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OCCASIONAL PAPERS

A FRAMEWORK FOR ECONOMIC ANALYSIS OF FAMILY PLANNING PROJECTS: A CASE STUDY OF THE PLANNED NIGER FAMILY HEALTH AND DEMOGRAPHY PROJECT

by

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SPECIAL NOTE

This is the first in a series of Occasional Papers to be published by the Population Technical Assistance Project (POPTECH).

The series is designed to disseminate to the population community insights that have arisen or lessons that have been learned from assignments undertaken for the U.S. Agency for International Development by the POPTECH project.

Author Robin Barlow here offers a new methodology to analyze the economic benefits of family planning projects. As he notes on page 3 of this paper, the cost-benefit analysis of family planning projects is in a state of some confusion. This, he writes, is because "the typical family planning project will at the same time raise the level of per capita income and lower the level of total income, at least after a number of years" because of a reduction in the labor force, and therefore, "it is not clear whether the economic benefits should be considered positive or negative." The various methodologies that have been used to analyze cost-benefit ratios for family planning projects have yielded widely varying results.

The methodology set forth in this paper addresses this problem. It can be used for both projects like family planning that will affect the size of the population and those like agriculture that will not, and thus will allow for comparisons of projects in different sectors.

It is hoped that the insights in this paper will be useful to others wishing to conduct similar types of analyses.

I. INTRODUCTION

This paper was prepared to support the preparation of a Project Identification Document (PID) for the Family Health and Demography Project in Niger to be funded by the U.S. Agency for International Development.

The project consists of two subprojects:

a. Family planning services (Family Planning Subproject)

b. The collection and analysis of demographic data and training in demography and population-related planning (Demographic Research Subproject).

The economic analysis was designed (1) to analyze the implications of an expanded family health program for the budget of the Ministry of Public Health and Social Affairs, in particular recurrent costs and staffing requirements; (2) to assess issues of contraceptive pricing and cost-recovery options, including fees for family health services; (3) to prepare a framework for an analysis of economic issues at the project planning stage; and (4) to identify the technical assistance and training requirements for integrating demographic data into economic planning.

This paper addresses item (3) above. It presents a framework for conducting an economic analysis of a family planning project using the analysis of the proposed Niger family planning subproject as a case in point. The framework provides a means of estimating the costs and benefits, cost-effectiveness, recurrent costs, and cost-recovery possibilities of a project.

The paper was prepared by health economist Robin Barlow, based on field work conducted in Niger in April 1987, and revised in February 1988 on the basis of additional demographic and cost data that became available following his visit. Mr. Barlow is Director, Center for Research on Economic Development, and Professor, Department of Economics, Department of Population and International Health, University of Michigan.

II. COST-BENEFIT ANALYSIS

A. Introduction

A cost-benefit analysis of a planned project involves estimating the value of the additional income generated by the project and then comparing that with its costs. If the benefits exceed the costs, the project can be said to increase the average material well-being of the population.

Implicit in cost-benefit analysis is the judgment that raising the average material well-being of the population is one social objective to which the government attaches some importance. At the same time, other social objectives may also exist. In the case of the family planning subproject, the point is important, because many would argue that the main value of the project lies in promoting certain social objectives other than the raising of average material well-being. Among those other objectives would be:

1. Improving health: Wider spacing of births results in health gains for both mothers and children.

2. Reducing unemployment: In the long run, family planning reduces the growth rate of the labor force and may in consequence reduce unemployment rates.

3. Reducing income inequality: The slower growth of the labor force, by restricting labor supply, will tend to raise real wage rates and reduce income inequality.

The existence of social objectives other than the raising of average material well-being means that cost-benefit analysis cannot provide by itself a definitive answer as to whether a project should be undertaken or not.

It may be quite rational to implement a project with an unfavorable cost-benefit ratio if that project makes sufficient contributions toward other objectives, such as reducing mortality (viewed as an end in itself and not as an economic goal).

In the case of this project, because the two subprojects have distinctly different sets of benefits, it is desirable to conduct a separate cost-benefit analysis of each subproject.

B. Cost-Benefit Analysis of Demographic Research Subproject

By improving the demographic data base and by improving

the ability of Nigerien planners to exploit those data, the Demographic Research Subproject should improve the quality of economic planning in Niger and thus contribute to the future growth of output. The potential economic benefits of the subproject seem clear in qualitative terms, but their quantification is not possible, and so a cost-benefit ratio cannot be calculated. Of course, given an economy of Niger's size, where gross domestic product approximates $2 billion, only a minuscule improvement in macroeconomic planning is needed in order to generate gains equal to the cost of the Demographic Research Subproject, which may be about $2 million.

C. General Cost-Benefit Analysis of Family Planning Subproject

Compared with projects in areas like irrigation or transportation, cost-benefit analysis of family planning projects is in a state of some confusion. The confusion arises because the typical family planning project will at the same time raise the level of per capita income and lower the level of total income, at least after a certain number of years. (Total income will tend to be lower in the long run because of a reduction in the labor force.) In these circumstances, it is not clear whether the economic benefits of the project should be considered positive or negative. Various methodologies have been proposed in attempts to solve this conundrum and yield widely varying cost-benefit ratios for family planning projects.

In choosing a methodology for estimating the economic benefits of proposed family planning projects, it seems important to choose a formulation that can be used without modification both for projects like family planning, which affect the size of the population, and those in other sectors, like transportation, which have no significant effect on population size. After all, one important function of cost-benefit analysis is to permit comparisons between projects in different sectors.

Accordingly, it is proposed that in each year of the period of analysis, project benefits be defined as (a) the increase in per capita income due to the project, multiplied by (b) the population in the area served by the project. This formula is set out in mathematical notation in the Technical Appendix, where it is also shown that in the absence of population effects, this definition of benefits is equivalent to the increase in total income due to the project, which is the conventional measure of benefits in project analysis.

Defining project benefits along these lines means projecting over the period of analysis what population and income would be with the project and without it. Projecting the population year by year means estimating the evolution of birth

rates and death rates. Projecting income (as represented, for example, by gross domestic product) can be done by specifying an aggregate production function of the following form:

gross domestic product = function of (labor force, capital stock)

Labor force projections are obtained from population projections, and capital stock projections are obtained by assuming a certain ratio between annual investment and gross domestic product. The projections of population, vital rates, labor force, capital stock, and gross domestic product, both with and without the Niger family planning subproject over a sixteen-year period ending in 2003, are shown in Tables 3 and 4 of the Technical Appendix.

