

DEPARTMENT OF ECONOMICS

Growth linkages and policy effects in a village economy in Ethiopia: An analysis of interactions using a social accounting matrix (SAM) framework

Tadele Ferede Agaje

UNIVERSITY OF ANTWERP
Faculty of Applied Economics



Stadscampus
Prinsstraat 13, B.213
BE-2000 Antwerpen
Tel. +32 (0)3 220 40 32
Fax +32 (0)3 220 47 99
<http://www.ua.ac.be/tew>

FACULTY OF APPLIED ECONOMICS

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University of Antwerp, City Campus, Prinsstraat 13, B-2000 Antwerp, Belgium
Research Administration – room B.213
phone: (32) 3 220 40 32
fax: (32) 3 220 47 99
e-mail: joeri.nys@ua.ac.be

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Tadele Ferede Agaje

Department of Economics

Faculty of Applied Economics, University of Antwerp

Prinsstraat 13, 2000 Antwerpen, Belgium

Tadele.Ferede@ua.ac.be

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Abstract

Accelerating economic growth and poverty reduction are and continue to be the critical policy challenges in Ethiopia. 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, investments in human and environmental capital in the study village. Apart from providing a quantitative analysis of a village economy, the study considers a sectoral disaggregation that takes into account the diversity of not only economic activities in terms of supply response but also heterogeneity of rural households. This study also incorporates investment in human and environmental capital in the analysis of growth linkages using a village social accounting matrix-based framework.

Using constrained and unconstrained SAM multipliers, growth linkages of different sectors are explored and activities that best promote growth and household income are identified. Since the growth linkage model is based on the detailed SAM estimated for the village economy, this helps to gauge the effects of policy reforms and strategies on growth, household livelihoods, and investment in human and environmental capital. Accordingly, some simulations are 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 sustainable development.

Key words: village economy, Ethiopia, growth linkages, human capital, multipliers, social accounting matrix, environmental capital

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1. Introduction

The livelihood of the Ethiopian poor remains firmly linked to the performance of agriculture, conditioned by timely rainfall. Although the contribution of the agricultural sector diminished over time from 54% in 1995 to 48% in 2006, it is still the key to livelihoods for the majority (80%) of the population. Smallholders produce more than 90% of the total agricultural output and cultivate close to 95% of total cropped land. Given the size of the sector in terms of its contribution to output, employment, foreign exchange, overall growth and poverty reduction, the government adopts a development strategy popularly known as Agricultural Development-Led Industrialization (ADLI) that focuses on the development of smallholder agriculture since the early 1990s. The premise of the strategy is that smallholder agriculture is viewed as crucial to transforming Ethiopia's agrarian economy through deeper linkages between agriculture and non-agriculture (see MOFED, 2005). Deteriorating living standards and critical food shortages, especially in rural areas, where the bulk of the population resides, have contributed to the recent focus on agricultural growth.

Despite strenuous efforts to boost agricultural production and productivity, the agricultural sector fails to satisfy the growing demand for food and to reduce poverty and malnutrition.¹ The proportion of people living below the absolute poverty line remains high. Poverty is also more widespread in rural than in urban areas. Lack of broad-based economic growth, massive poverty, exploding population, shrinking resource base, especially agricultural land, accelerating land degradation, and worsening terms-of-trade open lively policy discussions and debates in the country over the relevant direction and locus of development efforts. A good part of the explanation for the problems can be lack of knowledge in terms of identifying and prioritizing activities that have high growth linkages and strong income-enhancing impacts. It is argued that the long-term sustainability of economic growth and its welfare improving impact largely depend on the magnitude and strength of inter-sectoral linkages and the manner in which income is distributed.² To optimize development strategies and selection of feasible policy instruments, a deeper understanding of the magnitude of growth linkages between sectors and the structure of consumption or income is of paramount importance.

This study is a step in that direction. Specifically, apart from providing a quantitative analysis of a village economy, the study considers a sectoral disaggregation that takes into account the diversity of not only economic activities in terms of supply response but also heterogeneity of rural households. Moreover, this study explores the growth linkages of different activities and identifies activities that best promote growth, household income, human and environmental capital. Although modelling of village economies is not new,

¹The performance of the agricultural has been sluggish. For instance, the sector registered a very small growth rate (about 3.6% between 1995 and 2006) given the population growth rate of about 3% per annum. About 31 million people live under abject poverty and between 6 and 13 million people are at risk of starvation each year (MOFED, 2005).

² A recent study by Dercon and Hoddinott (2005) indicate a myriad of linkages between rural villages and local towns in Ethiopia.

this study attempts to include investment in human capital in the analysis of growth linkages using a village social and environmental accounting matrix framework. Inclusion of human and environmental capital helps to assess and evaluate the sustainability of economic and other policies in terms of economic growth, improvements in human and environmental capital. Since the growth linkage model is based on the detailed social accounting matrix (SAM) estimated for the village economy for the year 2006/07, which is well inside the post-reform era, the findings of the study would serve as a basis for gauging the effects of economic reforms on livelihoods. 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.

The rest of the paper is organized as follows. Section 2 briefly reviews growth linkages in rural areas. Structure of the village economy and description of the village social accounting matrix are presented in Section 3. In Section 4, analysis of growth linkages and policy effects are provided. Finally, summary and policy implication are given in Section 5.

2. Growth linkages: Some relevant literature

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 difference 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 economy. 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, especially with the ground realities of developing economies such as Ethiopia. Some villages participate in the marketing for some output in the village or surrounding markets and some involve in factors of production markets such as labour both inside and outside the village, yielding an intermediate case.

The linkages literature of the 1970s and early 1980s (Mellor, 1976) has been accompanied by extensive use of SAM-based models to support development policies and strategies both at national and regional levels. These models have also been extended to investigate growth linkages at village levels (Adelman et al., 1988

for Mexico; Subramanian and Sadoulet, 1990 for India; Xiaoping, et al., 2005 for China; Lewis and Thorbecke, 1992 for Kenya; Golan, 1996 for Senegal; Ralston, 1996 for Indonesia)). The nature of economy-wide growth linkages between the different activities helps to evaluate and identify target sectors that best promote economic growth.³

Because of growing problems of environmental deterioration, many countries face sustainability problems and this calls for protection and maintenance of the environment as an integral part of their development objectives and this is continued to be one of the main development objectives in the years to come as reflected in the UN Millennium Development Goals (Goal # 7). In recognition of this issue, the 1993 SNA provides a mechanism for linking issues of environmental concerns with System of National Accounts (SNA) (UN, 1993). The argument is 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 income is necessary to conserve and restore the environment (King et al., 2000; Goodland *et al.*, 1991). This implies that development policies and strategies should integrate economic development with the environment 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 Bolivia; Morilla et al., 2007 for Spain; and Xie, 2000 for China). When linking environmental issues to economic activities, difficulties arise with respect to what environmental indicators to use and how to measure and integrate them in the overall economic accounts. Given the diverse nature of environmental data, the type of environmental indicators may vary depending on specific circumstances and pressing environmental problems of countries. While some environmental data can be obtained in the form of stocks such as quantities of natural assets at a particular point in time, other types can be in terms of flows such as defensive expenditures or emissions of chemicals over a period of time (Atkinson, 1995; Patriquin et al. 2003). The choice of an environmental indicator depends on economic settings, objective of the study and data availability.

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 outcome (World Bank, 2006; Lucas, 2001). The literature on SAM-based growth linkages focus mainly on issues of growth, poverty and environment and very limited effort is made to include investment in human capital in the analysis of those issues.⁴ Human capital, especially investment education, can contribute to agricultural growth and poverty reduction since it facilitates technological change in agriculture (Weir and Knight, 2000).

³ See Delgado et al (1998) for a comprehensive review of growth linkages.

⁴ Lewis and Thorbecke (1992) include investment in human capital in estimating the regional SAM for Kenya, but the regional SAM lacks an environmental account.

The current practice of treating investment outlays in human capital as current expenditures misrepresent overall saving and investment. Inclusion of investment expenditure in human capital as current consumption distorts intersectoral linkages, resource allocation, growth and income distribution (Sharma and Ram, 1974). As human capital is one of the most important assets, human development expenditures that have a long-run qualitative and quantitative payoff should be classified as investment and appropriately accumulated into human capital stock (Eisner, 1999). Given the centrality of human capital for sustainable economic growth and poverty reduction, broad indicators of well-being and growth performance require integration of human capital component into the standard economic and environmental accounting system and this establishes linkages between economic, environmental, and human capital issues. Despite the fact that there is a wide consensus regarding the importance of human capital for sustained growth and poverty reduction, there is no agreement on the measurement of human capital (Lange, 2003; Hamilton and Ruta, 2006). Educational variables are often used as a proxy for investment in human capital. Even so, different approaches have been employed to measure human capital, such as through years of schooling and labour market experience⁵ (e.g. Barro, 1991; Barro and Lee, 1993; Mankiw, Romer, and Weil, 1992; Asteriou and Agiomirgianakis, 2001; Jones, 1998; Mulligan and Sala-i-Martin, 1995; Wasmer, 2001; Laroche, 2005), through income-based approach, i.e. labour income⁶ (Mulligan and Sala-i-Martin, 1997; Carlos and de Saliva, 2004; Le et al., 2005), or 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.

The following remarks can be made. First, the sectoral structure of growth linkages is important for boosting output and household income. In this respect, the heterogeneity among economic activities and institutions households is important to assess growth linkages. Second, while environmental indicators have been included in most 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. Third, the size of growth multipliers depends critically on the supply response of sectors. For instance, in traditional agriculture, supply is generally inelastic at least in the short term, while it is relatively elastic in the services and non-farm sectors.

In this study, an attempt has been made to incorporate supply constraints in some sectors such as crop agriculture. In addition, expenditures on education, health and land and soil conservation activities are treated as investments in human and environmental capital, respectively, since these expenditures should be seen as investment in assets that have the potential to enhance welfare in a sustainable way (see Hamilton and Ruta,

⁵ Jones (1998) notes that years of schooling or educational attainments can be viewed as investment rate, but not as a human capital stock.

⁶ This approach is more useful in skill-intensive economies such as developed countries than developing countries which are characterized by low human capital.

