A SAM-based Multiplier Model to Track Growth-Poverty-Inequality Nexus in Bangladesh

Husain, M. Jami
Fachhochschule für Technik und Wirtschaft (FHTW) Berlin

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Muhammad Jami Husain[*]

School of Economics

Research Institute for Public Policy and Management

Keele University, UK

Abstract

This paper offers a social accounting matrix (SAM) based analysis leading to a better understanding of the way various agents in the real economy interact, the way socio-economic groups make their living, the channels through which demand driven interventions may affect the poor, and the potential growth-poverty-inequality nexus. This is done in two steps. First, the paper reveals the economic structure of Bangladesh with a SAM framework where the macro (national accounts and input-output table) and micro (national surveys) data are juxtaposed under a unified data matrix to portray the meso level interactions of various economic agents, that is production sectors, factors of production, household groups, and other institutions. Subsequently, the SAM is used to develop a multiplier simulation model, which enables tracking and quantifying the nature and extent of the linkages among the demand driven shocks (stimuli), economic growth, income generation, and concomitant poverty and distribution implications from the perspective of different socio-economic groups in Bangladesh.

Key Words: Social Accounting Matrix, Multiplier, Growth-Poverty-Inequality

JEL Classification: **O21, O41, O40**

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[*] Address for correspondence: Claus Moser Research Centre (CM 2.02), Research Institute for Public Policy and Management, Keele University, ST5 5BG, Staffordshire, UK. email: m.j.husain@ippm.keele.ac.uk ecojami@yahoo.com .

1. Introduction

The pervasive nature of poverty in Bangladesh renders it to be the overriding issue in development. Development strategy requires not only a concern with accelerating economic growth, but also a direct concern with improving the standard of living for the very sizable segments of the population largely bypassed in the growth processes. Therefore, one needs to clearly characterize the development strategy required to achieve the poverty alleviation targets. Although a substantial body of literature on conceptualizing poverty and related issues is available in Bangladesh, the nature of the transmission channel of intervention impacts affecting different household groups is still poorly understood. Investigation of the poverty and distribution implications of the growth processes in Bangladesh under variants of economic policy and political regimes have usually involved ex-post statistical and econometric analysis without explicit consideration of poverty levels for households classified either by income groups or by occupational classes (Mujeri, Khandker, 1998, p. 48). Identifying the impact-transmission mechanisms with economic models that link different socio-economic groups to the growth and development process is deemed critical in the contemporary research agenda.

The challenge, then, lies in linking various targets or interventions to macroeconomic, structural and social policies within a consistent framework that traces and quantifies each stage of the propagation channels related to the adopted programs and facilitate in conducting, holistically, simulation exercises to envisage the prospect. Pyatt (2001) emphasizes that such research agenda will remain inadequately addressed without reference to the structure of the economy. A framework of analysis is therefore called for, which articulates the salient characteristics of the interface between different household groups and the monetized economy. This refers to a prudently designed data framework, the so-called Social Accounting Matrix, familiarly known as 'SAM' (Pyatt, 2001, p. 43).

Accordingly, the objective of this paper is to construct a SAM for Bangladesh; and based on that a Keynesian-type multiplier model, which would reveal the structural features and interdependencies of the economy in one hand, and quantitatively trace the transmission mechanism of demand driven interventions on the other hand. The paper offers an analysis leading to a better understanding of the way various agents in the real economy interact, the way socio-economic groups make their living, the channels through which various demand shocks (stimuli) may affect the poor, and the potential growth-poverty-inequality nexus. The paper adopts twofold objectives. The first is concerned with revealing the economic structure of Bangladesh with a framework of analysis where the macro (i.e. national accounts and input-output table) and micro (i.e. national surveys) data are juxtaposed under a unified data matrix. The second objective entails investigation and quantification of the nature and extent of the linkages among the demand driven macro-policies, economic growth, income generation, and concomitant poverty and distribution implications from the perspective of different socio-economic groups in Bangladesh. In order to develop a thorough understanding of these linkages, the paper addresses a wide array of interconnected issues and related research questions; in particular, the following:

1. How do interventions into different sectors affect household income via their effects on sectors, products, factors and consumption patterns?
2. How do sector-wise growth performances impart differential income impacts for variants of household groups; and what would be the ranking of sectors in terms of poverty alleviation (i.e. income generation) effects?
3. How do different labour categories benefit from their linkages with sectors in terms of value additions?
4. Is a specific growth strategy, and the concomitant poverty reduction impact, inequality increasing; equity enhancing; or distribution neutral?
5. Does the observed positive growth impulse trickle down to the poor?

The mentioned research questions are addressed, firstly, by constructing a SAM with 30 disaggregated sectors, 10 factors of production, 10 household groups, 9 household-consumption items, other institutional accounts (i.e. government, corporation, and foreign countries designated as 'rest of the world'), and a consolidated capital account. The SAM reveals the structural features of the economy in terms of the monetary transactions among the mentioned economic agents, and thereby provides the baseline numerical specification of the real economy of Bangladesh for the year 2000 in a consistency framework. It is constructed using the data from the latest input-output (IO) table-2000 of Bangladesh, national accounts statistics of 2000, and the distributive parameters derived from the primary record level data of the latest Household Income Expenditure Survey (HIES-2000) and the labour force survey (LFS-2000). Subsequently, a multi-sector, multi-factor and multi-household multiplier model, based on the SAM, facilitates economy-wide impact assessment by simulating various scenarios of demand shocks (stimuli). The SAM-based multiplier model is of Keynesian type that treats the circular flow of income endogenously, and analogous to that of traditional input-output models.[1] The whole exercise is envisaged to explore how the real side of the economy works by identifying the nature of the causal relationship among various economic agents and looking more closely at the growth process and the nature of the growth-poverty nexus it engenders.

The rest of the paper takes up the research agenda in steps. Section 2 provides a retrospective of the growth, poverty, and inequality trends in the Bangladesh economy; and briefly reviews the existing research methodologies to tackle the concepts of growth, poverty, distribution, and their 'pro-poor' features.[2] This section also casts some light on how the objectives of this paper, as articulated under several research questions, and the methodology adopted, complement the existing wisdom. The backbone of this paper is a social accounting matrix (SAM) of Bangladesh. Section 3 elaborates the salient features of the Bangladesh SAM 2000 newly constructed for this research. Section 4 shows how the constructed SAM 2000 for Bangladesh has been used to compute Keynesian-like multipliers to help assess the impacts of policies and external shocks on sectoral outputs, value additions (i.e. GDP), household incomes, expenditures on consumption; and subsequently on poverty and distribution. The first, second, and the third research questions are related directly to the multiplier values of the various SAM accounts. While the multiplier model offers useful insights by quantifying the transmission mechanisms of demand shocks or stimuli, it is based on various assumptions. Therefore, the scopes and the limitations of the model are also made explicit in this chapter.

Section 5 undertakes simulation exercises to address the research questions 4 and 5. In an attempt to gauge the nexus among growth, poverty and inequality (i.e. research question 4), the simulation design entails increasing the exogenous demand of each sector in a way that generates 1 percent GDP growth in each case. The simulation outcomes in terms of the corresponding households' income generation are then used as inputs to simulate the unit record data of the nationally representative HIES-2000 survey of Bangladesh and derive the income poverty and inequality implications. Research question 5 is addressed in a similar way, where the exogenous injections are set to restore the annual average nominal growth impulse of the economy observed during 1997 to 2000. Simulation outcomes are reported under the changes of sectoral outputs, value additions to different factor categories, consumption of various items, and income generation by different household groups. Section 6 concludes by briefly highlighting the policy relevance of the SAM approach and the outcomes of various simulation exercises conducted with the multiplier model.

2. Growth, Poverty, and Inequality in Brief Retrospection

The Pattern and Process of Growth in Bangladesh (1980-2000)

The real GDP of Bangladesh has registered an annual average growth of 4.3 percent between 1981 and 2000. The economy has experienced acceleration during the 1990s in comparison to the 1980s. GDP grew at an average rate of 4.8 percent in the 1990s compared to 3.7 percent in the 1980s.[3] The sectoral composition of growth indicates that the industrial sector witnessed a robust growth trend. The annual growth rate of industry increased from 5.8 percent in the 1980s to 7.0 percent in the 1990s, whereas the annual average growth rates of agriculture are 2.5 and 3.2 percent for the respective decades. The service sector grew at 4.1 percent during 1980-2000, while it performed better in the 1990s (4.5 percent) compared to the 1980s (3.7 percent).

Table 1: Growth of Sectoral GDP

Sectors	**Average Yearly Growth (%)** (At constant 1995/96 prices)		
	1981-2000	**1981-1990**	**1991-2000**
Agriculture	2.9	2.5	3.2
Industry	6.4	5.8	7.0
Services	4.1	3.7	4.5
Total	**4.3**	**3.7**	**4.8**

Source: BBS (2001); BBS (2000)- as cited in Sen *et al* (2004), p. 70.

At the more disaggregated level, differential growth patterns are observed (Appendix 1). For instance, within agriculture, fishery sector turned out to be the most dynamic sector in the 1990s with an average real growth rate of 8.2 percent, while the growth rate for crops and horticulture declined from 2.7 percent in 1980s to 1.8 percent in 1990s. Within industry, manufacturing sub-sector experienced acceleration of growth from 5.0 percent in the 1980s to 6.9 percent in the 1990s. Largest acceleration of growth appeared to be in the construction sub-sector with an annual average growth rate of 7.5 percent during the 1990s. Within the service sector, wholesale and retail trade, hotel and restaurants, and financial intermediation registered more growth.

The relative performance and the underlying dynamism of different broad sectors also postulate how their relative contribution to the incremental value addition has been changing. Sen *et al* (2004) calculated the share of absolute contribution of the broad sectors to the GDP increment during the 1980s and 1990s. The contributions of agriculture, industry and service sectors in the 1980s were 21.1, 29.2, and 49.7 percent respectively. The contribution of industry rose to 34.2 percent in the 1990s, accompanied by the decline of both the agriculture and service sectors. The manufacturing sub-sector within industry category appeared to be the largest contributor among all sub-sectors to the incremental growth during the last decade (Appendix 2).

Table 2: Contribution of Different Sectors to Incremental GDP (percent)

Sectors	**Period** (Values in percentage)		
	1980-2000	**1980-1990**	**1990-2000**
Agriculture	19.6	21.1	18.8
Industry	32.5	29.2	34.2
Services	47.9	49.7	47.0
Total	100	100	100

Source: BBS (2001); BBS (2000) – as cited in Sen B *et al* (2004), p. 71.

The results of the disaggregated sectoral growth trends highlight the role of the non-tradable sectors in the process of growth acceleration. It was estimated that the combined contribution of the two major tradable sectors (i.e. large and medium scale industries and fisheries) was less than 30 percent, indicating that about 70 percent of the growth increment of the 1990s came from the non-tradable sectors comprising services, construction, small-scale industry and other demand driven activities (Sen *et al.*, 2004, p. 18). With similar estimates, Osmani (2004) searches for the underlying causes of the increasing dominance of non-tradable sectors, and advances the hypothesis that growth acceleration of the 1990s originated from an enhanced dose of demand stimulus enjoyed by the non-tradable sectors – but arising from outside that sector. Osmani (2004) asserts that the source of enhanced demand stimulus enjoyed by the non-farm non-tradable sector in the 1990s lay in the significant higher level of spending by three groups of people – farmers who enjoyed a higher level of income due to improvement in the crop production, garment workers (with significant ties with rural families) whose income increased with the phenomenal growth of the garment sector, and all those who benefited from the greater inflow of foreign remittances (Osmani, 2004, p. 9).

On the other hand, if one takes into account the possibility of a kind of endogenous growth arising from autonomous productivity improvement within the sector, the estimates of total factor productivity growth (TFPG) by Sen *et al.* (2004) indicate relatively low contribution of TFPG to the overall growth of the economy.[4] The estimates were modest with average values of less than one - with very low TFPG estimates (in some cases negative) in the 1980s showing almost no TFPG in the economy, and relatively higher TFPG during the 1990s.

The accelerated growth in the 1990s led to faster reduction of poverty, but also a widening of income inequality. The head count poverty estimates show poverty declining from 58.8 percent in 1992 to 49.8 percent in 2000. During 1992-2000, the national head count ratio declined by 9 percentage points, indicating a reduction of poverty by an annual average of 1 percentage point in this period as against the annual average of 0.23 percentage point decline during 1984-1989. Both the urban and rural poverty declined during the 1990s, although, the incidence of rural poverty remained higher than that of urban poverty. Over the entire period, since the early 1980s, the improvement in the poverty incidence is rather slow with variations in different sub-periods and between rural and urban areas.

Table 3: Poverty and Inequality in Bangladesh

Indicator	Head Count Poverty (Consumption Based Estimates)					Gini Index of Inequality (Consumption based estimates)				
	1984	**1989**	**1992**	**1996**	**2000**	**1984**	**1989**	**1992**	**1996**	**2000**
National	58.50	57.13	58.84	53.08	49.8	0.254	0.270	0.259	0.293	0.306
Rural	59.61	59.18	61.19	56.64	53.0	0.246	0.257	0.243	0.265	0.271
Urban	50.15	43.88	44.87	35.04	36.6	0.293	0.314	0.307	0.353	0.368

Note: The head count estimates represent the cost of basic needs approach by BBS and the World Bank based on respective unit record data of the household income expenditure surveys.
Source: GOB-IMF (2005), p. 13; World Bank, 2002 p 4, 7; World Bank, 1998, p. 6, 58.

With respect to the inequality it is evident that the Gini index of consumption expenditure remained largely unchanged between 1984 and 1992 (notwithstanding increasing tendency in between) for both rural and urban areas. While absolute poverty declined faster in urban areas compared to rural areas over the nineties, this was associated with a rise in inequality. The estimates show that the Gini coefficient based on consumption expenditure over the nineties increased from 0.307 to 0.368 in urban areas and from 0.243 to 0.271 in rural areas. Overall, the Gini index of inequality increased from 0.259 to 0.306 during this period. However, the increase of Gini index was modest during the second half of the 1990s (e.g. from 0.293 in 1996 to 0.306 in 2000) as against a sharp rise during the first half (e.g. from 0.259 in 1992 to 0.293 in 2000).[5]

Pro-Poor Growth: The Growth-Poverty-Inequality Nexus

The impact of economic growth on the pace and magnitude of poverty reduction depends to a large extent on the nature of income inequality arising from the very growth process. Contemporaneous rise in income inequality dissipates the full impact of growth on poverty reduction. World Bank (1998) estimated that one-fifth of the potential poverty reduction from growth in Bangladesh was lost due to rising inequality (World Bank, 1998, p. 17). In this context, the concept of a 'pro-poor' growth strategy appears to point out the crucial association of growth and inequality on the extent of poverty reduction.[6] Recent conscience favors adoption of a pro-poor growth strategy over growth-maximization as a means of achieving faster decline of poverty. The critical elements of a pro-poor strategy would then include investigation of the sectoral growth patterns and their impact on various socioeconomic groups, feasibility of pursuing pro-poor growth and viability of pursuing growth-maximization, together with a policy of pro-poor distribution of productive assets (GOB, IMF, 2005, p. 19).

The inter-temporal growth, poverty and inequality nexus shows that Bangladesh has moved from a situation of lower growth with equity having a smaller impact on poverty reduction in the 1980s to a situation of higher growth with inequality having a larger impact on poverty reduction in the 1990s. The impact of rising inequality on poverty reduction has been strong in urban areas and modest in rural areas. In the formulation of the poverty reduction strategy framework, the government has identified four core strategic blocks, which include: (a) enhancing pro-poor growth; (b) boosting critical sectors for pro-poor economic growth; (c) devising effective safety nets & targeted programs; and (d) ensuring social development (GOB, IMF, 2005, p. 11). The question then remains how to implement these, and in what basis? Formulation of policies based on the above four strategic blocks requires more disaggregated level impact analysis of adopted policies taking into account different sectors and their interface with different socio-economic groups. This is necessary given the strong hypothesis that poverty and distribution response to changes in economic growth is heterogeneous with respect to sectoral growth patterns.[7]

Analysis of Growth, Poverty and Income Distribution: Methodological Issues

Several methodological alternatives exist to relate the policy interventions to the underlying growth-poverty-inequality tendencies. It is, however, critical to recognize whether the focus of the analysis is *ex post* assessment, i.e. what has been the impact of a certain reform implemented in the past, or *ex ante* analysis, i.e. what would be the future impact of a simulated policy change or a shock. *Ex post* studies are based on a rigorous analysis of the actual past data, while *ex ante* analysis generally uses a model with a base period (FAO, 2003, p. 140). The substantial body of literatures that exists in Bangladesh, mostly, are based on ex-post analysis, and conducted within partial equilibrium framework.

The analysis of macroeconomic shocks and the analysis of income distribution and poverty in Bangladesh have used very different techniques and sources of data.

