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A COST-BENEFIT ANALYSIS OF THE PROPOSED JAMAICAN FAMILY PLANNING PROJECT

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ABBREVIATIONS

AID/W	Agency for International Development/Washington
CDSS	Country Development Strategy Statement
CICRED	Committee for International Coordination of National Research in Demography
CYP	Couple Year of Protection
GDP	Gross Domestic Product
GFR	General Fertility Rate
IBRD	International Bank for Reconstruction and Development
KAP	Knowledge, Attitude, and Practice
LACB	Bureau for Latin America and the Caribbean
USAID	United States Agency for International Development

I. INTRODUCTION

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The objective of this economic analysis is twofold: (1) to estimate the micro and macro benefits to the Jamaican economy and people of the proposed project and (2) to relate the projected costs of the project to the projected outputs (or achievements) to compare the cost-effectiveness of this project to that of other similar programs and projects. This definition of objectives is a slight variation on the guidelines in the Agency for International Development (AID) Handbook (Volume 3, Part I, pages 5-3 and 5-4), but it is very much in the spirit of those guidelines, which urge the use not only of "imaginative techniques," but also of "good common sense."

The general approach to the relationship between project inputs and outputs is illustrated in Figure 1. The ultimate goal of the exercise is to compare project costs (A) to social and economic benefits (E) (see Chapter V). The initial steps in this process are to define specifically the expected outputs of the project (B); relate these outputs to the ultimate goals of fertility reduction ((B) to (C 1)); and consider the indirect and direct effects of the project (C 2). To determine cost-effectiveness, one must compare (B) to (A) and also (C 2) to (A) (Robinson and Schutjer, 1980).

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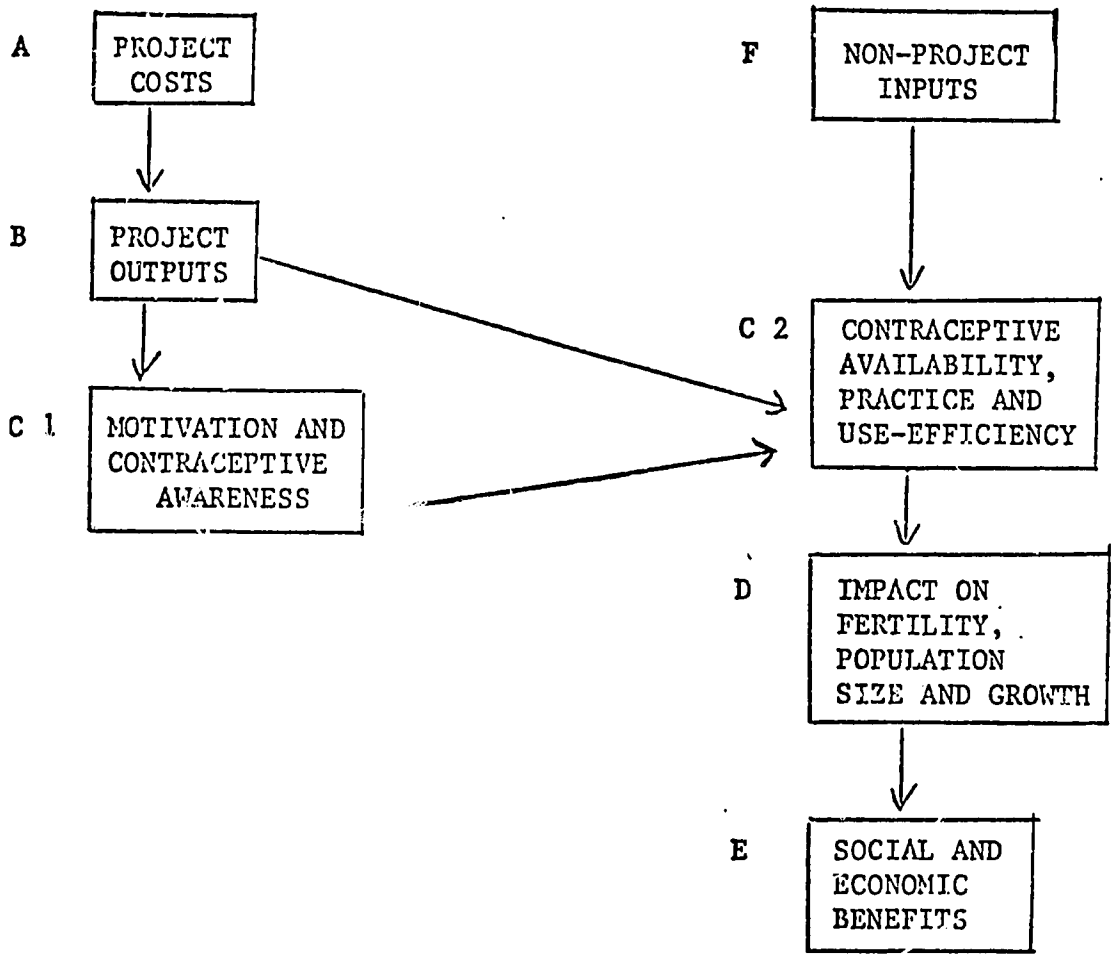
* This is the background paper for Part IVB, "Economic Analysis," of the Jamaica Population and Family Planning Services Document.

Figure 1

THE RELATIONSHIP BETWEEN INPUTS AND OUTPUTS



II. THE GOAL AND PURPOSES OF THE PROJECT

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The stated goal of the Jamaican Family Planning Project is "to improve the health, social and economic welfare of the people of Jamaica by reducing the crude birth rate from an estimated 26/1,000 in 1980 to 20/1,000 or less by 1990." The specific purposes are to "increase the rate of contraceptive prevalence from 58 percent in 1980 to 70 percent in 1984" and to "support the development and implementation of a comprehensive population policy and plan for Jamaica."

