

THE EDUCATIONAL OPPORTUNITY BANK: AN ECONOMIC ANALYSIS OF A CONTINGENT
REPAYMENT LOAN PROGRAM FOR HIGHER EDUCATION

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THE EDUCATIONAL OPPORTUNITY BANK: AN ECONOMIC ANALYSIS OF A CONTINGENT REPAYMENT LOAN PROGRAM FOR HIGHER EDUCATION

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I. INTRODUCTION AND SUMMARY

1. *Recommendations of the Panel on Educational Innovation.* In a recent report,¹ the Panel on Educational Innovation recommended that the federal government establish an Educational Opportunity Bank. It was proposed that

¹ *Educational Opportunity Bank: A Report of the Panel on Educational Innovation to U.S. Commissioner of Education Harold Howe II, Director of the National Science Foundation, Leland J. Haworth, and Special Assistant to the President for Science and Technology, Donald F. Hornig, Washington, D.C.: U.S. Government Printing Office, August 1967.* The Chairman of the Panel is Jerrold R. Zacharias (Massachusetts Institute of Technology) and the other members are Frederick Burkhardt (American Council of Learned Societies), Andrew M. Gleason (Harvard University), Jacqueline Grennan (Webster College), John Hawkes (Brown University), George G. Stern (Syracuse University), John M. Mays (Office of Science and Technology).

the Bank be authorized to borrow money at government rates and to lend money to postsecondary students, regardless of the student's resources. The Panel recommended that the student be able to borrow an amount sufficient to cover tuition, fees, and subsistence costs (including room and board charges). In exchange for the loan, a borrower would pledge a given percentage of his annual gross income for a fixed number of years² after graduation. For example, the Panel's preliminary estimates suggested that the Bank could be self-sustaining if, for every three thousand dollars borrowed, it charged the borrower 1 per cent of annual gross income for thirty years.³

² In the literature on the economics of education, loans in which repayment is made to depend upon future income are referred to as Contingent (or Conditional) Repayment Loans. The feasibility and desirability of various contingent repayment loan schemes have been discussed by several authors including Milton Friedman, "The Role of Government in Education," in R. A. Solo (ed.), *Economics and the Public Interest*, New Brunswick: Rutgers University Press, 1955, pp. 135-43; Kingman Brewster, Jr., *Yale Alumni Magazine*, June 1961, pp. 13-14; Seymour E. Harris, *Higher Education: Resources and Finance*, New York: McGraw-Hill, 1962, esp. Ch. 22; William Vickrey, "A Proposal for Student Loans" in S. Mushkin (ed.), *Economics of Higher Education*, U.S. Department of Health, Education, and Welfare, 1962, pp. 268-80; Charles C. Killingsworth, *How to Pay for Higher Education*, Presidential Address at Economics Society of Michigan, March 17, 1967, revised version of paper presented to U.S. Senate Subcommittee on Employment and Manpower, September 20, 1963; Allan M. Cartter, *Proposal for a Federal Government Program to Help Meet the Costs of College Education*, unpublished manuscript, February 14, 1962; R. S. Eckaus, "A Conditional Loan Program for Higher Education," unpublished manuscript, April 1962; Arthur B. Beroz, "The High Cost of a College Education: The Problem and a Solution," unpublished and undated manuscript, Mattapan, Mass.

³ The Panel also proposed that the Bank allow a borrower to treat his debt as a conventional six per cent interest rate loan if that is to his advantage. This "opt-out" provision is discussed in subsection I.5 and Section IV below.

2. *Purposes of Our Study.* In our study we investigate the Ed Op Bank proposal in greater detail and provide an independent analysis of the feasibility and desirability of the program.

The Report of the Panel on Educational Innovation was intended to be of a preliminary nature. For example, in the Panel's report it was recognized that certain unsolved problems existed—especially with respect to the role of married women in the Ed Op Bank. In their Appendix on Financial Calculations, the simple derivations are submitted only to give rough estimates of self-sustaining repayment-tax rates and projected amounts of outstanding Ed Op loans. And other topics, like the fiscal impact of the Ed Op Bank upon the federal budget, were not discussed in the Panel's report.

