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The Food Security Role of Agriculture in Ethiopia

Berhanu Adenew

Ethiopian Economic Policy Research Institute
Addis Ababa, Ethiopia
berhanuad@yahoo.com

Abstract

This study analyses income, expenditure and food consumption data in Ethiopia to help explains the country's high probability of national food consumption shortfalls. The study argues that to reach the goal of increased national food security, it is necessary to improve market functioning, invest in infrastructure which reduces food transaction costs, provide incentives for increased production through strong support for producers, and, most importantly of all, reform current land tenure arrangements.

Keywords*:* Ethiopia, food insecurity, rural development, rural poverty

1. Introduction

Ethiopia is one of the world's poorest countries with indicators suggesting low levels of development. Many Ethiopians live in conditions of chronic hunger with both a low average daily energy supply (kcal/capita/day or DES) of 1880 and a very high (44%) prevalence of under-nourishment. This compares to an average 2199 kcal/capita/day and a prevalence of 33% under-nourishment for the whole of sub-Saharan Africa (1998-2000 average). Moreover, 81% of this calorie supply comes from cereals, roots and tubers.

About 80% of the population resides in rural areas. Agricultural exports are the country's source of foreign exchange for the country. The Ethiopian government's development policy emphasizes agricultural sector development led industrialization. In 1996, the government initiated a food security

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strategy built around: increasing the availability of food through domestic production; ensuring access to food for food deficit households, and strengthening institutional emergency response capabilities.

In Ethiopia, national food supply management continues to be a major policy concern. This paper focuses on this issue. A stable food supply in the aggregate is directly linked to concerns for the poor because they are most affected by short-term food supply shortages. While a stable supply of food in the aggregate is not synonymous with consumption for all segments of the population, it has the potential to reduce food price volatility and, indirectly impact on real wages.

2. Assessment of food security at the national level

The proportion of population unable to attain their minimum nutritional requirements is estimated at 52% of the rural population and 36% of the urban population (MEDaC 1999). The World Development Report indicators for the year 2000/01 reveal the prevalence of child malnutrition (children under age 5) is 48% during the period 1992/98. Despite efforts to improve food production through increased use of chemical fertilizers and improved seeds, notable improvement in national food production has not been achieved. At the national level the country continues to depend on food aid and to a lesser extent and mainly on food imports.

Table 1 provides indictors of food consumption and nutrition over the 1994/2000 period. During this period, the dietary daily per capita calorie supply increased 22% from 1656 kcal in 1994 to 2023 kcal in 2000. Overall, it averaged 1800 kcal/day/person, 15% lower than the usually cited minimum daily requirement per person of 2100 kcal with 81% of this calorie supply coming from cereals, roots and tubers. Some 47% of the population was undernourished during this same period. Malnutrition rates for children under 5 years old were very high - 47% under weight and 51% stunted. Per capita dietary fat supply per day did not exceed 20 grams and protein supply varied between 47 and 60 grams, averaging 53 grams. During this same period, the average per capita cereal supply went from 122 kg in 1994 to 158 kg in 2000, averaging only 135 kg. Data shows that while food production capacity did not improve over the period, the population increased at an alarming rate.[1] The National Food Security Strategy (FDRE, 1996) reports that as the Ethiopian population grew from 15 million in 1951 to 55 million during early the 1990s, the production of cereals dropped on per capita basis by more than 25% from around 200 kg in early 1950s to 150 kg in 1992.

Table 1 Probability of a national consumption shortfall below 95% of trend

	40 years (1961-2000)		20 years (1981-2000)	
	Probability	*CV**	*Probability*	*CV**
Calorie	24.0%	7.2	10.2%	3.8
Protein	30.0%	10.0	23.8%	7.2
Fats	29.2%	9.1	30.5%	9.8

Standard deviation of the variable 100(C(t) - C(t)trend)/C(t)trend.
Source: Computed from FAOSTAT.

Table 2 provides indicators for access to food. In the face of a growing population, access to land is becoming an increasingly critical factor in food production. An Ethiopian Economic Association/ Ethiopian Economic Policy Research Institute (EEPRI, 2002) survey of over 8500 rural households

[1] Ethiopia's population which was estimated at 10 million at the beginning of 20 century is now 67 million in 2003. Projections show population size to reach about over 130 million by 2030.

indicated that the average national holding of cultivated land is 1.02 hectares and the distribution shows that 63% of households operate less than 1 hectare. Per capita average holding of land under annual crops is less than 0.20 hectare. Anther factor influencing access to food is general consumer prices, in particular food prices.

Table 2 Grain production and area cultivated during the two and half decades

Period	Average grain production (million tons) and area of cultivated land ('000 ha)							
	Cereals		*Pulses*		*Oil crops*		*Total*	
	Prod.	*Area*	*Prod.*	*Area*	*Prod.*	*Area*	*Prod.*	*Area*
1974/75-'90/91	5.2	4,656.1	0.61	672.9	0.076	207.2	5.9	5,536.2
1991/92-'01/02	7.2	6,219.0	0.74	1,058.5	0.12	355.6	8.1	7,633.1
1974/75-'01/02	5.9	5,270.1	0.67	824.4	0.094	265.5	6.7	6,360.0

Source: Central Statistical Authority's various reports.

