# A SOCIAL ACCOUNTING MATRIX FOR NIGER: METHODOLOGY AND RESULTS

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<sup>\*</sup> The authors wish to thank the Direction d'Analyse Economique et Planification of Niger's Ministère du Plan for their support of this work. Special thanks are due to Patrick Augeraud and François Bigaud for their invaluable help in the interpretation and analysis of data.

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CFNPP is funded by several donors including the Agency for International Development, the World Bank, UNICEF, the Pew Memorial Trust, the Rockefeller and Ford Foundations, The Carnegie Corporation, The Thrasher Research Fund, and individual country governments.

Preparation of this document was financed by the U.S. Agency for International Development under USAID Cooperative Agreement AFR-000-A-0-8045-00.

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ISBN 1-56401-118-6

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This document was word processed by Diane Retson. The manuscript was edited by Elizabeth Mercado. The text was formatted by Gaudencio Dizon. The cover was produced by Jake Smith.

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## ABBREVIATIONS

AGRHYMET	Agriculture, Hydrology, and Meteorology Regional Center
BCEAO	Banque Centrale des Etats de l'Afrique de l'Ouest
CGE	Computable General Equilibrium
CFAF	CFA Franc
ECFE	Enquête sur la Consommation des Produits Essentiels à Niamey
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
ROW	Rest of the World
SAM	Social Accounting Matrix
TEE	Tableau Economique d'Ensemble
TES	Tableau Entrée-Sortie
TOF	Tableau des Operations Financières

## FOREWORD

The Social Accounting Matrix (SAM) for Niger presented in this working paper is the third in a series that is being done by the Cornell Food and Nutrition Policy Program (CFNPP) for countries in sub-Saharan Africa. As in the preceding SAMs for Cameroon (Working Paper 4) and Madagascar (Working Paper 6), this paper by Paul A. Dorosh and B. Essama Nssah comprises the internally consistent data set that details the relationships among production, factor payments, employment, and the distribution of income. It is prepared from a combination of national and sectoral accounts, and household-level data wherever possible.

The importance of the SAM in delineating the key flows in the economy, and how they affect the household groups according to a classification of the functional distribution of income, is that it will serve as the basis for future modeling of the counterfactual that is required in order to answer the critical question of how alternative policies will affect both growth and poverty. In particular, like the SAMs for Cameroon and Madagascar, the extensive labor required to construct the SAM for Niger was necessary in order to have an appropriate data set to serve as the basis for preparing a computable general equilibrium model (CGE). The CGE for Niger that will be presented in future CFNPP publications will map policy options into the SAM-based framework that relates macroeconomic policy changes to growth and income distribution.

It is worth noting that this work for Niger builds upon a number of other CFNPP publications. First, this effort to formally model the economy represents the second phase of CFNPP's work in Niger. It follows the first phase that involved a review of the evolution of Niger's economic crisis during the early 1980s, and the nature of the response to the years of adjustment. This work is found in CFNPP Monograph 11 by Cathy Jabara. Furthermore, the SAM discussed in this paper and the CGE that will follow are part of CFNPP's larger, multicountry effort to examine the impact of economic reforms on growth and household-level outcomes in sub-Saharan Africa. The conceptual framework for the research is found in CFNPP Monograph 1 by Grant Scobie, and the details of a prototype CGE model, which is being adopted for many of the countries in the research program, are found in CFNPP Monograph 5 by Alexander Sarris. This entire effort is funded under a Cooperative Agreement with the Africa Bureau of the United States Agency for International Development (AID).

Washington, DC December 1991 David E. Sahn Deputy Director, CFNPP

## 1. AN INTRODUCTION TO SOCIAL ACCOUNTING MATRICES (SAMS)

At the heart of national income accounting and any economywide model lies the concept of the circular flow of product and income. Firms receive payment from households for goods and services produced using intermediate inputs and factors of production (labor and capital). Payments to labor and capital, in turn, comprise the incomes of households and other owners of factors of production. Thus, apart from adjustments made for foreign trade and other transactions with the "rest of world," the total value added in an economy, i.e., the total value of goods and services produced less the value of intermediate inputs, is equal to the total income of owners of factors of production.

National accounting is essentially a statistical description of economic activity at an *aggregate* level. The importance of the activity in the economy largely determines the extent of disaggregation of productive activities into approximately homogeneous sectors. National income accounts provide a database for the analysis of macroeconomic issues relating to sectoral output and employment, national income, and foreign trade. However, to examine the relationships among production, employment, and income distribution among various household groups, a more disaggregated set of accounts called a social accounting matrix (SAM) is needed (Decoster 1982; Hayden and Round 1982).

### THE STRUCTURE OF A SAM

A SAM describes the circular flow of income and products in matrix form. Incomings (receipts) into each account are recorded in the row representing the account; outgoings (payments) are shown in the corresponding column. Each account in the SAM must balance: that is, row sums must equal corresponding column sums. Moreover, since each cell in the matrix represents the receipt of the row account and the payment of the column account, construction of a SAM enforces consistency across all accounts. These "tight bookkeeping constraints" in a SAM are particularly useful in the construction of computable general equilibrium models since they ensure that the data is consistent with the national income and input-output accounting (Taylor 1990).

The structure of a SAM and its level of disaggregation depend on the analytical objective of the exercise and on the availability of data. In general, though, a number of basic accounts are common to all SAMs.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> What follows is a brief discussion of the basic SAM accounts. A more detailed treatment is found in the overview of the Niger SAM in Section 2.

The production accounts depict the supply side of the economy: intermediate inputs and payments to factors of production are shown as expenditures of activities (productive sectors), and the values of the outputs are shown as receipts. In some SAMs separate commodity accounts are included. For these accounts the output of activities are the expenditures on commodities. Sales of commodities for use as final demand or as intermediate inputs into production are the receipts.

The factor accounts show the distribution of value added — that is, payments from activities accounts to factors of production, and the mapping from factor income columns to institution rows. Depending on data availability and the policy issues to be addressed, the major factors — capital, labor, and land — may be further disaggregated, e.g., into formal and informal sector capital, skilled and unskilled labor, or irrigated and unirrigated land.

The current accounts of institutions describe the incomes and current expenditures of the main institutions that engage in economic activity: households, enterprises, financial institutions, public sector institutions, and the rest of the world (ROW). Households are more often disaggregated since household current expenditures are of major interest in analyzing distributional impacts of macroeconomic policies and performances. Exports of the country are shown as current expenditures of the rest of the world; imports of the country are receipts for the rest of the world.

The capital accounts show the basic savings and investment flows within the economy and the means by which institutions, through changes in financial assets and liabilities, participate in the intermediation between savings and investment.

#### SAMS IN SUB-SAHARAN AFRICA

Construction of a SAM requires a substantial amount of both macroeconomic and microeconomic data. National accounts statistics and an input-output table are needed to construct the accounts for production activities and to set the levels of various macroeconomic aggregates. A *Tableau Economique d'Ensemble* (TEE), or Comprehensive Economic Table (included as part of the national accounts in the French system of national accounting), if available, facilitates the estimation of transfers and other payments between institutions.<sup>2</sup> Scattered microlevel data can be found from a number of sources, but some information from household budget surveys on the sources of revenue and expenditure patterns of households, and from labor force or population surveys, is essential for disaggregation of factors of production and households. Where national data are unavailable, plausible estimates based on data from similar countries and the judgments of those constructing the SAM are the only alternative. In addition to the problems of data gaps, inconsistencies between data sources arise.

 $<sup>^2</sup>$  A TEE is essentially a SAM without disaggregation into factor and household groups.

Despite the formidable data requirements and problems outlined above, a number of SAMs have been constructed in recent years for countries in sub-Saharan Africa, including Botswana (Hayden 1981; Greenfield 1985), Kenya (cited in Hayden and Round 1982), Côte d'Ivoire (Michel and Noël 1984), and Swaziland (Webster 1985). These SAMs have been used for the analysis of the effects on poor households in Botswana of lower beef export prices, the implications of the Swaziland government's employment policies, and the effects of trade policies on various household groups in Côte d'Ivoire, among other purposes.

As part of the Cornell Food and Nutrition Policy Program's research, SAMs have also been constructed for Cameroon (Gauthier and Kyle 1991) and Madagascar (Dorosh et al. 1991). The social accounting matrix for Niger, like the aforementioned two SAMs, is designed as a database for a computable general equilibrium model used to analyze the effects of structural adjustment policies on lower income groups.

### PLAN OF THE PAPER

Section 2 presents an overview of the Niger SAM and describes the rationale behind the structure chosen. Section 3 describes in detail the methodology used to estimate the sizes of the various household groups and the size of the labor force. Section 4 describes production and income flows, based on Niger's National Accounts, as well as various adjustments in the trade accounts. Section 5 outlines the methodology used for estimating expenditures of the various household groups. Finally, Section 6 presents some major results from the SAM and highlights the main data problems and uncertainties. Appendix A consists of an analysis of the production linkages in Niger's economy reflected in the 1987 Input-Output Table used in the SAM, and the earlier 1981 Input-Output Table.

## 2. OVERVIEW OF THE NIGER SAM

The economy of Niger, a low-income, landlocked nation in the west African Sahelian region, is characterized by large agriculture and livestock sectors, a small industrial base, and a heavy reliance on uranium exports for foreign exchange earnings. The Niger SAM is designed to reflect this structure, given the availability of data and the ultimate use of the SAM as a database for a general equilibrium model to analyze the effects of macroeconomic policies on low-income household groups.<sup>3</sup>

#### PRODUCTION ACTIVITIES

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The set of input-output accounts for Niger published in July 1990 by the Ministère du Plan organized production activities into 28 subsectors: 3 primary subsectors (agriculture, livestock, and forestry and fishing) accounting for 36.9 percent of GDP in 1987; 13 secondary subsectors (all industries including mining) accounting for 15.6 percent of GDP; and 12 tertiary subsectors (various public and private services) accounting for 47.6 percent of GDP.

In view of the importance of food-related issues in this agriculture-based economy, the agriculture subsector was further disaggregated into three subsectors (grains, export crops, and other crops). For the secondary and tertiary sectors, a higher level of aggregation was deemed sufficient for later modeling purposes. The mining subsector of the national accounts was left as a single subsector, given Niger's dependence on uranium as a major source of foreign exchange and government revenue. The remaining 13 secondary subsectors in the national accounts were aggregated into 3 subsectors in the SAM (meat processing, other food processing, and other industry). Likewise, the 12 tertiary subsectors were collapsed into 5 subsectors in the SAM, making a total of 14 subsectors in the SAM (Table 1).

The national accounts include separate accounts for formal and informal enterprises in the secondary and tertiary sectors. This split between formal and informal enterprises is important because of the major differences in technologies used and in the behavior of the two types of enterprises. Informal enterprises enjoy greater flexibility of adjustment than do formal enterprises. They do not import goods through official channels, and they pay no taxes on production.

The proposed framework for the model is provided in Sarris (1990).

