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Decomposition Methods for Analyzing Intra-regional and Inter-regional Income distribution

Srinivas Raghavendra†

Abstract

In this paper we propose to study the world income distribution in the framework of Richard Stone-Richard Goodwin decomposition method [Goodwin, EJ 1949 and JPKE 1980, Stone’s foreword to Pyatt-Roe, 1977]. The objective here is to collate the social accounting matrices of a group of nations with ROW treated exogenous and decompose the transactions matrix, in a common unit of account, to delineate effects of intra (‘direct effects’) country income disparity from inter (‘cross effects’) group income disparities. This decomposition is pertinent from the point of view of understanding whether the inter-regional income disparities are mainly mediated through the intra-regional income disparities implied by their structure of production and thereby assessing the impact of various growth policies on the macro structure of the economies.

Keywords: World income distribution, growth, social accounting matrix
JEL Codes: D31, F43, O41

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The decade of the nineties witnessed the revival of empirical growth literature, which brought with it a renewed interest in question of the world distribution of income. Treating the world economy as a closed unit, there are number of methods proposed in the literature to estimate the distribution of world income – ranging from calculating per capita GDP of individual countries (Quah, 1996), Jones (1997), or calculating population-weighted GDP per capita taking into account the within-country income disparities (Bourguignon and Morrisson, 2002) to integrating individual country density functions to construct the world income distribution (Sala-i-Martin, 2002). In another interesting study an attempt has been made to decompose the total inequality between the individuals in the world, by continents and regions (Milanovic, 2002).

In this paper we propose an alternative framework to study the world income distribution based on the method proposed by Richard Stone-Richard Goodwin (Goodwin, 1949 & 1980, Stone’s foreword to Pyatt-Roe, 1977). The underlying idea in these methods is the emphasis placed on the intertwining of the question of income distribution with the existing structure of production, where income distribution affects final demand, and hence the structure of production and the structure of production, in turn, influences factor demands and hence the structure of income distribution.

Given that the world economy is a closed unit and the constituent economies are inextricably interwoven through the process of globalization, it is then obvious that the issue of income distribution of the world economy as a whole is interrelated to questions of structural interdependencies through trade among its members. This question of linkages between economic systems and the spillover and possible feedback effects is not new in the literature and it dates back to Machlup (1943), Goodwin (1949) and Metzler (1950).

Richard Goodwin, in his pioneering work, formalized the structural interdependencies in an economy by computing the compound-matrix multiplier using the Leontieff input-output table. Metzler’s proposition was to understand ‘the mechanism by which an
expansion or contraction of income in one region or country is transmitted to other regions or countries … the conclusions apply without modification to the regions within a single country, or, indeed to any regional classification of the world economy, such as the economies comprising Eastern Europe, Western Europe, Latin America, and similar regions.\(^1\) These important results coincided with the international efforts to systematically organize a system of social accounts going beyond the simple Keynesian income categories.\(^2\)

These two developments served as the initial condition for Richard Stone’s proposal for reclassifying the social accounting matrix and decomposing the compound-matrix multiplier to separate out the intra (‘own’) and inter (‘indirect’) components. Pyatt and Roe (1977) conducted the first empirical exercise along these lines for the Sri Lankan economy to understand the interrelation between the structure of production and income distribution. Subsequently, Richard Goodwin (1983) used this decomposition technique to develop a world trade multiplier to analyze the interrelation between unemployment and world trade.

Given this history of analyzing the income distribution in an accounting framework, it seems reasonable to use this method for analyzing the world income distribution instead of relying on probabilistic approaches. This decomposition is pertinent from the point of view of understanding whether the inter-regional income disparities are mainly mediated through the intra-regional income disparities implied by their structure of production and thereby assessing the impact of various growth policies on the macro structure of the economies.

In this paper we discuss how this technique could be harnessed to study the question of world income distribution. In the following section, we briefly discuss the aggregate

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1. Metzler (1950, p. 329)
SAM framework in a regional perspective. In section 3 we show how this decomposition method could be used in the case of two regions and discuss the economic implications of different multipliers and in section 4 we generalize the this procedure for three regions and discuss various limitations of such an exercise in extending it to higher order geographical dimensions. In section 5 we conclude by some general remarks on applying this method to India including those of data requirement and its consistency.