The prevalence of food insecurity in Ethiopia can be partly attributed to the low purchasing power of the population. Per capita GDP (constant 1995) is only $110 USD. Income distribution is significantly unequal. Other major factors influencing access to food in Ethiopia are infrastructure and communication. Although recent efforts to construction major highways have been made, Ethiopia's infrastructure and communication networks are not developed. For example, road accessibility is very limited in Ethiopia. World Bank Data (2002) shows that in Ethiopia, between 1970 and 1990 the road availability per million inhabitants grew from 250 km to only 550 km. Although many agricultural areas of the country have good surplus production potential, there are road access problems for effective food movement between surplus producing and deficit areas. Poor infrastructure also adds to high marketing costs and is a further disincentive to provide for the market.

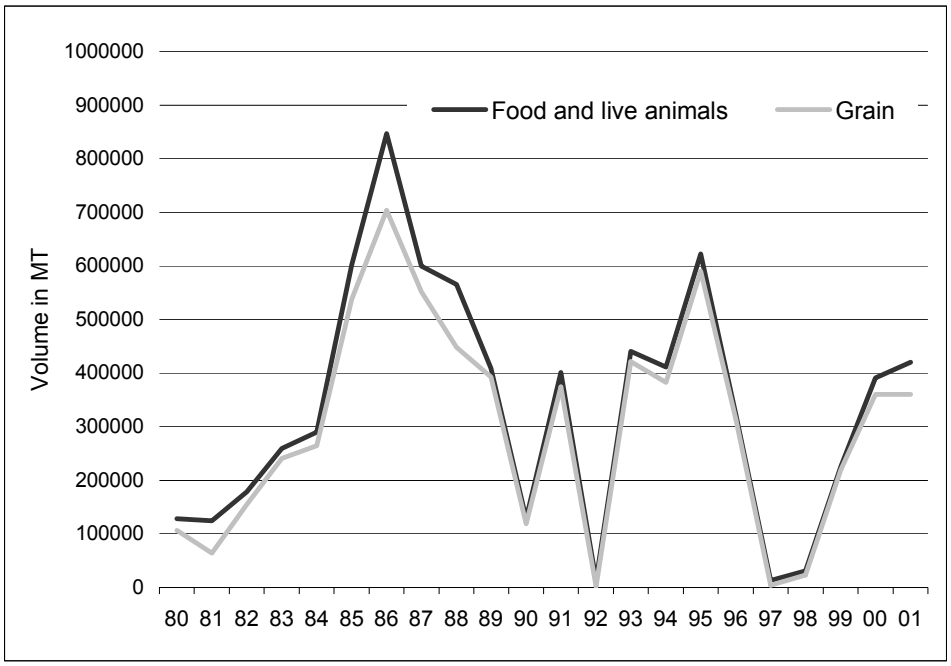
Analysis of dependence on food imports

Ethiopia is categorized as a low income food deficient country [9] extremely dependent on commercial food import and food aid in Ethiopia. Food import yearly average was USD 203 million (current) during the 1980s and USD 147.4 million (current) during 1990s (World Bank, 2000). Commercial food imports between 1980 and 2001 (Figure 1) fluctuated from year to year, but rose by over 8 fold from 100,000 MT in 1980 to over 800,000 MT in 1986, averaging 400,000 MT per year.

The value of food imports, the majority of which were for grains (82% on average), varied significantly in relation to the value of exports (Table 3). The value of food imports was on average USD $199.5 million between 1990 and 1995 and USD $172 million between 1990 and 2000. During these periods, accounting for debt repayment needs, the country's food import capacity was USD $370 million between 1990 and 1995 and USD $556 million between 1990 and 2000.

The food import capacity index (value of import divided by import capacity) shows that on average 65% and 44% of the import capacity was allocated for food during the 1990-1995 and 1990-2000 respectively. This percentages underscore the country's vulnerability to uncertainties of food import from the international market. One of the risk factors is the unreliability of export earnings. The country's major export earner, coffee, faced a drastic fall in world market coffee prices in recent years. According to the National Bank's Annual Report (2000/01), earnings from coffee exports fell from 2.8 billion Birr in 1997/98 to 1.4 billion Birr in 2000/01, a 50% decline. The country's food trade balance was negative, amounting to an average value of 193 million Birr during 1990 to 1995, and 151 million Birr during 1990 to 2000.

Figure 1 Volume of food import-grain and live animals (MT)



Source: Computed from the Annual Report of National Bank of Ethiopia, 2000/01.