2006). Inclusion of these factors permits a more realistic evaluation of growth linkages and their effects on household income, investments in human and environmental capital.⁷ 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.

3. The structure of the village economy

3.1. The study setting and data sources

The study focuses on the village of *Yetemen* located in the Enemay woreda of the East Gojjam zone of the Amhara National Regional State. It is located about 248 km northwest of Addis Ababa, the capital city of the country, and lies between two nearby towns: Dejen and Bichena. The former is 17 km south and the latter 15 km north of *Yetemen*. The village is one of the fifteen villages subject to repeated studies by the Department of Economics of Addis Ababa University in collaboration with different institutions and Universities since 1994 as part of the Ethiopian Rural Household survey (ERHS).⁸ The village was selected in the ERHS to represent one of the major cereal producing villages since the study village is situated in the highlands of the Amhara National Regional State (ANRS).

About 60 households have been included in the ERHS. In this study, 90 additional households have been included in the survey, making the total number of households equal to 150. Two steps were followed in selecting the new households. First, a complete list of households residing in the village was obtained from the Peasant Association (PA) office.⁹ From the list, we have identified those households who were included in the ERHS. Second, 90 households have been randomly selected from those who were not in the ERHS.

Detailed information at household and village levels has been collected using household survey instruments in 2007/08. The household survey provides information on a wide spectrum of socio-economic issues including household composition and structure, education, household 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 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

⁷ 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).

⁸ On ERHS, see Dercon and Krishnan (1998) and Dercon and Hoddinott (2005).

⁹ Peasant Association or *kebeke* is the smallest administrative unit.

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 *Yetemen* village social accounting matrix (YV-SAM). In what follows, we present the structure of the *Yetemen* village-SAM (YV-SAM).

3.2 Description of the village Social Accounting Matrix (SAM)

The framework of estimating the village SAM for 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 1 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, firms, etc.¹⁰ For instance, production activities require factors of production in order to produce goods and services. Factors of production obtain income from the services they rendered 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, and hence the factors of production account indicates the amount of income paid by production activities to different types of factors of production and shows the factoral distribution of income. The factors of production account routes factor incomes towards institutions 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.

¹⁰ No distinction is made between activities and commodities in the diagram. The arrows show the direction of influence.

Figure 1: Schematic characterization of village economic interactions¹¹

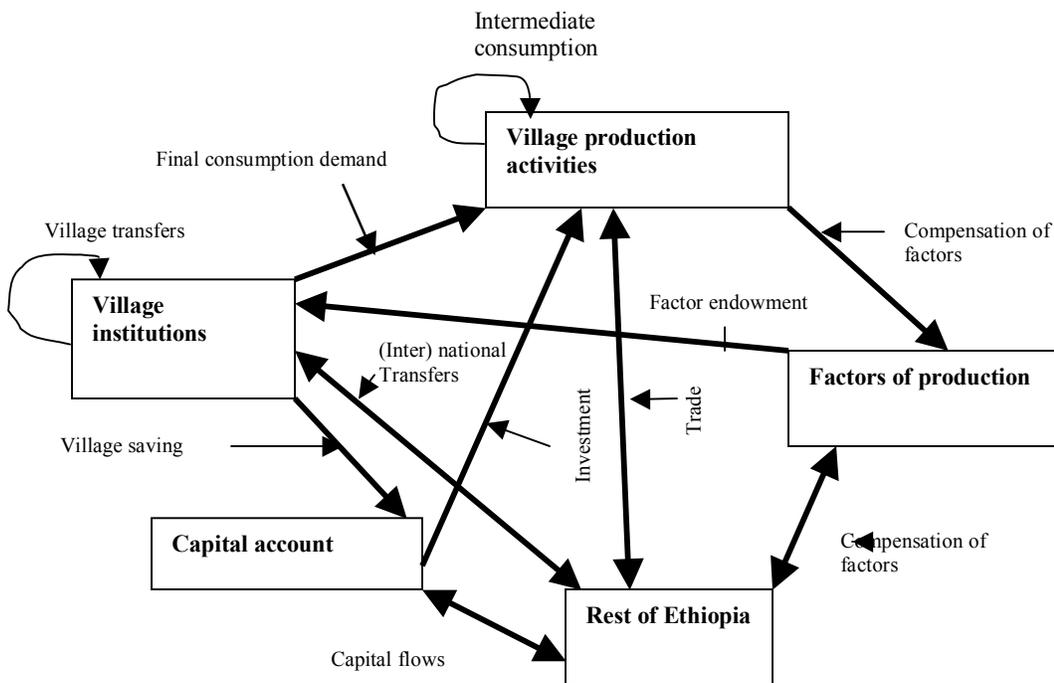


Table 1 depicts, in tabular form, the relationships and interactions indicated in Figure 1. Such interactions can be presented in a convenient way by using a social accounting matrix (SAM). A SAM is a socio-economic information system that describes all interactions and transactions that occur in an economy in a particular year. 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). Accordingly, the rows of the SAM record incomings while the columns record the outgoings or expenditures. Hence, the intersection of the rows and columns of an account has a dual meaning, that is, receipts for one account and expenditure for another, with row and column totals being equal.

The village SAM includes production activities, factors of production, commodities, institutions, capital account, and rest of the world (i.e. rest of Ethiopia 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 and emphasis has been placed on the disaggregation of agricultural activities.

(ii) The commodities account captures product markets and household consumption structure. An 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, including the value of

¹¹ Although the interactions can assume both real and financial flows, the diagram shows the latter.

domestic production marketed and imports after taxes and marketing margins (columns), and total demand, including demand for intermediary input by activities, consumption of goods and services by institutions, investment demand, and exports (rows). A total of 14 commodity accounts have been distinguished in the YV-SAM. We have also a separate account for environmental goods and services and other accounts represent manufacturing, services and household chores.

(iii) The factors account describes the source of factor income, i.e., value added in each domestic activity and from the rest-of-Ethiopia (RoE), 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 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 government accounts 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 (row), and payments made by households. Households spend 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 (column). Note that farm households are not a homogeneous set of farm families all 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:

- Agricultural marginal-Female: female headed households that own up to 0.75 ha of land
- Agricultural marginal-Male: male headed households that own up to 0.75 ha of land
- Agricultural small-Female: female headed households owning between 0.75-1.50 ha of land
- Agricultural small-Male: male headed households owning between 0.75-1.50 ha of land
- Agricultural medium-Female: female headed households that own above 1.50 ha of land,
- Agricultural medium-Male: male headed households that own above 1.50 ha of land

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). Note that four capital accounts have been distinguished in the village SAM, namely human capital, environmental capital and other capital.

(vi) The Rest of Ethiopia (RoE) account links the village economy with the rest of the country.¹² Transactions that flow 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 payment for imports of goods and services, transfer payments to village institutions, factor income transfers to the village, and savings.

The elements of the village social accounting matrix are given in the annex (Table A1).

Table 1: The schematic structure of the *Yetemen* village social accounting matrix (YV-SAM)

	1	2	3	4	5	6	Row Total
Production activities (1)		Market Sales (1,2)		Home consumption (1,4)			Total output
Commodities (2)	Intermediate input consumption (2,1)	Marketing margins (2,2)		Consumption demand (2,4)	Investment (2,5)	Exports (2,6)	Total demand
Factors of production (3)	Value-added (3,1)					Factor income transfers (3,6)	Total receipts from factor income
Households and Government (4)			Distribution of factor income (4,2)	Subsidies, taxes and inter-institutional transfers (4,4)		Transfer income (4,6)	Total income
Combined capital account (5)				Savings by institutions (5,3)		Deficit/Surplus (5,6)	Total savings
Rest of Ethiopia (6)		Imports (6,2)	Factor payments (6, 3)	Transfer payments (6,4)	Net capital outflow (6,5)		Total imports
Column total	Total payments	Total supply	Total payments to factors of production	Total current expenditures & savings	Gross investment	Total exports	

¹² Note that RoE includes all areas outside the village.

3.3 Characteristics of the village economy

Table 2 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.¹³ In terms of gender pattern, female headed households have lower families and lower average holding size than male headed households. Female-headed households have also low literacy rate compared with male headed households.

Table 2: Selected socioeconomic indicators by household group

	Agricultural marginal-Female	Agricultural marginal-Male	Agricultural small-Female	Agricultural small-Male	Agricultural medium-Female	Agricultural medium-Male	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

3.3.1 Production structure and input use

The village economy is dominated by crop agricultural activity: it generates more than three-fourth of the gross output (figure 2). The key feature of the village agriculture is the predominance of *teff*¹⁴ which accounts for more than two-third of total cropped land and three-fourth of the total crop output in 2006/07. This crop has been grown in the village for several centuries and almost all households grow this crop with limited diversification to other crops. Wheat and vetch are other crops grown in the village which together account for about 15% and 20% of the total crop output and cropped land over the same period, respectively. The share of livestock and non-agricultural activities in gross output is very limited. As one expects, the village agricultural sector in general and crop agriculture in particular, are characterized by low input-intensity, reflecting low use of modern and other inputs, akin to the overall agricultural sector in the country.

In terms of factor use among the various activities, crop agriculture absorbs a significant proportion of production factors. Human and animal labour accounts for close to 46% of the total value added and land for about 28.5% (figure 3). Figure 4 shows the factor intensity of the competing activities. Labour is the most important of all productive factors and is supplied almost mainly by the family, augmented by traditional

¹³ There is a diminishing trend in per capita in the study village. It declined from 0.92 ha in 1994 to 0.29 ha in 2006/07, mainly due to population pressure.

¹⁴ *Teff* is a cereal unique to Ethiopia and is grown mainly in the highlands. It is the main staple food, especially in northern and central Ethiopia.

community labour pools. The use of hired labor is generally limited. Labour sharing arrangement 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 rate and this is included in the category of hired labour.¹⁵ Other costs such as food are also included as the host household is supposed to provide food to the work party. Land and other capital such as farm tools and equipment are also important in crop production.