3. *The Advantages of a Contingent Repayment Loan Program for Higher Education.* In our society, investment in education cannot be financed on the same terms or with the same ease as investment in machines or in houses, or indeed, purchases of automobiles. The reason for this is very simple. When one borrows to purchase a machine, the lender will get some security for his loan in the form of a residual claim upon the machine. If the borrower defaults on the loan, the lender can claim the machine. On the other hand, if a loan is made to finance the education of an individual who does not possess any tangible assets, the lender possesses no such security.⁴ However, the Ed Op Bank will be able to make such loans because it will be able to employ taxation powers similar to those of the Internal Revenue Service to ensure that the pledge be fulfilled.

⁴ It is not merely that such a loan is "risky," it is almost an invitation to default. The individual with few tangible assets and large debts will be quite tempted to declare himself bankrupt. (We need bankruptcy laws in order to ensure individual freedom. Without the possibility of bankruptcy, the danger of men entering involuntary servitude would be great.)

There is a further difficulty associated with the process of investment in education (or, human capital—as economists call it). That is the inherent riskiness of the return from the individual investment. Although the average anticipated return may be high, there is a large variation about this average. Thus, an individual who is reluctant to borrow in the form of a conventional fixed money repayment loan may be prepared to borrow in the form of a contingent repayment loan where, if his lifetime income is low, repayments are small. (This may be especially true in the case of the financially poor high school student unfamiliar with professional salaries and their expected rates of growth.) The Ed Op Bank mutualizes the risks of investment in education in the same way that fire insurance mutualizes the risks of investment in housing.

There are two advantages of the Ed Op Bank over a scheme relying heavily upon federal scholarships. (1) Many of the benefits of higher education accrue to the individual student. This makes it desirable that the individual student be involved in a “cost-benefit” evaluation of his education. Of course, there are benefits from higher education that are diffused throughout society and do not accrue to the specific student. It is for this reason that it is desirable that the average interest rate charged by the Ed Op Bank be lower than the market rate of interest. (2) Because of its immediate impact on the federal budget, any federal scholarship program is likely to be limited in scope. If it is restricted to tuition and fees, financially poor students who cannot afford to pay for room and board and other subsistence costs will continue to be excluded from college. If it is restricted to academically elite students, then students who are not destined to be at the top of the class but may benefit a great deal from postsecondary education would be excluded. Summing up: Because the Ed Op Bank improves an im-

perfect capital market while encouraging prospective students to balance costs and benefits in making decisions about education, the Bank is likely to promote a more economical use of the Nation’s resources than a program relying heavily upon federal scholarships.

Similarly, the Ed Op Bank is to be preferred to a system relying heavily on federal income tax credits or deductions for parents of postsecondary students. Tax credits and tax deductions may ease the burden on middle-class families, but will not be very helpful to the financially poor student.

There are certain advantages of the Ed Op Bank that derive from the fact that the program would be coordinated with the federal income tax. This coordination should allow for negligible costs of collection. But more important, it makes it feasible to collect repayments over long periods (thirty or forty years) and makes the contingent repayment feature feasible.

4. *The Definition of “Income” to Be Used by the Ed Op Bank.* It has been argued that the Ed Op repayment taxation should be applied to the increment in earned income (wages and salaries) attributable to postsecondary education.⁵ This argument follows from the notion of mutualization of risk. It is only this increment that is involved in the individual decision to invest in education.

There are several difficulties with this approach, not the least of which is to determine a practical definition of “incremental earned income.” Also, when a tax is applied to wages and salaries but not to property income, taxpayers can often avoid taxation by shifting their sources of income.⁶ And if the repayment tax is only applied to incremental income, the marginal tax rate would have to be high; this

⁵ See Vickrey, *op. cit.*

⁶ A leading example is that of the family-owned corporation that can choose for tax purposes to declare high dividends while paying family members low salaries.

might have serious consequences on the supply of work effort put forward by participants in the Ed Op Bank.