Increased Food Aid dependency in Ethiopia

One stark indicator of the precariousness of food security in Ethiopia is the rising dependence on foreign food aid. According to USAID reports (1998, No. 1), the amount of food aid as a share of Ethiopia's foreign exchange earnings has grown from about 2% in 1954 to over 40% . Food aid has been granted in response to acute food shortages which occur mainly following drought seasons. Between 1984 and 1998, eight such incidences were registered (World Bank, 2000).

The number of draught affected people who require foreign food aid is commonly used as an indicator for Ethiopia's national and household level food security crises. Data obtained from DPPC's food security profile shows that the share of the draught affected population in Ethiopia rose from slightly over 8% in 1975 to 16% in 2003. For three decades, there has never been a year in which some portion of the population was not affected. The growth rate of the share of population affected by draught was 2.6% until 1991, and increased to 4.6% per annum there after. Food aid requirements to mitigate the impacts of drought and famine increased to 1.4 million MT in 2003 from 0.4 MT in 1990.

Analysis of food consumption variability: risk of food consumption shortfall

Another aspect of national food security important to considered is the risk from fluctuations in food availability and consumption. On the basis of aggregate food consumption trends, Table 1 gives the probability of a consumption shortfall computed using the procedure developed by Sadoulet and De Janvry (1995). Taking a 40 year period (1961 to 2000), the index of variability of food consumption is 7.2%, 10% and 9.1%, for calories, protein and fats, respectively. This variability corresponds to the probability that national consumption falls below 95% of long-term (trend) consumption which is 24%, 30%, and 29% for calorie, protein and fats intake, respectively. It implies that one can expect aggregate calorie consumption to fall below 95% of the trend once in 5 years, and more than 1 year out of 5 years in the case of both protein and fats consumption.

Table 3 Estimated welfare gain from subsidy and reduced food import dependence

	Price subsidy (% increase in average price)			
	10	20	30	40
Total food requirement (tons)*	15,554,250	15,554,250	15,554,250	15,554,250
Domestic prod (livestock + others) (ton)	1,975,000	1,975,000	1,975,000	1,975,000
Domestic prod. Grain (tones)	7,881,571	7,881,571	7,881,571	7,881,571
Dom. net grain (allow 15% seed and loss) (ton)	6,699,335	6,699,335	6,699,335	6,699,335
Domestic prod (crop + others) (ton)	8,674,335	8,674,335	8,674,335	8,674,335
Food aid, average (ton)	800,000	800,000	800,000	800,000
Total supply (domestic + aid), ton	9,474,335	9,474,335	9,474,335	9,474,335
Desired food import (demand minus supply)	6,079,915	6,079,915	6,079,915	6,079,915
Cultivated area for cereals (ha)	7,286,850	7,286,850	7,286,850	7,286,850
Area elasticity wrt cereals price, short-run**	0.380	0.380	0.380	0.380
Average yield of cereals, tons/ha	1.1	1.1	1.1	1.1
Subsidy (rise in cereal price, assumed), %	10	20	30	40
Current cereal price (avr. 1995-2000) birr/ton	1,500	1,500	1,500	1,500
Grain price including subsidy (birr/ton)	1,650	1,800	1,950	2,100
Price subsidy (birr/ton)	150	300	450	600
Increased area of cereals due to subsidy (%)	3.8	7.6	11.4	15.2
Net increment (allow 15% seed and loss) (ton)	258,902	517,804	776,705	1,035,607
New level of doms. food supply with subsidy	8,933,237	9,192,139	9,451,041	9,709,942
Food supply (dom + aid) (ton), with subsidy	9,733,237	9,992,139	10,251,041	10,509,942
New desired level of import (tones)	5,821,013	5,562,111	5,303,209	5,044,308
Reduction in import demand (%)	4.3	8.5	12.8	17.0
Welfare gain (0.5 x subs x Δ prod) (birr)	19,417,634	77,670,534	174,758,702	310,682,137
Area of cereals fertilized (40%), hectare ***	110,760	221,520	332,280	443,040
Incre.. yield from fertilizer in cereals (ton/ha)	0.83	0.83	0.83	0.83
Incre. Prod. use of fertilizer (ton)	78,141	156,283	234,424	312,565
Food supply (dom. + aid) (ton), sub + fertilizer	9,811,378	10,148,421	10,485,464	10,822,507
Total incr. prod (ton), with sub. + fertilizer	337,043	674,086	1,011,129	1,348,172
Import demand with subsidy + fertilizer (tone)	5,742,872	5,405,829	5,068,786	4,731,743
Reduced import demand (%)	6	11	17	22
Welfare gain (0.5 x subs x Δ prod) (birr)	25,278,228	101,112,914	227,504,055	404,451,654

Source: Authors' calculations using different data sources.

Calorie intake in recent periods is less variable. Computing data over the 1981 to 2000 timeframe, the probability that calorie intake will fall below 95% of trend consumption is reduced to 10%, though the risk of deviation remains high for both protein and fats consumption.