It should be noted that a sixteen-year period of analysis was used here despite the fact that the present project is designed to last only five years. A long period of analysis is chosen because the project will continue to have important effects after the end of the initial five-year period. It is also assumed here that the family planning activities will be continued on the scale reached in the fifth year, with costs and benefits to match.

The results of the analysis are shown in Table 1. Without the project, per capita GDP in Niger is projected to fall from $300 in 1988 to $296.8 in 2003, given the assumptions made about the economic and demographic parameters of the system.[1] If the project is implemented, per capita GDP is projected to rise to $307.9 by 2003. Multiplying these annual gains in per capita GDP by the population served by the project produces annual project benefits which cumulate to a total of $864.5 million over the sixteen-year period of analysis. At an annual discount rate of 10 percent, those benefits add up to $298.8 million, and a highly favorable benefit-cost ratio of 27.8 is implied. If the period of analysis were extended beyond sixteen years, the benefit-cost ratio would not change dramatically, due to the effect of discounting on values in the distant future. The ratio is sensitive to the discount rate, because the benefits increase over time whereas the costs are concentrated in the near term. However, even at a high discount rate of 15 percent, the ratio still exceeds twenty.

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[1] If more optimistic assumptions were made, these should be applied also to the scenario that includes the family planning project, and they would not produce any significant change in the differences projected between the scenarios with and without the project.

TABLE 1

COST-BENEFIT ANALYSIS OF NIGER FAMILY PLANNING SUBPROJECT

	With Project			Without Project			Project Benefits ((3)-(6)) times (1) ($mil.) (7)	Project Costs ($mil.) (8)
	Population (mil.) (1)	GDP ($mil.) (2)	Per Capita GDP ($) (3)	Population (mil.) (4)	GDP ($mil.) (5)	Per Capita GDP ($) (6)		
1988	7.019	2,106	300.0	7.019	2,106	300.0	0.0	1.8
1989	7.209	2,162	300.0	7.225	2,162	299.3	4.8	1.8
1990	7.404	2,220	299.9	7.437	2,220	298.6	9.9	1.8
1991	7.604	2,280	299.8	7.655	2,280	297.8	15.3	1.8
1992	7.309	2,341	299.8	7.880	2,341	297.1	20.9	1.8
1993	8.020	2,404	299.7	8.111	2,404	296.3	26.8	0.9
1994	8.231	2,474	300.6	8.353	2,474	296.2	36.1	0.9
1995	8.447	2,547	301.5	8.602	2,547	296.1	45.9	0.9
1996	8.669	2,621	302.4	8.859	2,621	295.9	56.2	0.9
1997	8.897	2,698	303.3	9.123	2,698	295.8	67.0	0.9
1998	9.130	2,777	304.2	9.395	2,777	295.6	78.4	0.9
1999	9.380	2,860	304.9	9.682	2,864	295.8	85.4	1.0
2000	9.637	2,946	305.7	9.977	2,954	296.1	92.7	1.0
2001	9.901	3,034	306.4	10.281	3,046	296.3	100.3	1.0
2002	10.172	3,125	307.2	10.595	3,142	296.5	108.3	1.0
2003	10.451	3,218	307.9	10.918	3,240	296.8	116.5	1.1
				SIXTEEN-YEAR TOTAL at discount rate of		0%	864.5	19.7
						5%	494.7	14.1
						10%	298.8	10.7
						15%	189.8	8.6

SOURCE: Tables 3 and 4.

NOTES: Dollars are of 1988 purchasing power; project costs as estimated by Population Office, USAID/Niamey.

It is clear from Table 1 why the Family Planning Subproject produces such large discounted benefits. In the short run, the project reduces the size of the population but has no effect on the size of the labor force and, hence, no effect on GDP. Therefore per capita GDP rises relative to the situation without the project. After a certain lag (ten years is assumed in this analysis), the project starts to have a negative impact on the labor force and GDP. The gap between per capita GDP with and without the project then grows at a diminishing rate but still remains substantial.

D. Partial Cost-Benefit Analysis of Family Planning Subproject

Another type of cost-benefit analysis that is of some interest looks at the effect of a project not on aggregate economic activity, (which is the concern of the general cost-benefit analysis just described), but on the activity in a specific sector, such as education or agriculture. This type of partial analysis cannot substitute for the general or aggregate analysis, and it is always open to the criticism that any gains from the project found in sector A may be offset by losses in sector B, which the analyst has ignored.

With this caveat in mind, we can note the individual sectors where family planning projects are often said to produce economic gains:

1. Education.

   Fewer births mean a budgetary saving for the educational system, after a lag of five or six years. In analyses undertaken for the bilateral family planning project in Senegal, for example, it was estimated that the value of this saving, by itself, will exceed the cost of the project.[2]

2. Health care.

   Fewer pregnancies and deliveries mean less pressure on health care facilities, initially at the maternal and child health level and later for other facilities in the system.

3. Urban infrastructure.

   A slowing down of the rate of urban population growth means budgetary savings for the authorities responsible

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[2]USAID, Senegal Family Health and Population Project Paper, Annex F (1985), p. F-16.

for providing such urban services as sanitation, water supply, and mass transit.

4. Housing.

In the long run, fewer births mean a decline in the number of new households being formed and, hence, a decline in the need for new housing.

5. Agriculture.

In Niger, the growth of agricultural output has been relatively slow over the past twenty-five years. The curve indicating agricultural output in Figure 1 implies a growth rate of only 1.2 percent annually, on average, between 1961 and 1985. It seems unlikely that growth was held back to any important extent by agricultural labor shortages, as the population was growing at an average annual rate of 2.6 percent over the same period. Rather, the reasons for slow agricultural growth seem to be factors like water shortages, lack of funds for investment, and various institutional difficulties. In these circumstances, slower population growth is likely to improve the balance between agricultural production and consumption as a result of reducing consumption needs while having little or no effect on production. This improvement in the agricultural sector can lead to an increase in exports, a decrease in imports, an increase in per capita consumption, or a combination of all three.

