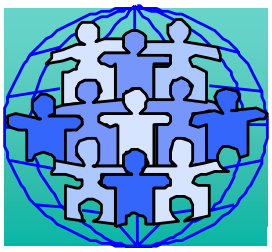

Family Planning in Egypt Is a Sound Financial Investment

The POLICY Project

A Technical Report of a Prospective Cost-Benefit Analysis of Egypt Family Planning Program, 2000-2030

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Executive Summary

In recent years, cost-benefit analysis has been applied to evaluate the financial implications of family planning programs in numerous countries. The financial cost-benefit analysis compares the monetary cost of the family planning program to the monetary benefits in terms of reduced levels of social services required at lower levels of fertility. Economists routinely use cost-benefit analysis to evaluate the "profitability" of investment projects, such as building a bridge or a power plant, that generate a future stream of revenues but also incur initial and subsequent costs. The more total revenues exceed total costs, the more profitable an investment project will be. When the principles of cost-benefit analysis are applied to family planning programs, the most crucial elements are defining and measuring the "benefits" of family planning programs. The results, and more importantly the interpretation of the results, depend on how "benefits" are defined and measured. When benefits are defined as savings from public sector services resulting from a smaller population size, the cost-benefit study is sometimes referred to as a "public cost-benefit analysis" or "financial cost-benefit analysis."

Conducting a financial cost-benefit analysis of a family planning program can provide answers to two policy questions. The first is whether a family planning program is financially viable and sustainable. Because either continuing or expanding an existing program requires substantial financial commitment from the government, policy makers and financial planners would definitely want to know how much the program would cost and how much it would save. The second question is what impact family planning program expenditures would have on the quality of services in the relevant social service sectors. As those social service sectors are the most likely competitors for a given amount of resources, administrators and planners in those sectors would naturally like to know the short-run and long-run benefits to their respective sectors from investment in family planning programs.

Such a study was conducted for Egypt in 1996, and the results of that study have been utilized extensively to support a strong public family planning program in Egypt. Because the original study was conducted 8 years ago, a new study was carried out in 2004 to reflect the current situation. The main purpose of this paper is to discuss the results of this study and to compare them with results from the original Egypt study and studies from other countries.

The new Egypt family planning cost-benefit analysis was based on two family planning scenarios and associated population projections. One scenario assumed that the current contraceptive prevalence rate would remain constant; the other scenario assumed that the contraceptive prevalence rate would continue to increase until it reached 73.28% in year 2017. Because of this expanded family planning program, a total of 23.6 million births would be averted over the 30-year period and, as a result, the total population size would be 18% smaller by 2030. Family planning programs would reduce the population size significantly in Egypt.

Given specific sectoral plans and targets (such as enrollment rates in schools or coverage rates of child immunization programs), government expenditures on social services (public health, education, housing, and others) depend on population size. By limiting population growth rates, family planning allows the government to avoid spending a considerable amount of

resources just to keep the quality of services the same. Projected annual government expenditures on health, education, and other social services under the two family planning scenarios were derived by multiplying the relevant population (children, students, etc.) by per capita expenditures in that sector. By comparing total expenditures for social services under these two alternative family planning program scenarios, we estimated total savings in government expenditures due to the family planning program for each year. Total government savings in providing health, education, food subsidy, and other infrastructure services to a smaller population base, due to an expanded family planning program, starts in 2001 at 10 million £E, increases over time and ends in 2030 at 16 billion £E. The total cumulative savings over the 30 years is estimated to be over 172 billion £E.

On the cost side of the cost-benefit analysis, by combining the projected numbers of acceptors and users for the next 30 years and the unit costs of acceptors and users, it was possible to project the total costs of family planning programs for the family planning scenarios. Unit costs of acceptors and users were estimated from cost per couple-year protection and the standard conversion rates between per couple-year protection and contraceptive acceptors and users. The total cumulative extra costs of the expanded family planning program is estimated to be over 2 billion £E over the 30 years.

To compare costs and benefits of the family planning program, all costs and benefits occurring in the future were converted to present values. This is accomplished by the use of the discount rate, which may be defined as the rate at which the present value of a pound declines over time. Future costs and benefits were converted to present values by finding the amount today which, if invested at some given rate of compound interest (the discount rate), would yield those future costs and benefits. These values could then be expressed in a benefit-cost ratio that measured the returns to the public investment in the Egypt family planning program. At a 10% discount, the *benefit-cost ratio* for the benefits and costs through the year 2030 is 40.27.

An *internal rate of return* was also calculated from the streams of net savings to measure the overall rate of return to family planning program expenditures. An internal rate of return is defined as the discount rate that would make the present value of all costs equal to the preset value of all benefits. It measures the actual rate of return to, or the "profitability" of, the total investment in a project over a period of time. In the present case, the calculated internal rate of return is 182%, which is much higher than that of most ordinary investment projects.

Results from the 1996 original study and the current study were compared. Under similar assumptions, the benefit-cost ratio of the Egypt family planning program has increased 50%, from 26.6 to 40.3. The fundamental reasons for the increases in benefit-cost ratios are increases in service coverage rates and per capita expenditures. Everything else being equal, the more people to whom the government provides the basic social services and the more the government spends on each person, the higher the benefit-cost ratios for family planning programs. In Egypt's case, between 1996 and 2000, coverage rates for health and education services increased and per capita expenditures went up significantly. In the health sector, per capita expenditures increased from £E14.7 (in 2000 constant values) in 1996 to £E147 in 2000. In the education sector, enrollment rates increased and per student expenditures increased significantly. For

example, for secondary education, the enrollment rate rose from 52% to 64.5%, and per student expenditure rose from 66 £E (in 2000 constant value) to 1,292.

Comparing results from Egypt to that of other countries is important for understanding why the benefit-cost ratios of the family planning program are high in Egypt. A comparison was made between Egypt and the benefit-cost ratios of family planning programs in six Asian countries with varying degrees of success in family planning programs. These results were for the period of 1970 to 1990, with a discount rate of 10%. The benefit-cost ratios range from a high of 14 in Thailand to a low of 1 in Pakistan. By comparison, Egypt's projected benefit-cost ratios for the period of 2000 through 2030 is 40.3. Egypt has the highest family planning benefit-cost ratios in all the countries that have conducted similar studies, because it has a very cost-effective family planning program and because it provides extensive social services to its citizens. This, of course, speaks well of the efficiency of Egypt's family planning programs and the extent to which the public is being provided with social services.

In summary, our analysis, using 2000 data, reconfirms the results of the 1996 study on the favorable financial returns to Egypt's family planning program. Surprisingly, the benefit-cost ratio has gone up by 50% in four years from 27 to 40.7. This change in benefit-cost ratio reflects recent significant increases in social service expenditures, particularly in the health and education sectors.

The extremely high benefit-cost ratio can be interpreted in two ways. First, it acknowledges that expenditures on Egypt's family planning program are indeed an attractive financial investment. The high benefit-cost ratio suggests that continuing a successful family planning program would help the government reduce the fiscal burdens of providing social services to the population. Second, it serves as a warning that the government will face a serious problem in the near future providing the current level of social services to a much larger population if sufficient funds are not allocated to maintain a successful family planning program. In a way, the high benefit-cost ratio is a double-edged sword. If the government can manage to continue a successful family planning program, then it will benefit greatly from the favorable financial consequences; on the other hand, if no further progress is made to expand the current program, then there will be severely detrimental effects in the future. Therefore, the new benefit-cost analysis once again underlines the importance and urgency of having an expanded family planning program with a goal of achieving replacement-level fertility in the next 10-15 years.

USAID will stop its funding for all contraceptives in 2009, and the government must provide replacement funds. The additional contraceptive costs to the government are estimated to be £E200-300 million annually, which is only a small fraction of the potential reduction in social services expenditure burdens (in billions of Egyptian pounds per year). Therefore, the government should prepare to take over the funding of contraceptives without any reservation or hesitation, and it would be the best of all public investments. Even with the added costs of contraceptives, the cost of this family planning program as a percentage of the total GDP would decrease over time, which suggests that the family planning program is financially sustainable.