Constraints on Food Supply

Food production and supply are constrained by the dominance of subsistence production units, degradation of soil fertility, underdeveloped production inputs and techniques, and severe weather conditions. A large body of literature documents the major threats posed to the country's agricultural development and food security by environmental degradation such as decline of soil fertility, loss of water resources and vegetative land cover.

3. Analysis of Household Level Food Security Role

Background

Rural households produce their own food and also purchase from the market. While the majority of urban households are only purchasers of food, some engage in urban agriculture (mainly livestock and produce) both for their own consumption and for the market. Urban and peri-urban agriculture is intensive in nature and plays an important role in ensuring food security. Most smallholder agriculture in Ethiopia is characterized by a mixed farming system combining livestock and crop activities. Their products are used for both home consumption and sale at the market. In cash crop producing areas, farmers sell cash crops (coffee, t'chat, fruits and vegetables, etc.) and purchase food grains from the

market. For them, the effectiveness of food market systems is as important as the reliability of food production for personal use. In urban areas where household food security is dependent on household income, work opportunities as well as an efficient food market system are crucial to improving access to food.

Household level income, consumption and expenditure

According to the national household income consumption and expenditure survey HICE, at the national level, 8.0% of households spend below 2,000 Birr annually while 4% of households spend 12,600 Birr (CSA, 1999/2000). The remaining 88% spend between 2,000 and 12,559 Birr annually (see Table 4). At the rural level, 8.0% of households spend below 2,000 Birr and 2.6% spend 12,600 Birr. and the remaining constitute 89.4%. In urban areas, 7.4% of the population spends below 2,000 Birr annually while 13.3% spends 12,600 Birr or more. The majority (79%) of the urban households spend between 2,000 and 12,599 Birr per annum. A comparison of the last two surveys, at national, rural and urban levels, shows that the percentage of households falling in the lower expenditure category (below 2000 Birr) for the 1999/2000 survey year is lower than that of the year 1995/96 while for the top expenditure categories (12,600 Birr or more) the reverse is true. This suggests that the income/expenditure of households increased slightly between the two periods.

Table 4 Percentage distribution of households by domestic expenditure categories at country, rural and urban area levels by survey year

Level	Domestic Expenditure in Birr per Household per annum					
	Less than 2000		*2000-12599*		*12600 or more*	
	1995/96	*1999/2000*	*1995/96*	*1999/2000*	*1995/96*	*1999/2000*
Country	9.7	8.0	86.9	87.8	3.4	4.1
Rural	10.0	8.0	88.4	89.4	1.7	2.6
Urban	8.5	7.4	78.5	79.2	13.0	13.3

Source: CSA Household Consumption and Expenditure Survey of 1999/2000.

The per capita expenditure

The annual per capita average expenditure (all payments) at the national level is Birr 1,412 while per capita average domestic expenditure (excluding non-consumption expenditure) is Birr 1,223. The per capita annual average of all payments for the rural area is Birr 1,244 while that of domestic expenditure is Birr 1,109. For urban areas, per capita average of all payments and domestic expenditure is Birr 2,400 and Birr 1,921, respectively.

Table 5 Per capita expenditure categories at country, rural and urban area levels by survey year

Level	Categories			
	Domestic Expenditure by Survey Year		*All Payments by Survey Year*	
	1995/96	*1999/2000*	*1995/96*	*1999/2000*
Country	1,223	1,223	1,319	1,412
Rural	1,137	1,110	1,210	1,244
Urban	1,697	1,921	1,919	2,401

Source: CSA Household Consumption and Expenditure Survey of 1999/2000.

The source of all payments/expenditure

The breakdown of total receipt for rural households is: 74% from agriculture, 6% from non-agricultural activities, 3% from wages, and 17% from remittances and other income transfers. The breakdown for urban households is: 38% from non-agricultural activities and 37% from wages and salaries, 3% from agriculture, and 14% from remittances and other income transfers.

The pattern of household expenditure

At the country level, 53% of total household income is spent on food. In rural areas, 57% of income is spent on food, while urban areas spend only 36%. The survey result also indicates that with the exception of a slight deviation in one or two expenditure groups, the proportion of income spent on food tends to decline as income/expenditure increases. Survey results indicate that per capita calorie intake per day is 2,211 at country level, 2,292 at rural level, and 1,738 in urban areas. At country level, cereals make up 69% of calorie intake, and pulses, potatoes, others tubers and stems constitute a total of 17%.