E. Conclusions

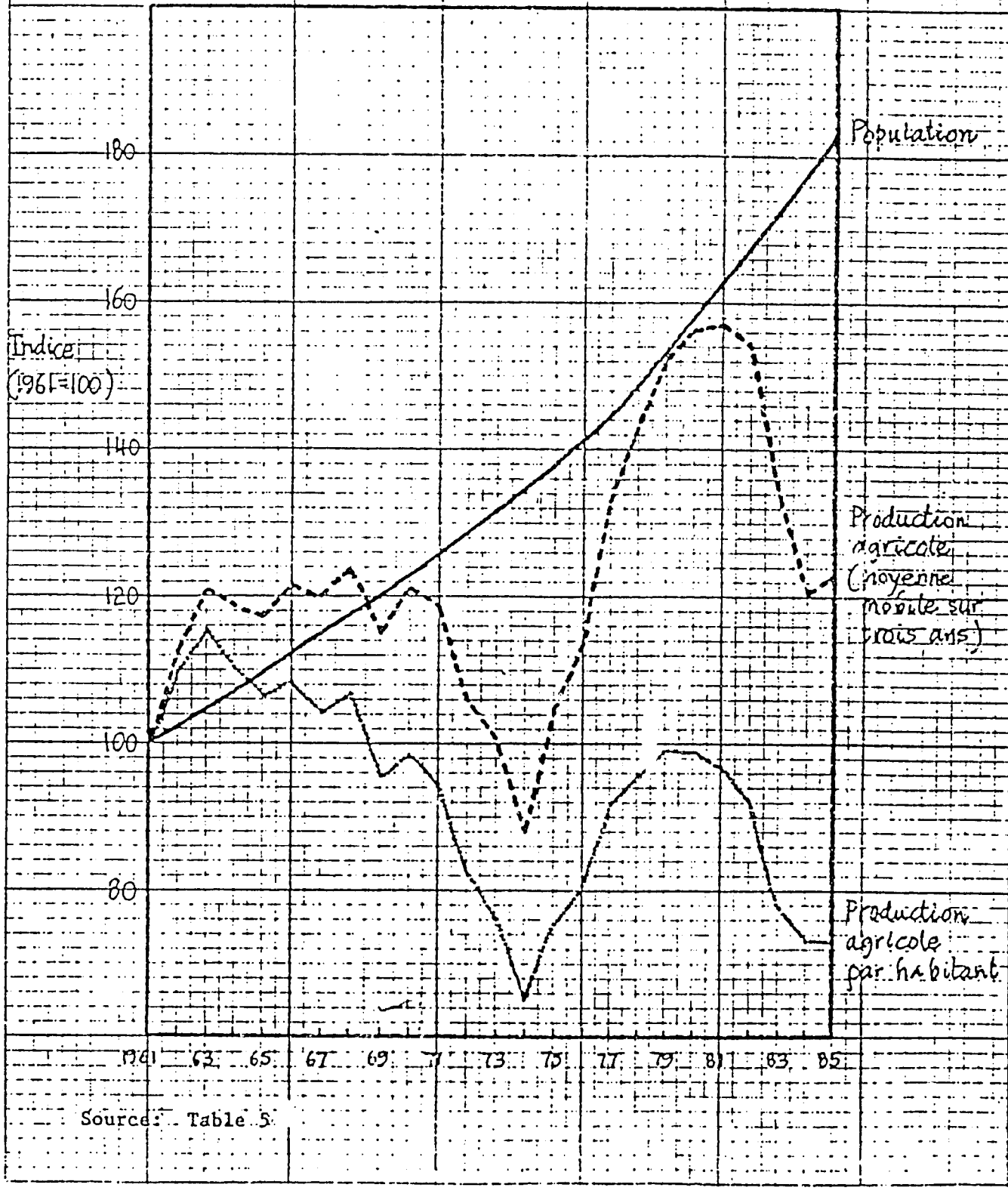
1. The family planning component of the Family Health and Demographic Project is likely to have a favorable effect on the growth of per capita GDP in Niger. It is estimated that after sixteen years, per capita GDP will be about 3.8 percent higher with the project than without it. This translates to a benefit-cost ratio of about 28 when a 10 percent discount rate is used.

2. In specific sectors, the Family Planning Subproject is likely to produce budgetary savings for public agencies concerned with education, health care, urban services, and housing. The subproject is also likely to make a positive contribution towards the attainment of agricultural self-sufficiency.

3. The Demographic Research Subproject is also likely to have a favorable benefit-cost ratio, although a quantitative estimate in this area does not seem feasible.

Figure 1

EVOLUTION OF POPULATION AND AGRICULTURAL PRODUCTION IN NIGER
1961-85



Source: Table 5.

III. COST-EFFECTIVENESS ANALYSIS

A. Introduction

As noted in the previous section, the Family Health and Demography Project can be divided into a family health subproject and a demographic research subproject. Cost-effectiveness analyses for each of these subprojects involves (1) defining measures of effectiveness, (2) defining alternative systems for achieving the project's objectives, and (3) estimating for each alternative system its effectiveness per dollar of expenditure.

B. Cost-Effectiveness of the Demographic Research Subproject

The question of training in how to incorporate demographic variables in national and sectoral planning is discussed in section VI of this report. There it is proposed that four training modalities should be considered: long-term degree programs abroad, medium-term programs abroad, short-term programs abroad, and workshops in Niger. A cost-effectiveness analysis of these alternatives could consist of estimating for each one its cost per person month of training. The estimates would provide useful information and should be made, but they should not be used as the sole guide for choosing between the alternatives, because the training offered by each alternative differs as to quality and content. A desirable solution, as suggested in section VI, probably involves a mix of all four types.

C. Defining Effectiveness in the Family Planning Subproject

A commonly used measure of effectiveness for family planning activities is "couple years of protection" (CYP). A couple using a contraceptive method for an entire year is said to receive one CYP. The CYP can be related to another commonly used measure of project effectiveness, namely "births prevented." The number of births prevented per CYP depends on such factors as the efficacy of the contraceptive method employed. Because a family planning project will yield health benefits for mothers and infants, other measures of effectiveness become relevant, such as reductions in rates of maternal and infant mortality and morbidity. In the rest of this section, CYP is used as the sole measure of effectiveness, but this is not to deny that other measures (such as the reduction in the number of deaths of women in childbirth) are also important.[3]

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[3]As indicated in Tables 3 and 4 in the Technical Appendix, it is estimated that the Family Planning Subproject will prevent 595,000 births over the sixteen-year period from 1988 to 2003.