We think, therefore, that a more inclusive definition of "income" is appropriate for purposes of Ed Op Bank repayment taxes. In fact, for purposes of calculating the relationship between repayment-tax rates and rates of return in Section IV, we employ the Census Bureau's broad definition of income, including wages, salaries, interest, dividends and capital gains. Before the Bank could be established, a precise definition of the "income" to which Ed Op repayment taxes would apply would have to be decided upon.

5. *The "Opt-Out" Provision.* The Panel on Educational Innovation recommended that a borrower be allowed to "buy out" of the program treating his loan as a conventional six per cent loan, if that is to his advantage. For purposes of buying out (or "opting out"), a borrower's previous repayment taxes would be credited toward payment of interest (at six per cent) and reduction in the principal of the loan. This provision is meant to minimize adverse selection of participants in the scheme. In the absence of this "opt-out" provision, there would be a tendency for loans to be concentrated among students with income prospects that are below the average.

Since an Ed Op loan also provides life insurance, health insurance, and income insurance features, we think that such a loan at a six per cent (or even somewhat higher) rate of interest should be desirable even to those students who feel they have exceptionally good prospects. (We envisage that the Internal Revenue Service would treat Ed Op loans in the same way that it treats mortgages and other loans. For purposes of personal income taxation, payments to the Ed Op Bank which would be interpreted as interest on a six per cent loan would be deductible from income.⁷ The remaining pay-

ments, if any, would be interpreted as reduction in the principal and would not be deductible from income.) In our calculations in Section IV, we also consider the effects on the Bank of 6.5 and 8.0 per cent "opt-out" rates.

6. *Women and the Ed Op Bank.* Women on the average have lifetime incomes which are about one-third of that of the average man. This is mostly a reflection of their low labor participation rates due to child-rearing, etc. If women are subject to the same repayment-tax rates as men, then the men will be heavily subsidizing female education. Under this scheme, the woman planning to spend her life as a housewife would be able to obtain a college education at no cost to herself. On the other hand, if women had a separate Ed Op Bank, then women planning to have careers would have to subsidize those who are not planning to have careers. Adverse selection would probably make this scheme infeasible.

An alternative scheme was tentatively proposed by the Panel on Educational Innovation. It was proposed that all borrowers pledge a percentage of future *family* income. A woman would be given the option of paying on only her own income if she filed a separate personal income tax return, while having to pay on family income if she filed jointly.

In Section III, we examine this proposal in detail. We find that it has two important disadvantages. (1) Because it would often be profitable for families to file separate returns, the Ed Op Bank would be running large "losses" on married women not participating in the labor force. (2) Since this proposal would encourage an increase in the filing of separate returns by married couples, personal income tax payments to the Internal Revenue Service would be increased. If the Bank attempted to recoup these funds

the opt-out interest rate is R , then payments which could be interpreted as interest on a loan with rate of interest R should be deductible from personal income.

⁷ If the opt-out interest rate is six per cent. If

from the IRS, its independence might be jeopardized.

We propose instead a scheme in which married women fully participating in the labor force pay only on their own incomes. Married women not participating in the labor force must pay on family income. As a proxy for "full participation in the labor force" we propose that a minimum earned income test be employed. For a married woman earning more than some minimum \bar{W} , repayment would be based upon her income. For a married woman earning less than \bar{W} , repayment would be based partly on her income and partly on her husband's income. Our proposal is discussed in detail in Section III.

7. *The Repayment-Tax Rate and the Rate of Return.* In Section IV, we estimate the implicit rates of return for various repayment-tax rates. The rate of return can be thought of as that interest rate at which each cohort of borrowers pays back its borrowings plus interest charges. To the economist, this rate of return should serve as a crude estimate of the marginal *private* "profitability" of investment in higher education to be expected after the adoption of the Ed Op Bank.⁸

Our calculations in Section IV apply only to undergraduate students who begin their freshman year at age eighteen. Adjustment in the calculations must be made to handle different cases. We begin with undergraduates entering in the academic year 1969-70. We ask the question: If members of this cohort are offered one thousand dollar loans in exchange for a pledge to pay τ per cent of their annual

income over the T years following graduation, what is the implied rate of return r on loans to this cohort?