Estimates for household income elasticity of consumption

The data on income and expenditure used in this analysis shows that total expenditure in rural areas averages Birr 33,03, out of which 61% (or 2015 Birr) is spent on food including consumption of own produced food. In urban areas, average expenditure per household is 8,317 Birr excluding input costs for business activities, and 14,957 Birr including business input costs. Expenditure on food accounts for 83%, excluding enterprise input costs, and 46% where enterprise input costs are included in total expenditure. Regarding income distribution, 21.6% of the sample rural households spend below 1500 Birr, 35.5% between 1500 Birr and 3000 Birr, 40.5% between 3000 and 10000 Birr, and the remaining 2.4% spent over 10,000 Birr. In urban areas it is in the order 5.15% below 1500 Birr, 16.2% between 1500 Birr and 3000 Birr, 54.1% between 3000 Birr and 10000 Birr, and the remaining 24.7% of the sample households spent over 10,000 Birr. The distribution shows that income poverty is more prevalent in rural areas than urban. In rural areas, the average per capita nutrient intake per day is found to be 2032 kcal, 55 grams of protein, and 16 grams of fat, while in urban areas, it is 2300 kcal, 63 grams of protein and 40 grams of fat per day.

Table 6 Estimates of income elasticity of food expenditure and nutrient intake by income source and income groups

Location and measures	Income group											
	All				*1st quartile*				*2nd Quartile*			
	Food exp	*calorie*	*protein*	*fat*	*Food exp*	*calorie*	*protein*	*fat*	*Food exp*	*calorie*	*protein*	*fat*
Rural												
Elasticity and	0.57*	0.62*	0.67*	0.61*	0.64*	0.50*	0.57*	0.28**	0.58*	0.54*	0.57*	0.44*
t-value	(11.2)	(11.7)	(12.9)	(8.4)	(6.1)	(4.5)	(5.4)	(1.8)	(7.4)	(6.5)	(6.9)	(3.9)
Model, R2	0.40	0.46	0.48	0.37	0.53	0.55	0.54	0.46	0.44	0.48	0.48	0.42
Urban												
Elasticity and	0.57*	0.33*	0.35*	0.42*	0.98*	0.76*	0.86*	0.84*	0.96*	0.61*	0.70*	0.70*
t- value	(38.8)	(16.9)	(17.9)	(17.6)	(42.9)	(9.1)	(10.9)	(7.82)	(60.7)	(13.4)	(15.7)	(12.4)
Model, R2	0.76	0.39	0.43	0.47	0.94	0.47	0.53	0.39	0.93	0.44	0.50	0.43

Table 6 (cont.)

Location and measures	Income group 4th quartile				1st decile				2nd decile			
	Food exp	*calorie*	*protein*	*fat*	*Food exp*	*calorie*	*protein*	*fat*	*Food exp*	*calorie*	*protein*	*fat*
Rural												
Elasticity and	0.48*	0.47*	0.48*	0.44**	0.54**	0.45**	0.52**	0.32	0.63*	0.50*	0.58*	0.27***
t-value	(3.8)	(4.3)	(4.1)	(3.1)	(3.5)	(2.8)	(3.2)	(1.4)	(5.5)	(4.2)	(5.0)	(1.7)
Model, R2	0.14	0.19	0.27	0.12	0.58	0.60	0.58	0.54	0.54	0.55	0.54	0.47
Urban												
Elasticity and	0.19*	0.12*	0.13**	0.13*	0.98*	0.92*	0.74*	0.88**	0.98*	0.83*	0.94*	0.85*
t-value	(5.2)	* (2.2)	(2.4)	(2.53)	(18.3)	(4.6)	(5.5)	(3.17)	(38.63)	(7.75)	(9.39)	(6.22)
Model, R2	0.47	0.22	0.23	0.31	0.93	0.46	0.49	0.26	0.94	0.42	0.50	0.35

*Significant at 1%; ** significant at 5%; and *** significant at 10% prob. Sample size: Rural: all = 1062; 1st quartile = 294; 2nd quartile = 596; 1st deciles= 117; 2nd deciles = 239; Urban: all = 1380; 1st quartile = 345; 2nd quartile = 690; 4th quartile = 345; 1st decile = 138; 2nd decile = 276 Source: Authors' calculations.

4. Macro and Sectoral Development Policies and Strategies

Government development policies and strategies at the national and sectoral levels can bolster the role agriculture plays in national and household food security. They directly and indirectly influence domestic food production, food import levels, and food supply stability. Recent Ethiopian government development policies and strategies can be evaluated in terms of their impact on domestic food production and supply and, dependence on food imports.

Public expenditure and agriculture

Analysis of the government's budgetary allocation shows that agriculture receives less support than might have been expected. During fiscal years 1999/2000 and 2000/2001, overall government investment amounted to 8.3 and 8.5 billion Birr, respectively. Of this 6.8% in 1999/2000 and 6.7% in 2000/2001 went to the agriculture sector. Compared to other sectors, domestic capital expenditure on agriculture shows a sharp decline, and neither loan nor assistance-based financing of the sector seems to be sustainable since both are characterized by erratic movements Alemayehu (2002) .

