DSGD DISCUSSION PAPER NO. 4

PUBLIC EXPENDITURE, GROWTH, AND POVERTY REDUCTION IN RURAL UGANDA

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March 2004

ACKNOWLEDGEMENTS

The authors acknowledge financial support from the World Bank and USAID. They are grateful to the Uganda Bureau of Statistics, Ministry of Planning, Finance, and Economic Development (MPFED), and the staff of the IFPRI Uganda Office, particularly Dr. Ephraim Nkonya and Simon Bolwig, for their assistance in collecting most of the data used in this report. They also thank Peter Hazell, Jock Anderson, Karen Brooks, and Rob Townsend for helpful comments, and Nienke Beintema, who provided most of the data and information on agricultural research in Uganda. Any remaining errors are the responsibility of the authors.

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ABSTRACT

Using district-level data for 1992, 1995, and 1999, the study estimated effects of different types of government expenditure on agricultural growth and rural poverty in Uganda. The results reveal that government spending on agricultural research and extension improved agricultural production substantially. This type of expenditure had the largest measured returns to growth in agricultural production. Agricultural research and extension spending also has the largest assessed impact on poverty reduction. Government spending on rural roads also had substantial marginal impact on rural poverty reduction. The impact of low-grade roads such as feeder roads is larger than that of high-grade roads such as murram and tarmac roads. Education's effects rank after agricultural research and extension, and roads. Government spending in health did not show a large impact on growth in agricultural productivity or a reduction in rural poverty, but in part because of difficulties in measuring some of the impacts of this type of investment. Additional investments in the northern region (a poor region) contribute the most to reducing poverty. The poverty-reduction effect of spending on infrastructure and education is particularly high in this region. However, it is the western region (a relatively well-developed region) where most types of investment have highest returns in terms of increased agricultural productivity.

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1. INTRODUCTION

At independence in 1962, Uganda showed prospects for sustainable development with high growth and savings rates, and a well-developed education system. The country was running a trade surplus, primarily through agricultural, textile, and copper exports. It was self-sufficient in terms of food, and small-scale industry supplied the domestic market with basic inputs. Uganda suffered, however, from political turmoil and economic mismanagement from the early 1970s until the mid-1980s. Many skilled workers fled the country, leading to a rapid deterioration of human capital and managerial skills. Industry was nationalized and placed under state control. Rampant inefficiency led to a collapse of the economy, and agricultural output plummeted because of insecurity and war in rural areas.

Uganda has made great strides toward economic growth and poverty reduction since the late 1980s. In the 1990s annual GDP growth climbed steadily to 6.9 percent from only 3 percent per annum during the 1980s. As a result, the share of the population below the poverty line fell from 56 percent in 1992 to 35 percent in 1999. This rapid poverty reduction over such a short period is rare, not only in Sub-Saharan African countries but across the developing world.[1] This success, however, was not equally distributed among regions or between rural and urban areas. The incidence of poverty in rural areas was 39 percent, while it was only 10 percent in urban areas in 1999/2000. As a

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[1]Another major achievement in poverty reduction took place in China from 1978 to 1984. Within six years, the rural poverty rate was reduced from 33 to 11 percent, and the number of rural poor declined from 260 to 89 million (Fan, Zhang, and Zhang 2002). Uganda's success contrasts sharply with other African nations (World Bank 2002).

result, the majority of the poor in Uganda (95 percent) are concentrated in rural areas, with agriculture as their primary source of livelihood.

Economic growth and income distribution are the fundamental forces driving poverty reduction in Uganda. Government polices play a crucial role in promoting both economic growth and better income distribution. Among these policies, government spending has been the most important instrument used by Uganda to achieve these two goals.

Economic theory provides rationales for government expenditure; correcting market failures and improving equity are the two primary ones. When a market economy fails to allocate resources efficiently, market failure occurs. One such example is the case of "externalities." Governments can curb negative externalities (for example, pollution) and promote positive externalities (for example, R&D) by means of regulation, taxation or subsidy, and public provision. Similarly, justification for government provision of pure "public" goods is clear. The nonrival and non-excludable characteristics of these goods (and consequent inability to charge for the costs) imply that the private sector lacks any incentive to supply them.

Equity and poverty reduction considerations lead governments also to provide private goods—those that are disproportionately consumed by the poor—as a means of targeting the transfer of resources to those in need. Theoretically, a market-based economy may distribute income in socially unacceptable ways, and it is often the case that governments intervene to protect vulnerable segments of the community. Food and housing services are some of the main anti-poverty programs offered by governments; but very few countries have been successful in achieving better income distribution or poverty reduction through welfare transfers alone. Government expenditure on public investment, in addition to its growth-promoting effects, can be effectively used for this purpose, however.

Government spending is also needed to provide an enabling environment for the private sector. Much of the role of government spending and interventions can be viewed

as establishing infrastructure in its broadest sense—educational, technological, financial, physical, environmental, and social. Since markets cannot operate in a vacuum, this infrastructure is necessary for markets to play a central role in increasing wealth and living standards. Because constructing extensive infrastructure is often beyond the capacity or interest of any single firm or community-based organization, it is usually the responsibility of government.

The World Bank recently undertook a research project to analyze the impact of public spending in Uganda. The results were published in a World Bank book titled "Uganda's Recovery: The Role of Farms, Firms, and Government" coedited by Ritva Reinikka and Paul Collier (2001). This research used data from a series of household surveys (1992–99) to investigate certain issues concerning Uganda's social and economic development in rural areas. Some of the major findings of this report were: (1) education, access to roads, and access to extension services have a significant positive effect on agricultural production; (2) rural producers over-use nontraded inputs such as homegrown seeds and under-use purchased inputs such as fertilizers; (3) credit constraints significantly affect demand for inputs; lack of access to financial services negatively affects the start-up of nonagricultural enterprises and integration of markets for agricultural produce; and (4) knowledge about the causes and treatment of diseases, in addition to access to health services and their quality, has a significant impact on reducing individuals' propensity to fall sick.

Based on these findings, it is clear that public investment must play an even larger role in promoting future growth and poverty reduction. However, different types of investment may have differential effects on both growth and poverty reduction, and there is need for studies of their individual impacts. Such studies were done for selected countries in Asia (China, India, Viet Nam, and Thailand) at the International Food Policy Research Institute.[2] These studies were primarily based on secondary-level data available at the national and local government levels. However, these types of data are either not

[2]Fan, Hazell, and Thorat (2000) on India; Hao and Fan (2001) on Viet Nam; Fan, Zhang, and Zhang (2002) on China; and Fan, Jitsuchon, and Methakunnavut (2003) on Thailand.

easily available or are of poor quality for most African countries. Fortunately, many African countries have begun to systematically collect household-level data for the past decade. These surveys have recorded detailed information on consumption and expenditure, making it possible to monitor changes in income and poverty. But, these surveys have limited information on production, market policies, and public investment made by various levels of government. By combining household survey data with community survey data and secondary data from local and central governments, it is possible to paint a meaningful picture of overall progress in economic growth and poverty reduction.

This paper reviews relevant literature, discusses data, develops an analytical framework, and applies it to analyze the impact of public investment on agricultural growth and poverty reduction in Uganda. Since the majority of the poor are concentrated in rural areas, this study focuses on the rural poor. Particular attention is paid to how different types of public investment may affect rural poverty through different channels, and how results differ by region. The report is organized as follows: first, we provide a brief overview of Uganda's trends and patterns of public expenditure. Second, we review Uganda's economic growth and poverty reduction, which provides a background on how different government expenditures may affect poverty reduction. Third, we describe the development of physical and human capital as a result of government spending in Uganda. We then propose an analytical framework for the analysis. Empirical estimation and results are discussed, and we then conclude with recommendations for future investment priorities. Data sources and explanations, including most of the variables used at the district level, are set out in an appendix.

Since Uganda varies sharply in its agroclimatic conditions across regions, for the purposes of this study it is useful to divide Uganda into four distinct regions:[3]

- *Central region.* The central region is a high rainfall area around Lake Victoria where bananas, robusta coffee, and food crops are grown. This region is the

[3]This regional division is used commonly in government publications. Poverty and GDP data by region are taken from the Uganda Bureau of Statistics (UBOS).

most developed in terms of social and economic indicators, and includes the capital city, Kampala. The rural poverty incidence in the central region is the lowest among all regions (25.7 percent in 1999).

- *Eastern region.* The eastern region has two distinct rainy seasons, separated by a four-month dry period, and its main crops include millet, cassava, and cotton. This region is the second most developed region in terms of its social and economic indicators, but its rural poverty rate is still high (at 38.4 percent in 1999).
- *North/northeastern region.* In the north, the rainfall pattern restricts cultivation to one season, with the main crops being cotton, maize, and millet. The northeastern region is included as part of the northern region, where the low average rainfall of 80 mm per year is suitable for pastoralism, sorghum, and millet. This region is the poorest of the four. More than 67 percent of the rural population and some 30 percent of the urban population is below the poverty line. In addition, this region has been struggling with a war between the government and rebels since the early 1980s.
- *Western region.* The western region has mountainous areas where the altitude permits cultivation of temperate fruits, vegetables, and some traditional food crops. Infrastructure permitting, this region has the potential to be able to grow high-value crops. The rural poverty rate was around 29 percent in 1999.

2. GROWTH AND POVERTY

This section reviews growth and poverty in Uganda and highlights the potential role of government spending.

Economic and Agricultural Growth

From the 1970s until the mid-1980s, economic mismanagement and civil war destroyed most of the country's physical infrastructure, and manufacturing was decimated after the Asian business community was expelled en masse in the 1970s. In the 1980s and 1990s, when the National Resistance Movement (NRM) took over government, the tax base was small and inflation was high. Uganda embarked on economic reforms in 1987; challenges included increasing tax revenue and controlling public expenditure. A series of new macroeconomic policies were introduced. First, liberalization of prices and trade in the domestic market further boosted agricultural growth. Second, liberalization of foreign exchange, payments, and the trade system led to diversification of Uganda's exports and to higher competitiveness of traditional agricultural products in external markets such as those for coffee and tea. Beginning in the late 1980s, the government also encouraged diversification of commercial agriculture and export of nontraditional agricultural commodities (Byrnes 1992). Last in this list of changes, monetary restraint led to price stability, contributing to the restoration of confidence and external competitiveness (IMF 2000).

As a result of these efforts, the Ugandan economy outperformed most other countries in Sub-Saharan Africa (SSA). The long-term growth from 1982 to 1999 was 5.2 percent per annum (Table 1), and this accelerated to 6.9 percent per annum in the 1990s. As a result, GDP per capita rose from 251 dollars in 1990 (1995 constant prices) to 347 dollars in 1999.

Table 1—Economic and population growth in Uganda

Year	GDP (million constant 1995 U.S. dollars)	GDP Per Capita (constant 1995 U.S. dollars)	Population (millions)	Ag GDP (million constant 1995 U.S. dollars)	Ag GDP per worker (constant 1995 U.S. dollars)
1982	3,146	236	13	1,772	288
1983	3,327	245	14	1,884	301
1984	3,315	239	14	1,827	287
1985	3,206	227	14	1,764	273
1986	3,218	223	14	1,806	275
1987	3,346	225	15	1,843	276
1988	3,622	237	15	1,944	286
1989	3,853	244	16	2,065	299
1990	4,102	251	16	2,173	308
1991	4,330	256	17	2,235	312
1992	4,478	256	17	2,213	303
1993	4,851	269	18	2,419	325
1994	5,161	277	19	2,462	325
1995	5,756	300	19	2,607	338
1996	6,278	318	20	2,718	346
1997	6,576	324	20	2,748	344
1998	6,944	332	21	2,800	345
1999	7,458	347	21	2,992	362
			Annual Growth Rate		
1982–89	2.94	0.51	2.42	2.21	0.51
1990–99	6.87	3.66	3.09	3.62	1.80
1982–99	5.21	2.30	2.84	3.13	1.35

Source: World Bank 2002.

However, Uganda is facing many new challenges as it moves into the new millennium. Uganda is still predominantly an agricultural economy with most of its export earnings coming from cash crops, particularly coffee and cotton. It is also a landlocked country with high transportation costs that hinder international trade. The country undertook macroeconomic reforms in the late 1980s, which led to trade-liberalizing measures to encourage exports. Even with the lifting of certain crucial trade barriers, the rise in exports was modest because the ability to increase production was curtailed by the lack of appropriate inputs, especially for the agricultural sector. Nontrade policy barriers such as high transportation costs also featured prominently in curtailing export growth. Consequently, the recent performance of the agricultural sector has been less than hoped for. From 1982 to 1999, agriculture grew at 3.13 percent per annum, which was lower than the overall economic growth of 5.21 percent. Agricultural labor productivity grew at a

mere 1.35 percent per annum.[4] Such modest rates of agricultural growth will definitely hinder future reductions in rural poverty.

Poverty and Inequality

Table 2 shows poverty measures from five recent Ugandan household surveys by rural and urban areas, and by region. The incidence of poverty declined from 56 percent in 1992 to 36 percent in 1999, but nearly half of this reduction occurred after 1997. In five years from 1992 to 1997, Uganda reduced its poverty by 11.5 percentage points. However, it reduced poverty by more than 10 percent percentage points just in two years between 1997–99.

Table 2—Incidence of poverty in Uganda

Region	1992/93	1993/94	1994/95	1995/96	1997/98	1999/2000
National	55.5	52.2	50.1	48.5	44	35.2
Rural	59.4	56.7	54.0	53.0	48.2	39.1
Urban	28.2	20.6	22.3	19.5	16.3	10.3
Central	45.5	35.6	30.5	30.1	27.7	20.3
Rural	52.8	43.4	35.9	37.1	34.3	25.7
Urban	21.5	14.2	14.6	14.5	11.5	7.4
East	59.2	58.0	64.9	57.5	54.3	36.5
Rural	61.1	60.2	66.8	59.4	56.8	38.4
Urban	40.6	30.5	41.5	31.8	24.8	15.7
West	52.8	56.0	50.4	46.7	42.0	28.1
Rural	53.8	57.4	51.6	48.3	43.2	29.5
Urban	29.7	24.9	25.4	16.2	19.9	5.6
North	71.3	69.2	63.5	68.0	58.8	65.8
Rural	72.2	70.9	65.1	70.3	60.7	67.7
Urban	52.6	46.2	39.8	39.6	32.6	30.6

Source: UBOS, various years.

[4]FAO reported even more pessimistically on Ugandan agricultural growth. For example, FAO reported that no growth in agricultural production occurred in the 1990s, and per capita food production actually declined over time. This differs sharply from World Bank and UBOS assessments of agricultural GDP growth. As the year 2003 ended, IFPRI was engaged in a process of reconciling this difference.

