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IN SEARCH FOR BROAD-BASED GROWTH: LINKAGES AND POLICY EFFECTS IN A VILLAGE ECONOMY IN RURAL ETHIOPIA

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ABSTRACT

The sluggish growth in agriculture coupled with lack of broad-based economic growth raises debates over the relevant direction and emphasis of development interventions in the country. In this study, we develop a social accounting matrix (SAM) for a cereal dependent village economy in rural Ethiopia and examine relevant growth options in terms of their impact on output, household income, and investments in human and environmental capital. Apart from providing a quantitative analysis of a village economy, the study incorporates investments in human and environmental capital in the analysis of growth linkages. Using SAM-based model, growth linkages of different sectors are explored and activities that best promote growth and household income are identified. Accordingly, policy simulations are also performed to investigate the trade-offs and complementarities of economic and environmental policies on the village economy. Key development pathways and sectoral investment priorities are also identified that help to move the village economy in the direction of broad-based growth.

Keywords: village economy**,** Ethiopia, growth linkages, human capital, environmental capital, SAM

INTRODUCTION

Farm household models have been the main analytical tools to examine the behaviour of smallholders in terms of their resource use and allocations in developing countries (Singh *et al*.,1986). Farm households in many developing countries often live in villages and communities which are partially integrated into regional and national markets, and interact among themselves

in different markets such as input and output markets (Subramanian and Sadoulet, 1990; Kuiper, 2005; Dercon and Hoddinott, 2005). In such socioeconomic settings, although household models can link the behaviour of households to economic and other shocks, they do not capture the interactions among households, especially when household linkages within a village are strong (Xiaoping, *et al*., 2005). Such market interactions among and within villages and communities could create local linkages and feedbacks that shape the impact of economic and environmental policies (Shiferaw and Holden, 2000). Even in a small village economy, differences among households are noticeable due to differences in ownership of resources such as land, labour, etc, and this influences households' participation in different markets which ultimately generates heterogeneous responses to policy-induced or exogenous shocks. Since such types of interactions and their multiplier effects are not readily captured in microeconomic farm household and sectoral models, the use of economy-wide models such as village social accounting matrix (SAM)-based models provide a robust analytical tool to examine the interaction among policies, institutions, and economic activities (Taylor and Adelman, 1996).

In the village modeling literature, two cases can be distinguished where the use of village-wide modeling may not be appealing (see Taylor and Adelman, 1996; Holden *et al*., 1998; Shiferaw and Holden, 2000; Kuiper, 2005). First, in subsistence communities or villages where all households are self-sufficient and markets do not exist (i.e. a closed economy), there are no interactions among households and between the village and the rest of the world. In this case, all commodities are non-tradables, i.e. households supply their own inputs and consume what they produce. The second case represents a polar opposite of the first, i.e. no within village interactions occur if villages are highly integrated with local, national and international markets, a typical feature of a well-developed open village economies. In this case, all goods and services are village tradables and village households are price takers, since all input and output prices are determined by markets outside the village. The two cases represent extreme characterizations and simplifications of the real world economies which do not tally with the ground realities of developing economies such as Ethiopia. Some villages participate in product markets in the village or outside the village and some involve in factor markets such as labour both inside and outside the village, yielding an intermediate case.

Because of growing problems of environmental deterioration, many countries face sustainability problems. This calls for the protection and maintenance of the environment as an integral part of their development objectives, as reflected in the UN Millennium Development Goals (Goal # 7). The 1993 System of National Accounts (SNA) provides a mechanism for linking issues of environmental concern with national accounts (UN, 1993). It is argued that emphasis on economic development at the expense of environmental protection can lead to major environmental problems such as air pollution and land degradation, especially in agrarian economies. Similarly, environmental protection will not be maintained without economic development, as investments are necessary to conserve and restore the environment (Pender, 1996; Nkonya *et al*., 2004; Goodland *et al*., 1991). This implies that development policies and strategies should integrate environmental aspects, and efforts have been made to extend the traditional SAM to include environmental indicators (e.g. Shiferaw and Holden, 2000 for Ethiopia; Martin and Holden, 2004 for Mozambique; Alarcon *et al*. 2000 for Bolvia; Morilla *et al*., 2007 for Spain; and Xie, 2000 for China).

Although environmental deterioration has been identified as one of many causal factors for the dismal growth performance of developing countries, low human capital also stands out as a key candidate for such an outcome (World Bank, 2006; Lucas, 1988). The literature on SAM-based growth linkages focuses mainly on issues of growth, poverty and environment, and very limited effort has been made to include investment in human capital.[1] Human capital, especially investment in education, can contribute to agricultural growth and poverty reduction since it facilitates technological change in agriculture. The common practice of treating investment outlays in human capital as current expenditures misrepresent overall saving and investment, and distorts inter-sectoral linkages, resource allocation, growth and income distribution (Sharma and Ram, 1974). Given the centrality of human capital for sustainable economic growth and poverty reduction, broad indicators of well-being and growth performance require the integration of human capital components into the standard economic and environmental accounting system, and this establishes linkages between economic, environmental, and human capital issues.[2]

[1] Lewis and Thorbecke (1992) include investment in human capital in estimating the regional SAM for Kenya, but the regional SAM lacks an environmental account.

[2] Different approaches have been employed to measure human capital, such as through years of schooling and labour market experience[2] (e.g. Barro, 1991; Barro and Lee, 1993; Mankiw, Romer, and Weil, 1992; Jones, 1998; Mulligan and Sala-i-Martin, 1995; Wasmer, 2001; Laroche, 2005), through income-based approach, i.e. labour income[2] (Mulligan and Sala-i-Martin, 1997; Carlos and de Saliva, 2004; Le *et al*., 2005), or

While environmental indicators have been included in most of the growth linkage literature, little effort is made to include human capital in the evaluation of growth linkages, which is one of the key factors for sustaining socioeconomic transformation. This study is a step in that direction. Although modelling of village economies is not new, this study attempts to include investment in human capital in the analysis of growth linkages using a village social and environmental accounting matrix framework.[3]This will enhance the capacity of policy-makers and development planners to properly evaluate the complex trade-offs and complementarities between economic expansion and investment in human and environmental capital. It is hoped that the results of this study will guide policy makers in terms of identifying sectors, prioritize investment allocations, and map out the most effective route for enhancing growth, improving livelihoods and halting land degradation in the country. While the conclusions reached here are specific to the study setting, the issues raised are relevant for other villages of the country possessing similar characteristics.

A SAM-BASED CHARACTERIZATION OF THE VILLAGE ECONOMY

Data sources

Ethiopia has 11 regions, with each region divided into zones and each zone into *woredas*. *Woredas* are further subdivided into Peasant Associations (PAs) or *kebeles*.This study focuses on the village of Yetmen in the Enemay woreda of the East Gojjam zone of the Amhara National Regional State (ANRS), Ethiopia (figure 1).The data for constructing the village SAM come from a household survey conducted in 2007. A total of 150 households were surveyed. The survey provides detailed information on a wide spectrum of socio-economic issues including household composition and structure, education, assets, production and input use, land conservation activities, employment and income, consumption expenditure, health status and other non-income welfare indicators. To support information obtained at household level and other village level data, a focus group discussion has been conducted. In so doing, efforts have been made to include different groups of people in the focus group discussion such as the elderly, officials of the PA, religious representatives, youths, and females. In addition, prices of

through education expenditure, i.e. cost-based approach (World Bank, 2006; Becker, 2002; Eisner, 1999; Hamilton and Ruta, 2006). The cost-based approach measures the flow of resources invested in education and other human capital related activities and this can be interpreted as investment in human capital.

[3] Specifically, treating educational expenditure as an investment in human capital means that it becomes part of genuine saving (see World Bank, 2006; Hamilton and Ruta, 2006).

commodities have been collected in the village market. In the study setting, there are three market days in the week where agricultural and non-agricultural commodities are exchanged. Price data for the various commodities have been collected in three market visits at different time intervals.

The dataset collected refer to the activities of the previous 12 months and this dataset is used for the construction of the *Yetmen* village social accounting matrix (YV-SAM). In what follows, we present the structure of the YV-SAM.

Figure 1: Location map of the study area

Description of the Village Social Accounting Matrix (SAM)

The procedure to estimate the village SAM of this study follows the approach described in Taylor and Adelman (1996). Households interact with other households within their own village and households from neighbouring villages and beyond. Interactions may also occur with government, institutions in the village as well as with other local and international institutions. Figure 2 portrays the interconnections that exist in a village economy, such as between

production activities (e.g. crop production, livestock activities, household businesses, etc), production factors (e.g. labour, capital, land, etc), and institutions such as households, government, etc.[4] For instance, production activities require factors of production. Factors of production earn income from the services they render and the income so obtained is channelled to institutions such as households according to their factor endowments, and institutions, in turn, allocate their income to final consumption of goods and services, make transfers, and save. Production activities obtain income by selling their produce to other sectors or activities (for intermediate consumption), to institutions (for final consumption expenditure), or by exporting to the external sector. On the other hand, these sectors pay the factors of production for their services. As owners of production factors, households get factor income according to their factor endowments. Institutions also make transfers among themselves and buy commodities from production activities for their consumption and save the remaining income.