The PRSP of Bangladesh asserts that income sources such as non-farm enterprises, non-farm employment, transfers and remittances, and property income have in-equalizing effects on overall income distribution in Bangladesh. It also states that "a dynamic sector-based growth process is not pro-poor and hence the growth pattern itself offers limited scope to address the growth and equity objectives simultaneously." (GOB, IMF, 2005, p. 20) The PRSP, in this context, favors the 'growth-first' approach; and implicitly follows the trickle down theory, which asserts that the fruit of growth is automatically transmitted to all segments of the society. The policy stance of the PRSP with regards to the growth-poverty-inequality nexus is based on the indicators, such as the 'Gini income elasticity (GIE)' that calculates the contribution of different income sources to the income inequality; and the 'inequality-growth-trade off index (IGTI)' that assesses the relative strengths of the growth and inequality components and the extent of trade-off between them in reducing poverty (GOB, IMF, 2005, p. 20). In any case, systematic tracking and quantification of this trickle down mechanism to different socioeconomic groups are far from being explicit in the PRSP. Other types of indicators recently used include, *inter alia*, the elasticity of poverty and inequality with respect to growth as derived from the observed trends (World Bank, 1998, p. 18 ff); the 'growth incidence curve' showing the growth rate of real per capita expenditure for different groups ranked by level of income (World Bank, 2002, p. 8); the distinction between the 'over-all growth' and the 'pro-poor growth'- basically a derivative of the growth incidence curve (Sen *et al.*, 2004, pp. 18-23).

In the backdrop that the policies in the PRSP are geared toward attaining the Millennium Development Goal (MDG) of reducing head count poverty by 50 percent of the reference level, identification of the policy priorities based merely on the above indicators, without detailed and quantitative understanding of their ramifications to the different socioeconomic groups, is deemed inadequate. Existing wisdom needs to be supplemented by a coherent framework of analysis that reveals the interdependences, interactions and the structure of the economy in greater detail; and traces and quantifies each stage of the trickle down process emanating out of the growth processes, shocks or stimuli. Of the several approaches and analytical methods to estimate and simulate the effects of exogenous shocks (including policies) on income generation by heterogeneous household groups, the one adopted in this paper relies on a SAM framework that is assumed to reflect closely the underlying socioeconomic structure and interdependence of the country.

Subsequently, as a first-cut *ex-ante* analysis, SAM multipliers are derived from the base year (i.e. 2000) SAM to explore quantitatively how different exogenous shocks affect household groups' incomes; and thereby, the structural mechanisms and linkages through which the initial shock contributes, directly and indirectly, to the income generation process.

However, the concept of SAM is not entirely new in Bangladesh. The 'Sustainable Human Development (SHD)' project of the Planning Commission of Bangladesh constructed a SAM (captioned as 'SHD-SAM 1993') based on the IO table 1993. Subsequently, a dynamic computable general equilibrium model is constructed based on the SHD-SAM 1993, which enabled a wide range of modeling exercises, including multiplier analysis.[8] As part of their in-house exercise, the project also constructed a SAM for the year 2000 (SHD-SAM 2000) with the latest IO table 2000. However, the crucial link between the sectors and household groups via the factors of production remains deficient and fuzzy in the absence of disaggregated labour categories in both the SHD-SAM 1993 and the SHD-SAM 2000, which would render modeling exercises to be lacking and limiting in portraying appropriate impact transmission process. This paper constructs a new SAM 2000 for Bangladesh with more objectively designed classification scheme pertinent to the research questions. In particular, the SAM used in this paper differs from the SHD-SAM 2000 in several respects; including, introduction of disaggregated gender and skill based labour factor classification; skill-based disaggregation of rural non-farm household groups; new 'production account (sectors)' classification for better compliance with HIES 2000 survey information; use of LFS 2000 survey to compliment the HIES survey parameters etc. Subsequently, the construction and the design of the multiplier model allow addressing a wide range of research questions, which otherwise have remained inadequately addressed in the current literature. Notwithstanding some limiting assumptions and scopes, the new SAM and the SAM-based multiplier model exercises provide very useful insights on the issues articulated in the research questions.

3. The Social Accounting Matrix (SAM) of Bangladesh for 2000

A SAM is a data framework in the form of a square matrix that describes quantitatively the economic transactions taking place in an economy during a specified period of time, generally one year; and thereby, integrates in an explicit, coherent and consistent manner the information from various sources (e.g. national accounts, input-output table, national surveys etc.). As a data framework, it may be thought as a natural extension of the input-output (IO) accounting systems, which brings together in a coherent way not only disaggregated data on the inputs and outputs of the productive branches in the economy, but also the data concerning the distribution of the various kinds of factor incomes over institutional groups, the redistribution of income among these groups, the expenditure made by these groups on different types of commodities, and savings and investments made by them. The data blocks in the SAM can be said to follow, in disaggregated terms, the main consecutive stages which can be distinguished in the circular flow that characterizes the full economic process (Alarcon *et al.*, 1991, p. 2).

The SAM is therefore a snapshot of the economy that incorporates explicitly various crucial transformations among variables, such as the mapping of factorial income distribution from the structure of production and the mapping of the household income distribution from the factorial income distribution; and additionally, the income and expenditure flows between the represented institutions, namely, household, government, corporations, and rest of the world. As far as the degree of disaggregation is concerned, the SAM framework is a flexible one, allowing in principle any disaggregation level.

The Structure of the Bangladesh SAM 2000 [9]

The SAM approach is a flexible tool which can be deployed with varying degrees of sophistication. The structure of SAM varies across countries. The differences involve the kinds of classifications applied, the kinds of sectors, groups and transactions distinguished, the degree of detail with which this is done, etc. In general, the formats of the SAMs are guided by the socio-economic structures of the countries the SAMs apply to, varying situations as regards to availability, scope and nature of basic data needed for the SAM; and are often tailored to the pertinent research questions.

Table 4: Classification Schemes of the Accounts in the SAM 2000 for Bangladesh

SAM Accounts	Elements/Classification Scheme
Activities (sectors) (30)	**Agriculture (7)** Cereal Crops, Jute, Other Crops, Tea Cultivation, Livestock and Poultry, Fish and Shrimp, Forestry; **Industry (16)** Rice and Grain Milling, Other foods, Tea products, Leather Products, Jute Textile, Yarn, Textile Clothing, Woven Ready Made Garments, Knit Ready Made Garments, Chemical Products, Miscellaneous Industry, Fertilizer, Petroleum Products, Clay and Cement Products, Iron and Steel Products, Machinery, **Utility and Construction (2)** Construction and Infrastructure, Utility **Service (5)** Trade and Transport Service, Housing, Health, Education, Other Services
Factors of Production (10)	**Labour (8)** Rural Low-skilled Male, Rural High-skilled Male, Rural Low-skilled Female, Rural High-skilled Female, Urban Low-skilled Male, Urban High-skilled Male, Urban Low-skilled Female, Urban High-skilled Female. (**) **Capital (2)** Land Based Capital Factor, Non-Land Based Capital Factor
Final Consumptions (9)	Food, Clothing, Education, Health, Housing, Energy, Transport, Entertainment, Other Household Consumption
Institutions	
Households (10)	**Rural Household Groups (6):** *Rural Agriculture (4)*: Rural Landless, Rural Marginal Farmers, Rural Small Farmers, Rural Large Farmers. (*) *Rural Non-agriculture (2):* Rural Low-Skilled Non-agriculture, Rural High-Skilled Non-agriculture. (**) **Urban Household Groups (4):** Urban Illiterate, Urban Low-Education, Urban Medium-Education, Urban High-Education. (***)
Other Institutions (3)	Government, Corporations, Rest of the World
Capital Account (1)	Consolidated Gross Fixed Capital Formation (GFCF) and Stock Change (SC)

Note: Figures in the parentheses indicate the number of subgroups for the corresponding accounts.
(*) Land ownership criteria: Landless = no land; Marginal = less than 0.5 acre of land, Small = between 0.5 and 2.5 acres; Large = 2.5 acres and above. (**) Skill criteria: Low-skilled = less than primary education; high-skilled = above primary education. (***) Education criteria: Illiterate = no education; Low = class 1-9; medium = class 10-12; High = above 12 class.

The accounting relations of the Bangladesh SAM 2000 bring together the structure of production, income generation by factors of production, distribution of income by institutions in return for factor services, consumption of wants (i.e. final consumption items) by household, savings and investment patterns. There are 62 sets of current accounts in seven broad groups: (i) 30 production sectors; (ii) 10 factors of production; (iii) 10 household groups; (iv) 9 final consumption items; and other institutions, namely, (v) corporation, (vi) government and (vii) the rest of the world. Finally, there is one consolidated capital account to capture the flows of savings and investment by institutions and the rest of the world.[10] The main data sources for compilation of the SAM 2000 are: Bangladesh IO table 2000; Bangladesh Household Income Expenditure Survey (HIES) 2000; Bangladesh Labour Force Survey (LFS) 2000; and national accounts statistics.[11]

The *production* account composed of 30 sectors is derived from the aggregation of the 86 sectors of the IO table 2000. The *factors* of production are disaggregated into 8 types of labour categories and 2 types of capital factor categories. Classification of the labour categories is based on location, gender, and skill level to capture a wide perspective of the labour market. The *final consumption*s block is introduced with 9 items representing different basic wants of the households. This classification is derived by blowing up of the private consumption vector of the IO 2000 and the subsequent mapping of 94 commodities of IO 2000 into 9 items mentioned in table 4. This helps in capturing the situation of the household groups in terms of those 'wants' which characterize their well being situation. The next bloc is *households*, where they have been classified on the basis of rural and urban location at the first level. The rural households are categorized into two broad groups based on their occupation, i.e. agricultural and non-agricultural households. Then the former group is further classified based on their land ownership and the later based on their skill level. The urban households are classified into four groups based on the level of education. The household classification scheme, in general, is guided by the principle that the households should be heterogeneous across groups, and homogeneous within.[12] A household is identified as falling into a particular group based on the classification criteria met by the respective heads of the households.[13]

As indicated earlier, how large the SAM is depends on data availability and the motivation one adopts for constructing it. In principle, there is no limit to the fineness of detail; and in practice, both the data and effort available for constructing the SAM impose limitations (King, 1981, p. 2). The consolidated capital account (i.e. investment vector) of the SAM forms the major limitation in the design. However, it is a common practice in the SAM construction to consolidate the financial transactions between major institutions and production sectors of the economy, when there is virtually no information on flow-of-funds among institutions; behaviour of the money market, financial market; and the relationship between financial and non-financial institutions such as households, sectors, government and the rest of the world. Aggregation of such information conceals vital information and reduces the scope for analysing the impact of financial sector reforms involving major financial instruments such as interest rate, bank rate and credit control (Mujeri, Khandker, 1998, p. 54). Another limiting feature in the Bangladesh SAM is the somewhat mixed characteristics of the 'capital' factor account. In a developing country like Bangladesh, it is extremely difficult to separate the operating surplus or profits from the 'mixed income' item, which refers to the characteristics of the subsistence economy where the owner of the capital also acts as a labourer. Also, in the SAM 2000, a univocal relation between commodities and production activities is assumed. This implies that there are no by-products, secondary products or the like, and each sector produces one principal product. Another constraint includes non-availability of the distribution data on intra-household transfers. The distribution matrix in this case is derived on the basis of assumptions and using RAS method.[14]

It is worthwhile to present the salient features of the aggregate SAM before delving into the disaggregated meso level representation. The SAM follows the fundamental economic accounting principle that for every income or receipt there is a corresponding expenditure or outlay. This principle underlies the double entry accounting procedures embedded in the macroeconomic accounts of any country. However, instead of double entry conventions of national accounts to depict the correspondence between income and expenditure, SAM uses a single entry accounting to show the income and expenditure correspondence. Thus, SAMs embody this principle, but record the transactions between accounts in a square matrix. The transactions or accounts constitute the dimension of the square matrix.

Table 5: The Aggregate SAM 2000 for Bangladesh

SAM ACCOUNTS ➔ ↓	Activity (Sector)	Factor of Productrion	Consumption Demand	Households	Government	Corporation	Rest of World	Capital Account	TOTAL RECEIPTS
Activity (Commodity)	**M-1** **(30x30)** Intermediate Use **2,038,994**		**M-4** **(30x9)** Final Consumption Domestic **1,619,146**		**V-12** **(30x1)** Govt. Consumption **108,386**		**V-15** **(30x1)** Exports **331,446**	**V-17** **(30x1)** GFCF & SC **405,691**	**V-18** **(30x1)** **Demand** **4,503,663**
Factor of Productrion	**M-2** **(10x30)** Value Addition **2,246,212**								**V-19** **Receipt** **2,246,212**
Consumption Demand				**M-5** **(9x10)** Household consumption **1,833,631**					**V-20** **Income** **1,833,631**
Households		**M-3** **(10x10)** Factor Return **2,164,302**		**M-6** **(10x10)** Intra-HH Transfer **56,342**	**V-13** **(10x1)** Govt. Transfer **26,440**	**V-14** **(10x1)** Dividend **512**	**V-16** **(10x1)** Remittances **98,250**		**V-21** **Income** **2,345,846**
Government	**V-1** **(1x30)** Tax & Tariffs **69,438**		**V-6** **(1x9)** Duty on Final Cons. Imports **31,769**	**V-9** **(1x10)** Direct Tax **38,041**		**S-3** **(1x1)** Corporate Tax **2,739**		**S-8** **(1x1)** Import Duty –Cap. goods **20,431**	**S-11** **(1x1)** **Income** **162,418**
Corporation		**V-4** **(1x10)** Factor Return **81,910**							**S-12** **(1x1)** **Income** **81,910**
Rest of World	**V-2** **(1x30)** Intermediate Import **149,019**		**V-7** **(1x9)** Import of Final Consumption **182,716**					**S-9** **(1x1)** Imports of Capital Good **106,250**	**S-13** **(1x1)** **Income** **437,985**
Capital Account				**V-10** **(1x10)** Household Saving **417,833**	**S-1** **(1x1)** Govt. Saving **27,592**	**S-4** **(1x1)** Corporate Saving **78,659**	**S-6** **(1x1)** Foreign Saving **8,289**		**S-14** **(1x1)** **Savings** **532,372**
TOTAL OUTLAYS	**V-3** **(1x30)** **Total Supply** **4,503,663**	**V-5** **(1x10)** **Outlay** **2,246,212**	**V-8** **(1x9)** **Outlay** **1,833,631**	**V-11** **(1x10)** **Outlay** **2,345,846**	**S-2** **(1x1)** **Outlay** **162,418**	**S-5** **(1x1)** **Outlay** **81,910**	**S-7** **(1x1)** **Outlay** **437,985**	**S-10** **(1x1)** **Investment** **532,372**	

Note: (i) M=Matrix; V=Vector; S=Scalar elements; (ii) Dimensions (Row x Column) of corresponding matrices, vectors and scalars are shown in the parentheses; (iii) The values are in million taka in current prices and show the sums of corresponding matrices, vectors or scalars.

Table 5 basically consists of a set of rows and columns with the same headings. By convention, incomes or receipts are shown in rows while expenditures or outlays are shown in columns. The numbers in the cells of the matrix can be interpreted as the money values (million taka) of transactions between the accounts. These can be read in their row context as receipt for the accounts to which row heading refer, while at the same time implying expenditure for the accounts which relate to the column context of the cells. For example, row 1 indicates how production activities (i.e. sectors) receive income from the supply of different kinds of commodities, like consumer goods (M-4, V-12), capital goods (V-17) and exports (V-15). They also receive revenue from the supply of intermediate commodities to other sectors (M-1). Column 1 shows the cost components of each activity (sector). One of the major cost components is the purchases of raw materials, which may be either domestically produced (M-1) or imported (V-2). The sectors are also paying indirect taxes and import duties to the government (V-1). The remaining of the production costs takes the form of the value added, which is paid out to factors of production in the form of wages to different types of labour, rents on land and other natural resources, and profits as the reward of capital (M-2). Similarly, the receipts and outlays of all other accounts can be seen in the corresponding rows and columns. Table 5 and appendix 3 also show that the SAM 2000 ensures equality between sectoral supply and demand; between factor receipts and outlays; between income and expenditures of institutions; and the savings and investment identity. This consistency is maintained not only at the macro level, but also for each of the meso level disaggregated accounts of the SAM.

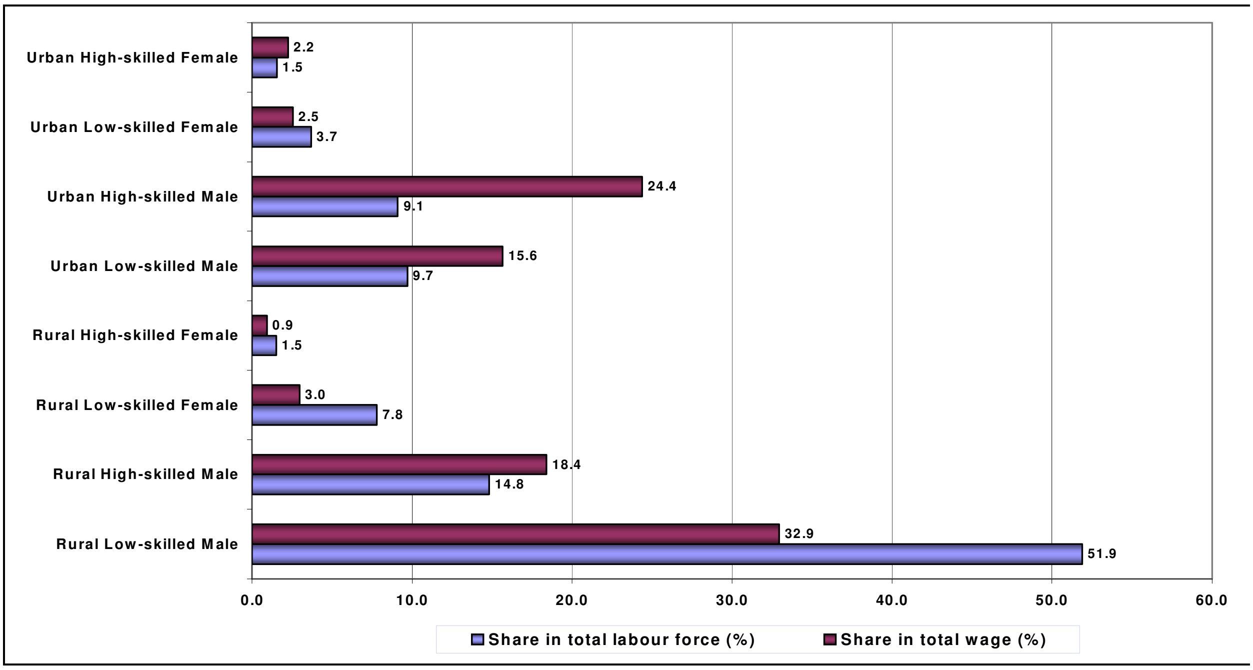
Salient Features of the Meso-Consistent Disaggregated SAM 2000

Some salient features of the disaggregated SAM, particularly the links between sectors and factors of production, factors of production and households, households' income-expenditure sources and consumption patterns are presented below.