Figure 2: Composition of crop output by major activities (%)

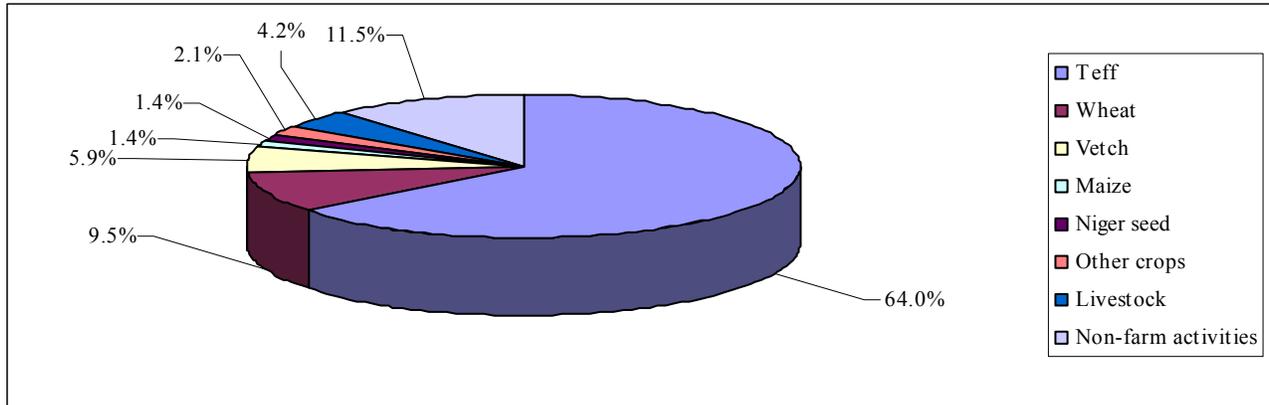
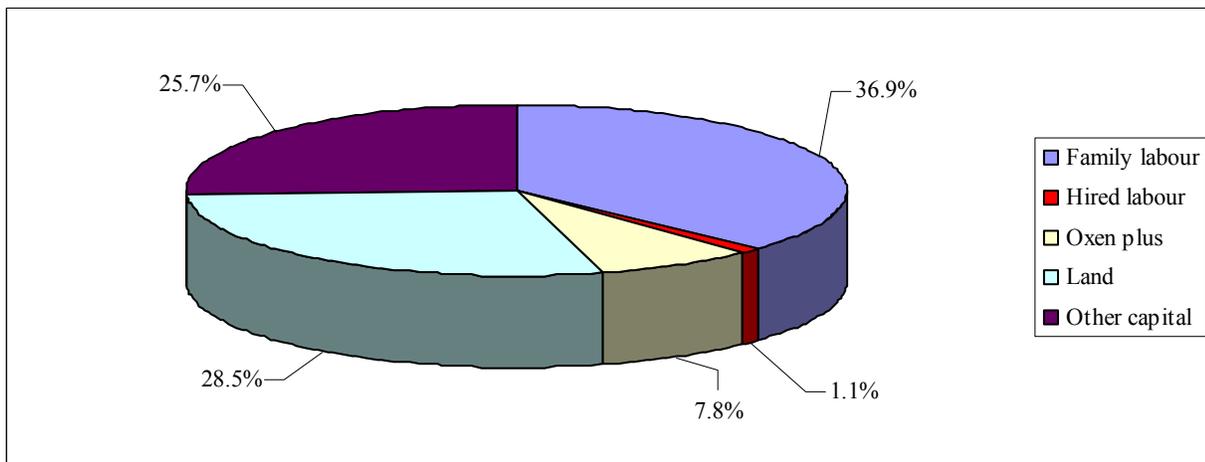
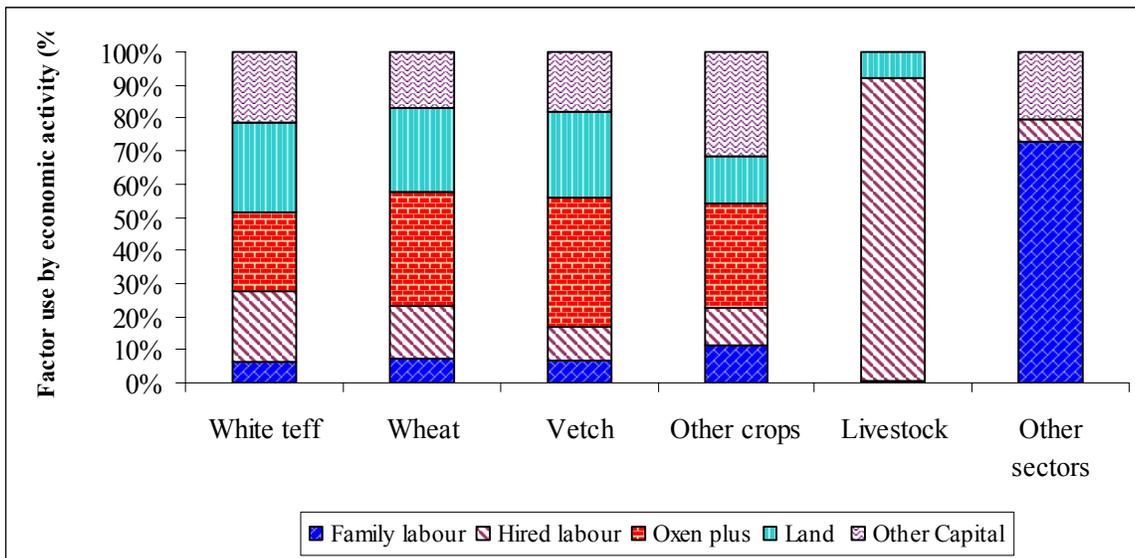


Figure 3: Contribution of factors of production to total value added



¹⁵ 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.

Figure 4: Factor use among economic activities



3.3.2. Composition of household income

Figures 5 and 6 present the allocation of factor incomes and the pattern of per capita income across different 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, households headed by males 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 agricultural medium-male headed households as it accounts for about 46% of the total factor income (Figure 5). 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 agricultural-male headed households, the per capita income of all household groups is below the sample average (which is 1,797.80 birr).

Figure 5: Distribution of factor income shares across household groups (%)

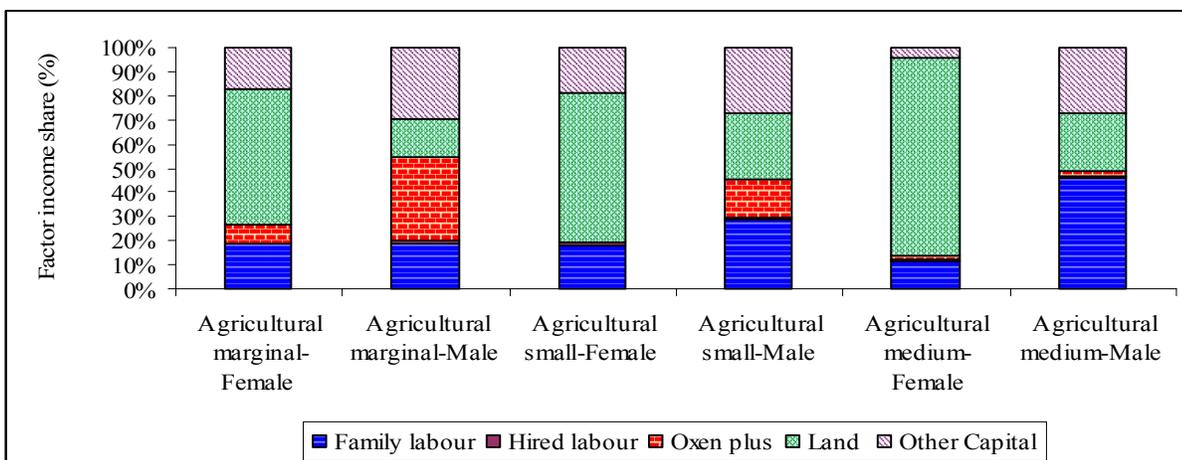
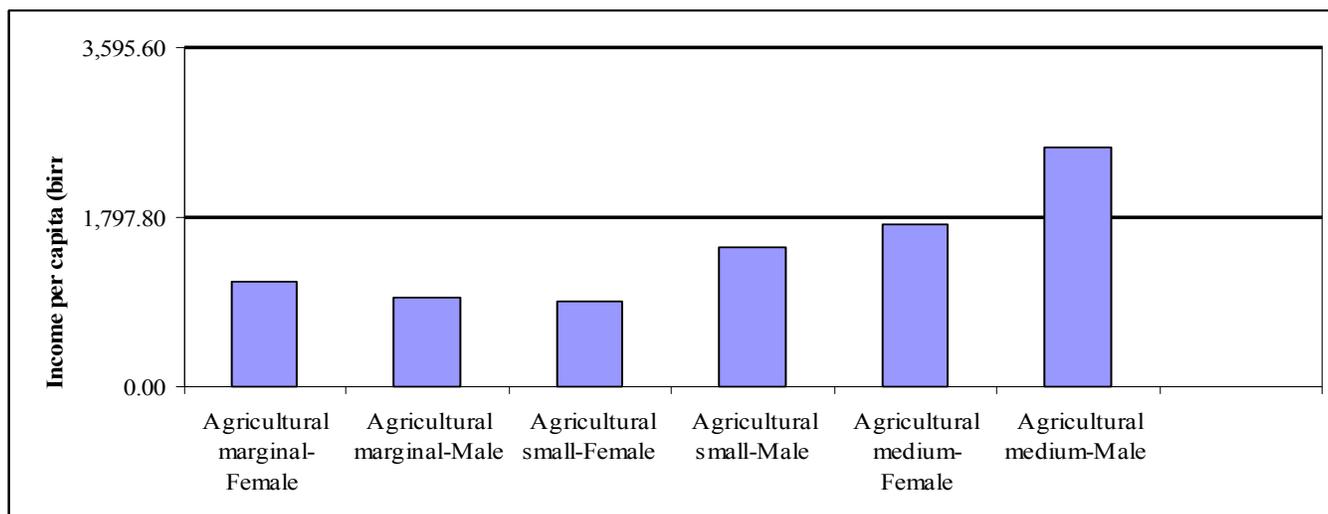


Figure 6: Income per capita across household groups (in birr)