Section 1: Introduction

Studies that demonstrate the financial benefits, in addition to other nonmonetary benefits, of family planning programs can help governments reaffirm their commitments and allocate their scarce resources accordingly. Furthermore, estimating the degree of financial returns to the program can help planners negotiate for external loans in support of family planning programs.

In recent years, cost-benefit analysis has been applied to evaluate the financial implications of family planning programs in numerous countries (Chao, 1997). The financial cost-benefit analysis compares the monetary cost of the family planning program to the monetary benefits in terms of reduced levels of social services required at lower levels of fertility. In these recent applications, benefits are defined as savings in government expenditures on social services. The main purpose is to rationalize increased governmental financial investment in family planning programs. More specifically, the objectives of these family planning program financial analyses are (1) to estimate the impacts of family planning programs on government expenditures for social services such as health, education, housing, and food subsidies; (2) to compare reductions in government social services spending as a result of family planning programs to the costs of family planning services; and (3) to show the financial viability of family planning programs and their effectiveness in improving the quality of social services.

Such a study was also conducted for Egypt in 1996 (Moreland, 1996) and the results of that study have been utilized extensively to support a strong public family planning program in Egypt. Because the original study was conducted 8 years ago, it was suggested that the analysis should be updated to reflect the current situation. Under the POLICY Project and using the BenCost Model (Chao, Dunn, and Springle, 1999) developed by the POLICY Project, a new analysis was carried out recently. The main purpose of this paper is to discuss the results of this study and to compare them with results from the original Egypt study and studies from other countries. We first provide some background on the methodology of cost-benefit analysis and its application to the family planning programs. Then the results of the *current* Egypt family planning cost-benefit studies are summarized and compared with the 1996 results. Finally, the paper discusses the policy implications of this new study.

Section 2: Cost-Benefit Analysis and Its Applications to Family Planning Programs

2.1 Principles of Cost-Benefit Analysis

Economists routinely use cost-benefit analysis to evaluate the “profitability” of investment projects, such as building a bridge or a power plant, that generate a future stream of revenues but also incur initial and subsequent costs. The more total revenues exceed total costs, the more profitable an investment project will be. In order to compare the total costs and total benefits of an investment project, it is necessary to discount back to the present the costs and benefit streams generated over the entire life of the project.

The concept of discounting future economic magnitudes in order to make a present judgment is based on the economic assumption that consumption now is always preferred to consumption in the future. Therefore, before we can compare future values to present values, the future values must be reduced, or "discounted." The prevailing market rate of interest is a measure of the inferiority of future goods relative to present goods and can be used as the rate by which future benefits can be converted into present values.

Cost-benefit analysis aims to compare the present value of all benefits expected to be generated by a project with the present value of all expected costs associated with the project. The comparison can be made in the following way. Let:

C_1, C_2,..., C_n = the series of expected costs in year 1, 2,..., n;

B_1, B_2,..., B_n = the series of expected benefits in year 1, 2,.., n;

i = the appropriate discount rate for annual compounding.

If a particular project satisfies the inequality such that

$$\frac{B_1}{(1+i)} + \frac{B_2}{(1+i)^2} + \cdots \frac{B_n}{(1+i)^n} > \frac{C_1}{(1+i)} + \frac{C_2}{(1+i)^2} + \cdots \frac{C_n}{(1+i)^n},$$

then the benefits generated by the project exceed the costs of the project and the benefit-cost ratio is greater than one. The total benefits could also be less than, or equal to, the total associated costs, depending on the actual values pertaining to a specific project.

The most important result of such an analysis is the creation of a simple, straightforward decision rule: If benefits exceed costs, the project should be undertaken. Alternatively, the project that shows the highest ratio of present benefits to costs should be chosen from a possible array of competing projects. This simple decision rule is why cost-benefit analysis has gained so much favor in recent years for analyzing and comparing alternative investment projects.

When we turn to the application of the principle, however, we are immediately confronted with a series of issues that complicate actual analysis and that may obviate much of the conceptual neatness of the technique. Questions arise, for example, concerning the proper enumeration of costs and benefits, the valuation of benefits, and the choice of and appropriate rate of discount. All these problems become even more important when one attempts to apply the methodology to analyze public family planning programs.

2.2 Applications to Public Family Planning Programs

When the principles of cost-benefit analysis are applied to family planning programs, the most crucial elements are defining and measuring the "benefits" of family planning programs

(Warner and Luce, 1982). The results, and more importantly the interpretation of the results, depend on how "benefits" are defined and measured.

For example, the benefit of a national family planning program can be defined as the contribution it makes to improving the per capita income of the country. With the establishment of a family planning program, fertility rate and population growth rate would be lower. Assuming that total production were to remain unaffected by fertility decline in the short run and that it were to increase in the long run by way of increases in savings and female labor participation, a lower fertility rate would lead to higher income per capita. This average increase in per capita income multiplied by the total population would approximate the total economic benefit of the family planning program. Cost-benefit analysis of a family planning program based on this type of benefit definition is usually called an "economic cost-benefit analysis." Even though the debate has been renewed in recent years on the validity and significance of benefits defined in this way, a review study commissioned by the National Research Council in the United States as early as 1986 did support conclusions drawn from this approach (National Research Council, 1986).

Some would argue that the scope of benefits should be broader than income per capita. Many important noneconomic benefits—such as improvements in maternal and child health—are associated with family planning and lower fertility rates and should be included in any family planning cost-benefit analysis. This argument is correct if the cost-benefit analysis is intended to be used to formulate a population and family planning policy. But, in practice, it is very difficult to measure these noneconomic benefits. Even if they can be measured correctly, it still is difficult to convert them into monetary units so that they can be combined with other economic benefits.

It is also possible to define benefits in terms of the two components of income per capita: private consumption and public consumption. Given total resources available for consumption, each individual's share would increase if there were fewer people to share. On the private consumption side, resources that otherwise would have been consumed by additional people could then be used either to augment individual consumption or, better yet, to increase savings, investment, and production. On the public side, resources saved from not serving more people at the basic level could be used to improve the quality of public services for the rest.

For policy formation, obviously all benefits need to be considered and to be weighed against all of costs. However, sometimes it is useful and appropriate to consider only one aspect of the benefit. A case in point is public consumption.

2.3 Financial Cost-Benefit Analysis of Family Planning Programs

When benefits are defined as savings from public sector services resulting from a smaller population size, the cost-benefit study is sometimes referred to as a "public cost-benefit analysis" or "financial cost-benefit analysis." Many public services provided by the government are closely related to the population size. For example, if elementary school education is compulsory, then the number of students enrolled each year will depend on the number of children in the 6-12 age group. The larger this group of children, the higher the demand for

classrooms, teachers, books, etc. Other services that are affected by population size and distribution include health, education, food subsidies, social welfare, housing, utilities, and infrastructure. Some of these relationships are direct and immediate, such as health and population; others are less direct and become apparent only after long delays, such as housing programs and population.

The main purpose of conducting a financial cost-benefit analysis of a family planning program is to evaluate the financial savings to the government as a result of providing the same level of services to a smaller group of people. Resources "saved" theoretically can be used to pay for the cost of the family planning program; but most likely they will be used to improve the quality of services. For example, let us assume a government is committed to maintaining certain classroom-student and teacher-student ratios. With smaller incoming classes of schoolchildren as a result of family planning programs, resources that otherwise would have to be spent just to maintain the ratios and keep the quality of education at the same level, can be used instead to improve quality.

The basic policy issue involved here is the optimal allocation of resources among the social service sectors. It poses two questions. The first is whether a family planning program is financially viable and sustainable. Because either continuing or expanding an existing program requires substantial financial commitment from the government, policy makers and financial planners would definitely want to know how much the program would cost and how much it would save.