Factor Returns from Sectors

Graph 1 shows the share of each labour category in the total labour force vis-à-vis the share of wage returns accrued to respective categories in the year 2000.

Graph 1: Share of Wage Received by Labour Categories vis-à-vis Share in the Labour Force



Source: Own calculation - the SAM 2000 for Bangladesh. Distribution parameters and population shares are derived using HIES-2000.

It is evident that the rural low skilled male category constitutes the largest group in the labour force with about 52 percent; however, they receive only 33 percent of the total wage generated as value addition by all the sectors. Similarly, except high skilled urban female group, all the female labour categories receive less as remuneration than their share in the total labour force. The graph indicates the existence of wage differentials not only between rural and urban labour categories, but also between male and female labour categories.

Table 6 shows row-wise how different labour categories are being remunerated by different sectors. In disaggregated terms, depending on how different factor categories are engaged in respective sectors, variations are observed in terms of factor returns.

Table 6: Sectoral Wage Payments to different Labour Categories in 2000

		Distribution of Sectoral Wage among the Labour Categories (percentage)							
	Sectoral Wage Payments (Mill.Tk)	Rural Low-skilled Male	Rural High-skilled Male	Rural Low-skilled Female	Rural High-skilled Female	Urban Low-skilled Male	Urban High-skilled Male	Urban Low-skilled Female	Urban High-skilled Female
Cereal Crops	62,412	77.24	8.81	4.96	0.14	3.14	4.73	0.15	0.83
Jute	7,857	80.79	0.00	0.84	0.00	15.47	0.51	2.39	0.00
Other Crops	40,988	74.00	0.52	4.70	0.00	20.32	0.00	0.46	0.00
Tea Cultivation	613	62.49	0.21	30.60	0.00	5.31	0.00	1.40	0.00
Livestock and Poultry	6,889	36.17	1.17	10.74	0.00	42.48	0.11	9.32	0.00
Fish and Shrimp	18,454	82.64	6.92	1.11	0.00	5.38	3.88	0.06	0.00
Forestry	10,630	50.36	27.83	6.10	0.00	2.24	13.34	0.00	0.13
Rice and Grain Milling	29,177	44.22	0.89	4.92	0.00	44.39	0.00	5.58	0.00
Other food	20,690	31.63	11.05	6.75	0.00	29.12	11.85	9.02	0.58
Tea products	532	35.02	11.38	22.00	0.00	31.61	0.00	0.00	0.00
Leather Products	5,708	25.38	0.00	0.00	0.00	15.08	59.54	0.00	0.00
Jute Textile	9,123	37.54	0.31	7.70	0.00	51.04	0.00	3.07	0.35
Yarn	3,507	32.38	1.81	12.50	0.20	38.71	0.00	14.39	0.00
Textile Clothing	14,263	49.17	18.56	7.22	2.07	7.26	11.45	3.30	0.98
Woven RMG	18,840	18.75	30.78	6.38	4.48	9.39	15.71	11.65	2.85
Knit RMG	17,190	18.75	30.78	6.38	4.48	9.39	15.71	11.65	2.85
Chemical Products	7,904	9.81	10.15	0.87	0.00	8.99	54.80	0.53	14.83
Miscl. Industry	25,876	53.76	16.25	1.93	0.18	12.03	11.91	3.44	0.51
Fertiliser Insecticides	8,482	57.47	17.60	0.00	0.00	24.93	0.00	0.00	0.00
Petroleum Products	5,661	0.00	69.13	0.00	0.00	0.00	30.87	0.00	0.00
Clay and Cement	4,759	37.02	4.04	2.03	0.00	56.18	0.00	0.73	0.00
Iron and Steel	18,636	23.63	38.01	0.00	0.00	28.15	9.15	0.00	1.05
Machinery	21,962	30.15	23.43	1.39	0.00	16.15	27.96	0.17	0.75
Construction and Infr.	86,310	55.32	9.61	3.83	0.82	13.42	16.54	0.44	0.02
Utility	9,461	16.27	18.17	0.54	4.63	22.11	36.48	0.00	1.79
Trade and Transport	318,041	36.22	14.11	0.54	0.08	24.31	23.80	0.61	0.32
Housing	102,041	12.95	7.26	10.21	0.00	15.35	30.80	13.45	9.98
Health	6,930	8.32	21.58	5.13	8.27	7.26	40.42	2.95	6.07
Education	42,600	1.57	53.55	0.87	6.72	0.22	25.82	0.01	11.24
Other Services	215,076	7.75	34.38	1.06	1.66	3.57	48.41	0.73	2.44

Source: Own calculation - the SAM 2000 for Bangladesh. Sectoral wage payments are obtained from IO-2000. Distribution parameters are derived using HIES 2000 and Labour Force Survey 2000.

It is observed that the agricultural sectors' wage payment mostly go to the rural low-skilled male workers, except that the highest proportion of the wage payment generated from the livestock and poultry sector go to urban low-skilled male category. Major shares from miscellaneous industry, fertilizer and insecticides, construction and infrastructure, and trade and transport sector are also accrued by the rural low skilled male workers. High skilled male in the rural area are found to be more engaged in forestry, textile sectors, ready made garments, petroleum products, education and other services. The rural low skilled female workforce, albeit their low participation, makes their living mainly from tea cultivation, tea products, livestock-poultry, textile and clothing, garment industries, and housing sector. The high skilled rural female workforce is found to be more engaged in textile and clothing sectors, utilities, health and education.

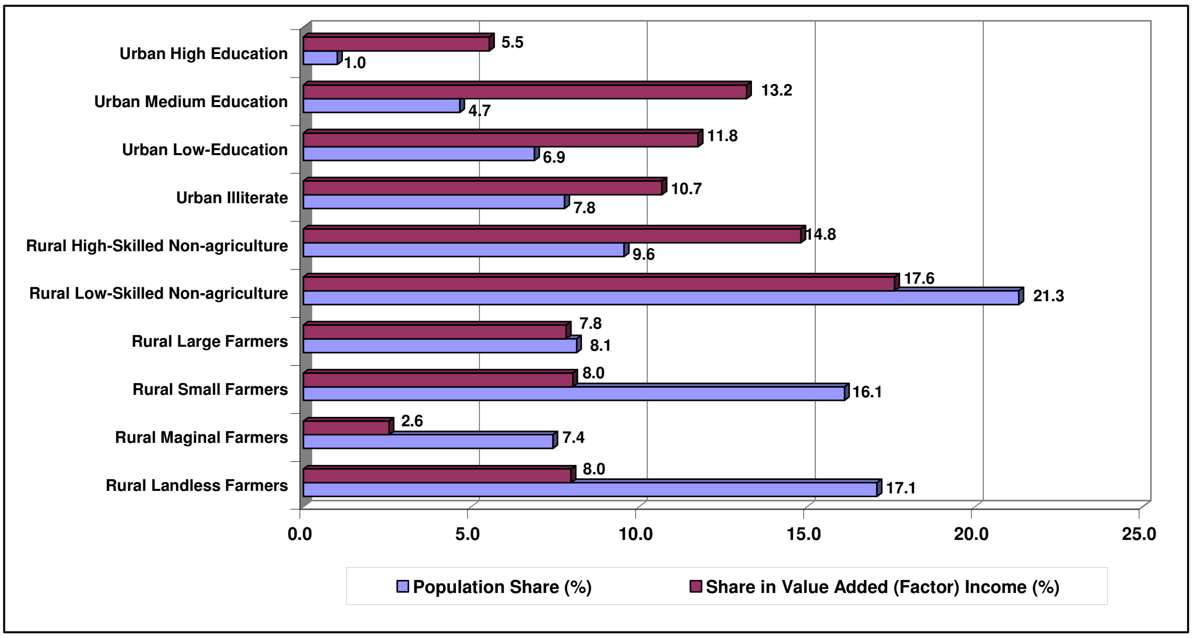
Table 6 also shows that while urban high skilled males get higher returns from service sectors in relative terms, urban low skilled male category is found to be scattered all over (except petroleum, education, forestry, tea and cereal crops, where they get much less wage returns as a group). Again, wage return to urban female is very low. While the urban low-skilled female are found to accrue relatively more wage from livestock and poultry, other food, yarn, textile, garments and housing sectors, urban high skilled female are getting relatively more wage from the service sectors, i.e. housing, health and education. Urban high skilled female are also engaged visibly in chemical industries, garments and other services.

Distribution of Primary Income to Households

While the SAM 2000 reveals the way different labour categories are receiving money as factor payments from different sectors, it also makes explicit how these factor returns are in turn distributed to different households groups and corporations who are the suppliers of the factors of production, either as labour or as capital. Graph 2 shows how the total value addition in the economy is distributed among the household groups.

All the rural household groups, except high skilled non-agricultural households receive less than their population share. In contrast, all the urban household groups receive proportionately more relative to their population share. This indicates per capita income differentials attributable to the factor incomes.

Graph 2: Distribution of Primary Income (Value Addition) to the Household Groups in 2000



Source: Own calculation - the SAM 2000 for Bangladesh. Distribution parameters and population shares are derived using HIES-2000.

Table 7 shows, row-wise, the distribution of particular type of wage remuneration directed towards various rural household groups who supply the respective labours. For instance, of the 375,735 million taka wage received by the rural low-skilled male category, almost four-fifths are distributed to the landless farmers and the low-skilled non-agricultural households (i.e. 35.7 and 42.2 percent respectively). A similar pattern is observed for the distribution of rural low skilled female wage incomes. In contrast, the total wage received by the rural high-skilled male and female categories is mostly distributed to the rural high-skilled non-agricultural household groups (i.e. 60.9 and 63.9 percent respectively). Taking another perspective, the column on total wage shows that the bulk of the wages are received by the male workers vis-à-vis female workers.

Table 7: Rural Wage Distribution across Household Groups in 2000

Rural Labour Categories	**Total Wage income** (Million. Taka)	Distribution of Wage across the household groups (percentage)					
		Landless Farmers	Maginal Farmers	Small Farmers	Large Farmers	Low-Skilled Non-agri.	High-Skilled Non-agri.
Low-skilled Male	375,735	35.7	9.0	9.4	1.8	42.2	1.9
High-skilled Male	209,880	7.2	3.5	12.5	7.7	8.2	60.9
Low-skilled Female	33,741	38.8	6.1	4.9	0.3	41.6	8.2
High-skilled Female	10,453	5.0	1.7	7.0	18.5	3.9	63.9

Source: Own Calculation – the SAM 2000 for Bangladesh. The distribution parameters are derived by using HIES-2000.

The urban wage distribution among various household groups in table 8 indicates that the urban illiterate households are the main suppliers of the low-skilled male labour, followed by low education household groups. The wages accrued by urban high skilled male are shared by urban low education, urban medium education and urban high education groups, as revealed by the percentage values of 25.0, 47.0, and 25.0 respectively. While most of the urban female low-skilled workers are coming from illiterate household group, urban medium education group appears to be the main supplier of high-skilled female household groups, followed by urban low education and urban high education.[15]

Table 8: Urban Wage Distribution in 2000

Urban Labour Categories	Total Wage Income (Million Taka)	Distribution of Wage across the household groups (percentage)			
		Urban Illiterate	Urban Low Education	Urban Medium Education	Urban High Education
Low-skilled Male	178,461	72.0	27.0	1.0	0.0
High-skilled Male	278,056	3.0	25.0	47.0	25.0
Low-skilled Female	28,910	66.0	21.0	9.0	4.0
High-skilled Female	25,373	4.0	19.0	64.0	13.0

Source: Own calculation – the SAM 2000 for Bangladesh. The distribution parameters are derived by using HIES-2000.

Appendix 5 shows the distribution of the 'capital factor' returns (i.e. the returns in terms of operating surplus and mixed income) in the SAM 2000. Appendix 5 suggests that most of the land-based capital returns are channeled to the large farmer households, followed by the small farmer groups. The total land-based capital return amounts to 273,678 million taka, of which 44.2 percent are going to the large farmer groups. On the other hand, the low-skilled non-agriculture households are getting the major share of the non-land based capital income, as a group. However, this group is the largest in the population share. While the rural farmer groups receive relatively much less portion of the non-land based capital returns, urban richer household groups are getting much higher returns than their population shares. As a whole, significant variations can be observed. For example, landless farmers in rural area constitute about 17 percent of the total population, but they receive less than 1 percent of the total capital returns. On the other side of the continuum, the urban high education group receives 4.6 percent of the total factor return, albeit low population-share (i.e. 1 percent). The distribution pattern is in line with the poverty profiles for the respective households.

Income Sources of the Household Account

The household accounts in the SAM describe their inter-dependence with sectors through consumption expenditure; their linkages with factors through factorial income generation; association with government and corporations through transfers receipts and payments of income tax; their relationships with the rest of the world accounts via remittances; intra-group transfer income and transfer payments; and their savings patterns.

Table 9: Sources of Income for the Households and their Distribution in 2000

Household Groups	Total Factor Returns	Intra-Household Transfer Receipt	Government Transfers and Corporate Dividends	Remittance Income from Abroad	Total Income
Rural Landless Farmers	172,563 (8.0)	5,933 (10.5)	4,367 (16.2)	9,593 (9.8)	192,458 (8.2)
Rural Maginal Farmers	55,296 (2.6)	3,197 (5.7)	2,341 (8.7)	5,844 (5.9)	66,678 (2.8)
Rural Small Farmers	173,752 (8.0)	7,870 (14.0)	2,182 (8.1)	20,520 (20.9)	204,324 (8.7)
Rural Large Farmers	169,493 (7.8)	4,079 (7.2)	2,667 (9.9)	9,697 (9.9)	185,935 (7.9)
Rural Low-Skilled Non-agriculture	381,224 (17.6)	7,393 (13.1)	6,369 (23.6)	19,912 (20.3)	414,898 (17.7)
Rural High-Skilled Non-agriculture	320,645 (14.8)	5,870 (10.4)	2,987 (11.1)	17,414 (17.7)	346,196 (14.8)
Urban Illiterate	231,206 (10.7)	3,202 (5.7)	505 (1.9)	4,709 (4.8)	239,623 (10.2)
Urban Low-Education	254,451 (11.8)	5,110 (9.1)	2,797 (10.4)	5,494 (5.6)	267,852 (11.4)
Urban Medium Education	285,722 (13.2)	10,498 (18.6)	1,903 (7.1)	2,825 (2.9)	300,949 (12.8)
Urban High Education	119,950 (5.5)	3,189 (5.7)	835 (3.1)	2,241 (2.3)	126,215 (5.4)
Total	2,164,302 (100)	56,342 (100)	26,952 (100)	98,250 (100)	2,345,846 (100)

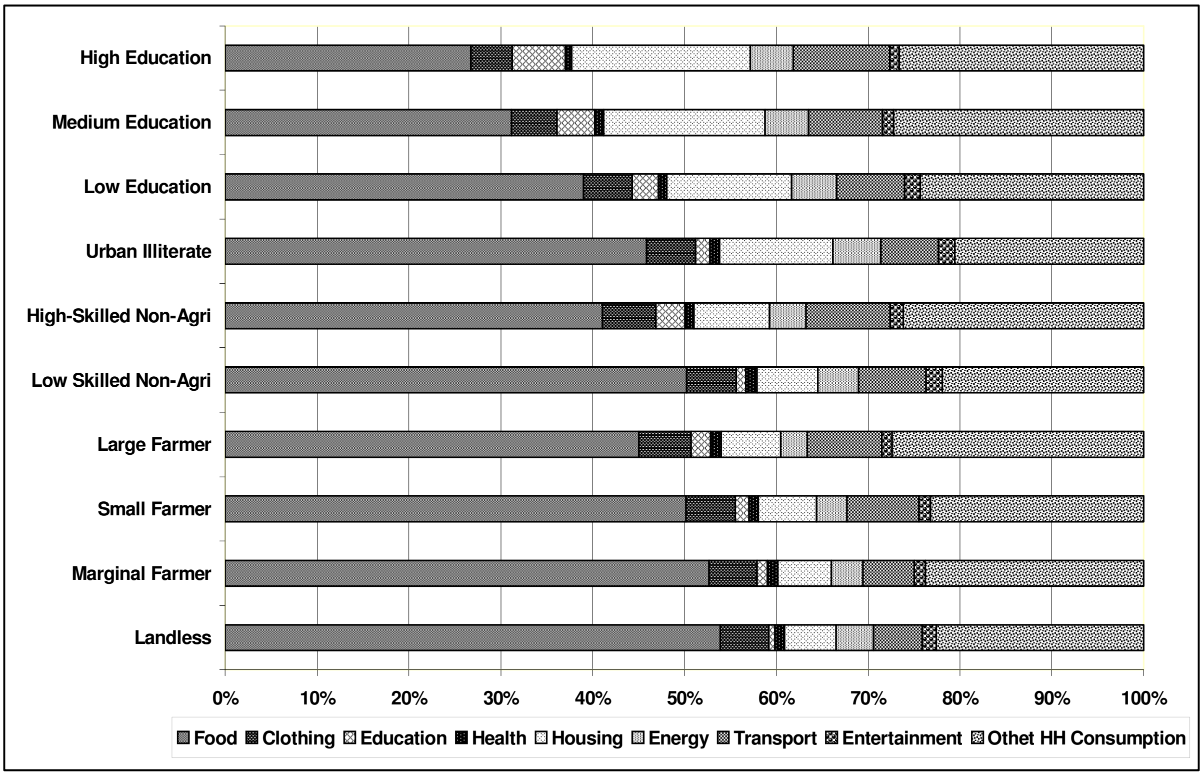
Source: Own calculation - SAM 2000 for Bangladesh. The distribution parameters are derived by using HIES-2000.
Note: Values are in Million taka. Figures in the parentheses indicate the respective column percentages.