	National Accounts			
SAM Subsector	Subsector	Production	Value Added	Value Added
		CFAF Bi	llions	Percentage
Grains	11	• 70,932	64,211	9.8
Export crops	11	23,821	18,314	2.8
Other crops	11	56,835	53,157	.1
Livestock	12	84,772	83,441	12.7
Forestry, fish	13	23,384	22,319	3.4
Mining <sup>a</sup>	21	91,194	43,948	6.7
Meat processing	31	63,935	9,487	1.4
Food processing Formal Informal	31	17,189 10,279 6,910	7,048 3,573 3,475	1.1 0.5 0.5
Manufacturing Formal Informal	32-39, 41-42	84,553 56,880 27,673	41,413 22,262 19,151	6.3 3.4 2.9
Construction Formal Informal	51, 52	55,835 37,303 18,532	20,674 14,583 6,091	3.2 2.2 0.9
Trade Formal Informal	61	165,827 31,179 134,648	123,781 18,926 104,855	18.9 2.9 16.0
Transportation/communication Formal Informal	63, 71, 72	56,602 25,099 31,503	34,169 16,392 17,777	5.2 2.5 2.7
Private services Formal Informal	81, 83, 94, 95	76,920 16,576 60,344	58,928 10,745 48,183	9.0 1.6 7.4
Public services	91, 96	106,291	73,962	11.3
Total		968,089	654,852	100.0
Primary sectors		259.744	241,443	36.9
Formal industry <sup>b</sup>		158,353	69,783	10.7
Informal industry <sup>C</sup>		88,518	32,113	4.9
Formal services		110,157	60,646	9.3
Informal services		245,026	176,905	27.0
Public services		106,291	73,962	11.3
Total		968-089	654.852	100_0

#### Table 1 - Niger: Production Activities in the Niger SAM

<sup>a</sup> Mining and meat processing subsectors include both formal and informal activities.

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<sup>D</sup> Formal industry figures include informal mining activities.

<sup>c</sup> Informal industry includes formal meat processing activities.

Note: Production and value figures differ slightly from the national accounts for the livestock and trade subsectors due to the adjustments described in section 4.

Separate technologies (the activities columns in the SAM, Figure 1), representing formal and informal enterprises, are specified for six subsectors: other food processing, manufacturing, construction, trade, transport, and private services. Meat processing (which consists almost exclusively of informal enterprises) and mining (consisting almost entirely of formal enterprises) are kept as single columns.

#### FACTORS OF PRODUCTION

The intersection of the production activities columns and the commodities rows is the table of intermediate consumption giving commodity inputs into production activities. Value added from each production activity is subdivided into returns to the various factors. Eight factors of production are defined in the SAM: skilled and unskilled labor; formal and informal capital; land north of the 400 mm rainfall isohyte belonging to high-income and low-income farmers; and land south of the 400 mm isohyte belonging to high-income and low-income farmers (Table 2). Returns to the farmer's own capital and to farm management are included in returns to land.

#### COMMODITIES

The intersection of the production activities rows and the commodities columns gives the mapping between the output of production activities and commodities. Every activity produces only one commodity (its characteristic commodity), so there is only one non-zero entry in each activity's row. Moreover, no differentiation is made in the SAM (or in the national accounts) between the products of formal and informal enterprises for a given subsector. Thus, the 20 activities in the SAM produce only 14 commodities.

All flows in the SAM are expressed in terms of purchasers' prices — that is, marketing and transport costs and indirect taxes are included as part of the value of a commodity. Marketing margins (indirect taxes on commodities) are shown in the intersection of the commerce (government) row and the commodities columns.

#### INSTITUTIONS

Ten domestic institutions are specified in the SAM: seven types of households, formal nonfinancial enterprises (Sociétés et Quasi-Sociétés Non-Financières), financial enterprises, and the government (Table 3). Household types are defined so as to focus on the lower-income groups, given the constraints on data availability. Three urban household groups are specified. In large urban centers (cities with a population greater than 50,000 in 1988), households are divided according to the skill level of the head of household. A third household group consists of all households in small urban centers. The remaining four types of households are located in rural areas: high- and low-

## Figure 1 - Niger: Structure of the Niger SAM

<b></b>	1				EXPENDITURES				····			1
		CURRENT ACCOUNT							CAPITAL ACCOUNT			
					INSTITUTIONS							
RECEIPTS	ACTIVITIES 114 DOMESTIC	COMMODOTIES	FACTORS (L,K,LAND)	HOUSEHOLD	ENTERPRISES		REST OF WORLD	HOUSEHOLDS/ ENTEAPRUSES	PUBLIC ADMIN	CHANGE	REST OF WORLD	TOTAL
CURRENT ACCOUNT		Domestic supply of		· · · · · · · · · · · · · · · · · · ·								Totel
PRODUCTION ACTIVITIES DOMESTIC 114		commodițies					×					output .
COMMODITIES 114	intermediste consumption	(Marketing Margine)		Houpehold consumption		Government Consumption	Exports	l,	nvestment			Totel damend
FACTORS	Distribution of											Factor
LABOR	volue edited emong factore											Tevenues
CAPITAL	of preduction											
LAND												
INSTITUTIONS			Factor income		Transform		Current transfers from					income of dom.
HOUSEHOLDS							ROW					institutions after
ENTERPRISES										·		trensfora
PUBLIC ADMIN	Indirect taxes	indirect texes	i	Dire	ect taxes and transfers							Govt. Favanues
REST OF WORLD (imports)		Importe		Current	t transfers to rest of work	d				•		RDW receipte
CAPITAL ACCOUNT					Sivingi			Capital transfere	ta domesti	: institutions	Cepitel	Domentia
INSTITUTIONS											transfore from the	Tryingt
HOUSEHOLDS/ ENTERPRISES											rest af world	
PUBLIC ADMIN												
CHANGE IN STOCK												
REST OF WORLD							Foreign savings	Capital 1	remeters to l	low		Forbign sevinge
TOTAL	Totel conte	Absorption	Factor income		Uses of Income		ROW Expenditures	Dome	ntic Investma	ent	÷	TOTAL

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Table 2 - Niger: Factors of Production in the Niger SAM

SAM Row Number	Factor
	Labor
15	Skilled
16	Unskilled
	Capital
17	Formal sector
18	Informal sector
	Land
19	North High income
20	North — Low income
21	South — High income
22	South - Low income

Source: Niger SAM.

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SAM Row Number	Classification				
	Households				
23	Urban 1 - Skilled head of household				
24	Urban 2 — Unskilled head of household				
25	Semiurban				
26	Rural North — High income				
27	Rural North — Low income				
28	Rural South — High income				
29	Rural South — Low income				
	Other Institutions				
30	Formal sector enterprises				
31	Financial institutions				
32	Public administration				
33	Rest of the world				

T <b>able 3 —</b> Niger: Institu	tional Classifications	in the	Niger	SAM
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Source: Niger SAM.

income rural households north of the 400 mm isohyte, and high- and low-income rural households south of the 400 mm isohyte.

Household receipts include factor incomes (the intersection of the factor columns with the households rows), transfers from other institutions (including other households), and transfers from abroad. Household current expenditures include consumption, indirect taxes paid on consumer goods, direct taxes, and transfers to other institutions (including interest payments and land rent). The difference of total household revenues less expenditures is household savings (shown in the capital account). Accounts for formal nonfinancial enterprises and financial enterprises are similar. Returns to capital comprise the incomes of these institutions; expenditures consist of investment and savings; while final consumption by these institutions is zero.

Government receipts are the indirect taxes paid on intermediate consumption, taxes on production, export and import taxes, and direct taxes. Government expenditures on current account are government consumption of the output of the public administration sector and transfers to other institutions (including interest payments abroad); the residual between current revenues and the above expenditures enters as government savings in the capital account.

The ROW current account row shows receipts of the ROW from Niger's imports of goods and services (at the intersection of the row with the commodities columns) and current transfers to abroad from domestic (Nigerien) institutions (at the intersection of the row with the institutions columns). The ROW current account column shows the expenditures of the ROW on Nigerien exports (at the intersection of the column with the commodities rows) and current transfers from abroad to domestic institutions (at the intersection of the column with the institutions rows). Foreign savings of the ROW (which appear as positive numbers in the SAM when Niger runs a current account deficit) are shown at the intersection of ROW current account expenditures and ROW capital account receipts.

#### CAPITAL ACCOUNT

In the capital account, only two domestic institutions are specified: the private sector (including all households and formal enterprises) and the public sector. Receipts include savings and capital transfers from other institutions. Expenditures include investment in real goods and services, indirect taxes paid on investment, and capital transfers to other institutions. A separate account is specified for changes in stocks of commodities belonging to domestic private institutions.

Similarly, receipts on the capital account for the ROW are foreign savings (the negative of Niger's balance on current account) and capital transfers to the ROW from Nigerien institutions. Expenditures by the ROW on capital account consist of capital transfers by the ROW to Nigerien institutions.

## 3. HOUSEHOLD GROUPS

The classification of the population by household groups is at the core of any social accounting matrix that is designed for analysis of income distribution. As discussed above, the choice of definitions for household groups depends on the policy issues to be addressed and on the data that are available. For Niger, the 1988 population census provides a statistical base that enables an estimation of the size of household groups classified by location, occupation, or sector of employment. Unfortunately, the paucity of available household surveys on incomes and expenditures greatly limits the feasible options for disaggregation of households.

In this section, estimates of the sizes of the household groups specified in the Niger SAM are given along with labor force estimates. The tables presented in this section are based on preliminary results of the 1988 population census covering 10 percent of the sample. Once the full census data are available, it will be possible to calculate exactly the number of households and workers in many of the categories estimated here.

#### DEFINITIONS OF HOUSEHOLD GROUPS

Table 4 presents estimates of the size of the six household groups defined in the SAM. Urban households are those residing in the five cities with a population of more than 50,000 in 1988: Niamey (398,265 inhabitants), Zinder (120,892), Maradi (112,965), Tahoua (51,607) and Agadez (50,164) (Ministère du Plan 1989a). Together, these cities accounted for 65.9 percent of the urban population of Niger.<sup>4</sup>

Population estimates for 1987 were derived from 1988 population census figures (Ministère du Plan 1989a) and estimates of total and urban population growth, 3.3 and 8.0 percent per year, respectively (World Bank 1990). The implied rural population growth rate is 2.5 percent per year. Average household size for rural and urban households was used to derive the number of households in each SAM category given the census data on population by region.

Eighty-five percent of Niger's population live in rural areas. Unfortunately, no countrywide data on income sources, assets, and expenditures of rural households exist. Thus, the breakdown of rural households in the SAM is based on data from surveys conducted at a number of sites in western Niger by

<sup>&</sup>lt;sup>4</sup> According to Ministère du Plan (1989a), the urban centers are Niamey and all cities that are either the capital of a *département* or an *arrondissement*.

	1988			1987				
	Households	Average Size	Population	Households	Population	Population		
						Percentage		
Urban I	41,010	6.00	246,220	37,972	227,982	3.2		
Urban II	81,226	6.00	487,673	75,209	451,549	6.4		
Semiurban	61,934	6.00	371,847	57,346	344,303	4.9		
Total Urban	184,170	6.00	1,105,740	170,528	1,023,833	14.6		
Rural North High income Low income	462,679 115,670 347,009	6.47 6.47 6.47	2,991,329 747,832 2,243,497	451,407 112,852 338,556	2,918,455 729,613 2,188,841	41.6 10.4 31.2		
Rural South High income Low income	487,381 263,186 224,195	6.47 6.47 6.47	3,151,031 1,701,557 1,449,474	475,507 256,774 218,733	3,074,266 1,660,104 1,414,162	43.8 23.7 20.2		
Total Rural	950,060	6.47	6,142,360	926,915	5,992,720	85.4		
Total Niger	1,134,230	6.39	7,248,100	1,097,443	7,016,554	100.0		

Table 4 - Niger: Size of Household Groups, 1987 and 1988

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Sources: Ministère du Plan (1990b and 1990c); Ministère du Plan (n.d.); authors' estimates.