§ 2
The principle of a Social Accounting Matrix (henceforth SAM) is really nothing more than that of double entry bookkeeping in accounting. A SAM is a series of accounts in each of which incomings and outgoings must balance and what is ‘incoming’ into one account must be ‘outgoing’ from another account. In this respect, a SAM resembles traditional national accounts. For want of space, we shall keep the discussion on the framework of a SAM at the most aggregated level, which will bring out the essential point underlying this analysis. The SAM for any region would have some principal accounts pertinent to the region and two accounts relating to current and capital transactions with the rest of the world. For each region, considered as part of an integrated system, each of the own-region ‘domestic’ accounts records incomes and outlays wholly within the region as well as the origin of receipts and destination of payments externally.\(^3\) The external transactions are recorded in some detail between the region and other regions, and the rest of the world.

Essentially embracing the concepts developed by Stone (1961), a distinction has been drawn between functional flows (transactions) and geographical (interregional) flows.\(^4\) Thus, all transactions between different functional accounts are represented as taking place within each region. Inter-regional flows in the accounting system therefore represent transfers, which simply augment the receipts of an account in one region and simultaneously deplete the same (functional) account in the other region. In sum,

\(^3\) For a detailed account of the social accounting framework and the decomposition technique, see Pyatt et al. (1977) or Pyatt and Round (1979)

\(^4\) Or one could use the terminology of ‘endogenous’ and ‘exogenous’ accounts for ‘functional’ and ‘interregional’ flows.
therefore, this way of representing regional accounts allows the functional and geographical elements of transactions to be clearly distinguished. The idea here is to collate the social accounting matrices for different regions according to these broad principles and analyze the linkages between economic systems and the spillover and possible feedback effects one system may have on another by decomposing the transactions matrix, in a common unit of account, to delineate effects of intra (‘direct effects’) country income disparity from inter (‘cross effects’) group income disparities.

§3
In the multiplier decomposition studies the objective is to delineate the effects and linkages that may take place between the designated endogenous accounts and the accounts exogenous to the system. In a study that covers a broader geographical dimension, say, a country or a region, say EU etc., these designated categories and their disaggregations must be carefully done to avoid inconsistencies so that the final, reclassified transaction matrix be of a good representation of the production structure of the economy or a group of economies in question. In this section, first we shall consider a simplified two-region system and then generalize to a three-region system to show how the decomposition technique results in different multipliers and in that process, we shall also discuss some of the limitations of this exercise for higher-order systems.

In the case of two-region systems, by endogenising households as well as factors of production, the impact multiplier \( M \) of exogenous outlays \( x \) on endogenous income \( y \), represented as

\[
y = Mx
\]

(1)
captures the reciprocal relationship between income distribution and the structure of production. But it can further be shown that \( M \) can be multiplicatively decomposed to give

\[
y = M_3M_2M_1x
\]

(2)
where the components of \( M \) can be ascribed to the separate effects of multipliers wholly within a group of accounts (\( M_1 \)); the effect of an exogenous injection which feeds back upon itself but via other parts of the system (\( M_2 \)); or simply the effect of an increase in
income in one group of accounts has upon another \((M_i)\). The separation of these effects gives a useful picture of structural independence within the endogenous accounts of the system. The derivation of the compound multiplier from the transaction matrix is as follows.\(^5\) Defining \(U\) as the matrix of endogenous account transactions, bordered by the vector \(x\), a row vector \(w'\) of payments by endogenous accounts to the consolidated exogenous account, and a scalar \(\psi\) representing the consolidated payment between exogenous accounts; then the complete social accounting matrix \(S\) where

\[
S = \begin{bmatrix}
U & x \\
\psi & w'
\end{bmatrix}
\]

has the property that

\[
Si = S'i = \begin{bmatrix}
y \\
\theta
\end{bmatrix}
\]

where \(y\) is the vector of endogenous account totals and \(\theta\) a scalar of total receipts and payments by the exogenous account. Thus defining

\[
U = A\hat{y}
\]

where \(A\) is a matrix of average propensities with respect to income across the broad group of endogenous transactions. From these definitions, it follows that