Table 9 presents in money terms the income components of the respective household groups for the year 2000. The distribution of a particular income item across household groups is given by the respective column percentages in the parenthesis. Distribution patterns differ category-wise. For instance, the rural small farmers as a group receive 8 percent of the total factor returns in the economy vis-à-vis 21 percent of the total remittances. In general, it is evident that the poor household groups receive relatively less income when their population share in the economy is taken into consideration.

Consumption Patterns of the Household Groups

The SAM 2000 reveals the consumption patterns of different household groups, as derived from the expenditures they incur in the 9 types of consumption items.

Graph 3: Consumption Patterns of the Household Groups



Source: Own calculation - the SAM 2000 for Bangladesh. Distribution parameters are derived using HIES-2000.

The patterns postulate that while expenditure on food constitutes the major portion of the total household consumption expenditures, the poorer households' shares in the corresponding budgets are much higher than the richer ones. For example, the share of expenditure on food in the landless, marginal farmers, small farmers and low-skilled non agriculture household groups are more than 50 percent of the respective budgets. The urban high education, medium education, low education, rural large farmers, and high skilled non-agricultural households' expenditure shares on food are 27 percent, 31 percent, 39 percent, 45 percent and 41 percent respectively. In general, expenditure shares on education and housing are larger for the urban groups when compared with that of the rural household groups.

4. The SAM Multiplier Model

A SAM, with its systematic data and classification systems, has the principal objective of providing the statistical basis for creating a plausible model in order to analyze how the economy works and to predict the effects of policy interventions. Since a SAM inherits the feature of a modular analytical framework, it has frequently been used to examine the consequences of real shocks, using a multiplier model that treats the circular flow of income endogenously. More specifically, the SAM framework, under certain assumptions, can be used to estimate the effects of exogenous changes and injections, such as increases or decreases in the demand for specific products (i.e. sectoral outputs) on the whole socioeconomic system. Therefore, the move from the SAM structure to a model structure requires that the accounts of this matrix be segregated into endogenous and exogenous. The need for this arises from the fact that there must be an entry into the system, i.e. some variables must be manipulated exogenously via injections in order to evaluate the consequences on the endogenous accounts. As a general guideline, accounts *a priori* specified as objectives or targets when the SAM was built should be made endogenous. On the other hand, the accounts intended to be used as policy instruments, or beyond the control of the domestic economy and institutions, should be made exogenous (Alarcon, 2000, p. 17). Following the above criteria, the following four accounts of the SAM 2000 for Bangladesh have been selected as endogenous accounts: the production account; the factors account; the final consumption account; and the households account. Government, corporations, rest of the world, and the consolidated capital accounts are made exogenous.

The impact of any given injection into the exogenous accounts of the SAM is transmitted through the interdependent SAM system among the endogenous accounts. The interwoven nature of the system implies that incomes of factors, households and production sectors are all derived from exogenous injections into the economy via a multiplier process. Accounting multipliers are calculated according to the standard Leontief inverse formula:

$$Y = A * Y + X = (I - A)^{-1} * X = M_a * X \qquad (1)$$

Here: $\boldsymbol{Y}$ is a vector of endogenous variables (accounts); $\boldsymbol{X}$ is a vector of exogenous variables (accounts); $\boldsymbol{A}$ is the matrix of average propensities of expenditures for endogenous accounts; $\boldsymbol{I}$ is the identity matrix; and $\boldsymbol{M_a}$ or $\boldsymbol{(I - A)^{-1}}$ is the matrix of aggregate accounting multipliers.[16] The dimension of the $\boldsymbol{M_a}$ matrix is 59*x*59 with broadly categorized four endogenous accounts (i.e. 30 sectors, 10 factors, 9 consumption items, and 10 households).[17]

The interpretation of the values in the $\boldsymbol{M_a}$ is straightforward. When read column-wise, the values show the increase of income in each of the 59 endogenous elements due to 1 unit of external injection into the column element via the exogenous accounts.[18] The sum of all the values in a particular column would then show the total backward linkage that is generated due the 1 unit injection in the corresponding column account. Since there are four broader categories of endogenous accounts, i.e. sectors, factors, consumption items, and households, four modular partial backward linkages can be identified. Table 10, in which the $\boldsymbol{M_a}$ matrix is partitioned and presented as a collection of sub matrices, illustrates this further.

Table 10: Impact Sub Matrices of the Multiplier Matrix (M_a)

	Sectors	**Factor**	**Consumption**	**Household**
Sectors	M_{11} (30x30)	M_{12} (30x10)	M_{13} (30x9)	M_{14} (30x10)
Factor	M_{21} (10x30)	M_{22} (10x10)	M_{23} (10x9)	M_{24} (10x10)
Consumption	M_{31} (9x30)	M_{32} (9x10)	M_{33} (9x9)	M_{34} (9x10)
Household	M_{41} (10x30)	M_{42} (10x10)	M_{43} (10x9)	M_{44} (10x10)
Total	Backward Linkage	Backward Linkage	Backward Linkage	Backward Linkage

Note: The dimension of each matrix is shown is the parentheses.

When the demand driven interventions occur through sectors, the relevant blocks for impact-analysis refer to M_{11} (gross output impact for 30 sectors), M_{21} (GDP impact for 10 factors of production), M_{31} (consumption impact in terms of 9 consumption items), and M_{41} (household income impact for 10 household groups). Similarly, when the injections are inserted via the household account (e.g. increase of government transfers), the relevant blocks for impact-analysis refer to M_{14}, M_{24}, M_{34}, and M_{44}.[19] Since the present multiplier framework has four endogenous accounts, four types of multiplier measures can be calculated. These are shown in table 11.

Table 11: Types of Multiplier Impacts on Endogenous accounts via Exogenous Instruments

Impact on Endogenous Account	Exogenous Instruments
1. **Gross Output Multiplier**, which indicates the total effect on sectoral gross output of a unit-income increase in a given account *i* in the SAM, is obtained by adding the activity elements in the matrix along the column for account *i*.	Intervention through activities • Exports • Government Expenditure • Inventory Demand
2. **Value added or GDP multiplier,** giving the total increase in GDP resulting from the same unit-income injection, is derived by summing up the factor-payment elements along account *i*'s column.	No instruments
3. **Consumption multiplier,** showing the total increase in the consumption of basic needs resulting from the unit-income injection, is obtained by summing up the basic need elements along the column of account *i*.	No instruments
4. **Household income multiplier** shows the total effect on household income and is obtained by adding the elements for the corresponding household groups along the account *i* column.	Intervention through households • Remittance • Government Transfers • Corporation Transfers

This paper reports the impact-outcomes in terms of all these four multipliers, with necessary sub-details.

The multiplier matrix M_a can be decomposed in two ways: the multiplicative decomposition and the additive decomposition.[20] In the first version, the multiplier matrix is decomposed into three multiplicative components M_3, M_2 and M_1.

$$M_a = M_3 * M_2 * M_1 \qquad (2)$$

The matrix M_1 is defined as intra-group or transfer effect, which measures the within account effects resulting out of an external income injection into the system. M_2 is denominated as cross-effects or extra-group effects, which measures the effects on the accounts other than the one where the injection took place. M_3 is the circular or inter-group effects**,** which measures the full circular effects resulting out of an exogenous income injection into the system, after returning to the account where the injection originated (Alarcon, 2000, p. 31).

In the second method of decomposition the multiplier is decomposed into four additive effects; these are: the initial injection *(I)*; the net contribution of transfer multiplier effect resulting from direct transfers within endogenous accounts *(T)*; the net contribution of open loop effects capturing the interaction among and between the endogenous accounts *(O)*; and the net contribution of the close loop effect *(C)*. However, these two types of multiplier decomposition are not significantly different, but the interpretation of the additive decomposition is straightforward. Mathematically, the additive and multiplicative components can be related to the generalized Leontief inverse as follows:[21]

$$M_a = I + T + O + C = M_3 * M_2 * M_1 \qquad (3)$$

Where: $T = (M_1 - I)$; $O = (M_2 - I) * M_1$; $C = (M_3 - I) * M_2 * M_1$; I = Identity Matrix.

While the multipliers obtained using the SAM as a linear model allow to capture the structural features of income distribution and the interrelations among various economic agents, the model rests on some critical assumptions. It assumes that there exists excess capacity that would allow relative prices to remain constant in the face of demand shocks; that expenditure propensities of endogenous accounts remain constant; and that production technology and resource endowments are given for a period. Therefore, the SAM based multiplier model inherits the assumptions of the traditional input-output analysis, particularly the following (Alarcon, 2000, p. 16):

a) the average propensities to spend are fixed, linear, and considered constant or at least stable over the short-to-medium term;
b) relative prices are constant over the time horizon of the model, usually the short-term. This implies that the components which make up any account bunch have substitution elasticities which are zero across accounts and infinite within accounts, i.e. they are homogenous within and heterogeneous across accounts;
c) expenditure-income elasticities are constant and equal to unity;
d) there is perfect complementarity between capital and other factor inputs;
e) it offers a nominal analysis in current prices.
f) the economy has idle capacity utilization; and
g) a number of accounts are exogenous.

The SAM-multiplier model is driven by changes in exogenous demand and solve for a resulting change in supply and demand that balances all endogenous accounts (Robinson, 2003, p. 4). The model resembles the mechanisms of the simple Keynesian model where unemployment is assumed and output is determined by demand; whereas the SAM multiplier model achieves macro equilibrium through induced changes both in incomes and demand. The model, however, ignores the issues of resource allocation, productivity and factor utilization. Its fixed coefficients ignore substitution possibilities in consumption, production, imports and exports triggered by changes in relative prices. It also ignores possibilities for partial shifting of the incidence of taxes, tariffs and subsidies through interaction between supply and demand. Additionally, the model does not capture the behavior of economic agents interacting within markets in response to shifts in price signals, through which non-transfer government policies affect the economy.

While some of the assumptions may be justified and some remains to be the limiting features of the model, the SAM and the SAM-based multiplier model has been widely appreciated in examining the effects of real shocks on the economy on the distribution of income across socio-economic groups of households, particularly from a short term perspective. "One important feature of the SAM-based multiplier analysis is that it lends itself easily to decomposition, thereby adding an extra degree of transparency in understanding the nature of linkage in an economy and the effects of exogenous shocks on distribution and poverty." (Round, 2003, p. 271) The richness of the SAM multipliers comes from their tracing out chains of linkages from changes in demand to changes in production, factor incomes, household incomes, and final demands (Thorbecke, 2000, pp. 21-22). Therefore, the SAM framework permits tracing and quantifying all the propagation channels in the economy; and in doing so, provides a very useful policy instrument for meso level economy-wide impact analysis of demand driven interventions.

Sectoral Impacts on Gross Output, GDP, Household Income and Consumption

This section addresses the research question 1: how do interventions into different sectors affect household income via their effects on sectors, products, factors and consumption patterns? The M_{11}, M_{21}, M_{31}, and M_{41} sub-matrices of the M_a multiplier matrix show column-wise the increase in the gross outputs of the sectors, income of the factors of production, income of the households, and consumption expenditure on all the items respectively, that results from 1 unit amount of injection into that particular column sector.[22]

Table 12: Total Multiplier Impact on Output, GDP, Household Income and Consumption

1 unit injection into each sector		Gross Output Multiplier	GDP Multiplier	Income Multiplier	Consumption Multiplier
1	Cereal Crops	5.083	2.530	2.529	1.962
2	Jute	5.089	2.600	2.600	2.031
3	Other Crops	5.063	2.555	2.554	1.987
4	Tea Cultivation	4.983	2.474	2.465	1.918
5	Livestock and Poultry	5.569	2.448	2.439	1.892
6	Fish and Shrimp	5.006	2.418	2.416	1.865
7	Forestry	4.741	2.503	2.505	1.918
8	Rice and Grain Milling	5.631	2.495	2.491	1.935
9	Other foods	5.401	2.410	2.388	1.866
10	Tea products	5.155	2.311	2.288	1.794
11	Leather Products	5.649	2.415	2.383	1.857
12	Jute Textile	5.368	2.577	2.550	2.017
13	Yarn	4.018	1.785	1.764	1.383
14	Textile Clothing	4.697	2.152	2.120	1.662
15	Woven Ready Made Garments	4.864	2.195	2.164	1.691
16	Knit Ready Made Garments	4.651	2.376	2.342	1.829
17	Chemical Products	4.554	2.109	2.079	1.616
18	Miscellaneous Industry	4.541	2.180	2.149	1.683
19	Fertiliser	4.688	2.440	2.397	1.886
20	Petroleum Products	4.834	2.239	2.204	1.713
21	Clay and Cement Products	4.805	2.284	2.248	1.769
22	Iron and Steel Products	4.679	2.390	2.346	1.835
23	Machinery	4.740	2.377	2.336	1.826
24	Construction and Infrastructure	4.714	2.392	2.353	1.847
25	Utility	4.383	2.114	2.074	1.616
26	Trade and Transport Service	4.807	2.623	2.593	2.04
27	Housing sector	4.787	2.543	2.511	1.963
28	Health sector	4.646	2.483	2.435	1.891
29	Education sector	4.556	2.528	2.511	1.927
30	Other Services	4.733	2.483	2.462	1.900

Source: Own calculation - Multiplier model outcomes.

The values in table 12 indicate how 1 unit increase in the demand for each of the sectors' product leads to the total increase in the income of four endogenous accounts as a whole. For instance, considering the gross output multiplier, 1 unit injection in cereal crops leads to 5.083 units of output increase in the economy, vis-à-vis 4.018 unit increase when injection occurs in the yarn sector. The top five sectors in terms of generating highest gross output multipliers are leather products, rice and grain milling, livestock and poultry, other foods, and jute textile; which indicate their high integration with other sectors. The bottom five sectors that generate the least gross output multiplier values are yarn, utility, chemical products, education, and health sectors, indicating their lower level of integration with other sectors.

Observation of the GDP multipliers shows that the sectors that produce high (low) gross output multipliers do not automatically generate high (low) GDP multipliers accordingly.

For example, while education and health sectors rank in the bottom in terms of output multipliers with values of 4.556 and 4.646, injection into these sectors produce relatively higher GDP multipliers placing them to be among the top ten sectors that produce highest GDP multipliers. The top five sectors that produce the highest GDP multipliers are trade and transport, jute, jute textile, other crops, and housing; which indicate their high contribution in the value additions. The bottom five sectors are, ready made garment, miscellaneous industry, textile clothing, utility, chemical products, and yarn – indicating high leakages and lower integrations with the domestic factors of production.

Similarly, the next column shows the increase in total household income due to 1 unit injection into each of the sectors. Jute, trade and transport, other crops, housing and education are among the top sectors, injecting into which generate higher income for the households. However, as will be shown later, the distribution of these total increases in household income is uneven across households.

Appendix 12 presents the decomposition of the output multipliers into three components, i.e. injection, transfer multiplier, and close-loop multiplier.[23] The decomposition reveals the important fact that the indirect impact of intervention is much higher than the direct impact that is triggered by the initial injection. This is evident in the decomposition of GDP multipliers as well.

Ranking of Sectors in Terms of Poverty Alleviation Effects

The income multipliers in the M_{41} sub-matrix presents the distribution of total household income increase across households; and facilitate in addressing the second research question: how do sector-wise growth performances impart differential income impacts for variants of household groups; and what would be the ranking of sectors in terms of poverty alleviating effects?