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the International Center for Research in the Semi-Arid Tropics (ICRISAT) and the International Food Policy Research Institute (IFPRI) (Hopkins 1988).

Based on the data available, two criteria were used for the disaggregation of rural households: agroecological zone (since cropping patterns and income sources are more limited in the drier, northern region) and cattle ownership (a wealth as well as a determinant of current incomes measure of and expenditures).<sup>5</sup> Rural population is divided by zone (north and south of the 400 mm/year rainfall isohyte is the cutoff between northern and southern zones because it is equal to the approximate level of rainfall in the villages in the northern zone of the ICRISAT/IFPRI survey [Figure 2]).<sup>6</sup> Based on data on rural population by canton, 51.3 percent of the rural population live south of the 400 mm isohyte and the remaining 48.7 percent live in the drier northern region. Cattle ownership in each region was estimated using the structure of cattle ownership in the ICRISAT/IFPRI household surveys in western Niger (Hopkins and Reardon 1989), where only 25 percent of rural north households and 46 percent of rural south households owned cattle.

Urban households were disaggregated according to the skill level of the head of the household as reflected in his occupation. The group Urban I consists of all urban households headed by a skilled worker; Urban II consists of all households headed by unskilled workers. Fourteen percent of urban workers are classified in the SAM as skilled workers (military personnel, administrative staff, specialists, scientific personnel, and office employees) (Table 5). Assuming each of these workers is the head of a household and that all skilled urban workers live in the five largest cities, 41,010 households were in Urban I in 1988. Eighty-one percent of the rural labor force is employed as agricultural workers. It is important to note that 23.1 percent of all employed workers in urban areas (including small urban centers) worked as agricultural laborers as well.

## LABOR FORCE ESTIMATES

Table 6 presents data on the size of the labor force for the major SAM household groups. Sixty-two percent of the urban population and 61 percent of the rural population are over age 10; 33.5 and 32.5 percent of the urban and

<sup>&</sup>lt;sup>5</sup> An alternative to extrapolating the ICRISAT/IFPRI survey results across Niger along rainfall isohytes would be to assume that the survey results were representative of only a very limited area of western Niger and to define a third region, i.e., all of eastern Niger. Further microlevel data on incomes and expenditures by region would show which assumption is more appropriate.

<sup>&</sup>lt;sup>6</sup> Both sorghum and millet, with water requirements of 400 and 300 to 350 mm, respectively, are widely grown in the northern region. Maize, with water requirements of 500 to 600 mm over the growth period, is widespread only in the southern zone. (Water requirements are from Frere 1984.)



Source: AGRHYMET (n.d.)

-14-

	Urban	Rural	Total	Total Labor
				<b>D</b>
· •	,	·	×	Percentage
Occupation				
Military	1,820	290	2,110	
Administration	2,780	930	3,710	
Specialist	19,250	19,270	38,520	
Scientific personnel	11,150	5,850	17,000	
Office employees	6,010	660	6,670	
Service workers	12,790	10,830	23,620	
Agricultural workers	67,290	1,644,050	1,711,340	
Artisans	39,830	64,530	104,360	
Machine operators	15,040	3,910	18,950	
Manual laborers	101,800	209,670	311,470	
Other	13,570	62,290	75,860	
Total	291,330	2,022,280	2,313,610	
Labor Class				
Urban-skilled	41,010		41,010	1.8
Urban-unskilled	183,030		183,030	7.9
Urban-agriculture	67,290		67,290	2.9
Rural-agriculture		1,644,050	1,644,050	71.1
Rural-nonagriculture		378,230	378,230	16.3
Total	291,330	2,022,280	2,313,610	100.0

Table 5 - Niger: Occupations of the Nigerien Labor Force, 1988

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Sources: Ministère du Plan (1990b); Ministère du Plan (n.d.); authors' calculations.

Note: Total of occupations does not equal total number of employed in census tables, because of non-responses, incomplete questionnaires.

	<u>Households</u>	Population Per Household	Population	Population Age > 10	Active Population	Skilled Labor	Unskilled Labor
Urban I	37,972	6.00	227,982	142,722	76,299	37,972	38,326
Urban II	75,209	6.00	451,549	282,680	151,120	· 0	151,120
Semiurban	57,346	6.00	344,303	21 <b>5,</b> 542	115,228	0	115,228
Total urban	170,528	6.00	1,023,833	640,944	342,646	37,972	304,674
Rural North High income Low income	451,407 112,852 338,556	6.47 6.47 6.47	2,918,455 729,613 2,188,841	1,774,585 443,646 1,330,939	948,686 237,171 711,514	0 0 0	948,686 237,171 711,514
Rural South High income Low income	475,507 256,774 218,733	6.47 6.47 6.47	3,074,266 1,660,104 1,414, <b>162</b>	1,869,326 1,009,436 859,890	999,334 539,641 459,694	0 0 0	999,334 539,641 459,694
Total rural	926,915	6.47	5,992,720	3,643,911	1,948,020	0	1,948,020
Total Niger	1,097,443	6-39	7,016,554	4,284,855	2,290,666	37,972	2,252,694

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Table 6 - Niger: Population and Labor Force by Household Group, 1987

Sources: Ministère du Plan (1990b and 1990c); Ministère du Plan (n.d.); authors' calculations.

rural population, respectively, are active in the labor force. These percentages were used to estimate the structure of each urban and rural household group. For simplicity, the rural labor force is considered to be unskilled labor. This estimate ignores the 27,000 workers (1.3 percent of the rural employed in 1988) in skilled occupations. Of these, 19,270 workers are unspecified "specialists" (Table 5).

In all, the skilled urban labor force as defined above represents less than 2 percent of Niger's labor force: only 38,000 people. Moreover, this figure, based on the results of the 1988 population census, includes expatriate residents. According to the census, only 7,520 Nigerien nationals had more than a secondary school education in 1988; another 112,450 Nigeriens had some secondary school education (Ministère du Plan 1990b).

## 4. PRODUCTION AND INCOME FLOWS

Production and income flows for the SAM are based largely on data from Niger's revised 1987 national accounts. Since the construction of the national accounts is already well documented (Ministère du Plan 1989b and 1990a), this section focuses on the adjustments to the national accounts figures and on the disaggregation of total household income by household group. Section 5 describes expenditures by household group.

#### PRODUCTION ACTIVITIES

As explained in Section 2, the Niger SAM contains a different grouping of production activities than the one found in the 1987 national accounts (Ministère du Plan 1990a). The 26 secondary and tertiary subsectors in the national accounts were aggregated into 9 activities in the SAM. Two national accounts subsectors, agriculture and food processing, were disaggregated, however, because the outputs of these sectors form a major part in the consumption expenditures of lower-income groups in Niger.<sup>7</sup>

## Disaggregation of Agriculture<sup>8</sup>

In the national accounts, agriculture crop production appears as one subsector generating a total of CFAF 135.7 billion in value added, 20.7 percent of GDP. In the SAM, this sector has been divided into 3 subsectors using the supply-demand balances underlying the national accounts (*equilibres réssourcesemplois*). Cereals (SAM subsector 1), mostly millet and sorghum, the staple foods in Niger, account for 47 percent of total agricultural production. Export crops (cowpeas and peanuts) account for 16 percent of total production; other crops represent 37 percent of agricultural production.<sup>9</sup>

<sup>&</sup>lt;sup>7</sup> An analysis of production linkages reflected in Input-Output Tables of 1981 and 1987 is presented in Appendix A.

<sup>&</sup>lt;sup>8</sup> The disaggregation of the food processing sector into meat processing and other food processing involved a straightforward use of data found in the Ministère du Plan's disaggregated production and input use data and is not further discussed here.

<sup>&</sup>lt;sup>9</sup> Crop production data published by the Ministry of Agriculture are not identical to the figures used in the national accounts. The discrepancy arises (continued...)

For each of the three agricultural activities, the same production technology (i.e., the same inputs and productivity) is assumed to be used by all farmers. Thus a single column is used to represent each agricultural activity in the SAM. Moreover, in this initial SAM, the same input-output relations are used for all three agricultural subsectors. Since each of the three subsectors is dominated by crops using few material inputs, this assumption is not too severe.

#### Output Matrix

By construction, the subsectors of the national accounts produce only their own characteristic commodities, i.e., there is no joint production. This convention is maintained in the SAM, so that the 14 subsectors in the SAM likewise produce only their own characteristic commodities.

## **Returns to Factors of Production**

Eight factors of production are distinguished in the Niger SAM: skilled labor, unskilled labor, formal sector capital, informal sector capital, land belonging to high-income and low-income farmers in the north, and land belonging to high-income and low-income farmers in the southern zone of the country.

The national accounts present estimates of payments of wages to labor and returns to capital. Neither the implicit wages of family or self-employed labor nor explicit wages paid out to workers in the informal sector are included with wages, however. For purposes of modeling the labor market of Niger using the SAM as a database, some estimate of returns to family and self-employed labor is required.

All returns from agricultural activities go to unskilled labor and land. For this initial SAM, the share of (unskilled) labor in total value added (less indirect taxes on production) in agriculture was assumed to be 90 percent for the grains and export crops subsectors and 85 percent for the "other crops" subsector. This is consistent with the extensive, low-input agriculture practiced in Niger.<sup>10</sup> By contrast, the share of labor in value added in livestock and forestry is smaller (assumed here to be 60 percent).

<sup>&</sup>lt;sup>9</sup>(...continued)

for two reasons. First, the Ministry of Agriculture's published data on total production often excludes off-season harvests and production from irrigated areas, apparently because the agencies in charge of such areas do not fall under its jurisdiction. Second, national accounts figures are production net of estimated losses.

<sup>&</sup>lt;sup>10</sup> Returns to land and capital are higher for the "other crops" subsector, since many of these crops are grown during the dry season on the relatively scarce land with access to water.

The distribution of crop production by the two agroecological zones in the SAM (i.e., north and south of the 400 mm isohyte) was used to allocate returns to land by region (Table 7). These estimates are based on crop production data by district (arrondissement). In cases where the 400 mm isohyte cuts across an arrondissement, production of the crop is split between zones in proportion with each zone's rural population. The underlying assumption behind this method is that, even though farm size might vary from zone to zone, productivity per capita is about the same.<sup>11</sup> Production was also allocated between rich and poor farmers within a zone according to population shares.

A similar procedure was used to allocate returns to capital from livestock production to agricultural capital belonging to the four rural household groups (Table 8). Cattle, sheep, and goat populations were divided into northern and southern zones using data on livestock population in 1986/87 by arrondissement (Ministère des Ressources Animales 1988).<sup>12</sup> Within each zone, livestock ownership by animal type is based on July 1988 data from the ICRISAT/IFPRI survey villages (Hopkins 1988). It is assumed that 30 percent of net value added (after taxes) in livestock accrues to capital, with the remainder representing implicit and explicit wages. Returns to capital in forestry and fishing, assumed to equal 10 percent of net value added, are allocated to rural land according to population shares of the four rural household types.

Wage payments to skilled and unskilled government workers were estimated using data on the number of government employees and wage rates for 1987 (Table 9). Skilled workers, defined as employees in Categories A and B, accounted for 42 percent of the government permanent work force (*cadres*), and received an estimated 62.1 percent of the government wage bill paid to permanent staff. This share (62.1 percent) is used in the SAM to calculate total government wages received by skilled workers (both permanent staff and *auxiliares*). The implied average wage rate for skilled workers in 1987 was CFAF 1,085 thousand per year, 2.24 times the average wage rate for unskilled workers.