The overall benefits of the project are the improved health and social and economic welfare of the Jamaican people. To achieve these benefits, the rate of contraceptive use must increase and the birth rate must decline further.

The projected decline in the birth rate implies a reduction of approximately 13,000 births per year by 1985 and 28,000 births per year by 1990 (assuming that the fertility rate will level off at the present figure if the expanded program is not launched). As is shown in Table 1, the cumulative total number of births to be averted by the project by 1990 is approximately 150,000. By 1984, the end of the specific project funding period, approximately 10,000 births will have been averted annually (26,000 in total).

It is important to understand that the projected achievements shown in Table 1 are incremental to the existing level of achievements of the ongoing program. The past and present achievements are presented in Table 2. (The basis for the estimates in Tables 1 and 2 is explained in Appendix A.)

Between 1971 and 1979, the birth rate fell from 35 per 1,000 population to 27 per 1,000 population. The implication of this decline is that more than 127,000 births (approximately 26,000 births per year) will have been averted by the end of the period. Much of the decline can be attributed to the changed practices and attitudes of Jamaican couples. It would have occurred even if the population program had not been launched. But certain other goals would not have been reached, because their achievement depends on the availability of supplies, motivational reinforcement, and access. Program support will be required to maintain fertility at even half the level to which it has been reduced. Continuation of the program is justified for this reason alone.

To repeat, by 1985, 21,500 births will have been averted. This number represents the level of achievement which the project aims to maintain. By expanding the program's scope and by increasing its effectiveness, 13,000 additional births will be averted by 1985. This will

Table 1

PROJECTED INCREMENTAL BIRTHS AVERTED
(1980-1990)

Year	Target Birth Rate	Implied General Fertility Rate (Births per 1,000 Females, 15-49)	Annual Births To Be Averted	Cumulative Births To Be Averted
1980	27.0	118	--	--
1981	26.3	113	2,700	2,700
1982	25.6	108	5,100	7,800
1983	24.9	103	7,900	15,700
1984	24.3	99	10,400	26,100
1985	23.6	95	13,300	39,400
1986	22.9	90	16,300	55,700
1987	22.2	86	19,100	74,800
1988	21.5	82	21,800	96,600
1989	20.8	78	24,700	121,300
1990	20.0	74	28,300	149,600

Source: See Appendix A.

Table 2

PROJECTED INCREMENTAL BIRTHS AVERTED
(1970-1980)

Year	Actual Birth Rate	General Fertility Rate (Births per 1,000 Females, 15-49)	Annual Births Averted	Cumulative Births Averted
1970	35.0			
1971	34.9	170	--	--
1972	34.3	167	1,100	1,100
1973	31.4	153	5,400	6,500
1974	30.6	149	8,500	15,000
1975	30.1	145	10,300	25,300
1976	29.3	139	13,600	38,900
1977	28.8	133	16,600	55,500
1978	27.4	124	21,700	77,200
1979	27.1	120	24,000	101,200
1980	27.0	118	25,900	127,100

Source: MOH data for births; see Appendix A.

represent a 50 percent increase in program achievement. The total achievement of the project by 1985 will be approximately 34,800 births averted per year. The cumulative total, which is derived from present and incremental program achievements between 1981 and 1985, will be 122,800 births averted. Table 3 contains the year-by-year figures.

Figure 2 illustrates the logic of the calculations with respect to trends. In 1970, the general fertility rate was 170 births per 1,000 females aged 15-49. By 1980, the number of births had been reduced to 118. By 1985, it will be reduced to 95, and, by 1990, to 80. Thus, between 1981 and 1985, the decline from 170 to 95 will be a cumulative program achievement, whereas the change from 118 to 95 will be an incremental achievement. (For details, see Appendix A.)