3.3.3 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. Table 3 shows 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). 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, consistent with other studies in Africa (see Wobst et al., 2005). A look at figure 7 shows that expenditure per student for male headed households is lower than the village average (which is about 59.71 birr). Within female headed household groups, educational expenditure per student increases with income, i.e. female headed households that have relatively higher income spend more on education per student than those that have low income. A possible explanation can be that female headed households do not use children for farming activity as they sharecrop/rent-out their farm land to other households. For instance, marginal female headed households sharecropped/rented-out more than three-fourth of their plot and the figure for marginal male headed households was only 6.3% in 2006/07. 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 have shown that the contribution of child work to household income stands as a key factor influencing child work and schooling decisions in rural Ethiopia (Cockburn, 2004). Factors such as

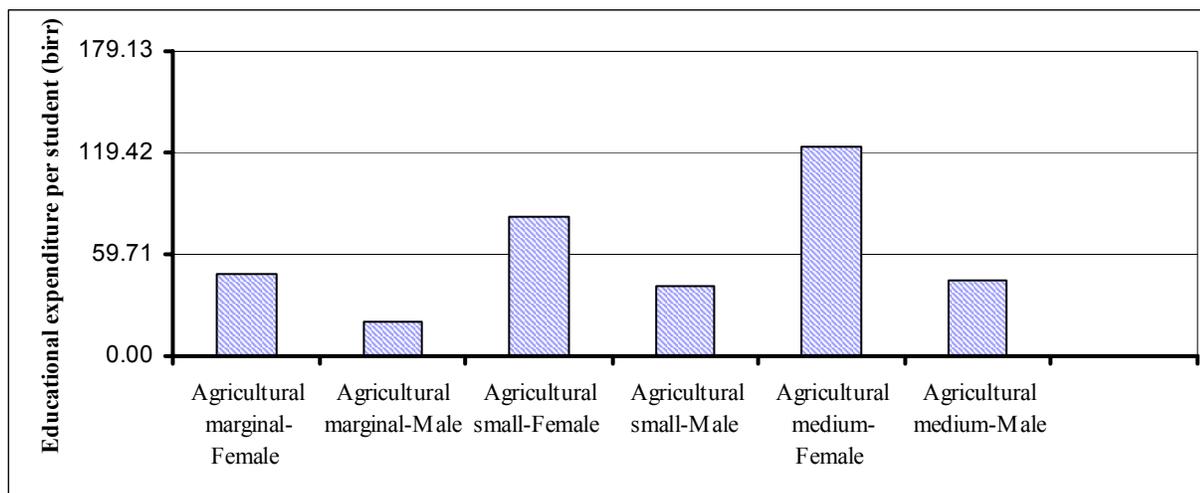
demographic composition, asset profile of households, type of activity a household is engaged in, and other characteristics affect the income contribution of children which in turn influence child time use.

Table 3: Household expenditure and savings (%)

	Agricultural marginal-Female	Agricultural marginal-Male	Agricultural small-Female	Agricultural small-Male	Agricultural medium-Female	Agricultural medium-Male	Total
Consumption expenditure	93.06	92.14	92.09	81.77	61.49	52.07	78.77
Human capital-education	1.15	0.88	3.92	0.91	2.25	0.71	1.64
Human capital-health	0.67	0.07	0.41	0.23	0.00	0.10	0.25
Environmental capital	0.09	0.24	0.00	3.28	0.55	25.16	4.89
Other capital	5.03	6.67	3.58	13.82	35.71	21.96	14.46
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: YV-SAM

Figure 7: Educational expenditure per student across households groups



The composition of household expenditure, disaggregated by major commodity group, reveals the dominance of home consumption over market purchases, which is typical for a rural economy. The village households retain a significant proportion of agricultural output for home consumption; market purchases of agricultural commodities for consumption are very small, less than 3% of the total agricultural commodities consumed. Instead, village households purchase a bulk of non-agricultural goods and services such as manufacturing and other products. Note, however, that home consumption is dominated by a single cereal, *white teff*, which accounts for about two-third of the total own-farm consumption in the study village.¹⁶

Table 4 shows the commodity mix of household consumption expenditures, both home consumption and marketed purchases. The share of home consumption, especially food crops and livestock products, is

¹⁶ Since a high self-supply rate does not indicate the commodity composition of consumption, it should be interpreted cautiously, especially seen from the nutritional perspective.

relatively high in all household groups. Market purchases are dominated by manufacturing products. It is also apparent that agricultural marginal and small households spend more on environmental goods and services than agricultural-medium households. In other words, the proportion of consumption expenditure in environmental goods and services is relatively high in low income household groups, indicating that relatively low income households depend more on environmental goods and services than better off households.

Table 4: Commodity composition of household consumption expenditure (%)

	Agricultural marginal-Female	Agricultural marginal-Male	Agricultural small-Female	Agricultural small-Male	Agricultural medium-Female	Agricultural medium-Male	Total
(a) Own farm consumption							
<i>White teff</i>	59.90	45.71	56.14	61.66	57.16	49.11	54.95
<i>Wheat</i>	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							
<i>White Teff</i>	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 expenditure	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: YV-SAM

The relatively high share of home consumption in total household consumption indicates a small marketed surplus, which is the proportion of output not directly consumed by households. Table 5 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 to be weakly commercialized since close to 30.9% of crop output is marketed although this figure is slightly higher than the national average.¹⁷ The marketed surplus ratio varies substantially across household groups: it ranges from 13.7% for agricultural small-male head households to 54.2% for agricultural medium-female head households. Households that have a low marketed surplus ratio, especially agricultural marginal and small household groups, will benefit less following an increase in producer prices. 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.

¹⁷ The national figure is 28% (Dessaiegn et al., 1998).

Table 5: Consumption and marketing surplus of agricultural crops

	Agricultural marginal-Female	Agricultural marginal-Male	Agricultural small-Female	Agricultural small-Male	Agricultural medium-Female	Agricultural medium-Male	Total
Total production (birr)	39,784.72	143,164.40	28,516.28	171,404.25	66,562.77	560,163.42	1,009,595.83
Total consumption (birr)	33,655.60	117,172.19	17,441.63	151,637.98	32,549.99	363,875.25	716,332.64
Own-farm consumption (birr)	31,789.58	113,312.93	16,705.86	147,918.23	30,477.14	357,526.90	697,730.64
Marketed surplus ratio	0.201	0.209	0.414	0.137	0.542	0.362	0.309
Self-sufficiency rate	1.182	1.222	1.635	1.130	2.045	1.539	1.409
Self-supply ratio	0.945	0.967	0.958	0.975	0.936	0.983	0.974

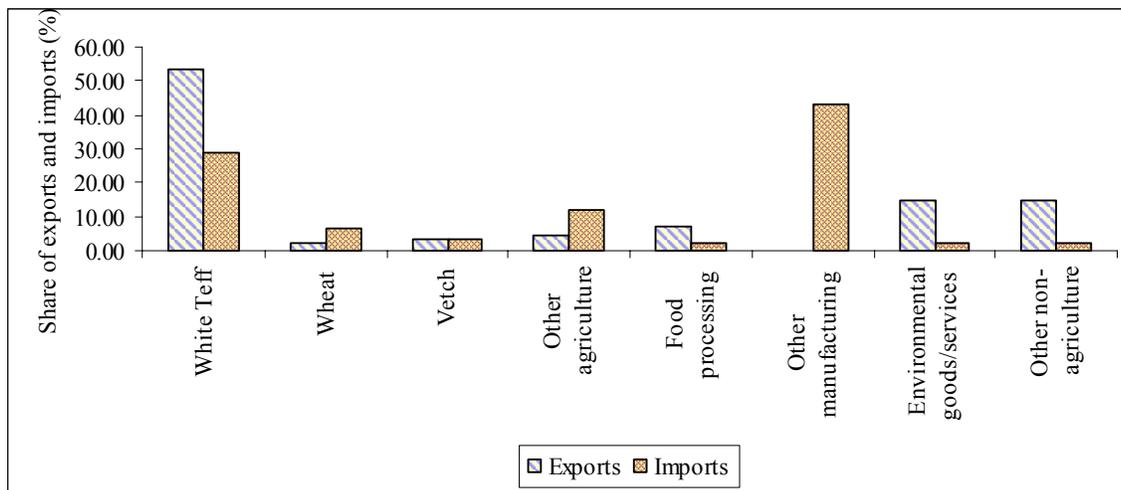
Source: Village survey and YV-SAM

3.3.4 Village trade

As discussed earlier, the village economy produces goods and services for home consumption and for sales which can be within the village or outside the village, i.e. exports. While exports are mainly agricultural commodities such as *white teff*, wheat, vetch, and other crops, the village economy imports chiefly non-agricultural items such as manufacturing goods. Note that exports account for about 37% of the total output and 66% of marketed output (Figure 8). This high share of exports in the marketed output 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. As can be seen from figure 6, the commodity mix of exports is very limited as it is dominated by a single crop, *white teff*, which accounts for more than half of the total value of exports.

Imports account for a fifth of total village demand for goods and services. As a typical rural economy, the village economy is net importer of manufacturing products, which account for close to 43% of the total value of imports. Chemical fertilizer is the most important part of the manufacturing imports (about 16% of the total import value).

Figure 8: Commodity composition of village exports and imports (%)



Overall, 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 pattern. When it comes to investment in environment, relatively better off households undertake such investments. Fourth, the proportion of agricultural output retained for home consumption is high in all household groups and this share is dominated by the retained value of crop production. 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.

4. Analysis of growth linkages and policy effects in a village economy

4.1 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. The village social accounting matrix (SAM) describes the structure of an economy in a consistent and complete way in a given period or year. It is also the basis for building different economy-wide models, such as SAM-based multiplier and computable general equilibrium (CGE) models which are used for economic policy analysis. 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 distinguished in the SAM. 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. It is customary to consider the accounts of production activities, factors of production and domestic or village institutions (such as households) as endogenous, and those of government, combined capital and the rest of the world (i.e. rest of Ethiopia in this case) accounts as exogenous (Sadoulet and de Janvry, 1995). In this study, however, we consider the human capital (which includes education and health) and environmental capital accounts as endogenous and other capital (saving) account as exogenous.

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 i^{th} account ($i, j = 1, 2, \dots, 5$)
- X be the vector of exogenous injections into endogenous accounts; it is also grouped into blocks X_i , which denote exogenous injections into the i^{th} account ($i = 1, 2, \dots, 5$)
- Y refer to the vector of row total of endogenous accounts; it is partitioned into blocks Y_i , which represent the row sums of the i^{th} account ($i = 1, 2, \dots, 5$);
- 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 ($i = 1, 2, \dots, 5$);

- U be the vector of column total of endogenous accounts; it is partitioned into blocks U_i , which indicate the column sums of the i^{th} account ($i = 1, 2, \dots, 5$); and
- F, T and W are 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 6.