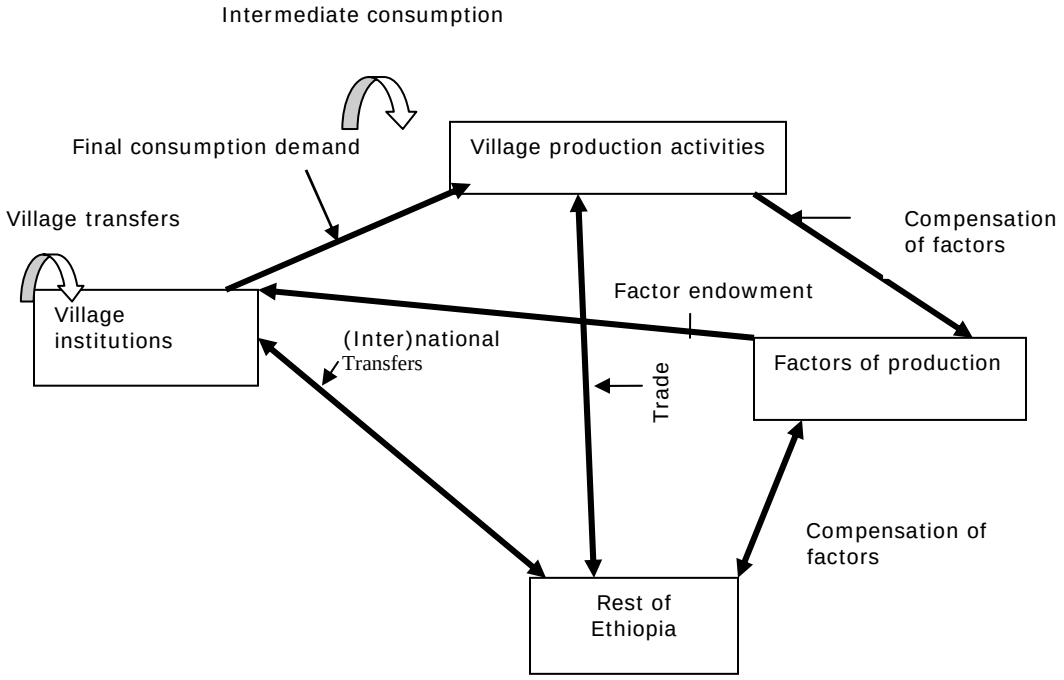

Figure 2: Schematic characterization of village economic interactions

Such interactions can be presented in a convenient way by using a social accounting matrix (SAM), which is a socio-economic information system that describes all interactions and

[4] No distinction is made between activities and commodities in the diagram. The arrows show the direction of influence.

transactions that occur in an economy in a particular year.[5] It is a way of presenting socioeconomic interactions in a consistent and complete way. It is consistent because for every receipt there is a corresponding outlay, and complete since both the receiver and the sender of each and every transaction is clearly identified (Sadoulet and Janvry, 1995). By convention, the rows of the SAM record incomings while the columns record the outgoings or expenditures. Thus production activities, production factors, and institutions have a separate accounts in a SAM. Hence, the intersection of a row and column of an account has a dual meaning since it indicates receipts for a row account and expenditures for a column account, with row and column totals being equal.

The village SAM includes accounts of production activities, commodities, factors of production, institutions, capital, and rest of the world (i.e. rest of Ethiopia (RoE) in our case).

(i) The production account describes the values of the intermediate inputs used in the production of goods and services and the payments to factors of production (columns), and market sales and home consumption of goods and services (rows). The YV-SAM has 13 production activities.

(ii) The commoditiesaccount captures product markets and household consumption. The explicit inclusion of this account in the YV-SAM makes it possible to separate household home consumption and consumption of goods and services from purchases. It records the value of total supply, i.e. the value of domestic production sold locally, imports after taxes, and of marketing margins (columns), and total demand, i.e. the value of goods used as intermediate inputs by activities, of goods and services consumed by institutions, of investment, and of exports (rows). We have also a separate account for environmental goods and services and other accounts represent manufacturing, services and household chores. A total of 14 commodity accounts have been distinguished in the YV-SAM.

(iii) The factors account describes the source of factor income, i.e. the value added in each domestic activity and from the RoE (rows), and how factor payments are channelled to the various institutions, including the different household groups and the RoE according to their factor endowments (columns). The YV-SAM includes five factor accounts, namely family

[5] SAM consists of three words. The word 'social' refers to different socioeconomic groups, such as households, government, and firms. 'Accounting' denotes that all transactions are expressed in monetary values. Finally,' matrix' refers to these socioeconomic groups and the monetary values of transactions are represented and arranged in rows and columns (Vandemoortele, 1987).

labour, hired labour, oxen-plus, land and other capital. Oxen-plus refers not only to oxen used in the production of goods and services, but also to other animals such as calves, cows, and donkeys that are involved in the farming activity. In many studies of this kind, the contribution of other animals in the farming activity has not been included and this tends to underestimate the contribution of livestock to crop production.

(iv) The households and governmentaccounts comprise all the income and expenditures of village households and government. The household accounts record both the value of domestic factor income of households, transfer payments from the government, and remittances from the RoE (rows), and payments made by households on home-consumed output from the activities they engage in, consumption expenditures of marketed goods and services, transfers to other households, payment of taxes, private savings, and remittances to the RoE (columns). Notice that farm households are not a homogeneous set of farm families with the same status and prospects in the village. Rather they are typified by internal differentiations along many lines. Using gender and land holding size, six types of households have been distinguished in the YV-SAM:

- Fe-mar: marginal female-headed households that own up to 0.75 ha
- Ma-mar: marginal male-headed households that own up to 0.75 ha
- Fe-sma: small female-headed households owning between 0.75-1.50 ha
- Ma-sma: small male-headed households owning between 0.75-1.50 ha
- Fe-med: medium female-headed households that own above 1.50 ha, and
- Ma-med: medium male-headed households that own above 1.50 ha

The Government account collects taxes on income from activities, commodities, factors, and receives transfers from the RoE (row), and pays for government consumption of goods and services, transfers to households and to the RoE (column). The role of the government in this village is limited. Income sources for the local government include income from agricultural land use tax and other income taxes.

(v) The capital or saving-investment account records the savings made by all the institutions (rows) and how they are spent in investment goods (columns). Four capital accounts have been distinguished in the village SAM, namely human capital-education, human capital-health, environmental capital and other capital.

(vi) The Rest of Ethiopia (RoE) account links the village economy with the rest of the country.[6] Transactions into and out of the village economy are recorded in this account. The receipts of this account (row) include factor income received from the rest of the country or abroad, income from exports of goods and services, and transfer or remittance received from institutions from outside the village. The expenditures of this account (column) include payments for imports of goods and services, transfer payments to village institutions, factor income transfers to the village, and savings.

Characterizing the village economy

Table 1 shows some selected socioeconomic characteristics of the sample households. The mean land holding size is 1.54 ha and varies across household groups. With an average family size of 5.13, the mean land holding per capita is 0.30 ha. In terms of gender pattern, female-headed households have smaller family size and lower average holding size than male-headed households. Female-headed households have also lower literacy rates compared with male-headed households.

Table 1: Selected socioeconomic indicators by household group

	Fe-mar	Ma-Mar	Fe-sma	Ma-sma	Fe-med	Ma-med	Village average
Average family size	2.41	5.96	2.67	4.48	4.63	6.09	5.13
Adult equivalent household size	2.13	5.26	2.31	3.85	3.95	5.13	3.77
Land holding size (ha)	0.54	0.58	1.14	1.16	2.04	2.53	1.54
Average land holding per capita	0.22	0.10	0.43	0.26	0.44	0.41	0.30
Age of household head (years)	53.40	49.30	61.00	51.40	50.38	51.71	52.87
Read and write rate (% yes)	11.80	48.00	0.00	61.80	12.50	43.60	29.62

Source: Household survey data, 2007

Production Structure and Input Use

The village economy is dominated by agricultural activity: agriculture generates more than three-fourth of the total gross output (figure 3). The agricultural activity is dominated by *teff*. The

[6] Note that RoE includes all areas outside the village.

contribution of non-agricultural activities to the village economy is very limited. Labour is the most important of all productive factors and is supplied almost mainly by the family, augmented by traditional community labour pools (figure 4). The use of hired labour is generally limited. Labour sharing is an important part of labour exchange practiced by village households in response to labour constraints, especially during crop harvesting. The contribution of labour sharing to crop agriculture has been imputed using age-specific village wage rates and included in the category of hired labour.[7] Other costs such as food are also included since the host household is supposed to provides food to the work party. Land and other capital such as farm tools and equipment are also important in crop production.