The second question is what impact family planning program expenditures would have on the quality of services in the relevant social service sectors. As those social service sectors are the most likely competitors for a given amount of resources, administrators and planners in those sectors would naturally like to know the short-run and long-run benefits to their respective sectors from investment in family planning programs.

A public family planning cost-benefit analysis usually includes four components:

- an *impact* component that estimates and projects the impact of a family planning program on total or age-specific fertility rates (TFR or ASFR);

- a *demographic* component that makes alternative population projections under different fertility scenarios;

- a *sectoral* component that estimates and projects resource requirements of various social services (e.g., education, health) under different population projections; and

- a *cost-benefit* component that compares the monetary costs of the family planning program to the monetary benefits in terms of reduced levels of social services required at lower levels of fertility.

Two important points regarding the interpretation of a financial cost-benefit analysis of family planning are worth emphasizing. First, such an analysis addresses only the financial

implications of family planning programs and therefore should never be used by itself for formulating population policy. Secondly, measuring benefits in terms of "savings" does not imply that the government would spend less on social services. Rather, it suggests that a family planning program alleviates the burden of providing the same services to an ever-increasing clientele and gives the government an opportunity to improve the quality of services.

Section 3: Estimated Demographic Impact of the Projected Egypt Family Planning Programs

The Egypt family planning cost-benefit analysis just completed was based on two family planning scenarios prepared by the POLICY Project recently using the FamPlan model. One scenario assumed that the current contraceptive prevalence rate would remain constant; the other scenario assumed that the contraceptive prevalence rate would continue to increase until it reached 73.28% in year 2017. We first present impacts of these two scenarios on total fertility rates and on population sizes.

3.1 Impacts of Family Planning Programs on Fertility

Table 1 shows the changes in contraceptive prevalence rates (CPRs) and total fertility rates for the period 2000-2030 under the two CPR scenarios. Under the constant CPR scenario, CPR would remain at the year 2000 level of 56.1% for the next 30 years and the corresponding TFR would remain at the year 2000 level of 3.5. Under the alternative scenario, the CPR would increase continuously until 2017, when it would reach 73.28%, and remain constant after that. Under this higher CPR scenario, the TFR would decline to its replacement level of 2.1 by 2017 and stay the same after that.

3.2 Estimated Total Number of Births Averted by Family Planning Programs and Their Impacts on Population Size

Two 30-year population projections were prepared under these two family planning/fertility scenarios. Projection A was under the constant CPR and TFR scenario and Projection B was under the replacement TFR scenario. ***Table 2*** shows the total number of births and total population sizes during a 30-year period between 2000 and 2030 under these two projections. The differences are the results of an expanded family planning program in Egypt. Because of this expanded family planning program, a total of 23.6 million births would be averted over the 30-year period and, as a result, the total population size would be 18% smaller by 2030. Family planning programs would reduce the population size significantly in Egypt.

Table 1. Changes in TFR under Two Different CPR Assumptions

Year	Contraceptive Prevalence Rate		Total Fertility Rate	
	Constant TFR Scenario	Replacement TFR Scenario	Constant TFR Scenario	Replacement TFR Scenario
2000	56.10	56.10	3.50	3.50
2005	56.10	61.15	3.50	3.09
2010	56.10	66.21	3.50	2.68
2015	56.10	71.26	3.50	2.26
2020	56.10	73.28	3.50	2.10
2025	56.10	73.28	3.50	2.10
2030	56.10	73.28	3.50	2.10

Table 2. Changes in Births and Population Under Two Different CPR Assumptions

Year	Number of Births (in millions)		Total Population (in millions)	
	Constant TFR Scenario	Replacement TFR Scenario	Constant TFR Scenario	Replacement TFR Scenario
2000	1.77	1.77	64.20	64.20
2005	2.07	1.83	71.87	71.20
2010	2.33	1.78	80.82	78.12
2015	2.46	1.59	90.60	84.32
2020	2.55	1.53	100.58	89.48
2025	2.77	1.61	110.91	94.53
2030	3.16	1.70	122.24	99.56

Section 4: Costs of Family Planning Programs

How much would it cost to provide this expanded family planning program to the public? For this cost-benefit analysis, we first estimated the unit cost of providing different contraceptives through the family planning program. Our baseline information was the cost data presented in the *Report on the Costs of the Family Planning Program in Egypt*, for the period 1999-2000 (Rowan, Abdel-Meguid, and Abdel-Akhar, 2003). Based on costs of family planning activities that received funding from the public sector and the number of acceptors and users of various methods, the report estimated the cost per couple-year of protection (CYP) at 36 Egyptian pounds (£E). This average cost per CYP includes all program costs related to delivering family planning methods to users. In addition to contraceptive costs, it also reflects personnel and facility costs.

Because the FamPlan model requires cost inputs in the form of cost per acceptor and per user, we took the intermediate step of estimating them. Cost per acceptor and cost per user were derived by combining the cost per CYP and the number of CYP generated by each acceptor and user. The standard conversion factors were used. ***Table 3*** provides the estimated unit costs by method in Egyptian pounds and in United States dollars (US$).

By combining the projected numbers of acceptors and users for the next 30 years and the unit costs of acceptors and users, it was possible to project the total costs of family planning programs for the family planning scenarios. ***Table 4*** provides total program cost projections for the two scenarios. The costs of family planning programs would be higher under Projection B (replacement TFR scenario). The difference would peak in 2016 at 32% and gradually come down to 14% by 2030.

The cost projections we prepared are also consistent with the ones presented in the report *Estimating MOHP's Contraceptive Commodity Costs to 2017* (Connell, Ramlow, Ravenhold, Thomas, and Zardo, 2003). The Connell report projects future commodity costs of family planning programs based on actual costs of contraceptives and the projected number of acceptors and users. Projection B in Table 4 of the current report is similar to the Base scenario prepared by the Connell study—both make the same assumptions that the TFR reaches replacement level at 2017, contraceptive method mix and unit costs remain the same over the next 17 years, and public and private shares of the program also remain unchanged. The difference between the two is that the study by Connell et al. only estimates the commodity costs, while the current study includes other program costs. Under the Base scenario of the Connell et al. study, the total cost of contraceptives in year 2017 is estimated to be £E265.5 million; under the replacement fertility projection in Table 4, the total program cost in year 2030 is estimated to be £E538 million. The difference between the two projections reflects noncommodity costs of the family planning program.

Table 3. Unit Cost of Contraceptives, by Method, 2000

Method	Conversion Factor	Unit Cost (£E)
CYP		36
Acceptor		
Sterilization	9.0	324.0
IUD	2.5	90.0
Norplant	5.0	180.0
Diaphragms	1.0	36.0
User		
Pills	1.0	36.0
Condoms	1.0	36.0
Vaginal foaming tablets	1.0	36.0
Injectables	1.0	36.0
Creams	1.0	36.0

Table 4. Projected Total Family Planning (FP) Program Costs

Year	Total FP Program Cost (in millions of £E) Projection A (Constant TFR Scenario)	Projection B (Replacement TFR Scenario)	% of Difference
2000	264.97	274.14	-3.46%
2001	270.99	285.27	-5.27%
2002	276.78	296.36	-7.07%
2003	282.40	307.48	-8.88%
2004	287.88	318.64	-10.69%
2005	293.21	329.83	-12.49%
2006	298.41	341.07	-14.30%
2007	303.49	352.36	-16.10%
2008	308.51	363.74	-17.91%
2009	313.49	375.28	-19.71%
2010	318.45	386.96	-21.51%
2011	323.51	398.94	-23.31%
2012	328.80	411.38	-25.12%
2013	334.47	424.50	-26.92%
2014	340.60	438.41	-28.72%
2015	347.89	453.26	-30.29%
2016	355.26	468.02	-31.74%
2017	363.01	470.46	-29.60%
2018	371.08	478.76	-29.02%
2019	379.40	486.86	-28.32%
2020	387.96	494.72	-27.52%
2021	396.73	502.25	-26.60
2022	405.57	509.29	-25.57%
2023	414.36	515.64	-24.44%
2024	423.01	521.21	-23.21%
2025	431.51	525.96	-21.89%
2026	439.84	529.87	-20.47%
2027	447.91	532.84	-18.96%
2028	455.67	534.79	-17.36%
2029	463.12	535.73	-15.68%
2030	471.10	537.64	-14.12%
Cumulative	11,099.38	13,401.66	-20.74

Section 5: Impacts on Government Social Services Expenditures

Given specific sectoral plans and targets (such as enrollment rates in schools or coverage rates of child immunization programs), government expenditures on social services (public health, education, housing, and others) depend on population size. With a higher rate of population growth, the number of children and adults demanding these services will be greater and so will government expenditures. By limiting population growth rates, family planning allows the government to avoid spending a considerable amount of resources just to keep the quality of services the same.