Agricultural Development Policies and Strategies

During the last four decades, Ethiopia experimented with different economic policy and development strategies. During the end of the Imperial regime up to the revolution of 1974, agricultural development policy was based on localized integrated rural development projects designed to assist smallholder farmers by improving farm input technologies and market institutions. The Derg government (1974-1991) converted land into public/state property according farmers user rights only. It adopted a socialist economic development model and established rural organizations (peasant associations and service cooperatives) to implement development and promote literacy on a wide scale. 'Villageisation', resettlement, administratively controlled agricultural product prices and product delivery quota systems were practiced. With the focus on collective and large-scale commercial farms there was a near total negligence of smallholder producers. Private sector development was plagued, by insecurities and free market operations were largely undermined. A costly civil war, led to the wide spread poverty and food insecurity, which culminated in the fall of the regime in 1991.

After 1991 a new government introduced a free market economy and adopted economic liberalization policies. The policy of Agricultural Development Led-Industrialization (ADLI) viewed

the development of agriculture as an important vehicle for industrialization by providing raw materials, a market base, surplus labor and capital accumulation (MOFED, 2002). The strategy was to enhance agricultural sector productivity through modern technology. Special attention is given to the smallholder agriculture. An agricultural extension package was designed which supplied farmers with inputs (seed, fertilizer and chemicals), technical support (demonstration of input uses and agronomic practices) and training.

In 1996, a food security strategy was initiated, it was finalized in 2002. The strategy focuses on increasing the availability of food through domestic production, ensuring access to food for food deficit households and strengthening institutional emergency response capabilities (FDRE, 2002). The strategy is to address both the supply and demand side of the food equation, ie, availability and entitlement, at national and household levels for Ethiopia's different food production zones (adequate moisture, moisture deficit and pastoral). Increased investment and development of health services, education and roads to rural areas were also emphasized in the rural development strategy.

Economic Liberalization and Impact on Agriculture

The government implemented various measures to promote economic liberalization aimed at bringing about overall economic development. In assessing the effects of the liberalization, Almayehu (2002) notes opposing tendencies with respect to food supply: production of food crops increased and food import and food aid also increased. Land cultivated with grain crops increased by 60% between 1991 and 2001. From his examination of the link between macro-economic policy and agriculture he drew the following major conclusions: 1) the link between priority given to macro-economic stability and agricultural development is weak 2) fiscal and monetary policies are weakly linked to the agricultural sector, 3) agricultural macro-policy needs to move from establishing an incentive-compatible environment towards tackling supply side issues (fertilizer and related factors of production), stabilization of the market for agricultural produce and provision of regulatory and supporting services.

5. Major Impediments to national and household food security in Ethiopia

The preceding sections review agriculture's actual and potential roles in ensuring national food security. Efforts to improve national and household food security, however, are constrained by many factors. The major ones can be summarized as follows:

Institutions

Land policy is the most important institutional factor which influences Ethiopian agriculture and is a highly debated issue in Ethiopia today. Land policy is criticized for hindering rural-urban migration and putting population pressure on land. Consequences are decreased agricultural productivity and underdevelopment of alternative livelihoods outside of agriculture [14].[2] The problems of tenure insecurity in terms of national and household food security can be implied through declining land holdings per household and inadequate investment in methods for increasing food production. Impediments to rural-urban migration means increasing rural population pressure resulting in lowering productivity of agricultural land in the absence of viable livelihood alternatives in rural areas and sustainable means of intensification of farming.

[2] Two joint studies recently conducted by the Ethiopian Economic Policy Research Institute and the World Bank (Deininger et al, 2003) confirmed that tenure insecurity is found to be among the causes for low investment in land augmenting technologies and poor development of the non-farm sector. The latter is due to the fact that farmers engaged in off-farm jobs have a fear of losing their land to administrative redistribution, as the land policy requires that farmers are not allowed to stay away from their localities for a long time.

Input and output market system

Lack of efficient and effective input and output market systems is a major impediment to the development of Ethiopian agriculture and food production. In Ethiopia, surplus food may be produced in some parts of the country, but because of weak transport and market links it cannot be easily transported to food deficit areas. The country's high transport costs and poor infrastructure aggravate the negative terms of trade for farmers. In surplus years, facing falling grain prices mean low net returns. Studies on the grain market (Mulat et al. 1998) and input use confirm the existence and consequences of these problems. Improvement in market policy and investment in infrastructure is necessary to reduce food transaction costs and enhance the incentive to produce more.

6. Summary and conclusions

The future of agricultural development and food security in Ethiopia depends to a great extent on whether production systems move away from a rain-fed system (the potential of irrigation technology and various water resources for more food production has not been exploited) and the extent to which sustainable conservation and fertility management of soil is integrated into farming. The Ethiopian Highlands Reclamation Study (EHRS) of the 1980s revealed that the rate of land degradation poses a huge threat to the country's future food security and general economic development.

A second issue is the persistent failure in the history of rural and agricultural development in Ethiopia is the inability to transmit improved technology and farming practices to producers in participatory and accountable ways. Over the years, many development agendas and practices were prescribed in a top-down approach to the rural people and farmers. Potentially well designed programs and practices usually failed simply because farmers were not given the chance to ask "why", "where", "how" and "when" they should adopt these practices. Extension workers mandated to persuade or teach farmers at grassroots level are quite often unskilled or even irresponsible. Many examples of weak technology transfer efforts to farmers exist.