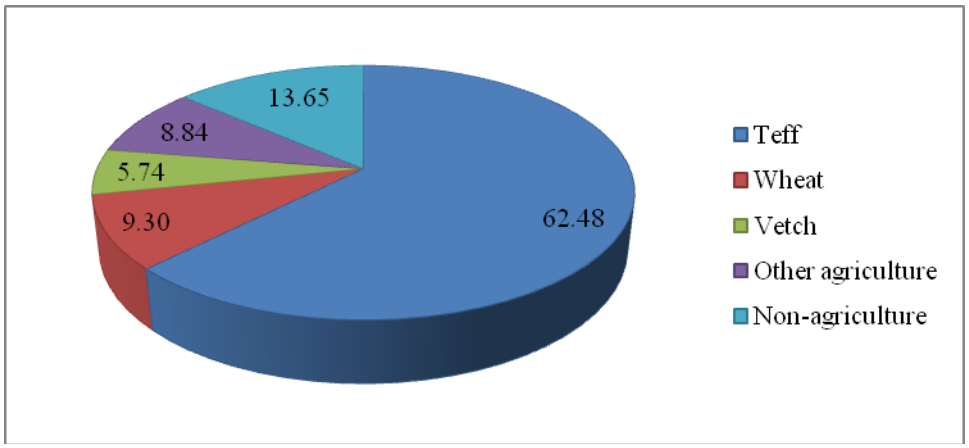

Figure 3: Composition of Crop Output by Major Activities (%)

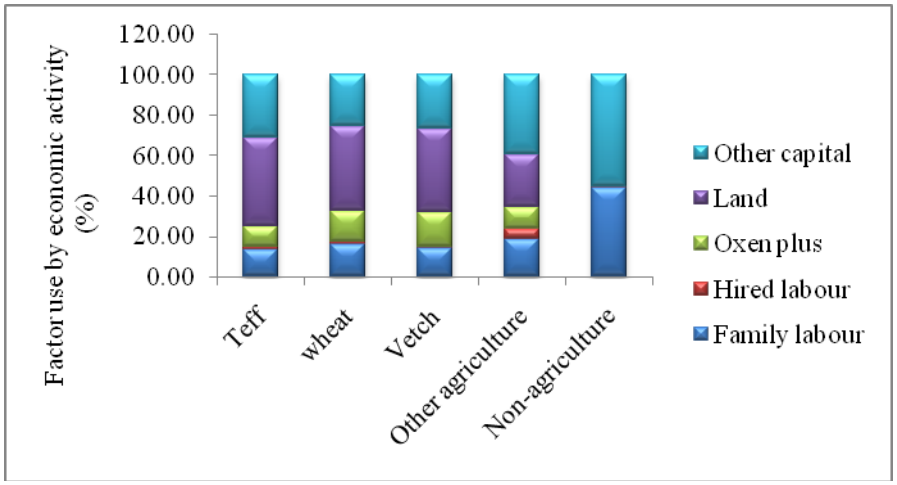

Figure 4: Factor Use Among Economic Activities (%)

[7] It is reasonable to treat labour sharing as hired labour though this is a kind of reciprocity, i.e. households pay back the same service to households who provide exchange labour.

Composition of Household Income

Figures 5 and 6 present the allocation of factor incomes and the level of per capita income across household groups. Factor income is the main source of income for the village households as remittances or transfers from outside the village are negligible. While female-headed households depend largely on land as their main source of factor income, male-headed households receive income from a combination of factors, reflecting the gender distribution of factors of production in rural areas. Family labour is an important source of income for medium-male-headed households as it accounts for about 46% of their total factor income. In terms of per capita income, figure 6 portrays that households with relatively larger plots of farm land are better off. With the exception of male-headed households, the per capita income of all household groups is below the sample averge (which is birr 1,797.80).

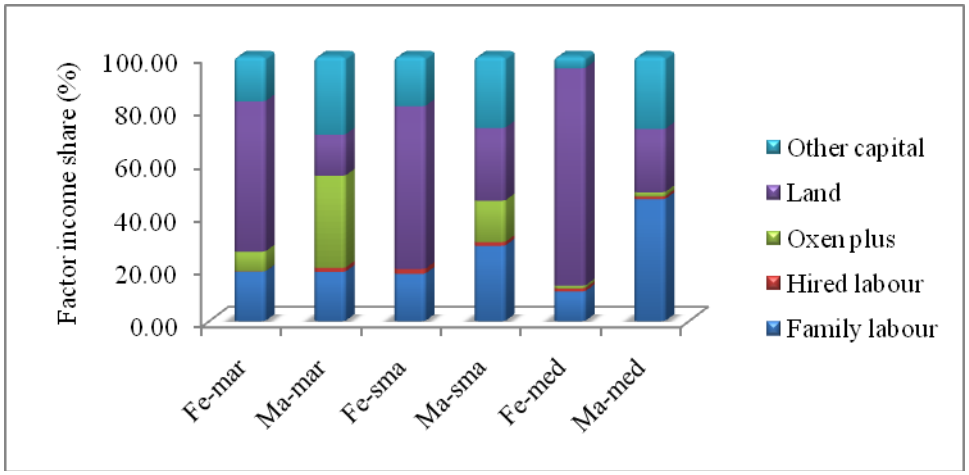

Figure 5:Distribution of Factor Income Shares Across Household Groups (%)

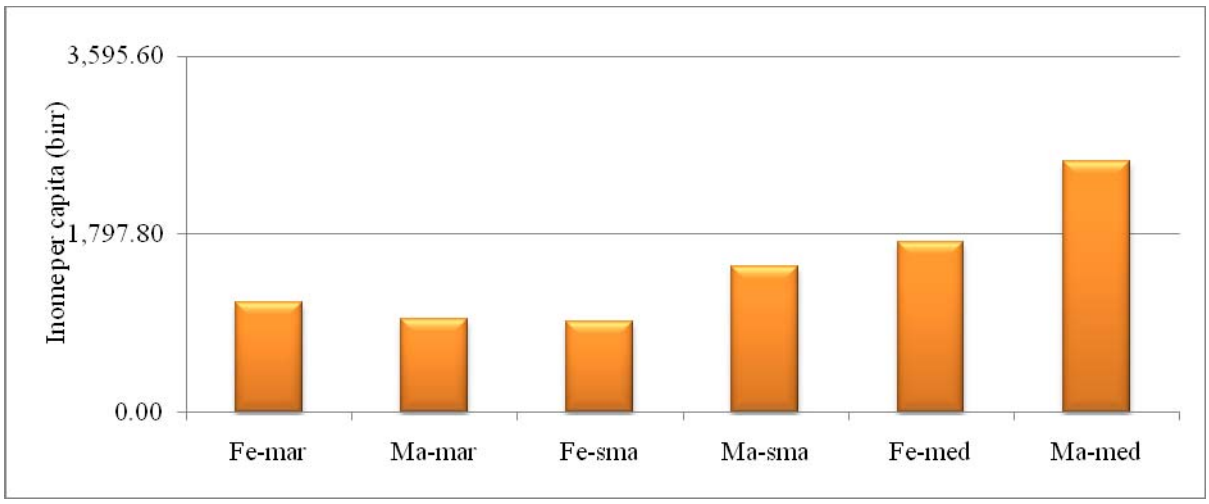

Figure 6: Income per Capita Across Household Groups (in birr)

Household Expenditure and Savings

Households can spend their income on consumption goods and services, make transfers to other institutions or households outside the village, pay taxes to the government, and save. Figure 7 and Table 2 show how household income is spent. Households use on average 78.77% of their income on various expenditures and save about 21.23% (including investment in human and environmental capital). Own farm consumption accounts for more than three-fourth of the total consumption expenditure (Table 2). The commodity composition of consumption expenditure shows that expenditure on *teff* accounts for more than half of the total expenditure.

A remark is in order regarding the level of saving. If investment in human and environmental capital is considered as expenditure as is usually assumed in the national income accounts, then the saving rate reduces to 14.46%. The average saving rate varies across household groups. Better off households spend less and save more. In terms of gender pattern, female-headed households spend more on education than male-headed households, however small the magnitude of the expenditure might be. Although expenditure per student increases with income, the increase is stronger for female than male-headed households (figure 8). A possible explanation can be that female-headed households do not use children for farming activity as they sharecrop/rent-out part of their farm land to other households. For instance, marginal female-headed households sharecropped/rented-out more than three-fourth of their plot in 2007 (the for marginal male-headed households was only 6.3%). Given that subsistence crop production is highly labour-intensive and wage labour is limited in the study village, male-

headed farm households depend heavily on own family labour. Studies (e.g. Cockburn, 2004; Admassie, 2003) have shown that the contribution of child work to household income is a key factor influencing child work and schooling decisions in rural Ethiopia. Factors such as demographic composition, asset profile, type of activity, and other characteristics affect the income contribution of children.