Table 3

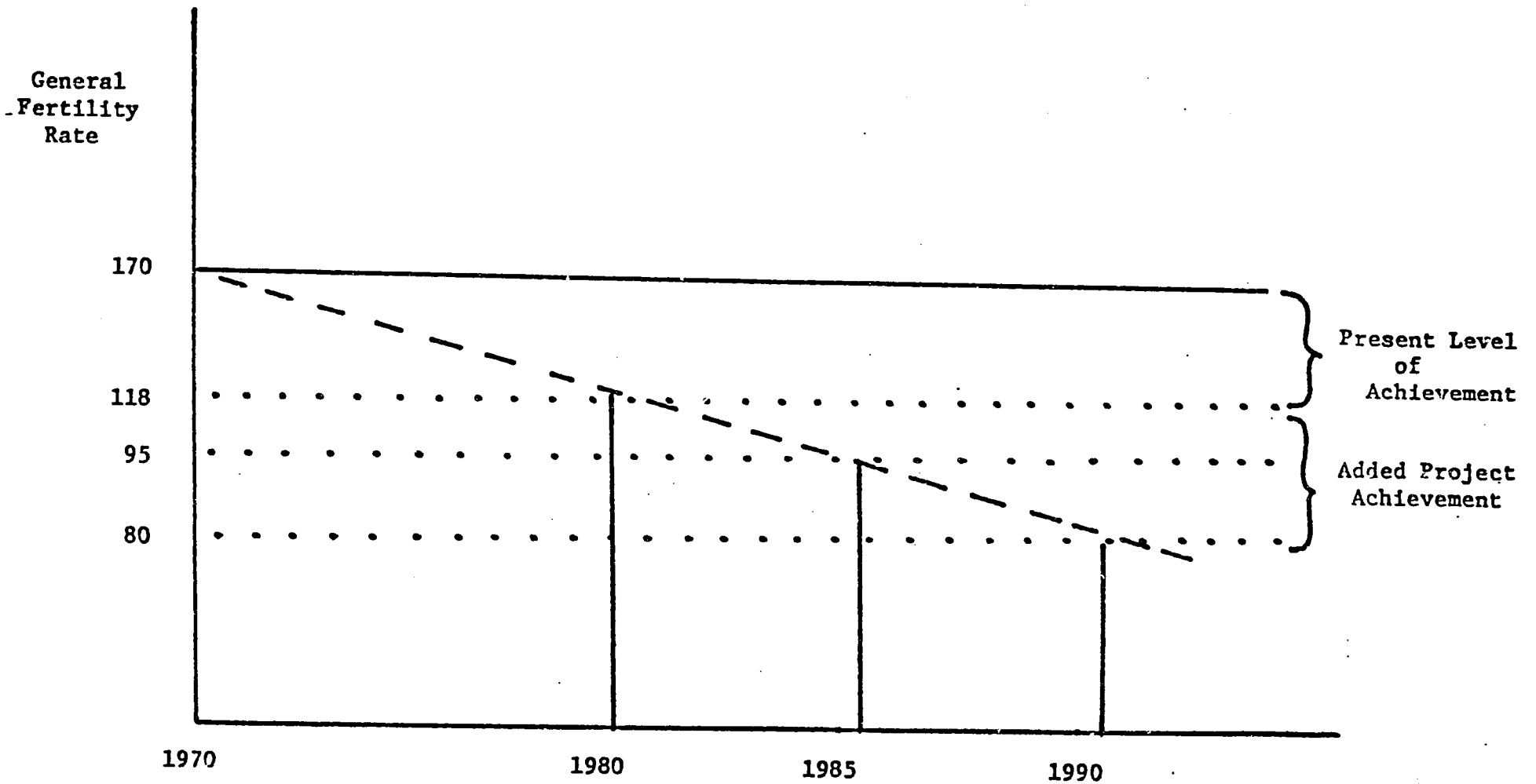
PROJECTED TOTAL BIRTHS AVERTED
(1981-1990)

Year	New Program Achievements		Continuation of Present Achievements		Total	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1981	2,700	2,700	13,200	13,200	15,900	15,900
1982	5,100	7,800	14,600	27,800	19,700	35,600
1983	7,900	15,700	16,100	43,900	24,000	59,600
1984	10,400	26,100	18,000	61,900	28,400	88,000
1985	13,300	39,400	21,500	83,400	34,800	122,800
1986	16,300	55,700	23,200	106,600	39,500	162,300
1987	19,100	74,800	25,500	132,100	44,600	206,900
1988	21,800	96,600	26,700	158,800	48,500	255,900
1989	24,700	121,300	28,500	182,300	53,200	303,600
1990	28,300	149,600	30,700	213,000	58,900	362,600

Sources: Tables 1 and 2 and Appendix A.

Figure 2

THE RELATIONSHIP BETWEEN PROJECT ACHIEVEMENT AND ANNUAL BIRTHS



III. MEASURING THE OUTPUTS OF THE PROJECT

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Program Output Data

The service statistics for the Jamaican program are far from ideal. Data on new acceptors, old (or continuing) acceptors, and total attendance are reported. A "new acceptor" is anyone who has actually accepted contraceptive supplies after visiting a clinic. "Attendance" refers to total visits; no allowance is made for possible multiple visits (or revisits) by a single user. The method used to determine how a person "drops out" seems to vary considerably from clinic to clinic. As a result, there are no data on the average time the average acceptor spends in the program.

Data are not available for 1979, a year of administrative reorganization and confusion in the program, and data for some earlier years are highly suspect. The "New Acceptors" series seems to be reasonably consistent. In 1980, a new system was installed to measure new and continuing acceptors, and not merely total attendance. Table 4 presents the service statistics for the last decade.

The survey data (Powell, 1980) show that 60 percent of the women currently at risk (in a union of some kind) are contracepting. The total number of females 15-49 was estimated to be approximately 20.5 percent (497,000) of the total population in 1980 (U.S. Census Bureau, 1977). Some 66 percent, or 330,000, of these women were at-risk (in a current union). If 60 percent of these women are contracepting at this time, there would be approximately 200,000 current active users. The survey data also show that approximately 60 percent of the current users obtain their supplies from program clinics, whereas the remaining 40 percent use private, commercial outlets. This means that there are roughly 120,000 continuing contraceptors in the official program and that each makes roughly two visits per year. (These figures are derived by comparing the survey data with the program attendance data in Table 4.)

The goal for the project is to reach 70 percent of the at-risk females by 1984. In relation to total population, the number of females 15-49 is increasing (see Appendix A). By 1985, there will be 568,000 women (25 percent of the total population) in this category. Assuming that two-thirds of this number are at risk, the figure would be 375,000 females. Given the goal of 70 percent, 265,000 women would have to be program users in 1984. (Included in this figure are the 60 percent who would be serviced by the network of clinics and those women who would be resupplied through commercial channels.) The increase in prevalence during the new project period would be 32 percent.

Table 4

PROGRAM SERVICE STATISTICS
(1970-1980)

Year	Total New Acceptors (000s)	Total Attendance (000s)
1970	19.3	111.1
1971	22.1	132.2
1972	23.1	146.6
1973	27.9	187.3
1974	24.7	200.4
1975	23.8	219.6
1976	18.6	191.4
1977	27.5	206.2
1978	25.1	196.2
1979	25.0*	200.0*
1980	25.0*	--

* Estimated.