\[
y = (I - A)^{-1}x = Mx
\]

where \(M\) is the compound accounting multiplier showing the effect of exogenous injections \(x\) on endogenous income \(y\) at given prices. Extending the basic SAM and decomposing multipliers further according to regional dimension means that attention will be focused on the patterns of inter-regional trade and transfers and their impact on income distribution. The decomposition technique proposed by Richard Stone can be derived for a two-region system, by reorganizing and reclassifying the transaction matrix as outlined above. This can be expressed analytically as follows:

\[
S = \begin{bmatrix}
U_{11} & \hat{u}_{12} & x_1 \\
\hat{u}_{21} & U_{22} & x_2 \\
w'_1 & w'_2 & \psi
\end{bmatrix}
\]

where the account totals are

\(^5\) The detailed derivation of the compound multiplier and its decomposition is found in Pyatt and Roe (1977), Pyatt and Round (1979) and Round (1985).
\[ Si = S'i = \begin{bmatrix} y_1 \\ y_2 \\ \theta \end{bmatrix} \]

The analytical structure of S would be maintained even if the endogenous accounts were disaggregated further into say, separate factor, household or commodity accounts. This is the advantage of this method – one can do this analysis for different levels of disaggregation to study the impact of exogenous injections on various accounts. Expressing the proportion of inter-regional transfers from region i to j as a proportion of total outlays in region i as \( \hat{c}_{ij} \), where

\[ \hat{u}_{ij} = \hat{c}_{ij} y_i \]

and \( U_{ii} \) as the product of average propensities \( C_{ii} \) and total outlays \( y_i \),

\[ U_{ii} = C_{ii} \hat{y}_i \]

gives a final two-equation system in y and x:

\[ \begin{align*}
y_1 &= C_{11}y_1 + \hat{c}_{12}y_2 + x_1 \\
y_2 &= \hat{c}_{21}y_2 + C_{22}y_2 + x_2
\end{align*} \]

(11)

The commodity trade element of \( \hat{c}_{ij} \), shows the proportion of imports to the total supply (domestic plus imports) in region i. This may be written as

\[ \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} C_{11} & \hat{c}_{12} \\ \hat{c}_{21} & C_{22} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} + \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \]

(12)

and solved as

\[ \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} \left(I - C_{11}\right)^{-1} & 0 \\ 0 & \left(I - C_{22}\right)^{-1} \end{bmatrix} \begin{bmatrix} \hat{c}_{12} & y_1 \\ \hat{c}_{21} & y_2 \end{bmatrix} + \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \]

(13)

This becomes

\[ \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} 0 & B_{12} \\ B_{21} & 0 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} + \begin{bmatrix} \left(I - C_{11}\right)^{-1} & 0 \\ 0 & \left(I - C_{22}\right)^{-1} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \]

(14)

where \( B_{12} = \left(I - C_{11}\right)^{-1} \hat{c}_{12} \) and \( B_{21} = \left(I - C_{22}\right)^{-1} \hat{c}_{21} \) so that

\[ \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} I & -B_{12} \\ -B_{21} & I \end{bmatrix}^{-1} \begin{bmatrix} \left(I - C_{11}\right)^{-1} & 0 \\ 0 & \left(I - C_{22}\right)^{-1} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \]

(15)

or

\[ y = M M_1 x \]

(16)
where \( y \) and \( x \) are stacked vectors of endogenous account incomes and exogenous outlays, respectively; and \( M \) and \( M_1 \) are multiplier matrices since \( M \geq I \) and \( M_1 \geq I \). Together, they capture the total repercussions within and between endogenous accounts in the inter-regional systems.

\( M_1 \) is the intra-regional multiplier matrix. It shows the multiplier effects that result from linkages wholly within each of the regions taken separately. Thus, an exogenous outlay of \( x_1 \) in region I may create multiplier repercussions within that region via \( (I - C_{11})^{-1} \), but the zero off-diagonal sub-matrices indicate that the multiplier matrix as a whole capture no inter-regional repercussions; and similarly for region 2.