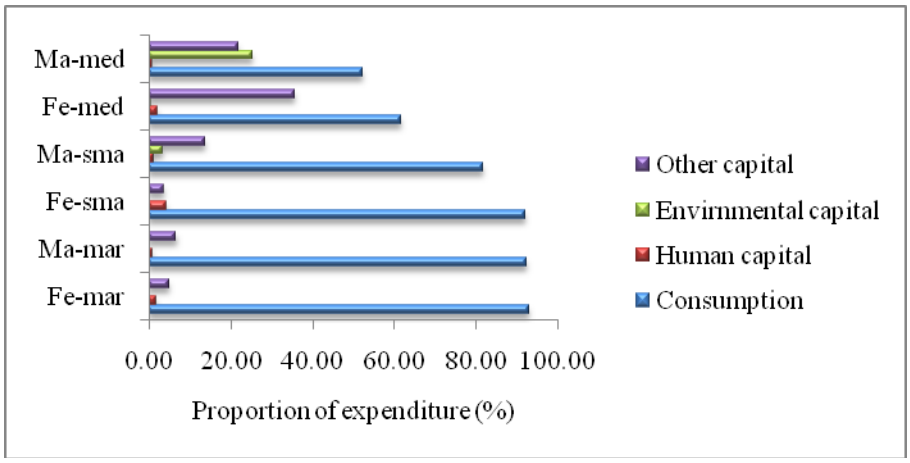

Figure 7: Pattern of saving and expenditure by household groups

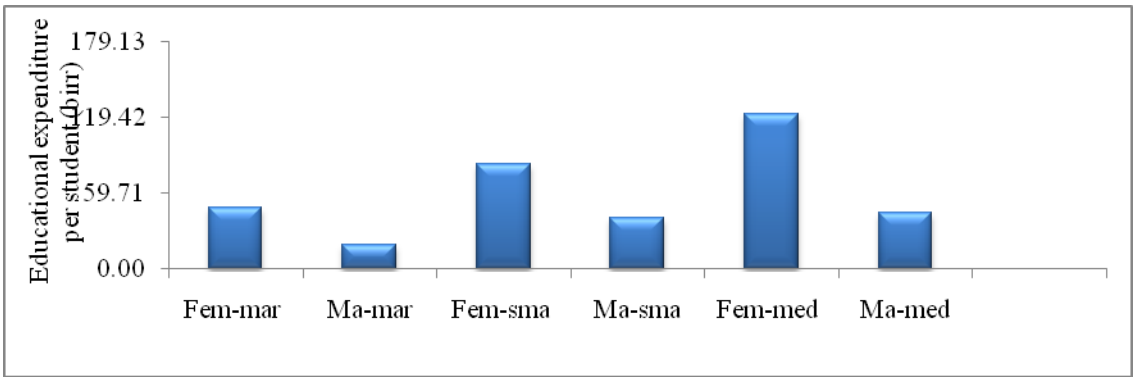

Figure 8:Educational Expenditure per Student Across Households Groups

Table 2: Commodity Composition of Household Consumption (%)

	Fe-mar	Ma-mar	Fe-sma	Ma-sma	Fe-med	Ma-med	Total
(a) Own farm consumption							
Teff	59.90	45.71	56.14	61.66	57.16	49.11	54.95
Wheat	6.85	15.06	0.00	4.02	6.15	14.99	7.84
Vetch	0.00	0.21	0.00	8.94	8.10	7.15	4.07
Other crops	2.12	15.71	0.00	2.29	2.73	4.27	4.52
Livestock products	4.71	3.16	5.40	5.25	1.83	5.58	4.32
Environmental goods/services	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other goods and services	0.11	0.26	0.00	0.00	0.00	0.99	0.23
(b) Consumption from purchases							
Teff	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wheat	0.36	0.48	0.00	0.00	0.00	0.00	0.14
Vetch	0.00	0.02	1.08	0.50	0.28	0.22	0.35
Other crops	3.96	2.22	1.63	1.56	4.89	1.22	2.58
Livestock products	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food processing	0.00	0.32	0.48	1.80	0.92	2.07	0.93
Other manufacturing	10.37	8.94	21.33	6.95	11.11	8.08	11.13
Environmental goods/services	5.42	1.89	7.27	5.74	0.75	1.54	3.77
Other goods and services	6.21	6.03	6.66	1.29	6.10	4.77	5.18
Total consumption	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Household survey, 2007

The relatively high share of home consumption in total household consumption indicates a small marketed surplus. Figure 9 presents marketed surplus and self-supply ratio, which is the ratio of own-farm consumption to total consumption (Ralston, 1996). The village economy is considered as weakly commercialized since only 30.9% of crop output is marketed, although this figure is

slightly higher than the national average.[8] The marketed surplus ratio varies substantially across household groups: it ranges from 13.7% for small-male-headed households to 54.2% for medium-female-headed households. The village economy has also an average self-supply rate of about 97.4%, i.e. village households are able to satisfy their crop consumption needs from their own produce.[9]

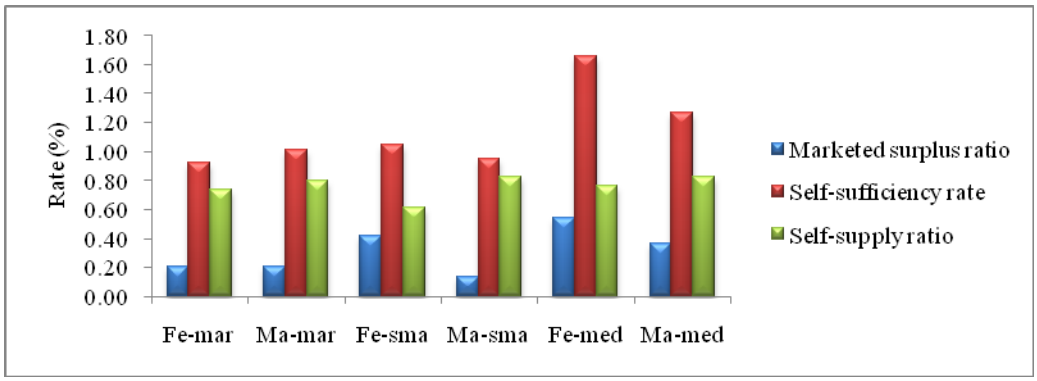

Figure 9: Marketed surplus, self-sufficiency and supply indicators by household groups

Village trade

As discussed earlier, the village economy produces goods and services for home consumption and for sales within the village or outside the village, i.e. exports. While exports are mainly agricultural commodities such as *teff*, wheat, vetch, and other crops, the village economy imports chiefly non-agricultural items such as manufacturing goods (figure 10). This high share of exports may seem on the high side. But given that village households consume largely their own produce and they produce very similar items, it is expected that a bulk of marketed output would be exported. The commodity mix of exports is very limited as it is dominated by a single crop, *teff*, which accounts for more than half of the total value of exports.

As a typical rural economy, the village economy is net importer of manufacturing products. Chemical fertilizer is the most important part of the manufacturing imports.

[8] The national figure is 28% (Dessalegn *et al*., 1998).
[9] Self-supply is the proportion of total consumption met by own-farm production.

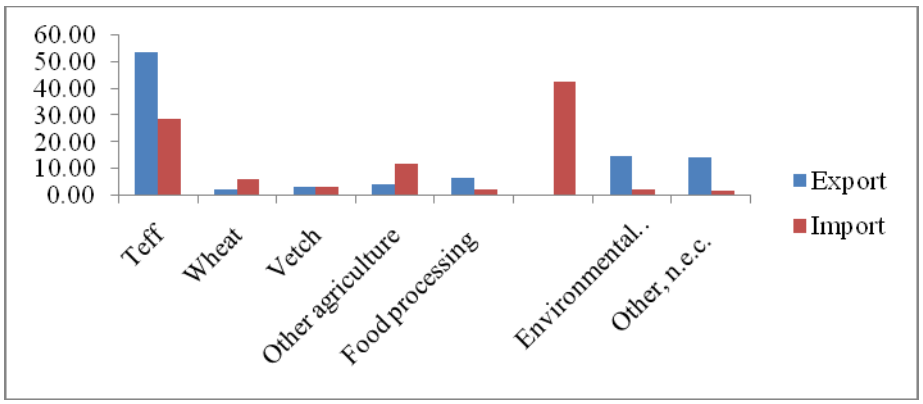

Figure 10: Commodity Composition of Village Exports and Imports (%)

By and large, there are several findings worth pointing out. First, family labour is the most important factor of production for crop agriculture, followed by agricultural land. Second, households that have relatively larger plots of land have higher per capita income than those with smaller plots, indicating that holding size makes a difference in a rural area where agriculture is the main livelihood such as the study setting. Third, female-headed households spend more on education than male-headed households and this suggests that a policy intervention that raises income of female-headed households can have two positive effects, namely human capital formation and poverty reduction, assuming unchanged spending patterns. When it comes to investment in land conservation, relatively better off households undertake such investments. Fourth, the proportion of agricultural output retained for home consumption is high in all household groups. Finally, the share of consumption expenditure in environmental goods and services is relatively high in low income household groups, suggesting that poor households depend heavily on environmental goods and services compared with non-poor households. At the same time, these household groups made little investment in environment, such as in land soil conservation activities in the form of planting of trees, terraces, etc.

Modelling SAM-Based Growth Linkages in a Village Economy

Conceptual and Analytical Framework

The main thrust of this study is to examine growth linkages and the effects of policy reforms through counterfactual simulation experiments in the village economy. Apart from providing a snapshot of the village economy, the village social accounting matrix (SAM) can be used to build different economy-wide models such as SAM-based multiplier and computable general equilibrium (CGE) models. Since one of the issues to be addressed in this study is to assess the magnitude of growth linkages and the prospects for growth in the village economy, we use the village SAM-multiplier model for the purpose. To use the village SAM as a model requires describing the underlying technical and behavioural relationships of the various accounts. Accordingly, the village SAM accounts need to be partitioned into endogenous and exogenous accounts, in which a change in the latter influences the former, i.e. endogenous accounts can be solved as functions of the exogenous accounts. Hence, it is customary to consider the accounts of production activities, factors of production and domestic or village institutions (e.g. households) as endogenous, and those of government, capital and the rest of the world accounts as exogenous (Sadoulet and de Janvry, 1995). It should be noted that one of the objectives of development policies is to stimulate investment in human and natural capital. In this study, the human (which includes education and health) and environmental capital accounts are considered as endogenous since these investment types are influenced by the behaviour of households. This implies that savings are translated into purchases of investment goods (Haggblade and Dorosh, 1992).