Table 6: 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:

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

$$U = [U_1, U_2, U_3, U_4, U_5]$$

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 6, 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 follows:

$$Y = A E + X \quad (1)$$

In addition, a balanced SAM requires that for each account, row and column totals must equal, i.e. $U' = Y$ where the prime in K indicates transposition. It will be useful to express the endogenous accounts in terms of average expenditure propensity by dividing each sub-matrix of the endogenous accounts by the column total

of the same account. Let a_{hk} and y_k indicate the individual cell 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:

$$z_{hk} = \frac{a_{hk}}{y_k} \quad (2)$$

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

$$Y = ZY + X \quad (3)$$

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

$$Y = (I - Z)^{-1} X \text{ or}$$

$$Y = MX \quad (4)$$

where $M = (I - Z)^{-1}$ and I is the identity matrix.

Matrix M is called the SAM multiplier matrix (Pyatt and Round, 1979; Thorbecke and Jung, 1996) and individual sectoral multiplier is given by $M = (m_{hk})$. This multiplier matrix has been termed the accounting multiplier matrix since it is computed from the average expenditure propensities of the endogenous accounts. It gives insight into the anatomy of 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 multiplier measures the direct impact of an exogenous expenditure placed on the k^{th} sector, the off-diagonal multipliers measure the indirect impacts of exogenous injections on other sectors.

4.2 Changes in exogenous accounts and the SAM multiplier

Under certain assumptions such as fixed prices, given technology, unitary expenditure elasticities, excess capacity in all sectors, etc, a change in the incomes of endogenous accounts is given by the product of the SAM multiplier and a 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 groups of households (Kone and Thorbecke, 1996). To account for this, marginal expenditure propensities can be computed and incorporated into the SAM coefficient matrix Z . Marginal expenditure propensities can be either derived econometrically from household budget survey data or can be taken from the literature. If expenditure elasticities and average expenditure propensities are known, then marginal expenditure propensities can be easily obtained.¹⁸

Second, perfectly elastic supply means that there always exist unemployed resources to meet new demand and 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). Empirical evidence does suggest that supply response in agriculture is very low, especially in developing countries (Schiff and Montenegro, 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 Abrar et al. (2004) indicate that supply response in Ethiopian agriculture is very low and 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 can be assumed and output can be increased without increasing prices.

¹⁸ Let ϵ_{gi} , Z_{gi} and \tilde{Z}_{gi} be, respectively, expenditure elasticity, average and marginal expenditure propensities for household group g and commodity i , then we have, $\epsilon_{gi} = \frac{\tilde{Z}_{gi}}{Z_{gi}} \Leftrightarrow \tilde{Z}_{gi} = \epsilon_{gi} Z_{gi}$. In many cases, lack of information makes it difficult to replace average expenditure by marginal expenditure propensities for all endogenous accounts distinguished in the SAM. In that case, marginal propensities can be obtained only for some accounts such as for the household consumption module.

To address the issue of supply constraints in selected sectors and to obtain reasonable SAM multipliers, SAM accounts can be classified into two sets: supply constrained and unconstrained.¹⁹ 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. Instead, supply in these sectors is taken to be fixed and thus exogenous to the system. Fixed supply in some sectors does not mean that resources are fully employed, rather 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. Hence, output and income estimates based on the unconstrained SAM multipliers can be considered as upper and lower bounds in the case of positive and negative exogenous injections, respectively. 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 7.²⁰

Table 7: 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	

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; A_{uu} is 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

¹⁹ 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 unconstrained-SAM model.

²⁰ For details, see, among others, Lewis and Thorbecke (1992); Dorosh and Hagbladde (1996); Resosudarmo and Thorbecke (1996); Kone and Thorbecke (1996).

represent transactions among exogenous accounts, column and row totals of exogenous accounts, respectively. The rest are as defined earlier.²¹

In addition, let R_{cu} be matrix of marginal expenditure propensities of unconstrained accounts on output of the constrained accounts; and R_{uc} denote marginal expenditure propensities of the constrained accounts on output of unconstrained accounts. In terms of changes, Table 8 can be expressed algebraically as:

$$R_{cu}dY_u + dX_c = (I - Z_{cc})dY_c \quad (5)$$

$$(I - Z_{uu})dY_u = R_{uc}dY_c + dX_u \quad (6)$$

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. Note that output in the constrained accounts (Y_c) is fixed and any exogenous change in domestic demand will lead to a decrease in exports.

In more compact form, we can write (5) and (6) as:

$$\begin{bmatrix} R_{cu} & I \\ (I - Z_{uu}) & 0 \end{bmatrix} \begin{bmatrix} dY_u \\ dX_c \end{bmatrix} = \begin{bmatrix} (I - Z_{cc}) & 0 \\ R_{uc} & I \end{bmatrix} \begin{bmatrix} dY_c \\ dX_u \end{bmatrix} \quad (7)$$

where 0 is the null matrix. Solving for X_c and Y_u yields the following:

$$\begin{bmatrix} dY_u \\ dX_c \end{bmatrix} = \begin{bmatrix} R_{cu} & I \\ (I - Z_{uu}) & 0 \end{bmatrix}^{-1} \begin{bmatrix} (I - Z_{cc}) & 0 \\ R_{uc} & I \end{bmatrix} \begin{bmatrix} dY_c \\ dX_u \end{bmatrix} \quad (8)$$

The term $\begin{bmatrix} R_{cu} & I \\ (I - Z_{uu}) & 0 \end{bmatrix}^{-1} \begin{bmatrix} (I - Z_{cc}) & 0 \\ R_{uc} & I \end{bmatrix}$ is called the constrained SAM multiplier matrix.²²

Let $M_c = \begin{bmatrix} R_{cu} & I \\ (I - Z_{uu}) & 0 \end{bmatrix}^{-1} \begin{bmatrix} (I - Z_{cc}) & 0 \\ R_{uc} & I \end{bmatrix}$. Thus, we have

$$\begin{bmatrix} dY_u \\ dX_c \end{bmatrix} = M_c \begin{bmatrix} dY_c \\ dX_u \end{bmatrix} \quad (11)$$

The constrained SAM multiplier model implies that in supply-constrained sectors, output and household incomes can be increased through improvements in yield 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 induce growth in sectors that have slack capacity (Diao et al., 2007; Dorosh and Haggblade, 1993). It has

²¹ To save notations, we maintain F , T and W as before but there is a change in the composition of accounts. For instance, exports are not exogenous and crop activities are now exogenous as these are assumed to be supply constrained activities.

²² This multiplier matrix is also known as mixed multiplier matrix in the literature (Lewis and Thorbecke, 1992).

been indicated that unconstrained SAM multiplier models overestimate growth linkages compared with their constrained counterpart since the former ignores supply rigidities (Haggblade, Hammer and Hazell, 1991). In the derivation of constrained SAM multipliers for the village economy, activities are classified into supply constrained and unconstrained. Accordingly, all agricultural activities including land and soil conservation and livestock are classified as supply constrained while food processing and other services are supply non-constrained. For comparison purposes, both the constrained and unconstrained SAM multipliers are computed and discussed. To provide a contrasting analysis that can show the growth prospects of the village economy, the impact of growth in the output of main cereal crop, *white teff*, vis-à-vis other activities is examined under the conditions of constrained and unconstrained environment.

4.3 Assessing growth linkages in the village economy

The derived unconstrained and constrained multipliers are used to examine structural features and policy effects on the village output growth and household incomes. In this section, we present model results and discussions.

Table 8 contains the unconstrained multipliers for sectoral gross output, own sector, inter-sectoral linkages, and household income that arise from growth in the output of selected sectors. The first column of the same table indicates sectoral production or output multipliers and shows the impact of growth of each sector on village output. For instance, while an injection of 1.00 birr in the *white teff* activity generates about 3.15 birr of additional output in the entire village economy, an equivalent increase in wheat and vetch output leads to a 3.23 and 3.33 birr increase in village output, respectively. Similarly, the livestock sector generates relatively large output multipliers in the village economy compared with major cereals. This sector has strong linkages with other sectors, especially with crop agriculture as it is the main source of input for crop production, and it also consumes crop residue as an important source of animal feed. The sector also provides inputs such as animal dung for fuelwood which is the main input for household chores. It should be noted that the own multipliers of the livestock sector are lower mainly due to the lower factor value added generated in this sector. The livestock value added accounts for only a fifth of the total village output, indicating that the sector is not as important as crop production in the village economy. 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. For instance, a 1.00 birr expansion in food processing activity can generate a 2.90 birr increase in village output. Given its linkages with other sectors, it has the potential to trigger growth in the village economy which helps to sustain agricultural growth as the sector depends 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.²³

The second column shows the impact of growth of a sector on itself. For instance, *white teff* output has relatively a large own sector multiplier, i.e. a 1.00 birr increase in output generates a 2.04 birr additional output in the sector itself. The third column shows the degree of inter-sectoral linkages in the village economy and indicates how an expansion in a given sector affects other sectors. Consider, for example, three cereals: *white teff*, wheat and vetch. A 1.00 birr increase in the output of each of these activities leads to a 1.12, 2.01 and 2.18 birr increase in the output of other sectors, respectively.²⁴ *White teff* has limited linkages with other sectors compared with wheat and vetch. The fourth column shows household income effects of

²³ This is in support of Mellor's (1976) argument about the myriad linkages that bind the two activities.