Poverty reduction was uneven across different groups. There was a large spread between rural and urban areas in poverty reduction. In 1992, almost 60 percent of the rural population was under the poverty line compared with 28 percent of urban residents. In 1999, almost 40 percent of rural population was still under the poverty line, but the incidence of urban poverty had dropped to 10 percent. It is clear that urban residents benefited more from the recent economic boom than did their rural counterparts. As noted earlier, some 95 percent of Uganda's poor live in rural areas today.

Regional disaggregation shows that areas with better infrastructure have been more successful in reducing poverty. For example, the central region has the best infrastructure in the country and the lowest incidence of both rural and urban poverty. Poverty reduction here was also the largest among all regions. In the north, however, where infrastructure is poor, the incidence of poverty is almost double the national average, and poverty reduction has been the smallest among all regions.

Wages and Employment

Both agricultural and nonagricultural earnings are important sources of income for rural residents in Uganda. Data aggregated from Uganda's National Household Surveys show the following distinct features (UNHS 1995/96, 1999/2000) (Table 3). First, both agricultural and nonagricultural wages increased substantially within a relatively short time between 1992/93 and 1999/2000. Second, nonagricultural wages rose more than agricultural wages on average. Third, women were paid less than men in both sectors (irrespective of region), while men in nonagricultural sectors, on average, do better than those in engaged agriculture. In contrast, women receive better wages in agriculture than in other sectors.

There are considerable and highly visible differences across regions in terms of wages. As expected, wages in the more developed region of central Uganda increased relatively strongly between 1992/93 and 1999/2000, while in the eastern and western regions the increases were moderate. In the north increases were negligible, with the exception of an increase in nonagricultural wages for men. By 1999/2000, men and

women in agriculture in the northern region received almost 50 percent less than their counterparts in other regions.

Table 3—Agricultural and nonagricultural wages rates in Uganda, various years (shillings per day)

Regions	Agriculture		Nonagriculture	
	Male	Female	Male	Female
1992/93				
National	600	475	725	625
Central	900	600	1,000	800
East	500	400	600	600
West	500	400	500	500
North	500	500	800	600
1995/96				
National	875	725	1050	700
Central	1,600	1,100	1,900	1,200
East	700	700	900	500
West	700	600	800	600
North	500	500	600	500
1999/2000				
National	1,030	940	1,280	1,020
Central	1,630	1,420	1,640	1,230
East	920	860	1,230	1,130
West	1,020	940	1,200	1,070
North	550	550	820	540

Source: UNHS 1995/96, 1999/2000.

It is estimated that the number of new job entrants into Uganda's economy is about 306,500 people per annum (MPED 2000). The economy must be productive enough new jobs to absorb these new workers. It is evident that Uganda's agriculturally based economy is not growing fast enough to provide a lasting solution for rural under-employment and poverty. Agriculture employs the majority of people—about 85 percent in most regions. The nonfarm sector is yet to be well developed. The 1992/93 National Household Survey showed that 6.7 percent of all households in rural areas in Uganda were engaged in nonfarm activities. Many of those employed in agriculture often also work off-farm in other activities, for example, 8.2 percent in the central region and 14.7 percent in the northern region during 1992/93 (MPED 2000). As such, nonfarm employment may also become the most promising avenue for supplemental income

generation for poor people in rural Uganda, and an important pathway out of poverty. There exists regional variation in nonfarm employment[5] patterns across the country (Appendix Tables A1 and A3). The central region showed the highest share of nonfarm employment in total employment in Uganda (30 percent), followed by the eastern and northern regions (24–25 percent). The western region lagged behind with an average of 18 percent.

[5]Defined as labor force that is not engaged in crop farming or other agricultural activities. Calculated by the authors from UNHS (various years).

3. PUBLIC EXPENDITURES: TRENDS AND COMPOSITION

Total Government Expenditures

Uganda's government expenditures in constant 1997 prices increased from 264 billion shilling sin 1982 to 1,043 billion shillings in 1999 (Table 4), a growth rate of more than 8.4 percent per annum.[6]

Table 4—Government expenditure of Uganda (billion 1997 shillings)

Year	General Public Admin.	Defense Affairs & Services	Public Order & Safety Affairs	Educ. Affairs & Services	Health Affairs & Services	Social Affairs & Welfare	Agric., Veterinary, & Forestry	Road & other Transport Affairs	Total
1982	64.78	42.13	53.70	53.09	19.16	2.30	19.47	9.86	264.50
1983	58.48	96.44	23.47	66.40	14.99	2.41	15.45	17.25	294.88
1984	109.42	154.06	35.43	117.50	32.03	3.64	33.75	31.23	517.06
1985	92.21	192.61	30.31	102.42	17.10	2.51	33.38	39.26	527.96
1986	100.80	200.05	52.61	83.75	16.29	2.39	42.68	44.68	543.24
1987	88.10	234.68	47.95	133.85	17.43	1.28	32.30	46.22	601.81
1988	82.91	193.41	31.49	78.08	19.98	2.18	25.26	22.59	455.90
1989	82.63	169.84	37.87	56.58	15.74	0.95	12.34	32.83	408.78
1990	150.19	146.08	34.00	58.39	26.01	6.37	19.03	46.18	486.26
1991	343.60	134.60	47.36	93.63	29.42	4.83	19.73	32.68	705.86
1992	368.12	98.64	32.98	67.94	23.64	2.66	14.13	14.22	622.33
1993	130.63	101.47	47.92	54.42	20.78	5.23	9.57	22.23	392.25
1994	151.80	138.10	62.30	139.07	46.04	3.81	18.01	30.64	589.77
1995	176.72	129.15	66.87	128.89	44.14	1.89	10.19	29.86	587.71
1996	191.29	151.98	72.00	180.98	54.11	3.99	11.53	56.04	721.93
1997	216.60	146.39	72.14	204.60	58.42	1.52	11.36	48.95	759.98
1998*	175.20	206.92	71.96	306.52	57.54	1.64	13.75	56.71	890.24
1999*	238.12	195.18	82.27	369.88	70.68	2.04	11.96	73.15	1043.29

Source: Ministry of Finance, Planning and Economic Development (MFPED)
Note: *Extrapolated using the trend of UBOS government expenditure data for 1998 and 1999

As a percentage of GDP, Uganda consistently increased its spending during the 1980s, from 9 percent in 1980 to 16 percent in 1990 (Fan and Rao 2003). The share remained constant over the 1990s. Compared with the more-developed countries and neighboring African countries, this percentage is small. For more-developed countries,

[6]All government expenditures have been converted into 1997 constant prices using the GDP deflator.

the average is 30–40 percent for 1960–85 while the African average was 28 percent in 1998.

Uganda's total government revenue was 10–11 percent of GDP, 4–9 percent percentage points smaller than the expenditure share (Fan and Rao 2003). As a result, Uganda experienced a severe fiscal deficit in the past decade. This problem is attributed to a weakening tax administration, noncompliance with tax regulations, difficulties of taxing a large informal sector, granting of value-added tax (VAT) exemptions, and reduction in import duties as part of trade reform (World Bank 2002). This problem is particularly important in the short and medium terms and increases Uganda's dependence on foreign aid to fund expenditures. As such, the Ugandan government must find innovative ways to increase its tax and nontax revenues if it wants to decrease reliance on external funding of its economy and to achieve a balanced budget.

Composition of Government Spending

The composition of government expenditures reflects government priorities. The relative spending priorities in Uganda have not changed much since the late 1980s. In fact, the top three expenditures for Uganda in both the 1980s and 1990s were defense, general public administration, and education while lowest percentages of expenditures were for agriculture, roads, health and social security (Table 5).

There is a global trend to increase expenditure on education as a share of government expenditure. Uganda is no exception, spending 35.5 percent in 1999 (Table 5). Per capita education expenditure has increased four-fold since the late 1980s (Table 6). But this national aggregate masks substantial regional differences. It is in the poor regions where the government spends substantially less on education (Tables A13 and A14).

In 1999, Uganda spent 6.8 percent of government expenditure on health (Table 5), compared with an African average of 4 percent. Agriculture's share in total expenditure is also small (1.2 percent in 1999) and has declined from 7.4 percent in 1982. This is particularly worrisome considering that agriculture is the largest sector and that the

majority of the poor live in rural areas and are primarily engaged in agriculture. In addition, expenditure on agricultural research and development, one of the investments most crucial for growth in agricultural production, saw no visible growth. As a percentage of agricultural GDP, agricultural R&D remained relatively stable between 0.35–0.5 percent in Uganda in the past two decades. This is relatively low when compared to the average for other African countries, which was about 0.85 percent in the late 1990s, and extremely low when compared to most Asian and Latin American countries, which averaged about 1 percent (Pardey and Beintema 2001).

Table 5—Sector shares of government expenditure of Uganda (percent)

Year	General Public Admin.	Defense Affairs & Services	Public Order & Safety Affairs	Educ. Affairs & Services	Health Affairs & Services	Social Affairs & Welafare	Agric., Veterinary, & Forestry	Road & other Transport Affairs
1982	24.49	15.93	20.30	20.07	7.25	0.87	7.36	3.73
1983	19.83	32.70	7.96	22.52	5.09	0.82	5.24	5.85
1984	21.16	29.79	6.85	22.73	6.19	0.70	6.53	6.04
1985	17.47	36.48	5.74	19.40	3.24	0.49	6.32	7.44
1986	18.56	36.82	9.68	15.42	3.00	0.44	7.86	8.22
1987	14.64	39.00	7.97	22.24	2.90	0.21	5.37	7.68
1988	18.19	42.42	6.91	17.13	4.38	0.48	5.54	4.95
1989	20.21	41.55	9.26	13.84	3.85	0.23	3.02	8.03
1990	30.89	30.04	6.99	12.01	5.35	1.31	3.91	9.50
1991	48.68	19.07	6.71	13.26	4.17	0.68	2.80	4.63
1992	59.15	15.85	5.30	10.92	3.80	0.43	2.27	2.28
1993	33.30	25.87	12.22	13.87	5.30	1.33	2.44	5.67
1994	25.74	23.42	10.56	23.58	7.81	0.65	3.05	5.19
1995	30.07	21.98	11.38	21.93	7.51	0.32	1.73	5.08
1996	26.50	21.05	9.97	25.07	7.50	0.55	1.60	7.76
1997	28.50	19.26	9.49	26.92	7.69	0.20	1.49	6.44
1998*	19.68	23.24	8.08	34.43	6.46	0.18	1.54	6.37
1999*	22.82	18.71	7.89	35.45	6.77	0.20	1.15	7.01

Source: Ministry of Finance, Planning and Economic Development (MFPED)
Note: Expenditures include recurrent and development expenditure at the both central and local levels.
* Extrapolated using the trend of UBOS government expenditure data for 1998 and 1999

Government spending on social security and welfare expenditure has been remarkably low. In absolute terms, social security and welfare expenditure decreased from 2.30 in 1982 to 2.04 billion shillings in 1999. As a percentage of GDP, social security expenditure remained at about 0.4 percent between 1980 and 1998. Its share in

total government expenditures also declined from 0.87 percent in 1982 to 0.20 percent in 1999 (Table 5).

Uganda increased its infrastructure expenditure (road and other transport services) in absolute terms from 9.9 billion shillings in 1982 to 73.2 billion shillings in 1999. However, infrastructure expenditure as a percentage of GDP was maintained at 0.22–0.24 percent. Infrastructure spending as a share of total government expenditures increased from 3.73 percent in 1982 to 7.01 percent in 1999. This share is substantially higher than in many Asian and Latin American countries.[7]

Table 6—Social sector expenditure, per capita (1997 Shillings)

Year	Education Affairs & Services	Health Affairs & Services	Social Affairs & Welfare
1982	3,979.96	1,436.57	172.50
1983	4,883.73	1,102.90	177.05
1984	8,479.82	2,311.36	262.92
1985	7,246.36	1,209.65	177.40
1986	5,791.65	1,126.35	165.22
1987	9,019.90	1,174.54	86.49
1988	5,111.84	1,308.34	142.74
1989	3,587.87	998.28	60.25
1990	3,575.52	1,593.04	390.35
1991	5,540.98	1,741.30	285.87
1992	3,888.78	1,353.17	152.29
1993	3,014.92	1,151.52	289.64
1994	7,463.80	2,470.93	204.74
1995	6,706.00	2,296.39	98.37
1996	9,135.99	2,731.67	201.41
1997	10,019.59	2,860.92	74.44
1998*	14,568.50	2,734.84	77.91
1999*	17,108.21	3,269.29	94.22

Source: Calculated by authors using Ministry of Finance, Planning and Economic Development data and World Development Indicators 2003 population data.

Note: * Calculated using trend of UBOS government expenditure data.

Africa has been ravaged by war in the post-independence era, and Uganda has been no exception. Rebels have been fighting government forces in the north for more

[7]In 1998, the share of government spending on infrastructure was 3.86 percent for Africa, 4.94 percent for Asia, and 6.37 percent for Latin America (Fan and Rao 2003).

than a decade. As such, Uganda although a predominantly agricultural economy, routinely spends more on defense than on any productive or social sectors such as education, health, social security, and infrastructure. Uganda's defense spending in total government expenditures increased from 15.93 percent in 1982 to 18.71 percent in 1999, a level that is high when compared with other countries in Africa (11 percent), Asia (11 percent), or Latin America (6 percent).

Decentralization of Spending

Decentralization is expected to improve services provided to the poor by increasing transparency and accountability in the use of public funds, and the capacity of local communities to mobilize, plan, and manage their resources. Uganda has done remarkably well in this process, spending over one-third of total public expenditure through local authorities, the largest share in Africa (Foster and Mijumbi 2002). However, Uganda continues to wrestle with the problem of how to reconcile national program priorities and the need for accountability, with the objective of decentralizing resources to local government. In the face of clear evidence that district administrations were absorbing funds intended for service delivery, Uganda has limited the discretion of local government, providing 80 percent of their funding in the form of highly conditional grants. These require local governments to use the funds in ways determined at the center, and specify planning, reporting, and accounting requirements. Government has also made increasing use of transparency provisions. Public notices, FM radio stations, and newspapers are being used to publicize the resources provided to individual schools and health facilities, and what they are to be used for. The intention is to empower communities to hold civil servants and councilors to account.

However, several problems have been encountered in the process, such as inadequacy of locally generated revenues, inexperience of local officials, an underdeveloped system of public accounting, and a poorly informed citizenry. Conditional grants tend to lead to a pattern of local expenditures that has a strong focus on poverty but one that is inflexible in responding to the specific problems and

preferences of different communities. Therefore, as decentralization progresses and budgeting procedures are strengthened, conditional grants are expected to be phased out, enabling local governments to tailor anti-poverty expenditures to district priorities (IMF 2000).