Table 13: Ranking of Sectors for the Rural Households in terms of Income Generation

Rural Households->		Landless Households		Marginal Farmers		Small Farmers		Large Farmers		Low-skilled Non-Agriulture		High-skilled Non-Agriculture	
Sectors		Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank
1	Cereal Crops	0.2354	2	0.0814	2	0.2779	4	0.3308	4	0.4383	6	0.335	12
2	Jute	0.2547	1	0.0861	1	0.2792	3	0.3271	5	0.4598	1	0.3219	23
3	Other Crops	0.2346	3	0.0813	3	0.2793	2	0.3364	2	0.4362	7	0.3235	20
4	Tea Cultivation	0.2279	4	0.0757	5	0.2547	7	0.2956	7	0.4323	8	0.329	14
5	Livestock & Poultry	0.2006	11	0.0704	9	0.2487	8	0.2922	8	0.4025	18	0.3274	17
6	Fish and Shrimp	0.2036	9	0.0738	6	0.2707	5	0.3328	3	0.3985	19	0.323	21
7	Forestry	0.1935	14	0.0737	7	0.2899	1	0.3656	1	0.3886	23	0.362	6
8	Rice & Grain Milling	0.2194	7	0.0763	4	0.2634	6	0.3116	6	0.4195	10	0.329	15
9	Other foods	0.1987	13	0.0665	11	0.2175	9	0.2324	9	0.4148	14	0.325	18
10	Tea products	0.2043	8	0.065	12	0.2029	11	0.209	11	0.4138	15	0.3157	24
11	Leather Products	0.1805	18	0.0601	16	0.1954	14	0.1964	12	0.4095	16	0.3221	22
12	Jute Textile	0.2262	5	0.0716	8	0.2131	10	0.212	10	0.4567	2	0.3243	19
13	Yarn	0.1446	29	0.0474	30	0.1516	30	0.1549	28	0.3115	30	0.2403	30
14	Textile Clothing	0.1805	19	0.0576	22	0.1746	24	0.1647	23	0.3926	22	0.3053	28
15	Woven RMG	0.1705	25	0.0553	25	0.1705	27	0.1573	25	0.3776	25	0.3282	16
16	Knit RMG	0.1806	17	0.0591	17	0.186	18	0.1737	16	0.4054	17	0.3657	5
17	Chemical Products	0.148	28	0.0492	28	0.1596	28	0.1524	29	0.3485	29	0.2901	29
18	Miscl. Industry	0.1824	16	0.059	19	0.1794	23	0.171	19	0.3937	21	0.3077	27
19	Fertiliser	0.2019	10	0.0644	13	0.1902	15	0.1689	21	0.4507	4	0.3504	10
20	Petroleum	0.1572	27	0.0529	27	0.172	25	0.1568	26	0.3743	26	0.354	8
21	Clay and Cement	0.1739	21	0.056	24	0.1711	26	0.156	27	0.3973	20	0.3137	26
22	Iron and Steel	0.1706	24	0.057	23	0.1841	19	0.1659	22	0.416	12	0.3716	3
23	Machinery	0.1762	20	0.0577	21	0.1809	22	0.1632	24	0.4149	13	0.3515	9
24	Construction & Infrstr.	0.2001	12	0.0636	14	0.189	17	0.1731	17	0.4391	5	0.334	13
25	Utility	0.1439	30	0.0481	29	0.1582	29	0.1454	30	0.3605	28	0.3139	25
26	Trade & Transport	0.2202	6	0.0697	10	0.1987	13	0.1781	14	0.4559	3	0.356	7
27	Housing sector	0.1864	15	0.0591	18	0.1827	21	0.1692	20	0.4178	11	0.3383	11
28	Health sector	0.1636	26	0.0547	26	0.1841	20	0.1722	18	0.4204	9	0.3705	4
29	Education sector	0.172	23	0.0609	15	0.2021	12	0.1873	13	0.3742	27	0.491	1
30	Other Services	0.1736	22	0.0589	20	0.1892	16	0.1758	15	0.3831	24	0.3954	2

Source: Own calculation - Multiplier model outcomes.

The multiplier values in table 13 show the increase of income of the respective household groups due to 1 unit increase in the corresponding sectoral exogenous demand. For example, when read row-wise, 1 unit increase in the exogenous demand of cereal crops increases landless household's income, as a group, by 0.2354 units, marginal farmer group's income by 0.0814 unit, and so on; and resulting in total income increase of household income by 2.529 units (table 12).[24] However, when read column-wise, the values show how a particular household group's income increases due to 1 unit injection in different sectors. For example, 1 unit injection in the cereal crop would increase landless groups' income by 0.2354 units, whereas they accrue only 0.1572 units when injection occurs in the petroleum sector. Column-wise ranking of values in descending order for each of the household groups would then reveal the ranking of the sectors for corresponding households in terms of income generation, and therefore, poverty alleviation. Table 13 shows that the agricultural sectors possess the higher ranks for all the agricultural households; and therefore play very important role in promoting their income. In contrast, the rural high-skilled non-agricultural households accrue greater benefit from the stimuli generated in the service sectors (health, other services, education etc.). The rural low-skilled non-agricultural household experience more increase in income when the stimuli originate in jute, jute textile, trade and transport, fertilizer and construction & infrastructure sectors. In general, trade and transport appear to be an important sector for all the rural households in promoting their incomes.

The column values, besides indicating differential impacts of sectoral growth patterns on a particular household group's income generation, also postulate an important feature about the extent and the way the trickle down effects operate in the economy. It is observed that a household group experiences considerable income increase even in the case that the particular household has minimum integration with that sector. To make this point explicit, for instance, while the landless farmers experience the highest income increase of 0.2547 units when the injection occurs in jute sector, the same group experiences the least income increase of 0.1439 units when injection occurs in the utility sector.

Table 14 presents the ranking of sectors for the urban households. It is observed that growth stimuli that originate in the service sector results in higher incomes for all the urban households in general; high education, medium education, and low education groups, in particular. Agricultural sectors, on the other hand, are found to be least income generating for the urban households.

Table 14: Ranking of Sectors for the Urban Households in terms of Income Generation

	Urban Households->	Illiterate		Low Education		Medium Education		High Education	
Sectors		Mult. Value	Rank	Mult. Value	Ranking	Mult. Value	Rank	Mult. Value	Rank
1	Cereal Crops	0.2213	25	0.2348	27	0.2667	26	0.1071	26
2	Jute	0.2559	10	0.2455	22	0.2639	27	0.1059	27
3	Other Crops	0.2538	12	0.2438	24	0.2612	29	0.1044	29
4	Tea Cultivation	0.2288	20	0.2411	26	0.2707	22	0.1096	24
5	Livestock and Poultry	0.2514	13	0.2529	19	0.2793	19	0.1134	19
6	Fish and Shrimp	0.2174	27	0.2302	29	0.2613	28	0.105	28
7	Forestry	0.2105	29	0.2345	28	0.275	20	0.1112	21
8	Rice and Grain Milling	0.246	17	0.2458	21	0.2707	23	0.1094	25
9	Other foods	0.2636	7	0.2651	15	0.2873	18	0.1175	18
10	Tea products	0.2462	16	0.2506	20	0.2704	24	0.1102	22
11	Leather Products	0.256	9	0.2896	6	0.3333	6	0.1404	6
12	Jute Textile	0.3404	1	0.2971	5	0.2908	17	0.1179	17
13	Yarn	0.2063	30	0.2032	30	0.2159	30	0.0881	30
14	Textile Clothing	0.2235	24	0.2425	25	0.2684	25	0.1097	23
15	Woven Ready Made Garments	0.2357	18	0.2566	18	0.2916	15	0.1211	15
16	Knit Ready Made Garments	0.2575	8	0.2753	12	0.3109	10	0.1281	10
17	Chemical Products	0.2182	26	0.2621	16	0.3188	8	0.1321	8
18	Miscellaneous Industry	0.2246	23	0.2453	23	0.2736	21	0.1125	20
19	Fertiliser	0.2687	6	0.2809	10	0.2994	13	0.1215	14
20	Petroleum Products	0.2257	21	0.2671	14	0.3133	9	0.1312	9
21	Clay and Cement Products	0.2886	4	0.2802	11	0.2911	16	0.1197	16
22	Iron and Steel Products	0.2706	5	0.2837	8	0.303	12	0.1232	13
23	Machinery	0.2539	11	0.2847	7	0.32	7	0.1329	7
24	Construction and Infrastructure	0.2491	15	0.275	13	0.3048	11	0.1257	11
25	Utility	0.2251	22	0.2598	17	0.2962	14	0.1233	12
26	Trade and Transport Service	0.3093	2	0.3148	2	0.3445	5	0.1459	5
27	Housing sector	0.3009	3	0.3207	1	0.3792	2	0.1562	2
28	Health sector	0.2499	14	0.3061	3	0.3635	4	0.1498	4
29	Education sector	0.2109	28	0.2824	9	0.3765	3	0.1539	3
30	Other Services	0.2304	19	0.302	4	0.3853	1	0.1679	1

Source: Own calculation - Multiplier model outcomes.

The ranking of sectors from the perspective of the urban illiterate households show that jute textile, trade and transport, housing, clay and cement product, iron and steel are the top five sectors that generate higher income for them. Again, the range of column values postulates the nature of trickle down effect at work for the urban economy.

Sectoral Impact on the Factor Returns to Different Labour Categories

Appendix 10 and 11 present the multiplier values of the M_{21} block and show the increase of the income of each factor category due to 1 unit exogenous injection in different sectors. This is related to the third research question: how do different labour categories benefit from their linkages with sectors in terms of value additions?

For instance, it is observed from appendix 10 that 1 unit exogenous increase in demand for jute leads to 0.602 units increase for the rural low-skilled male workers, which indicates their high degree of integration with that sector. Similarly, other crops, cereal crops, jute textile, and rice and grain milling are some of the sectors that generate high benefits for this labour category. The same category is found to be relatively less integrated with service sectors, and most of the manufacturing sectors. In contrast, rural high skilled male categories are found to be more integrated with the manufacturing and service sectors relative to the agricultural sectors. Trade and transport sector appears to be a very important sector for both the rural male labour categories in promoting their income.

Low multiplier values for the female labour categories indicate both their low level of participation in the labour force, as well as the existence of male-female wage differentials. However, the ranks show that tea cultivation, tea products, housing, jute textile and RMG sector impart relatively higher benefits to the rural low-skilled female labour category. The rural female high skilled categories are found to accrue more benefits from the stimuli that originate in education, health, knit and woven ready made garments, other services, and livestock and poultry.

Appendix 11 presents the multiplier values for the urban labour categories. It is observed that both male and female high skilled categories are least integrated with the agricultural sectors. Whereas service sectors are important for both the categories, high skilled male are found to be more integrated with large scale manufacturing industries, like petroleum products, iron and steel, cement and clay, machinery, utility, construction and infrastructure etc. Besides all the service sectors, woven and knit ready made garment, and chemical product industries are important for the urban high skilled female category. The ranking for the low-skilled male and female categories show mixed pattern.

5. Simulations with the SAM Multiplier Model

This section presents the results of some simulation exercises performed with the multiplier model, which are designed to address the rest of the research questions.[25]

The Growth-Poverty-Inequality Nexus

The sectoral growth patterns impart differential income impacts on various socio-economic groups. The impact of the growth stimuli that originate in the agricultural sectors would be different for a particular household group from the growth stimuli that originate in the manufacturing or service sectors. In the process, different growth patterns would bear diverse poverty and inequality implications. Given this hypothesis, this section attempts to tackle the research question 4: is a specific growth strategy, and the concomitant income impact, inequality increasing; equity enhancing; or distribution neutral? The simulation design in this case entails insertion of exogenous injection in each of the sectors separately in such a way that generates 1 percent GDP growth in each case. Therefore the exercise involves 30 simulations for 30 sectors of the SAM, where in each case the exogenous amount of a particular sector is increased (while keeping the other sectors constant) in a way that produces 1 percent GDP growth. The corresponding income impacts on all the 10 households constitute the basis of analysis.

Each row in Table 15 shows the percentage increases of income for different households due to 1 percent GDP increase, and which is attributable to the stimulus that originates in a particular sector.[26] For example, 1 percentage GDP growth attributable to the stimulus of 8877 million taka in cereal crops would lead to 1.086 percent increase of the income of the rural landless farmers, as against 0.753 percent increase in the income of urban high education households. In contrast, 1 percent GDP growth attributable to the exogenous injection in the 'other service' sector would increase the income of landless farmer group by 0.816 percent vis-à-vis 1.204 percent income increase of the urban high education group.

Table 15: Differential Household Income Impacts of Sectoral Growth Patterns

Sl.	Sectors	Injection Amount (Million Taka)	GDP growth (%)	Rural Households						Urban Households			
				Landless	Maginal Farmers	Small Farmers	Large Farmers	Low Skilled Non agri	High Skilled Non agri	Illiterate	Low Education	Medium Education	High Education
1	Cereal Crops	8877	1.00	1.086	1.085	1.207	1.580	0.938	0.857	0.820	0.778	0.787	0.753
2	Jute	8640	1.00	1.144	1.116	1.181	1.520	0.958	0.802	0.923	0.792	0.758	0.726
3	Other Crops	8791	1.00	1.071	1.072	1.202	1.591	0.924	0.820	0.931	0.800	0.763	0.728
4	Tea Cultivation	9080	1.00	1.076	1.032	1.132	1.444	0.946	0.861	0.867	0.817	0.817	0.789
5	Livest. -Poultry	9175	1.00	0.957	0.969	1.117	1.442	0.890	0.866	0.963	0.867	0.852	0.825
6	Fish and Shrimp	9285	1.00	0.983	1.029	1.230	1.662	0.892	0.865	0.843	0.798	0.806	0.773
7	Forestry	8975	1.00	0.903	0.993	1.273	1.765	0.841	0.937	0.789	0.786	0.820	0.792
8	Rice-Grain Mlg	9005	1.00	1.027	1.031	1.161	1.509	0.911	0.854	0.925	0.827	0.810	0.781
9	Other food	9320	1.00	0.963	0.930	0.993	1.165	0.932	0.873	1.025	0.922	0.890	0.868
10	Tea products	9720	1.00	1.032	0.948	0.965	1.093	0.970	0.885	0.999	0.909	0.874	0.849
11	Leather Products	9300	1.00	0.872	0.838	0.890	0.983	0.918	0.864	0.994	1.005	1.030	1.035
12	Jute Textile	8718	1.00	1.025	0.937	0.909	0.994	0.960	0.815	1.239	0.967	0.843	0.815
13	Yarn	12580	1.00	0.946	0.895	0.933	1.048	0.945	0.872	1.083	0.955	0.903	0.878
14	Textile Clothing	10435	1.00	0.979	0.902	0.892	0.925	0.988	0.918	0.974	0.945	0.931	0.907
15	Woven RMG	10235	1.00	0.907	0.849	0.854	0.866	0.932	0.969	1.007	0.980	0.992	0.982
16	Knit RMG	9455	1.00	0.887	0.839	0.861	0.884	0.924	0.997	1.016	0.972	0.977	0.959
17	Chemical	10650	1.00	0.819	0.787	0.832	0.873	0.895	0.891	0.970	1.042	1.128	1.115
18	Miscl. Industry	10305	1.00	0.977	0.912	0.905	0.948	0.978	0.914	0.966	0.944	0.937	0.919
19	Fertiliser	9205	1.00	0.966	0.890	0.857	0.837	1.000	0.930	1.032	0.965	0.916	0.887
20	Petroleum	10030	1.00	0.819	0.796	0.845	0.847	0.905	1.024	0.945	1.000	1.044	1.043
21	Clay and Cement	9832	1.00	0.889	0.827	0.823	0.825	0.942	0.889	1.184	1.029	0.951	0.933
22	Iron and Steel	9395	1.00	0.833	0.804	0.847	0.838	0.942	1.007	1.061	0.995	0.946	0.917
23	Machinery	9450	1.00	0.866	0.819	0.837	0.829	0.945	0.958	1.002	1.005	1.005	0.996
24	Constr.-Infrstr.	9390	1.00	0.976	0.896	0.869	0.874	0.994	0.904	0.977	0.964	0.951	0.936
25	Utility	10625	1.00	0.795	0.767	0.823	0.831	0.923	0.962	0.998	1.031	1.046	1.038
26	Trade&Transport	8565	1.00	0.980	0.895	0.833	0.821	0.941	0.879	1.106	1.007	0.981	0.990
27	Housing	8830	1.00	0.856	0.783	0.790	0.804	0.889	0.861	1.109	1.057	1.113	1.093
28	Health	9047	1.00	0.770	0.743	0.815	0.838	0.917	0.967	0.944	1.034	1.093	1.074
29	Education	8885	1.00	0.794	0.812	0.879	0.895	0.801	1.258	0.782	0.937	1.112	1.084
30	Other Services	9045	1.00	0.816	0.800	0.838	0.855	0.835	1.031	0.870	1.020	1.158	1.204

Source: Own calculation - Simulation Results of the SAM Multiplier Model

Table 15 suggests that, in general, the rural households experience higher percentage increases in their incomes when the GDP growth emanates out of the stimuli in the agricultural and food processing sectors. In contrast, the urban household groups experience higher percentage increases in the incomes if the GDP growth is led by the service sectors. Although the manufacturing sector-led GDP growth tend to benefit the urban households relatively more than their rural counterparts, the pattern in this case is mixed.

Appendix 13 presents the outcomes, for each sectoral growth pattern, in terms of the Gini index of income inequality and head count poverty index. It is observed that in 16 cases (i.e. the agricultural sectors, and some other sectors) the sectoral growth impulses are 'equity' enhancing resulting in the decreases of the Gini coefficients from its base value of 0.44162. The rest of the 14 sectoral growth impulses are found to be 'inequality' increasing resulting in the increase of the Gini coefficients from its base value. The ranking shows the relative strengths in terms of imparting inequality reduction impact.