²⁴ Note that the figures for linkages with other sectors do not include own effects. Output multiplier is the sum of own multipliers and linkages with other sectors.

sectoral growth. Total household income would increase by 2.68, 2.80 and 2.89 birr following a 1.00 birr growth in the output of *white 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 any increase in agricultural output (Table 9).²⁵

Constrained multipliers can be interpreted in a similar way as the unconstrained multipliers. Table 10 presents constrained multipliers for sectoral output, own account, inter-sectoral linkages and household income for selected production activities. The constrained multipliers are lower than the unconstrained ones, suggesting that the latter overstate growth multipliers. Under the constrained environment, for example, a 1.00 birr growth in the output of *white teff*, wheat, livestock products and food processing leads village output to increase by 1.97, 2.02, 1.24 and 1.97 birr, respectively.²⁶ Note that the livestock sector has very low multipliers indicating that the sector is increasingly constrained by shortage of grazing land, lack of animal feed, disease, etc and higher emphasis on crop production rather than livestock production in the study village. An earlier study has also shown that size of grazing land has become smaller as it is used for crop cultivation due to population pressure in the study village (Tiumelissan and Birhanu, 2005). Moreover, Hence, a combination of factors limits the sector's contribution to the village economy. With regard to the impact on household income, a similar expansion in these activities increases household income by 1.73, 1.81, 0.41 and 1.40 birr in that order and the better off households are the main beneficiaries of the gain from output expansion (Table 11).

Both the unconstrained and constrained multipliers indicate that the existing farming system apparently does not realize the village's potential for more diversified agricultural activity. Although *white teff* is the dominant cereal in terms of output in the village economy, it has a total production multiplier below the average of all activities in the unconstrained case, and slightly higher than the average in the constrained case. Moreover, it has also weak linkages with other sectors in both cases. This suggests that the main subsistence crop, *white teff*, has the lowest economic potential in terms of stimulating and sustaining growth, particularly when compared with wheat, vetch, Niger seed, and other crops. A recent study indicates that the mean area under *teff* per household has increased from 1.2 ha in 1999/00 to 1.6 ha in 2006/07 and the figures for wheat are 0.39 ha in 1999/00 and 0.43 ha in 2006/07. The average area allocated to vetch virtually remained unchanged, about 0.32 ha between the period 1999/00 and 2006/07 (Demeke et al., 2007).²⁷ This suggests absence of crop diversification away from this traditional crop to other crops.

²⁵ This may be due to this household group has relatively large initial consumption level.

²⁶ Columns two and three can be interpreted in the same way as Table 8 (i.e. the unconstrained case).

²⁷ 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.

The following observations can be made.

- (1) Growth in other agricultural output than the main subsistence crop has a much higher impact on both village production and household income. 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. 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 could 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 that 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 low marketable surplus ratio and the market for subsistence products such as *teff* is rather limited and offers little incentive to market surpluses.
- (3) Female headed farm households including those who have medium land size benefit less from an increase in agricultural output compared with male headed farm households.

Table 8: Unconstrained multipliers for selected production activities

	<i>White teff</i>	<i>Mixed teff</i>	Wheat	Maize	Chickpeas	Vetch	Niger Seed	Other crops	Livestock	Food processing	Other services	Mean multipliers
Total output multipliers	3.153	3.148	3.251	3.003	3.203	3.329	3.287	3.286	3.313	2.910	3.226	3.214
Own account multipliers	2.036	1.021	1.238	1.042	1.064	1.146	1.044	1.040	1.072	1.028	1.026	1.184
Linkages with other sectors	1.117	2.127	2.012	1.961	2.139	2.183	2.243	2.246	2.241	1.882	2.200	2.030
Household income	2.821	2.827	2.945	2.621	2.828	3.033	2.998	3.004	2.270	2.444	2.768	2.817

Source: Extracted from YV-SAM multiplier matrix

Table 9: Unconstrained household income multipliers for production activities

	<i>White teff</i>	<i>Mixed teff</i>	Wheat	Maize	Chickpeas	Vetch	Niger Seed	Other crops	Livestock	Food processing	Other services
Agricultural marginal-Female	0.105	0.109	0.109	0.084	0.098	0.112	0.101	0.100	0.085	0.074	0.084
Agricultural marginal-Male	0.332	0.327	0.364	0.353	0.359	0.383	0.375	0.336	0.259	0.278	0.302
Agricultural small-Female	0.067	0.070	0.068	0.050	0.060	0.070	0.063	0.065	0.057	0.048	0.054
Agricultural small-Male	0.469	0.469	0.497	0.446	0.477	0.515	0.504	0.489	0.376	0.396	0.442
Agricultural medium-Female	0.155	0.171	0.159	0.109	0.135	0.163	0.132	0.134	0.132	0.090	0.106
Agricultural medium-Male	1.694	1.682	1.748	1.580	1.699	1.791	1.822	1.881	1.362	1.558	1.779
Total	2.821	2.827	2.945	2.621	2.828	3.033	2.998	3.004	2.270	2.444	2.817

Source: Extracted from YV-SAM multiplier matrix

Table 10: Constrained multipliers for production activities

	<i>White teff</i>	<i>Mixed teff</i>	Wheat	Maize	Chickpeas	Vetch	Niger Seed	Other crops	Livestock	Food processing	Other services	Mean multipliers
Total output multipliers	1.970	1.983	2.023	1.918	1.943	2.048	2.037	2.011	1.240	1.768	1.805	1.893
Own account multipliers	1.593	1.006	1.132	1.022	1.003	1.068	1.019	1.014	1.013	1.016	1.012	1.072
Linkages with other sectors	0.377	0.977	0.891	0.896	0.940	0.981	1.017	0.997	0.227	0.753	0.792	0.821
Household income	1.733	1.756	1.815	1.623	1.675	1.855	1.847	1.830	0.408	1.397	1.474	1.608

Source: Extracted from YV-SAM constrained multiplier matrix

Table 11: Constrained household income multipliers for production activities

	<i>White teff</i>	<i>Mixed teff</i>	Wheat	Maize	Chickpeas	Vetch	Niger Seed	Other crops	Livestock	Food processing	Other services
Agricultural marginal-Female	0.072	0.077	0.075	0.055	0.063	0.076	0.066	0.065	0.018	0.042	0.044
Agricultural marginal-Male	0.225	0.222	0.252	0.255	0.242	0.265	0.262	0.222	0.045	0.172	0.170
Agricultural small-Female	0.046	0.049	0.047	0.031	0.038	0.047	0.041	0.043	0.014	0.028	0.029
Agricultural small-Male	0.303	0.305	0.324	0.294	0.299	0.334	0.329	0.310	0.070	0.234	0.240
Agricultural medium-Female	0.110	0.127	0.113	0.069	0.088	0.115	0.086	0.087	0.033	0.047	0.051
Agricultural medium-Male	0.977	0.975	1.005	0.921	0.945	1.017	1.062	1.104	0.229	0.874	0.941
Total	1.733	1.756	1.815	1.623	1.675	1.855	1.847	1.830	0.408	1.397	1.474

Source: Extracted from YV-SAM constrained multiplier matrix

4.4 Policy simulations

The SAM multiplier model can also be used to investigate economy-wide effects of alternative growth strategies such as the effect of technology adoption, transfers, etc on village output, household income, investment in human and land and soil conservation. 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) Direct income transfer to one of the household groups
- (2) Household investment in land and soil conservation
- (3) Investment in land and soil conservation by better-off households only; and
- (4) Investment in land and soil conservation by an outside agent such as the government

Simulation 1: 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. Such transfers can come from government with the objective of helping rural households. This policy experiment simulates an exogenous income transfer equal to a fifth of the total income of agricultural marginal female head households to one of the six household groups. This is equivalent to injecting a fixed amount of about 9,112 birr²⁸ to one of the household groups in the base year. In order to examine individual impacts, a total of six simulations is conducted. The result indicates that transferring income to agricultural marginal and small households stimulates the village economy and household income (Table 12). For instance, while an income transfer directed to agricultural marginal female headed households increases village output and total household income by 1.06% and 1.47%, respectively, the same magnitude of income transfer to agricultural medium male headed households leads to a 0.65% and 1.16% increase in village output and household income in that order.

Interestingly, transfers to agricultural marginal and small male headed households also have a beneficial effect on human capital, especially on education, which is a key factor for sustaining economic growth. The effect of the same transfer of resources to agricultural marginal and small households on human capital seems larger than the effect of the same transfer to agricultural medium households. Specifically, transfers to agricultural marginal and small female headed households have a relatively strong impact on human capital compared to a similar transfer to agricultural male headed households. This indicates that interventions will have a relatively strong effect on inducing village production and incomes if directed to the poorest groups

²⁸ 1USD= 9.40 birr on March 5, 2008.

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 agricultural 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 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, extension services and other assistance is likely to have a positive impact on their well-being.

However, the effect of an exogenous income transfer on investment in environment is different. In terms of gender, transfers directed to agricultural male head households have a strong impact in terms of inducing investment in land and soil conservation activities. A possible explanation can be that environmental investment in the form of land or soil conservation activity is a labour-intensive activity and female headed households lack such resources to undertake land conservation structures. Transfers to the better off male headed households have the effect of enhancing environmental investment. Within female headed households, direct income transfer to marginal female headed households encourages investment in land soil conservation activities. In a rural areas such as the study setting where market imperfections prevail, factors such as absence of adult male members in the household, lack of oxen, and shortage of finance necessary to purchase essential farm inputs force female headed households to rent or sharecrop out their land.²⁹ Under these conditions, direct income transfer lessens the cash constraint facing marginal female headed households and this helps to start cultivating their own land instead of renting or sharecropping-out it. On the other hand, better off female headed households might switch to other non-farm activities as their income improves while continue renting or sharecropping out their land and hence do not concern about investment in land and soil conservation activities.

Two observations can be made.

- (1) Interventions directed towards low income groups will have a relatively strong effect on inducing village production and household incomes as these groups spend relatively a greater proportion of their income on locally produced goods as their income improves.
- (2) Gender consideration is important when designing and implementing policies and strategies that target land and soil conservation activities. Interventions in land and soil conservation activities would bring the desired outcome if targeted to the male headed households in general and well-off male headed households in particular. This finding also supports the view that relatively low income

²⁹ For instance, about 69% of the marginal female headed households do not have access to credit, indicating that finance appears to be the main constraint.

households do not invest in land and soil conservation as subsistence constraints hinder to undertake such investments.