D. Alternative Delivery Systems for Family Planning Subproject

Alternative systems for delivering family planning services include the following:

1. Consultations and contraceptives dispensed at fixed-location governmental health units.

2. Consultations and contraceptives dispensed at fixed-location private clinics (commercial or nonprofit).

3. Consultations and contraceptives dispensed from mobile units.

4. Contraceptives sold in pharmacies or other commercial outlets ("social marketing").

These systems are, of course, not mutually exclusive. Present thinking is that the Family Planning Subproject will certainly use the first of these systems, and may also conduct some research and experimentation into the feasibility of using one or more of the other three systems. In the rest of this section, it is assumed that only the first system is in use. This means that at selected fixed-location governmental health units (the Centre National de Santé Familiale, Centres Médicaux, units of Protection Maternelle et Infantile [PMI], and Maternités), the trained personnel of those units (physicians, nurses, midwives) provide consultations and contraceptive supplies to clients visiting the units.

E. Cost-Effectiveness of the Family Planning Subproject

The couple years of protection to be generated by the Family Health Project are presently projected as follows:[4]

Year	1	(1988)	26,173 CYPs
Year	2	(1989)	53,722
Year	3	(1990)	82,645
Year	4	(1991)	112,945
Year	5	(1992)	144,620
Five-year total			420,105

Given a maternal mortality rate of 7 per 1,000 in Niger, the project therefore implies 4,165 fewer maternal deaths over this period.

[4] It is assumed (see Table 4) that by 1993, the project will lower the total fertility rate by 10 percent of the 1988 level. Hence CYPs created by the project in 1992 are assumed to equal 10 percent of the population of married and fertile women, which in turn is assumed to equal 80 percent of females aged 15-49. In 1988-91, CYPs are assumed to equal 2, 4, 6, and 8 percent of the corresponding populations in successive years.

It is important to confirm that these projections are consistent with the planned number of service providers. It can be surmised that to obtain one couple year of protection, three visits to a health unit will be required on the average. Hence in the fifth year of the project, three times 114,620 or 433,860 visits will be required. By that time, it is expected that 224 health agents will have been trained under the project to provide family planning services. Assuming that 85 percent of the agents are actually employed as scheduled and that there are 230 working days in a year, it appears that the projected number of family planning visits can be handled if each agent deals with ten such visits per working day. This seems to be a feasible workload, even though as part of their job the agents are also expected to carry out tasks unrelated to family planning.

The cost of achieving this level of service is presently estimated at $9.2 million. The cost per couple year of protection achieved over the five-year period of the project is therefore $21.90. This compares favorably with the equivalent figure for the bilateral family health project currently being undertaken in Senegal. Under that project, 600,000 CYPs are expected over a seven-year period, during which there will be an A.I.D. contribution of $17.4 million (a total project cost of $20 million minus $2.6 million for census operations).[5] That implies for Senegal a cost of $29 per CYP.

In some ways a more interesting cost-effectiveness measure would be recurrent cost per CYP. At the end of the five-year project in Niger, an annual level of 144,620 CYPs is projected, and the annual recurrent costs are likely to be less than $900,000 (see section IV on recurrent costs). Hence, recurrent cost (or marginal cost) per CYP will probably be less than $6.

F. Conclusions

The Family Planning Subproject is expected to generate 420,106 couple-years of contraceptive protection over its five-year life at a cost of about $9.2 million. This represents a cost of $22 per CYP, a figure that compares favorably with estimates for a similar project in Senegal. Because many of the costs of the Niger project are of a fixed or one-time nature, the marginal cost per couple year of protection is much lower, probably less than $6 per couple year of protection.

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[5]USAID, Dakar, Senegal Family Health and Population Project Paper, Annex F (1985), Tables V and XIII.

IV. RECURRENT COSTS

A. Introduction

To assess this project's sustainability after outside financial support is withdrawn, it is important to estimate the project's recurrent cost burden. This means determining the level of recurrent costs and comparing that amount with the resources out of which the recurrent costs would eventually have to be financed, namely the total budget of the Ministry of Public Health and Social Affairs.

B. Budget of the Ministry of Public Health and Social Affairs

Budgetary data for the Ministry from 1978 to 1987 are shown in Table 2. The future growth of this budget is a speculative matter. Suppose that under conditions of continuing austerity, the budget grows by only one percent annually in real terms. Then by 1993, the year after the withdrawal of the outside support presently envisioned for the Family Health and Demography Project, the Ministry's budget will stand at 5.89 billion CFA francs of 1987 purchasing power. This will be equivalent to about $21.5 million (in dollars of 1988 purchasing power) if the exchange rate in 1993 is the same as currently (287 CFA francs per dollar in February 1988).

C. Recurrent Costs of the Family Planning Subproject

Over the five years of the project, outside contributions toward the financing of the Family Planning Subproject will amount to about $1.8 million annually. It seems clear that a large proportion, probably well over half, of the subproject's costs will be of a one-time or nonrecurrent nature. The substantially nonrecurrent items include the following:

1. Initial training of the managers and providers of family planning services, including IEC activities. After the five-year period of the project, it can be envisioned that training in family planning services will be integrated into the normal curriculum of the Ecole Nationale de Santé Publique and that training materials and local expertise pertaining to these services will have been accumulated. Hence, after that point, no large-scale special expenditures for training will be required.

2. Design of IEC materials.

3. Design of management and service delivery systems.

TABLE 2

BUDGETED OPERATING EXPENDITURES
OF THE MINISTRY OF PUBLIC HEALTH AND SOCIAL AFFAIRS
REPUBLIC OF NIGER: 1978-1987

(in millions of CFA francs)

Fiscal Year	Total Person-nel	Medicines and Vaccines	Trans-port	Other Operating Expend.	Total Operating Expend.
1978	1,061	530	221	398	2,210
1979	1,200	800	267	400	2,666
1980	1,368	942	304	426	3,040
1981	1,641	971	301	435	3,348
1982	1,944	1,105	305	457	3,812
1983	2,327	1,150	360	529	4,366
1984	2,405	1,150	345	556	4,455
1985	2,487	1,150	360	836	4,833
1986	2,613	1,300	383	775	5,071
1987	2,918	1,415	362	855	5,550

This means that the main recurrent costs of the subproject will consist of:

1. Contraceptive supplies.

2. Depreciation and operation of project vehicles.

3. Depreciation of IEC equipment; production of IEC materials for public distribution (posters, shirts, etc.).

It should be noted that the project, as presently proposed, involves the hiring of no additional permanent personnel by the Ministry of Public Health and Social Affairs.