Interpretation of the poverty implications in terms of the head count index (and the corresponding ranking) requires caution. While increase of household income leads to a decrease in the poverty counts, it is found that growth impulses generated in some of the 'inequality' enhancing sectors lead to relatively larger reductions in the poverty counts. This is plausible when the poor people in relatively richer household groups with low gaps of income from the poverty line are pulled above the poverty lines with a smaller income increases. On the other hand, a large income increase due to a growth impulse generated by an 'equity' enhancing sector may not be enough to pull the poor people above the poverty line because of large poverty gap index for the poor in the particular household.[27]

The Trickle down Impact of the Observed Nominal Growth Impulse

After the quantitative impact assessment of different sectoral growth stimuli in the previous section, it is pertinent to examine how the observed nominal growth impulse imparts differential income impacts. This would address the research question 5: does an observed positive growth impulse trickle down to the poor? The exogenous injection amounts in this scenario are set in ways that replicate the observed nominal growth pattern after the simulation.

Table 16: Observed and Simulated Nominal GDP Growth Rates

Sectors	**Base nominal GDP 2000** (Million Taka)	**Annual average nominal GDP growth (1997-2000)** (Percentage)	**Post-simulation GDP** (Million Taka)	**Post-simulation nominal GDP growth** (Percentage)
Agriculture and Forestry	317,328	8.4	343,968	8.4
Fishery	60,683	12.5	68,248	12.5
Industry	519,170	9.1	566,497	9.1
Utility and Construction	244,079	11.5	272,027	11.5
Trade and Transport	515,455	8.7	560,753	8.8
Other Services	589,498	9.7	646,764	9.7
Total	2,246,212	9.4	2,458,257	9.4

Source: Own calculation – Siumulation results of the multiplier model. The annual average nominal GDP growth is calculated from the yearly growth rates obtained from MoF, 2004, p. 233.

Table 16 shows the actual yearly average nominal GDP growth rates for the broad sectors during the period 1997-2000. Then, the exogenous injections are inserted in ways that regenerate the exact observed nominal growths while comparing the base GDP of 2000 with the post-simulation GDP.[28]

Table 17 presents the simulated outcomes in terms of household income generation. The observed pattern of GDP growth impulse increases the total income of the rural landless farmers from 192,457 million to 208,363 million taka. This amounts to an increase of 15,906 million taka, which is 8.26 percent of their total income. Similarly, the percentage increase of income as a group is shown for all other household groups. The highest percentage income increase is experienced by the urban high education group (i.e. 9.97 percent). In general, the income growths of the poorer groups are less than their richer counterparts. Also, the income growths of the urban households are higher than that of the rural groups.

Table 17: Income impact of the Observed Nominal Growth Impulse

Household Groups	Base Household Income (Million Taka)	Post-Simulation Houshold Income (Million Taka)	Increase in Income (Million Taka)	Percentage Increase in Income
Rural Landless	192,457	208,363	15,906	8.26
Rural Maginal Farmers	66,677	72,312	5,635	8.45
Rural Small Farmers	204,323	223,069	18,746	9.17
Rural Large Farmers	185,934	202,955	17,021	9.15
Rural Low Skilled Non agriculture	414,897	452,254	37,357	9.00
Rural High Skilled Non agriculture	346,915	380,481	33,566	9.68
Urban Illiterate	239,622	261,828	22,206	9.27
Urban Low Education	267,852	293,738	25,886	9.66
Urban Med Education	300,949	330,822	29,873	9.93
Urban High Education	126,215	138,802	12,587	9.97

Source: Own calculation – Siumulation results of the multiplier model.

The results highlight the trickle down process of the economic growth. In the context of the dominance of the contemporary ‘growth-first’ approach in the policy formulation, the income growth figures for different household groups may not be disappointing. However at the same time, the postulated income growth may not be sufficient to pull majority of the poor people above the poverty line. The model outcomes in terms of percentage increases of household incomes are then used in the HIES 2000 survey to simulate the poverty and inequality implications.

Table 18: Poverty and Income inequality Impact of the Observed Nominal Growth Impulse

Initial Gini Coefficient	Post-Simulation Gini Coefficient	Change in Gini Coefficient
0.4416	**0.4430**	**0.0014**
Initial Head Count Ration (HCR) (percent)	Post Simulation HCR (percent)	Change in HCR (percentage points)
44.77	**41.82**	**2.95**

Source: Own calculation. Calculated by using the simulation outputs and the HIES-2000 data.

Table 18 shows that the observed growth impulse would deteriorate the inequality situation, which is reflected in the increased Gini coefficient from its initial value. The head count ratio, on the other hand, shows that the observed growth impulse leads to a reduction of 2.95 percentage points.[29] This may be considered as the upper estimate of poverty reduction, because this exercise assumes 'equal' within household distribution. In reality, in proportional terms, the income increases may vary among the poor and non-poor households within the same group; probably, the later group benefiting more than the former groups. While the model captures differential income implications across household groups, tracking within household differentials in the distribution remains beyond the scope of the model.

6. Conclusion

In the formulation of the PRSP, the government faces the obligation to relate its policy actions to the adopted targets, particularly, to that of poverty reduction. In the absence of an adequate analytical framework, it is difficult to evaluate, quantitatively, how the proposed strategies are expected to contribute to the achievement of this target. A joint committee of the IMF and the World Bank staff has recently reported to their respective boards:

"…. Early experience with the Poverty Reduction Strategy Paper program has highlighted the need for further research, in addition to work already underway, in a number of critical areas. A central topic for more work is that of the linkages between expenditures on interventions and inputs designed to reduce poverty on the one hand, and results in terms of actual outcomes for the poor on the other. Not enough is known about what the programs and actions that constitute the core of a poverty reduction strategy will in practice 'buy' in terms of poverty reduction, or about the time frame over which outcomes are likely to emerge. Without more knowledge of the relationship between expenditures and results, it is difficult to evaluate the impact of proposed strategies." (IMF, IDA, 2000, p. 5)

The SAM approach adopted in this paper in examining the research questions bears immense policy relevance in this context, particularly from the short-run perspective. It offers a framework of analysis that brings together the growth and redistributive elements in a single framework, and facilitates in conducting simulation exercise to trace and quantify each stage of the propagation channels of various demand shocks (stimuli). The model outcomes suggest that the impacts of the interventions of similar extent lead to differential income generation outcomes for various socio-economic groups. It is then possible to simulate different intervention options to find out better ways to address the needs of the target groups. Since one can simulate how much injection amount is required to achieve a target growth in the GDP or the income of different household groups, the model may also be used in costing and feasibility exercises that are deemed critical in the plan formulation. The model allows ranking the sectors in terms of poverty alleviation effects from the perspective of various household groups. It distinguishes the sectors imparting inequality enhancing effects in the economy from the ones that enhance equity. In the process it reveals the potential trade-offs that exist among growth, income poverty and inequality. The model reveals the way different labour categories (classified by location, gender and skills criteria) incur benefit (or loss) form their linkages with the sectors.

The growth-poverty-inequality nexus is both complex and multi-dimensional. Understanding of this relationship and its underlying determinants constitutes the critical element in the formulation of successful poverty reduction strategies. The modeling approach of this paper in this context is a modest attempt to develop a better understanding on the processes by which the living standards (in terms of the income level) and their distribution are determined simultaneously. The construction of the SAM, if embodied as a routine task of the national accounting exercise, would facilitate not only in portraying the structural characteristics of the economy at the reference periods, but also in revealing the dynamic features of the relationships among economic agents and enabling modeling exercises to simulate and envisage the prospect in a more accurate manner.

Appendices

Appendix 1: Average Yearly Growth of Sectoral GDP (1980-2000)

Sectors	Average Yearly Growth (%) (At constant 1995/96 prices)		
	1981-2000	**1981-1990**	**1991-2000**
Agriculture	**2.9**	**2.5**	**3.2**
Crop and Horticulture	2.3	2.7	1.8
Animal Farming	2.3	2.1	2.5
Forestry	3.2	2.7	3.6
Fishing	5.3	2.4	8.2
Industry	**6.4**	**5.8**	**7.0**
Manufacturing	6.0	5.0	6.9
Large and Medium Scale	6.0	4.9	7.0
Small Scale	6.0	5.2	6.8
Mining and Quarrying	7.3	8.6	6.0
Electricity Gas and Water Supply	9.4	13.2	5.5
Construction	6.8	6.0	7.5
Services	**4.1**	**3.7**	**4.5**
Wholesale and Retail Trade	5.1	4.5	5.7
Hotel and Restaurant	4.8	4.1	5.5
Transport, Storage, Communication	4.6	4.7	4.6
Financial Intermediations	4.3	3.7	4.8
Real Estate, Renting and Business Activities	3.3	3.2	3.5
Others	3.5	3.0	4.0
Total	**4.3**	**3.7**	**4.8**

Source: BBS (2000); BBS (2001)- as cited in Sen *et al* (2004), p. 70.

Appendix 2: Contribution of Different Sectors to the GDP Increment

Sectors	Period (Values in percentage)		
	1980-2000	1980-2000	1980-2000
Agriculture	**19.6**	**21.1**	**18.8**
Crop and Horticulture	9.2	14.3	6.4
Animal Farming	2.0	2.3	1.8
Forestry	1.5	1.6	1.5
Fishing	6.9	2.9	9.1
Industry	**32.5**	**29.2**	**34.2**
Manufacturing	18.8	15.7	20.4
Large and Medium Scale	13.4	11.0	14.6
Small Scale	5.4	4.7	5.8
Mining and Quarrying	1.4	1.7	1.2
Electricity Gas and Water Supply	2.1	3.1	1.6
Construction	10.2	8.7	11.0
Services	**47.9**	**49.7**	**47.0**
Wholesale and Retail Trade	15.0	14.2	15.4
Hotel and Restaurant	0.7	0.6	0.7
Transport, Storage, Communication	9.7	11.2	9.0
Financial Intermediations	1.6	1.6	1.6
Real Estate, Renting and Business Activities	7.6	8.8	7.0
Others	13.3	13.3	13.3
Total	**100**	**100**	**100**
Incremental GDP (Billion Taka at constant prices)	**1105.2**	**380.7**	**724.5**

Source: BBS (2000); BBS (2001) – as cited in Sen *et al* (2004), p. 71.

Appendix 3: Consistency of the Bangladesh SAM 2000: Balances of the SAM Accounts

Incomes, Expenditures and Balances of the Accounts in the Aggregate SAM 2000

(All values in Million Taka)

1. Activity (sector) Account: Balance of total Supply and Demand

Intermediate use + Domestic final consumption + Govt. consumption + Exports + Capital formation = Total demand
(2,038,994) (1,619,146) (108,386) (331,446) (405,691) **(4,503,663)**

Intermediate use + Value additions + Indirect taxes and import duties + Intermediate imports = Total supply
(2,038,994) (2,246,212) (40,781 + 28,657 = 69,438) (149,019) **(4,503,663)**

2. Factor Account: Balance of total Receipts and Outlays

Value Addition = Factor returns to households + Factor returns to corporations
(2,246,212) (2,164,302) (81,910)

3. Final Consumption Account: Balance of income and Expenditure

Household consumption = Domestically supplied final products + Final imports + Duty on final imports
(1,833,631) (1,619,146) (182,716) (31,769)

4. Household Account: Balance of income and Expenditure

Factor returns + Intra-household transfer income + Govt. transfer + Dividend + Remittance = Total income
(2,164,302) (56,342) (26,440) (512) (98,250) **(2,345,846)**

Household consumption + Intra-household transfer payment + Direct tax + Savings = Total expenditure
(1,833,631) (56,341) (38,041) (417,833) **(2,345,846)**

5. Government Account: Balance of income and Expenditure

Indirect taxes and tariffs on intermediate inputs (69,437) + Duties on final imports (31,769) + Direct tax (38,041) + Corporate tax (2,739) + Duties on imports of capital goods (20,431) = Total income **(162,418)**

Govt. consumption (108,386) + Govt. transfers (26,440) + Saving (27,592) = Total expenditure **(162,418)**

6. Corporation Account: Balance of Income and Expenditure

Factor return = Dividend + Corporate tax + Savings
(81,910) (512) (2,739) (78,659)

7. Rest of the World Account: Balance of Income and Expenditure

Import (intermediate) + Import (final) + Import (Capital goods) = Export + Remittance + Foreign saving
(149,019) (182,717) (106,250) (331,446) (98,250) (8,289)

8. Capital Account: Balance of Savings and Investment

Household saving + Government saving + Corporate saving + Foreign saving = Total savings
(430,243) (15,181) (78,659) (8,289) **(532,372)**

Capital formation net of stock change + Import of capital goods + Duties on capital import = Investment
(404,691) (106,250) (20,431) **(532,372)**

National Account Identity: Value Addition = Final Demand - Import

- Value Addition (incl. indirect tax) = 2,246,212 + 40,781 = **2,395,233**
- Final demand = Domestic final consumption + Govt. consumption + Exports + Capital formation
  (2,464,669) (1,619,146) (108,386) (331,446) (405,691)
- Intermediate Import (incl. duties) = 149,019 + 28,657 = 177,676
- Final Demand – Import (incl. duties) = 2,464,669 – 177,676 = **2,395,233**

Source: Own calculation – the SAM 2000 for Bangladesh

Appendix 4: Poverty Profile of the Household Groups in the SAM 2000 for Bangladesh

	Head Count Index (HCI)	Poverty Gap Index (PGI)	Poverty Severity Index (SPGI)
Rural Households			
Landless Farmers	0.67	0.23	0.11
Maginal Farmers	0.62	0.24	0.13
Small Farmers	0.50	0.18	0.09
Large Farmers	0.22	0.06	0.03
Low-Skilled Non-agriculture	0.48	0.14	0.06
High-Skilled Non-agriculture	0.19	0.04	0.02
Urban Households			
Urban Illiterate	0.53	0.16	0.07
Low-Education	0.25	0.07	0.03
Medium Education	0.05	0.01	0.00
High Education	0.00	0.00	0.00

Source: Own calculation using HIES-2000 unit record data.
Note: Rural and urban poverty line incomes are taken from the World Bank and BBS estimates of upper poverty lines (World Bank, 2002, p. 95). World Bank and BBS use 14 upper poverty lines for 7 urban and 7 rural regions. The averages for rural and urban poverty lines are used. For rural households the poverty line is set at 652 taka/person/month; for urban household the poverty line is set at 807 taka/person/month. The estimates refer to 'income' based poverty profile.

Technical Notes on Poverty and Inequality Indicators

Head Count Index (HCI): Head Count Index is the proportion of population with a per capita income below the poverty line.

Poverty Gap Index (PGI): The depth of poverty is measured by the poverty gap index (PGI), which estimates the average distance separating the income of the poor from the poverty line as a proportion of the income indicated by the line. The poverty gap, therefore, estimates on the average, how far below the poverty line are the poor as a proportion of that line (for the non-poor the distance is zero).

Squared Poverty Gap Index (SPGI): The average of the squared poverty gap for each poor person is the (SPGI). This is a dispersion measure about the severity of poverty.

For households the three poverty measures may be computed with the following formula, popularly known as the FGT index of poverty (Foster *et al.* (1984) proposed this family of poverty indices, based on a single formula):

$$P_{\alpha h} = \frac{1}{n_h} \sum_{i=1}^{q_h} \left[(z_h - y_{ih}) / z_h \right]^{\alpha}$$

α = 0, 1, 2 for HCI, PGI and SPGI, respectively;
$h \in \{1,2, \ldots, 10\}$ refers to the ten households considered;
$P_{\alpha h}$ is the composite FGT index by household;
$i \in \{1,2, \ldots, q_h\}$ refers to each poor person by household;
q_h is the number of the poor by each household group;
n_h is the number of persons (sample size) by household;
z_h are the poverty lines for each household group.
y_{ih} is per capita income of the i^{th} poor person by household.
The head-count index corresponds to α=0, the poverty gap index to α=1, and the squared poverty gap to α=2.

Gini Inequality Index: The Gini coefficient is the ratio of the area between the Lorenz curve and the line of equality, to the area of the triangle below this line. Suppose there are n individuals (or households) who are labeled in non-descending order of income as: $Y_1 \leq Y_2 \leq Y_3 \leq \ldots \ldots \leq Y_n$. Let us denote this income distribution by the vector Y = (Y_1, Y_2, Y_3 . . . Y_n) and let μ be its mean. Let Fi be the cumulative population share and Q_i the cumulative income share corresponding to individual i (i =1, 2, 3,. . . .. n).
Define $F_0 = Q_0 = 0$. Thus. $F_i = i/n$ and $Q_i = 1/n\mu \sum Y_k$ *for i= 0,1.....n.*
Then the Gini coefficient is:
$G = 1 - \sum(F_{i+1} - F_i)(Q_{i+1} + Q_i)$

Appendix 5: Distribution of Mixed Income and Operating Surpluses (Capital Returns) in 2000

(Values are in Million Taka) Household Groups	Land based Capital return		Non-Land based Capital return		Total		Population Share
	Value	(%)	Value	(%)	Value	(%)	(%)
Landless Farmers	0	0.0	9,575	1.2	9,575	0.9	17.1
Maginal Farmers	7,184	2.6	4,691	0.6	11,875	1.2	7.4
Small Farmers	68,728	25.1	41,370	5.0	110,097	10.8	16.1
Large Farmers	120,925	44.2	23,677	2.8	144,602	14.1	8.1
Low-Skilled Non-agriculture	13,818	5.0	176,993	21.3	190,811	18.6	21.3
High-Skilled Non-agriculture	36,326	13.3	139,876	16.8	176,203	17.2	9.6
Urban Illiterate	6,106	2.2	67,834	8.2	73,940	7.2	7.8
Urban Low-Education	8,222	3.0	117,350	14.1	125,572	12.3	6.9
Urban Medium Education	10,574	3.9	123,644	14.9	134,217	13.1	4.7
Urban High Education	1,795	0.7	45,005	5.4	46,800	4.6	1.0
Total Capital Returns	**273,678**	**100.0**	**831,924**	**100.0**	**1,023,693**	**100.0**	**100.0**

Source: Own calculation - the SAM 2000 for Bangladesh. The distribution parameters are derived by using HIES-2000.