This study explores the reasons behind the huge food availability gap in Ethiopia, which has resulted in heavy dependence on food aid, and food imports. An analysis of historical consumption data reveals a high probability of national food consumption shortfalls. To reach the goal of increased national food security, it is necessary to improve market functioning, invest in infrastructure which reduces food transaction costs, provide incentives for increased production through strong support for producers, and, most importantly of all, reform current land tenure arrangements.

Notes:

1) Indicators provided by the ROA central team (World Development Indicators 2002 and The FIVIMS indicators) are used to reveal/describe the level of food security at the national level.
2) A Lorenz curve plots the cumulative percents of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percent of the maximum area under the line. Thus a Gini index of zero represents perfect equality, while an index of 100 implies perfect inequality.
3) The food import data obtained from NBE includes grain, live animals and livestock by-products. Time series data on live animals and livestock products that takes about 6% share of the total domestic production is not readily available. Hence, only total grain production (cereals, pulses, oil seeds) is used in the regression analysis.
4) A book by M. Corden entitled "*Trade Policy and Economic Welfare*" (1997), Clarendon Press, Oxford, as quoted by Valdes (2002).
5) A research report by Alemayehu Geda (2002) shows negative supply response elasticity of cereals to own prices. The Author thought that this might mean a possibility of having a backward supply curve.
6) For example, Murty and Radhakrishna (1981), Strauss (1982), and Pitt (1983) as quoted in Gaiha (2003).
7) The ROA central team used the FAOSTAT database to compute and provide the indicators.
8) Ethiopia's population which was estimated at 10 million at the beginning of 20 century is now 67 million in 2003. Projections show population size to reach about over 130 million by 2030.
9) Based on the FAO database which takes a criteria that LIC are countries with per capita income of less or equal to US $785 in 1996.
10) Sadoulet and De Janvry (1995) quoted Valdes and Konandreas (1981) and reported that in comparative studies made for the periods 1961 to 1976, the probability of national consumption falling below 95% of trend consumption was found to be 20% to 27% in Asian countries and 37% to 42% in African Counties.
11) The Ethiopian Economic Association Annual Report on Ethiopian Economy, Vol. I, 1999/2000 has documented that for the period covering 1980/81 to 1997/98, the average growth rate of the agricultural sector was 1.6%, and during 7 observation years negative rates reaching up to –20.9% were observed.
12) The Food Security Strategy document (FDRE, 2002. p.7) also acknowledges that over the last 15 years the country was importing an average amount of 700,000 MT of food aid per annum.
13) Earlier fertilizer response trails made on the major five cereal crops shows (Mulat et al, 1997) that on average fertilizer use increases yield by 8.3 quintals per hectare. The incremental yield due to fertilizer use for different cereals is weighted with area under respective crop to estimate an average (weighted) yield increment. Individual yield increments range between 5.9 quintals (for teff) to 14 quintals (for maize).
14) Two joint studies recently conducted by the Ethiopian Economic Policy Research Institute and the World Bank (Deininger et al, 2003) confirmed that tenure insecurity is found to be among the causes for low investment in land augmenting technologies and poor development of the non-farm sector. The latter is due to the fact that farmers engaged in off-farm jobs have a fear of losing their land to administrative redistribution, as the land policy requires that farmers are not allowed to stay away from their localities for a long time.

Annex Tables

Annex table 1 Core food security and nutrition indicators for Ethiopia

Indicators	1994	1995	1996	1997	1998	1999	2000	Average
Dietary calorie supply per person (cal/cap/day)	1656	1686	1830	1799	1759	1851	2023	1800
Cereals, roots and tubers as a % of dietary calorie supply			80%	81%	81%	80%	82%	81 %
Life expectancy at birth, total (years)			..	43.3	..	42.4	42.3	42.7
Mortality rate, under-5 (per 1,000 live births)			..	166.2	..	..	178.9	172.6
Malnutrition, weight for age (% of under 5 that are underweight)		..	..	..	..	..	47.2	47.2
Malnutrition, height for age (% of under 5 that are stunted)	..	..	..	..	..	..	51.4	51.4
Food Availability								
Animal protein supply (gr/cap/day)	7	7	7	7	7	7	7	7
Cereals supply per person (kg/cap/yr)	123	122	135	134	132	138	158	135
Dietary fat supply gr/cap/day	20	19	21	19	19	20	21	20
Dietary protein gr/cap/day	47	50	54	53	51	54	60	53

Souce: FAO FIVIMS indicators.