If, for example, the cut-off salary \bar{W} for married women is set at mean college-educated female income and the "opt-out" rate is set at 6.5 per cent, then a tax rate $\tau = .33$ per cent paid over $T = 30$ years will imply a rate of return $r = 3.3$ per cent. Under the same assumptions: $\tau = .50$ per cent and $T = 30$ years implies that $r = 4.5$ per cent; $\tau = .33$ per cent and $T = 40$ years implies that $r = 4.3$ per cent; $\tau = .50$ per cent and $T = 40$ years implies that $r = 5.1$ per cent.

To repeat: Assume that the Ed Op Bank can borrow at 4.3 per cent. If it offers to lend \$1,000 to members of the cohort entering college in 1969 in exchange for a pledge to pay .33 per cent of income over the forty years following graduation, then the Bank will "break even" on this cohort.

In Section IV, we present a detailed discussion of the derivation of the rate of return. Rates of return are calculated under a variety of stipulations of \bar{W} , T , τ , the "opt-out" rate, and so forth.

It should be mentioned that to achieve a given rate of return r , our calculations suggest a higher tax rate than is suggested in the Report of the Panel on Educational Innovation. The major reason for this difference is that the Panel based its calculations upon average incomes whereas our calculations are based upon more disaggregated data. Since aggregation reduces the importance of the "opt-out" feature, it is not surprising that the Panel's estimates of tax rates were biased downward.

But since we expect salary levels to be growing every year, students entering college in years later than 1969-70 should be able to borrow at more favorable terms while preserving the same rates of return. This is shown in Tables I.1 and I.2. Similar tables for $T = 30$ years appear in Section IV.

We chose to charge the same repay-

⁸ Because of important external effects the private rate of return to investment in higher education can only serve as a rough guide to the social rate of return. There is a further complication in that our tax laws do not allow for writing off depreciation of human capital as they do for writing off depreciation of physical capital. Both these biases imply that the social rate of return to higher education is greater than the private.

TABLE I.1
 $T = 40$ years
 $r = 4.0$ per cent

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed *
1969	.29%
1970	.28%
1971	.27%
1972	.27%
1973	.26%
1974	.25%
1975	.25%
1976	.23%
1977	.23%
1978	.22%
1979	.21%
1980	.21%
1981	.20%

* Opt-out rate is 6.5 per cent.
 Source: Table IV.9.

TABLE I.2
 $T = 40$ years
 $r = 4.5$ per cent

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed *
1969	.36%
1970	.35%
1971	.34%
1972	.33%
1973	.33%
1974	.32%
1975	.30%
1976	.29%
1977	.29%
1978	.28%
1979	.28%
1980	.27%
1981	.26%

* Opt-out rate is 6.5 per cent.
 Source: Table IV.7.

ment-tax rate to all borrowers who entered college in the same academic year.⁹ This is not the only way we could have subdivided the population for tax purposes. For example, we could have employed one prevailing tax rate for all "college-age" students enrolled as full-time students in any given year. It is

⁹ Under the assumption, however, that freshmen are 18 years old, sophomores 19, juniors 20, and seniors 21.

clear that the quantitative results about tax rates and rates of return should not be substantially altered by this reformulation.

On the other hand, one might argue that seniors and freshmen, for example, should not be lumped together. Seniors, after all, are closer to graduation and thus to repayment than are freshmen. Also, the probability of a senior receiving his degree (and thus higher lifetime earnings!) is higher than that of a freshman. Under such a reformulation, the tax-rate and rate-of-return calculations might be substantially altered.

8. *Projections of Outstanding Loans.* The amount of borrowing from the Bank is difficult to project because it will depend crucially upon our uncertain projections of items such as tuition charges at public and private institutions of higher learning. Also the amount of loans will depend upon what estimate of average subsistence cost the Bank adopts in its maximum loan formula. We project¹⁰ that the amount of outstanding loans will be approximately \$1.6 billion in 1969 and will rise to approximately \$132.0 billion by 1984.