For formal sector activities, payments to skilled and unskilled labor are based on the results of a survey of formal sector enterprises from which average wage rates for Nigerien and expatriate labor are calculated (Ministère du Plan 1991). Formal sector employment of skilled and unskilled Nigerien salaried workers is derived from total formal sector employment figures and the formal sector survey data on expatriate labor (which was assumed to be skilled labor).

<sup>&</sup>lt;sup>11</sup> Reardon, Matlon, and Delgado (1988) showed that per capita production of crops did not vary much across income groups in Burkina Faso. These findings are consistent with a land extensive, nonmechanized, low-input agriculture where output depends largely on labor inputs. If detailed data on production of crop by canton were available, a more exact estimate of crop production by agroecological zone could be made.

<sup>&</sup>lt;sup>12</sup> The distribution of camel and horse production by region was estimated on the basis of data by department, since no arrondissement-level data was available.

	North Pro	duction	Total Production all Niger
	Value	Total Production	Value
	CFAF Millions	Percentage	CFAF Millions
Millet	19,928	41.3	48,301
Sorghum	7,666	46.5	16,482
Paddy	1,430	41.5	3,449
Maize	76.	7.6	1,003
Wheat, fonio	0	0.0	1,820
Total grains	29,100	41.0	71,055
Cowpeas	9,362	44.9	20,872
Groundnuts	501	17.0	2,949
Total export crops	9,863	41.4	23,821
Cotton	207	21.1	977
Voandzou	218	35.3	617
Gombo	146	14.1	1,037
Total other crops	571	21.7	2,631

 Table 7 — Niger:
 Agricultural Production by Region, 1987

**Sources:** Ministère du Plan (n.d.); Ministère de l'Agriculture (n.d.); authors' calculations.

·····	Cattle	Sheep	Goats	Camels	Horses	Total
Poor North	0	1,619	4,295	0	0	5,914
	(0.0)	(23.4)	(21.6)	(0.0)	(0.0)	(8.4)
Rich North	19,950	3,778	10,021	3,588	242	37,579
	(51.4)	(54.5)	(50.4)	(75.3)	(74.8)	(53.1)
Total North	19,950	5,397	14,316	3,588	242	<b>43,493</b>
	(51_4)	(77.9)	(72.0)	(75.3)	(74.8)	(61.5)
Poor South	0	459	1,670	0	0	2,130
	(0.0)	(6.6)	(8.4)	(0.0)	(0.0)	(3.0)
Rich South	18,863	1,072	3,897	1,177	81	25,091
	(48.6)	(15.5)	(19.6)	(24.7)	(25.2)	(35.5)
Total South	18,863	1,531	5,567	1,177	81	<b>27,220</b>
	(48_6)	(22.1)	(28.0)	(24.7)	(25.2)	(38.5)
Total Niger	38,813	6,928	19,884	4,765	323	70,713
	(100_0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Livestock	23,929	6,928	13,335	4,765	323	49,280
Fresh milk	11,751	-	6,549	-	-	18,300
Manure	3,133	-	-	-	-	3,133

Table 8 - Niger: Livestock Ownership by Household Group, 1987

Sources: Hopkins (1988); Ministerè des Ressources Animales (1988); Ministère du Plan (n.d.); authors' calculations.

Notes: Figures in parentheses are percentages; - denotes data not available.

Category	CFAF 1,000/an Wage <sup>a</sup>	No. of Workers	Wage	Bill
			CFAF Millions	Percentage
Α	1,375	3,751	5,158	30.6
В	900	5,904	5,314	31.5
С	544	7,910	4,301	25.5
D	394	5,306	2,089	12.4
Total	737	22,871	16,862	100.0
A and B	1,085	9,655	10,471	62.1
C and D	484	13,216	6,390	37.9
Ratio <sup>b</sup>	2.24	0.73	1.64	-

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Table 9 - Niger: Average Salaries for Government Workers, 1987

Source: Ministère du Plan (1990c).

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Wages are for first class, second echelon. Ratio of figure for A and B relative to figure for C and D. ъ

Assuming the same wage rate differential between skilled and unskilled labor as in the government pay scale (2.24), the average wage rates for Nigerien labor by skill types are calculated (Table 10). The share of the wage bill in the formal sector going to skilled labor (80.3 percent) is then used to divide shares of wages according to skill type in the SAM.<sup>13</sup>

In the informal sector, data from a survey of the informal sector conducted for use in the construction of the national accounts (Ministère du Plan 1991) were used to split value added between labor and capital. The estimated value of the owner's labor was added to reported wage payments from the survey to give total wage payments for each informal enterprise. All labor in the informal sector is classified as unskilled labor in the SAM.

#### Factor Payments to Institutions

Factor payments to institutions together with transfers between institutions determine the income of each institution in the SAM. Wage payments are allocated to each household according to its ownership of skilled and unskilled labor resources. Returns to formal capital are allocated to formal enterprises and financial institutions according to a preliminary version of the Comprehensive Economic Table (*Tableau Economique d'Ensemble* or TEE), a part of the national accounts.

Little information exists on the distribution of returns to informal capital. In the SAM, these revenues are divided between households so as to determine household incomes consistent with assumed savings rates and estimated levels of household expenditures. For Urban 2 and semiurban households, returns to informal capital are set at a level consistent with zero savings by these groups. Total returns to informal capital for rural households are equal to total investment in livestock. These returns are allocated across rural households in the same proportion as their shares in total livestock production. Urban 1 households' earnings from informal capital are the residual.

#### Transfers and Government Accounts

The transfer matrix, the intersection of the expenditures by institutions columns with the resources of institutions rows, shows transfer payments between institutions. In the preliminary TEE on which the SAM's transfer matrix is based, direct taxes and transfers to the government, social insurance deductions from salaries, social insurance payments, interest payments, and current

<sup>&</sup>lt;sup>13</sup> The estimate of the share of formal sector wages paid to unskilled labor may be understated to the extent the temporary workers (probably not included in the employment statistics used) are a significant part of the formal sector labor force. On the other hand, the estimate may miss highly-paid skilled workers in firms not included in the formal sector survey results.

Formal Sector Survey	Nigerien	Expatriates	Total	Total
	h			Percentage
Number of employees	17,981	1,322	19,303	-
Wage bill (CFAF millions)	23,926	13,842	37,768	-
Average wage (1,000 CFAF per year)	1,331	10,470	1,957	-
Skilled workers	14,435	1,322	15,757	56.4
Unskilled workers	12,191	0	12, 191	43.6
Total workers	26,626	1,322	27,948	100.0
Skilled wages (CFAF millions)	25,729	13,842	39,571	80.3
Unskilled wages (CFAF millions)	9,700	0	9,700	19.7
Total wages (CFAF millions)	35,429	13,842	49,271	100_0
Average wage skilled (CFAF 1,000 per year)	1,782	10,470	2,511	-
Average wage unskilled (CFAF 1,000 per year)	796	-	796	-
Average wage all workers (CFAF 1,000 per year)	1,331	10,470	1,763	-

Table 10 - Niger: Salaries in the Formal Sector, 1987

Sources: Ministère du Plan (1991); authors' calculations.

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**Notes:** Wage differential of 2.24 assumed between Nigerien skilled and unskilled laborers; - denotes data not available.

transfers from abroad are among the largest items included. Ideally, interest payments on loans between households, gifts, and land and housing rents would also be included. These interhousehold transfers are not included in the TEE or the SAM because of lack of data.

Transactions of the government are shown in three separate accounts in the SAM. Most of the output of the public administration activity is nonmarketed, and is valued as the sum of government salaries paid, consumption of intermediate inputs, indirect taxes paid, and an imputed return to government capital. (The latter is not always included in estimating production of government services.) The public services commodity is consumed almost entirely by the government itself. Other expenditures include transfer payments (mostly interest payments to the rest of world and social insurance payments to households). The institution "Public Administration" receives its income from indirect taxes on production (included in the activities accounts), from commodities and foreign trade (both shown in the commodities accounts), and from direct taxes on households and formal enterprises (shown in the transfer matrix).

The various taxes on uranium are shown in several places: tax revenues on uranium exports are shown as payments from the commodities account 6C to the government. Other taxes on production are included as payments from the mining activities account (6). Income taxes on the profits of mining enterprises are shown in the transfer matrix as payments from formal enterprises to the government.

## Rest of World

Because of the large unrecorded trade across the Niger-Nigeria border, estimates of Niger's foreign trade (apart from the level of exports of uranium) are especially uncertain. A number of adjustments were made to customs and balance-of-payment data in the construction of the 1987 national accounts because of the inadequate coverage of the trade data.<sup>14</sup> Further revisions were made in this SAM as well.

The national accounts are based largely on estimates of trade by broad category constructed by the central bank, Banque Centrale des Estats de l'Afrique de l'Ouest (BCEAO), for the balance of payments. (Customs data on the level of trade in 1987 are even less complete than in most years, because of a changeover in methodology used for compiling the statistics that was instituted during the year.) The national accounts' detailed breakdown of trade by commodities and services for 1987 was estimated using the shares of individual commodities and services in each broad category in the more complete 1988 customs data.

Two major adjustments were then made in constructing the national accounts. A new livestock export estimate was constructed by using the quantity of

<sup>&</sup>lt;sup>14</sup> The discussion on the methodology used in the national accounts for 1987 is based on Ministère du Plan (1990a).

livestock exported in 1988 multiplied by two (assuming that only half of livestock are exported legally), valued at market prices in Niger. The resulting figure of CFAF 7 billion is several times the official level of livestock exports in 1988, but less than the balance-of-payment figure (which includes BCEAO's own estimates of illegal trade) of CFAF 11 billion. The second major adjustment was to increase the figure for imports of petroleum products in the national accounts to CFAF 18 billion, from CFAF 6 billion in the balance-of-payment statistics.

In order to maintain consistency with the balance-of-payment aggregates and with microlevel information on livestock and cowpeas (two of Niger's major nonuranium exports), three further adjustments were made to the national accounts trade figures in constructing the SAM.

1. Illegal livestock exports were raised substantially based on two microlevel studies. According to Cook (1988), customs officials along the Niger-Nigeria border estimated that only 10 percent of livestock trade goes through legal customs. Confirmation of this opinion is provided in Cook (1989), where data on cattle imports by Nigeria suggest that 105,000 head of cattle were exported by Niger in 1987, compared with the national accounts estimates of official trade of 11,030 head and illegal trade of another 11,030 head (Table 11). In the SAM, total cattle exports estimates for 1987 are increased to 88,240 head, four times the national accounts estimates, but still only 84 percent of the Cook (1989) estimate. For other livestock (mainly sheep and goats), for which evidence suggests that the 1987 illegal trade may not have been so high, it is assumed that illegal exports are twice the level of official exports. making the share of illegal exports out of total exports equal to two-thirds.<sup>15</sup>

In order to maintain a balance in the input-output table and in the overall SAM, sales by the livestock sector to the meat processing industry and final consumption of meat were both reduced by the total increase in the adjusted livestock export figures (CFAF 9,969 million, Table 11).<sup>16</sup>

<sup>&</sup>lt;sup>15</sup> Other analysts of the illegal cross-border trade in 1987 suggest much lower levels of illegal exports. Grégoire (1988) argues on the basis of price comparisons between markets in Maradi and in northern Nigeria that there was little incentive for illegal trade in 1987. The Cook (1989) estimates were judged to be more reliable, however, since they are based on data on Nigeria's imports of cattle and because exports of cattle through legal channels (subject to export taxes) continued from Maradi, albeit at lower levels than authorized by the Nigerien government (2,500 head exported out of 10,000 head authorized) (Grégoire 1988, 25).