To formalize the exposition, let:

- A represent the matrix of endogenous accounts; it is partitioned into blocks, A_{ij}, which denote payments by the j^{th} account to the i^{th} account $(i, j = 1, 2, \ldots, 5)$
- X be the vector of exogenous injections into endogenous accounts; it is also partitioned into blocks X_i, which denote exogenous injections into the i^{th} account $(i = 1, 2, \ldots, 5)$
- Y refer to the vector of row totals of endogenous accounts; it is partitioned into blocks Y_i, which represent the row sums of the i^{th} account $(i = 1, 2, \ldots, 5)$;
- L indicate the vector of leakages from endogenous accounts such as tax payments, transfers outside the village, payment to imports etc; it is partitioned into blocks L_i, which refer to the endogenous payments to the i^{th} account $(i = 1, 2, \ldots, 5)$;

- U be the vector of column totals of endogenous accounts; it is partitioned into blocks U_i, which indicate the column sums of the i^{th} account $(i = 1, 2, \ldots, 5)$; and
- F, T and W be scalars which represent transactions among exogenous accounts, column and row totals of exogenous accounts, respectively.

The schematic elements of the village social accounting matrix are presented in Table 3.

Table 3: Components of the village social accounting matrix

		Endogenous accounts					Exogenous accounts	Row total
		1	2	3	4	5	6	
Production activities	1	0	A_{12}	0	A_{14}	0	X_1	Y_1
Commodities	2	A_{21}	A_{22}	0	A_{24}	A_{25}	X_2	Y_2
Factors of production	3	A_{31}	0	0	0	0	X_3	Y_3
Households	4	0	0	A_{43}	A_{44}	0	X_4	Y_4
Combined endogenous capital account	5	0	0	0	A_{54}	0	X_5	Y_5
Exogenous accounts	6	L_1	L_2	L_3	L_4	L_5	F	W
Column total		U_1	U_2	U_3	U_4	U_5	T	

Let:

$$A = \begin{bmatrix} 0 & A_{12} & 0 & A_{14} & 0 \\ A_{21} & A_{22} & 0 & A_{24} & A_{25} \\ A_{31} & 0 & 0 & 0 & 0 \\ 0 & 0 & A_{43} & A_{44} & 0 \\ 0 & 0 & 0 & A_{54} & 0 \end{bmatrix}; X = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \end{bmatrix}; Y = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ Y_4 \\ Y_5 \end{bmatrix}; L = \begin{bmatrix} L_1, L_2, L_3, L_4, L_5 \end{bmatrix}; \text{ and}$$

$$U = \begin{bmatrix} U_1, U_2, U_3, U_4, U_5 \end{bmatrix}$$

For mathematical convenience, let us also introduce a unitary vector of appropriate dimension. Let this vector be denoted by E. As can be seen from Table 3, the income of the

endogenous accounts is the sum of the endogenous transactions and injections. Formally, the income of the endogenous accounts can be expressed algebraically as:

$$Y = AE + X \tag{1.1}$$

In addition, a balanced SAM requires that for each account, row and column totals must equal, i.e. $U' = Y$, where the prime indicates transposition. It will be useful to express the endogenous accounts in terms of average expenditure propensity by dividing each column of the endogenous accounts by its column total. Let a_{hk} and y_k indicate the individual elements of matrix $A = (a_{hk})$ and vector $Y = (y_k)$, respectively. That is, a_{hk} refers to the intersection of the h^{th} row and k^{th} column and y_k to the total of the k^{th} column. Then z_{hk} will be defined as the average expenditure propensity of the endogenous sectors for row h and column k of the SAM. Thus, we have:

$$z_{hk} = \frac{a_{hk}}{y_k} \tag{1.2}$$

If we partition matrix $Z = (z_{hk})$ in the same way as matrix A, then the total income of the endogenous accounts can be expressed as follows:

$$Y = ZY + X \tag{1.3}$$

where $$Z = \begin{bmatrix} 0 & Z_{12} & 0 & Z_{14} & 0 \\ Z_{21} & Z_{22} & 0 & Z_{24} & Z_{25} \\ Z_{31} & 0 & 0 & 0 & 0 \\ 0 & 0 & Z_{43} & Z_{44} & 0 \\ 0 & 0 & 0 & Z_{54} & 0 \end{bmatrix}$$

From (1.3), it follows that the levels of endogenous income can be expressed as a function of exogenous accounts. Formally, it is given by:

$$Y = (I - Z)^{-1} X \tag{1.4}$$

where I is the identity matrix. Let $M = (I - Z)^{-1}$ and equation (1.4) can be written as:

$$Y = MX \tag{1.5}$$

Matrix M is called the SAM multiplier matrix (Pyatt and Round, 1979; Thorbecke and Jung, 1996). This multiplier matrix is computed from the average expenditure propensities of the endogenous accounts. It gives insight into the structure of an economy in terms of inter-sectoral linkages, transfer effects, cross-effects between different parts of the economy, etc. While the diagonal measures the direct impact of an exogenous expenditure, the off-diagonal elements measure the indirect impacts of exogenous injections on other sectors.

Exogenous Accounts and the SAM Multiplier

Under certain assumptions such as fixed prices, given technology, unitary expenditure/income elasticities (i.e. the responsiveness of consumption expenditure to changes in income (Delgado *et al*, 1998)), excess capacity in all sectors, etc, the change in the incomes of endogenous accounts is given by the product of the SAM multiplier matrix and the change in the exogenous accounts. Although constant prices and given production technology may hold in the short-run, the assumptions of unitary expenditure elasticities and unused capacity in all sectors can be relaxed. First, unitary expenditure elasticities may not hold at least for all elements of Z. For instance, different household groups tend to have different expenditure elasticities and hence average and marginal expenditure propensities differ for different household groups (Kone and Thorbecke, 1996). To account for this, marginal expenditure propensities can be computed and incorporated into the SAM coefficient matrix Z. If expenditure elasticities and average expenditure propensities are known, then marginal expenditure propensities can be easily obtained.Let φ_{jh} and (ε_{jh}) be, respectively, average expenditure propensities and expenditure elasticities of commodity j for household group h. Then, the marginal expenditure propensities (λ_{jh}) are simply the product of the average expenditure propensities and expenditure elasticities $(\text{i.e. } \lambda_{jh} = \varepsilon_{jh}\varphi_{jh})$.[10] However, due to lack of information, it is difficult to replace average expenditure by marginal expenditure propensities for all endogenous accounts of the SAM.[11]

Second, perfectly elastic supply means that there always exist unemployed resources to meet new demand. This may hold in an economic environment without scarcity. It has been argued that "if farmers in the developing world could increase crop output in unlimited amounts, agriculture would indeed represent a powerful engine of economic growth, and both malnutrition and poverty would vanish overnight as hungry farmers availed themselves of this perfectly elastic cornucopia" (Diao *et al*., 2007:11). But empirical evidence suggests that supply response in agriculture is very low, especially in developing countries (Schiff and Montenetgro, 1995). For instance, in a subsistence agriculture-dominated economy like the study setting, shortage of land, rainfall, and other bottlenecks often limit output expansion following an exogenous increase in demand. A study by Suleiman *et al*. (2004) indicates that supply

[10] The resulting multiplier matrix is known as a fixed price multiplier matrix due to the fact that expenditure elasticities are computed based on the assumption that prices remain unchanged (Thorbecke and Jung, 1996).

[11] Substituting the average with marginal expenditure propensities for selected endogenous accounts would violate the consistency of the underlying SAM. In most empirical applications, the average expenditure propensities are used since it helps to maintain the consistence of the SAM. In this study, we follow the latter approach.

response in Ethiopian agriculture is very low and that factors such as land, rainfall, access to infrastructure, etc are the main constraints for agricultural production in the country, especially in the northern and central parts of the country. On the other hand, in some sectors such as food processing and services, excess capacity does exist and output can be increased without increasing prices.

To address the issue of supply constraints in selected sectors, SAM accounts can be classified into two sets: supply constrained and unconstrained.[12] Since output cannot be increased in supply constrained sectors, an exogenous increase in village demand simply reduces exports. This implies that exports in the supply constrained sectors can no longer be exogenous to the village economy as opposed to the traditional SAM multiplier analysis. Fixed supply in some sectors does not mean that resources are fully employed, but rather that they are not fully utilized because of structural constraints. In these sectors, output could eventually be increased, without increasing prices, by addressing supply-side constraints through appropriate interventions such as improving access to inputs, building roads and other infrastructures. To derive the constrained SAM multiplier matrix, the traditional SAM needs to be modified such that accounts are classified as supply constrained and unconstrained as indicated in Table 4.[13]

Table 4: The village SAM with constrained and unconstrained accounts

		Endogenous accounts		Combined exogenous accounts	Row total
		Constrained accounts	Unconstrained accounts		
Endogenous accounts	Constrained accounts	A_{cc}	A_{cu}	X_c	Y_c
	Unconstrained accounts	A_{uc}	A_{uu}	X_u	Y_u
Combined exogenous accounts		L_c	L_u	F	W
Column total		Y_c'	Y_u'	T	

[12] Such SAM models are also called semi-input-output (SIO) models in the literature. A similar terminology has been used for non-square SAM or input-output models which are widely used in the estimation of national economic parameters for evaluating development projects. To avoid this confusion, we use the term (un)constrained-SAM model.