9. *Fiscal Impact.* Even though the Ed Op Bank may require no appropriations from Congress, it will have an impact upon the Nation's fiscal and monetary policy decisions which is similar to an increase in government spending. This is because the Bank will stimulate the Nation's effective demand for goods and services. The government will have to raise taxes¹¹ (or forego a tax cut) to prevent a rise in prices that comes when people try to buy more than the economy can produce. The fiscal impact (the size of this tax increase) of the Ed Op Bank, we estimate to be \$2.1 billion in 1969 and increasing to a peak of \$15.2 billion in the year 1977 and falling to \$9.5 billion

¹⁰ Assuming that the program begins in 1969.

¹¹ Assuming that monetary policy is such that interest rates are unchanged.

in 1984. Fiscal impact is discussed in Section V; our estimates of fiscal impact are presented in Section VI.

10. *Educational Opportunity Grants.* One can conceive of several possible programs that might be complementary to the Ed Op Bank. One important current proposal is that of Ed Op grants designed to help support college students from low-income families. In Section VII we have studied several particular versions of this program. Depending upon the particular terms of the proposal, an Ed Op grant program would cost the Treasury about one to five billion dollars per year. The proposed grant program has two serious drawbacks. (1) Through high effective marginal rates of income taxation, Ed Op grants would create large disincentives to work effort for families of grant recipients. (2) There seems to be a serious difficulty in defining "family income" for grant purposes in cases where students have set up or could set up households legally separate from their parents. These problems are fully discussed in Section VII.

II. THE ALLOCATIONAL AND DISTRIBUTIONAL EFFECTS OF THE ED OP BANK

What will be the effects of the Ed Op Bank on the distribution of our expenditures among different sectors and on the distribution of income among people?

Present capital markets appear to do a rather bad job of making financing available to college students on a uniform and universal basis. It is notoriously easier for the child of a wealthy family to borrow, although he does not need to, than for the child of a poor family. The basis of this discrimination appears to be the promise of future income without present capital assets as collateral. You can mortgage your house, but not your future income. This deficiency in capital markets probably stems from the existence of personal bankruptcy, which offers an easy way out of unsecured personal liabilities

for debtors, and from the illegality of selling shares of one's future income to raise money.

Private lenders would finance education without the requirement of collateral only if they could be sure of collecting some part of the borrower's income regardless of the borrower's ability to pay other debts. Such a contract would be a 'share' in the borrower's income similar to common stock shares in corporate income. In fact, our laws will not enforce this kind of contract, because it represents the sale by one man of part of his labor to another. This difficulty does not arise when the borrower puts up some tangible asset as collateral, since we object only to the sale of people, not to the sale of things.

In addition, poorer citizens are not as well informed about the programs that exist for guaranteeing loans, and there is little incentive for banks to advertise to bring such people into their offices who are unfamiliar with or frightened by large financial institutions. These imperfections in capital markets prevent the Nation from exploiting fully its opportunities to provide for our needs. As things stand, we are investing educational resources in some people who have physical assets, and not investing in others who cannot find financing. If we just shifted resources from those who are obtaining education now, but for whom it is accomplishing the least, to those who are not now obtaining it at all, but who would become much more productive if they could, we would in the future have increased our productive capacity. Something would be lost by denying education to the first group, but it would be more than made up for by our gains on the second group.

One of the chief aims of the Ed Op Bank is, by being ready to finance everyone on the same terms, to eliminate this irrational discrimination which is reducing our productive capacity. Its loans would be freely available on a uniform basis, and its status as a Federally-spon-

sored institution would give it the wide publicity and easy accessibility required. Its operation, insofar as it improves the performance of capital markets, will therefore produce a net increase in the Nation's welfare.

The Bank also has two other features. First, it seems likely that a Federal subsidy element will be built into its loan terms, so that financing for higher education will be available at lower rates of interest than for other investments. This feature will tend to shift resources toward higher education (as will the increased availability of loans mentioned above).