<sup>&</sup>lt;sup>16</sup> According to Cook (1988), illegal livestock exports have probably varied considerably from year to year, more because of droughts in Niger than due to changes in government trade policy (such as the closure of the border with Nigeria from December 1983 to March 1986). SEDES (1987) estimates of illegal trade in 1982 imply that two-thirds of livestock exports were illegal.

	1987 National Accounts	Niger SAM	Difference
Cattle			
Production			
(head)	337.987	337.987	Ó
(CFAF millions)	23,929	23,929	Ō
Intermediate uses			-
(head)	192.000	125.820	-66.180
(CFAF millions)	23 040	15 096	-7 944
Exports	21040	12,0,0	1,744
(head)	22 060	88 240	66 180
(as percent of production)	6.5	26.1	55,155
(CEAF millions)	2 648	10 592	7 944
Illegal exports	E1040	10,572	.,,,,,
(head)	11 030	77 210	66 180
(as percent of total exports)	50-0	87-5	667,166
(CFAF millions)	1.324	9,268	7.944
	.,	,1200	.,
Other livestock (CFAF millions)			
Production	25.351	25.351	0
Intermediate uses	31, 181	29,156	~2.025
Exports	4.050	6,075	2,025
Illegal exports	2 025	4,050	2 025
	2,025	1,020	2,023
Total livestock (CFAF millions)			
Production	49,280	49,280	0
Intermediate uses	54,221	44,252	-9,969
Exports	6,698	16,667	9,969
Illegal exports	3,349	13,318	9,969
Cowpeas (CFAF millions)			
Production	20,872	20,872	0
Imports	4,804	, 0	-4,804
Total supply	30,602	25,798	-4,804
Final consumption	24,077	3,173	-20,904
Exports	1,761	17,861	16,100
Illegal exports	0	16,100	16,100
Exports of percentage of total			
livestock and cowpeas	5.8	69.2	
Exports	8,459	34,528	26,069

Table 11 - Niger: Livestock and Cowpea Trade Adjustments

Sources: Ministère du Plan (n.d.); authors' calculations.

Note: Figures are in CFAF millions unless otherwise noted.

2. Noncontrolled imports of cowpeas were reduced to zero (from CFAF 4,804 million in the national accounts) and exports were increased to CFAF 17,861 million. This latter figure was chosen so as to achieve a balance between the SAM figures for exports and the level of exports given in the preliminary TEE (CFAF 145,100 million). Large illegal cowpea exports are consistent with SEDES (1987), which reports that nearly 90 percent of cowpeas are exported illegally.<sup>17</sup>

3. Total imports were increased by CFAF 23,908 million to CFAF 193,800 million so as to match the total level of imports in the TEE (Table 12). These additional imports are assumed to be imports of manufactured products in the SAM. Total final consumption of manufactured goods are also increased by the same amount.

#### Capital Accounts

Only five institutions are specified in the capital account: (1) all households and the informal sector, (2) formal sector nonfinancial enterprises, (3) financial institutions, (4) government, and (5) the rest of world. Savings, shown as the intersection of institutions' current expenditure columns with the corresponding institutions' capital account row, are specified separately for each household group. Savings by each rural household group are assumed to equal the household's investment in livestock (calculated using the share of each household in value of total livestock sector production). Savings by low-income households in the large urban centers and by households living in the small urban centers are assumed to be zero. The residual savings are then allocated to the high-income households in large urban centers. Net domestic savings by the urban high-income households are negative, (CFAF -11,576 million). However, recorded transfers abroad (CFAF 16,388 million), a figure taken from the preliminary TEE, are larger in absolute magnitude. Thus, for urban high-income households in the SAM, total income exceeds the sum of domestic consumption and domestic transfers.

Fixed investment by commodity is shown for all three domestic institutions (fixed investment by the rest of world is zero). Change in stock, whether by households, by the formal sector, or by the government, is also shown separately. Changes in stock of livestock are assigned to rural households in the same proportions as their estimated production of livestock products. All other changes in stock are assigned to formal sector enterprises. The SAM does not include financial assets or a flow of funds matrix.

<sup>&</sup>lt;sup>17</sup> The national accounts figures show legal cowpea exports together with illegal imports. The SEDES (1987) and SAM figures are also consistent with microlevel survey data that show significant cash income from cowpea sales and very low cowpea consumption (Hopkins and Reardon 1989 and 1990). Along with the reduction in imports by CFAF 4,804 billion, exports were increased by CFAF 15,939 billion and consumption was reduced by CFAF 20,743 billion. Marketing margins were left unchanged.

	National Accounts	SAM	Difference (SAM less National Accounts)
Exports			
Merchandise Uranium Livestock Cowpeas Other	119,031 86,991 6,698 1,761 23,581	145,100 86,991 16,667 17,861 23,581	26,069 0 9,969 16,100 0
Services	0	0	0
Total	119,031	145,100	26,069
Imports			
Merchandise Cowpeas Other	164,096 4,80 <b>4</b> 159,292	183,200 0 183,200	19,104 -4,804 23,908
Services	10,600	10,600	0
Total	174,696	193,800	19,104

Table 12 - Niger: SAM and National Accounts Trade Totals

Sources: Ministère du Plan (1990a); Niger SAM.

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## 5. CONSUMPTION BY HOUSEHOLD GROUPS

No comprehensive household budget surveys are yet available for Niger. As a result, disaggregation of total national consumption by household groups involves a series of adjustments to the results of several household surveys. Here, the SAM accounting framework guarantees the consistency between production, estimated consumption, and household incomes.

## ESTIMATING URBAN CONSUMPTION SHARES

Estimates of consumption by urban households are based on the *Enquête sur la Consommation des Produits Essentiels à Niamey* (ECPE), conducted in December 1986 and January 1987 (Ministère du Plan 1988). Unfortunately, the published results of the survey do not give complete expenditure data by household group. Moreover, the household groups defined in the published survey results, based on employment status of the head of household, do not correspond with the SAM categories.

Using the ECPE data (Ministère du Plan 1988), average expenditures for households headed by government workers were estimated. Data on the expenditures by cadres employés and all households from the first round of a 1988/89 survey of Niamey (Giucci and Maffioli 1990) were used to determine budget shares on food items. Consumption shares for nonfood items were based on the ECPE data (Ministère du Plan 1988). The above procedure led to an estimate of consumption by government worker-headed households of CFAF 187,760 per person per year, compared to the Niamey average of CFAF 139,100 per person per year.

Since the ECPE category of government worker-headed households contains both skilled and unskilled heads of households, it was necessary to adjust the above expenditure estimates to account for differences in the income levels between skilled and unskilled government workers. From data on wage levels and the number of government workers by skill categories, it was estimated that skilled government workers and 1.47 times the average government wage (Table 9). This latter ratio was used to calculate the average consumption of households headed by skilled workers as CFAF 276,300 (= $187,760 \times 1.47$ ) per person per year.

The estimated budget shares for all government workers were used to calculate total consumption expenditures by Urban I households. Total expenditures for Urban II households were calculated as the residual between total expenditures for all households in Niamey and the total expenditures of Urban I households. Budget shares and average levels of expenditures per household for all Urban I and II households in Niger were assumed to equal those in Niamey.

In order to achieve consistency with the national accounts/SAM consumption categories, adjustments were made to the consumption figures described above for government services and extractive industries. Consumption of government services was not clearly identified in the Ministère du Plan (1988) survey and was presumed to be part of "other" expenditures. For Urban I households, the budget share for consumption of government services was arbitrarily set as equal to 3.0 percent. It was also assumed that per capita consumption of Urban II households is equal to per capita consumption of government services by Urban I households. Concerning extractive industries, 60 percent of the national accounts figure for total consumption of the products of this sector (assumed to be mostly natural gas) is allocated to Urban I households (equal to 2.6 percent of household consumption) with the remainder allocated to Urban II households (1.6 percent of Urban II household consumption).

Table 13 presents the estimated budget shares and total expenditure levels for Urban I and Urban II households, as well as data from the 1986/87 survey in Niamey and a household budget survey in Bamako, Mali (Rogers and Lowdermilk 1988). The SAM estimates are broadly consistent with a priori expectations. Budget shares for basic food categories (grains, other food crops, fish and forestry products, processed food) are higher for Urban II households than for Urban I households. Nonfood expenditures and expenditures on meat products are higher for Urban I households, implying that these goods have an expenditureelasticity of demand greater than 1.0. These results are similar to those in Bamako, where the share of expenditures on food declines sharply for the richest 25 percent of households, but unlike in Niger, meat consumption in Mali appears to be much lower and has an income elasticity less than 1.0.

#### RURAL CONSUMPTION

Because so little information is currently available on patterns of household consumption outside of Niger's urban centers, estimates of the consumption levels of rural and semiurban households were constructed largely from other information contained in the SAM. First, total consumption by each of these households was derived from income and savings estimates of households. Then the composition of consumption by household was derived.

Total consumption by rural and semiurban households was estimated as the residual between the adjusted national accounts figures for final consumption and the urban consumption estimates outlined above. The consumption levels of semiurban households and of each of the four rural household groups (high- and low-income households in the northern and southern zones) were estimated as estimated incomes (Section 4) less assumed levels of savings. All savings are assumed to be used for investment in livestock, the major asset in the rural economy of Niger. Thus savings by rural household group are derived from livestock ownership estimates.

	Ba	nako 1985	Nia	mey 1986	SAM Ni	ger 1987	
· · · · · · · · · · · · · · · · · · ·	Total	High Income	Total	Government	Urban I	Urban II	
Grains	19.0	13.6	15.8	11.7	11.7	17.0	
Export crops	2.8	1.7	0.9	0.7	0.7	1.0	
Other crops	15.6	12.7	10.8	8.0	8.0	11.7	
Livestock	-	-	0.0	0.0	0.0	0.0	
Forestry/fish	_	-	3.6	2.7	2.7	3.9	
Mining		-	0.0	0.0	2.6	1.6	
Meat	8.3	7.6	8.4	12.5	12.5	7.1	
Processed food	9.0	8.0	6.9	5.4	5.4	7.4	
Manufacturing	45.2	56.5	39.9	45.9	43.3	36.3	
Construction	-	-	0.7	0.7	0.7	0.7	
Trade/restaurants	-	-	4.4	3.2	3.2	4.7	
Transport	-	-	2.9	2.1	2.1	3.1	
Private services	-	-	5.1	6.5	6.5	4.6	
Public services	-	-	0.6	0.5	0.5	0.8	
Total	100.0	100.0	100.0	100_0	100.0	100.0	
All Food	54.8	43.5	46.5	41.1	41.1	48.1	
Annual per capita expenditures (CEAE 1,000)	115.8	211_1	139, 1	187.8	276 3	152 6	

Table 13 - Niger: Urban Household Budget Shares

Sources: Rogers and Lowdermilk (1988); Ministère du Plan (1988); authors' calculations.

Note: Bamako, Mali figures are for the first round of the survey.