Appendix 6: Household Expenditure Items in the Bangladesh SAM 2000

(Values are in Million Taka)	Household Consumption	Intra-Household Transfer Payments	Direct Tax	Saving	Total Expenditure	Saving in percent of Total Expenditure
Landless Farmers	184,152	2,165	23	6,117	192,458	3.2
Maginal Farmers	61,455	1,446	0	3,777	66,678	5.7
Small Farmers	169,460	7,966	14	26,884	204,324	13.2
Large Farmers	102,893	6,866	896	75,279	185,935	40.5
Low-Skilled Non-agriculture	349,160	5,592	688	59,458	414,898	14.3
High-Skilled Non-agriculture	237,212	9,408	6,596	93,700	346,916	27.0
Urban Illiterate	219,430	2,169	1,612	16,411	239,623	6.8
Low-Education	224,554	8,019	12,229	23,050	267,852	8.6
Medium Education	221,935	9,259	8,810	60,945	300,949	20.3
High Education	63,379	3,450	7,174	52,213	126,215	41.4
Total	1,833,631	56,342	38,041	417,833	2,345,846	17.8

Source: The SAM 2000 for Bangladesh. Distribution parameters are derived using the unit record data of the Household Income Expenditure Survey 2000 of Bangladesh. Savings are derived as residuals after taking into account total income of the respective households.

Appendix 7: Share of Households' Expenditure in the Various Final Consumption Items

Consumption Items	Item-wise Total Expenditure (Mill. Taka)	Distribution of Expenditure across Household Groups (percent)									
		RLL	RMF	RSF	RLF	LNA	HNA	UIL	ULE	UME	UHE
Food	809,137	11.9	3.9	10.5	5.7	21.7	12.4	12.4	10.8	8.5	2.1
Clothing	98,217	9.6	3.1	9.3	5.9	19.3	14.6	11.9	12.1	11.2	2.9
Education	40,630	2.9	1.7	6.4	5.5	8.9	19.0	8.6	15.7	22.3	9.0
Health	18,725	10.0	3.6	8.9	6.1	22.2	12.5	12.0	11.1	11.2	2.3
Housing	183,159	5.5	1.9	5.9	3.7	12.6	11.0	14.8	16.6	21.3	6.7
Energy	79,097	9.2	2.6	7.1	3.8	19.6	12.4	14.5	13.9	13.3	3.7
Transport	137,489	6.9	2.4	9.7	6.1	18.6	16.3	10.0	12.1	13.0	4.9
Entertainment	27,509	10.0	2.7	7.7	4.2	22.5	12.7	14.1	13.9	9.8	2.4
Other Consumption	439,667	9.1	3.2	8.9	6.4	17.4	14.6	10.3	12.4	13.7	3.8
Total Expenditure	1,833,631	9.7	3.2	9.2	5.6	19.0	13.4	12.0	12.2	12.1	3.5

Note: RLL = Rural Landless; RMF = Rural Marginal Farmer; RSF = Rural Small Farmer, RLF = Rural Large Farmer; LNA = Rural Low-skilled Non-agriculture; HNA= Rural High-Skilled Non-agriculture; UIL = Urban Illiterate; ULE = Urban Low Education; UME = Urban Medium Education; UHE = Urban High Education. Row-wise the percentages show distribution of expenditure across household groups.

Source: Own calculation. Item-wise expenditures are derived from the 'private final consumption' vector of the input-output table 2000 of Bangladesh; Distribution parameters are derived using the unit record data of the HIES- 2000.

Appendix 8: Intra-Household Transfer Matrix in the SAM 2000.

A specific feature of the SAM is the transfer of resources among households in Bangladesh. The HIES 2000 report total as well as distribution of transfer receipts and payments by the 10 household groups. The intra-household transfers however require further disaggregation because although total transfer amounts received and paid are known for each household group, what is not shown yet is who transfers what to whom. Given the column (payments) and row (row) totals and assuming that transfer flows from richer households to either same or poorer households, the "RAS" technique has been adopted to generate a more complete disaggregation of intra-household transfers. The derived intra-household transfer matrix is shown in the table below.

- **Transfer Receipts and Payments by Household Groups in the SAM 2000.**

(Values Million Taka)	RLL	RMF	RSF	RLF	LNA	HNA	UIL	ULE	UME	UHE	Total Receipts
Landless	902	476	798	567	505	777	196	662	765	285	5933
Maginal Farmers	0	303	507	360	321	494	125	421	486	181	3197
Small Farmers	0	0	1379	980	873	1342	339	1144	1321	492	7870
Large Farmers	0	0	0	616	549	843	213	719	830	309	4079
Low-Skilled Non-agri	0	0	1295	920	820	1261	318	1075	1241	462	7393
High-Skilled Non-agri	0	0	1029	731	651	1001	253	853	985	367	5870
Illiterate HH	487	257	431	306	273	419	106	357	413	154	3202
Low-Education	777	410	687	488	435	669	169	570	659	245	5110
Med-Education	0	0	1840	1307	1165	1791	452	1526	1762	657	10498
High-Education	0	0	0	592	0	811	0	691	798	297	3189
Total Payments	2165	1446	7966	6866	5592	9408	2169	8019	9259	3450	56342

Source: Own calculation – the SAM 2000 for Bangladesh.

Note: RLL = Rural Landless; RMF = Rural Marginal Farmer; RSF = Rural Small Farmer, RLF = Rural Large Farmer; LNA = Rural Low-skilled Non-agriculture; HNA= Rural High-Skilled Non-agriculture; UIL = Urban Illiterate; ULE = Urban Low Education; UME = Urban Medium Education; UHE = Urban High Education.

Technical Note: RAS Method

"RAS" is not a direct acronym of any phrase; it entails an iterative algorithm of bi-proportional adjustment of matrices. It is generally used when information (or, new information) on matrix row and column becomes available, and based on that one wants to develop a distribution matrix based on the initial distribution parameters or assumed distribution parameters. It has been applied in updating IO or SAM to derive a new transaction or coefficient matrix. The generalization to any matrix, rather than only the IO or SAM, is the following problem: Find a new matrix coefficient, A^*, based on a given coefficient matrix $\overline{A}$, but yields a matrix T^*, with the new row and column sums. That is:

$t^*_{i,j} = a^*_{i,j} y^*_i$ and $\sum_j t^*_{i,j} = \sum_j t^*_{j,i} = y^*_i$; where, y^* are known new row and column sums. Then the RAS approach to solve this problem is to generate a new matrix A^* from the old matrix $\overline{A}$ by means of bi-proportional row and column operations: $a^*_{i,j} = r_i \overline{a_{i,j}} s_j$; or in matrix terms: $A^* = \hat{R}\overline{A}\hat{S}$, where the hat indicates a diagonal elements r_i and s_j.

Here, $\hat{R}$ = Row-adjustment factor; $\hat{S}$ = Column adjustment factor; and $\overline{A}$ = Input-output or any other matrix. The elements of $\hat{R}$ and $\hat{S}$ are found by a simple iterative procedure. (Robinson et al., 2000, p. 4)

Appendix 9: SAM Decomposition for a four Endogenous Accounting System[1]

	PA	FP	FC	HH	EXO	INCOME
PA	A_{11}	0	A_{13}	0	x_1	y_1
FP	A_{21}	0	0	0	x_2	y_2
FC	0	0	0	A_{34}	x_3	y_3
HH	0	A_{42}	0	A_{44}	x_4	y_4

Where,
PA = Production accounts (sectors).
FP = Factors of production accounts.
FC = Final consumption account
HH = Household account.
A_{ij} = Average propensities to expenditure
EXO = Vector of exogenous accounts
INCOME = Income of endogenous accounts

A_n Matrix

A_{11}	0	A_{13}	0
A_{21}	0	0	0
0	0	0	A_{34}
0	A_{42}	0	A_{44}

A_0 Matrix

A_{11}	0	0	0
0	0	0	0
0	0	0	0
0	0	0	A_{44}

$$\mathbf{A_n - A_0} = \begin{pmatrix} 0 & 0 & A_{13} & 0 \\ A_{21} & 0 & 0 & 0 \\ 0 & 0 & 0 & A_{34} \\ 0 & A_{42} & 0 & 0 \end{pmatrix}$$

<u>M_1 Matrix:</u> $\mathbf{M_1 = (I - A_0)^{-1}}$

$$M_1 = (I - A_0)^{-1} = \begin{pmatrix} (I-A_{11})^{-1} & 0 & 0 & 0 \\ 0 & I & 0 & 0 \\ 0 & 0 & I & 0 \\ 0 & 0 & 0 & (I-A_{44})^{-1} \end{pmatrix}$$

<u>M_2 Matrix</u>: $\mathbf{M_2 = I + A^* + A^{*2} + A^{*3}}$

Where,

$$A^* = (I-A_0)^{-1}(A_n - A_0) = \begin{pmatrix} 0 & 0 & A^*_{13} & 0 \\ A^*_{21} & 0 & 0 & 0 \\ 0 & 0 & 0 & A^*_{34} \\ 0 & A^*_{42} & 0 & 0 \end{pmatrix}$$

Where,

$\mathbf{A^*_{13} = (1 - A_{11})^{-1} A_{13}; \quad A^*_{21} = A_{21}; \quad A^*_{34} = A_{34}; \quad A^*_{42} = (1 - A_{44})^{-1} A_{42}}$

Iterating A* three times (for 4 endogenous accounts) and adding all iteration plus the I matrix one can derive $\mathbf{M_2}$.

$$A^{*2} = A^* A^* = \begin{pmatrix} 0 & 0 & 0 & A_{13}^* A_{34}^* \\ 0 & 0 & A_{21}^* A_{13}^* & 0 \\ 0 & A_{34}^* A_{42}^* & 0 & 0 \\ A_{42}^* A_{21}^* & 0 & 0 & 0 \end{pmatrix}$$

[1] Details of accounting multiplier decomposition can be found in Pyatt, Round (1979). The decomposition algorithms are implemented in the 'vensim' simulation software and largely adopted from the SHD-multiplier model algorithms.

$$A^{*3} = A^{*} A^{*} A^{*} = \begin{pmatrix} 0 & A_{13}^{*} A_{34}^{*} A_{42}^{*} & 0 & 0 \\ 0 & 0 & 0 & A_{21}^{*} A_{13}^{*} A_{34}^{*} \\ A_{34}^{*} A_{42}^{*} A_{21}^{*} & 0 & 0 & 0 \\ 0 & 0 & A_{42}^{*} A_{21}^{*} A_{13}^{*} & 0 \end{pmatrix}$$

M_2 Matrix: $M_2 = I + A^{*} + A^{*2} + A^{*3}$

$$M_2 = I + A^{*} + A^{*2} + A^{*3} = \begin{pmatrix} I & A^{*}_{13} A^{*}_{34} A^{*}_{42} & A^{*}_{13} & A^{*}_{13} A^{*}_{34} \\ A^{*}_{21} & I & A^{*}_{21} & A^{*}_{21} A^{*}_{13} A^{*}_{34} \\ A^{*}_{34} A^{*}_{42} A^{*}_{21} & A^{*}_{34} A^{*}_{42} & I & A^{*}_{34} \\ A^{*}_{42} A^{*}_{21} & A^{*}_{42} & A^{*}_{42} A^{*}_{21} A^{*}_{13} & I \end{pmatrix}$$

M_3 Matrix:

Iterating A* four times, subtracting from the I matrix and inverting it one can derive M_3: $\mathbf{M_3 = [1 - A^{*4}]^{-1}}$

$$M_3 = [I - A^{*4}]^{-1} = \begin{pmatrix} [I - A^{*}_{13} A^{*}_{34} A^{*}_{42} A^{*}_{21}]^{-1} & 0 & 0 & 0 \\ 0 & [I - A^{*}_{21} A^{*}_{13} A^{*}_{34} A^{*}_{42}]^{-1} & 0 & 0 \\ 0 & 0 & [I - A^{*}_{34} A^{*}_{42} A^{*}_{21} A^{*}_{13}]^{-1} & 0 \\ 0 & 0 & 0 & [I - A^{*}_{42} A^{*}_{21} A^{*}_{13} A^{*}_{34}]^{-1} \end{pmatrix}$$

Then,

<u>**Multiplicative Decomposition**</u>: $\mathbf{M_a = M_3 M_2 M_1 = [1 - A^{*4}]^{-1}. (I + A^{*} + A^{*2} + A^{*3}). (I - A_0)^{-1}}$

The matrix M_1 is defined as intra-group or transfer effect which measures the within account effects resulting out of an external income injection into the system. M_2 is denominated as cross-effects or extra-group effects, which measures the effects on the accounts other than the one where the injection took place. M_3 is the circular or inter-group effects**,** which measures the full circular effects resulting out of an exogenous income injection into the system, after returning to the account where the injection originated (Alarcon, 2000, p. 31).

<u>**Additive Decomposition**</u>: $\mathbf{M_a = I + T + O + C = I + (M_1 - I) + (M_2 - I).M_1 + (M_3 - I).M_2.M_1}$

Where, I = identity multiplier, which shows the effect of an injection into one account which amounts to an income increase identical to the original injection;

$T = (M_1 - I)$, or net transfer multiplier, which measures the net intra-group effect or direct effects or within account effects where the original injection took place;

$O = (M_2 - I) * M_1$, or open–loop multiplier measures the net extra-group effects or net cross effects arising out of an initial injection when it has completed a tour outside the original accounts without returning to it.

$C = (M_3 - I) * M_2 * M_1$, or the closed-loop multiplier measures the net contribution of circular effects which arise when after the original injection has completed a tour through all groups of accounts and returned to the one where it originally started (Alarcon, 2000, pp. 30-33).

Appendix 10: Ranking of Sectors for the Rural Labour Groups in terms of Wage Generation

Rural Labour Categories->		Low Skilled Male		High Skilled Male		Low Skilled Female		HighSkilled Female	
Sectors		Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank
1	Cereal Crops	0.5349	3	0.1906	13	0.041	8	0.0066	16
2	Jute	0.6021	1	0.1715	27	0.0321	20	0.0066	17
3	Other Crops	0.5366	2	0.1711	28	0.0413	6	0.0064	19
4	Tea Cultivation	0.4652	7	0.1823	20	0.0869	1	0.0064	20
5	Livestock and Poultry	0.4378	10	0.1854	16	0.0411	7	0.0082	8
6	Fish and Shrimp	0.4619	8	0.178	23	0.0302	23	0.006	25
7	Forestry	0.4135	13	0.2281	7	0.039	11	0.0064	21
8	Rice and Grain Milling	0.492	5	0.1886	15	0.0398	10	0.0066	18
9	Other foods	0.4326	12	0.1854	17	0.0389	12	0.0062	23
10	Tea products	0.4088	14	0.1821	21	0.077	2	0.006	26
11	Leather Products	0.389	16	0.1733	26	0.0318	21	0.0067	14
12	Jute Textile	0.4957	4	0.1738	25	0.0511	4	0.0064	22
13	Yarn	0.3075	28	0.1318	30	0.0338	16	0.0049	30
14	Textile Clothing	0.3827	17	0.1761	24	0.0401	9	0.0088	7
15	Woven RMG	0.3474	23	0.2182	9	0.0387	13	0.0131	5
16	Knit RMG	0.3586	21	0.2465	4	0.0453	5	0.0182	3
17	Chemical Products	0.309	27	0.1707	29	0.027	28	0.0057	29
18	Miscellaneous Industry	0.3985	15	0.1841	19	0.0296	25	0.006	27
19	Fertiliser	0.4436	9	0.2078	10	0.0272	27	0.0067	15
20	Petroleum Products	0.3109	26	0.2535	3	0.0302	24	0.0071	10
21	Clay and Cement Products	0.3716	18	0.18	22	0.0306	22	0.0071	11
22	Iron and Steel Products	0.3505	22	0.2452	5	0.0257	29	0.006	28
23	Machinery	0.3679	19	0.2216	8	0.0294	26	0.0062	24
24	Construction & Infrastructure	0.4352	11	0.1894	14	0.0351	15	0.0079	9
25	Utility	0.2939	30	0.1849	18	0.0245	30	0.0118	6
26	Trade and Transport Service	0.4854	6	0.2338	6	0.0323	19	0.0068	12
27	Housing sector	0.3595	20	0.2016	12	0.0674	3	0.0068	13
28	Health sector	0.3203	25	0.203	11	0.0384	14	0.0243	2
29	Education sector	0.3043	29	0.4583	1	0.0324	18	0.0432	1
30	Other Services	0.339	24	0.3214	2	0.0332	17	0.0142	4

Source: Own calculation - Multiplier model outcomes.