What sectors will have to shrink to make room for this increase in expenditures on higher education? This depends on whether the government allows interest rates to rise as a result of the Bank's operations. If interest rates are held constant, the increase in higher education will be at the expense of a broad range of consumption goods since it will be paid for out of ordinary income taxes and repayments to the Bank. To the extent that interest rates are permitted to rise, investment in housing, and plant and equipment will also decrease, and these sectors will bear part of the burden.

Can an expansion of higher education at the expense of other investment and consumption goods be justified? First, education is already put at a disadvantage with respect to ordinary tangible investment, since the whole realized extra income attributable to education is taxed, while the owners of tangible investments are taxed only on that part of the income from the machine or building that exceeds depreciation. Educational investment also depreciates, since it becomes obsolete and finally disappears at death, just as machines wear out and break down. A person choosing between investing a dollar in education and a dollar in a machine will be biased toward the machine because of tax treatment. The low

interest rates on Ed Op loans would tend to offset this advantage.¹²

Although this *a priori* argument tends to justify a low rate of interest for educational borrowing, there is some empirical evidence to the contrary. It is generally accepted that the rate of return to real capital in the United States is more than 18 per cent.¹³ The most careful study of investment in higher education indicates an after-tax rate of return of about 12 per cent.¹⁴ Allowing for a 25 per cent personal tax, this implies a before-tax rate of return to education of 16 per cent. This figure does not indicate any strong bias against education; in fact, it tends to show a slight over-investment in education. This rate of return, however, does not include the non-market-valued part of income mentioned in the footnote above, and this income, which is espe-

¹² It would be very difficult to demonstrate conclusively that the tax laws discriminate against educational investment. There are other distorting factors. Some of the income from education is presumably non-market-valued services which the individual performs for himself. A college-educated person may be better able to manage his money, fill out tax forms, inform himself about job and investment opportunities, teach his children, and so on. Since this service income is not taxed at all, it tends to offset the disadvantage to education from not being depreciated. Another complicating factor is wide difference in tax rates. Income from tangible investments is typically taxed first at the corporate profits rate, and again at personal rates. This, in turn, is offset by the fact that much of the return on corporate investment is in the form of realized capital gains based on retained earnings which are taxed at lower than personal rates. Finally, the tax treatment of consumer durables such as cars and owner-occupied houses falls into another category, since in those cases there is no tax on the service income and no depreciation allowance. This may result in over-investment in these durables with respect to both education and plant and equipment.

¹³ See, e.g., Robert M. Solow, *Capital Theory and the Rate of Return*, Chicago: Rand McNally & Company, 1964.

¹⁴ See Gary S. Becker, *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, New York: National Bureau of Economic Research, 1964.

cially important for women, might raise the rate of return above the rate of return to real capital. The Ed Op Bank is in many ways similar to the numerous special institutions we have created to lower the cost of mortgage borrowing. Our special treatment of Savings and Loan Associations and mortgage guarantee programs has increased investment in housing and lowered the rate of return to housing investment. The Ed Op Bank will have the same effect on investment in education.

A subsidy of this kind can be justified on the ground that there are benefits which accrue to the society as a whole from college education, but which are not measured by increased income to the educated person. Similarly, there may be non-economic or non-market-valued advantages to the society from widespread home ownership. If college graduates are better informed citizens, or add to our future knowledge, for instance, it makes sense to encourage more investment in education than is strictly warranted by the private return.

The subsidy element also shifts income from taxpayers to those who borrow from the Bank. It is likely that this will be a regressive element in the tax and transfer structure of the Nation, since we may expect taxpayers on average to have lower lifetime incomes than the average Bank-financed college graduate.

The second important feature of the plan is the partial insurance it provides against low future income. This has the effect of making the prospective returns from education less variable and increases the incentive to attend college for people who are reluctant to do so because they feel the future gains are very uncertain. Since the risk to the society as a whole inherent in spending on education is much lower than the risk to any given individual, this insurance feature is probably desirable. Each individual sees a possibility of failure, but the soci-

ety can pool these individual risks and be actuarially certain of the average return.