4. AGRICULTURAL R&D, AND PHYSICAL AND HUMAN CAPITAL DEVELOPMENT

This section reviews the development of public technical, physical, and human capital in Uganda. Such public capital is a major source of long-term economic growth and poverty reduction. It contributes not only to growth in agricultural production, providing an adequate food supply for an increasing population, but also to development of the rural nonfarm sector, which has become increasingly important for further poverty reduction in rural areas. Given limited availability of data on irrigation, telecommunications, and electricity, our analysis focuses on agricultural R&D, roads, education, and health.

Agricultural R&D

Agricultural R&D activities in Uganda date back to the 1920s when the British colonial administration set up research stations under the Departments of Agriculture and Veterinary Services.[8] Makerere University, initially established as a training center in the 1920s, began research activities in the 1950s. Most of the research activity prior to Uganda's independence was part of the British colonial research network in East Africa, and was aimed at improving productivity on plantations. Coffee, tea, and cotton were the priority crops for research. Needs of small-scale and traditional farmers were largely ignored.

Most of these research institutions were intact after independence until the establishment of the National Agricultural Research Organization (NARO) in 1992, although most of the other colonial research agencies were transferred to national governments of the region. Prior to 1992, most research was still very much focused on commercial export crops. Research on food crops, which are so important for the poor, received little attention. In addition, much of the research infrastructure was destroyed by war in the 1970s.

[8]For more detailed information about the agricultural research system in Uganda, refer to Beintema and Tizikara (2002).

Data on public spending for agricultural research in Uganda are available only in the 1990s. Total spending then amounted to 27 million international dollars measured in 1993 prices, and increased to 49 million international dollars in 2000 (Beintema and Tizikara 2002). As a percentage of agricultural GDP, agricultural research increased from 0.32 percent in 1995 to 0.5 percent in 2000. However, even the latter percentage is much lower than the African average of 0.85 percent in 1995 (Beintema and Tizikara 2002).

Prior to 1993, agricultural extension in Uganda was under several government agencies including the Ministry of Agriculture, the Ministry of Animal Industry and Fisheries, the Ministry of Environmental Protection, and the Ministry of Commerce, Cooperatives, and Marketing. After merging the Ministry of Agriculture and the Ministry of Animal Industry, and Fisheries, agricultural extension was reorganized under the Directorate of Extension of the Ministry of Agriculture, Animal Industry, and Fisheries. The agency is largely responsible for extension policy formulation and communication, technical and methodological guidance, coordination of different stakeholders and setting standards for monitoring and evaluation of extension services in the districts, and training at the national level of various cadres of staff for the agricultural sector. Most extension activities have been decentralized to districts.

Supported by international donors, the National Agricultural Advisory Service (NAADS) was created in 1997 as part of the Plan for Modernization of Agriculture (PMA). The NAADS was designed to redress the past shortcomings of the agricultural extension system by establishing a decentralized extension delivery system owned by farmers but serviced by the private sector. As a result, spending on extension, including both government and international donations, increased substantially over the past several years. Assessments of these new initiatives are mixed. However, it is largely accepted that a more decentralized agricultural extension system will better serve the poor.

Infrastructure

Development of rural infrastructure is key to rural social and economic life. Rural populations tend to define poverty in terms of access to infrastructure, most often roads, education, and health centers, rather than just services. Field studies of mobility among women and men in rural settlements in Africawith poor road access illustrate the frustrations and costs of living "off-road" (Porter 2002). It is particularly important to note that for women, financial, time, and—in some cases—cultural constraints on mobility are highly restrictive for commerce and trade. Uganda is no exception to this phenomenon. Four aspects of access to infrastructure have especially far-reaching implications for development in general and agricultural production in particular, namely (1) schools, (2) medical care, (3) markets, and (4) credit facilities.

The plight of the rural poor emphasizes the need for access to health care in emergencies, but health facilities are usually hard to find in remote locations. Moreover, the poor in remote areas are often the most in need of medical assistance, since water and sanitation facilities are frequently inadequate and poverty levels are above regional averages. A recent Uganda Participatory Poverty Assessment (cited by Booth, Hammer, and Lovell 2000) indicates that vaccination programs often miss remote areas, thus exposing populations to further risk. Moreover, the costs of medicine further exacerbate existing high costs of transporting the sick to a health facility.

Many farmers in remote areas prefer to send produce for sale in major markets, which are usually located on paved roads. This has important implications for women in Africa since they are the principal marketers and/or porters of agricultural produce (Porter 2002). In some parts of Uganda, such as the rural northeast, where there are severe physical and economic constraints, remote market closures following road construction have a particularly severe impact on women. By the same token, a journey to remote rural areas of Uganda needs motorized transportation, which when obliged to use poorly maintained roads has high maintenance costs.

Roads are crucial for effective rural transport systems , but the mountainous and hilly topography in many parts of Uganda hinders development of roads. The poorest communities are often the most isolated ones. The roads program, which was the earliest focus of government poverty reduction efforts, had some impact. This effort was on "classified" roads, 70 percent of which are now in fair to good condition, compared to 50 percent of feeder roads (Foster and Mijumbi 2002). The more recent 10-year Road Sector Development Program focuses on rehabilitation, maintenance, and selective upgrading of existing roads, emphasizing the main paved and gravel roads. The average distance of households to a tarred road fell from 32 km in 1997 to 22 km in 1999/2000, and 60 percent (15,000 km) of district feeder roads were rehabilitated and improved.[9] The effects of economic growth and improved transport links were evident in improved access to *matatu* taxis, which were on average within 6 km of homes in 1999/2000 compared with 9 km in 1997. The 2000 service delivery survey found that 65 percent of communities were of the view that public transportation had improved over the previous five years, due largely to improved road maintenance.

What is also worrisome for rural Ugandans is their extremely low access to electricity. Only 12 percent of all villages and only 2.1 percent of all rural households have electricity connections in Uganda. These rates are among the lowest in the world. The Ministry of Energy and Mineral Development is planning to increase the rate of rural household electricity access to 10 percent by 2010. This rate is considerably lower than the rates achieved in India and China, for example, several decades ago. Access to electricity poses a great challenge for future development of rural areas in Uganda.

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[9] Tarmac Roads: Tarmac (or tarred) roads are generally well maintained and sealed by tar. These roads feed into cities from different border posts and towns.

Murram Roads: They are gravel roads (small stones mixed with sand) with varying degrees of maintenance dependent on seasons and traffic.

Feeder Roads: Feeder (or dirt) roads link communities to commercial and socio-economic centers or connect them to the classified road network. These roads are therefore very important for the livelihood of rural communities since they facilitate delivery of farm inputs, marketing of agricultural produce, delivery of social and administrative services. They are passable by motorized vehicles although some roads are passable only during the dry period.

Source: http://www.miniworks.go.ug/road_network.htm

Government investment in improved water infrastructure is also important for economic growth and poverty reduction. A study of micro- and small enterprises (MSEs) in Uganda showed that economic benefits to MSEs of water supply improvements might be limited (Davis et al. 2001). Enterprises in both communities where research was conducted preferred a system of public kiosks to private connections. Small retail operations that sell foodstuffs or dry goods have very little need for large quantities of water. These findings have important implications for both the design and pricing of piped water services in Uganda in that piped water services with private connections may be more appropriate for residential areas, whereas piped services to central business districts will probably require more public taps than are commonly envisioned or constructed. These findings emphasize the importance of providing a range of technological options for planning a new water supply system, and importantly, for obtaining reliable information on preferences held and demand by different groups of consumers.

Regional variation in infrastructure access is enormous. Analysis of distances to various types of infrastructure from the 1999/2000 Ugandan National Household Survey shows that urban areas of the central region fare better because people have relatively short distances to travel. For example, urban residents' travel an average of 2.4 km to a factory and 0.21 km to an all-season road. As expected, rural areas of the northern region fare the worst and people there commute 39 km on average to get to a factory and 2.4 km to reach an all-season road. The central region has the largest road network. Similarly, travel to the closest consumer market is shortest for the central region (UNHS 1999/2000). Again, the numbers for the northern region show that the poor travel longer distances to reach the nearest market.

Budget estimates for approved expenditure for feeder road maintenance from 1994/95 to 1996/97 show that expenditures were cut for most districts. However, fiscal transfers to local governments for the same years show substantial increases in the commitment to improved water supply in central, eastern, and western Uganda, the only years and regions for which these data are available.

Infrastructure for electricity, measured as the percentage of villages with such access, is the worst in the northern region with most districts in single-digit values, while most of the other regions fare slightly better. Unsurprisingly, Kampala fares best in the central region, and 73% of the city is connected to electricity.

Health

Uganda has achieved great success in containing the incidence of HIV/AIDS. The rate has declined from more than 30 percent in early 1990s to less than 6 percent today (CIA 2003). This is due to an aggressive government campaign against the disease. But Uganda has not fared well on many other fronts. Table 7 shows the changes in health indicators in Uganda during 1980–99. Although infant mortality rate has declined, all other indicators, such as death rate and life expectancy, have deteriorated over this period. Health indicators also show differences across regions. Data gathered from UNHS (1995/96, 1999/2000) show that the central region has fared best. The number of workdays "lost in the past 30 days" due to illness is lowest in this region (1.8 days). The northern, eastern, and western regions lost on this count an average of 2.3 days of work due to illness in 1999/00. What is striking for the same year is that female workers lost more time to illness than did male workers. Again, regional trends show that the central and more urban region fared best.

Table 7—Health indicators, various years

Indicators	1980	1982	1985	1987	1990	1992	1995	1997	1999
Mortality rate, infant (per 1,000 live births)	115.50	115.50	115.50	115.50	104.40	97.00	98.20	99.00	88.33
Death rate, crude (per 1,000 people)	17.68	17.60	17.60	17.60	17.96	18.20	19.16	19.80	19.40
Birth rate, crude (per 1,000 people)	49.10	49.10	49.94	50.50	50.32	50.20	48.82	47.90	46.26
Life expectancy at birth, female (years)	49.43	49.10	49.10	49.10	47.12	45.80	43.60	42.14	42.40
Life expectancy at birth, male (years)	47.51	47.51	47.57	47.61	46.40	45.60	43.92	42.80	41.90
Life expectancy at birth, total (years)	48.45	48.29	48.32	48.34	46.75	45.70	43.77	42.48	42.14

Source: World Bank 2002.
Note: Data were only readily available for the years shown.

The deterioration in health indicators is a result of an inefficient health management system. In 1993, the Ministry of Health (MOH) delegated managerial responsibility to district councils for local health care, arguing that these councils were best informed about local situations. However, decentralization did little to mitigate tensions between the MOH and districts over budgetary allocations (Brown 2000). Local councils were also so overwhelmed by the huge demand for services in rural areas that they could not deliver needed services to the poor effectively. Improving the legal and regulatory framework within which a health sector can thrive is crucial. Reinikka and Ablo (2000) found that input flow into Uganda's health system suffers from serious problems, which to a large extent has to do with governance and a lack of accountability. This problem has serious implications for funding because budget allocations are wasted when institutions or their controls are weak. Because inputs did not reach the intended facilities, actual service delivery was often lacking despite nominally adequate funding.

The government has taken action on several fronts, the most important of which was a significant increase in budget allocation toward primary health care through the Poverty Action Fund, set up specifically to direct and monitor funds from debt relief and other government and donor resources earmarked for the welfare of poor people. Further annual increases for primary health care are not only protected from budget cuts but also show a projected increase of between 21 and 27 percent (Njie 2001). Another prominent feature of the health plan is to shift services from a tertiary and curative nature to a primary and preventive nature.

Education

During 1991–99, rural literacy improved across all regions in Uganda. This success resulted from a series of government policy reforms in the education sector. The Universal Primary Education (UPE) policy aims to provide free education to four children per family, emphasizing gender equity. The UPE policy led to a substantial increase in primary school enrollment, from 2.7 million pupils in 1996 to 6.6 million pupils in 1999. A striking feature of this increase was that almost one-half of the students

were female. Dropout rates, however, remained high due to lack of facilities or poor health of children. Incentives should be given to female teachers to remain in rural areas, serving as role models for girls (Tumushabe et al. 2001).

The government's policy on education in the 1990s focused on increasing access to primary education and economic opportunities for poor people. Furthermore, improving the quality of education was also considered crucial. Since 1991/92, public expenditure on education has shifted toward primary education relative to secondary or tertiary education. Measures have been taken to contain costs because of the increase in demand for education during the initial phase of macroeconomic reforms. With debt relief through the HIPC Initiative, Uganda qualified for a diversion of funds away from debt service and toward its social sectors.

5. CONCEPTUAL FRAMEWORK AND MODEL

This section reviews previous studies and develops a conceptual framework and econometric model for application to rural Uganda.

Model

Public investment affects rural poverty through many channels. It directly increases farmer incomes by increasing agricultural productivity, and increased productivity, in turn, reduces rural poverty. Increased agricultural productivity also helps to increase rural wages and employment. It creates more nonfarm employment opportunities and migration into urban or other rural regions. More agricultural output through public investment in rural areas often leads to lower food prices, helping the poor indirectly because they are often net buyers of food grains.

Previous studies on public expenditure focused on performance of budget implementation. For example, Foster and Mijumbi (2002) evaluated such performance by analyzing differences between budgets and outruns of various government expenditure items. There have also been several studies of poverty changes in Uganda by Appleton (2001a and b). These studies focused on measures of poverty in rural and urban areas and by regions, and they provide important and valuable information on the current status of and changes in Ugandan poverty.

Deininger and Okidi (2003) were the first to analyze the impact of various infrastructure, education, and health variables on farmers' income and poverty using a panel dataset created from the 1992 and 1999 Uganda National Household Surveys. The authors concluded that education, health, and infrastructure are all important. However, it proved difficult to compare relative returns to such investments, relativities that are required to make informed allocative decisions for public expenditures.

Fan, Hazell, and Thorat (2000) and Fan, Zhang, and Zhang (2002) constructed an econometric model to estimate the effects of government spending on poverty reduction through various channels, using secondary data from government statistical agencies in

India and China. These two countries have long time-series data, particularly data on disaggregated government spending, but most African countries lack this luxury. Hence, such models need to be adjusted and adapted to the African context.

Building on previous IFPRI studies in Asia and Ugandan data availability, this study develops and adapts a simultaneous equations model to estimate the effects of government expenditure on agricultural production and on rural poverty through different channels. Equations (1) to (4) give the formal structure of the system.

Equation (1) models the hypothesized major determinants of rural poverty (*P*). These include agricultural output per agricultural laborer (*AOUTPC*), rural daily wage (*RWAGES*), and the nonagricultural employment share (*NFE*).

$$P = f(AOUTPC, RWAGES, NFE) \quad (1)$$

$$AOUTPC = f(LANDP, FERTP, AGEXT, RLITER, DROADS, PSICK) \quad (2)$$

$$RWAGES = f(AOUTPC, RLITER, DROADS, PSICK) \quad (3)$$

$$NFE = f(AOUTPC, RLITER, DROADS, PSICK) \quad (4)$$

The agricultural labor productivity variable captures how improved agricultural productivity contributes to poverty reduction directly through increased income. Nonfarm employment income is the second most important source of income after agricultural production for rural residents in Uganda. The wage and share of nonfarm laborers in total laborers are reasonable proxies for nonfarm income. Moreover, in this manner, it is possible to distinguish between the differential impacts of changes in wages and shares of workers in the nonfarm sector on rural poverty reduction.