The second component of the overall multiplier matrix, which premultiplies the intra-regional multiplier matrix in equation (16), is \( M \) and this may referred to as the ‘inter-regional’ multiplier matrix. It captures all of the (spatial) repercussions between the accounts of one region and those of the other, but it excludes all of the ‘within region’ effects since these have already been accounted for by \( M_1 \). Note that the inter-regional multiplier essentially depends upon the linkages represented by \( \hat{c}_{12} \) and \( \hat{c}_{21} \), and the degree of departure of \( M \) from the identity matrix depends on the strength of bilateral trade linkages and other endogenous inter-regional transfers. This can be seen by multiplicatively decomposing the inter-regional multiplier matrix \( M \) further.

\[
M = \begin{bmatrix} I & -B_{12} \\ -B_{21} & I \end{bmatrix}^{-1} \\
\times \begin{bmatrix} (I - B_{12}B_{21})^{-1} & (I - B_{12}B_{21})^{-1}B_{12} \\ (I - B_{21}B_{12})^{-1}B_{21} & (I - B_{21}B_{12})^{-1} \end{bmatrix} \\
= \begin{bmatrix} (I - B_{12}B_{21})^{-1} & 0 \\ 0 & (I - B_{21}B_{12})^{-1} \end{bmatrix} \begin{bmatrix} I & B_{12} \\ B_{21} & I \end{bmatrix} \\
= M_3M_2, \tag{17}
\]

where \( M_3 \) and \( M_2 \) represent the matrices in equation (17). Like \( M_1, M_3 \) is block diagonal and hence shows the extent to which outlays in one region affect the incomes of
endogenous accounts in the same region. But $M_3$ shows the component multipliers accounting for inter-regional feedback effects and may therefore be referred to as an inter-regional ‘closed-loop’ multiplier matrix. The matrix $M_2$, is also a multiplier matrix (since $M_2 \equiv I$ ) and has identity matrices in its diagonal. Analogous to the decomposition in equation (2), $M_2$ is an inter-regional ‘open loop’ multiplier matrix. It captures the effect that one region has upon the other, after accounting for all ‘own-region’ effects and hence the block diagonal matrices are identity matrices. The total inter-regional multiplier effect for ‘own-region’ is obtained as the product of corresponding diagonal blocks of $M_3$ and $M_1$; while the equivalent multiplier effect of one region upon the other is the product of the appropriate inter-regional ‘open loop’ effect and the total ‘own-region’ effect for the former region. Hence the total multiplier relationship for the two-region system can be expressed as

$$y = M_3 M_2 M_1 x$$

(18)

This clarifies the nature of the separate effects involved in the regional system and the decomposition technique would be great help in delineating the different effects of exogenous injections on the endogenous accounts.6

Considering the above technique for a three-region system to trace out the effects of a multilateral trade on endogenous accounts, the analogue of equation (12) is

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} C_{11} & \hat{c}_{12} & \hat{c}_{13} \\ \hat{c}_{21} & C_{22} & \hat{c}_{23} \\ \hat{c}_{31} & \hat{c}_{32} & C_{33} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

(19)

and solution for the system is

$$y = (I - B)^{-1} (I - C)^{-1} x$$

(20)

where $(I - C)^{-1} = \begin{bmatrix} (I - C_{11})^{-1} & 0 & 0 \\ 0 & (I - C_{22})^{-1} & 0 \\ 0 & 0 & (I - C_{33})^{-1} \end{bmatrix}$

6 The matrix $M_1$ has some interesting features, especially in so far as it related to the phenomenon of ‘cross-hauling’ of commodities between regions, although it more general and related to all inter-regional transfers. For two-region systems, the cross-hauling phenomenon is especially simple (two-way trade between two regions). However, for third and higher-order systems, the nature of the cross hauls is more complex. See Round (1985) for a detailed exposition on this issue.
As in the two-region case, equation (20) may be viewed as the product of an inter-regional multiplier $M$ and intra-regional multiplier $M_i$, where

$$M_i = (I - C)^{-1} \quad \text{and} \quad M = (I - B)^{-1}.$$  

However, unlike the two-region case $M$ does not exhibit the same simple structure for immediate further decomposition to inter-regional open and closed loop effects. For example, consider the way in which exogenous outlays in one region may leak into other regions and feedback on to itself. In this three-region system there are four routes. For any region say region 1, there are two finds of bilateral feedbacks (via region 2 and region 3) and two kinds of trilateral feedbacks (via region 2 first and then region 3, or region 3 first and then region 2). These direct and indirect effects can be calculated and decomposed from the inter-regional multiplier in equation (20). In sum, as in the case of two-region system, the overall impact multiplier for the three-region system may be expressed as

$$y = M_4 M_3 M_2 M_1 x$$  \hspace{1cm} (21)

Thus the impact multiplier may be decomposed into four separate multiplier components, each capturing inter and intra effects of an exogenous injection on the endogenous accounts.