The composition of expenditures by commodity was derived by first constructing an initial estimate of household consumption. In the initial estimate, it is assumed that per capita consumption of grains and export crops is constant across rural household groups and that consumption of other crops and livestock products (mostly milk and poultry) is distributed according to each household group's estimated share in rural production. Consumption shares of all other products are assumed to be the same for all rural household groups. The matrix of initial estimates of consumption expenditures was then adjusted using an iterative matrix-multiplier technique (RAS),<sup>18</sup> so that total consumption by each rural household group equals income less savings and that for each commodity, the sum of consumption of each rural household group equals national consumption less consumption by urban and semiurban household groups. Budaet shares and per capita consumption of the rural household groups are shown in Table 14. High meat consumption per capita for the rural poor may reflect market purchases as well as consumption of sheep and goats, since by definition these households do not own cattle.

<sup>&</sup>lt;sup>18</sup> In the RAS technique, the column elements and row elements of a matrix are alternatively multiplied by a factor so that the row or column total is equal to a target level. The mathematical properties of this technique are described in Bacharach (1970).

ı .		8u	dget Shares			Per Capita Consumption					
Expense Category	North Rich	North Poor	South Rich	South Poor	Total Rural	North Rich	North Poor	South Rich	South Poor	Totai Rurai	
			Percentage				CFAF 1	,000 Per P	erson		
Grains	10.4	24.6	15.0	19.6	17.7	10.9	11.9	9.7	9.6	10.6	
Export crops	0.8	2.0	1.2	1.6	1.4	0.9	1.0	0.8	0.8	0.9	
Other crops	4.0	9.5	22.0	28.7	15.8	4.2	4.6	14.2	14.0	9.4	
Livestock	29.6	3.7	12.6	1.6	11.4	30,9	1.8	8.1	0 <b>.8</b>	6.9	
Fish/forestry	2.6	2.8	2.3	2.2	2.5	2.7	1.4	1.5	1.1	1.5	
Meat	11.4	12.4	10.1	10.0	11.1	11.9	6.0	6.6	4.9	6.6	
Food industry	7.5	8.2	6.7	6.6	7.3	7.9	4.0	4.3	3.2	4.4	
Manufacturing	12.6	13.7	11.2	11.0	12.2	13.1	6.6	7.2	5.4	7.3	
Construction	0.3	0.3	0.2	0.2	0.3	0.3	0.1	0.1	0.1	0.1	
Hotels, restaurants	5.3	5.8	4.8	4.7	5.2	5.6	2.8	3.1	2.3	3.1	
Transportation	5.7	6.3	5.1	5.0	5.6	6.0	3.0	3.3	2.5	3.3	
Private services	9.7	10.6	8.7	8.6	9.5	10.2	5.2	5.6	4.2	5.7	
Public services	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	
Total	100.0	100.0	100.0	100.0	100.0	104.6	48.4	64.6	48.9	59.8	

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Table 14 - Niger: Rural Household Budget Shares

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Sources: Rogers and Lowdermilk (1988); Ministère du Plan (1988); authors' calculations.

### 6. OBSERVATIONS ON THE NIGERIEN ECONOMY AND FURTHER DATA NEEDS

Construction of the Niger SAM required a number of assumptions to fill data gaps and resolve data inconsistencies, especially regarding foreign trade and rural households' income and expenditures. In this section, the implications of the most important assumptions for the SAM are discussed and major data needs are highlighted. Summary tables on the structure of Niger's economy are also presented.

## SAM RESULTS

An aggregated version of the entire SAM is shown in Table 15. All activities accounts are aggregated into a single column and row. In the same manner, all commodities accounts are shown as a single column. Disaggregated activities accounts including the table of intermediate consumption and payments to factors are shown in Appendix Table A.1. Submatrices of the SAM where all the entries are zero by definition, e.g., payments by factors of production to factors of production, are left blank.

#### HOUSEHOLD CONSUMPTION AND SAVINGS

Table 16 presents income and consumption levels and savings rates for the household groups in the SAM. As described in earlier sections, the national accounts figures for production, total income, and consumption are the starting point for these estimates. Data from urban surveys underlie urban consumption estimates: total rural and small urban center consumption is a residual. Savings in rural areas are assumed to equal estimated livestock investment by household group, and net savings by households headed by unskilled workers in large and small urban centers are assumed to be zero. Domestic savings by urban households headed by a skilled worker (Urban I households) are a residual. In Table 15, household expenditures do not include net transfers abroad, which are thus implicitly counted as savings. Although domestic savings by Urban I households are negative, their net transfers abroad are greater in magnitude, so that their overall savings rate is 5.1 percent. Given the number of assumptions required and the relatively poor microeconomic data underlying the estimates, the figures presented in Table 16 indicate only broadly at best actual income and expenditure levels in Niger.

The rural data underlying the SAM is especially weak. No microlevel data on nonagricultural income in Niger are currently available, apart from estimates of production by informal sector enterprises in the rural areas used in the national accounts and the SAM. Workers' remittances from outside Niger that do

#### Table 15 - Niger SAN (Aggregated)

	Activ	Commod	15 SkLab	16 UskLab	17 FCap	18 ICap	19 LandNR	20 LandNP	21 LendSR	22 LandSP	23 HHVrb1	24 HNUrb2	25 HHSrb
Activities Commodities	0 313,237	968,096 138,200	0	0 0	0 0	. O	0 0	0 0	0 0	0	0 66,745	0 72,199	0 20, <b>603</b>
CURRENT ACCOUNTS													
15 Skilled labor	69,164	0									5		
16 Unskilled labor	300,273	0											
17 Capital formation	92,646	0											
18 Capital information	121,147	0											
19 Land north - Rich	14,635	. 0		•									
20 Land north - Poor	6,582	0											
21 Land south - Rich	15,389	.0											
22 Land south - Poor	6,372	0											
23 Household urban 1	O	0	69,164	5,109	0 ·	15,695	0	0	0	0	0	0	0
24 Household urban 2	0	0	0	20,144	0	28,236	332	149	349	145	0	0	0
25 Household semiurban	0	0	0	15,359	0	4,500	253	114	266	110	0	0	0
26 Rural rich - household north	0	0	0	31,614	0	38,612	14,050	0	0	0	0	0	o
27 Rural poor - household north	0	0	0	94,841	0	6,108	0	6,318	0	0	0	0	o
28 Rural rich - household south	0	0	0	71,931	0	25,814	0	0	14,774	0	0	0	0
29 Rural poor - household south	0	0	0	61,275	0	2,181	0	0	0	6,117	0	0	0
30 Enterprise formation	0	0	0	0	68,470	0	0	0	0	0	1,743	0	٥
31 Financial institution	0	0	0	0	0	0	0	0	0	0	2,293	0	0
32 Public administration	28,645	26,660	0	0	Z4,176	0	O	0	0	0	18,907	0	o
33 Rest of world (imports)	0	193,800	0	0	0	0	0	0	Ŭ	0	16,388	0	o
CAPITAL ACCOUNTS													
34 Drivate											-11 576	n	
35 Public administration											1,5,0	0	'n
36 Change stock											n 0	0	0
37 Rest of world											0	ů	0
Total	968,089	1,326,756	69,164	300,273	920,646	121,147	14,635	6,582	15,389	6,372	94,501	72,199	20,603

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#### Table 15 (continued)

	26 HHNR	27 HHNP	28 HKSR	29 HHSP	30 FEnt	31 Infin	32 PAcha	33 Row	34 Prilmy	35 Publiny	36 ChStk	37 ROM	Total
Connodities	76,297	106,006	107,186	69,123	0	0	109,006	144,939	35,784	54,979	12,456	0	1,326,761
CURRENT ACCOUNTS													
15 Skilled labor													69, 164
16 Unskilled labor													300,273
17 Capital formation													92,646
18 Capital information													121,147
19 Land north - Rich													14,635
20 Land north - Poor													6,582
21 Land south - Rich			, •										15,389
22 Land south - Poor													6,372
23 Household urban 1	0	0	0	0	2,339	713	0	1,481					94,501
24 Household urban 2	0	0	0	0	0	0	22,844	0					72,199
25 Household semiurban	0	0	0	0	0	0	0	0					20,603
26 Rural rich - household north	0	O	0	0	0	0	0	0					84,275
27 Rural poor - household north	0	0	0	0	0	0	0	0			•		107,268
28 Rural rich - household south	0	0	0	· • 0	0	0	0	0		*			112,519
29 Rural poor - household south	0	0	0	0	0	a	0.	0					69,573
30 Enterprise formation	0	0	0	0	183	9,319	0	0					79,715
31 Financial institution	0	0	0	0	13,343	48	5,702	0					21,386
32 Public administration	0	0	0	0	12,376	2,521	5,187	34,655					153,127
33 Rest of world (imports)	0	0	0	Q	5,431	3,310	19,618	0					238,547
CAPITAL ACCOUNTS					,								
34 Private	6,014	951	4,020	340	37,290	5,475	0	0	0	0	0	0	42,514
35 Public administration	. 0	0	. 0	0	. 0	. 0	-9,320	0	6,730	0	0	57,479	54,979
36 Change stock	1,966	311	1,315	111	8,753	0	0	0	0	0	0	0	12,456
37 Rest of world	0	0	0	0	0	0	0	57,472	0	0	0	Ó	57,472
Total	84,277	107,268	112,521	69,574	79,715	21,386	153, 127	238,547	42,514	54,979	12,456	57,479	

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	Revenue Per Capita	Expenditure Per Capita	Savings Rate	Consumption Per Capita
	CFAF 1,000	CFAF 1,000	Percent	CFAF 1,000
Urban I	414.5	393.4	5.1	292.8
Urban II	159.9	159.9	0.0	159.9
Semiurban	59.8	59.8	0.0	59.8
All urban	182.9	178.2	2.6	155.8
Rural North - high income	115.5	104.6	9.5	104.6
Rural North - low income	49.0	48.4	1.2	48.4
Rural South - high income	67.8	64.6	4.7	64.6
Rural South - low income	49.2	48.9	0.6	48.9
All rural	62.3	59.8	4.0	59.8
All Niger	79.9	77.1	3.5	73.8

Table 16 - Niger: Incomes, Expenditures, and Savings by Household Type

Source: Niger SAM.

not pass through the formal banking system are not included in the balance-ofpayment data in Niger, and are thus not included in the national accounts or in the current SAM. These flows can only be estimated from microlevel data on household incomes and expenditures.

The level and distribution of the returns to informal capital paid to the various households were also major uncertainties in determining household revenues. As discussed in Section 4, the national accounts figures for wages paid in the informal sector do not include imputed wages for the owner or unpaid family workers in individual enterprises. The estimates constructed for the SAM using data from the informal sector survey (Ministère du Plan 1990d) are only approximate. Ideally, the distribution of earnings from informal capital would be based on microlevel data on sources of household revenues. As Section 4 describes, the allocation of returns to informal capital to rural households is based on the distribution of livestock holdings.

Table 17 shows the sources of income for rural household groups assumed in the SAM. Rural north — high-income households are estimated to be net purchasers of labor. The shares of southern households' incomes derived from crops (41.4 and 57.1 percent for high- and low-income households, respectively) is similar to the 43.1 percent share in two villages in Zinder *département* in 1977/78 (Sutter 1982). The SAM estimates for livestock income shares for southern farmers are widely spread (25.0 and 3.4 percent for high- and low-income households, respectively), while data from Zinder show variations in livestock income shares of 11.0 to 19.6 percent for various household groups. The overall structure of rural revenues is quite close to the aforementioned survey results, however. The average nonagricultural income share in the SAM, 38.7 percent, is almost identical to the 40.5 percent found in the Zinder survey.