Table 12: Effects of an exogenous income transfer to households on the village output and household income (%)

	Agricultural				Agricultural	
	marginal-Female	Agricultural marginal-Male	Agricultural small-Female	Agricultural small-Male	medium-Female	Agricultural medium-Male
Production	1.06	1.15	0.89	0.98	0.74	0.65
Household income	1.47	1.55	1.33	1.42	1.24	1.16
Human capital-Education	1.67	1.56	3.52	1.44	2.23	1.03
Human capital-Health	4.00	1.26	2.62	1.84	0.59	1.00
Environmental investment	0.75	0.83	0.62	0.82	0.55	1.48

Source: Model simulation

Simulation 2: Household investment in land and soil conservation

This simulation describes the impact of government policy that compels households to invest in environment-related activities. Specifically, assume that such policies require households to invest at least 10% of their income in land and soil conservation activities in the base year. This is equivalent to injecting a total of 137,961 birr into land and soil conservation activities. The assumption is that land users are required to invest on their farm land so as to ameliorate it and to maintain its quality for future production (this is akin to the ‘polluter pays’ policy). This policy has a negative impact on village output, household income, investment in human and environmental capital. Although this policy has a positive effect on investment in land and soil, it leads to reduced village output, household income and investment in human capital (Table 13). 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 that can compensate such forced savings, households respond by cutting education and health-related expenditures. A study in Peru also indicates a negative income shock affects education and health expenditures, i.e. household respond by cutting expenditures related to education and health which have a direct impact on human capital accumulation (Escobal et al., 2004). Note 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. Thus, this policy does not lead to a sustainable outcome since it involves a trade-off between household welfare, investments in human and environmental capital.

Simulation 3: 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 agricultural small and medium male-headed household groups are required to invest in land and soil conservation activities since they are also the main beneficiaries of any positive expansion in crop output. Moreover, assume that the objective is to invest an amount equal to 137,961 birr and this is apportioned to the two groups of households 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 13. The impact of this policy is such that village output, total household income and investment in human capital all decline. Specifically, such intervention does not stimulate village production, as the better off households are discouraged to expand production. 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.

Simulation 4: Government investment in land and soil conservation

In this simulation, the effects of land and soil conservation by government on village production and household income are examined. Assume that government that the same amount (i.e. similar to simulations 2 and 3) is invested in land and soil conservation activities. The result indicates that if government invests in the conservation of farm land, it will not help to stimulate both village production and household income in the short-run as the benefits of such investment are realized over a relatively long period. Although investment costs are covered by the government, farm households are not able to shift additional resources towards the expansion of village production which consequently improve their income. Given the current low income level and meager investment in land improvement activities, the amount of income that could be shifted from land and soil conservation to other activities such as crop production may not be enough which will help households to increase production further. The experience shows that government interventions in land and soil conservation activities, through different forms such as community development, food-for-work and cash-for-work in the past, have not been successful in terms of improving production and household income mainly because of lack of participation by local communities in the choice of technologies, planning and implementation stages (Shiferaw and Holden, 2000). More importantly, past efforts and programs of adoption of soil conservation structures have not been linked with yield-enhancing technologies (e.g.

chemical fertilizers, improved seeds, etc) and the two programs (soil conservation and yield improving programs) were carried by different institutions with poor coordination efforts (Mohmud et al., 2005).

In economic settings characterized by subsistence-oriented production systems, such external intervention in land and soil conservation activities will at least maintain production and household income from falling in the short-run compared with other measures such as imposing taxes on land users.

Table 13: Effects of environmental investment by households and government on the village output, household income and investment in human capital (%)

	All households pay for land and soil investment	Only better of male headed households invest in land and soil conservation	Government pays for land and soil investment
Production	-1.04	-0.47	0.00
Household income	-0.93	-0.88	0.00
Human capital-Education	-2.14	-0.18	0.00
Human capital-Health	-1.81	-0.84	0.00

Source: Model simulation

5. Summary 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 village economy. The village economy is dominated by agricultural activities and is characterized by low input-intensity, indicating low use of modern and other inputs. Factor income is the main source of income for the village households as remittances or transfers from outside the village are negligible. The gender pattern of factor income indicates that while female headed households depend largely on land as their main source of income, male headed households obtain income from a combination of factors, reflecting that female headed households are constrained by other forms of resources or assets.

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. Note 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 unconstrained and constrained multipliers analysis indicate that the existing farming system does not yield a diversified agricultural activity. Despite the dominance of *white 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, *white 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 and 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 distribution of income across household groups resulting from a demand stimulus in the various sectors reveals that better off and male headed households are the main beneficiaries of any increase in output compared with female headed farm households.

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 agricultural 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 agricultural marginal and small female headed households have relatively strong impact on human capital compared to a similar transfer to agricultural male headed households. This indicates that interventions will have a relatively strapping effect in inducing village production and incomes 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 agricultural male headed households would have the effect of inducing investment in land and soil conservation activities. Within agricultural male headed households, transfers to the better off households have a relatively strong impact on environmental investment. 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 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 investment costs are covered by an external agent such as the government, it leads to maintain village production and household income from falling in the short-run. This implies that in subsistence-oriented economic setting, external interventions in land and soil conservation activities will contribute towards maintaining household income and human capital as well as improving the quality of land in the short run compared with imposing taxes on households for land and soil conservation activities.

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) Both rural households and agricultural activities are diverse. Ignoring such heterogeneity hinders targeting of agricultural investments towards specific households and profitable opportunities as they produce heterogeneous responses to a policy stimulus. This implies that heterogeneity not only among rural households but also within agricultural activities should be taken into account when designing policies and strategies that are responsive to the needs of agricultural households and at the same time ensure sustainable and broad-based agricultural development.
- (3) In subsistence-oriented economic setting, external support such as income transfers to farm households will lead to a ‘win-win-win’ outcome as it helps to simultaneously stimulate output (or household incomes), human capital as well as improve the quality of land in the short run.

- (4) 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 and sustainable 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 to higher value crops and this can be done through reallocation of 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, priority also needs to be given to the promotion of farm-based-non-farm activities which have direct links with the farming activity. All else the same, as the income of agriculture-dependent households increases, demand for rural non-farm goods increases due to higher propensity to consume for locally made goods and hence plays a vital role in propelling and sustaining growth. 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, investment 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, note that although the SAM-based model is useful for assessing growth linkages, it is based on a number of assumptions such as fixed prices, linear relationships, and unitary elasticities. To address some of these shortcomings and get further analytical insights, a computable general equilibrium (CGE) model will be constructed for the village economy.

References

- Abrar, S., O. Morrissey and T. Rayner (2004), “**Crop-Level Supply Response by Agro-Climatic Region in Ethiopia,**” *Journal of Agricultural Economics* 55: 289-311.
- Adelman, I., and C. Morris (1973), *Economic growth and social equity in developing Countries*, Stanford, Calif., U.S.A.: Stanford University Press.
- Adelman, I., J. Taylor, and S. Vogel (1988), “Life in a Mexican Village: A SAM perspective,” *Journal of Development Studies* 26:387-407.
- Alarcon, J., J. van Heemst, and N. De Jong (2000), “Extending the SAM with Social and Environmental Indicators: an Application to Bolivia,” *Economic Systems Research* 12: 473-496.
- Alarcon, J., J. van Heemst, S. Keuning, W. de Ruijter and R. Vos (1991), *The Social Accounting Framework for Development; Concepts, Construction and Application*, Aldershot: Avebury, UK.
- Bell, C. and P. Hazell (1980), “Measuring the indirect effects of an agricultural investment project on its surrounding region,” *American Journal of Agricultural Economics* 62: 75–86.
- Benfica, R. (2007), “*Income Poverty Effects of Expansion and Policies in Cash Cropping Economies in Rural Mozambique: An Economy-wide Approach*” Ministry of Agriculture, Directorate of Economics, Research Paper Series, Research Report No. 64, Republic of Mozambique.
- Block, S. (1999), “Agriculture and Economic Growth in Ethiopia: Growth Multipliers from a Four-Sector Simulation Model,” *Agricultural Economics*, 20:241-252.
- Cockburn, J. (2004), “Income Contributions of Child Work in Rural Ethiopia,” CSAE WPS/2002-12
- Delgado, C., P. Hazell, J. Hopkins, and V. Kelly (1994), “Promoting intersectoral growth linkages in rural Africa through agricultural technology and policy reform,” *American Journal of Agricultural Economics* 76: 1166–1171.
- Delgado, C., J. Hopkins, V. Kelly, with P. Hazell, A. Mckenna, P. Gruhn, B. Hojjati, J. Sil, and C. Courbois (1998), “Agricultural Growth Linkages in Sub-Saharan Africa”, IFPRI, Research Report 107, Washington, D.C.
- Demeke, M., A. Alemu, B. Bushie, S. Yiferedew, S. and N. Teferra (2007), “Factors behind the recent developments in grain prices in Ethiopia: Household survey findings from three selected sites (Bako (maize), Yetmen (teff) and Tiyo/Eteya (wheat))”, research report prepared for the World Bank/Ethiopia Office.
- Dercon, S. and J. Hoddinott (2005), “*Livelihoods, Growth, and Links to Market Towns in 15 Ethiopian Villages,*” Food Consumption and Nutrition Division, IFPRI, FCND Discussion Paper 194, Washington, D.C.
- Dercon, S. and P. Krishnan (1998), “Changes in Poverty in Rural Ethiopia 1989-1995: Measurement, Robustness Tests and Decomposition”, Center for Economic Studies, KULeuven, WPS/98-19.
- Dessalegn, G., T.S. Jayne, and J.D. Shaffer (1998) *Market Structure, Conduct, and Performance: Constraints of performance of Ethiopian Grain Markets*, Working Paper 9, Grain Market Research Project, Ministry of Economic Development and Cooperation.
- Diao, X., B. Fekadu, S. Haggblade, A. Taffesse, K. Wamisho, and B. Yu (2007), *Agricultural Growth Linkages in Ethiopia: Estimates using Fixed and Flexible Price Models*, Development Strategy and Governance Division, IFPRI, Discussion Paper No. 00695, Washington, D.C.
- Dorosh, P. and S. Haggblade (1993), “Agricultural-led growth: Food grains versus export crops in Madagascar,” *Agricultural Economics* 9: 165–180.