Annex table 2 Factors of access to food and food stability

Access to food	1994	1995	1996	1997	1998	1999	2000	Average
Land use, arable land (hectares per person)	0.18	0.17	0.17	0.17	0.16	0.16	..	0.17
Consumer price index (1995 = 100)	91	100	95	97	100	106	106	99
Food price index (1995 = 100)	89	100	100	100	102	111	110	102
GINI index	..	40	..	..	..	..	..	40
Roads, paved (% of total roads)	15	16	15	..	14	13	12	14
Poverty headcount, national (% of population)	..	..	..	..	..	..	..	..
GNI per capita, PPP (current international $)	530	560	610	620	590	630	660	600
GDP per capita, PPP (current international $)	533	565	611	629	599	634	668	606
GDP per capita (constant 1995 US$)	99	102	110	113	108	113	116	109
		Food Stability						
Cereals Dependency Ratio	16.1%	9.6%	5.3%	3.4%	7.5%	7.8%	12.4%	8.9%
Index of variability of gross food production (1985-2000)							6.3%	
Index of variability of net food production (1985-2000)							6.4%	
Index of variability of food prices (1985-2000)							33.9%	
Alternative index of variability of gross food production (1985-2000)							5.9	
Alternative index of variability of net food production (1985-2000)							6.1	
Alternative index of variability of food prices (1985-2000)							7.5	

Souce: FAO FIVIMS indicators.

Annex table 3 Import capacity, value of food import ('000 USD), and import capacity index for Ethiopia

Year	1995	1996	1997	1998	1999	2000	Avr. '90-'95	Avr. '90-'00
Import [a]	190,000	142,000	79,200	135,000	133,000	206,000	199,500	172,018
Import capacity [b]	636000	455000	914000	919000	765000	847000	369,833	556,273
Imp. cap. index (%)[c]	29.9	31.2	8.7	14.7	17.4	24.3	64.80	44.10

[a] Food imports (cereals, diary products, meat, oils) 1000 US$. [b] Export revenues minus debt repayment, 1000US$.
c Import capacity index: (Food imports) / (Export revenues minus debt repayment), percentage. Source: FAOSTAT.

Annex table 4 Regression estimate of determinants of household income in rural areas

Explanatory variables	Unstandardized Coefficients		Stand. Coeffi.	t	Sig.
	B	*Std. Error*	*Beta*		
Constant	-2625	787.99		-3.331	.001
Educational grade of household head	85.683	30.242	.058	2.833	.005
Total farm input cost (birr)	3.823	.218	.500	17.515	.000
Total cultivated land (ha)	401.23	84.876	.120	4.727	.000
Distance to input supply (minutes)	-3.944	1.514	-.050	-2.605	.009
Land quality index	801.97	315.050	.051	2.546	.011
Number of oxen owned (No)	232.48	73.73	.075	3.153	.002
Rainfall sufficiency index	44782	876.30	.100	5.110	.000
Household labor force (ME)	203	52.86	.077	3.84	.000
Age of household head (year)	-1.01	4.77	-.004	-.211	.833
Sex of head (1= male)	14.65	175.65	.002	.083	.934
Region dummy, Tigray	503	292	.039	1.724	.085
Region dummy, Oromiya	877	192.30	.116	4.561	.000
Region dummy, SNNP	-37	230.88	-.004	-.159	.873
Fertilizer used (kg)	3.32	.96	.106	3.447	.001
Labor input in farming (MD/ha)	.570	.327	.035	1.740	.082

Y = Total household income (birr); F = 120.921 and significant at 1% probability level. R2 adj = .57; N = 1322.
Source: Authors' calculations.

Annex table 5 Determinants of food intake in rural areas (figures are provided only significant variables)

Explanatory variables	All				Income groups 1 quartile				2nd quartile			
	Food exp.	*Cal*	*pro*	*Fat*	*Food exp*	*Cal*	*pro*	*Fat*	*Food exp*	*Cal*	*pro*	*Fat*
Household income,ln	.57	.62	.67	.61	.5	.5	.57	.28	.58	.54	.57	.44
Cash loan taken	.051	.04	-.09	.04	..	..	..	..	.06	.05	.05	.06
Family size square	-.07	..	-.25	..	..	-.11	-.08	-.13	-.08	-.08	-.07	-.08
Educational grade attained by head	-.07	-.09	-.10	-.09	..	..	..	..	-.12	-.13	-.13	-.12
price index	-.15	-.28	-.25	-.32	..	-.35	-.29	-.53	-.13	-.32	-.26	-.43
value share of purchased food (%)	-.33	-.21	-.10	-.12	..	-.32	-.18	-.13	-.41	-.26	-.15	-.06
Sex of head, 1= male												
DUMYTIGR	.043	..	..	..	..	..	..	..	.06	..	..	..
DUMYAMHA	-.27	-.29	-.16	-.59	..	-.53	-.57	-.59	-.47	-.51	-.52	-.59
DUMYSNNP	.17	.18	.32	-.15	..	-1.5	-1.6	-1.9	-.78	-1.3	-1.4	-1.7
DUMYOROMY	-.52	-.86	-.88	-1.4	..	-.33	-.52	..	-.41	-.38	-.53	..

Source: Authors' calculations.

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