Appendix 11: Ranking of Sectors for the Urban Labour Groups in terms of Wage Generation

Urban Labour Categories->		Low Skilled Male		High Skilled Male		Low Skilled Female		HighSkilled Female	
Sector		Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank	Mult. Value	Rank
1	Cereal Crops	0.1740	18	0.2437	30	0.0246	22	0.0231	14
2	Jute	0.2155	5	0.2399	29	0.0326	6	0.0216	21
3	Other Crops	0.219	4	0.2355	28	0.0257	19	0.0213	24
4	Tea Cultivation	0.1803	16	0.2473	27	0.0265	17	0.0214	23
5	Livestock and Poultry	0.2059	10	0.2594	26	0.0318	7	0.0244	10
6	Fish and Shrimp	0.1708	19	0.2401	25	0.0246	23	0.0211	26
7	Forestry	0.1600	29	0.2636	24	0.0232	28	0.0216	22
8	Rice and Grain Milling	0.2041	11	0.2512	23	0.029	12	0.0232	13
9	Other foods	0.212	8	0.257	22	0.0354	5	0.0226	18
10	Tea products	0.202	12	0.2357	21	0.025	20	0.0212	25
11	Leather Products	0.1974	13	0.3305	20	0.0274	16	0.0231	15
12	Jute Textile	0.3117	1	0.2449	19	0.0364	4	0.0238	11
13	Yarn	0.1644	25	0.1845	18	0.0307	8	0.0165	30
14	Textile Clothing	0.1637	26	0.2249	17	0.0305	9	0.0207	28
15	Woven Ready Made Garments	0.1699	20	0.2687	16	0.0418	3	0.0262	7
16	Knit Ready Made Garments	0.177	17	0.2747	15	0.0562	2	0.0296	6
17	Chemical Products	0.162	27	0.3102	14	0.0236	27	0.0451	3
18	Miscellaneous Industry	0.1674	22	0.2384	13	0.0284	14	0.0209	27
19	Fertiliser	0.2127	7	0.2357	12	0.0242	24	0.0224	19
20	Petroleum Products	0.1606	28	0.298	11	0.0283	15	0.026	8
21	Clay and Cement Products	0.2499	3	0.2503	10	0.0258	18	0.0227	17
22	Iron and Steel Products	0.2154	6	0.2396	9	0.0228	29	0.0229	16
23	Machinery	0.1935	14	0.2869	8	0.0242	25	0.0234	12
24	Construction and Infrastructure	0.1901	15	0.2643	7	0.0238	26	0.0207	29
25	Utility	0.1672	23	0.2676	6	0.0212	30	0.0222	20
26	Trade and Transport Service	0.268	2	0.3491	5	0.0296	11	0.0252	9
27	Housing sector	0.2096	9	0.3613	4	0.0765	1	0.0609	2
28	Health sector	0.1679	21	0.3228	3	0.0305	10	0.0388	4
29	Education sector	0.1459	30	0.3767	2	0.0248	21	0.0839	1
30	Other Services	0.1654	24	0.4521	1	0.0289	13	0.0343	5

Source: Own calculation - Multiplier model outcomes.

Appendix 12: Decomposition of Gross Output and GDP Multipliers

	Sectors	Total Gross Output Multiplier (GOM)	Decomposition of Gross Output Multipliers GOM = I + T + O			Total GDP Multiplier (GDPM)	Decomposition of GDP Multipliers GDPM = O + C	
			Injection Amount (I)	Transfer Effect (T)	Close Loop Effect (O)		Open Loop Effect (O)	Close Loop Effect (C)
1	Cereal Crops	5.083	1.000	0.810	3.273	2.530	0.936	1.594
2	Jute	5.089	1.000	0.699	3.390	2.600	0.951	1.650
3	Other Crops	5.063	1.000	0.747	3.316	2.555	0.940	1.615
4	Tea Cultivation	4.983	1.000	0.785	3.198	2.474	0.915	1.559
5	Livestock and Poultry	5.569	1.000	1.416	3.153	2.448	0.909	1.539
6	Fish and Shrimp	5.006	1.000	0.896	3.110	2.418	0.902	1.516
7	Forestry	4.741	1.000	0.544	3.196	2.503	0.943	1.560
8	Rice and Grain Milling	5.631	1.000	1.404	3.226	2.495	0.922	1.573
9	Other foods	5.401	1.000	1.293	3.107	2.410	0.893	1.517
10	Tea products	5.155	1.000	1.167	2.988	2.311	0.853	1.458
11	Leather Products	5.649	1.000	1.563	3.086	2.415	0.904	1.511
12	Jute Textile	5.368	1.000	1.007	3.361	2.577	0.937	1.640
13	Yarn	4.018	1.000	0.717	2.301	1.785	0.661	1.124
14	Textile Clothing	4.697	1.000	0.932	2.766	2.152	0.801	1.351
15	Woven Ready Made Garment	4.864	1.000	1.052	2.811	2.195	0.819	1.376
16	Knit Ready Made Garment	4.651	1.000	0.610	3.040	2.376	0.888	1.488
17	Chemical Products	4.554	1.000	0.872	2.682	2.109	0.793	1.316
18	Miscellaneous Industry	4.541	1.000	0.739	2.801	2.180	0.811	1.369
19	Fertiliser	4.688	1.000	0.549	3.139	2.440	0.907	1.534
20	Petroleum Products	4.834	1.000	0.990	2.844	2.239	0.845	1.394
21	Clay and Cement Products	4.805	1.000	0.863	2.941	2.284	0.846	1.439
22	Iron and Steel Products	4.679	1.000	0.629	3.051	2.390	0.897	1.493
23	Machinery	4.740	1.000	0.707	3.033	2.377	0.892	1.485
24	Construction & Infrastructure	4.714	1.000	0.641	3.073	2.392	0.890	1.502
25	Utility	4.383	1.000	0.700	2.683	2.114	0.799	1.315
26	Trade and Transport Service	4.807	1.000	0.415	3.392	2.623	0.964	1.659
27	Housing sector	4.787	1.000	0.529	3.259	2.543	0.945	1.598
28	Health sector	4.646	1.000	0.508	3.137	2.483	0.943	1.539
29	Education sector	4.556	1.000	0.360	3.195	2.528	0.958	1.570
30	Other Services	4.733	1.000	0.583	3.150	2.483	0.936	1.547

Source: Own calculation – Multiplier model outcomes

Appendix 13: Inequality and Poverty Impacts of Sectoral Growth Patterns

Sectors		Initial Gini Coefficient: 0.44162			Initial Head Count Index: 0.4477		
		Post-simulation Gini coefficient	Change in Percentage in Gini coefficient	Ranking in terms of inequality effects	Post Simulation Poverty Counts	Change in Percentage head count poverty	Ranking in terms of reduction of head count poverty
1	Cereal Crops	0.44131	-0.031	3	0.4413	-1.427	16
2	Jute	0.44123	-0.039	1	0.4409	-1.523	8
3	Other Crops	0.44129	-0.033	2	0.4409	-1.523	8
4	Tea Cultivation	0.44137	-0.025	4	0.4413	-1.427	16
5	Livestock and Poultry	0.44149	-0.013	9	0.4409	-1.523	8
6	Fish and Shrimp	0.44141	-0.021	6	0.4413	-1.427	16
7	Forestry	0.44150	-0.012	10	0.4414	-1.416	17
8	Rice and Grain Milling	0.44138	-0.024	5	0.4409	-1.523	8
9	Other foods	0.44153	-0.009	11	0.4408	-1.541	3
10	Tea products	0.44147	-0.015	8	0.4408	-1.539	4
11	Leather Products	0.44178	0.016	23	0.4409	-1.529	7
12	Jute Textile	0.44142	-0.020	7	0.4408	-1.547	1
13	Yarn	0.44156	-0.006	12	0.4409	-1.535	5
14	Textile Clothing	0.44158	-0.004	14	0.4408	-1.539	4
15	Woven Ready Made Garments	0.44172	0.010	21	0.4409	-1.531	6
16	Knit Ready Made Garments	0.44172	0.010	20	0.4409	-1.531	6
17	Chemical Products	0.44194	0.032	28	0.4412	-1.459	13
18	Miscellaneous Industry	0.44159	-0.003	15	0.4408	-1.539	4
19	Fertiliser	0.44156	-0.006	13	0.4408	-1.541	3
20	Petroleum Products	0.44186	0.024	24	0.4412	-1.459	14
21	Clay and Cement Products	0.44166	0.004	18	0.4410	-1.508	9
22	Iron and Steel Products	0.44171	0.009	19	0.4412	-1.464	12
23	Machinery	0.44176	0.014	22	0.4410	-1.499	10
24	Construction and Infrastructure	0.44160	-0.002	16	0.4408	-1.539	4
25	Utility	0.44186	0.024	25	0.4413	-1.438	15
26	Trade and Transport Service	0.44165	0.003	17	0.4408	-1.545	2
27	Housing sector	0.44189	0.027	26	0.4411	-1.489	11
28	Health sector	0.44194	0.032	27	0.4413	-1.438	15
29	Education sector	0.44202	0.040	29	0.4416	-1.363	18
30	Other Services	0.44204	0.042	30	0.4416	-1.363	18

Note: (1) Ranking of sectors in terms of inequality reduction effects: 1 indicates the sectoral growth impulse that reduces the inequality to the maximum extent, and 30 the sectoral growth impulse that reduces the inequality to the minimum extent (or, increases inequality).

(2) Similarly, in case of the ranking in terms of poverty, 1 entails maximum head-count index reducing effect and 30 indicates minimum effect.

(3) The values represent the impacts of 1 percent nominal GDP growth impulse in the economy attributable to the increase of exogenous injection in the respective sectors.

Source: Own calculation. The poverty and inequality indices are derived using the model outcomes and the unit record data of HIES-2000. Please see appendix 4 for detail on the indices.

Notes

1. However, it is important to stress that the results differ from input-output analysis by virtue of the fact that input-output multipliers are augmented by additional multiplier effects induced by the circular flow of income among activities, commodities, factors and households (Round, 2003a, p. 303).

2. The reference period of analysis is 1980 to 2000, with particular emphasis on the decade of the 1990s.

3. The growth momentum in the 1990s was higher in the second half of the decade in comparison to the first half: average growth rates were 4.4 and 5.2 percent during 1991-95 and 1996-2000 respectively (Osmani, 2004, p. 3).

4. TFPG is measured by the output growth unexplained by known factors (e.g. labour and capital) and reflects the result of more efficient use of the inputs or the adoption of new production technologies (Sen et al., 2004, p. 16).

5. An alternative set of estimates for poverty and inequality is also reported in the PRSP of Bangladesh, along with those mentioned in table 3, which shows the national head count poverty declining from 49.7 percent in 1992 to 39.8 percent in 2000, accompanied by a decline of rural poverty from 52.9 percent to 43.6 percent, and the urban poverty from 33.6 percent to 26.4 percent (GOB, IMF, 2005, p. 13). The annual average rate of decline of the head count ratio, however, remains more or less the same. Similar pattern is observed for the inequality estimates. It is to note that, the poverty and inequality estimates in Bangladesh for the last three decades, as reflected in various literatures, show considerable variations. These variations are attributable to the surveys and methods used, the way income or consumption estimates were derived, whether the estimates are income or consumption based, the different techniques applied to derive the poverty line, and so on. For a survey of these estimates, please see Ravallion, Sen (1996); Rahman, Haque (1988); Rahman (1993); Osmani (1990); World Bank (2001); Rahman, Hossain (eds) (1995); and Sen et al. (2004).

6. The concept of pro-poor growth has not been given a concrete shape as yet. The various concepts put forward to articulate the notion of 'pro-poor growth' may be broadly categorized into two groups. One refers to the 'absolute pro-poor growth' that considers only the incomes of poor people. However, in doing so, almost any growth pattern will be pro-poor, provided that the income of the poor increases over time. Other more justified and acceptable definition refers to the 'relative pro-poor growth' that compares changes in the incomes of the poor with that of the non-poor, and checks whether the income of the poor grows faster that the income of the non-poor. Therefore, a growth process is qualified as pro-poor if it is accompanied by a reduction of income inequality (Fuentes R., 2005, p. 7). This paper assumes the later definition.

7. This hypothesis asserts that economic growth originating from different sectoral stimuli would impart differential income generation implications for various socio-economic groups. Loyaza and Raddatz (2005) provide a cross-country perspective on this issue.

8. The SHD project produced various in-house documents (unpublished) on SAM and SAM-based models, which include, *inter alia,* SHDU (2000), SHDU (2000a), SHDU (2002). Other literatures on SAM-based modeling include Mujeri, Khondker (1998), Fontana (2001).

9. The captions 'Bangladesh SAM 2000' or 'SAM 2000 for Bangladesh' or 'SAM 2000', hereafter, refer to the new SAM constructed by the author in this research.

10. In the SHD-SAM 1993, there are 45 sectors, 2 factors of production, 9 household groups, and 9 consumption items. In the SHD-SAM 2000, except the 'sectors' account, the classification scheme for other accounts is the same as in the SHD-SAM 1993. The SHD project conducted a couple of in-house exercises in constructing SAMs with two versions of 'sectors' and 'commodity' classifications, i.e. one with 45 sectors and 55 commodities (SHDU, 2002), and the other version with 86 sectors and 94 commodities. For modeling purpose, and better compliance with the survey information as well as the research questions, this paper assumes a univocal relationship between the 'sector' and the 'commodity'

with a 'sector' classification consisting of 30 sectors. The univocal relationship between 'sector' and 'commodity' is also maintained in the SHD-SAM 1993.

11. Some information and parametric guidelines, particularly related to the income and expenditure flow of the corporation account, are adopted from the SHD-SAMs.

12. The poverty profiles of the household groups are given in the Appendix 4.

13. In the HIES 2000, a head of the household may be either male or female, and is determined or identified by the respective household members.

14. "RAS" is not a direct acronym of any phrase; it entails an iterative algorithm of bi-proportional adjustment of matrices. See Appendix 8 for details on the RAS method and the intra-household transfer matrix.

15. A special feature of the household classification in SAM 2000 is that households are classified based on the status of the heads of households. Therefore, within a household, members' status may differ from that of the head's. For instance, an illiterate household may contain a high educated member who is engaged in some sort of employment, and thereby providing a source of income for that household.

16. The multiplier process is developed here on the assumption that when an endogenous account receives an exogenous injection, it spends exactly it in the same proportions as shown in the matrix of average propensities to spend (APS). The elements of the APS matrix is calculated by dividing each cell by its corresponding column sum totals.

17. The dimensions of both the Y (endogenous) and X (exogenous) vectors are 59x1.

18. The term 'injection' refers to the income increase via exogenous accounts due to increased demand for sectoral outputs, or investment demand, or exogenous income transfer to the households; and is expresses in monetary unit.

19. The present SAM framework allows intervention through sectors and households accounts only. There are evidences in the SAM construction to consider the foreign remittances as exogenous income for factors of production. But due to the unavailability of data, the SAM 2000 considers all the remittance income being directed to the respective households, and hence there is no scope for intervention via the factor account. Similarly, the exogenous elements of the consumption accounts are zeros by definition, and hence there is no corresponding instrument to intervene via this account.

20. The original multiplicative decomposition was presented by Pyatt and Round (1979), and an additive rearrangement was done by Defourny and Thorbecke (1984).

21. The derivations of the multiplicative and additive components are described in Appendix 9.

22. Therefore, row-sums of the respective sub-matrices show, the total increase in output (i.e. gross output multiplier), GDP (i.e. GDP multiplier), household income (i.e. income multiplier), and consumption expenditure (i.e. consumption multiplier).

23. There is, by definition, no open loop multipliers for the activity account. Also, there are no injection and transfer multiplier components in the decomposition GDP multipliers.

24. Across households differential income increments are explained, besides the integration pattern and existing wage differentials, mainly by the size of the labour force supplied by the respective households. The values in each cell represent absolute increase of income earned as a group.

25. While the model outcomes show the income impact of exogenous stimuli or shocks on all the endogenous accounts in the system, the poverty and inequality indicators are derived by taking the model outcomes as inputs in the household income expenditure survey (HIES) 2000.

26. The injection amounts, on the other hand, show the extent of exogenous injections (million taka) required to generate 1 percent GDP growth. It is evident that it requires 12580 million taka increase of

exogenous demand for yarn sector to generate 1 percent GDP growth, while the same GDP growth may be achieved if the demand for jute sector could be increased by 8640 million taka.

27. The head count poverty index is derived with the same urban and rural poverty lines as used in the base case. Since the stimulus in each case is only 1 percent GDP growth, usage of an inflation-adjusted poverty line would result in the increases of the poverty counts. Thus, the poverty counts in this case would provide only a quantitative assessment of the relative strengths of the sectors in terms of reducing the head count index.

28. In order to avoid arbitrary settings of the exogenous injection amounts, some of the observed growth stimuli (i.e. export and remittance growth) are taken as guidelines, which explain the major part of the GDP growth.

29. Inflation-adjusted poverty lines have been used to calculate the head count ratio. While in the base case the rural and urban poverty lines are 652 and 807 taka/person/month, the simulated income vector was compared with a 4 percent increased poverty lines, i.e. 678 and 839 taka/person/month for rural and urban respectively. The poverty lines used during the 1990s by the World Bank and Bangladesh Bureau of Statistics also show an annual increase (growth) of about 4 percent per year (World Bank, 2002, p. 95).

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