For the purposes of analysis, the conservative assumption is made that the subproject's annual recurrent costs are equal to 50 percent of the annual level of outside financing, or $0.9 million.

D. Recurrent Costs of the Demographic Research Subproject

The demographic research component of the Family Health and Demography Project will not entail significant ongoing recurrent costs. Its activities are basically of a one-time nature, namely the collection and analysis of new demographic data and the training of planners in the incorporation of demographic variables into planning models.

E. Conclusions

At the end of the five-year project period, the project's recurrent costs will probably not exceed $900,000, which is 4.2 percent of what the Ministry's total budget is likely to be at that point.

V. COST RECOVERY

A. Introduction

It is desirable to look into the possibilities for cost recovery in the Family Planning Subproject. "Cost recovery" is defined as the collection of fees from clients of the project and the use of these fees to defray all or part of the project's costs.

B. Reasons for Cost Recovery

In general terms, there are two principal reasons for cost recovery:

1. In conditions of extreme budgetary stringency, such as exist presently in Niger, it is difficult to add new government services unless they generate a significant fraction of their own financing. The Family Health and Demography Project will be financed by outside sources to a significant degree for a five-year period, but after that new sources of financing, such as cost recovery, will have to be found.

2. Charging a price for a product tends to increase the aggregate benefit obtained from that product. It will then be consumed only by those people who value it highly enough to pay for it. Free distribution of a commodity places significant quantities in the hands of people who place little or no value on it.

C. Reasons against Cost Recovery

In the particular context of the Family Planning Subproject in Niger, there are also some reasons for objecting to cost recovery:

1. It would be necessary to set up a system to collect and account for the funds obtained from clients, as the government health units involved now provide their services without charge.

2. There is likely to be significant nonenforcement of charges by the service providers. The health units in question lack financial autonomy, and any revenues they obtained would be transferred directly to the Ministry of Finance. Under these circumstances, the physicians, nurses, midwives, and other providers have little incentive to enforce rigorously a system of patient fees. This situation already exists in the case of the governmental hospitals in Niger. They are supposed to collect fees from patients, but it seems that the

amounts collected have typically been less than half of what the official tariff requires.[6]

3. Because of this same lack of financial autonomy, there is no guarantee that funds collected from clients will be used for the financing of the Family Planning Subproject. In the first place, the funds may not be returned by the Ministry of Finance to the Ministry of Public Health and Social Affairs, either in the form of larger budgetary allocations or otherwise. In the second place, any extra funds obtained by the Ministry of Public Health and Social Affairs might be allocated to ministerial functions other than the Family Health and Demography Project.

4. As indicated by the cost-benefit analysis in section II, the Family Planning Subproject is projected to be highly profitable from a social point of view. In technical terms, the consumption of family planning services generates "positive externalities." That consumption ought therefore to be encouraged through subsidization, that is, the price to the consumer should be kept low.

5. The total costs of family health services include not only the costs of running the health units (personnel time, contraceptive supplies, etc.) but also the costs borne by clients in visiting the units. These client costs include round-trip transportation between home and clinic and the value of the household work or other employment foregone during the visit. By all accounts these costs are likely to be substantial in an expanded program of family health services. It could be convincingly argued that even without paying a fee, the clients will have to bear a large fraction of the total social costs of the service.

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[6]USAID, Country Development Strategy Statement: Niger, FY 1988, Annex B (March 1986), p. 16. Receipts of the eight government hospitals in 1986 amounted to 205 million CFA francs, or about 8 percent of their operating expenditures, which amounted to about 2,535 million CFA francs. Data on hospital receipts have been provided by the Direction des Affairs Administratives et Financieres in the Ministry of Public Health and Social Affairs. The estimate of hospital expenditures is based on (1) an estimate by the World Bank (Staff Appraisal Report: Niger Health Project, February 1986) that 50 percent of the Ministry's operating budget is spent on the hospitals, and (2) a figure of 5,071 million CFA francs for that operating budget in 1986.

D. Opportunities for Cost Recovery

In the Family Planning Subproject, there may be two opportunities for cost recovery:

1. At the government health units providing consultations and contraceptive supplies. These units include the Centre National de Santé Familiale, the Centres Médicaux, the PMIs, and the Maternités. Clients could pay a fee either on a per visit basis or upon the receipt of pills or other contraceptives. It seems, however, that the opportunities for developing charges for family planning services at these health units are severely constrained, quite apart from the difficulties discussed in the preceding paragraphs. The units in question will continue to offer consultations and medicines in areas other than family planning, and it would be quite unworkable to try to collect charges for family planning visits when visits for other purposes are free. In any case, major emphasis in the Family Health and Demography Project is placed on the full integration of family planning services with the maternal and child health services already existing, and it would seem logical that the integration should apply to the fee system as well as to all other aspects of the two types of service. No fees are presently charged for maternal and child health services, but this practice is currently under review. Whatever measures of cost recovery are adopted in the future for maternal and child health services should be applied without modification to family planning services, for both practical and symbolic reasons.

2. At government pharmacies and private depots selling contraceptives. It has not yet been determined what fraction, if any, of the contraceptives supplied by the Family Planning Subproject will be distributed through the pharmacies and depots. To the extent that some are so distributed, a ready-made form of cost recovery exists in that the pharmacies and depots sell their products at a price. Even if this distribution system were to be used, however, a high degree of cost recovery could not be expected. The fraction of total project costs to be represented by contraceptive supplies has not yet been determined, but in the current Senegal Family Health Project, similar in many respects to what is proposed for Niger, the fraction is only 8 percent.

E. Magnitude of Cost Recovery

In addition to the possibility of selling some of the project contraceptives through pharmacies and depots, what degree of cost recovery could be expected from a system of charges to be levied by the governmental health units? A charge sometimes suggested as reasonable is 100 CFA francs per visit. In the fifth and last year of the Family Planning Subproject, a total of 144,620 contraceptive users is projected. For each user, an average of three clinic visits during the year might be supposed. There would then be about 433,860 visits during the fifth year, which at 100 CFA francs per visit implies a total revenue of 43 million CFA francs, or about $150,000 at the current rate of exchange (287 CFA francs per dollar in February 1988).