Equation (2) is an agricultural labor productivity function, in which gross crop production value per unit of agricultural labor is the dependent variable, while independent variables include the conventional inputs land (*LANDP*) and fertilizer (*FERTP*) expressed on a per unit labor basis The following public investment variables capture the direct impact of technology, infrastructure, and education on agricultural growth: an agricultural research and extension variable measured in stock terms (*AGEXT*) which in turn is a function (described below) of lagged government spending on

agricultural research and extension; rural literacy rate (*RLITER*); average distance of households to different types of roads (*DROADS*), that is, tarred, murram, and feeder roads, and a health indicator measured by the share of people who have been sick in the past 30 days. Complications arose in calculating combined government expenditure on agricultural research and extension since only the latter is available at the district level. Since most agricultural research is conducted at the national level in a small country such as Uganda, this may not be an important limitation. In our empirical analysis, we allocated national agricultural research expenditures to each district in proportion to the district extension expenditures, and then added them to extension spending, thus making this variable agricultural research and extension.

Equations (3) and (4) are wages and employment determination functions in the rural nonfarm sector. The independent variables include a set of public investment variables such as rural infrastructure and education. Agricultural productivity is also included in both equations to capture effects of improved labor productivity on rural wages and rural nonfarm employment.

Ideally, we should also include a set of equations to model the relationship between government expenditures and improved public capital such as roads, education, and health, as Fan et al. (2000 and 2002) have done in their studies in Asia, but historical data on government spending by region in Uganda are available only after 1993. For this reason, we used an alternative approach. We first estimated growth and poverty impacts of physical infrastructure, health, and education. We then used estimates of the unit cost of public capital to obtain benefit-cost ratios of various types of government spending.

Marginal Impact on Growth and Poverty Reduction

By totally differentiating equations (1) to (4), we can derive marginal impacts and elasticities for different types of public capital on growth in agricultural production and rural poverty. The growth effect is straightforward—that is, we take the derivative of the equation with respect to each variable of agricultural services, education, infrastructure,

and health. For poverty effects, public capital not only affects poverty through agricultural productivity but also through wages and employment.

The impact of government investment in agricultural research and extension on poverty can be derived as:

$$\begin{aligned} dP/dAGEXT \;=\; & (\partial P/\partial AOUTPC)\,(\partial AOUTPC/\partial AGEXT) \\ & + (\partial P/\partial RWAGES)\,(\partial RWAGES/\partial AOUTPC)\,(\partial AOUTPC/\partial AGEXT) \\ & + (\partial P/\partial NFE)\,(\partial NFE/\partial AOUTPC)\,(\partial AOUTPC/\partial AGEXT) \end{aligned} \quad (5)$$

The first term on the right hand side of Equation (5) captures the impact on poverty of government investments in agricultural research and extension through yield-enhancing technologies such as improved varieties, and therefore also increased agricultural labor productivity. Such labor productivity also affects poverty through changes in rural nonfarm wages and employment, which are captured in the remaining two terms.

The impact of government investments in rural roads through shortened distance to different types of roads is derived as:

$$\begin{aligned} dP/dDROADS \;=\; & (\partial P/\partial AOUTPC)\,(\partial AOUTPC/\partial DROADS) \\ & + (\partial P/\partial RWAGE)\,(\partial RWAGE/\partial AOUTPC)\,(\partial AOUTPC/\partial DROADS) \\ & + (\partial P/\partial NFE)\,(\partial NFE/\partial AOUTPC)\,(\partial AOUTPC/\partial DROADS) \\ & + (\partial P/\partial RWAGE)\,(\partial RWAGE/\partial DROADS) \\ & + (\partial P/\partial NFE)\,(\partial NFE/\partial DROADS) \end{aligned} \quad (6)$$

The first term on the right side of Equation (6) measures direct effects on poverty of improved productivity attributable to shorter distance to rural roads. Terms 2 and 3 are indirect effects of improved productivity through changes in rural wages, and employment. Terms 4 and 5 capture direct effects on poverty of higher rural wages and greater nonagricultural employment opportunities arising from government investment in roads. We can similarly derive the impact on rural poverty of increased investment in health and education.

To calculate returns in growth and poverty reduction per unit of monetary spending, we also need information on the unit cost of public capital. For example, how much it would cost to build one additional kilometer of rural roads, or how much it would cost to educate a rural laborer to become literate. There are several ways to estimate such unit costs. One way is to use the actual cost of building one additional unit of public capital under present conditions. However, this type of information is not readily available. A second approach is to estimate the average unit cost from past investments. For the unit cost of rural roads, total length of rural roads divided by total investment in rural roads during the past 30 years can be used. Another approach would be to regress the length of roads against the investment in roads using time-series data. A difficult problem with this second approach is the time lag between spending and creation of public capital. Once again, estimating the time lag empirically would require long time-series data, seldom available for Africa.

Considering the data availability and situation in Uganda, the second approach is preferable—that is, calculating the average unit cost of spending of each type of public capital. For agricultural research and extension, we first constructed a stock variable using an arbitrary but plausible set of weights of lagged expenditures:

$$AGEXT_t = 0.05*rd_{t-1}+0.1*rd_{t-2}+0.2*rd_{-t-3}+0.3*rd_{t-4}+0.2*rd_{t-5}+0.1*rd_{t-6} + 0.05*rd_{t-7},$$

where $AGEXT_t$ is research stock at year t, rd_{t-i} is government spending in agricultural research and extension at year t-i, i = 1..7. As noted above, agricultural research spending was distributed among districts in proportion to extension expenditures.

Roads were disaggregated into feeder, murram, and tarmac roads. Since we do not have unit cost data for these three categories, we arbitrarily assumed that the unit cost of feeder roads is one-quarter of the cost of murram roads, and one-eighth of the cost of

tarmac roads.[10] We then allocate total government expenditures on roads across these three categories based using these assumptions and the respective road lengths. For education, we first calculated unit spending per unit of rural population, and then divided per capita spending by reduction in rural illiteracy rate to achieve a unit cost of reduction in rural illiteracy rate. Similarly, we calculated the unit cost of health in terms of reduction in the percentage of rural residents who were sick in the previous 30 days.

[10]This differential cost of different types of roads can be found and supported by the World Bank Road Information System, which provides unit cost of the World Bank-funded road projects across different countries.

6. DATA, MODEL ESTIMATION, AND RESULTS

Data

The unit of analysis in this study is a combination of national, regional, and district levels. Most of the data are collected from various agencies of the Ugandan government and/or aggregated from the UNHS, crop surveys, and community surveys conducted by the Uganda Bureau of Statistics (UBOS). Crop-production and land-use variables were generated from crop surveys, while most of infrastructure variables such as access to market, roads, school, health service, and post office were from community surveys. Poverty, income, employment, and wages by districts were aggregated from different national household surveys. Most of the government spending variables at the national level were obtained from the Ministry of Planning and Finance, while spending data at the district level were from the Ministry of Local Governments and the Ministry of Planning and Finance. More detailed data sources and descriptions are included in the appendix.

We collected data for various indicators and years for 45 districts in Uganda, with some indicators going as far back as 1980. For the purpose of comparison, we converted all government expenditures into 1997 Ugandan Shillings. A 10% discount rate is also used to inflate or deflate expenditures or output into a common base year. Total expenditure is broken down into various sectors following the *Statistics Abstract* (UBOS various years). They includes both recurrent and development expenditure. Other sources include the FAOStat Database (June 2000) and the World Bank's *2002 World Development Indicators*. Total GDP, agricultural GDP, total population, agricultural population, employment by sector, road density, and literacy rate are taken from various agencies of the Republic of Uganda. Due to lack of systematic secondary data at the district level, we generated a panel dataset at the district level for 1992, 1995, and 1999 by directly aggregating survey data at household and community levels in these years. Numerous studies, notably a set of studies collected in the book edited by Reinikka and Collier (2001), have used these surveys. Data on agricultural output and inputs are

generated from crop surveys. Employment, education level, health status, and poverty incidence are from household surveys. Information on markets, wages, prices, and infrastructure are derived from community surveys. Appendices in Reinikka and Collier (2001) provide a detailed discussion of these surveys.

The crop and household surveys cover the same households. The surveys in 1992 and 1999 are large and comprehensive in that they cover about 10,000 households and address a wide range of topics. Between 1992 and 1999, there were four monitoring surveys with shorter questionnaires and a smaller sample size of 5,000 households. The surveys in 1995 used in the analysis contain 5,435 usable observations. The community surveys involve about 1,000 communities across the country. These surveys cover all districts except several in the northern region. As each household or community in the surveys corresponds to a particular sample multiplier, we can use the multiplier as a weight for data aggregation.

Poverty. With respect to poverty estimation, we closely followed Appleton's method (2001a) to estimate values of consumption per adult equivalent. Based on regionally specific poverty lines described in Appleton (2001a), we then calculated poverty rates at the district level.[11] The traditional approach uses a single national poverty line derived from a common "food basket". Uganda has large regional variation in diets with six major staple foods being eastern. For example, matooke is mainly consumed in the central and western regions, and not in the northern region. Therefore, a single national "food basket" approach may not be appropriate. Based on this concern, Appleton calculates regional-specific poverty lines following the standard approach of Ravallion and Bidani (1994). By comparing the poverty incidence based on national and regional poverty lines, he shows that region-specific poverty line is more appropriate for estimating regional patterns of poverty in Uganda.

Output values. Because the questionnaire in the crop survey provides more than 30 units for each crop, and many crops are only for self-consumption, it is difficult to

[11]Appleton (2001a) has reported poverty rates at the regional level only.

aggregate output values across households and crops. For those crops with reported market sales in a household, we used the market price to derive total output value. In cases where price information was not available for a particular crop, we used the median price measured by the same quantity among all the households within a district to derive the output value for this particular output. If for the same quantity there was no available price at the district level, we used the national median price as a proxy to calculate the output value of the crop produced by the household. The questionnaire includes the following crops: matooke, maize, finger millet, sorghum, rice, beans, field peas, cowpeas, pigeon peas, groundnuts, sim-sim, cotton, Irish potatoes, sweet potatoes, cassava, coffee, tea, tobacco, trees, flowers, oranges, passionfruit, pineapples, mangoes, papaw, onions, cabbages, dodo, tomatoes, carrots, other vegetables, other fruits, and other crops. Unfortunately, estimates of production of livestock and fishery are not included in the crop survey. Considering that most poor rely primarily on cropping for a living, the impact of exclusion of livestock and fishery on poverty measures is minimal.

Land. Land variable is agricultural land, which is taken from the Crop Survey by UBOS.

Fertilizer. Fertilizer is aggregate value of fertilizer used by farmers for crop production. The data are from the Crop Survey of UBOS.

Employment. The household socioeconomic survey reports the activity status as well as the codes for industry and occupation. Based on this information, we estimated total labor force, employment rate, and share of farming and nonfarm employment in total employment.

Wages. Farming and nonfarm wage rates for men and women at the district level are aggregated from the community survey, expressed as shillings per month.

Health outcome. The household socioeconomic survey reports data on household members who had fallen sick due to illness in the previous 30 days and on how many days were lost. Based on this information, we created two indicators at the district level:

percentage of residents who had fallen sick and average days of work lost due to illness over the past 30 days.

Education level. The literacy rate is from the household socioeconomic survey, and is defined as the share of population over the age of 15 who can read and write.

Roads. Average distances in kilometers to the nearest feeder road and all-season murram and tarred (or tarmac) roads are generated from the community survey.

Agricultural research and extension. Agricultural research expenditures are available only at the national level. After mid-1990s, agricultural extension expenditures were available for most of the districts. The expenditures were available for selected districts in the early 1990s. For earlier years, we aggregated the district level expenditures into regions, and used regional aggregate expenditures for all districts within a region, assuming extension services spill into each district equally. Finally we allocated national agricultural research expenditures by district in proportion to their extension expenditures.

Model Estimation and Results

We used double-log functional forms for all equations in the system. The observations with missing or zero (for example in the case of fertilizer) values are deleted from our sample during the estimation. As a result, we have 90 observations (3 years and 30 districts). More flexible functional forms (such as translog or quadratic equations) impose fewer restrictions on estimated parameters, but many coefficients are not statistically significant because of multicollinearity problems. The system is estimated using the full information maximum likelihood technique.

The results of the estimated system are presented in Table 8. The estimated poverty equation (Equation 1) show that growth in agricultural labor productivity and nonfarm employment are both significant factors in determining rural poverty in Uganda. For every 1 percent of growth in agricultural production, 0.27 percent of rural poor people would escape poverty. Rural nonfarm employment had about the same

influence on the incidence of poverty. In contrast, rural wages did not significantly reduce rural poverty. This may be because there is surplus rural labor, consistent with the so-called efficient wage theory.

The estimated agricultural labor productivity function (Equation 2) shows that the coefficients of land input and fertilizer are statistically significant with elasticities of 0.126 and 0.161, respectively.[12] The strong and significant coefficient of the fertilizer variable indicates that increased fertilizer use has great potential for promoting future agricultural production. The results also show that investment in agricultural research and extension, improvements in rural literacy rate, shortened distances to feeder roads, and reduced days of sickness of labor have all contributed significantly to growth in agriculture. However, shortened distances to murram roads and tarmac roads do not appear to have statistically significant impacts on improvement in agricultural labor productivity.

The estimates for Equation (3) show that improved health has contributed to increases in rural wages; but all the other variables included have an insignificant impact on wages.

The estimates for Equation (4) suggest that nonfarm employment is highly correlated with proximity to murram roads and tarmac roads, but not to feeder roads. The rural literacy variable and days of sickness are not significant at the 10 percent level.

Marginal Returns to Public Investment

Using the estimated equations (1) to (4) in Table 8 and the estimated relationship between government average investment for the past four years and physical public capital stocks, we derived marginal returns to different types of government expenditures in growth and reduction of rural poverty, as shown in Equations (5) and (6). This is done in two steps. First, we calculate the marginal returns in agricultural output and poverty

[12] The land variable is measured as agricultural land per agricultural worker while the fertilizer variable is measured as fertilizer purchased value per agricultural worker. Since both variables are only available for 1999, we use the same values for these two variables for 1992 and 1995.

reduction per unit of physical unit, for example increased agricultural output or number of poor reduced per kilometer of feeder roads.[13] Then we use the unit cost of these physical units, for example shillings per kilometer, to convert the effects to a per unit of investment (or cost) basis.[14]

We calculated marginal returns by different types of investments in four regions and for Uganda as whole. Results are presented in Table 9. Only statistically significant coefficients are used in this calculation.