Projected annual government expenditures on health, education, and other social services under the two family planning scenarios were derived by multiplying the relevant population (children, students, etc.) by per capita expenditures in that sector. By comparing total expenditures for social services under these two alternative family planning program scenarios, we could calculate total savings in government expenditures due to the family planning program for each year and for each country.

5.1 Projected Expenditures on Public Health

In the public health sector, total expenditure is assumed to be a function of the population. Therefore, total expenditure for public health in year t was calculated as follows:

Total Health Expenditure (t) = Population (t) * Per Capita Health Expenditure (t).

Baseline per capita health expenditure was derived from actual total health expenditure in year 2000 and the population size in 2000. In order not to overestimate expenditures in the future, the per capita expenditures were held constant at the 2000 value for the 30-year projection. The values are expressed at the 2000 constant price.

Calculated expenditures for the two projections, as given in ***Table 5,*** begin to differ immediately after the first group of births is averted in the second year. Expenditures under Projection B reach £E12.39 billion in 2015, 7% less than Projection A; and £E14.63 billion in 2030, or 19% less. In each year, the savings achieved as a result of the smaller population amount to the difference between expenditures under the two projections. The cumulative savings for the entire projection period are £E37 billion.

Table 5. Projected Total Public Health Expenditures

Total Public Health Expenditures (in billions of £E)			
Year	Projection A (Constant TFR Scenario)	Projection B (Replacement TFR Scenario)	% of Difference
2000	9.44	9.44	0%
2001	9.65	9.64	0.06%
2002	9.86	9.85	0.19%
2003	10.09	10.05	0.38%
2004	10.32	10.26	0.62%
2005	10.56	10.47	0.93%
2006	10.81	10.67	1.3%
2007	11.07	10.88	1.73%
2008	11.33	11.08	2.22%
2009	11.61	11.29	2.76%
2010	11.88	11.48	3.34%
2011	12.16	11.68	3.98%
2012	12.45	11.87	4.66%
2013	12.73	12.05	5.38%
2014	13.02	12.23	6.14%
2015	13.32	12.39	6.93%
2016	13.61	12.55	7.76%
2017	13.90	12.71	8.62%
2018	14.20	12.86	9.45%
2019	14.49	13.01	10.25%
2020	14.78	13.15	11.03%
2021	15.08	13.30	11.79%
2022	15.38	13.45	12.54%
2023	15.68	13.60	13.29%
2024	15.99	13.75	14.03%
2025	16.30	13.90	14.77%
2026	16.62	14.04	15.51%
2027	16.95	14.19	16.27%
2028	17.29	14.34	17.04%
2029	17.63	14.49	17.82%
2030	17.98	14.63	18.62%
Cumulative	416.18	379.30	8.86%

5.2 Projected Expenditures on Education

The impact of the family planning program on student enrollment and public expenditures at the primary (age 6-10), preparatory (age 11-13), and secondary (age 14-16) levels of the educational system in Egypt also were analyzed. Student enrollments in each of the three education levels and the total expenditures for the three levels are presented and discussed below.

Student enrollment in a given year was calculated by multiplying the school-age specific population in that year by the enrollment rates in 2000 for each of the three education levels. Enrollment ages for the primary level are 6-10 years for the primary level and 11-13 years and 14-16 years for the preparatory and secondary levels, respectively.

Tables 6, 7, and 8 present the projected number of students in the three levels of school under the two family planning and population projections. The times needed for the initial impact of the family planning program on primary, junior secondary, and senior secondary school enrollment to take place are 6, 11, and 14 years, respectively. By 2015, the enrollment at the primary level is 17% less in Projection B than in Projection A; and 7% and 1% less at the preparatory and secondary levels, respectively. By 2030, there are 40%, 40%, and 35% fewer students in the three levels of education, respectively, under Projection B.

Education expenditures were assumed to be a function of the school-age specific population and the per student expenditure by level. The per student expenditure during the base period (2000) was calculated from the total expenditures on education at each level, and the projected school-age specific population. The total cost of education at each level for a given year was found by multiplying the number of students, from the population projection, by the per student expenditure. Constant per capita education expenditures for the three levels of education were assumed for projecting future education expenditures.

More precisely,

Total Education Expenditures (i,t) = Number of Students (i, t) * Per Capita Education Expenditure (i, t),

where

i = the level of education
t = year.

Table 6. Projected Number of Primary Students

Year	Number of Students (in millions) Projection A (Constant TFR Scenario)	Projection B (Replacement TFR Scenario)	% of Difference
2000	7.22	7.22	0.00%
2001	7.22	7.22	0.00%
2002	7.23	7.23	0.00%
2003	7.25	7.25	0.00%
2004	7.31	7.31	0.00%
2005	7.41	7.41	0.00%
2006	7.55	7.55	0.00%
2007	7.78	7.74	0.51%
2008	8.05	7.93	1.51%
2009	8.35	8.10	2.98%
2010	8.68	8.25	4.89%
2011	9.02	8.37	7.22%
2012	9.32	8.43	9.57%
2013	9.62	8.47	11.91%
2014	9.91	8.49	14.25%
2015	10.18	8.49	16.60%
2016	10.44	8.46	18.94%
2017	10.68	8.41	21.28%
2018	10.89	8.32	23.62%
2019	11.08	8.20	25.96%
2020	11.24	8.06	28.30%
2021	11.38	7.90	30.64%
2022	11.50	7.71	32.99%
2023	11.60	7.50	35.34%
2024	11.69	7.34	37.22%
2025	11.77	7.22	38.64%
2026	11.85	7.16	39.60%
2027	11.95	7.15	40.13%
2028	12.06	7.21	40.23%
2029	12.21	7.28	40.40%
2030	12.38	7.35	40.66%
Cumulative	304.82	240.73	21.03%

Table 7. Projected Number of Preparatory Students

Year	Number of Students (in millions) Projection A (Constant TFR Scenario)	Projection B (Replacement TFR Scenario)	% of Difference
2000	4.34	4.34	0.00%
2001	4.32	4.32	0.00%
2002	4.30	4.30	0.00%
2003	4.29	4.29	0.00%
2004	4.28	4.28	0.00%
2005	4.27	4.27	0.00%
2006	4.27	4.27	0.00%
2007	4.29	4.29	0.00%
2008	4.32	4.32	0.00%
2009	4.37	4.37	0.00%
2010	4.46	4.46	0.00%
2011	4.57	4.57	0.00%
2012	4.75	4.71	0.82%
2013	4.95	4.83	2.43%
2014	5.17	4.92	4.76%
2015	5.35	4.97	7.11%
2016	5.53	5.01	9.46%
2017	5.71	5.03	11.81%
2018	5.88	5.05	14.16%
2019	6.04	5.05	16.51%
2020	6.20	5.03	18.86%
2021	6.34	5.00	21.21%
2022	6.47	4.95	23.56%
2023	6.58	4.88	25.91%
2024	6.68	4.79	28.26%
2025	6.76	4.69	30.61%
2026	6.83	4.58	32.96%
2027	6.89	4.46	35.31%
2028	6.94	4.32	37.67%
2029	6.98	4.24	39.25%
2030	7.03	4.21	40.06%
Cumulative	169.16	142.80	15.58%