The total annual cost of the subproject is budgeted at about $1.8 million. However, the annual recurrent costs at the end of the project are perhaps no more than $900,000 per year. Hence, a charge of 100 CFA francs per visit would cover about one-sixth of the project's recurrent costs in its final year.

F. Conclusions

1. A fee of 100 CFA francs per clinic visit would cover about one-sixth of the recurrent costs of the Family Planning Subproject in its final year.

2. However, the case for charging any fee is not overwhelming, even in the hypothetical instance of services offered by independent family planning clinics with financial autonomy.

3. In the actual situation in Niger, where the family planning services are to be integrated with other maternal and child health services, the fees for the former should be on the same basis as the fees for the latter. So long as maternal and child health services remain free, the same should be true for family planning services.

VI. TRAINING IN THE INCORPORATION OF VARIABLES IN PLANNING MODELS

A. Introduction

It is believed by many observers that national and sectoral planning in Niger will be improved if greater account is taken of demographic factors in the models used by planners. This project therefore proposes to offer training in this area. What needs to be established is (1) the clientele of the training program, (2) the subjects to be covered, and (3) the duration and location of the training activities.

B. Trainees

The main group targeted for the proposed training consists of technicians in the Ministry of Planning and in planning units of other ministries who are engaged in project evaluation, forecasting, and other planning activities involving the use of quantitative models; who are already trained in economics and other disciplines related to planning; but who have had little experience in incorporating demographic variables in their planning. In addition to this group, it would be desirable to make short training sessions available for senior officials in the different ministries so that they could become generally familiar with the techniques used in planning models that incorporate demographic variables.

C. Subjects

Given the objectives of the training and the clientele, the main subjects to be covered should include the following:

1. General principles of demography.

2. Planning models incorporating demographic as well as other variables. Because some trainees will lack experience in the design and use of quantitative models for planning purposes, courses in this area should begin at a fairly elementary level. Depending on the makeup of the training group, the courses could cover economic-demographic models used for one or more of the following types of planning:

   a. General long-term macroeconomic planning. Example: the BACHUE models (Research Triangle Institute).

   b. Educational planning. Example: World Bank models.

   c. Manpower planning.

d. Health planning. Example: the DYNPLAN model (University of Michigan).

e. Agricultural planning.

f. Urban development planning.

g. Transportation planning.

3. Microcomputer use. Because many of the planning models with demographic variables have been adapted for use with microcomputers, it would be desirable for the trainees to develop microcomputer skills.

D. Duration and Location of Training

A variety of durations and locations for the training can be considered:

1. Long-term degree programs abroad (more than 18 months)
   In a period of this length, the trainee will have time to learn English, and so standard university programs in the United States become feasible. An example of such is a master's degree program in population planning offered by the University of Michigan's School of Public Health.

2. Medium-term programs abroad (4-18 months)
   In this instance, the typical Nigerien trainee would be restricted to programs offered in Francophone countries. An example is a nine-month course in population and development offered at the University of Louvain.

3. Short-term programs abroad (less than 4 months)
   Here also the typical trainee would be restricted to Francophone courses. At least one appropriate course of this nature has been available in the United States: the USAID-funded INPLAN course offered by the Research Triangle Institute (North Carolina). Francophone INPLAN courses, which are focused on the precise topic of "integrating demographic variables into planning," have also been presented at selected African locations.

4. Workshops in Niger (1-2 weeks)
   Workshops could be organized in Niger at which training would be provided by experts resident in the country or brought in from the outside. A major advantage of such workshops is that they could be attended not only by the technicians who

are the main target group but also by more senior officials who cannot be absent from their posts for extended periods.

The number of trainees who should participate in each of these forms of training depends on such factors as the fraction of project funds allocated to this purpose and the availability of particular courses (e.g., INPLAN). The following program for the five-year period of the Family Health and Demography Project is proposed as a starting point:

3	trainees on long-term degree programs abroad
3	trainees on medium-term programs abroad
10	trainees on short-term programs abroad
5	workshops in Niger, each with 10-15 participants.

E. Conclusions

Under this project, planning technicians in the Ministry of Public Health and Social Affairs and in other ministries should receive training in the integration of demographic variables into planning models. Subjects covered by this training should include general demography, the design and use of planning models incorporating demographic as well as other variables, and microcomputer skills. Possible training modalities include long-term, medium-term, and short-term programs at American universities and other locations abroad, and annual workshops in Niger.

VII. SUMMARY

A. Cost-Benefit Analysis

1. The family planning component of the Family Health and Demography Project is likely to have a favorable effect on the growth of per capita gross domestic product (GDP) in Niger. It is estimated that after fifteen years, per capita GDP will be about 3.8 percent higher with the project than without it. This translates to a benefit-cost ratio of about 28 when a 10 percent discount rate is used.

2. In specific sectors, the Family Planning Subproject is likely to produce budgetary savings for public agencies concerned with education, health care, urban services, and housing. The subproject is also likely to make a positive contribution toward the attainment of agricultural self-sufficiency.

3. The component of the Family Health and Demography Project concerned with demographic data collection and analysis is also likely to have a favorable benefit-cost ratio, although a quantitative estimate in this area does not seem feasible.

B. Cost-Effectiveness Analysis

The Family Planning Subproject is expected to generate 420,105 couple years of contraceptive protection over its five-year life, at a cost of about $9.2 million. This represents a cost of $22 per CYP, a figure that compares favorably with estimates for a similar project in Senegal. Because many of the costs of the Niger project are of a fixed or one-time nature, the marginal cost per couple year of protection is much lower, probably less than $6 per couple year of protection.

C. Recurrent Costs

At the end of the five-year period of the Family Health and Demography Project, the project's recurrent costs will probably not exceed $900,000, which will be about 4 percent of the total annual budget of the Ministry of Public Health and Social Affairs.

D. Cost Recovery

1. A fee of 100 CFA francs per clinic visit would cover about one-sixth of the recurrent costs of the Family Health and Demography Project in its final year.

2. However, the case for charging any fee is not overwhelming, even in the hypothetical instance of services offered by independent family planning clinics with financial autonomy.

3. In the actual situation in Niger, where the family planning services are to be integrated with other maternal and child health services, the fees for the former should be on the same basis as the fees for the latter. So long as maternal and child health services remain free, the same should be true for family planning services.