[13] For details, see, among others, Lewis and Thorbecke (1992); Dorosh and Hagbladde (1996); Resosudarmo and Thorbecke (1996); Kone and Thorbecke (1996).

where A_{cc} and A_{cu} denote transactions within constrained accounts and between constrained and unconstrained accounts, respectively, A_{uc} refers to transactions between unconstrained and constrained accounts, and A_{uu} those within unconstrained accounts. X_c and X_u denote, respectively, vectors of exogenous injections in the constrained and unconstrained accounts; L_c and L_u describe vectors of leakages from the constrained and unconstrained accounts, respectively; and Y_c and Y_u denote, respectively, vectors of the total output or income in the constrained and unconstrained accounts. F, T and W are scalars which represent transactions among exogenous accounts, and column and row totals of exogenous accounts, respectively. The rest are as defined earlier.

In addition, let Q_c be the matrix marginal expenditure propensities of the constrained accounts on output of unconstrained accounts, and Q_u the matrix of marginal expenditure propensities of unconstrained accounts on output of the constrained accounts. In terms of changes, Table4 can be expressed algebraically as:

$$dX_c = -Q_u dY_u + (I - Z_{cc})\, dY_c \tag{1.6}$$

$$(I - Z_{uu})\, dY_u = Q_c dY_c + dX_u \tag{1.7}$$

where Z_{cc} is matrix of marginal expenditure propensities of constrained accounts on output of the constrained accounts and Z_{uu} is matrix of marginal expenditure propensity of unconstrained accounts. Since output in the constrained accounts (Y_c) is exogenously given, an exogenous increase in final demand will lead to a decrease in exports. This implies that exports of the constrained sectors are considered as endogenous.

In a more compact form, we can write (1.6) and (1.7) as:

$$\begin{bmatrix} -Q_u & -I \\ (I - Z_{uu}) & 0 \end{bmatrix} \begin{bmatrix} dY_u \\ dX_c \end{bmatrix} = \begin{bmatrix} -(I - Z_{cc}) & 0 \\ Q_c & I \end{bmatrix} \begin{bmatrix} dY_c \\ dX_u \end{bmatrix} \tag{1.8}$$

Solving for X_c and Y_u yields the following:

$$\begin{bmatrix} dY_u \\ dX_c \end{bmatrix} = \begin{bmatrix} -Q_u & -I \\ (I - Z_{uu}) & 0 \end{bmatrix}^{-1} \begin{bmatrix} -(I - Z_{cc}) & 0 \\ Q_c & I \end{bmatrix} \begin{bmatrix} dY_c \\ dX_u \end{bmatrix} \tag{1.9}$$

The matrix $M_c = \begin{bmatrix} Q_u & I \\ (I - Z_{uu}) & 0 \end{bmatrix}^{-1} \begin{bmatrix} -(I - Z_{cc}) & 0 \\ Q_c & I \end{bmatrix}$ is called the constrained SAM multiplier matrix.[14] Thus, we have

[14] This multiplier matrix is also known as mixed multiplier matrix in the literature (Lewis and Thorbecke, 1992).

$$\begin{bmatrix} dY_u \\ dX_c \end{bmatrix} = M_c \begin{bmatrix} dY_c \\ dX_u \end{bmatrix} \quad (1.10)$$

The constrained SAM multiplier model implies that output and household income can be stimulated through changes in exogenous demand from non-constrained sectors or a change in the output of the constrained sectors which can be achieved through improved technology, expansion in input use, etc. As a result, demand for inputs and consumer goods will rise which, in turn, induces growth in sectors that have slack capacity (Diao *et al*., 2007; Dorosh and Haggblade, 1993).

In the computation of the constrained SAM multipliers for the village economy, all agricultural activities including livestock are classified as supply constrained while food processing and other services are supply non-constrained. The agricultural activities face bottlenecks such as limited holding size, traditional technology, climate variability, etc and hence agricultural production cannot be increased following an exogenous increase in the demand for agricultural commodities. The constrained SAM multiplier can be considered as simulating the effects of supply-augmenting technological change in agriculture. On the other hand, non-agricultural activities such as local food processing and services are assumed to be determined by demand and hence these activities are considered as supply unconstrained.

To provide a contrasting analysis that can show the growth prospects of the village economy, the impact of a change in the output of the main cereal crop, *teff*, vis-à-vis other activities is examined under the conditions of a constrained and unconstrained environment.

Analysis of Growth Linkages and Policy Effects

Growth Linkages: Results from a Constrained SAM Multipliers

Table 5 provides the constrained and unconstrained SAM multipliers applicable to a change in the output of selected sectors. To illustrate the implications of supply constraints for village production and household income, we consider the constrained SAM multipliers for selected production activities. For supply-constrained sectors, the headings at the top of each column specifies the impact of growth of a sector on the village output and household income. In other sectors (i.e. supply-unconstrained sectors), the multiplier value shows the impact of changes in exogenous factors, such as a change in investment or demand for exports.

The total output multipliers show the impact of supply improvement and demand injection on village output and the multipliers vary across sectors. For instance, while an injection of 1.00 birr in the *teff* activitygenerates about 2.65 birr of additional output in the

entire village economy, an equivalent increase in wheat and vetch output leads to a 2.71 and 2.75 birr increase in village output, respectively. Notice that the livestock sector has very low multipliers indicating that the sector is constrained by a shortage of grazing land, lack of animal feed, disease, etc. An earlier study (e.g. Tiumelissan and Birhanu, 2005) has also shown that the area of grazing land has become smaller as it is used for crop cultivation due to population pressure in the study village.

The own account multipliers show the impact of growth of a sector on itself. For instance, *teff* output has a relatively large own sector multiplier, i.e. a 1.00 birr increase in output generates a 2.00 birr additional output in the sector itself. Linkages with other sectors show the degree of inter-sectoral linkages in the village economy and indicate how an expansion in a given sector affects other sectors. Consider, for example, three cereals: *teff*, wheat and vetch. A 1.00 birr increase in the output of each of these activities leads to a 0.65, 1.49 and 1.63 birr increase in the output of other sectors, respectively.[15]*Teff* has limited linkages with other sectors compared with wheat and vetch. Food processing activities, such as preparing and selling local beer and liquor, which are farm-based non-farm activities, also play an important role in stimulating village production. Given their linkages with other sectors, they have the potential to trigger growth in the village economy. They help to sustain agricultural growth since these sector depend on agricultural commodities for producing goods and services. Hence, agriculture and farm-based non-farm sectors can mutually support each other in a 'virtuous' cycle in which both sectors strengthen simultaneously.[16]

The household income effects of sectoral growth also vary across sectors. Total household income would increase by 2.32, 2.42 and 2.46 birr following a 1.00 birr increase in the output of *teff*, wheat and vetch in that order. In terms of the distribution of income gains across household groups, relatively better off and male-headed farm households take the lion's share of an increase in agricultural output (figure 11).[17]

The constrained multipliers indicate that the existing farming system apparently does not lead to a more diversified agricultural activity. Although *teff* isthe dominant cereal in terms of output in the village economy, it has weak linkages with other sectors. This suggests that the main

[15] Note that the figures for linkages with other sectors do not include own effects. The total output multiplier is the sum of own multipliers and linkages with other sectors.
[16] This is in support of Mellor's (1976) argument about the myriad linkages that bind the two activities.
[17] This may be due to this household group has relatively large initial consumption level.

subsistence crop, *teff*, has limited economic potential in terms of stimulating and sustaining growth, particularly when compared with wheat, vetch, Niger seed, and other crops. A recent study (e.g. Demeke *et al*., 2007) indicates that the mean area under *teff* per household has increased from 1.2 ha in 1999 to 1.6 ha in 2007 and the figures for wheat are 0.39 ha in 1999 and 0.43 ha in 2007. The average area allocated to vetch virtually remained unchanged, about 0.32 ha between the period 1999 and 2007.[18] This suggests a lack of crop diversification away from this traditional crop to other crops that have greater market potential.

The following observations can be made.

(1) Growth in other agricultural output than the main subsistence crop has a much higher impact in terms of promoting inter-sectoral production and household income. A move from low return subsistence crops such as *teff* to those that have relatively high pay-off is the main route out of traditional farming systems. Emerging empirical evidence also indicates that livelihood strategies away from traditional food crop production appear to be a key to improving household income and alleviating poverty in the country (Pender and Gebremedehin, 2007; Holden *et al.*, 2004). Such a shift could increase not only rural incomes and savings but also bring broad-based economic growth and speed up the commercialization of agriculture. Assuming that agricultural terms of trade remains stable, with appropriate interventions that would minimize risks, income to farm households would rise with the shift to other activities since the average multiplier effects for more diverse agricultural products are relatively higher than those of *teff*.

(2) Because farm households focus on production for home consumption, they generate little cash income or savings necessary to finance growth and trigger productivity. The study village is characterized by a very high subsistence-oriented production as reflected by a low marketable surplus ratio, and the market for subsistence products such as *teff* is rather limited and offers little incentive to market surpluses.

[18] During the field work, we have also observed that very few farmers who have access to irrigation facilities start cultivating vegetables such as onions, potatoes and beetroot.