Effects are measured as a ratio of shillings or the number of poor people brought out of poverty per unit of spending in 1999.[15] For example, returns to investments in agricultural research and extension are measured as shillings of additional production or number of persons brought out of poverty per one additional shilling spent on agricultural research and extension. These measures provide information for comparing relative benefits of additional units of expenditure on different items in different regions, which can contribute usefully to setting future priorities for government expenditure to further increase agricultural productivity and reduce rural poverty.

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[13] We use feeder roads to illustrate our calculation of the benefit-cost ratios. Table 8 shows that the elasticity of labor productivity with respect to feeder roads is 0.139. We assume heroically that a one percent increase in feeder roads will translate to a one percent reduction in the average distance of a household to the nearest feeder road. Using the expression for marginal product of a Cobb-Douglas or log-linear production function as elasticity*output/input, the output benefit of one additional km of feeder roads is then calculated as 0.139**AOUT/LFEEDER*, where *AOUT* is the total agricultural output value (given unchanged labor quantity) and *LFEEDER* is the length of feeder roads. At the national level *AOUT* in 1999 is 380 billion shillings while length of feeder roads is 12,721 km. Therefore, for the marginal km of feeder roads, 4.1 million shillings of agricultural production value would be produced. For the cost side, we first allocate the national road expenditures to the district level proportional to the district spending on roads. The average costs including both recurrent and investment is 597 thousand (0.597 million) shillings per km. The benefit-cost ratio for the feeder roads is therefore 7. For poverty reduction impact, equations 1 and 2 imply that the poverty reduction elasticity of the feeder roads variable is 0.266*0.139 = 0.037. Total number of poor in Uganda in 1999 is 6.7 million. This implies that, for one additional km of feeder roads, $0.037*6.7*10^6/12{,}721 = 19.5$, almost 20 poor would be lifted above the poverty line. This thus translates to a poverty reduction effect of about 33 poor lifted above the poverty line (19.5/0.597) per million shillings of spending.

[14] Ideally, this relationship should be estimated econometrically based on historical data such as by Fan et al (1998 and 2002) in China and India. But lack of long-term time series data on these physical capital items and investment at the regional level does not allow us to do so in Africa.

[15] When the constant return to scale is assumed, the effects on production of various inputs and public investment variables are equivalent to those on productivity.

Table 8—Estimates of system equations

(1) *P*	=	–	0.266*AOUTPC* (–4.04)*	–	0.183 *RWAGE* (–0.98)	–	0.270 *NFE* (–2.75)*							$R^2 = 0.407$
(2) *OUTPC*	=		0.126 *LANDP* (3.65)*	+	0.161 *FERTP* (2.99)*	+	0.189 *AGEXT* (1.75)*	+	0.332 *RLITER* (1.80)*	-	0.139 *DFROAD* (-1.94)*			$R^2 = 0.675$
		+	0.245*DMROAD* (1.39)	–	0.09 *DTROAD* (-1.04)	–	0.465*PSICK* (–2.04)							
(3) *RWAGE*	=	–	0.088*Y* (–1.52)	+	0.133 *RLITER* (1.00)	+	0.023 *DFROAD* (0.63)	–	0.068 *DMROAD* (–0.63)	–	0.048 *DTROAD* (–1.12)			$R^2 = 0.418$
		–	0.216 *PSICK* (–2.32)*											
(4) *NFE*	=	–	0.172*Y* (–0.78)	–	0.152 *RLITER* (–0.81)	–	0.053 *DFROAD* (–0.78)	–	0.216 *DMROAD* (–2.25)*	–	0.234 *DTROAD* (–3.05)*			$R^2 = 0.315$
		–	0.104 *PSICK* (–0.62)											

Note: Asterisk indicates that coefficients are statistically significant at the 10 percent level, based on the statistics reported in respective parentheses. The coefficients of regional dummies are not reported.

Table 9—Marginal returns to government investment in rural Uganda

Investment	Central	East	North	West	Uganda
Benefit–cost ratio					
Agricultural R&D	12.49	10.77	11.77	14.74	12.38
Education	2.05	3.51	2.10	3.80	2.72
Feeder Roads	6.03	8.74	4.88	9.19	7.16
Murram Roads	n.s.	n.s.	n.s.	n.s.	n.s.
Tarmac Roads	n.s.	n.s.	n.s.	n.s.	n.s.
Health	1.37	0.92	0.37	0.96	0.90
Number of poor people reduced per million shillings					
Agricultural R&D	21.75	66.31	175.52	48.91	58.39
Education	3.57	21.60	31.38	12.62	12.81
Feeder Roads	10.51	53.85	72.82	30.49	33.77
Murram Roads	4.08	11.88	14.80	9.77	9.70
Tarmac Roads	2.59	13.12	62.92	9.39	9.73
Health	2.60	6.15	5.95	3.46	4.60

Source: Calculated by authors as exposited in Footnote 13.

Note: n.s. indicates that the respective coefficients are not statistically significant.

An important feature of the results in Table 9 is that most of these investments reduce poverty while increasing agricultural productivity. However, there are sizable differences in production and poverty reduction gains among expenditure items and across regions. In terms of productivity effects, for the country as a whole, government expenditure on agricultural extension and research has the highest returns in labor productivity. For the marginal shilling invested, 12 shillings would be returned. The feeder roads investment ranks second, with a benefit-cost ratio about 7. Education also has positive returns, with a benefit–cost ratio of about 3. Health is the only government investment that has a return lower than its cost, of only 0.9 shilling per shilling spent.

Regional disaggregation reveals that, for all types of investments except health, the return is highest in the western region. For agricultural research and extension the eastern region has the lowest return, while central and northern regions fall in between. For education and roads, the central and northern regions have the lowest returns while the eastern region ranks in the middle.

In terms of poverty reduction, agricultural research and extension again ranks first, followed by feeder roads. Among different types of roads, feeder roads have the largest impact, murram roads the second-largest impact, and tarmac roads the least impact. Education's effects on poverty are smaller than those of agricultural services and feeder roads, but higher than for murram and tarmac roads and for health. Government investment in health has the smallest impact on poverty reduction.

For all types of investment, the northern region has the highest returns except for health. The north and east have similar impacts of health expenditures on poverty. On the other hand, in the central region all types of investment have impacts on poverty reduction that are the smallest among all regions.

It appears that there might be a tradeoff between growth in agricultural productivity and reduction in rural poverty when the government allocates investment across regions. If the government attempts to maximize poverty-reduction by investing more in the northern region, productivity may have to be sacrificed in other regions because this region has lower marginal returns in agricultural productivity. But the trade-off is small.

7. CONCLUSIONS

This section concludes our study by reporting the major findings. It then highlights implications for future government investment priorities, and points out limitations and future research directions.

Major Findings

Using largely district-level data for 1992, 1995 and 1999, this study developed a simultaneous equations model to estimate the effects of different types of government expenditure on agricultural growth and rural poverty in Uganda. Results show that most government investments, such as agricultural services, rural infrastructure, rural education, and health, have contributed to agricultural productivity growth and reduced rural poverty. However, variations in their marginal effects on production and poverty reduction were large, among different types of spending and across regions.

Government spending on agricultural research and extension improved agricultural productivity substantially. This type of expenditure had the largest measured returns to growth in agricultural production. Growth in agriculture is still much needed to meet the food needs of an increasingly larger population. Agricultural research and extension spending also has the largest assessed impact on poverty reduction. Government spending on rural roads also had substantial marginal impact on rural poverty reduction. The impact of low-grade roads such as feeder roads is larger than the impact of high-grade roads such as murram and tarmac roads. The large impact of feeder roads on poverty reduction is mainly through improved agricultural productivity, while murram and tarmac roads had no significant impact on agricultural productivity. The impact of these better roads on poverty reduction is mainly through improved nonfarm employment opportunities. Education's effects rank after agricultural research and extension, and feeder roads. These poverty-reduction effects appeared to come from growth in agricultural productivity, improved nonfarm employment, and increased rural wages.

Government spending on health did not show a large impact on agricultural productivity growth or rural poverty reduction. Four reasons are likely to account for this. First, health investment tends to affect growth and poverty reduction in the long run. Due to the nature of our data set, this aspect could not be captured. Second, a large share of health expenditures is spent on prevention and treatment of HIV/AIDS-related diseases, which has obvious significant impacts on long-term growth and poverty reduction and directly affects the well being of poor people. Without these efforts, Uganda would have had a much higher incidence of poverty; however, our model is unable to demonstrate these effects. Third, Uganda achieved great success in containing HIV/AIDS through a very aggressive public campaign whereby the prevalence of HIV/AIDS fell from 30 percent in 1998 to 6 percent today. While Uganda should continue to address HIV/AIDS, future government spending on this problem will likely yield lower returns in productivity and poverty reduction than in the past. Finally, there may be significant inefficiencies in the Ugandan health system, as briefly discussed earlier. Uganda ranks 149 among 191 countries in overall health system performance (Tandon et al. 2002).

Additional investments in the northern region contribute most to reducing poverty because this is where most of Uganda's poor people are now concentrated, and the government has relatively neglected this region in the past. The poverty-reduction effect of investing in infrastructure and education is particularly high in this region. Nonetheless, in terms of increased agricultural productivity, most types of investment have the highest returns in the western region.

Priorities of Future Government Investment

The results of this study have potentially important policy implications for future government investment priorities in Uganda. As Table 5 showed, education is the largest spending category among all public investments considered in the study, accounting for 35 percent of total expenditure in 1999. At the other extreme, agriculture accounts for only 1.2 percent of total government expenditure. All types of infrastructure (roads, electricity, and telecommunications) together accounted for only 7 percent of total

government spending. Health spending accounted for about 7 percent of the total. Are these allocations optimal for maximizing growth and poverty reduction? This study reveals large differentials in the effect of various types of government spending on growth and poverty reduction. The potential gains from reallocating government resources are enormous. The following policy suggestions are offered based on the results of this study:

1. With 86 percent of the population living in rural areas, and about half of rural income coming directly from agriculture, increased investment in agricultural research and extension is urgently needed. Agricultural R&D spending was less than 0.50 percent of agricultural GDP in 1998. This is extremely low compared with many more-developed countries, but it is also low compared with most developing countries. The highest returns in both agricultural growth and poverty reduction shown in this study suggest that increased investment in agricultural research and extension is a "win–win" (growth and poverty) strategy for national development.
2. Rural infrastructure and education should receive higher priority in the public investment portfolio. Investments in infrastructure and education reduce rural poverty mainly by spurring nonfarm employment and growth in agricultural productivity. Roads should receive particular attention among all types of infrastructure, and among all types of roads, low-grade roads such as feeder roads should have higher priority than tarmac or murram roads.
3. In the past, Uganda invested heavily in the health sector and made significant strides in confronting HIV/AIDS through an aggressive public campaign. As a result, the prevalence of HIV/AIDS has fallen from 30 percent of the population five years ago to 6 percent today. Uganda should continue its investments in health care, but future investments should be geared to improving the efficiency of existing public health-care systems.
4. Infrastructure and education investment in the northern region yields the highest returns in terms of reducing rural poverty and promoting agricultural growth. This suggests that the government should drastically increase its investment in this region, governance and security concerns permitting.

Limitations and Future Research Directions

This study has several limitations. Among the most critical are some data constraints. While we will continue to improve our data collection, the government should put serious effort into organized, coordinated, and systematic data collection for

the long run. Without such data, it is difficult for the government to monitor and evaluate the impacts of various investments and to set future investment priorities to achieve stated objectives.

A general-equilibrium analysis is needed to analyze how government investment in rural areas affects not only the agricultural sector and rural areas, but also other sectors and cities. Ignoring these impacts severely underestimates the overall impact of public investment on poverty. An effort similar to that described in this paper is also need to analyze the impact of urban investment on poverty reduction. Without such information documenting what we anticipate will be lower relative returns to public investment, it will be impossible to convince national policymakers to change the prevailing investment policy that is so biased to urban development.

Further, centralization versus decentralization of public spending is still an under-studied subject. Uganda was one of the first African countries to have followed a more radical process of decentralization of public provision to local government. The performance of this process has been mixed. It is important to analyze how a more decentralized spending pattern may be more pro-poor than a centralized one.

Finally, an analysis of the political and institutional context of public investments, and conditions for efficient provision of public goods and services is also much needed to improve the efficiency of public investments. In particular, how can the government design a mechanism (via policies, regulations and fiscal systems) to mobilize public resources to invest in rural areas? How can public institutions be reformed to improve incentive systems, accountability, human capital, and management? These are important research issues requiring further investigation.

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APPENDIX: DISTRICT DATA

Subnational-level data on growth, poverty, and public spending by various investment items are not easily available for most developing countries. Uganda is no exception, although these data have become more accessible. Most such data are compiled from different sources. Moreover, the definitions, scope, and coverage of the variables may vary over time and across regions. For these reasons, this appendix includes some of the recently released district-level data used in our analysis, which might be of more general interest.

Appendix Table A1—Agricultural labor productivity, 1992, 1995, and 1999 (current Ugandan shillings)

Region	District	1992	1995	1999
Central	Kalangala	24,940	29,092	105,444
	Kampala	16,044	1,101	53,520
	Kiboga	17,022	18,375	159,809
	Luwero	13,592	42,821	162,417
	Masaka	13,376	27,604	115,658
	Mpigi	11,467	12,438	139,516
	Mubende	9,797	31,408	128,451
	Mukono	n.a.	27,355	109,654
	Nakasongola	13,145	n.a	78,270
	Rakai	n.a.	40,745	96,324
	Sembabule	n.a.	n.a.	97,483
Eastern	Bugiri	n.a	n.a.	94,308
	Busia	14,826	n.a.	71,183
	Iganga	11,081	60,118	105,381
	Jinja	10,178	34,556	200,976
	Kamuli	9,129	32,319	79,882
	Kapchorwa	n.a.	56,487	133,011
	Katakwi	16,349	n.a.	63,268
	Kumi	12,086	19,630	60,283
	Mbale	9,898	33,888	90,546
	Pallisa	9,672	19,885	69,865
	Soroti	5,054	18,130	38,062
	Tororo	n.a.	15,351	93,926
Northern	Adjumani	14,241	n.a.	44,580
	Apac	10,597	16,581	40,815
	Arua	8,421	18,665	60,184
	Gulu	8,726	27,196	n.a.
	Kitgum	6,707	n.a.	n.a.
	Kotido	5,665	12,377	7,708
	Lira	9,395	12,785	47,787
	Moroto	6,886	10,656	4,509
	Moyo	6,715	13,382	40,720
	Nebbi	8,969	21,095	36,137
Western	Bundibugyo	14,762	34,707	n.a.
	Bushenyi	15,493	45,841	108,109
	Hoima	9,615	22,607	94,863
	Kabale	15,292	33,802	79,465
	Kabarole	11,314	36,858	92,449
	Kasese	12,961	22,896	n.a.
	Kibale	9,885	50,694	89,902
	Kisoro	10,225	36,530	63,498
	Masindi	14,511	35,233	93,637
	Mbarara	n.a.	41,813	88,320
	Ntungamo	18,012	n.a.	126,282
	Rukungiri	14,241	49,143	94,962

Source: Calculated by the authors from UNHS various years.