Source: Data obtained for 1980 from MOH officials; earlier years reported in Demographic Statistics, 1979, U.S. Census Bureau, 1977, and World Bank, 1978.

Ensuring adequacy of supplies in the commercial sector is an important part of this project, as it has been in past AID efforts. At this time, AID-supported private sector programs service 10,000 condom users and 20,000 pill users per year. This is slightly less than half the total non-clinic achievement. The balance includes other methods, including abortion.

Another important objective of the project is to increase continuation rates and reduce client turnover. This will be achieved if the proportion of total continuing users made up of new acceptors declines. At this time, the ratio in the clinic program is approximately 5 to 1 (25,000 acceptors and 125,000 total users). The ratio probably can be raised to 6 to 1 if the quality of the program effort is improved. (Each new acceptor would stay in the program somewhat longer than (s)he now does.) The 160,000 total users would represent 27,000 new acceptors per year by 1984. This figure represents a 10 percent increase over the 1980 level of 25,000 new program acceptors. The number of new acceptors would increase moderately, as would continuation rates. Total prevalence would increase rather sharply.

Indirect Outputs

There are indirect outputs in both the past program and the proposed project. The most important indirect program output is the steady increase in the percentage of females who know about some method and have ever practiced contraception (from 10 percent in the early Stycos-Back (1956) study to 70 percent today (Powell, 1980)). Increased "knowledge and awareness" are necessary prerequisites to increasing contraceptive practice, though not a "target" of the project.

IV. THE PROJECT IN RELATION TO FERTILITY

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The Linkage of Outputs to Fertility

As has been noted elsewhere (Robinson and Schutjer, 1980), relatively complex statistical procedures are used to relate specific program output to the final objective: fertility reduction. More simple techniques are available that require less computational sophistication and fewer data. Given the inadequacies of the data base of the Jamaican program, a relatively simple approach should be taken.

In 1980, roughly 200,000 women were continuing users of contraceptives and approximately 26,000 births were averted annually. These figures represent a ratio of 8 "users" per birth averted. (Note that a "user" is not a couple or a client year of protection (CYP). No data are available on the average time a client spends in the program or on use-efficiency; however, the 8-to-1 ratio suggests rather inefficient and sporadic use.) The project targets imply some 265,000 users by 1985. It is also anticipated that program effectiveness will be increased and that, as a result, the ratio of users to births averted will fall. If, incrementally, one assumes 7 continuing users per one birth averted by 1985, for 265,000 users, the number of births averted will be 38,000. This figure corresponds well to the number of projected births averted (35,000) (see Table 3; data are derived from birth rate targets).

Costs of the Project

The costs of the project are known and require no further analysis or justification. The total AID contribution is approximately $5,000,000 over the four years. The Government of Jamaica is contributing a like amount. The total is thus U.S.$10,000,000, or roughly $2,500,000 per year. It is this cost figure that is used in the economic analysis.

Cost Per Birth Averted

Total program costs can be combined with the estimates of births averted to calculate the "cost per unit" of output of the program. Given the project's targets, one can conclude that, in 1985, the project will prevent some 35,000 births per year. The current project is in fact a continuation of a successful, ongoing program, the two objectives of which are to improve the quality of service and increase overall coverage.

The birth rate is relatively low in Jamaica, and it is well known that once a certain level is reached, further declines are more difficult to achieve. The final total of births averted by this project is, then, the total number of incremental births plus the number of births averted by maintaining the program at current levels.

The project requires that no fewer than 35,000 births be averted annually by 1985. The annual total for 1984 would be approximately 28,000, and the total cumulative number of births averted would be approximately 90,000 for the period 1981-1984. The estimated cost per birth averted would be approximately U.S.$112.00. This figure is well within the range of costs described in surveys of other population programs around the world (Robinson, 1980; Srikantan, 1977). It also corresponds to earlier estimates for Jamaica (Walsh, 1972).

V. A COST-BENEFIT ANALYSIS OF THE PROJECT

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As we have seen, the costs of the project are known. But more complex issues are involved in the calculation of the social and economic benefits of the project. Generally speaking, one can look at two kinds of benefits: macro benefits (societal) or micro benefits (benefits for individual or household). Ordinarily, the cost-benefits of projects are justified at the macro level. A macro-level analysis is the focus of this study, but a micro-level analysis of the probable benefits of the project will also be attempted.

Macro Economic Benefits

Broadly speaking, the benefits to the Jamaican economy of reduced fertility are the net resources which will be saved because fewer children are born. Each child born inevitably represents a new claim against society for some minimal level of support--food, clothing, and shelter. In Jamaica, the government is committed firmly to providing health care, education, and other public sector social services as well. Thus, there is a stream of resource requirements or costs imposed by each additional birth.

Against these costs one must weigh the possible future productive economic contribution of additional members of the population (i.e., the contribution to total national output and to government revenues (from income and taxes) which they will make when they enter the labor force.) This contribution will be made only after a substantial period of years, because even in rural Jamaica children below the age of 12 or 15 perform few useful tasks.

Jamaica has a staggeringly high unemployment rate--30 percent and above--and substantial underemployment in the rural areas and in the informal urban sector. By any reasonable estimate, the country will be hard-pressed to find useful and productive economic roles for every member of the population. Thus, it is unlikely that with reduced fertility and the prevention of new births future levels of output in Jamaica will be reduced.

The net benefits at the macro level are thus the present value of the stream of future costs which the society will not incur because births are averted. It is this stream of costs which represents the macro economic benefits of fertility reduction.