E. Training in the Incorporation of Demographic Variables in Planning Models

Under the project, planning technicians in the Ministry of Public Health and Social Affairs and in other ministries should receive training in the integration of demographic variables into planning models. Subjects covered by this training should include general demography, the design and use of planning models incorporating demographic as well as other variables, and microcomputer skills. Possible training modalities include long-term, medium-term, and short-term programs at American universities and other locations abroad, and annual workshops in Niger.

TECHNICAL APPENDIX

TECHNICAL APPENDIX

A. Formula for Benefit-Cost Ratio

The formula proposed in this paper for calculating the benefit-cost ratio of the family planning project, or of any development project (whether or not it has effects on population size), can be written as follows:

$$\frac{\sum_{t=1}^{n} \left[P_t^a \left(\frac{GDP_t^a}{P_t^a} - \frac{GDP_t^s}{P_t^s} \right) \right] \Big/ (1+r)^{t-1}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^{t-1}}}$$

where the symbols are defined in the following way:

n	...	final year of period of analysis
t	...	any given year
a	...	with the project
s	...	without the project
P	...	population
GDP	...	gross domestic product
r	...	discount rate
C	...	project cost

In the case of a project that has no effect on population size, $P_t^a = P_t^s$, and the formula reduces to the following form:

$$\frac{\sum_{t=1}^{n} \left[\frac{GDP_t^a - GDP_t^s}{(1+r)^{t-1}} \right]}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^{t-1}}}$$

which is the standard expression for a benefit-cost ratio.

B. Model for Simulating Growth of Gross Domestic Product

Tables 1, 3, and 4 show projections of gross domestic product in Niger over the period from 1988 to 2003 both with and without the family planning project. Those projections were obtained by using the following simulation model:

$$GDP_t = b\ L_t^d\ K_t^f \qquad \text{(Production function)}$$

$$L_t = f\ P\ 10\text{-}59_t \qquad \text{(Labor force function)}$$

$$K_t = K_{t-1} + I_{t-1} \qquad \text{(Growth of capital stock)}$$

$$I_t = g\ GDP_t \qquad \text{(Investment function)}$$

where the symbols are defined in the following way:

L	...	labor force
K	...	capital stock
P 10-59	...	population aged 10 to 59
I	...	net investment
b,d,e,f,g	...	coefficients assumed constant

It should be noted that this model is deliberately designed to have a "pronatalist" bias in order to understate rather than overstate the economic benefits of family planning. In fact, a reduction in fertility is likely to raise f, the labor force participation rate (women with fewer children are more likely to participate in the labor force) and is also likely to raise g, the investment rate (both the reduction in the burden of dependency and the rise in per capita income will tend to raise the fraction of income that is saved and invested).

TABLE 3

SIMULATION OF ECONOMIC AND DEMOGRAPHIC VARIABLES IN NIGER, 1988-2003
WITHOUT FAMILY PLANNING SUBPROJECT

	Total Fertility Rate	Life expectancy at birth (yrs.)		In thousands				In millions of dollars at 1988 prices		
		Male	Female	Population (P)	Births	Population aged 10-59 (P10-59)	Labor Force (L)	Capital stock (K)	Gross domestic product (GDP)	Net Investment (I)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1988	7.00	42.0	45.0	7,019	374	4,447	3,113	8,423	2,106	253
1989	6.96	42.5	45.5	7,225	376	4,557	3,190	8,676	2,162	259
1990	6.92	43.0	46.0	7,437	382	4,670	3,269	8,936	2,220	266
1991	6.88	43.5	46.5	7,665	388	4,786	3,350	9,202	2,280	274
1992	6.84	44.0	47.0	7,880	396	4,904	3,433	9,476	2,341	281
1993	6.80	44.5	47.5	8,111	404	5,026	3,518	9,757	2,404	288
1994	6.76	45.0	48.0	8,353	412	5,173	3,621	10,045	2,474	297
1995	6.72	45.5	48.5	8,602	422	5,324	3,727	10,342	2,547	306
1996	6.68	46.0	49.0	8,859	432	5,480	3,836	10,647	2,621	315
1997	6.64	46.5	49.5	9,123	441	5,640	3,948	10,962	2,698	324
1998	6.60	47.0	50.0	9,395	449	5,804	4,063	11,286	2,777	333
1999	6.56	47.5	50.5	9,682	457	5,991	4,194	11,619	2,864	344
2000	6.52	48.0	51.0	9,977	464	6,186	4,330	11,963	2,954	354
2001	6.48	48.5	51.5	10,281	469	6,387	4,471	12,317	3,046	366
2002	6.44	49.0	52.0	10,595	473	6,594	4,616	12,683	3,142	377
2003	6.40	49.5	52.5	10,918	474	6,809	4,766	13,060	3,240	389

NOTES:

Col. (1) ... Number of lifetime births per woman; 1988 figure and projected rate of decline from World Bank World Development Report.

Cols. (2) & (3) ... 1988 figure from World Bank, op. cit.; life expectancy assumed to increase by six months each year.

Col. 4 ... 1988 figure from Ministry of Planning; projections for subsequent years made with DEMPROJ, software developed by and obtainable from The Futures Group, 1101 Fourteenth Street, N.W., Washington, D.C. 20005; age-sex distribution of population in 1988 assumed to be the same as that reported in the Mali census of 1984 (United Nations, Demographic Yearbook); zero net immigration assumed.

Cols. (5) & (6) ... Estimates generated by DEMPROJ.

Col. (7) ... Assumed to be 70 percent of Col. (6).

Col. (8) ... 1988 figure assumed to be four times the level of GDP, a typical relationship. For other years:

$$K_t = K_{t-1} + I_{t\,1}$$

Col. (9) ... 1988 figure equal to the population multiplied by per capita GDP of $300 (World Bank, op. cit.). For other years:

$$GDP = 0.4543\ L_t^{0.6}\ K_t^{0.4}$$

The exponents on the labor and capital variables are values typically found in the estimation of aggregate production functions of this type (Cobb-Douglas). The value of the constant term (0.4543) is obtained by taking the values of GDP, L and K for 1988, along with the assumed values of the exponents, and solving for the remaining unknown, namely the constant term.

Col. (10) ... Assumed to be 12 percent of GDP (World Bank, op. cit.).