Note: Per capita output is measured as total crop production value divided by total agricultural employment; n.a. indicates data were not available.

Appendix Table A2—Agricultural and nonagricultural wage at the district level, 1999/2000 (shillings per day)

Region	District	Men's agricultural wages	Women's agricultural wages	Men's nonagricultural wages	Women's nonagricultural wages
Central	Kalangala	1,357	1,143	1,625	1,100
	Kampala	n.a	n.a	2,177	1,613
	Kiboga	1,438	1,357	1,725	1,571
	Luwero	2,063	1,466	1,889	1,279
	Masaka	1,403	1,152	1,455	1,233
	Mpigi	2,756	2,517	1,690	1,450
	Mubende	1,299	1,155	1,653	852
	Mukono	1,303	1,105	1,534	1,274
	Nakasongola	2,300	1,922	1,833	1,056
	Rakai	1,000	958	1,460	1,000
	Sembabule	1,333	1,500	1,350	1,250
Eastern	Bugiri	1,022	1,022	1,778	1,333
	Busia	1,083	1,083	1,500	1,438
	Iganga	909	714	1,379	941
	Jinja	1,018	977	1,643	1,567
	Kamuli	937	701	1,416	1,712
	Kapchorwa	1,417	1,417	1,563	1,563
	Katakwi	600	600	750	750
	Kumi	985	946	1,625	1,625
	Mbale	993	993	1,541	1,542
	Pallisa	856	856	1,450	1,450
	Soroti	850	850	1,000	1,000
	Tororo	1,114	1,114	1,306	1,276
Northern	Adjumani	617	617	1,438	1,275
	Apac	539	539	1,857	688
	Arua	635	650	1,169	974
	Kotido	500	500	500	500
	Lira	525	525	2,417	1,750
	Moroto	554	586	1,000	1,000
	Moyo	1,017	733	1,313	1,125
	Bebbi	627	618	1,071	1,036
Western	Bushenyi	940	828	1,270	1,111
	Hoima	1,531	1,150	1,458	1,000
	Kabale	973	967	1,088	1,019
	Kabarole	1,130	1,091	1,398	1,083
	Kibaale	853	853	1,144	1,144
	Kisoro	1,129	886	1,253	947
	Masindi	2,371	2,064	2,265	1,518
	Mbarara	954	924	1,270	1,223
	Btungamo	823	823	993	993
	Rukungiri	1,000	980	1,304	1,269

Sources: Calculated by the authors from UNHS various years.

Note: n.a. indicates data were not available.

Appendix Table A3—Percentage of nonfarm in total employment, 1992, 1995, and 1999

Region	District	1992	1995	1999
Central	Kalangala	27	17	37
	Kampala	57	93	96
	Kiboga	7	6	15
	Luwero	12	18	21
	Masaka	13	22	20
	Mpigi	31	35	40
	Mubende	16	16	19
	Mukono	n.a.	25	34
	Nakasongola	22	n.a.	12
	Rakai	n.a.	12	15
	Sembabule	n.a.	n.a.	23
Eastern	Bugiri	n.a.	n.a.	20
	Busia	14	n.a.	37
	Iganga	12	25	22
	Jinja	35	44	54
	Kamuli	9	22	22
	Kapchorwa	n.a.	15	10
	Katakwi	20	n.a.	19
	Kumi	17	56	19
	Mbale	16	27	20
	Pallisa	6	56	18
	Soroti	13	46	23
	Tororo	n.a.	21	23
Northern	Adjumani	14	n.a.	34
	Apac	6	26	13
	Arua	8	29	20
	Gulu	7	31	n.a.
	Kitgum	4	n.a.	n.a.
	Kotido	6	70	49
	Lira	18	32	20
	Moroto	4	67	22
	Moyo	12	33	24
	Nebbi	23	29	16
Western	Bundibugyo	12	15	n.a.
	Bushenyi	12	24	16
	Hoima	16	21	20
	Kabale	24	24	20
	Kabarole	14	21	18
	Kasese	25	16	n.a.
	Kibale	12	13	9
	Kisoro	11	15	14
	Masindi	16	14	28
	Mbarara	n.a.	13	21
	Ntungamo	19	n.a.	21
	Rukungiri	14	14	19

Sources: Calculated by the authors from UNHS various years.
Note: n.a. indicates data were not available.

Appendix Table A4—Distance to the closest market, 1999/2000 (kilometers)

Region	District	Consumer Market		Input Market		Output market	
		Periodic	Most common	Periodic	Most common	Periodic	Most common
Central	Kalangala	2.00	2.00	2.00	2.00	3.00	3.00
	Kampala	1.67	1.76	n.a.	n.a.	n.a.	n.a.
	Kiboga	6.57	9.40	7.65	10.55	7.65	10.55
	Luwero	7.23	16.80	8.15	18.83	7.30	15.50
	Masaka	5.52	9.39	6.16	9.97	6.35	9.42
	Mpigi	4.48	7.41	4.18	8.90	4.39	10.25
	Mubende	8.30	12.60	9.41	12.37	8.26	13.40
	Mukono	3.74	6.99	4.26	7.66	4.88	7.35
	Nakasongola	13.42	7.47	11.40	12.27	13.42	12.44
	Rakai	6.76	9.09	6.98	10.40	6.98	10.39
	Sembabule	4.34	59.20	3.99	58.89	3.99	58.89
Eastern	Bugiri	4.12	4.08	3.20	6.89	3.60	6.25
	Busia	4.62	17.68	4.62	17.68	4.35	19.60
	Iganga	3.41	9.17	5.14	11.25	3.95	9.93
	Jinja	5.62	8.92	3.25	13.38	3.03	11.78
	Kamuli	5.73	7.02	13.15	13.15	8.11	7.37
	Kapchorwa	3.92	25.61	4.40	29.83	4.40	29.83
	Katakwi	7.54	7.23	9.18	13.55	7.65	8.95
	Kumi	5.25	5.58	6.50	6.64	6.50	6.45
	Mbale	3.77	19.79	4.71	23.51	4.79	23.53
	Pallisa	4.76	3.72	5.22	4.31	4.70	4.67
	Soroti	3.80	3.31	5.75	7.73	5.41	5.71
	Tororo	3.40	17.46	4.07	21.48	3.16	20.42
Northern	Adjumani	9.20	10.79	10.17	10.79	9.20	10.79
	Apac	5.42	14.92	5.92	14.76	5.92	13.18
	Arua	4.36	9.39	6.24	9.39	4.41	10.09
	Kotido	0.50	6.92	0.50	16.59	0.50	0.50
	Lira	6.75	8.98	6.72	9.61	8.47	9.81
	Moroto	17.50	18.40	18.92	20.36	21.50	3.00
	Moyo	15.64	5.35	15.64	5.35	15.64	5.35
	Bebbi	6.67	8.11	7.33	8.11	7.18	8.11
Western	Bushenyi	3.65	3.71	3.70	3.82	3.70	3.76
	Hoima	7.32	7.04	8.53	9.24	7.06	9.24
	Kabale	6.66	6.29	6.93	6.87	6.95	6.87
	Kabarole	5.07	4.88	5.07	4.74	5.14	4.95
	Kibaale	4.58	4.58	4.63	4.63	4.82	4.63
	Kisoro	4.67	2.75	7.54	5.67	5.75	5.75
	Masindi	7.63	15.85	10.18	18.85	7.87	18.48
	Mbarara	5.47	4.78	6.54	6.34	6.38	6.74
	Btungamo	4.66	3.43	5.96	3.45	5.96	3.45
	Rukungiri	4.43	5.59	7.33	5.59	3.9	5.71

Sources: Calculated by the authors form UNHS 1999/2000.
Note: n.a. indicates data were not available.

Appendix Table A5—Travel time to the closest market, 1999/2000 (minutes)

Region	District	Consumer Market		Input Market		Output market	
		Periodic	Most common	Periodic	Most common	Periodic	Most common
Central	Kalangala	141.67	139	141.67	175.83	50.00	170.00
	Kampala	15.00	15.22	n.a.	n.a.	n.a.	n.a.
	Kiboga	69.50	78.89	81.88	86.25	81.88	98.75
	Luwero	48.64	57.50	55.00	62.07	52.32	61.61
	Masaka	75.71	62.90	69.79	67.36	69.53	72.20
	Mpigi	43.31	43.98	51.00	51.91	46.95	56.03
	Mubende	70.68	75.71	77.58	79.85	68.75	79.85
	Mukono	48.33	56.89	52.33	53.45	55.54	60.52
	Nakasongola	65.00	75.00	61.88	75.00	65.00	76.88
	Rakai	66.25	53.75	78.08	62.69	103.46	62.69
	Sembabule	56.43	135.00	56.43	130.00	56.43	130.00
Eastern	Bugiri	56.00	51.67	38.33	62.86	36.67	75.00
	Busia	60.83	75.83	60.83	75.83	57.50	93.75
	Iganga	43.55	57.07	50.34	61.76	44.61	57.70
	Jinja	42.31	36.82	51.25	57.73	45.71	48.33
	Kamuli	58.97	59.69	76.73	70.89	66.96	56.55
	Kapchorwa	86.67	92.86	95.00	105.00	95.00	105.00
	Katakwi	59.17	50.83	64.09	79.09	62.00	67.27
	Kumi	45.42	47.08	56.50	57.27	56.50	55.46
	Mbale	46.36	72.25	51.51	73.90	52.64	74.36
	Pallisa	37.34	28.08	40.73	36.55	40.40	39.58
	Soroti	35.50	31.21	46.50	49.62	46.50	36.25
	Tororo	40.20	43.88	44.38	52.79	42.69	50.15
Northern	Adjumani	94.00	140.00	108.33	140.00	94.00	140.00
	Apac	82.66	119.23	92.50	127.90	83.13	116.94
	Arua	49.76	88.19	61.67	88.19	51.52	88.19
	Kotido	5.00	38.33	5.00	90.46	5.00	5.00
	Lira	62.11	97.56	65.88	103.78	67.88	103.33
	Moroto	122.69	124.09	132.50	135.00	135.00	15.00
	Moyo	76.88	57.50	76.88	57.50	76.88	57.50
	Bebbi	68.33	87.14	82.08	87.14	73.18	87.14
Western	Bushenyi	37.51	36.57	38.04	38.55	38.04	37.09
	Hoima	61.67	62.53	80.33	80.00	81.00	79.29
	Kabale	76.17	63.20	82.59	80.56	81.83	75.37
	Kabarole	60.72	59.94	62.03	60.87	62.01	57.81
	Kibaale	45.78	45.78	46.27	46.27	43.69	43.69
	Kisoro	58.46	31.60	85.00	70.83	70.83	70.83
	Masindi	61.67	61.33	68.46	68.21	80.00	68.57
	Mbarara	57.12	52.40	68.33	63.53	69.46	68.49
	Btungamo	30.00	14.29	36.92	21.36	36.92	21.36
	Rukungiri	50.95	56.36	49.52	56.36	49.05	58.33

Sources: Calculated by the authors form UNHS 1999/2000.
Note: n.a. indicates data were not available.

Appendix Table A6—Main road and railway network (kilometers)

Region	All weather tarmac	All weather murram, gravel	Dry weather feeder (dirt) road	Total roads	Railway Lines
CENTRAL	**1,009**	**2,404**	**4,136**	**7,549**	**293**
Kampala	126	81	5	212	23
Kiboga	0	104	182	286	0
Luwero	169	534	1,298	2,001	0
Masaka	149	151	526	826	19
Mpigi	275	746	575	1,596	76
Mubende	110	267	474	851	107
Mukono	147	441	773	1,361	68
Rakai	33	80	303	416	0
EASTERN	**565**	**2,337**	**2,288**	**5,190**	**535**
Iganga	103	371	570	1,044	111
Jinja	149	97	118	364	61
Kamuli	33	367	352	752	74
Kapchorwa	0	41	99	140	0
Kumi	75	231	167	473	72
Mbale	84	236	180	500	40
Pallisa	0	175	183	358	4
Soroti	36	674	373	1,083	72
Tororo	85	145	246	476	101
NOTHERN	**93**	**3,700**	**3,201**	**6,994**	**258**
Apac	35	519	308	862	51
Arua	1	503	680	1,184	0
Gulu	11	477	379	867	137
Kitgum	0	640	313	953	0
Kotido	0	362	372	734	0
Lira	46	365	404	815	70
Moroto	0	584	243	827	0
Moyo	0	172	156	328	0
Nebbi	0	78	346	424	0
WESTERN	**609**	**2,194**	**3,096**	**5,899**	**142**
Bundibugyo	0	106	19	125	0
Bushenyi	97	113	275	485	0
Hoima	10	135	250	395	0
Kabale	41	247	127	415	0
Kabarole	77	262	599	938	61
Kasese	93	107	127	327	38
Kibaale	0	47	375	422	0
Kisoro	0	46	105	151	0
Masindi	90	401	159	650	0
Mbarara	140	213	844	1,197	43
Ntungamo	61	86	133	280	0
Rukungiri	0	431	83	514	0
UGANDA TOTAL	**2,276**	**10,635**	**12,721**	**25,632**	**1,228**

Source: National Biomass Study, Forest Department, Uganda Railways, and Ministry of Works, Transport and Communication as cited in *Statistical Abstract 2001*, UBOS.

Appendix Table A7—Literacy rate by district, 1991 (percent)

Region/district	Rural	Urban	Average
Central			
Kalangala	71	82	72
Kampala	n.a.	88	88
Kiboga	54	79	55
Luwero	58	76	59
Masaka	60	82	62
Mpigi	71	87	73
Mubende	56	83	58
Mukono	59	78	61
Rakai	53	81	54
East			
Iganga	46	71	47
Jinja	61	83	67
Kamuli	40	69	41
Kapchorwa	54	68	54
Kumi	41	64	42
Mbale	54	72	56
Pallisa	47	62	47
Soroti	45	67	47
Tororo	50	70	53
West			
Bundibugyo	39	53	40
Bushenyi	54	77	55
Hoima	56	79	56
Kabale	50	71	51
Kabarole	48	75	49
Kasese	47	70	50
Kibaale	50	73	51
Kisoro	32	48	33
Masindi	50	83	52
Mbarara	51	82	53
Ntungamo	47	80	47
Rukungiri	56	76	57
North			
Apac	53	72	53
Arua	45	64	46
Gulu	46	71	49
Kitgum	38	67	39
Kotido	10	47	12
Lira	49	70	50
Moroto	8	54	11
Moyo	44	69	45
Nebbi	46	61	47

Source: UBOS 1991.
Note: n.a. indicates data were not available.