The underlying rationale must be clear. It is obvious that future trends in total output in Jamaica will not be affected by the number of births occurring in the next four years. Persons born next year will not

enter the labor force until they reach the age of 12 or 15. The economic productivity of these persons is likely to be very low because an enormous surplus of labor already exists. The presence of these extra persons will, however, increase the total minimum subsistence requirements of the economy because either the "surplus" output (i.e., output in excess of minimum needs) which might otherwise have been available for development will be decreased or the Jamaican economy will become more dependent on foreign imports to meet the gap between output and minimum needs.

This is illustrated vividly using economic and demographic projections for Jamaica. Total current output has been virtually stagnant for the last five years. Indeed, real GDP has declined in recent years, as has real income per capita. A new government with a new economic policy is now in place, and there is reason for cautious optimism about the economic future. However, in the short run (i.e., to 1984), a constant, real GDP seems to be the most reasonable forecast. With a 1980 base of U.S.$2.4 billion, this yields the figures shown in Table 5 for the years 1981-1985. If one assumes as constant the 1980 per capita consumption figure of $960 and rapid population growth at approximately 3 percent per year (roughly the rate that prevailed before the program began) between 1981 and 1985, the total consumption requirements would be the figures shown in Table 5. The consumption needs compared to output indicate the declining "surplus." By 1981, the "surplus" which still existed in 1980 would be gone and, after 1982, a "gap" in consumption needs in excess of output will have developed.

Even if output is increased 20 percent between now and 1990 (this would be a substantial achievement), unchecked population growth at 3 percent per year through 1990 would mean that consumption needs would equal that increased output. This, too, is shown in Table 5. The reduction in population growth since 1970 and further reduction between now and 1990 are as important to Jamaica as increased output.

These benefits, viewed as a present value, are the sum of the stream of consumption "needs" saved by reducing fertility from high to low levels. It is important to note that these "savings" for births averted between 1980 and 1984 extend well beyond the project period. If one assumes that children aged 0-14 and older persons aged 60-70 consume half the current average consumption and that all others between the ages of 15 and 59 consume that exact amount ($960), the total consumption requirements per person born now would be more than $50,000 over 70 years. The annual average would be approximately $700. Using a 15 percent discount rate, a 70-year series of $700 annual benefits has an accumulated value of more than $4,000 (see Table 6). This, then, is the estimate of the benefit per birth averted. Allowing for changes in prices and real income and for the decline in employment, this figure is quite consistent with earlier estimates for Jamaica derived by Enke (1966) and the IBRD (1970).

Figure 3 illustrates this logic in graphic form. Line 0 represents total output leveling off at current population (P_1) and indicates that

Table 5

ILLUSTRATION OF EFFECTS OF RAPID POPULATION GROWTH ON PRODUCTION VERSUS CONSUMPTION BALANCE

Year	Total GDP*	Total Current Consumption Needs	Population** (000s)	Present Level of Per Capita Consumption
1980	2,400	2,310	2,412	960
1981	2,400	2,400	2,490	960
1982	2,400	2,470	2,570	960
1983	2,400	2,540	2,650	960
1984	2,400	2,630	2,740	960
1985	2,400	2,700	2,826	960
1990	2,880‡	3,210	3,347	960

* In thousands of 1979 U.S. dollars.

** Assuming no decline in fertility from 1970 fertility level (1978-1982 Five-Year Plan, Projection I, p. 93).

‡ Assumes a 20 percent increase in output.

Source: Data for 1980 are estimated on the basis of past trends; see Department of Statistics, National Income and Product, 1979 and AID, Jamaica Country Development Strategy Paper, February 1981.

