix might have remained stable. The current practice with the statistical offices of various governments is to compile an input-output table on the basis of manufacturing censuses carried out once in five years. Annual tables are very uncommon and the prepared annual tables are based on RAS 4) forecasts of technology matrix. The assumption that the production technolo-

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3) The first model is the standard Leontief input-output model while the second one is due to Stone (1969). Both of these models are summarised in Section 1 of this paper.
4) The basis of RAS method is the hypothesis that various determinants of changes in input-output coefficient (economies of scale, technological evolution, variation in relative prices) may be summarised by biproportional relationships in which each industry is characterised by a pair of substitution and fabrication multipliers which are assumed to operate uniformly over the rows and columns of the input-output matrix.
gy does not change over the projection period is made in this paper, although this can be relaxed using the RAS [Parikh, 1979] method for forecasting technology on the basis of marginal totals in intermediate inputs and outputs. Even with this assumption, exogenous prediction of imports and final demand by sectors becomes necessary in order to estimate the future levels of sectoral gross domestic output.

The integration of Leontief model with Stone’s input-output model is suggested for forecasting employment intensities by sectors which requires the use of forecasts of gross domestic output by sectors through the Leontief model in which all imports are treated exogenously. The gross domestic output predictions are used for deriving import coefficients matrix on the basis of proportional allocation method (equivalent to market share approach) of imports in Stone’s model where imports are treated endogenously. The use of estimated import coefficients matrix with target year’s technology matrix will yield the estimated domestic coefficients matrix which can be used along with the labour coefficient for a target year for predicting employment intensities by sectors. The labour coefficient of the target year will bear the observed productivity changes of that year sector by sector.

The principal contribution of this paper lies in proposing an indirect approach in predicting total employment intensity by sectors for the target year. Most of the analysis is confined to two input-output models namely (i) Leontief version in which imports are treated exogenously and (ii) Stone model in which imports are treated endogenously and intermediate imported inputs are expressed in coefficients form as a fixed proportion of gross domestic output. The Leontief version treats all imports as competitive while Stone version treats all intermediate imports as non-competitive (complementary). There are thus some differences in the underlying assumptions of two models but for employment analysis, the integration or joint use of both approaches will yield the estimates of total employment intensities which can be useful for policy decisions.

The suggested use of two input-output models is made for Japan. The choice of Japan was made because of a sound base-year input-output table in which both the Hawkins-Simon and the condition that final demand exceeds imports of a sector (column of imports) were satisfied. Japan probably has a good data base and one need not have to estimate domestic coefficients matrix for a future year but it was with a view to demonstrate the use of our methodology, that Japan was chosen as an illustrative case.

In Section 1, the models and underlying assumptions are presented, whilst in Section 2, the predictions of imports and final demand are discussed. In Section 3, the simple model for estimating demand for labour is outlined and in Section 4, the predictions of imports and final demand made in Section 3 are used for the estimation of gross domestic output by sectors for 1980. The predicted gross domestic outputs are then used to derive the employment by sectors. Subsequently, labour coefficients in

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5) RAS method is not very successful for making predictions of technology matrix as shown by Parikh [1979].

6) If imports of a sector exceed the final demand of a sector, then gross domestic output in Leontief version will be negative.