TABLE 4

SIMULATION OF ECONOMIC AND DEMOGRAPHIC VARIABLES IN NIGER, 1988-2003
WITH FAMILY PLANNING SUBPROJECT

				In thousands				In millions of dollars at 1988 prices		
	Total Fertility Rate	Life expectancy at birth (yrs.)		Population (P)	Births	Population aged 10-59 (P10-59)	Labor Force (L)	Capital stock (K)	Gross domestic product GDP	Net Investment (I)
		Male	Female							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1988	7.00	42.0	45.0	7,019	364	4,447	3,113	8,423	2,106	253
1989	6.82	42.5	45.5	7,209	361	4,557	3,190	8,676	2,162	259
1990	6.64	43.0	46.0	7,404	362	4,670	3,269	8,936	2,220	266
1991	6.46	43.5	46.5	7,604	364	4,786	3,350	9,202	2,280	274
1992	6.28	44.0	47.0	7,809	368	4,904	3,433	9,476	2,341	281
1993	6.10	44.5	47.5	8,020	371	5,026	3,518	9,757	2,404	288
1994	6.06	45.0	48.0	8,231	376	5,173	3,621	10,045	2,474	297
1995	6.02	45.5	48.5	8,447	382	5,324	3,727	10,342	2,547	306
1996	5.98	46.0	49.0	8,669	389	5,480	3,836	10,647	2,621	315
1997	5.94	46.5	49.5	8,897	396	5,640	3,948	10,962	2,698	324
1998	5.90	47.0	50.0	9,130	402	5,804	4,063	11,286	2,777	333
1999	5.86	47.5	50.5	9,380	407	5,979	4,185	11,619	2,860	343
2000	5.82	48.0	51.0	9,637	413	6,159	4,311	11,962	2,946	354
2001	5.78	48.5	51.5	9,901	418	6,344	4,441	12,316	3,034	364
2002	5.74	49.0	52.0	10,172	422	6,536	4,575	12,680	3,125	375
2003	5.70	49.5	52.5	10,451	423	6,733	4,713	13,055	3,218	386

NOTES:

Col. (1) ... By 1993 and subsequently, the project is assumed to lower the total fertility rate by an amount equal to 10 percent of the 1988 level, i.e., by 0.7 births per woman.

Cols. (2) & (3) ... 1988 figure from World Bank, op. cit.; life expectancy assumed to increase by six months each year.

Col. 4 ... 1988 figure from Ministry of Planning; projections for subsequent years made with DEMPROJ, software developed by and obtainable from The Futures Group, 1101 Fourteenth Street, N.W., Washington, D.C. 20005; age-sex distribution of population in 1988 assumed to be the same as that reported in the Mali census of 1984 (United Nations, Demographic Yearbook); zero net immigration assumed.

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$$GDP = 0.4543\ L_t^{0.6}\ K_t^{0.4}$$

The exponents on the labor and capital variables are values typically found in the estimation of aggregate production functions of this type (Cobb-Douglas). The value of the constant term (0.4543) is obtained by taking the values of GDP, L and K for 1988, a ong with the assumed values of the exponents, and solving for the remaining unknown, namely the constant term.

Col. (10) ... Assumed to be 12 percent of GDP (World Bank, op. cit.).

TABLE 5

PRODUCTION OF AGRICULTURAL CROPS IN NIGER, 1960-86

Crop year beginning May 1	Production in thousands of metric tons					Index of agricultural production 1960-1962=100 (1)		Midyear population (thousands) (2)	Index of agricultural production per capita 1961=100 (3)
	Millet	Sorghum	Cowpeas	Peanuts	Rice	Annual Level	3-year moving average		
1960	718	222	46	150	7	87.4	...	3,422	...
1961	781	275	46	152	10	96.1	100.0	3,502	100.0
1962	934	315	58	205	11	116.5	112.2	3,583	109.7
1963	977	353	63	220	10	124.1	120.8	3,667	115.4
1964	1,013	315	66	194	12	121.9	118.4	3,752	110.5
1965	790	266	48	227	12	109.2	116.9	3,840	106.6
1966	842	277	68	312	20	119.7	121.6	3,929	108.4
1967	1,000	342	77	298	33	136.0	119.8	4,021	104.3
1968	723	215	74	252	39	103.7	123.5	4,114	105.1
1969	1,095	289	83	207	38	130.9	115.0	4,210	95.7
1970	871	230	84	205	37	110.3	121.3	4,308	98.6
1971	959	267	72	256	27	122.7	118.5	4,409	94.1
1972	919	208	144	260	32	122.4	106.1	4,511	82.4
1973	623	126	92	77	46	73.3	100.6	4,616	76.3
1974	883	219	133	129	30	106.1	88.0	4,724	65.2
1975	581	254	218	42	29	84.5	104.3	4,834	75.6
1976	1,019	287	216	79	29	122.4	113.5	4,947	80.3
1977	1,130	342	207	82	27	133.7	132.8	5,062	91.9
1978	1,123	371	271	97	32	142.4	142.6	5,214	95.8
1979	1,255	351	304	88	23	151.7	152.1	5,371	99.2
1980	1,363	368	268	126	30	162.2	156.3	5,533	98.9
1981	1,314	322	282	102	39	154.9	157.0	5,699	96.5
1982	1,293	359	282	81	41	153.9	153.9	5,870	91.8
1983	1,298	355	271	75	45	152.8	134.1	6,047	77.7
1984	771	236	195	31	49	95.7	130.6	6,229	73.4
1985	1,450	329	115	8	57	143.4	133.5	6,416	72.9
1986	1,383	360	293	54	75	161.5	...	6,609	...

NOTES:

(1) Index based on production of the five crops mentioned, with crop quantities weighted by mean producer prices over the 1975-85 period, which were follows:

	Mean price, 1975-85 (CFA francs per kg.)
Millet	55
Sorghum	52
Cowpeas	62
Peanuts	77
Rice	61

Source for agricultural data: Ministere de l'Agriculture, Annuaire Statistique.

(2) In line with Ministere du Plan, Annuaire Statistique, 1985 edition (May 1986), the annual rate of population growth before the census year of 1977 assumed to be 2.33 percent. In line with later Ministry of Plan documents, the growth rate after 1977 is assumed to be 3.0 percent.

(3) Three-year moving average of the agricultural production index divided by population of the given year, then expressed as a percentage of 1961 value.