Table 6

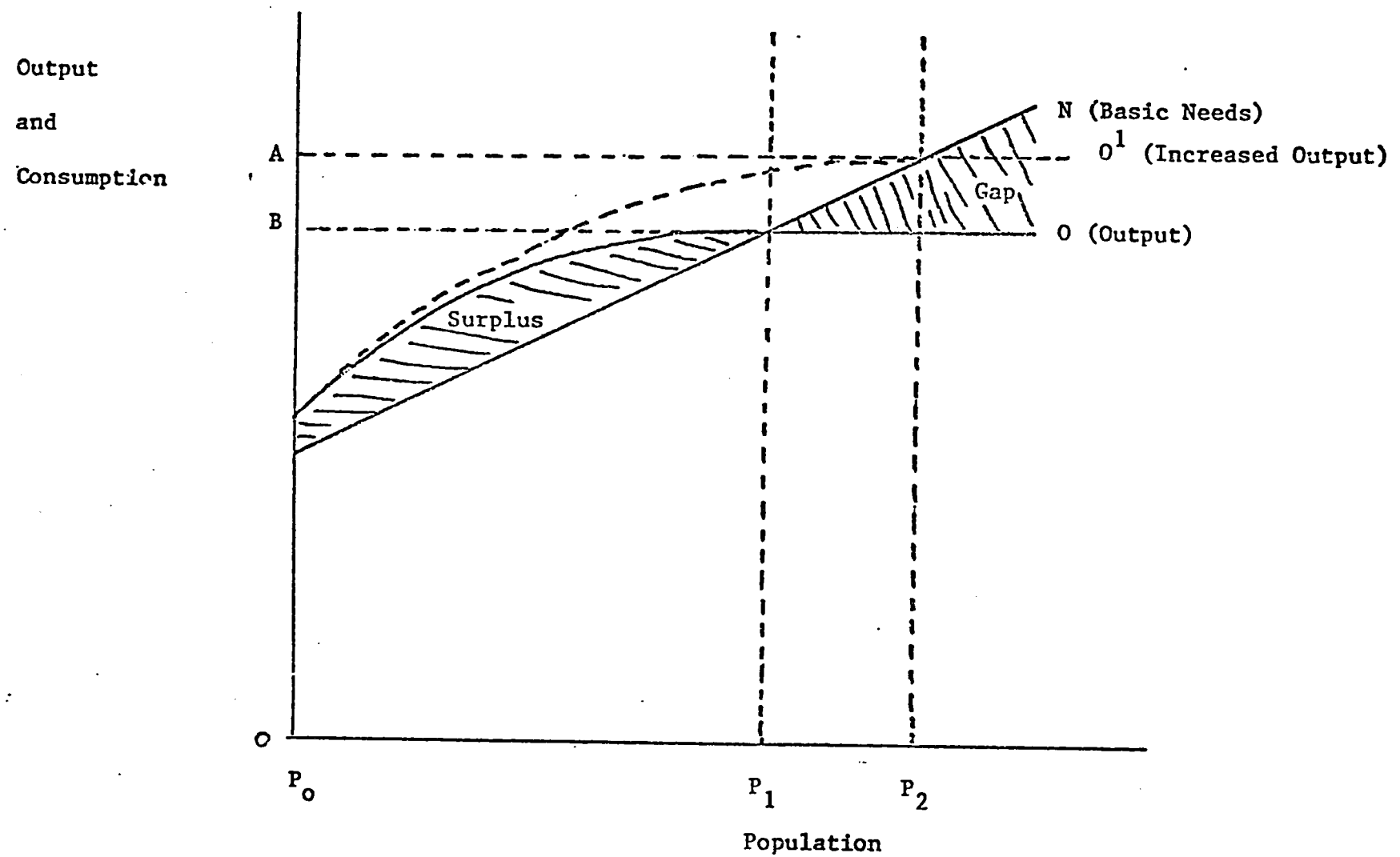
THE BENEFIT STREAM PER BIRTH AVERTED*

Future Year	
1	$ 700
2	595
3	506
4	430
5	366
6	311
7	264
8	224
9	191
10	162
11	138
12	117
13	99
14	85
15	72
16	61
17	52
18	44
19	37
20	32
TOTAL	$4,486

Based on an average consumption per capita of $700 (see Appendix B) and an annual discount rate of 15 percent. Discounting beyond 20 years is not felt to be meaningful.

Figure 3

OUTPUT AND CONSUMPTION IN RELATION TO POPULATION



further increases in population (and in the labor force) beyond P_1 do not result in increased output. (This is the assumption known as "zero marginal productivity.") In its development effort, the Jamaican government is aiming to shift the curve upwards to O^1 through increased investment and other measures. Line N represents basic economic needs (food, clothing, and shelter, but also basic health and educational and public services). It is a straight line because it is assumed that the per capita requirement will not change. (Note that the population axis does not begin at a zero population but at an actual population at some level of output (O) and need (N). If the population axis is extended to the left to zero, it is logical that both O and N would come from the origin, the intersection of the two axes.) At population P_1, N and O intersect and needs equal output. (This is the outcome for 1981 shown in Table 5.) N is greater than O, and a "gap" between output and needs exists at any population higher than this. If the Jamaican government succeeds in moving to output function O^1 at present population P_1, a "surplus" (the difference between A and B on the vertical axis) will result in the short run. But, at increased population P_2, the new, higher level of output B will just equal N. There is neither a "gap" nor a "surplus." (This point is already exceeded by 1990, as Table 5 shows.)

Thus, the efforts to increase the development surplus and to raise the growth rate of output are frustrated by the growth of population. The "benefits" to the Jamaican society of reducing fertility lie in the advantages of having a P_1 rather than a P_2 population (the difference in the requirements (or N) of A and B). This, to repeat, is a measure of the "gap" when output is plotted along curve O and a measure of the potential developmental surplus foregone if output shifts to O^1 because of successful economic programs. Along either O or O^1, the smaller the population, the greater the potential for development.

Micro Economic Benefits

The benefits discussed in the preceding section are fairly abstract societal benefits. Fertility actually occurs within households or families (or "unions," as they are described in Jamaica). Nearly all Knowledge, Attitude, and Practice (KAP) studies done in Jamaica show that knowledge of contraception is almost universal among men and women--90 percent or more. More than 70 percent of the females aged 15-44 have used contraceptives at some time, and most seem to feel that they have adequate access to services when they want them (Powell, 1979; Data Bank and Evaluation Unit, 1980; Harrison, 1978). However, only about 50 percent of the women at risk are contracepting. The desired family size still averages four or more children.

This seems to suggest that large family size in Jamaica is not unintended but the result of a rather rational desire for children. If true,

this hypothesis has disturbing implications, for it suggests that the benefits perceived at the macro level are absent at the micro level.

The evidence is mixed, however. The same surveys show that as many as 80 percent of the women who were interviewed do not want another pregnancy now, and more than 70 percent admitted that their last pregnancy had not been planned. Younger women seem to report a lower desired family size than do older women. And the number of abortions--legal and illegal--is increasing. The data show that there is considerable demand, or need, for contraception among females at risk who do not desire another pregnancy but who are not currently contracepting. As many as 35 percent of all females now in unions may need contraceptives.

A full exploration of the apparent contradiction in attitudes and behavior is beyond the scope of this paper. Indeed, its roots are in the structure of the family and in the traditional value system of Jamaican society. In economic terms, however, an interpretation is possible. The focus is micro-level costs and benefits of children as perceived by Jamaican women.

Children in Jamaica continue to have positive sociopsychological appeal to women. They are loved and wanted for the same, almost instinctive, reasons that societies all over the world encourage childbearing. Traditionally, children help women establish meaningful, semi-permanent relationships with men. The mother's family is likely to be supportive, providing resources, such as a place to live or shared income. Other peer groups also may be supportive. Thus, the positive and largely psychological benefits of children are not offset by costs, economic or otherwise, to the mother. In economic terms, the costs are externalized and shared by the larger group of which the mother is a member. To the extent that social support programs such as health care, education, and social welfare payments are available, the larger society also bears part of the cost.