§ 4

So far we have discussed how a SAM could be used to measure the changes in the level of income of the endogenous accounts caused by exogenous and unitary shocks. In this section we will discuss how this framework can also be articulated into a setting of income distribution to calculate the relative income distribution using the above analysis. We use the measurement proposed by Roland-Holst and Sancho (1992) to calculate the relative income distribution and propose a simple, straightforward extension of their method to further decompose to delineate the changes in the relative income distribution due to the exogenous shocks.

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7 See Round (1985) for a detailed formalization and discussion on this point.
The multiplier analysis starts by dividing the total accounts of a SAM into two separate categories: endogenous accounts and exogenous accounts. If we consider a social accounting matrix with k endogenous institutions and l exogenous institutions, the total accounts T are the sum of the two types: T=k+l. The SAM can then be written as,

\[
\begin{bmatrix}
  y_k \\
  y_l
\end{bmatrix} = 
\begin{bmatrix}
  A_{kk} & A_{kl} \\
  A_{rk} & A_{ll}
\end{bmatrix}
\begin{bmatrix}
  y_k \\
  y_l
\end{bmatrix}
\]  \tag{22}

where \( A_{ij} \), as discussed in section 2, are sub matrices that contain the expenditure share coefficients. Then the multiplier effect of the exogenous injections can be obtained as:

\[
y_k = A_{kk}y_k + A_{kl}y_l = (I - A_{kk})^{-1}A_{kl}y_l = Mx
\]  \tag{23}

where \( M = (I - A_{kk})^{-1} \) is the matrix of multipliers and \( x = A_{kl}y_l \) is the vector of exogenous injections. The multiplier matrix \( M \) shows the overall effect of a unitary increase in the exogenous components on the endogenous accounts. Therefore, the element \( m_{ij} \) of \( M \) quantifies the changes in the income of the institution i as a consequence of a unitary and exogenous injection received from the institution j.

From equation (23), it is clear that the multipliers corresponding to endogenous institutions illustrate the changes in the absolute level of income. To study the changes in the relative income of the endogenous institution due to the exogenous shocks, Roland-Holst and Sancho (1992) proposed a measure to calculate the distributive incidence. We summarize their result, by normalizing equation (23) such that,

\[
y_k^* = \frac{y_k}{e'y_k} = (e'Mx)^{-1}Mx
\]  \tag{24}

where \( e' \) is a unitary row vector. From the above definition, the changes in the relative income of the endogenous components generated by an increase in the exogenous injections are equal to

\[
dy_k = (e'Mx)^{-1}[I - (e'Mx)^{-1}(Mx)e']Mdx
\]

\[
= \frac{1}{e'y_k} \left[ I - \frac{y_k}{e'y_k}e' \right] Mdx
\]

\[
= R \, dx
\]  \tag{25}

In the above expression, \( R \) is the redistribution matrix and shows the change in the relative income of the endogenous accounts caused by a change in the exogenous
injections. Every individual element of the matrix, \( r_{ij} \), determines the magnitude and direction of the change in the relative income of the institution \( i \) as a result of an inflow from the institution \( j \). It is interesting that, irrespective of which endogenous components are chosen in the model, the sum of the columns in the matrix of redistribution is zero.\(^8\)

Now in equation (25), instead of the compound multiplier if we use its decomposed parts of inter and intra, we may get corresponding decomposed redistribution matrices. This would be interesting because these redistribution matrices would capture the origin of the change in the relative income of the institutions due to an exogenous shock. In other words, we would be able to delineate the total change in the relative income of institutions due to an exogenous shock into ‘intra’ and ‘inter’ categories corresponding to the respective multiplier component. In a sense, we would be able to quantify and decompose the total change in the relative income of institutions into the change that is mediated through ‘own’ (intra) accounts and the change that is mediated through ‘other’ (inter) accounts. We can see this straightaway if we substitute the decomposed compound multiplier in additive form in equation (25).