Table 8. Projected Number of Secondary Students

Year	Number of Students (in millions) Projection A (Constant TFR Scenario)	Projection B (Replacement TFR Scenario)	% of Difference
2000	2.95	2.95	0.00%
2001	2.94	2.94	0.00%
2002	2.91	2.91	0.00%
2003	2.89	2.89	0.00%
2004	2.88	2.88	0.00%
2005	2.87	2.87	0.00%
2006	2.86	2.86	0.00%
2007	2.85	2.85	0.00%
2008	2.85	2.85	0.00%
2009	2.85	2.85	0.00%
2010	2.86	2.86	0.00%
2011	2.88	2.88	0.00%
2012	2.92	2.92	0.00%
2013	2.97	2.97	0.00%
2014	3.05	3.05	0.00%
2015	3.17	3.14	0.82%
2016	3.30	3.22	2.43%
2017	3.45	3.28	4.76%
2018	3.57	3.31	7.11%
2019	3.69	3.34	9.46%
2020	3.81	3.36	11.81%
2021	3.92	3.37	14.16%
2022	4.03	3.37	16.51%
2023	4.14	3.36	18.86%
2024	4.23	3.33	21.21%
2025	4.32	3.30	23.56%
2026	4.39	3.25	25.91%
2027	4.45	3.20	28.26%
2028	4.51	3.13	30.61%
2029	4.56	3.05	32.96%
2030	4.60	2.97	35.31%
Cumulative	107.67	95.51	11.29%

Table 9 presents the total educational expenditures, the sum of the expenditures at each education level, under the two projections. Under both projections, the expenditures rise from £E13.37 billion in 2000 to £E13.44 billion in 2006. The first difference in expenditures does not appear until 2007, the same year the first difference in the enrollment at the primary level appears. By 2015, expenditures in education are 10% less in Projection B than in Projection A. But by 2030, education expenditures are 39% less in Projection B than in Projection A. Each year, the savings achieved as a result of the smaller school-age population amount to the difference between the total expenditures under the two population projection scenarios. The cumulative savings for the projection period 2000 to 2030 are £E89.7 billion.

5.3 Projected Expenditures on Food Subsidy

The total expenditure on the food subsidy program was assumed to be a function of the size of the population. Only the proportions of the population receiving food subsidies were included in the expenditure calculation.

The total food subsidy expenditure was calculated using the following relationship:

Total Food Subsidy Expenditures (t) = Food Subsidy Coverage Rate (t) * Total Population (t) * Per Recipient Food Subsidy (t)

The baseline per recipient food subsidy was calculated from the actual expenditures and the number of people who received food subsidies in 2000. The per recipient expenditure remained at the 2000 level throughout the projection period. ***Table 10*** shows the projected total food subsidy each year under the two projections. Differences in food subsidy expenditure begin in the second year. By 2015, the food subsidy expenditure under Projection B is 6.9% less than that under Projection A. The difference increases to 18.6% by 2030. The cumulative savings (the difference between the expenditures under the two projection scenarios) for the projection period 2000 to 2030 are £E23.61 billion.

5.4 Projected Expenditures on Water, Sanitation, and Utilities

The total expenditure on infrastructure is the sum of expenditures on water, sanitation, and utilities; and each of them was assumed to be a function of the size of the population and the coverage rates. The total expenditure on infrastructure was calculated using the following relationships:

Total Expenditures on Infrastructure (t) = Total Expenditures on Water Service (t) + Total Expenditures on Sanitation Service (t) + Total Expenditures on Utility Service (t)

Total Expenditures on Water Service (t) = Total Population (t) * Water Coverage Rate (t) * Per Person Expenditure on Water

Table 9. Projected Total Education Expenditures

Total Education Expenditures (in billions of £E)			
Year	Projection A (Constant TFR Scenario)	Projection B (Replacement TFR Scenario)	% of Difference
2000	13.37	13.37	0.00%
2001	13.32	13.32	0.00%
2002	13.28	13.28	0.00%
2003	13.26	13.26	0.00%
2004	13.28	13.28	0.00%
2005	13.34	13.34	0.00%
2006	13.44	13.44	0.00%
2007	13.62	13.59	0.23%
2008	13.86	13.77	0.70%
2009	14.15	13.96	1.39%
2010	14.50	14.16	2.32%
2011	14.89	14.38	3.47%
2012	15.34	14.60	4.83%
2013	15.82	14.81	6.41%
2014	16.34	15.00	8.18%
2015	16.87	15.16	10.13%
2016	17.41	15.28	12.24%
2017	17.94	15.33	14.53%
2018	18.42	15.32	16.83%
2019	18.87	15.26	19.13%
2020	19.29	15.16	21.43%
2021	19.68	15.01	23.72%
2022	20.03	14.82	26.02%
2023	20.34	14.58	28.32%
2024	20.62	14.34	30.42%
2025	20.86	14.12	32.32%
2026	21.08	13.91	34.02%
2027	21.29	13.72	35.55%
2028	21.50	13.57	36.90%
2029	21.71	13.45	38.06%
2030	21.94	13.37	39.04%
Cumulative	529.66	439.96	16.94%

Table 10. Projected Total Food Subsidy Expenditures

Total Expenditures on Food Subsidy (in billions of £E)			
Year	Projection A (Constant TFR Scenario)	Projection B (Replacement TFR Scenario)	% of Difference
2000	6.03	6.03	0.00%
2001	6.17	6.16	0.06%
2002	6.31	6.30	0.19%
2003	6.45	6.43	0.38%
2004	6.60	6.56	0.62%
2005	6.76	6.69	0.93%
2006	6.92	6.82	1.30%
2007	7.08	6.96	1.73%
2008	7.25	7.09	2.22%
2009	7.42	7.22	2.76%
2010	7.60	7.34	3.34%
2011	7.78	7.47	3.98%
2012	7.96	7.59	4.66%
2013	8.14	7.70	5.38%
2014	8.33	7.82	6.14%
2015	8.52	7.93	6.93%
2016	8.70	8.03	7.76%
2017	8.89	8.12	8.62%
2018	9.08	8.22	9.45%
2019	9.27	8.32	10.25%
2020	9.45	8.41	11.03%
2021	9.64	8.51	11.79%
2022	9.83	8.60	12.54%
2023	10.03	8.70	13.29%
2024	10.23	8.79	14.03%
2025	10.43	8.89	14.77%
2026	10.63	8.98	15.51%
2027	10.84	9.08	16.27%
2028	11.05	9.17	17.04%
2029	11.27	9.26	17.82%
2030	11.50	9.36	18.62%
Cumulative	266.16	242.55	8.87%

Total Expenditures on Sanitation Service (t) = Total Population (t) * Sanitation Coverage Rate (t) * Per Person Expenditure on Sanitation

and

Total Expenditures on Utility Service (t) = Total Population (t) * Water Coverage Rate (t) * Per Person Expenditure on Water.

The baseline per person expenditure on these three services was calculated from the actual expenditures and the number of people who received these services in year 2000. Per person expenditures were assumed to remain constant at the 2000 level throughout the projection period. ***Table 11*** presents the projected expenditures for these three infrastructure services and the overall total expenditures on social infrastructure. Differences in social infrastructure expenditures begin in the second year of the projections. By 2015, the infrastructure expenditure under Projection B is 6.9% less than that under Projection A. The difference increases to 18.6% by 2030. The cumulative savings (the difference between the expenditures under the two projection scenarios) for the projection period 2000 to 2030 are £E22.14 billion.