Another factor is highly relevant to this discussion. The surveys do indicate that Jamaican women have a strong negative perception of contraceptive use. Powell (1979) reports that 40 percent believe that family planning is "harmful" to their health. More than 70 percent of dropouts give this as the reason for not contracepting. Rightly or wrongly, there is a perceived cost to contracepting. There must also be a perceived benefit to reducing fertility before women will become effective users. If women can successfully externalize the negative features (or costs) of children and if there is even a minimum number of positive benefits, it will not be considered worthwhile to contracept.

The key element, it seems clear, is the ability of the female to externalize the costs of children, to shift those costs onto some larger group--her family, her peers, the larger society. Traditionally, Jamaican society made this an easy task. Children were frequently raised by aunts, by grandparents, or by other surrogate mothers. They were not a

"burden" on anyone. This practice was based on an economy of plenty, on a Jamaica that had ample resources to guarantee subsistence for all. Food, clothing, and shelter posed no real problems. But there have been dramatic changes in the last two decades. Resources are now scarce, and roughly half of Jamaica's foodstuffs is imported. Food must be purchased for money by the ultimate consumer. Tastes are more sophisticated, and now listed among minimum needs is a range of previously unknown consumer goods. The population is becoming predominantly urban, thus losing direct access to subsistence activities. Finally, public sector services--health, communications, education--have begun to play an important role in the standard of living of the people.

The overall economic and social situation has changed and is changing still further. Women now indicate that they see "disadvantages" to children, either out-of-pocket costs or lost opportunities (opportunity costs) because children prevent women from achieving desired career goals (Justus, et al., 1979). These trends are certain to continue. The perceived pressure, the internalized costs of children to mothers, will, in all likelihood, grow. This should mean that the inconsistency between micro and macro cost-benefit calculations will disappear.

Summary

In sum, the zero marginal productivity of additional members of the population leads to growing macro economic pressure as the population grows. At the micro level, this prevents women from finding economic and social support mechanisms to bear the costs of their children outside their own direct efforts. The costs of children to mothers rise, as does the effective demand for birth control. It is this scenario that is believed to be unfolding in Jamaica.

VI. CONCLUSIONS

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The total costs of the proposed Jamaican project are $10,000,000, including a 50 percent Jamaican contribution. The total number of births averted is approximately 90,000 for the first four years. The crude birth rate must be reduced to 24 by 1984 (and ultimately to 20 by 1990). To accomplish this goal, 70 percent of the eligible Jamaican women must be reached, mostly by direct program activity.

The cost per birth averted is U.S.$112.00. The direct economic benefits are the resources which Jamaica will save by not allowing further population growth in a stagnant economy with 30 percent unemployment. The economic benefits per birth averted are approximately $4,500. (A comparison of costs is presented in Table 7.) The results are highly favorable even though the substantial indirect social benefits which are likely to be created are not considered. Even if the estimate of benefits per birth averted is 50 percent too high (i.e., if the "true" figure is $2,000), the benefit-to-cost ratio is still highly favorable. Thus, it is possible to eliminate the zero marginal productivity assumption, and to allow for some future economic contribution by persons born now, without changing the conclusion.

Table 7

A COST-BENEFIT CALCULATION OF THE PROPOSED PROJECT
(1981-1984)

Year	Project Costs	Births Averted*	Discounted Project Benefits**
1981	$ 2,500,000	16,000	$ 72,000,000
1982	2,500,000	20,000	90,000,000
1983	2,500,000	24,000	108,000,000
1984	2,500,000	28,000	126,000,000
TOTAL	$10,000,000	88,000	$396,000,000

Cost per Birth Averted = $112.00

Benefit per Birth Averted = $4,500.00

$$\frac{\text{Benefits}}{\text{Costs}} = \frac{\$396}{10} = 40$$

* Total to 1985 equals 50,000; see Table 3.

** At 15 percent per year.

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APPENDICES

Appendix A

CALCULATING BIRTHS AVERTED

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CALCULATING BIRTHS AVERTED

The estimates of past (and future) averted births are based on official Jamaican government data on population and births to 1980, on stated program targets, and on a new, official set of population projections for Jamaica (Frejka, 1981). The general fertility rate (GFR) (births per 1,000 females, 15-49) was used to allow for the changing age structure of the Jamaican population. Between 1970 and 1980, the GFR declined 28 percent; this was roughly comparable to the 25 percent decline in the crude birth rate, from 35.0 to 27.0. In the period 1970 to 1980, both measures of the change in fertility thus yielded the same results. Reduction in fertility itself, however, will make this less true in the 1980s. Females, 15-49, all of whom were born before fertility began to decline, will become a larger proportion of the total population. Thus, the crude birth rate, which relates annual births to total population, will not necessarily be parallel to, for example, the GFR, a measure more sensitive to age structure. Births per female might continue to fall, but because the number of females giving birth is increasing in relation to the total population, the ratio of births to total population might rise.

Specific steps were followed that make the logic clear.

1. Table A-1 contains the official data on annual births for the period 1971 to 1980, the official estimate of the mid-year population, and the estimated female population, aged 15 to 49. The general fertility rate that is implied is shown also. The program's impact during the period can be estimated as the difference between births which did occur and births which would have occurred had the GFR remained constant at its 1970 level. This calculation also is shown in Table A-1; the results are the series presented in Table 1 in the text.