Table 5: Constrained multipliers for selected production activities

	Teff	Wheat	Maize	Chickpeas	Vetch	Niger Seed	Other crops	Livestock	Food processing	Other services
(a) Constrained multipliers										
Total output multipliers	2.646	2.714	2.547	2.592	2.748	2.784	2.772	1.397	2.372	2.453
Own account multipliers	1.997	0.214	1.035	1.006	1.118	1.033	1.022	1.022	1.030	1.021
Linkages with other sectors	0.649	1.488	1.513	1.586	1.631	1.751	1.750	0.375	1.342	1.432
Household income multipliers	2.320	2.415	2.169	2.237	2.462	2.502	2.490	0.545	1.921	2.038
(b) Unconstrained multipliers										
Total output multipliers	3.054	3.141	2.904	3.099	3.215	3.200	3.188	2.834	3.122	3.126
Own account multipliers	2.256	1.287	1.049	1.067	1.173	1.052	1.045	1.089	1.034	1.025
Linkages with other sectors	0.798	1.854	1.855	2.032	2.042	2.148	2.143	1.745	2.087	2.101
Household income multipliers	2.677	2.789	2.481	2.679	2.871	2.866	2.854	2.159	2.706	2.781

Source: Extracted from YV-SAM constrained multiplier matrix

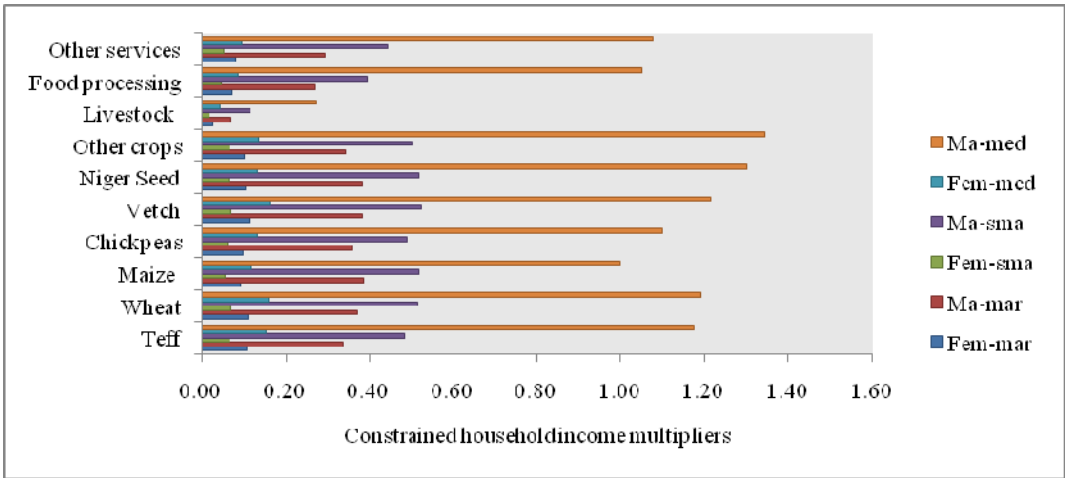

Figure 11: Constrained household income multipliers for selected production activities

Policy Simulations

The SAM multiplier model can also be used to investigate economy-wide effects of alternative growth strategies such as the effects of demand increases, income transfers, etc on village output, household income, investment in human capital and land and soil conservation.[19] This section examines the growth prospects of the village economy through conducting policy experiments. Specifically, we will simulate the economy-wide effects of the following policy interventions in the village economy.

(1) S1: Direct income transfer to one of the household groups
(2) S2: An exogenous increase in the demand for agricultural commodities
(3) S3: Household investment in land and soil conservation
(4) S4: Investment in land and soil conservation by better-off households only; and
(5) S5: S2+S3

S1: Direct income transfer to households

This simulation examines the effects of a direct transfer of income to farm households on village production, household income and investment in human and environmental capital. It evaluates the impact of spending linkages within and outside the village. Such transfers can come from government with the objective of helping rural households. Assume that the total income to be transferred is equal to a fifth of the total income of female-marginal households (about 9,386 birr[20]). Formally, let D and n_i denote, respectively, the total income to be transferred and the number of households in group i $\left(n = n_1 + n_2 + \ldots + n_6\right)$.

Then we assume the following allocation rules. First, the total amount is equally distributed to each household, i.e. all households get the same amount $\left(i.e.\ \frac{D}{n}\right)$. Second, the transfer is made to one of the six household groups, and each household in the group gets the same amount $\left(i.e.\ \frac{D}{n_i}, i = 1, \ldots, 6\right)$. In order to examine individual impacts, a total of seven simulations is conducted.

Notice that income transfers increase consumption and investment demand for farm and non-farm commodities which results in a rise in sectoral production. As production increases, new

[19] We use the unconstrained village SAM multiplier matrix to simulate a variety of recent policy and other exogenous shocks, such as a rise in the demand for agricultural commodities.
[20] 1USD= 9.40 birr on March 5, 2008.

value-added is generated which is channelled to households as income. This, in turn, triggers a new round of household expenditure linkages. In the process, demand for consumption and investment goods as well as production inputs from outside the village create income leakages, which dampens the multiplier effects of a positive income shock.

Table 6 summarizes the simulation results of a positive income shock to one of the household groups. The results indicate that the demand-induced increase in village production is higher if an exogenous income transfer is directed at female-headed households. For instance, while an income transfer directed to marginal female-headed households increases village output by 0.11%, the same magnitude of income transfer to marginal male-headed households has a smaller impact on village production. This is due to the fact that female-headed households spend on locally produced goods and services and thus have fewer leakages in the income-expenditure feedback mechanism compared with male-headed households and this stimulates the village economy. As a result, total household income improves. Although all household groups experience an improvement in their income, female-headed households benefit most.[21]

Interestingly, the income shock also improves savings in human capital (i.e. spending in education) and natural capital (i.e. spending in land improvement), which are key factors for sustaining economic growth. Specifically, transfers to marginal and small female-headed households have a relatively strong impact on human capital compared to a similar transfer to male-headed households. Notice that the impacts of an income transfer to female-headed households are higher for human capital savings (education spending) than natural capital savings.On the other hand, the impact of an income shock to the medium male-headed households is higher for natural capital savings than human capital.

Two observations can be made.

(1) Interventions will have a relatively strong effect on inducing village production and household incomes if directed to the poorest groups which consume locally produced goods as their incomes improve. Income gain for agricultural female-headed households will also have a long-lasting and multiple effects as they play a vital role as caretakers, food providers (household chores) and educators in their family. Even in the male-headed households, the responsibilities for many household chores such as food production and preparation as well as the overall well-being of the household continue

[21] The income transfer has also been implemented in per capita terms (not reported) and the results are quite similar.

to fall on women. This multiple role is often undervalued, especially in rural areas. Hence, a program to provide marginal and small agricultural producers, especially female-headed households with the necessary credit and other assistance is likely to have a positive impact on their well-being.

(2) Gender consideration is important when designing and implementing policies and strategies that target human capital formation and land conservation activities. Specifically, interventions in human capital development would bring the desired outcome if targeted to female-headed households.

Table 6: Effects of an exogenous income transfer to households on the village output and household income (% from the base)

	All households get the same amount	Each household in the group gets the same amount					
		Fem-mar	Ma-mar	Fem-sma	Ma-sma	Fem-med	Ma-med
Production	0.064	0.105	0.076	0.127	0.050	0.154	0.031
Household income	0.098	0.157	0.112	0.200	0.077	0.265	0.047
Fem-mar	0.198	1.284	0.077	0.129	0.051	0.158	0.032
Ma-mar	0.104	0.105	0.321	0.126	0.050	0.158	0.032
Fem-sma	0.269	0.108	0.077	2.751	0.051	0.158	0.032
Ma-sma	0.092	0.106	0.077	0.128	0.177	0.157	0.032
Fem-med	0.160	0.110	0.078	0.133	0.053	1.954	0.033
Ma-med	0.074	0.104	0.075	0.125	0.049	0.152	0.062
Expenditure on:							
Human capital-education	0.113	0.155	0.103	0.368	0.071	0.366	0.046
Human capital-health	0.113	0.297	0.091	0.292	0.083	0.155	0.046
Natural capital-land	0.086	0.114	0.094	0.126	0.070	0.281	0.053

Source: Model simulation

S2: An exogenous increase in the demand for agricultural commodities

Notice that Ethiopia has experienced a marked increase in the demand for agricultural commodities since 2004 (Demeke *et al*., 2007). This unprecedented increase in the demand for food items can have significant effects on village production, household income and on the composition of household expenditures. In this simulation, we assess the impact of an exogenous increase in the demand for agricultural commodities on the village production, household income, expenditure on human and natural capital. Specifically, we assume a 10%

increase in the demand for export of agricultural commodities, and this is distributed to agricultural activities according to their initial export levels in the base year. The simulation results indicate that an exogenous increase in the demand for agricultural commodities stimulates village production and household income (Table 7). Since households are net sellers of staple agricultural commodities, a rise in the demand for agricultural commodities benefits all household groups (figure 12). Specifically, female-headed households enjoy relatively the largest income gains compared with male-headed households. It should be noted that female-headed households have higher marketable surplus ratio, suggesting that, other things being the same, a positive demand shock for agricultural commodities would benefit female-headed households compared with male farm households. The results suggest that in a predominantly crop-based setting, improving agricultural markets benefits the smallholders in general and net sellers in particular.