Section 6: Total Savings Compared to Family Planning Program Costs

Total government savings in providing health, education, food subsidy, and other infrastructure services to a smaller population base, due to an expanded family planning program, are summarized in the second column of ***Table 12.*** Annual extra costs of the expanded family planning program are reported in the third column of the same table. The extra costs of the expanded family planning program were subtracted from the total savings in government expenditures to give the net savings in government expenditures, due to the expanded family planning program. Projected net savings for the period of 2000 through 2030 are reported in the fourth column of Table 12. Net savings start negative, become positive only after 2 years, and continue to increase thereafter. By 2030, net savings reach £E170 billion.

Section 7: Family Planning Program Benefit-Cost Ratios

Because projected program costs and benefits occur over a period of time, it is necessary to adjust for the effect of the passage of time on the value of each. That is, the value of an Egyptian pound is determined by the time at which the cost or benefit occurs. Moreover, costs and benefits occurring far in the future are not as important to us today as are costs and benefits occurring today. Consequently, all costs and benefits occurring in the future must be converted to present values. This is accomplished by the use of the discount rate, which may be defined as the rate at which the present value of a pound declines over time. Future costs and benefits are converted to present values by finding

Table 11. Projected Total Expenditures on Water, Sanitation, and Utilities

	Total Expenditures on Water, Sanitation, and Utilities (in billions of £E)								
	Water		Sanitation		Utility		Total		
Year	Proj. A	Proj. B	Proj. A	Proj. B	Proj. A	Proj. B	Proj. A	Proj. B	% of Difference
2000	2.05	2.05	3.00	3.00	0.60	0.60	5.66	5.66	0.00%
2001	2.10	2.10	3.07	3.07	0.61	0.61	5.78	5.78	0.06%
2002	2.14	2.14	3.14	3.13	0.63	0.63	5.91	5.90	0.19%
2003	2.19	2.18	3.21	3.20	0.64	0.64	6.05	6.02	0.38%
2004	2.24	2.23	3.29	3.27	0.66	0.65	6.19	6.15	0.62%
2005	2.30	2.28	3.36	3.33	0.67	0.67	6.33	6.27	0.93%
2006	2.35	2.32	3.44	3.40	0.69	0.68	6.48	6.40	1.30%
2007	2.41	2.36	3.52	3.46	0.70	0.69	6.64	6.52	1.73%
2008	2.46	2.41	3.61	3.53	0.72	0.71	6.79	6.64	2.22%
2009	2.52	2.45	3.69	3.59	0.74	0.72	6.96	6.76	2.76%
2010	2.58	2.50	3.78	3.66	0.76	0.73	7.12	6.88	3.34%
2011	2.64	2.54	3.87	3.72	0.77	0.74	7.29	7.00	3.98%
2012	2.71	2.58	3.96	3.78	0.79	0.76	7.46	7.11	4.66%
2013	2.77	2.62	4.05	3.84	0.81	0.77	7.63	7.22	5.38%
2014	2.83	2.66	4.15	3.89	0.83	0.78	7.81	7.33	6.14%
2015	2.90	2.69	4.24	3.95	0.85	0.79	7.98	7.43	6.93%
2016	2.96	2.73	4.33	4.00	0.87	0.80	8.16	7.53	7.76%
2017	3.02	2.76	4.43	4.05	0.89	0.81	8.33	7.62	8.62%
2018	3.09	2.79	4.52	4.09	0.90	0.82	8.51	7.71	9.45%
2019	3.15	2.83	4.61	4.14	0.92	0.83	8.69	7.80	10.25%
2020	3.21	2.86	4.71	4.19	0.94	0.84	8.86	7.88	11.03%
2021	3.28	2.89	4.80	4.24	0.96	0.85	9.04	7.97	11.79%
2022	3.34	2.92	4.90	4.28	0.98	0.86	9.22	8.06	12.54%
2023	3.41	2.96	4.99	4.33	1.00	0.87	9.40	8.15	13.29%
2024	3.48	2.99	5.09	4.38	1.02	0.88	9.59	8.24	14.03%
2025	3.54	3.02	5.19	4.42	1.04	0.88	9.77	8.33	14.77%
2026	3.61	3.05	5.29	4.47	1.06	0.89	9.96	8.42	15.51%
2027	3.68	3.09	5.40	4.52	1.08	0.90	10.16	8.51	16.27%
2028	3.76	3.12	5.50	4.57	1.10	0.91	10.36	8.60	17.04%
2029	3.83	3.15	5.61	4.61	1.12	0.92	10.57	8.68	17.82%
2030	3.91	3.18	5.73	4.66	1.15	0.93	10.78	8.77	18.62%
Cumulative	90.46	82.45	132.48	120.77	26.50	24.16	249.48	227.34	8.87%

Table 12. Projected Total and Net Savings in Public Expenditures

	Total Savings in Public Expenditures (in millions of £E)		
Year	Total Social Sector Savings	Extra Family Planning Costs	Net Social Sector Savings
2000	0.00	9.17	-9.17
2001	10.00	14.28	-4.28
2002	40.00	19.58	20.42
2003	80.00	25.08	54.92
2004	140.00	30.76	109.24
2005	220.00	36.62	183.38
2006	310.00	42.66	267.34
2007	460.00	48.87	411.13
2008	660.00	55.23	604.77
2009	920.00	61.79	858.21
2010	1,230.00	68.51	1,161.49
2011	1,600.00	75.43	1,524.57
2012	2,040.00	82.58	1,957.42
2013	2,540.00	90.03	2,449.97
2014	3,130.00	97.81	3,032.19
2015	3,780.00	105.37	3,674.63
2016	4,490.00	112.76	4,377.24
2017	5,290.00	107.45	5,182.55
2018	6,110.00	107.68	6,002.32
2019	6,930.00	107.46	6,822.54
2020	7,780.00	106.76	7,673.24
2021	8,650.00	105.52	8,544.48
2022	9,530.00	103.72	9,426.28
2023	10,420.00	101.28	10,318.72
2024	11,300.00	98.20	11,201.80
2025	12,130.00	94.45	12,035.55
2026	12,950.00	90.03	12,859.97
2027	13,740.00	84.93	13,655.07
2028	14,530.00	79.12	14,450.88
2029	15,290.00	72.61	15,217.39
2030	16,070.00	66.54	16,003.46
Cumulative	172,370.00	2,302.28	170,067.72

the amount today which, if invested at some given rate of compound interest (the discount rate), would yield those future costs and benefits. The appropriate discount rate is not easy to define, because it represents the degree to which present versus future consumption is valued. Three different discount rates were used to calculate the present value in 2000 of the costs and benefits of the family planning programs. These values could then be expressed in a benefit-cost ratio which measured the returns to the public investment in the family planning program. For comparability with results from the 1996 study, we made similar assumptions in generating the results of the prospective cost-benefit analysis.

7.1 Results of the Current Study

These results are listed in the third column of ***Table 13.*** The *benefit-cost ratio* for the benefits and costs through the year 2030 is 40.27 at a 10% discount rate. Table 13 also reports benefit-cost ratio by sector. In the current results, the education section contributes the most, followed by health, food subsidy, and then the water, sanitation, and utility sector.

An *internal rate of return* was also calculated from the streams of net savings to measure the overall rate of return to family planning program expenditures. An internal rate of return is defined as the discount rate that would make the present value of all costs equal to the preset value of all benefits. It measures the actual rate of return to, or the "profitability" of, the total investment in a project over a period of time. In the present case, the calculated internal rate of return is 182%, which is much higher than that of most ordinary investment projects.

7.2 Comparison to 1996 Results

Table 13 also provides a comparison of results from the 1996 original study and the current study. Under similar assumptions, the benefit-cost ratio of the Egypt family planning program has increased 50%, from 26.6 to 40.3. This increase has come in spite of the fact that the housing sector was not included in this new analysis. (The housing sector was excluded because we felt the relationship between government expenditures on housing and the change in population size was not well established.) Most of the housing expenditures are loans that borrowers pay back with interest and, therefore, are not a burden to the government.