Appendix Table A8—Literacy rate by district, 1999/2000 (percent)

Region	District	Average	Female	Male
Central	Kalangala	81.72	81.29	82.21
	Kampala	93.50	90.13	97.28
	Kiboga	66.51	51.41	78.86
	Luwero	78.11	72.86	84.22
	Masaka	78.07	72.73	84.19
	Mpigi	83.01	79.07	87.12
	Mubende	65.64	58.30	73.64
	Mukono	73.78	64.56	84.16
	Nakasongola	70.03	63.88	77.01
	Rakai	69.98	61.13	79.02
	Sembabule	67.27	57.73	77.02
Eastern	Bugiri	65.30	52.13	81.02
	Busia	60.65	45.53	78.24
	Iganga	63.50	51.23	78.05
	Jinja	74.08	67.75	80.70
	Kamuli	60.12	47.79	74.30
	Kapchorwa	62.37	48.26	76.82
	Katakwi	48.03	31.52	69.93
	Kumi	58.65	45.52	75.97
	Mbale	65.47	53.56	77.90
	Pallisa	59.14	43.22	76.44
	Soroti	54.28	37.85	73.01
	Tororo	61.60	46.64	75.68
Northern	Adjumani	59.68	38.09	83.26
	Apac	69.16	49.41	90.29
	Arua	58.87	38.28	82.25
	Kotido	13.53	7.05	29.82
	Lira	61.13	36.26	87.86
	Moroto	12.59	7.070	22.16
	Moyo	57.04	36.79	80.65
	Bebbi	54.28	34.59	79.08
Western	Bushenyi	68.69	59.78	78.22
	Hoima	70.20	63.01	77.56
	Kabale	66.31	56.08	77.81
	Kabarole	67.29	56.42	79.59
	Kibaale	70.99	63.91	77.91
	Kisoro	56.49	38.97	74.85
	Masindi	61.45	49.10	74.05
	Mbarara	69.39	59.74	79.25
	Btungamo	69.70	62.52	77.94
	Rukungiri	76.33	66.08	86.74

Sources: Calculated by the authors form UNHS 1999/2000.

Applendix Table A9—Distance from center of local community to nearest public services (kilometers)

Region	District	School	Clinic	Post office
Central	Kalangala	2.17	2.00	7.90
	Kampala	0.69	2.94	2.61
	Kiboga	1.23	12.25	27.39
	Luwero	0.88	5.41	7.86
	Masaka	1.30	3.74	8.75
	Mpigi	1.19	2.93	7.57
	Mubende	1.93	5.40	14.21
	Mukono	1.35	3.43	9.43
	Nakasongola	n.a.	6.00	24.69
	Rakai	1.58	5.88	7.15
	Sembabule	1.31	5.75	28.16
Eastern	Bugiri	n.a.	2.50	13.29
	Busia	n.a.	5.88	9.08
	Iganga	1.75	3.24	9.37
	Jinja	1.47	1.55	5.72
	Kamuli	1.65	3.83	12.53
	Kapchorwa	0.75	1.63	22.38
	Katakwi	1.73	2.80	20.27
	Kumi	0.35	4.00	9.71
	Mbale	1.40	2.47	9.73
	Pallisa	1.08	4.12	12.69
	Soroti	1.56	4.95	9.87
	Tororo	0.79	2.00	11.30
Northern	Adjumani	1.00	7.40	11.65
	Apac	2.37	6.83	25.17
	Arua	1.33	7.16	14.79
	Kotido	1.28	2.21	46.92
	Lira	1.54	3.29	38.79
	Moroto	1.60	5.71	38.71
	Moyo	0.56	2.90	21.20
	Bebbi	1.57	5.25	8.44
Western	Bushenyi	0.99	4.13	11.12
	Hoima	0.83	2.53	9.78
	Kabale	1.64	4.79	21.73
	Kabarole	2.45	5.58	15.15
	Kibaale	1.50	8.53	10.97
	Kisoro	2.14	4.20	10.05
	Masindi	1.81	4.34	10.91
	Mbarara	1.45	6.81	20.50
	Btungamo	1.33	4.61	12.71
	Rukungiri	1.04	3.93	10.15

Sources: Calculated by the authors from UNHS 1999/2000.

Appendix Table A10—Percentage of villages with access to electricity

Region	District	Percentage	Region	District	Percentage
Central	Kalangala	n.a.	Northern	Adjumani	13
	Kampala	73		Apac	3
	Kiboga	8		Arua	7
	Luwero	9		Kotido	n.a.
	Masaka	15		Lira	9
	Mpigi	35		Moroto	7
	Mubende	8		Moyo	9
	Mukono	27		Bebbi	4
	Nakasongola	3			
	Rakai	14	Western	Bushenyi	5
	Sembabule	0		Hoima	13
				Kabale	9
Eastern	Bugiri	10		Kabarole	10
	Busia	6		Kibaale	n.a.
	Iganga	14		Kisoro	9
	Jinja	45		Masindi	20
	Kamuli	9		Mbarara	15
	Kapchorwa	19		Btungamo	14
	Katakwi	n.a.		Rukungiri	1
	Kumi	10			
	Mbale	26			
	Pallisa	4			
	Soroti	17			
	Tororo	10			

Sources: Calculated by authors from UMHS 1999/2000.
Note: n.a. indicates data were not available.

Appendix Table A11: Fertilizer use by district, 1999/2000 (shillings/acre)

Region	District	Average Manure	Average Fertilizer	% of household using manure	% of household using fertilizer
Central	Kalangala	412.4	n.a.	2.1	n.a.
	Kampala	n.a.	n.a.	n.a.	n.a.
	Kiboga	32.1	n.a.	1.6	n.a.
	Luwero	567.2	55.4	8.6	1.2
	Masaka	2,748.5	270.6	14.0	2.8
	Mpigi	3,181.3	509.0	16.0	4.6
	Mubende	1,619.4	219.4	7.5	1.0
	Mukono	1,941.4	576.3	11.0	4.2
	Nakasongola	n.a.	n.a.	n.a.	n.a.
	Rakai	1,522.1	12.5	9.3	1.3
	Sembabule	2,809.8	84.5	10.9	1.6
Eastern	Bugiri	n.a.	771.1	n.a.	2.3
	Busia	n.a.	n.a.	n.a.	n.a.
	Iganga	53.5	64.9	2.4	1.0
	Jinja	45.5	35.0	2.3	1.8
	Kamuli	18.4	32.5	1.1	0.9
	Kapchorwa	341.5	1,898.2	4.4	7.4
	Katakwi	n.a.	n.a.	n.a.	n.a.
	Kumi	182.3	n.a.	1.4	0.0
	Mbale	72.4	730.7	2.9	7.6
	Pallisa	n.a.	n.a.	n.a.	n.a.
	Soroti	26.7	n.a.	0.6	n.a.
	Tororo	25.2	77.7	1.3	2.1
Northern	Adjumani	25.0	n.a.	1.8	n.a.
	Apac	22.5	19.8	0.5	0.7
	Arua	40.2	3,142.3	0.9	21.6
	Kotido	n.a.	n.a.	n.a.	n.a.
	Lira	n.a.	7.5	n.a.	0.3
	Moroto	n.a.	n.a.	n.a.	n.a.
	Moyo	n.a.	n.a.	n.a.	n.a.
	Bebbi	n.a.	2.0	n.a.	0.1
Western	Bushenyi	1,198.1	88.1	4.5	0.8
	Hoima	166.7	242.1	4.2	2.6
	Kabale	346.8	126.9	6.1	2.8
	Kabarole	100.9	45.3	3.7	2.1
	Kibaale	59.8	n.a.	0.6	n.a.
	Kisoro	9.3	n.a.	1.4	n.a.
	Masindi	213.1	108.7	1.1	0.8
	Mbarara	340.8	149.5	6.0	1.0
	Btungamo	1,145.9	n.a.	14.9	n.a.
	Rukungiri	401.3	632.7	8.9	1.1

Source: Ugandan National Household Survey 1999/2000: Crop Survey. UBOS.
n.a.: data missing.

Appendix Table A12: Land area by district, 1999/2000 (acres)

Region	District	1st season	2nd season	Total
Central	Kalangala	2,285	2,210	4,494
	Kampala	2,818	2,790	5,609
	Kiboga	101,355	97,805	199,160
	Luwero	190,990	175,834	366,824
	Masaka	244,672	246,499	491,171
	Mpigi	344,222	343,058	687,280
	Mubende	227,299	227,519	454,818
	Mukono	262,363	268,693	531,056
	Nakasongola	44,830	43,791	88,621
	Rakai	149,010	154,475	303,485
	Sembabule	51,811	52,368	104,179
Eastern	Bugiri	103,196	86,452	189,648
	Busia	72,959	57,910	130,869
	Iganga	264,441	223,475	487,916
	Jinja	62,948	51,092	114,040
	Kamuli	167,934	137,419	305,353
	Kapchorwa	40,737	33,114	73,851
	Katakwi	n.a.	n.a.	n.a.
	Kumi	199,314	128,209	327,523
	Mbale	251,934	221,869	473,803
	Pallisa	221,303	40,158	261,461
	Soroti	181,365	17,305	198,669
	Tororo	181,685	140,450	322,135
Northern	Adjumani	19,117	22,122	41,240
	Apac	232,705	232,024	464,729
	Arua	186,794	187,183	373,978
	Kotido	35,593	0	35,593
	Lira	301,982	189,304	491,286
	Moroto	n.a.	n.a.	n.a.
	Moyo	25,364	33,344	58,708
	Bebbi	183,357	183,977	367,333
Western	Bushenyi	227,888	55,134	283,022
	Hoima	108,410	23,696	132,107
	Kabale	140,655	682	141,337
	Kabarole	491,713	261,009	752,723
	Kibaale	129,720	7,756	137,476
	Kisoro	n.a.	n.a.	n.a.
	Masindi	99,860	26,145	126,005
	Mbarara	290,176	106,679	396,855
	Btungamo	112,180	15,002	127,182
	Rukungiri	135,759	132,533	268,292

Source: Ugandan National Household Survey 1999/2000: Crop Survey. UBOS.
n.a.: not available.

Appendix Table A13—Health status by district, 1999/2000

Region	District	Percentage of falling sick during the past 30 days			Days lost due to illness		
		Total	Female	Male	Total	Female	Male
Central	Kalangala	28.53	35.15	20.75	2.41	3.02	1.68
	Kampala	26.76	28.20	25.28	1.79	2.12	1.46
	Kiboga	26.49	23.87	28.36	2.34	1.91	2.65
	Luwero	21.47	22.85	20.18	1.85	2.20	1.52
	Masaka	17.21	18.64	15.69	1.48	1.57	1.40
	Mpigi	22.01	22.5	21.53	1.84	1.82	1.87
	Mubende	24.73	25.97	23.43	2.39	2.43	2.35
	Mukono	25.19	26.80	23.58	2.21	2.43	1.99
	Nakasongola	21.41	19.85	22.89	1.62	1.47	1.77
	Rakai	16.76	18.47	15.12	1.72	1.81	1.63
	Sembabule	15.87	20.01	12.45	1.42	1.82	1.08
Eastern	Bugiri	37.19	38.29	36.10	2.54	2.91	2.17
	Busia	40.52	45.76	34.72	2.44	2.72	2.13
	Iganga	42.43	44.82	39.78	2.76	2.97	2.53
	Jinja	31.80	32.84	30.73	1.76	1.84	1.67
	Kamuli	45.58	48.87	42.07	3.16	3.32	3.00
	Kapchorwa	20.76	25.35	16.14	1.51	1.69	1.32
	Katakwi	31.52	35.19	27.87	2.56	2.90	2.22
	Kumi	32.35	33.38	31.26	2.56	2.77	2.34
	Mbale	36.59	38.84	34.36	2.87	3.10	2.64
	Pallisa	30.57	32.65	28.48	2.25	2.53	1.96
	Soroti	33.26	39.19	26.90	2.74	3.63	1.79
	Tororo	34.30	37.86	30.82	2.87	3.18	2.56
Northern	Adjumani	21.73	26.17	16.43	1.71	2.11	1.23
	Apac	32.35	31.73	32.99	2.95	3.09	2.82
	Arua	25.53	26.64	24.36	2.22	2.28	2.16
	Kotido	19.34	19.48	19.15	1.44	1.62	1.20
	Lira	30.90	33.46	28.49	2.97	3.29	2.67
	Moroto	17.19	21.19	12.63	1.10	1.36	0.79
	Moyo	31.01	34.78	26.59	2.66	2.87	2.42
	Bebbi	29.68	34.93	23.86	2.48	3.04	1.86
Western	Bushenyi	26.22	27.98	24.43	2.82	3.02	2.61
	Hoima	27.02	29.36	24.90	2.13	2.22	2.04
	Kabale	15.04	16.34	13.66	1.61	1.69	1.54
	Kabarole	30.81	33.78	27.71	2.84	3.08	2.59
	Kibaale	30.48	32.07	28.98	2.93	3.08	2.80
	Kisoro	13.52	14.58	12.44	1.63	1.63	1.63
	Masindi	23.59	23.68	23.51	1.97	2.08	1.87
	Mbarara	18.55	20.45	16.60	1.80	2.00	1.61
	Btungamo	26.72	29.75	23.60	2.77	3.14	2.39
	Rukungiri	24.63	26.41	22.77	2.52	2.82	2.21

Sources: Calculated by the authors from UNHS 1999/2000.