Table 7: Effects of a 10% increase in the demand for agricultural commodities

	% from the base
Production	6.067
Household income	6.180
Expenditure on:	
Human capital-education	6.214
Human capital-health	6.176
Natural capital- land	6.168

Source: Model simulation

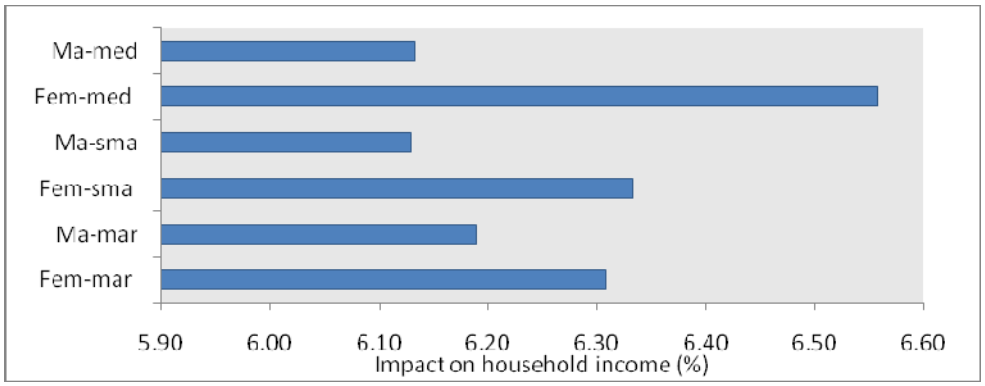

Figure 12: Impact of a 10% rise in demand for agricultural commodities on the distribution of household income

S3:Household investment in land and soil conservation

This simulation describes the impact of a government policy that compels households to invest in environment-related activities. Specifically, assume that such policy stipulates a total investment in land improvement equal to the amount indicated in the base year. This is equivalent to injecting a total of 5,074 birr into land and soil conservation activities and this is distributed to the household groups according to their income. The assumption is that land users are required to invest on their farm land so as to maintain its quality for future production. This policy has a negative impact on village output, household income, investment in human capital and land conservation. Although this policy has a positive effect on investment in land quality, it leads to reduced village output, household income and investment in human capital (Table 8). This is mainly because such policy reduces incomes of households as the benefits of such investments would accrue over a long period and in the absence of extra income, households respond by cutting education and health-related expenditures. A study in Peru (Escobal *et al*., 2004) also indicates that a negative income shock affects education and health expenditures, i.e. households respond by cutting expenditures related to education and health which have a direct impact on human capital accumulation. Notice that crop income is the main source of income for households in the study village as other sources of income such as income from non-farm employment is not common.

S4: Investment in land and soil conservation by better-off and male-headed households

Suppose that government policy requires only better off and male-headed households to invest in land and soil conservation activities. Specifically, assume that only small and medium male-headed household groups are required to invest in land and soil conservation activities. Moreover, assume that the objective is to invest an amount equal to 5,074 birr which is distributed to the two groups in proportion to their total income in the base year. The effects of such targeted policy intervention on village output, household income, investment in human and environmental capital are presented in Table 8. The impact of this policy is such that village output, total household income and investment in human capital all decline. This intervention does not stimulate village production since the better off households are discouraged to expand production. Expenditure on human capital also falls but the decline is small compared with simulation 3. If the objective is to increase household income, improve

human capital and at same time maintain the quality of land, then such policy does not seem to entail the desired outcome as it leads to trade-off between the different objectives.

S4: S2+S3

In this simulation, we examine the combined effects of a rise in the demand for agricultural commodities and an environmental policy on village production and household income. The simulation results indicate that such interventions would help to stimulate both village production and household income in the short-run (Table 8). In terms of income distribution, although the benefits accrue to all household groups, female-headed households gain more compared with male-headed households. Given that farming is the main livelihood of rural households, increased farm income enables farm households to shift resources to improve the quality of agricultural land and increase crop production. This also suggests that in settings where farm income forms a significant proportion of total household income, low-return of agricultural activities appears the main constraint for investment in land improvement. This underscores the fact that individual interventions are ineffective in terms of promoting both household welfare and natural capital, and that a package of policy interventions are important to improve household welfare and the quality of agricultural land simultaneously.

Table 8:Effects of environmental investment by households and government on the village economy (%)

	All households pay for land improvement	Only better off and male-headed households invest in land improvement	A 10% increase in the demand for cereals +S2
Production	-0.677	-0.678	5.359
Household income	-1.149	-1.148	4.984
Fem-mar	-1.166	-0.691	5.110
Ma-mar	-1.158	-0.680	5.000
Fem-sma	-1.164	-0.687	5.137
Ma-sma	-1.111	-1.294	4.986
Fem-med	-1.214	-0.740	5.311
Ma-med	-1.151	-1.335	4.919
Expenditure on:			
Human capital-education	-1.155	-1.101	5.013
Human capital-health	-1.145	-1.141	4.986
Natural capital-land	98.850	98.766	104.965

Source: Model simulation

Conclusion and policy implications

This study provides empirical evidence regarding the structure of economic linkages and prospects for sustainable growth in one of the main cereal producing villages in rural Ethiopia. It has been argued that income and expenditure linkages in the rural economies are instrumental in shaping the impact of policy reforms on village production, household income and investment in human and environmental capital. An extended village social accounting matrix-based multiplier model is employed to examine growth linkages and to evaluate economic and environmental policies in the village economy.

The descriptive analysis points to a number of key features of the study setting. village economy is dominated by agricultural activities. Family labour, augmented by traditional community labour pools, is the main input for agricultural production. Crop income is the main source of livelihood for village households as remittances or transfers from outside the village are negligible. Apart from labour, agricultural land matters for household income, i.e. household with relatively larger plots of land are better off in terms of income per capita.

The structure of food expenditure reveals that the proportion of agricultural output retained for home consumption is quite high, and this share is dominated by the value of crop production. The village economy is weakly commercialized as indicated by a small marketed surplus rate. Notice that market purchases of agricultural commodities for consumption are very small since village households are able to satisfy their crop consumption needs from their own produce as reflected in the high self-supply rate.

The growth linkages based on both constrained and unconstrained multipliers analysis indicate that the existing farming system does not yield a diversified agricultural activity. Despite the dominance of *teff* in terms of output and value added in the village economy, it has low linkages with other sectors under both constrained and unconstrained multipliers cases. This suggests that the main subsistence crop, *teff*, has the low economic potential in terms of stimulating growth and household income. Thus a move from low return subsistence crops such as *teff* to those that have relatively high pay-off crops is the main route out of traditional

farming systems. This shift could increase not only rural incomes and savings but also bring broad-based economic growth and speed up the commercialization of agriculture.

The effects of income transfer to households on village production, investment in human and environmental capital are quite mixed and heterogeneous. An income transfer to marginal and small households stimulates the village economy in terms of output and household income compared with the same transfer to relatively well-off households. It has also a positive impact on investment in human capital. Specifically, transfers to marginal and small female-headed households have relatively strong impact on human capital compared to a similar transfer to male-headed households. This indicates that interventions will have a relatively strapping effect in inducing village production and household income if directed to the marginal households which consume locally produced goods as their incomes improve. The result also provides a strong indication that transfers directed to better off and male-headed households would have the effect of inducing investment in land and soil conservation activities. The implication is that interventions in land and soil conservation activities would be effective if gender consideration were taken into account and targeted to the well-off and male-headed households.

It should be noted that a policy that requires either all land users or better off households to invest in land and soil conservation activity may not be effective in terms of stimulating village production, household income, and investment in human capital. On the other hand, if such policy is accompanied by a rise in the demand for agricultural commodities, this would help to stimulate both village production, household income and expenditure on human capital formation in the short-run.

The findings of the study have the following policy implications.

(1) It appears that the smallholder road to development strategy will not bring the desired result in terms of increasing rural incomes and reducing poverty if it targets the traditional crop which has low economy-wide linkages and limited income generating potential for farm households. Continued reliance on this traditional crop, *teff*, will only lead to limited growth not only in the study village but also in other areas of the country since high subsistence dependence on this crop is a nationwide phenomenon.

(2) If agriculture-led development strategy is to trigger broad-based growth, enhance income of rural households and to improve investment in human and environmental capital, complementary interventions and institutions need to be designed to address the

specific needs of farm households in general and marginal and small farm households in particular.

Overall, even in the current socioeconomic setting, there seem to be some opportunities to promote broad-based growth in the study village. To seize such opportunities, there is a need to look beyond traditional food crop production system, and this calls for strategic thinking in terms of re-orienting, fine tuning and prioritizing development strategies and interventions. Even under the existing environment, output and household income can be increased by shifting from low value crops to higher value crops, and this can done through reallocation of resources such as land from the former to the latter. Within the rubric of broad-based and pro-poor economic growth, prime entry for sectoral intervention within agriculture is to provide incentives or supports to non-*teff* crops, such as wheat, vetch and Niger seed. Similarly, it is also equally important to promote farm-based-non-farm activities which have direct links with the farming activity. It should be noted that such virtuous link between farm and non-farm activities crucially depends on policies that support the growth of high productivity non-farm activities along with measures that facilitate greater participation of the poorer groups in these activities. This requires, among others, investments in education and skill development of farm households, especially for the marginal and small farm households along with providing them access to finance and technology.

Finally, although the SAM-based model is useful for assessing growth linkages, it does not address the long-run effects of policy reforms such as investments in human and natural capital. The SAM-based model is also based on other assumptions, such as fixed prices, linear relationships, etc. These assumptions can be relaxed by using other models, such as computable general equilibrium (CGE) model.

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