First let \( D = \frac{1}{e^y} \left[ I - \frac{y}{e^y} e' \right] \) and substituting

\[
M = M_1 + [M_2 M_1 - M_1] + [M_2 M_2 M_1 - M_2 M_1] \tag{26}
\]

we get

\[
dy = \{DM_1 + D[M_2 M_1 - M_1] + D[M_2 M_2 M_1 - M_2 M_1]\} \, dx
\]

which can be written as

\[
dy = [R_1(x) + R_2(x) + R_3(x)] \, dx \tag{27}
\]

The first term \( R_1 \) would capture the change in the relative income distribution that result from linkages wholly within each of the accounts and the other two terms would capture the change in the relative income distribution due to inter-regional linkages in the accounting structure. By decomposing the redistribution matrix we would be able to delineate the intra-income disparity and inter-income disparity between a region or between different geographical regions.

\(^8\) See Roland-Holst and Sancho (1992)
We could do this decomposition exercise to understand the change in relative income distribution due to an exogenous injection at various levels of disaggregation. First, we could analyze this at the level of productive sectors, by taking different sectors into consideration when classifying the endogenous accounts and do this exercise to calculate the relative income distribution in various sectors. Secondly, we could use this decomposition technique to analyze the functional income distribution. By considering factors of production, say labour and capital, as two separate accounts, and study the impact of exogenous demand on the relative income distribution of the factors of production. Thirdly, from an institutional point of view, we could analyze the relative position of households by disaggregating the household sector in a meaningful way and study the relative position of various institutions that are in this sector. For instance, we could study the change in relative income distribution of different consumer groups and analyze the personal income distribution. By disaggregating the macro economy at different levels or viewing the macro economy at various levels of resolution would unravel the structural constraints that inhibit the process of income distribution.

§5

In the recent empirical growth literature, the issue of world income distribution has taken the center stage. Treating the world economy as a closed unit, there are number of methods proposed in the literature to estimate the distribution of world income—ranging from calculating per capita GDP of individual countries or calculating population-weighted GDP per capita taking into account the within-country income disparities to integrating individual country density functions to construct the world income distribution. In another interesting study an attempt has been made to decompose the total inequality between the individuals in the world, by continents and regions.

Here we proposed an alternative framework to study the world income distribution based on the method proposed by Richard Stone and Richard Goodwin. The underlying idea in these methods is that the question of income distribution is intertwined with the existing
structure of production, where income distribution affects final demand, and the structure of production and the structure of production influences factor demands and hence the structure of income distribution. We discussed how the decomposition methods, using the accounting framework of the social accounting matrix, proposed in the literature could be harnessed to measure the changes in the level of income of the endogenous accounts caused by exogenous and unitary shocks.

We also discussed how this decomposition method could be used to the problem of income distribution, by calculating the redistribution matrix for different accounts. We proposed a simple, straightforward extension in calculating the redistribution matrix to delineate the total change in the relative income distribution into ‘direct’ and ‘indirect’ effects. This is important from the policy perspective, because the decomposition of the redistribution matrix reveal the structural constraints that limit process of income distribution or redistribution.

Even though empirical estimates are crucial in order to assess the advantages of the proposed method over the existing methods, it is, however, pertinent as a crucial prerequisite to provide a framework for constructing an Inter-regional SAM and such an attempt is made here in the context of Indian economy. In India, given the data constraint, construction of SAM has proved to be very difficulty, particularly, in the context of the distribution of income.\(^9\) The original national SAM for India was assembled by Pradhan et al. (1999) contains 60 productive sectors, 2 factors of production, and 12 household occupational categories. This is an updated and expanded version of the 1989-90 IO table prepared by the Indian Central Statistical Organization. The data used to construct the national India SAM has been drawn from various sources including input-output tables, national accounts, government budgets, household survey, industrial surveys and agriculture production statistics. There is the issue of consistency here because different bodies of statistics are collected by a variety of agencies, which do not work on an agreed