Appendix Table A14—District development budget estimates, 2001/02 (thousand Ugandan Shillings)

Region	District	Rural water	LGDP	PHC dev't.	Dutch grant	SFG	Total
Central	Kalangala	163,700	230,673	234,000	0	428,535	1,056,908
	Kampala	0	2,854,868	182,335	0	857,071	3,894,274
	Kayunka	358,000	0	100,363	0	1,028,485	1,486,848
	Kiboga	262,000	371,353	311,387	0	1,542,727	2,507,467
	Luwero	555,200	811,712	403,832	0	857,071	2,627,815
	Masaka	745,500	1,274,577	270,504	0	685,565	2,976,236
	Mpigi	440,300	751,862	220,142	0	1,028,485	2,440,789
	Mubende	592,100	1,169,912	174,505	0	599,950	2,536,467
	Mukono	578,600	0	185,726	0	1,028,485	1,792,811
	Nakasongola	433,500	315,515	166,652	0	857,071	1,772,739
	Rakai	638,200	0	170,142	0	857,071	1,665,413
	Sembabule	410,400	334,235	164,000	0	1,028,485	1,937,119
	Wakiso	598,100	1,020,641	296,647	0	857,071	2,772,458
Eastern	Bugiri	342,700	595,197	242,298	0	1,371,314	2,551,509
	Busia	258,000	427,267	224,069	0	857,071	1,766,407
	Iganga	300,000	495,614	209,772	0	1,542,727	2,548,114
	Jinja	289,000	0	180,368	0	857,071	1,326,439
	Kagermaido	310,300	0	47,999	0	857,071	1,215,370
	Kamuli	583,300	1,052,454	559,899	0	857,071	3,052,724
	Kapchorwa	270,400	275,160	193,495	0	599,950	1,339,005
	Katakwi	549,300	513,730	64,000	1,156,793	685,656	2,969,480
	Kumi	542,800	0	112,529	0	857,071	1,512,400
	Mayuge	235,000	414,182	132,193	0	1,371,314	2,152,689
	Mbale	240,000	907,131	206,915	0	1,714,142	3,068,188
	Pallisa	303,200	734,476	274,404	0	857,071	2,169,150
	Sironko	235,000	418,135	208,101	0	1,371,314	2,232,550
	Soroti	494,000	0	135,570	2,318,967	1,028,485	3,977,022
	Tororo	250,000	768,967	209,376	0	1,028,485	2,256,827
Northern	Adjumani	324,400	225,117	91,998	478,859	599,950	1,720,324
	Apac	766,100	976,648	209,225	0	1,028,485	2,980,457
	Arua	739,000	0	284,347	2,318,967	760,782	4,103,096
	Gulu	489,600	875,441	287,634	2,636,414	685,656	2,338,331
	Kitgum	351,200	345,206	67,286	0	857,071	1,620,763
	Kotido	317,200	0	203,473	0	771,363	1,292,037
	Lira	702,300	0	308,253	0	857,071	4,504,037
	Moroto	284,300	701,988	133,956	0	780,690	1,900,934
	Moyo	357,700	224,857	192,975	425,053	599,950	1,800,535
	Nakapiripirit	310,800	0	101,956	0	247,777	660,533
	Nebbi	489,600	798,523	173,937	1,554,946	771,363	3,788,369
	Pader	405,400	283,355	109,725	0	857,071	1,655,551
	Yumbe	287,100	0	82,733	0	267,684	637,518
Western	Bundibugyo	428,900	327,718	486,444	0	1,028,485	2,271,546
	Bushenyi	817,900	1,312,719	268,909	0	857,071	3,256,599
	Hoima	444,400	0	154,000	0	857,071	1,455,471
	Kabale	501,500	0	169,970	0	1,285,604	1,957,074
	Kabarole	425,900	561,419	234,000	0	1,028,485	2,249,804
	Kamwenge	335,200	413,677	82,000	0	1,199,899	2,030,776
	Kanungu	323,700	0	96,344	0	325,223	745,267
	Kasese	304,400	0	190,236	0	857,071	1,351,707
	Kibaale	301,800	0	167,711	0	857,071	1,326,582
	Kisoro	491,400	0	144,798	0	857,071	1,493,269
	Kyenjojo	392,800	502,322	82,000	0	1,714,142	2,691,264
	Masindi	499,200	720,857	206,930	0	857,071	2,284,058
	Mbarara	1,073,900	1,642,003	178,770	0	599,950	3,494,623
	Ntungamo	535,100	567,123	223,157	0	857,071	2,182,452
	Rukungiri	370,600	889,616	146,000	0	531,832	1,938,049

Source: UMOF 2001/02.
Note: LGDP=Local Government Development Program; PHC=Primary Health Care; SFG=School Facilities Grant

Appendix Table A15—Fiscal transfers to local governments for primary education, 1993/94–1997/98 (thousand Ugandan shillings)

Region	District	1993/94	1994/95	1995/96	1996/97[a]	1997/98[a]
Central	Kalangala	0	0	8,283	13,751	9,453
	Kampala	0	243,168	0	650,282	446,435
	Kiboga	0	0	56,644	118,935	107,513
	Luwero	0	245,875	0	377,694	326,198
	Masaka	266,895	0	0	704,452	560,084
	Mpigi	419,882	0	0	767,554	654,776
	Mubende	0	240,500	0	420,768	323,731
	Mukono	312,839	0	0	692,583	660,061
	Nakasongola	0	0	0	0	90,649
	Rakai	212,304	0	0	322,101	347,710
	Sembabule	0	0	0	0	105,156
Eastern	Bugiri	0	0	0	0	140,138
	Busia	0	0	0	0	129,679
	Iganga	0	350,938	0	794,361	600,590
	Jinja	164,835	0	0	243,130	208,181
	Kamuli	0	0	263,658	407,530	374,284
	Kapchorwa	0	0	101,531	98,018	93,078
	Katawi	0	0	0	0	208,932
	Kumi	0	0	183,321	198,799	231,192
	Mbale	425,389	0	0	597,150	657,766
	Pallisa	0	0	186,426	300,394	294,200
	Soroti	0	421,980	0	361,483	370,380
	Tororo	259,902	0	0	466,625	375,216
Northern	Adjumani	0	0	0	0	57,434
	Apac	0	316,045	0	381,737	416,882
	Arua	43,295	0	0	535,805	769,272
	Gulu	193,893	0	0	284,245	328,406
	Kitgum	0	319,242	0	299,998	373,672
	Kotido	0	0	94,489	164,625	77,867
	Lira	278,524	0	0	420,759	458,236
	Moroto	0	0	0	146,492	29,716
	Moyo	0	71,788	0	147,524	53,370
	Nebbi	0	191,927	0	266,135	327,696
Western	Bundibugyo	0	0	68,830	97,903	103,083
	Bushenyi	0	423,622	0	483,896	530,174
	Hoima	0	131,968	0	166,175	152,872
	Kabale	293,397	0	0	350,420	362,464
	Kabarole	268,325	0	0	627,234	487,242
	Kasese	0	175,860	0	288,590	293,095
	Kibale	0	0	187,115	184,997	198,751
	Kisoro	0	0	0	156,793	140,593
	Masindi	0	0	153,405	219,042	285,681
	Mbarara	438,427	0	0	670,888	667,399
	Ntungamo	0	0	143,673	242,917	243,933
	Rukungiri	0	228,671	0	328,215	326,760

Source: Decentralization Secretariat, various years.
[a] Budget estimates.

Appendix Table A16—Fiscal transfers to local governments for secondary education through capitation grants, 1993/04–1997/98 (thousand Ugandan shillings)[a]

Region	District	1993/94	1994/95	1995/96	1996/97[b]	1997/98[b]
Central	Kalangala	0	0	1,236	13,751	9,453
	Kampala	0	364,897	407,368	650,282	446,435
	Kiboga	0	0	14,911	118,935	107,513
	Luwero	0	86,321	96,367	377,694	326,198
	Masaka	152,348	104,452	116,609	704,452	560,084
	Mpigi	151,378	217,721	243,061	767,554	654,776
	Mubende	0	62,494	69,767	420,768	323,731
	Mukono	144,228	181,505	202,630	692,583	660,061
	Nakasongola	0	0	0	0	90,649
	Rakai	78,850	66,223	73,931	322,101	347,710
	Sembabule	0	0	0	0	105,156
Eastern	Bugiri	0	0	0	0	140,138
	Busia	0	0	0	0	129,679
	Iganga	0	136,597	152,495	794,361	600,590
	Jinja	120,105	95,902	107,063	243,130	208,181
	Kamuli	0	0	54,855	407,530	374,284
	Kapchorwa	0	0	38,882	98,018	93,078
	Katawi	0	0	0	0	208,932
	Kumi	0	0	28,220	198,799	231,192
	Mbale	160,899	243,780	272,153	597,150	657,766
	Pallisa	0	0	97,833	300,394	294,200
	Soroti	0	83,840	93,598	361,483	370,380
	Tororo	89,394	226,522	252,886	466,625	375,216
Northern	Adjumani	0	0	0	0	57,434
	Apac	0	98,944	110,460	381,737	416,882
	Arua	124,128	110,725	123,612	535,805	769,272
	Gulu	75,091	82,872	92,517	284,245	328,406
	Kitgum	0	23,141	25,834	299,998	373,672
	Kotido	0	0	17,211	164,625	77,867
	Lira	104,088	154,837	172,859	420,759	458,236
	Moroto	0	0	14,005	146,492	29,716
	Moyo	0	22,704	25,346	147,524	53,370
	Nebbi	0	39,088	43,637	266,135	327,696
Western	Bundibugyo	0	0	24,736	97,903	103,083
	Bushenyi	0	20,597	108,265	483,896	530,174
	Hoima	0	49,355	55,100	166,175	152,872
	Kabale	138,871	109,571	122,323	350,420	362,464
	Kabarole	103,224	142,292	158,853	627,234	487,242
	Kasese	0	48,481	54,124	288,590	293,095
	Kibale	0	0	29,266	184,997	198,751
	Kisoro	0	63,508	70,899	156,793	140,593
	Masindi	0	0	53,078	219,042	285,681
	Mbarara	149,002	177,697	191,655	670,888	667,399
	Ntungamo	0	0	52,434	242,917	243,933
	Rukungiri	0	105,373	117638	328,215	326,760

Source: Decentralization Secretariat, various years.

[a]The UPE "capitation" grant is intended to provide the facilities and resources necessary for school-aged children to complete primary education, including improving equitable access by removing the burden of school fees from parents.

[b]Budget estimates.

Appendix Table A17—Fiscal transfers to local governments for health, 1993–1997/98 (thousand Ugandan shillings)

Region	District	1993/94	1994/95	1995/96	1996/97[a]	1997/98[b]
Central	Kalangala	0	0	6,409	51,608	64,585
	Kampala	0	885,991	0	0	69,516
	Kiboga	0	0	170,606	156,024	167,185
	Luwero	0	404,509	283,212	244,893	184,972
	Masaka	811,077	798,333	659,350	677,223	593,405
	Mpigi	849,910	848,664	609,158	525,294	457,401
	Mubende	0	450,642	420,460	374,508	352,741
	Mukono	767,832	765,770	537,149	466,215	300,000
	Nakasongola	0	0	0	0	73,028
	Rakai	274,478	356,139	210,236	175,556	337,600
	Sembabule	0	0	0	0	72,183
Eastern	Bugiri	0	0	0	0	170,444
	Busia	0	0	0	0	75,882
	Iganga	0	850,757	584,591	504,415	213,955
	Jinja	630,151	315,721	719,551	909,927	1,086,696
	Kamuli	0	0	189,964	152,959	160,397
	Kapchorwa	0	0	152,845	150,959	162,670
	Katawi	0	0	0	0	77,815
	Kumi	0	0	199,822	177,749	236,777
	Mbale	817,255	713,713	843,078	1,101,540	1,047,239
	Pallisa	0	0	247,180	215,881	182,972
	Soroti	0	406,587	460,428	671,112	580,927
	Tororo	551,603	515,935	457,857	408,220	365,350
Northern	Adjumani	0	0	0	0	99,461
	Apac	0	408,839	285,099	246,411	199,290
	Arua	916,103	621,585	722,202	837,581	896,869
	Gulu	558,664	343,441	509,814	743,936	798,266
	Kitgum	0	321,297	327,102	298,239	366,928
	Kotido	0	0	391,183	371,189	424,322
	Lira	469,525	494,382	505,344	464,357	497,699
	Moroto	0	0	195,467	178,743	308,952
	Moyo	0	157,997	233,012	210,070	204,749
	Nebbi	0	285,029	231,210	203,022	291,476
Western	Bundibugyo	0	0	156,797	155,029	169,677
	Bushenyi	0	662,377	333,891	284,755	240,369
	Hoima	0	177,972	209,469	321,534	273,710
	Kabale	540,130	416,610	422,491	537,073	482,065
	Kabarole	548,955	722,677	551,523	597,303	568,124
	Kasese	0	309,078	251,691	221,763	354,130
	Kibale	0	0	193,389	175,563	186,348
	Kisoro	0	167,924	208,280	190,860	197,237
	Masindi	0	0	366,482	340,046	386,074
	Mbarara	996,416	864,363	727,303	354,939	355,261
	Ntungamo	0	0	113,231	91,174	87,897
	Rukungiri	0	351,517	260,149	226,323	211,462

Source: Decentralization Secretariat, various years.
[a]Budget Estimates, including district hospital services, referral hospitals and health training schools.
[b]Budget estimates, including district hospital services, referral hospitals, NGO hospitals, and health training schools.

Appendix Table A18—Fiscal transfers to local governments for feeder road maintenance, 1993/94–1997/98 (thousand Ugandan shillings)

Region	District	1993/94	1994/95	1995/96	1996/97[a]	1997/98[a]
Central	Kalangala	0	0	22,880	23,823	24,261
	Kiboga	0	0	40,968	49,751	50,665
	Luwero	0	69,116	0	140,789	58,938
	Masaka	80,542	0	0	232,523	157,139
	Mpigi	152,673	0	0	237,312	241,671
	Mubende	0	56,454	0	149,438	152,183
	Mukono	96,769	0	0	239,714	244,117
	Nakasongola	0	0	0	0	84,437
	Rakai	0	0	0	114,932	117,043
	Sembabule	0	0	0	0	79,655
Eastern	Bugiri	0	0	0	0	128,802
	Busia	0	0	0	0	51,817
	Iganga	0	83,018	0	290,939	167,481
	Jinja	22,560	0	0	73,392	74,740
	Kamuli	0	0	54,758	140,428	143,007
	Kapchorwa	0	0	35,929	33,550	34,166
	Katawi	0	0			70,734
	Kumi	0	0	38,924	71,208	72,516
	Mbale	30,970	0		206,255	210,043
	Pallisa	0	0	46,360	103,243	105,139
	Soroti	0	53,865	0	136,634	68,410
	Tororo	29,684	0	0	167,478	118,738
Northern	Adjumani	0	0	0	0	37,681
	Apac	0	59,394	0	135,275	137,760
	Arua	84,698	0	0	202,170	205,883
	Gulu	40,271	0	0	135,513	138,002
	Kitgum	0	47,858	0	148,582	151,311
	Kotido	0	0	37,041	86,719	88,312
	Lira	65,799	0	0	156,259	159,129
	Moroto	0	0	46,058	82,470	83,985
	Moyo	0	39,037	0	62,852	26,326
	Nebbi	0	48,061	0	99,072	100,892
Western	Bundibugyo	0	0	39,540	40,545	41,290
	Bushenyi	0	65,145	0	166,839	169,903
	Hoima	0	38,203	0	60,276	61,383
	Kabale	31,762	0	0	115,200	117,316
	Kabarole	75,397	0	0	234,066	238,365
	Kasese	0	44,322	0	94,532	96,268
	Kibale	0	0	48,759	69,862	71,145
	Kisoro	0	36,473	0	49,304	50,210
	Masindi	0	0	46,460	90,249	91,907
	Mbarara	98,946	0	0	260,073	264,850
	Ntungamo	0	0	51,751	85,098	86,661
	Rukungiri	0	61,656	0	113,635	115,722

Source: Decentralization Secretariat, various years.
[a] Budget Estimates.