By comparing sector benefit-cost ratios, one observes that the largest increase (440%) comes from the public health sector. The second largest is food subsidies, with a 242% increase, followed by the education sector with a 189% increase. The benefit-cost ratio for the water, sanitation, and utility sector fell by 39%. The fundamental reasons for the increases in benefit-cost ratios are increases in service coverage rates and per capita expenditures. Everything else being equal, the more people to whom the government provides the basic social services and the more the government spends on each person, the higher the benefit-cost ratios for family planning programs. In Egypt's case, between 1996 and 2000, coverage rates for health and education services increased and per capita expenditures went up significantly. ***Table 14*** provides

Table 13. Benefit-Cost Ratios

	1996 Results (10% discount rate)	2000 Results (10% discount rate)
Health	1.74	9.41
Education	6.64	19.20
Food Subsidy	1.76	6.02
Water, Sanitation, and other Utilities	9.23	5.64
Housing	7.22	
Total	26.59	40.27

Table 14. Changes in Coverage Rates and Per Capita Expenditures of Social Services

Sectors	1996 Results (Expenditures in 2000 Constant £E)	2000 Results
Health		
Coverage Rate	100.0	100.0
Per Capita Exp.	14.7	147.0
Education		
Primary		
Enrollment	97.0	97.6
Per Capita Exp.	262.2	793.0
Preparatory		
Enrollment	80.0	96.6
Per Capita Exp.	328.3	880.0
Secondary		
Enrollment	52.0	64.5
Per Capita Exp.	80.9	1,292.0
Family Planning		
Cost per CYP	19.6	36.0

coverage rates and per capita expenditures for the health and education sectors in 1996 and 2000. In the health sector, per capita expenditures increased from £E14.7 (in 2000 constant values) in 1996 to £E147 in 2000. In the education sector, enrollment rates increased and per student expenditures increased significantly. For example, for secondary education, the enrollment rate rose from 52% to 64.5%, and per student expenditure rose from 80.9 £E (in 2000 constant value) to 1,292.

7.3 Sensitivity Analysis

Because the benefit-cost ratios depend on the assumptions made regarding the future expenditures on social services and the costs of family planning programs, it is advisable to conduct some sensitivity analyses to see how the results would be affected by changing assumptions. However, because it is the official policy that all the social service expenditures will increase in the future, it does not make sense for us to make them lower than they are now. On the other hand, one could argue that the assumption that family planning unit costs will remain the same in the future should be reconsidered and its impacts on the benefit-cost ratios should be tested.

Past studies have suggested that a U-shaped unit cost pattern exists for family planning programs. When contraceptive prevalence is relatively low, expansion of the program tends to take advantage of economies of scale and reduce average costs. But when the program matures, as is taking place in Egypt, further expansion increases the average costs of family planning services. This is because, in order to further increase the client base, more intense efforts have to be made to interact with the hard-to-reach segments of the population. For the past few years in Egypt, the unit costs estimated have been stable, but there is no guarantee that they will remain so for long. Because Projection B assumes a substantial increase in the CPR for the next 30 years, we suggest that the unit costs of the expanded family planning program be allowed to increase 1% per year to reflect the reality of the harder recruiting effort in the future. Given this modest increase in unit costs of the family planning program, total family planning expenditures over the 30 years would increase 16.9% from £E13.4 billion to £E15.7 billion.

As a result of the increase in cost, the benefit-cost ratio would fall by almost half—from 40 to 23.7. This is a strong indication that the benefit-cost ratio is very sensitive to the unit costs of family planning programs and that the assumptions made about future changes should be made
carefully.

7.4 Comparison to Results from Other Countries

Comparing results from Egypt to that of other countries is important for understanding why the benefit-cost ratios of the family planning program are high in Egypt. ***Table 15*** shows the benefit-cost ratios of family planning programs in six Asian countries with varying degrees of success in family planning programs. These results were for the period of 1970 to 1990, with a discount rate of 10%. The benefit-cost ratios range from a high of 14 in Thailand to a low of 1 in

Table 15. Financial Returns to Family Planning Programs

Country	Benefit-Cost Ratio (10% Discount Rate)
Thailand (1972-1990)	14.0
Indonesia (1971-1990)	12.5
Sri Lanka (1971-1990)	8.4
Philippines (1971-1990)	5.2
India (1971-1990)	3.3
Pakistan (1972-1990)	1.0
Egypt (2000-2030, constant FP costs)	40.3
Egypt (2000-2030, increasing FP costs)	23.7

Pakistan. By comparison, Egypt's projected benefit-cost ratios for the period of 2000 through 2030 are 40.3 and 23.7, assuming constant family planning costs first and then increasing family planning costs. It is very clear that investment in Egypt family planning has yielded much higher financial returns than in many other countries. To explain why this is the case, we have to look into the factors that determine the value of benefit-cost ratios.

The vast difference in benefit-cost ratios can be explained by two major factors: (1) the cost-effectiveness of a program in averting births and (2) the level of expenditures for public services, including education and health. According to the definition of benefit-cost ratio, the lower the cost per birth averted or the more savings for each birth averted, the higher the benefit-cost ratio. In general, given low per capita expenditures on social services, the impact of a reduction in the number of people using those services will be small. That is, if a government does not spend very much of its resources on social services, neither will it save much by providing those services to fewer people as a result of family planning programs.

Table 16 summarizes and compares the average costs per birth averted by family planning in the seven countries. Annual costs per birth averted are calculated by dividing current-year family planning expenditures by current-year births averted; average costs per birth averted are calculated by dividing cumulative family planning expenditures by cumulative births averted. Costs per birth averted declined in all countries, except in Thailand, where it remained at its initial low level. Table 16 shows that Egypt had the lowest cost per birth averted by the family planning program among the seven countries examined. The low cost per birth averted will remain so, even with the assumption of increasing family planning costs in the future.

The second reason that the benefit-cost ratios differ is that the overall level of social service expenditures varies. ***Table 17*** illustrates the per capita expenditures within the health, education, and other social services sectors in 1984 for the six countries and 2000 for Egypt. The table shows that expenditure levels were much higher in Egypt than in any of the six Asian countries. Egypt spent substantially more money per person on health, education, water, sanitation, and utilities.

When both cost per birth averted and per capita expenditures are taken into consideration, it becomes quite clear why the family planning benefit-cost ratio differs among countries. Thailand and Indonesia had the highest benefit-cost ratios among the six Asian countries during the period examined, because they had lower costs per birth averted and higher per capita expenditures. Thailand's ratio is even higher than Indonesia's, because Thailand had a lower average cost per birth averted in the early periods, which counts the most in a benefit-cost calculation. Sri Lanka's benefit-cost ratio is higher than the Philippines', because its costs per birth averted were much lower, even though its per capita expenditures were not as high as those in the Philippines. Sri Lanka's benefit-cost ratio is higher than India's, because its costs per birth averted were lower and per capita expenditures were higher. Pakistan's family planning benefit-cost ratio is the lowest, because it had the highest costs per birth averted. Finally, Egypt has the highest family planning benefit-cost ratios in all the countries that have conducted similar studies, because it has a very cost-effective family planning program and because it provides extensive social services to its citizens.

Table 16. Trends in Average Cost per Birth Averted

	1971	1981	1991	2000	2010	2020	2030
Thailand	23	30	32				
Indonesia	334	75	31				
Sri Lanka	32	24	11				
Philippines	218	89	51				
India	75	23	20				
Pakistan	353	113	85				
Egypt				47	12	8	3

Table 17. Per Capita Expenditures (in $US) by Category, by Country

		Education (per student)			
Country	Health (per person)	Primary	Lower Secondary	Higher Secondary	Other Social Services
Thailand (1984)	3.64	62.69	60.72	60.72	3.37
Indonesia (1984)	0.53	44.01	118.57	132.02	
Sri Lanka (1984)	2.15	14.35	27.40	31.65	4.65
Philippines (1984)	5.19	68.85	68.85	68.85	3.65
India (1984)	1.64	11.24	14.46	28.47	0.90
Pakistan (1984)	0.96	43.21	43.21	43.21	
Egypt (2000)	43.20	233.20	258.80	380.00	55.6

Egypt's benefit-cost ratio stands out as the highest of all the countries that have conducted similar analyses. This, of course, speaks well of the efficiency of Egypt's family planning programs and the extent to which the public is being provided with social services.