2. The estimated number of future births to be averted is derived in much the same way (see Table A-2). The estimated total population is based on the new official projections of rapid fertility decline with immigration (Frejka, 1981). The target for the crude birth rate, which is set by the plan, is used to obtain a rough estimate of births which would occur in the target years 1985 and 1990. These births are then related to the estimated female population, aged 15 to 49 (the same official projections are used), to get the implied GFRs.

3. The projected number of births averted between 1980 and 1990 should be considered in two ways, as the number of incremental

births averted annually (this is the difference between the births which would occur if the 1980 GFR remained unchanged compared to the births projected with a declining GFR) and as the continuing difference in the births which would occur if the GFR were at its pre-program, 1970 level compared to the actual 1980 level. As explained in the text, if the program were not continued, some of this accomplishment (about half) would be lost and the GFR would rise. Thus, the author calculated the births which would occur between 1980 and 1990 to females, 15 to 49, at the 1970 GFR (170) compared to the births which would occur at the 1980 GFR (117); half the annual difference is an output of the program from 1981 to 1990 (see Table A-3). In the author's judgment, it is appropriate to calculate the total number of births averted to assess costs per birth averted.

The implication is that, were the program eliminated, the current birth rate would rise to half its pre-program (1971) level. Similarly, were the program not expanded, the birth rate would level off at its current (1980) level. Because the project is intended to maintain existing program effort (and achievement), and also to extend and increase program effort (and achievement), it is appropriate to count both kinds of achievements as outputs of the project. The total comes to 28,000 births averted per year by 1984, the end of the project period; the cumulative total would be some 88,000 births averted.

Table A-1

BIRTHS AVERTED, 1971-1980

Year	Mid-Year Population (In 000s)	Females, 15-49 (In 000s)	Birth Rate	General Fertility Rate (Births per 1,000 Females, 15-49)	Annual Births	Constant 1971 GFR Births	Annual Births Averted	Cumulative Births Averted
1971	1,901	390	34.9	170	66,300	66,300	--	--
1972	1,932	396	34.3	167	66,200	67,300	1,100	--
1973	1,972	404	31.4	153	61,900	68,700	5,400	6,500
1974	2,008	412	30.6	149	61,500	70,000	8,500	15,000
1975	2,043	422	30.1	145	61,400	71,700	10,300	25,300
1976	2,072	437	29.3	139	60,700	74,300	13,600	38,900
1977	2,097	453	28.8	133	60,400	77,000	16,600	55,500
1978	2,123	470	27.4	124	58,200	79,900	21,700	77,200
1979	2,149	484	27.1	120	58,300	82,300	24,000	101,200
1980	2,170	497	27.0	118	58,600	84,500	25,900	127,100

Sources: (1) Annual births from MOH data.
(2) Populations: 1970 Census, 1975 and 1980 estimates from new official projections. Other years are interpretations, assuming constant growth rate between benchmark years.
(3) Other columns computed using method described in text, Appendix A.

Table A-2

PROJECTED INCREMENTAL BIRTHS AVERTED, 1980-1990

Year	Mid-Year Population (In 000s)	Females, 15-49 (In 000s)	Birth Rate	General Fertility Rate (Births per 1,000 Females, 15-49)	Annual Births	Constant 1971 GFR Births	Annual Births Averted	Cumulative Births Averted
1980	2,170	497	27.0	118	58,600	58,600	--	--
1981	2,192	511	26.3	113	57,600	60,300	2,700	2,700
1982	2,213	524	25.6	108	56,700	61,800	5,100	7,800
1983	2,235	539	24.9	103	55,700	63,600	7,900	15,700
1984	2,257	553	24.3	99	54,800	65,200	10,400	26,100
1985	2,275	568	23.6	95	53,700	67,000	13,300	39,400
1986	2,290	582	22.9	90	52,400	68,700	16,300	55,700
1987	2,305	595	22.2	86	51,100	70,200	19,100	74,800
1988	2,320	608	21.5	82	49,900	71,700	21,800	96,600
1989	2,336	621	20.8	78	48,600	73,300	24,700	121,300
1990	2,355	639	20.0	74	47,100	75,400	28,300	149,600

Source: See text, Appendix A.

Table A-3

PROJECTED CONTINUING BIRTHS AVERTED,
1980-1990

Year	Births at 1980 Fertility Level (GFR = 118)	Births at 1970 Fertility Level (GFR = 170)	Annual Difference	Annual Births Averted (½ Difference)	Cumulative Births Averted
1980	58,600	85,000	26,400	--	--
1981	57,600	86,900	29,300	13,200	13,200
1982	56,700	89,000	32,300	14,600	27,800
1983	55,700	91,600	35,500	16,100	43,900
1984	54,800	94,000	39,200	18,000	61,900
1985	53,700	96,600	42,900	21,500	83,400
1986	52,400	98,900	46,500	23,200	106,600
1987	51,100	102,000	50,900	25,500	132,100
1988	49,900	103,400	53,500	26,700	158,800
1989	48,600	105,600	57,000	28,500	182,300
1990	47,100	108,600	61,500	30,700	213,000

Appendix B

ESTIMATING THE BENEFIT STREAM PER BIRTH AVERTED

Appendix B

ESTIMATING THE BENEFIT STREAM PER BIRTH AVERTED

It is assumed that each person 0-14 and 60-70 consumes half the current average consumption per capita and that the age group 15-59 consumes that per capita amount. This yields:

Age Group	Annual Current Consumption	Years	Total Consumption Needs
0-14	481	15	$ 7,215
15-59	963	45	38,835
60-70	481	10	4,810
			$50,860

Thus, the average future consumption need is seen as $50,000/70, or roughly $700 per capita. This figure is the benefit per birth averted in Year 1 (700 X .85 is the benefit in Year 2, etc.).