- Dorosh, P. and S. Haggblade (1996), "Growth linkages in Madagascar: Implications for Development strategies", in Sahn, D. (ed.), *Economic reform and the poor in Africa*, Clarendon Press, Oxford University press.
- Escobal, J., J. Saavedra and P. Saureze (2005), *Economic shocks and changes in school attendance levels and educational expenditure in Peru*, Working paper No. 13, Young Lives, An International study of child poverty.
- Geda, A., A. Shimeles and J. Weeks (2002), "The Pattern of Growth, Poverty, and Inequality: Which way for pro-poor growth?" Ministry of Finance and Economic Development, Addis Ababa, mimeo.
- Golan, E. (1996), "The village economy and tenure security in West Africa: A Senegalese village SAM," in Taylor and Adelman (eds.) *Village economies: The design, estimation, and use of villagewide economic models*, Cambridge University Press.
- Haggblade, S., J. Hammer, and P. Hazell (1991), "Modelling agricultural growth Multipliers," *American Journal of Agricultural Economics* 73: 361–374.
- Haggblade, S., P. Hazell, and J. Brown (1987), *Farm/non-farm link ages in rural Sub-Saharan Africa: Empirical evidence and policy implications*. Discussion Paper No. ARU 67. Washington D.C.: World Bank.
- (1989), "Farm- non-farm linkages in rural Sub- Saharan Africa," *World Development* 17: 1173–1201.
- Hamilton, K. and G. Ruta (2006), *Measuring Social Welfare and Sustainability*, Environment Department, The World Bank, mimeo.
- Hazell, P. and A. Röell (1983), *Rural growth linkages: Household expenditure patterns in Malaysia and Nigeria*. Research Report 41. Washington D.C.: International Food Policy Research Institute, IFPRI.
- Holden, S., J. Taylor and S. Hampton (1998), "Structural adjustment and market imperfections: A stylized village economy-wide model with non-separable farm households," *Environment and Development Economics* 4:69-87.
- Kone, S. and E. Thorbecke (1996), "Sectoral investment priorities for renewed growth in Zaire", in Sahn, D. (ed.), *Economic reform and the poor in Africa*, Clarendon Press, Oxford University press.
- Kuiper, M.H. (2005), *Village modeling: A Chinese recipe for blending general equilibrium and household modeling*, PhD. Thesis, Wageningen University, Netherlands.
- Lewis, B. and E. Thorbecke (1992), "District Economic Linkages in Kenya: Evidence based on a Small Regional Social Accounting Matrix," *World Development* 20: 881-897.
- Mellor, J. (1976), *The new economics of growth*, Ithaca, N.Y., U.S.A.: Cornell University Press.
- MOFED (2005), *Ethiopia: Building on Progress: A Plan to Accelerate Sustainable Development and End Poverty (PASDEP) (2005/06-2009/10)*, Development Planning and Research Department (DPRD), Addis Ababa, Ethiopia.
- Morilla, C, G. Diaz-Salazar, and M. Cardenete (2007), "Economic and environmental efficiency using a social accounting matrix," *Ecological Economics* 60: 774 – 786.
- Pyatt, G., and J. Round (1979), "Accounting and fixed price multipliers in a social accounting matrix framework", *Economic Journal* 89:850-873.
- Ralston, K. (1996), "Household nutrition and economic linkages: A village social accounting matrix for West Java, Indonesia," in Taylor and Adelman (eds.) *Village economies: The design, estimation, and use of villagewide economic models*, Cambridge University Press.

- Resosudarmo, B. and E. Thorbecke (1996), "The impact of environmental policies on household incomes for different socioeconomic classes: The case of air pollutants in Indonesia," *Ecological Economics* 17:83-94.
- Sabramanian, S. and E. Sadoulet (1990), "Production fluctuations and Technical change in a Village Economy: A Social Accounting Matrix Approach," *Economic Development and Cultural Change* 39: 131-173.
- Sadoulet, E. and A. de Janvry (1995) *Quantitative development policy analysis*, Johns Hopkins University Press, Baltimore, London.
- Schiff, M. and C. Montenegro (1995), *Aggregate supply response in developing countries: A survey of selected issues*, Policy Research Paper 1485, World Bank.
- Shiferaw, B. and S. Holden (2000), *A Social and Environmental Accounting Analysis: An Extended Village SAM for Household-Farms in Ethiopia*, Department of Economics and Social Sciences Agricultural University of Norway, Discussion Paper #D-11/2000, Norway.
- Singh, I., L. Squire, and J. Strauss (1986), *Agricultural household models: Extensions, applications and policy*, Baltimore: Johns Hopkins University Press.
- Taye, Mengistae (1993), " Social Accounts of three Ethiopian Villages: A study of Institutions and Policy." In Doss, Cheryl R., and Carol Olson, (eds.), *Issues in African Rural Development* Arlington, VA: Winrock International, Institute for Agricultural development.
- Taylor, J.E., and I. Adelman (1996), *Village economies: The design, estimation, and use of village-wide economic models*. Cambridge University Press.
- Thorbecke, E. and H.S, Jung (1996), "A Multiplier Decomposition Method to Analyze Poverty Alleviation," *Journal of Development Economics* 48: 279-300.
- Tiumelissan, A. and K. Birhanu (2006), "Ethiopian Village Studies II: Yetemen", University of Bath, U.K., mimeo.
- United Nations (1993) *Integrated Environmental and Economic Accounting: Studies in Methods, Handbook of National Accounting*, Series F, No. 61, United Nations, New York.
- Vogel, S. (1994), "Structural Changes in Agriculture: Production Linkages and Agricultural Demand-Led Industrialization," *Oxford Economic Papers*, New Series, 46: 136-156.
- World Bank (2006), *Where is the wealth of nations? Measuring capital for the 21st century*, Washington D.C.
- Xiaoping, S., N. Heerink, S. Holden, and Q. Futian (2005), *Off-farm Employment, Factor Market Development and Input Use in Farm Production - A Case Study of a Remote Village in Jiangxi Province, China*, Department of Economics and Resource Management Norwegian University of Life Sciences, Discussion Paper DP-03/05, Norway.
- Xie, J. (2000), "An Environmentally Extended Social Accounting Matrix, Conceptual Framework and Application to Environmental Policy Analysis in China" *Environmental and Resource Economics* 16: 391-406.
- Weir, S. and J. Knight (2000) *Adoption and Diffusion of Agricultural Innovations in Ethiopia: The Role of Education*, Centre for the Study of African Economies, Working Paper Series WPS2000-5, University of Oxford.
- Wobst, P, E. Balint; K. Mduma, H. Seebens and H. Tchale (2005): *Policy Analysis for Sustainable Agricultural Development in Central and Eastern Europe and Southern Africa – Final Report*, Bonn.
- Yesuf, M., Mekonnen, A., Kassie, M. and J. Pender, (2005), *Cost of Land Degradation in Ethiopia: A Critical Review of Past Studies*, EDRI/EPPFE, Addis Ababa, Ethiopia.

Annexes

Table A1: Elements of the YV-SAM

I. Production activities

- | | |
|----------------------|----------------------------|
| 1. <i>White teff</i> | 8. Livestock |
| 2. <i>Mixed teff</i> | 9. Food processing |
| 3. Wheat | 10. Household chores |
| 4. Maize | 11. Other services |
| 5. Vetch | 12. Land/soil conservation |
| 6. Niger seed | |
| 7. Other crops | |

II. Commodities

- | | |
|-----------------------|--------------------------------------|
| 13. <i>White teff</i> | 20. Livestock |
| 14. <i>Mixed teff</i> | 21. Food processing |
| 15. Wheat | 22. Other manufacturing |
| 16. Maize | 23. Household chores |
| 17. Vetch | 24. Other services |
| 18. Niger seed | 25. Environmental goods and services |
| 19. Other crops | |

III. Factors of production

- | | |
|-------------------|-------------------|
| 26. Family Labour | 29. Land |
| 27. Hired labour | 30. Capital other |
| 28. Oxen-plus | |

IV. Households and Government

- 31. Agricultural marginal-Female
- 32. Agricultural marginal-Male
- 33. Agricultural small-Female
- 34. Agricultural small-Male
- 35. Agricultural medium-Female
- 36. Agricultural medium-Male
- 37. Government

V. Capital account

- 38. Human capital-education
- 39. Human capital-Health
- 40. Environmental capital account
- 41. Capital account-Other

VI. Rest of Ethiopia

- 42. Rest of Ethiopia

Table A2: A condensed SAM for *Yetemen* village (in '000' birr), 2006/07

		1	2	3	4	5	6	Row total
Production activities	1	0.00	844.26	0.00	703.25	0.00	0.00	1,547.51
Commodities	2	167.01	4.96	0.00	170.94	326.60	566.07	1,235.58
Factors of production	3	1,380.50	0.00	0.00	0.00	0.00	0.02	1,380.52
Households and Government	4	0.00	0.00	1,379.08	0.00	0.00	0.53	1,379.61
Combined capital account	5	0.00	0.00	0.00	504.29	0.00	174.54	678.83
Rest of Ethiopia	6	0.00	386.37	1.45	1.13	352.23	0.00	741.17
Column total		1,547.51	1,235.59	1,380.52	1,379.61	678.83	741.17	

Table A3: Characteristics of sample households by broad household categories

	Female-headed households	Male-headed households	Village average
Household size	3.1	5.75	5.13
Land holding size	1.05	1.70	1.54
Holding size per capita	0.35	0.29	0.30
Labour force (>= 15 years)	2.29	3.50	3.2
Fraction of adult male labour force	0.62	0.53	0.51
Fraction of adult female labour force	0.62	0.48	0.51
Children (less than 15 years)	1.81	2.80	2.65
Average male education level (years)	4.71	4.60	4.64
Average female education level (years)	2.37	4.10	2.95
Gini index for land	0.31	0.33	0.33

Source: Household survey data

Table A4: Livestock ownership by household group (in TLU)

Livestock type	Female headed households	Male headed households	Total
Calves	2.38	22.10	24.48
Bulls	3.00	19.00	22.00
Oxen	8.00	86.00	94.00
Heifer	2.25	21.00	23.25
Cows	9.00	70.00	79.00
Sheep	1.43	9.36	10.79
Goat	0.00	0.52	0.52
Horse	0.00	5.00	5.00
Donkeys	4.44	39.96	44.40
Camels	0.00	2.50	2.50
Chicken	0.52	1.56	2.08
Total	31.02	277.00	308.02
% of total	10.07	89.93	100.00

Source: Household survey data