Section 8: Policy and Program Implications

Our analysis, using 2000 data, reconfirms the results of the 1996 study on the favorable financial returns to Egypt's family planning program. Surprisingly, the benefit-cost ratio has gone up by 50% in four years from 27 to 40.7. This change in benefit-cost ratio reflects recent significant increases in social service expenditures, particularly in the health and education sectors.

The extremely high benefit-cost ratio can be interpreted in two ways. First, it acknowledges that expenditures on Egypt's family planning program are indeed an attractive financial investment. The high benefit-cost ratio suggests that continuing a successful family planning program would help the government reduce the fiscal burdens of providing social services to the population. Secondly, it serves as a warning that the government will face a serious problem in the near future providing the current level of social services to a much larger population, if sufficient funds are not allocated to maintain a successful family planning program. In a way, the high benefit-cost ratio is a double-edged sword. If the government can manage to continue a successful family planning program, then it will benefit greatly from the favorable financial consequences; on the other hand, if no further progress is made to expand the current program, then there will be severely detrimental effects in the future. Therefore, the new benefit-cost analysis once again underlines the importance and urgency of having an expanded family planning program with a goal of achieving replacement-level fertility in the next 10-15 years.

USAID will stop its funding for all contraceptives in 2009, and the government must provide replacement funds. The additional contraceptive costs to the government are estimated to be £E200-300 million annually, which is only a small fraction of the potential reduction in social services expenditure burdens (in billions of Egyptian pounds per year). Therefore, the government should prepare to take over the funding of contraceptives without any reservation or hesitation, and it would be the best of all public investments.

To have a successful family planning program also requires strong support from other ministries, particularly the Ministry of Education. The cost-benefit analysis of the family planning program in Egypt can also be used to explain clearly why all the line ministries should support the FP programs. ***Table 18*** illustrates the effects of family planning on the quality of education services. Assuming that the gross domestic product (GDP) and the per student expenditures were all to increase 5% annually (Columns 1-4), total education expenditures as a percentage of the total GDP would depend on the level of the family planning program. Considering the scenario of constant fertility with lower prevalence of contraceptives, the percentage of total GDP as total education expenditure would increase from the current 3.7 to 6.0 by 2030 (Column 7). Because the percentages of total GDP as social sector expenditures tend to remain fairly constant over

time, a rising percentage might prevent the education ministry from increasing the per student expenditure and improving the quality of services. On the other hand, under the reduced fertility scenario, the percentage of total GDP spent for the education sector would still be 3.70, with slight variance over the project period, by 2030 (Column 8). This demonstrates that improving the quality of services in the education sector would be much easier with a family planning program that would lead to replacement fertility. The savings from not having to serve an even larger population could be used to improve the quality of services that benefit the current number of people. Column 10 of Table 18 indicates that the cost of this family planning program as a percentage of the total GDP would decrease over time, which suggests that the family planning program is financially sustainable.

Section 9: Future Studies

To complement this prospective financial analysis and to demonstrate the full health and economic benefits of family planning programs, the current analysis can be expanded. The expanded cost-benefit analysis would go beyond considering just the financial aspect and reveal the many other benefits of family planning programs. Family planning programs have many direct and indirect benefits, and all benefits should be estimated and documented as potential total contributions of the Egypt family planning programs. The proposed expanded study would include such health benefits as maternal lives saved and infant and child deaths averted. It would also include analysis of the family planning program contributions to economic development, such as improvement in per capita income. It would be important to include an analysis in the study to show the benefits of declining fertility rate on the future age structure of the population. Faster growth rates of the productive segment of the population would contribute to future economic growth rates. By adopting results from recent studies on demographic dividends, we could estimate the “window of opportunity” for Egypt’s family planning program to enhance the economic growth of Egypt in the next 30 years. Such an expansion could provide very useful information to strengthen the government’s resolve for a strong family planning program and help to generate support for the higher future investments required.

Table 18. Total Education Expenditures as percentage of Total GDP

		Education Expenditure per Student at 5% Annual Increase			Total Education Expenditures		Ed Expenditures as % of Total GDP		FP Expenditures as % of Total GDP	
Year	(1) Total GDP (with 5% annual increase)	(2) Primary	(3) Preparatory	(4) Secondary	(5) Constant Fertility	(6) Reduced Fertility	(7) Constant Fertility	(8) Reduced Fertility	(9) Constant Fertility	(10) Reduced Fertility
2000	362	793	880	1,292	13.37	13.37	3.70	3.70	0.07	0.08
2001	380	833	924	1,357	13.99	13.99	3.68	3.68	0.07	0.08
2002	399	874	970	1,424	14.64	14.64	3.67	3.67	0.07	0.07
2003	419	918	1,019	1,496	15.36	15.36	3.67	3.67	0.07	0.07
2004	440	964	1,070	1,570	16.14	16.14	3.67	3.67	0.07	0.07
2005	462	1,012	1,123	1,649	17.02	17.02	3.69	3.69	0.06	0.07
2006	485	1,063	1,179	1,731	18.01	18.01	3.71	3.71	0.06	0.07
2007	509	1,116	1,238	1,818	19.17	19.13	3.77	3.76	0.06	0.07
2008	535	1,172	1,300	1,909	20.48	20.34	3.83	3.81	0.06	0.07
2009	561	1,230	1,365	2,004	21.95	21.65	3.91	3.86	0.06	0.07
2010	589	1,292	1,433	2,105	23.62	23.07	4.01	3.91	0.05	0.07
2011	619	1,356	1,505	2,210	25.47	24.59	4.12	3.97	0.05	0.06
2012	650	1,424	1,580	2,320	27.54	26.21	4.24	4.03	0.05	0.06
2013	682	1,495	1,659	2,436	29.83	27.92	4.37	4.09	0.05	0.06
2014	716	1,570	1,742	2,558	32.35	29.70	4.52	4.15	0.05	0.06
2015	752	1,649	1,829	2,686	35.08	31.53	4.66	4.19	0.05	0.06
2016	790	1,731	1,921	2,820	38.01	33.35	4.81	4.22	0.04	0.06
2017	829	1,818	2,017	2,961	41.13	35.15	4.96	4.24	0.04	0.06
2018	871	1,908	2,118	3,109	44.32	36.86	5.09	4.23	0.04	0.05
2019	914	2,004	2,224	3,265	47.69	38.57	5.22	4.22	0.04	0.05
2020	960	2,104	2,335	3,428	51.19	40.22	5.33	4.19	0.04	0.05
2021	1,008	2,209	2,452	3,599	54.82	41.81	5.44	4.15	0.04	0.05
2022	1,058	2,320	2,574	3,779	58.58	43.34	5.53	4.10	0.04	0.05
2023	1,111	2,436	2,703	3,968	62.47	44.78	5.62	4.03	0.04	0.05
2024	1,167	2,558	2,838	4,167	66.49	46.26	5.70	3.96	0.04	0.04
2025	1,225	2,685	2,980	4,375	70.64	47.81	5.77	3.90	0.04	0.04
2026	1,286	2,820	3,129	4,594	74.97	49.46	5.83	3.84	0.03	0.04
2027	1,351	2,961	3,285	4,824	79.50	51.24	5.89	3.79	0.03	0.04
2028	1,418	3,109	3,450	5,065	84.29	53.19	5.94	3.75	0.03	0.04
2029	1,489	3,264	3,622	5,318	89.36	55.35	6.00	3.72	0.03	0.04
2030	1,564	3,427	3,803	5,584	94.82	57.80	6.06	3.70	0.03	0.03

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