But the insurance feature also encourages people with low earning prospects to go to college, while they are now discouraged from this by the high costs. To a person with certain but poor prospects the Ed Op loan is very much like a partial education grant. In this respect, then, the insurance feature may cause some waste of resources.

The Ed Op Bank, then, has three significant aspects: it improves the uniformity and distribution of borrowing opportunities; it subsidizes higher education through a low interest rate; and it introduces a novel kind of insurance against failure. All three factors will probably tend to increase the demand for college education and the funds flowing into it. Both the uniformity of borrowing opportunity and the partial elimination of risk from individual calculations will tend to improve our allocation of resources and allow us to come closer to our maximum productive capacity as time goes on.

III. WOMEN AND THE ED OP BANK

Women pose a problem for the Ed Op Bank for three reasons: (1) women tend to go into lower paying professions than men; (2) for comparable work women tend to receive less pay than men; (3) women tend to drop out of the labor force permanently or for extended periods of time. Consequently, the average lifetime incomes of college women are approximately one-third of those of men.

In terms of repayment to the Ed Op Bank, the first two problems can probably be ignored. The lower paying professions of teaching, social work, etc., are thought to be socially desirable. Therefore, people who enter them (male or female) should not be penalized by paying higher repayment-tax rates. Similarly, the lower payment to women for equal services reflects imperfections in the labor market that would only be com-

pounded if women were forced by this disparity to pay higher repayment rates.

This leaves the third problem, namely, the married women who drop out of the labor force either permanently or for an extended period of time. If they repaid on the basis of their own income, their college education would be considerably underpriced. Consequently, some means must be found to make the private costs of their college education a better reflection of the true social costs.

The Report of the Panel on Education suggests that all borrowers be required to pledge a percentage of their future family income, with the woman receiving the option of paying her Ed Op tax on her own income if she files a separate tax return, while having to pay her Ed Op tax on family income if she files a joint tax return. The Report justifies this approach by saying, "Most families would find they would save more by filing a joint return and helping pay the wife's obligations than by filing separately." (p. 13)

In evaluating any proposed means of coping with the problems raised by women in the Ed Op Bank, it is important to keep certain criteria of equity and efficiency in mind. As long as a married woman is fully participating in the labor force, considerations of both equity and efficiency dictate that she be treated identically to a man or a single woman earning an identical income and incurring an identical educational obligation. Considerations of efficiency dictate that some means be found to ensure that non-working married women repay the costs of their college education to the Ed Op Bank. Otherwise the Bank will subsidize women who pursue higher education and divert resources from male to female post-secondary education. However, careful analysis of the Report proposal indicates that it fails to meet either of these criteria concerning equity or efficiency and creates considerable other complications.

Table III.1 shows the income and Ed Op tax liabilities of couples with varying incomes and earning shares. The problem of equity associated with the Report proposal can be seen most clearly in the case of a high income couple, in which the husband and wife are both fully employed. Consider, for example, the couple earning \$17,500, in which the husband earns three-fourths of this amount (\$13,125) and the wife earns one-fourth (\$4,375). Both spouses are assumed to incur an Ed Op tax of 4 per cent. Under the Report proposal, the couple has two choices: 1) it could file a joint tax return with each spouse paying an Ed Op tax of 4 per cent on total family income and pay an Ed Op tax of \$1,400 and an income tax of \$2,316; or 2) each spouse could file individually and pay its own Ed Op tax on its own income, reducing its Ed Op tax to \$700 but increasing its income tax to \$2,468. In this case, the savings on the Ed Op tax are greater than the increased payments on the income tax, and the couple will choose to file individually. Note, however, that because of the increased income tax payments, the couple's *effective* Ed Op tax payments are raised by the amount of these additional income tax liabilities. Hence their *effective* Ed Op tax payments are greater than the Ed Op tax payments made by two unmarried individuals, receiving identical incomes and incurring identical educational obligations to each spouse.