\(^9\) See Pradhan et al (1999) for a brief history on various attempts to build a Social Accounting Matrix for India.
set of definitions and classifications. This can be adjusted and updated using well-known numerical techniques like conjugate gradient algorithm or quasi-newton methods.\textsuperscript{10} The national SAM could serve as a benchmark for the estimation of its regional components to study the repercussions of exogenous injections on the endogenous accounts. As our objective is to construct an inter-regional social accounting matrix using these regional components, which has been estimated for Northern, Southern, Western and Eastern regions.\textsuperscript{11} The schematic structure of the inter-regional SAM and various matrices, referred here as Blocks, involved in the construction is given in the following Table.

### Table 1: Structure of the inter-regional Social Accounting Matrix (SAM)

<table>
<thead>
<tr>
<th>Expenditure Income</th>
<th>Production Sectors</th>
<th>Factors of Production</th>
<th>Institutions</th>
<th>Capital</th>
<th>ROW</th>
<th>Total Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N  W  S  E</td>
<td>N  W  S  E</td>
<td>N  W  S  E</td>
<td>T\textsuperscript{0}\textsubscript{N}</td>
<td>T\textsuperscript{0}\textsubscript{W}</td>
<td>T\textsuperscript{0}\textsubscript{S}</td>
</tr>
<tr>
<td>Production Sectors</td>
<td>N  W  S  E</td>
<td>Block I</td>
<td>Block II</td>
<td>C\textsuperscript{N}\textsubscript{RW}</td>
<td>C\textsuperscript{W}\textsubscript{RW}</td>
<td>C\textsuperscript{S}\textsubscript{RW}</td>
</tr>
<tr>
<td>Factors of Production</td>
<td>N  W  S  E</td>
<td>Block III</td>
<td></td>
<td></td>
<td></td>
<td>T\textsuperscript{I}\textsubscript{N}</td>
</tr>
<tr>
<td>Institutions</td>
<td>N  W  S  E</td>
<td>Block IV</td>
<td>Block V</td>
<td>Block VI</td>
<td>Block VII</td>
<td>T\textsuperscript{K}\textsubscript{N}</td>
</tr>
<tr>
<td>Capital</td>
<td>N  W  S  E</td>
<td>Block VIII</td>
<td></td>
<td></td>
<td></td>
<td>T\textsuperscript{I}\textsubscript{N}</td>
</tr>
<tr>
<td>ROW</td>
<td>X\textsuperscript{RW}\textsubscript{N}</td>
<td>.</td>
<td>X\textsuperscript{RW}\textsubscript{E}</td>
<td></td>
<td></td>
<td>T\textsuperscript{ROW}</td>
</tr>
<tr>
<td>Total Expenditure</td>
<td>T\textsuperscript{Q}\textsubscript{N}T\textsuperscript{W}T\textsuperscript{S}T\textsuperscript{E}</td>
<td>T\textsuperscript{F}\textsubscript{N}T\textsuperscript{F}\textsubscript{W}T\textsuperscript{F}\textsubscript{S}T\textsuperscript{F}\textsubscript{E}</td>
<td>T\textsuperscript{Q}\textsubscript{N}T\textsuperscript{Q}\textsubscript{W}T\textsuperscript{Q}\textsubscript{S}T\textsuperscript{Q}\textsubscript{E}</td>
<td>T\textsuperscript{K}\textsubscript{N}T\textsuperscript{K}\textsubscript{W}T\textsuperscript{K}\textsubscript{S}T\textsuperscript{K}\textsubscript{E}</td>
<td>T\textsuperscript{ROW}</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{10} See Stone, Champernowne and Meade (1942) and Byron (1978).

\textsuperscript{11} See Bussolo, Chemingui and O’Connor (2003).
For the study of income distribution it is pertinent to reconstruct a national SAM that incorporates the inter-regional transfers between Productive sectors, Institutions, Factors of production and Capital in each of these four regions. Each of these can be further disaggregated depending on the data availability and comparability. Such a construction, we believe, would be useful to study the repercussions of exogenous shocks on the relative income distribution and at a broader level, for an analysis of the structural interlinkages between the regions and their influence on the process of income distribution.
Reference