#### PRODUCTION DATA FROM THE NATIONAL ACCOUNTS

Apart from a small adjustment arising from the reduction of the cowpea import figure to zero, the Niger SAM maintains the production and value-added estimates of the national accounts. Utilization of output differs more substantially because of the adjustments for unrecorded trade in livestock, cowpeas, and manufactured goods described in Section 4 (Table 18).

The SAM also presents a different disaggregation of GDP by payments to factors of production, by including imputed values of wages paid to family labor in the informal sector of Niger's economy as part of the wage bill (Table 19). Total wages account for 56.4 percent of GDP in the Niger SAM, compared to 32.6 percent for capital and only 6.6 percent for land (agricultural capital).

## CONCLUSIONS

The SAM presented in this paper is not a final product. The Ministère du Plan's national accounts tables for 1987, which form the foundation of the SAM, are not yet complete, and inconsistencies remain between the input-output table

	Rural Rich Hholds North	Rural Poor Hholds North	Rural Rich Hholds South	Rural Poor Hholds South	Total Rural
			Percentage		
Crops	12.5	29.5	41.4	57.1	34.4
Labor	11.1	26.2	36.3	50.1	30.3
Land	1.4	3.3	5.1	7.0	4.1
Livestock	49.9	6.2	25.0	3.4	21.2
Labor	34.9	4.3	17.5	2.4	14.8
Land	15.0	1.9	7.5	1.0	6.4
Forestry, fishing	3.1	7.3	5.3	7.3	5.7
Labor	2.8	6.6	4.7	6.5	5.2
Land	0.3	0.7	0.5	0.7	0.6
Subtotal	65.5	43.0	71.7	67.8	61.3
Labor	48.8	37.1	58.6	59.0	50.3
Land	16.7	5.9	13.1	8.8	11.0
Returns to capital	45.8	5.7	22.9	3.1	19.5
Off-farm labor (net)	-11.3	51.3	5.4	29.1	19.2
Total income	100.0	100.0	100.0	100.0	100.0
Income per capita (CFAF 1,000)	115.5	49.0	67.8	49.2	62.3

Table 17 - Niger:Rural Income Shares

Source: Niger SAM.

Table 18 - Niger: GDP by End Use

	Niger SAM	Niger SAM Share of GDP	National Accounts	Difference <sup>a</sup>
	CFAF Billions	Percentage	CFAF Billions	CFAF Billions
Private consumption	518.2	76.0	529.0	-10.8
Private investment	48.2	7.1	48.2	0.0
Government	164.0	24.1	164.0	0.0
Consumption	109.0	16.0	109.0	0.0
Investment	55.0	8.1	55.0	0.0
Exports	144.9	21.3	119.0	25.9
Imports	193.8	28.4	174.7	19.1
Total GDP	681.5	100.0	685.5	-4.0
Total savings	103.2	15.1	_	-
Private savings	55.0	8.1	-	_
Government savings	-9.2	-1.4		-
Foreign savings	57.5	8.4	_	-

Sources: Ministère du Plan (1990a); Niger SAM.

<sup>a</sup> Difference is SAM less national accounts.

**Note:** - denotes data not available.

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	Value	Share
×	CFAF Billions	Percentage
Salaries	369.4	54.2
Skilled labor	69.2	10.1
Unskilled labor	300.3	44.1
Returns to capital	213.8	31.4
Formal sector	92.6	13.6
Informal sector	121.1	17.8
Returns to land	43.0	6.3
North, high income	14.6	2.1
North, low income	6.6	1.0
South, high income	15.4	2.3
South, low income	6.4	0.9
Net indirect taxes	55.3	8.1
Total GDP	681.5	100.0

Table 19 - Niger: GDP by Factors of Production

Sources: Ministère du Plan (1990); Niger SAM.

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(*Tableau Entrée-Sortie* or TES), the comprehensive economic table (*Tableau Economique d'Ensemble* or TEE), and the financial operations table (*Tableau des Operations Financières* or TOF). Few results from the ICRISAT/IFPRI rural household surveys are currently available. Small revisions are even being made to population figures from the 1988 census.

This current SAM, therefore, is heavily laden with assumptions, particularly concerning rural incomes and expenditures. It is broadly consistent with the national accounts for 1987, and, like all SAMs, it has the virtue of being internally consistent: receipts and payments balance for each account. On a macroeconomic level, the SAM appears to be fairly reliable, in spite of some uncertainty regarding cross-border unrecorded trade. Major improvements could be made on the microlevel using the forthcoming results of a number of household surveys.

In spite of its shortcomings, the current SAM does reflect the major characteristics of the Nigerien economy, particularly at the macroeconomic level. As such, it is suitable as a database for a general equilibrium model. Although detailed analysis of the effects of government policies and external shocks on various household groups will require more data, models based on the current SAM can provide meaningful insights for economic policy analysts in Niger.

#### APPENDIX A

## ANALYSIS OF THE INPUT-OUTPUT RELATIONS OF NIGER'S ECONOMY<sup>19</sup>

This appendix presents a preliminary investigation of the sectoral articulation of Niger's economy between 1981 and 1987, by comparing the inputoutput tables for these years. This exercise also highlights some of the differences between the 1987 national accounts and the older (and still official) series of accounts. These differences result both from structural changes in Niger's economy as well as from differences in methodologies used in the construction of the two input-output tables.

Within the context of structural analysis, one is interested in the identification of key sectors, the sources of growth and structural changes, and the role of economic policy in the process. These aspects can be investigated with the help of the basic input-output model pioneered by Leontief, which is the kernel around which all other economywide multisector models are built.

## THE BASIC INPUT-OUTPUT MODEL<sup>20</sup>

The simple input-output model of an economy assumes n industries or sectors where each industry produces only one good using a single process. In the course of production, the industry uses as inputs goods and services produced by other industries in addition to the primary factors. It is further assumed that the amount of input i required in the production process j is in direct proportion to the level of output in sector j. This may be formally stated as

$$x_{ii} = a_{ii}x_i \tag{1}$$

where  $a_{ij}$ , the technical coefficient, is assumed constant;  $x_{ij}$  is the amount of input i used by sector j to produce  $x_j$  units of gross output. The assumption of constant technical coefficients implies that technology is characterized by constant returns to scale and that each sector uses inputs in fixed proportions.

The distribution of sectoral output among intermediate uses, final demand, and the equilibrium condition that supply equals demand are described by a system

<sup>&</sup>lt;sup>19</sup> This appendix is a condensed version of the analysis found in Nssah (1991).

<sup>&</sup>lt;sup>20</sup> More detailed presentations of the theory of input-output analysis can be found in Bulmer-Thomas (1982) and Miller and Blair (1985).

of linear equations known as the material balance equations. These equations may be formally written as

$$x_i = \sum_j x_{ij} + b_i$$
,  $i = 1, 2, ..., n$  (2)

or in matrix form, using Equation 1,

$$x = Ax + b, \qquad (3)$$

where x is an n-dimensional vector of gross outputs, A an nxn matrix of technical coefficients, and b an n-vector of final demand. The system of material balance equations is equivalent to

$$(I - A)x = b, \tag{4}$$

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where I is the identity matrix of dimension n and (I - A) is known as the technology matrix. The levels of gross output x are endogenous variables. They are linked to final demands (exogenously determined) by the technology matrix. So long as this matrix is nonsingular, the unique solution to the system is

$$x = Ub, \tag{5}$$

where  $U = (I - A)^{-1}$ , the Leontief inverse. In other terms,

$$x_i = \sum_j u_{ij} b_j.$$
 (6)

This expression shows that the gross output from sector i required to meet a given configuration of final demand is a linear combination of the net demands, where the coefficients are determined by technology.

### BACKWARD AND FORWARD LINKAGES

One method of identifying key sectors of the economy is to measure the degree to which a sector uses inputs from other sectors (backward linkages) or provides inputs to other sectors (forward linkages). The most commonly used measures of backward and forward linkages are the Rasmussen indices based on the elements of the Leontief inverse.

Equation 6 shows that the (i,j) element of the Leontief inverse represents the partial derivative of the gross output in sector i with respect to final demand in sector j. In other terms,

$$\frac{\partial x_i}{\partial b_i} = u_{ij}.$$
 (7)

This is the total impact (direct and indirect) of a small change in final demand for sector j output on sector i. To find the total impact for all sectors of a change in final demand, we just sum over all i's. The result is the  $j^{th}$  column sum of the Leontief inverse. Hence, the average impact on the economy of a unit change in demand for sector j output is given by

$$\mu_{j} = \frac{1}{n} \sum_{i} u_{ij}, \qquad (8)$$

where n is the number of sectors in the economy.

The i<sup>th</sup> row sum of the Leontief inverse is obtained by setting  $b_j = 1$  in Equation 6. This measures the total effect on sector i output when each element of the bill of goods increases by unity. The average stimulation received by sector i would therefore be:

$$\mu_{i} = \frac{1}{n} \sum_{j} u_{ij}.$$
 (9)

The Rasmussen indices of backward and forward linkages are obtained through a normalization of Equations 8 and 9 using the average value of all elements of the Leontief inverse defined as

$$\mu = \frac{1}{n^2} \sum_{i} \sum_{j} u_{ij}.$$
 (10)

The index of backward linkage is therefore

$$\mu_{i}^{*} = \mu_{i} / \mu_{*}$$
(11)

That of forward linkage is

$$\mu_{j}^{*} = \mu_{j} / \mu. \tag{12}$$

In this context, any sector for which  $\mu_j^*$  or  $\mu_i^*$  is greater than unity is a key sector of the economy. Either a unit increase in final demand in that sector will generate a greater than average impact throughout the economy, or the sector will receive a greater than average stimulation from a unit increase in final demand in all sectors.

## SECULAR CHANGES IN ECONOMIC STRUCTURE

Structural analysis can also shed light on the structural transformation of an economy over time: in particular, the sources of changes and the role of economic policy in the process. The analysis of the first issue is commonly conducted within the input-output structural decomposition framework. The approach followed here is described in Dervis et al. (1982) and Skolka (1989).

For a given country, consider two different vectors of output  $x_1$  and  $x_2$  pertaining perhaps to a base year and a current year, respectively. If technology is approximated by a Leontief system, then the change in sectoral output between the two years may be written in accordance with Equation 5 as

$$\Delta x = x_2 - x_1 = U_2 b_2 - U_1 b_1. \tag{13}$$

Adding and subtracting  $U_2b_1$ , then rearranging, we get

$$\Delta x = (U_2 - U_1)b_1 + U_2 (b_2 - b_1).$$
(14)

This equation shows that, as expected, changes in technology or changes in final demand cause changes in sectoral output. Technological change is measured by the difference between the two Leontief inverses weighed by the base year's final demand. The shift in final demand is weighted by the current year's Leontief inverse.

There is an index number problem implicit in the above decomposition. Indeed, one alternative would be to use current year final demand as weights for technological change, and to use the base year Leontief inverse as weights for changes in final demand. Depending on the chosen weights, the resulting expressions would be analogous to the Laspeyres (base year) or Paasche (current year) index formulae. Thus, there seems to be no unique way of approaching the structural decomposition problem. Furthermore, changes in production technology or input substitution induced by changes in relative prices may cause changes in input-output coefficients as reflected by the difference between the two Leontief inverses. In any case, the two effects are not separable. Also, the net final demand is composed of domestic demand and net export, thus Equation 14 may be further disaggregated to account for these factors separately. The equation is the basis for the first difference formulation of structural decomposition. It allows one to ascribe first differences in gross output to causal factors such as technology and various components of final demand. The approach is most useful in identifying the major engines of sectoral growth.

To analyze the sources of changes in the structure of output, deviations from proportional growth are substituted for the first differences in Equation 14. Under the hypothesis of no structural change and given the linearity of the system, all sectoral output would grow at the same rate as the whole economy. Structural shift in sectoral output is thus described in terms of deviations of individual industries output from levels consistent with the overall growth rates. These deviations are written as

$$\delta x = x_2 - \lambda x_1, \tag{15}$$

where  $\lambda$  is the growth rate of the whole economy, which may be estimated by the growth rate of GDP, total demand, or the rate of growth of domestic demand. The fundamental decomposition equation in this context is

$$\delta x = (U_2 - U_1) b_1 + U_2 \delta b.$$
 (16)

The partial effects associated with either technology or various components of final demand are additive; they can therefore be distinguished by transforming the base year input-output transactions table into a terminal year table through a set of cumulative comparative static shifts in technology and demand parameters. (See, for example, the analysis of Austria by Skolka 1989.) In the following empirical results on changes in Niger's economic structure over time, however, Equations 14 and 16 are used in a straightforward manner.

## **EMPIRICAL RESULTS**

The available input-output accounts for 1981 and 1987 have organized production into 21 and 28 sectors, respectively (Lequiller 1984; Temple 1990). In order to allow strict comparability of the two matrices, the two I-O tables have been aggregated to 14 sectors: agriculture (AGR), livestock (LST), fishing and forestry (SYL), mining (MNG), formal manufacturing (MFG), informal manufacturing (ART), energy (ENR), formal construction (BTM), informal construction (BTA), trade (TRD), transport and communications (TCO), financial services (FNC), administration (ADM), and nonfinancial services (NFS). While the 1981 accounts make a distinction between intermediate consumption of home and imported goods, the 1987 accounts make no such distinction. Thus, the matrix of technical coefficients based on domestic goods had to be estimated.

#### **KEY SECTOR IDENTIFICATION**

Appendix Tables A.1 and A.2 present the computed measures of backward and forward linkages within the economy of Niger for the two years under consideration. In terms of backward linkages, the 1981 I-O table suggests that increases in output of trade, nonfinancial services, mining, and construction (both formal and informal) would generate a greater than average impact throughout the rest of the economy. Results using the 1987 I-O table are somewhat different: although the backward linkages of the trade, mining, and informal construction sectors are again greater than average, the backward linkages generated from the formal construction and nonfinancial services sectors are less than average. Instead, three new sectors, informal manufacturing, energy, and public services, are key sectors in terms of backward linkages. In 1981, the key sectors accounted for about 40 percent of gross value added and all but one produce nontradable goods. The share of gross value added accounted for by the key sectors in 1987 stood at about 45 percent, of which 11 percent is assigned to public services.

In terms of forward linkages, the sectors showing greater than average sensitivity to final demand expansion in the 1981 I-O table are fish and forestry, energy, transport and communications, and financial and nonfinancial services for 1981. In 1987, the list is slightly different: nonfinancial services are not included but livestock and formal manufacturing are. Again, only one other tradable sector, livestock, qualifies as a key sector in 1987 on the basis of measures of forward linkage. In 1981, the sectors most susceptible to be stimulated by a general growth in final demand accounted for only about 15 percent of gross value added in 1981 versus 26 percent in 1987.

The above analysis of linkage indices for 1981 and 1987 suggests that the economy of Niger exhibits a low degree of sectoral articulation. Backward and forward linkages from the agricultural sector are small: no index for agriculture was greater than 0.83. This is consistent with the low use of inputs and high share of home consumption of output in Niger's agriculture. Furthermore, of the sectors with greater than average forward or backward linkages, only two are tradable: mining and livestock. The others fall in the tertiary and are dominated by either the informal sector or the public sector.

Appendix Table A.3 shows the decomposition of economic growth for each sector between 1981 and 1987. According to the calculations, changes in inputoutput coefficients and export contraction largely explain the lack of positive growth observed from 1981 to 1987. Each of these factors had about the same influence on growth and their combined effect overwhelms the globally positive effect of domestic demand expansion. The crisis in the formal manufacturing and construction sectors is explained by changes in domestic demand, which, however, did significantly stimulate the informal manufacturing sector.

It is not clear, however, that the changes in the input-output coefficients between 1981 and 1987 reflect true changes in technology, rather than changes in the methodology used in estimating the coefficients. Most striking is the livestock sector, where although the contraction in output is attributed mainly to changes in final demand (both domestic and foreign), changes in input-output coefficients had a significant positive impact on the sector. Given that no major technical innovations have been widely adopted in the six-year interval, it seems likely that the change in the technical coefficient is largely caused by changes in the methodology used in national accounting.

Table A.1 - Backward Linkage Indices for Niger, 1981 and 1987

Sector	1981	1987
Agriculture	0.83135	0.79750
Livestock	0.78039	0.73317
Fishing and forestry	0.74016	0.74030
Mining	1.24779	1.33871
Formal manufacturing	0.85602	0.82566
Informal manufacturing	0.98839	1.15933
Energy	0.74576	1.14588
Formal construction	1.22609	0.92482
Informal construction	1.14355	1.12941
Trade	1.43147	1.29245
Transport and communications	0.92587	0.91605
Financial services	0.79730	0.79872
Administration	0.98239	1.21725
Nonfinancial services	1.30348	0.98076

Source: Computed.

Sector	1981	1987
Agriculture	0.83362	0.81823
Livestock	0.97594	1.19470
Fishing and forestry	1.12444	1.05864
Mining	0.73607	0.73247
Formal manufacturing	0.96137	1.14850
Informal manufacturing	0.99462	1.00815
Energy	1.37554	1.47227
Formal construction	0.82636	0.76471
Informal construction	0.99821	0.76008
Trade	0.73607	0.72431
Transport and communications	1.34003	1.20291
Financial services	1.24773	1.47409
Administration	0.73607	0.72529
Nonfinancial services	1.11394	0.91567

Table A.2 - Forward Linkage Indices for Niger, 1981 and 1987

Source: Computed.

Sector		Absol	solute Change Sectoral Output Change							
	IO	Dom Demand	Export	DX	10	Dom Demand	Export	DX		
		CFAF	Billions	illions		Percen	itage			
Agriculture	-3.677320	16.291300	-3.419400	9.194580	-0,399940	1.771837	-0.371890	1		
Livestock	15.192730	-16.388200	-7.529820	-8.725290	-1.741230	1.878241	0.862988	1		
Fishing and forestry	-2.100740	5.858680	0.178490	3,936430	-0.533670	1.488323	0.045343	1		
Mining	0.884880	6.065950	-19.270900	-12.320100	-0.071820	-0.492360	1.564188	1		
Formal manufacturing	-2.055720	- <b>24.91</b> 2600	1.903150	-25.065200	0.082015	0.993913	~0.075930	1		
Informal manufacturing	1.134120	9.382140	13.379820	23.896080	0.047461	0.392623	0.559917	1		
Energy	-1.013380	20.675450	-2.857130	16.804940	-0.060300	1.230320	-0.170020	1		
Formal construction	-4.091650	-47.199100	-0.226730	-51.517500	0.079423	0.916176	0.004401	1		
Informal construction	-13,140700	0,891230	-0.196390	~12.445900	1.055829	-0:071610	0.015780	1		
Transport and communications	1.030590	18.581950	-4.117370	15.495170	0.066510	1.199209	-0.265720	1		
Financial services	-7.878980	1.317310	-3.191760	-9.753430	0,807816	-0.135060	0.327245	1		
Administration	0.044640	32,313490	-0.000350	32.357780	0.001380	0.998631	-1.1??05	1		
Nonfinancial services	-5.339320	22.360580	-0.510980	16.510280	-0.323390	1.354343	~0.030950	1		

#### Table A.3 - The Sources of Change in Gross Output for Niger, 1981-1987

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Source: Computed.

#### APPENDIX B

#### NIGER SAN COMMODITY ACCOUNTS

	PRODUITS	Grn	СЕхр	AutC	Elev	Sylv	Nine	Bouc	AlmF	AlmI	ManF	Manl	BTPF	BTP I	ComF	ComI	TrnF	Trnl	SerF	Serl	SPub
1C	Graines	2579	0	0	3	0	0	0	2642	14	0	4	0		0	3744	0	0	0	0	0
2C	Cult d'Export	0	4116	0	0	0	0	0	0	0	0	0	0	0	718	435	0	0	0	0	0
3C	Aut Cultures	0	0	359	0	0	2805	0	61	0	637	158	15	0	0	4520	0	0	0	0	0
4C	Elevage	1466	492	1175	0	0	0	44277	1372	253	0	0	0	0	0	0	0	0	0	0	0
5C	Peche/Foret	0	0	0	0	480	0	0	0	8	131	294	577	8663	0	648	0	0	0	305	340
6C	Indust Extract	0	0	0	0	0	0	0	0	0	0	173	2751	0	. 0	· 0	0	0	0	0	0
7C	Boucheries	0	0	0	0	0	0	0	0	1528	0	5	-0	0	623	4091	0	0	0	1	0
8C	Indust Aliment	0	0	0	270	0	0	0	588	565	517	507	115	0	257	5875	110	0	0	0	10
9C	Indust Manufact	2676	899	2144	682	585	28040	37	1820	869	31337	6882	13006	1639	1767	581	5224	10741	3255	10332	19126
10C	Batiments	0	0	0	11	0	558	0	27	0	306	0	398	0	191	0	27	0	229	0	743
11C	Commerce	0	0	0	0	0	1	0	0	0	0	0	714	0	217	0	- 50	0	. 3	0	1693
	Commerce-Import					_															
12C	Transp/Commun	0	0	0	5	0	12480	113	7	31	661	134	1091	73	1442	8118	1898	810	908	320	8713
13C	Services	0	0	0	360	0	3362	21	189	167	1029	365	4002	2066	6960	1781	1392	2175	1435	1203	1701
14C	Admin publique	0	0	0	0	0	0	0	0	0	. 0	0	51	0	78	0	6	0	1	0	3
FACI	EURS																				
15	Md'Oeuv Qual						13243	0	703	0	4796	0	5682	_	4125	0	5667	0	4068	0	30881
16	Md Oeuv Non-Qual	57044	16232	44619	57713	20052	3249	248	172	2110	1176	11510	1394	2485	1012	32259	1390	6587	998	21094	18927
17	Capital Formel						22682		1443		15410		7164		8807		8618		4346		24176
18	Capital Informel							9093		1279		7128		3488		66599		8432		25128	
19	Terre N Riche	650	187	394	13134	271															
20	Terre N Pauvre	1949	560	1181	2078	814							•								
21	Terre S Riche	2019	5/1	3402	8781	617															
22	Terre S Pauvre	1720	486	2898	742	526															
INSI	TIUTIONS								4055					440					4777	40/4	
32	Admin Publique	829	278	664	994	39	4774	146	1255	86	880	515	545	118	4982	2226	(17	2758	1355	1961	-22
	a.Impots Directs																				
	p.impors indirect	920	270	441	00/	70	1771	1/4	1255	94	890	517	7/7	110	1093	5004	717	275.0	1777	1041	- 22
	d Thomatorta	029	210	004	994	76	4774	140	1200	00	000	212	343	110	4702	3770	111	2150	1223	1901	-22
77	PDM(Importe)																				
		*****																			
	TOTAL	70932	23821	56835	84772	23384	91194	53935	10279	<b>691</b> 0	56880	27673	37303	18532	31179	134648	25099	31503	16576	60344	106291

Source: Niger SAM.

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