However, it is possible to argue that this discrimination against married couples merely offsets the existing discrimination in favor of married couples under the income tax. The income-splitting provisions in the existing income tax laws ensure that, unless each spouse earns an identical amount, a married couple will have to pay a smaller income tax than two single individuals receiving incomes equal to those of each spouse. Consequently, by increasing the effective Ed Op tax payments of couples relative to

TABLE III.1
TAX LIABILITY UNDER JOINT AND SINGLE FILING, 4 PER CENT ED OP TAX PER SPOUSE

Family's Adjusted Gross Income * \$	Total Tax Liability (\$)			Income Tax Liability (\$)			Ed Op Tax Liability (\$)		
	Joint Filing	Single Filing When Husband's Share of Income Is	67%	Joint Filing	Single Filing When Husband's Share of Income Is	67%	Joint Filing	Single Filing When Husband's Share of Income Is	67%
500	40	100%	20	—	100%	—	40	100%	67%
1,500	148	88	88	28	28	—	120	20	20
2,500	286	187	186	86	87	28	200	60	60
3,500	436	302	298	156	162	86	280	100	100
4,500	607	442	431	247	262	157	360	140	140
5,500	796	609	583	356	389	249	440	180	180
6,500	996	789	752	476	529	359	520	220	220
7,500	1,209	978	934	609	678	482	600	260	260
8,500	1,446	1,199	1,125	766	859	624	680	300	300
9,500	1,687	1,426	1,327	927	1,046	774	760	340	340
12,500	2,345	2,084	1,903	1,345	1,584	930	1,000	380	380
17,500	3,716	3,611	3,168	2,316	2,911	1,381	1,400	500	500
35,000	7,755	8,332	6,884	4,955	6,932	2,379	2,800	700	700
75,000	25,019	27,952	23,130	19,019	24,952	5,203	6,000	1,400	1,400
300,000	89,328	89,965	79,630	65,328	77,965	19,484	24,000	3,000	3,000
						66,290	12,000	12,000	12,000

* Since tax liabilities are calculated on the basis of taxable income, it is necessary to determine the relationship between taxable income and total income in order to determine the relationship between total income and tax liabilities. In *Statistics of Income: Personal Income Tax, 1965* (Table 23, p. 60), the IRS has estimated the relationship between taxable income and adjusted gross income (AGI), which roughly consists of the sum of all wages, salaries, interest, dividends, and capital gains. Thus AGI is roughly equivalent to the Census Bureau's definition of income, although there are differences (e.g., Census income includes social security and unemployment benefit payments, while AGI does not). The income tax burdens were estimated by assuming that if a couple filed separately, family taxable income would remain constant and be allocated in the same proportion as total income. This procedure probably over-estimates the income tax burden associated with separate filing, since the high income spouse would probably take relatively more deductions.

those of single people, the Ed Op tax reduces discrimination against single people in the total tax structure. Those couples who choose to file jointly will find that their total tax burden is less than that of two single individuals with identical incomes and Ed Op tax obligations, while those couples who choose to file individually will find that their total tax burden is identical to that of two single individuals with identical incomes and Ed Op tax obligations. Thus under this proposal, the Ed Op tax reduces one of the main elements of discrimination in the personal tax structure.

This provision of the Report proposal may appear attractive at first glance, since one of the drawbacks of any plan that forces a husband to incur his wife's Ed Op tax obligations is the "negative dowry" associated with marriage. However, under the present tax laws, a woman brings a "positive dowry" with her in regard to income tax obligations. Under the Report proposal, two people can never pay more total taxes when married than when single. Thus, although the Ed Op tax reduces the "positive dowry" generated by the income tax, it cannot create a negative dowry in the sense that upon marriage the couple's total tax obligation is greater than it would be if the couple remained single.

Nevertheless, there is no obvious reason why inequities in the income tax structure should be corrected by compensating inequities in the Ed Op tax structure. The Ed Op tax is incurred voluntarily and is a repayment for a loan. It has no logical connection with the income tax structure. Thus, in evaluating the Report proposal, equity with regard to the Ed Op tax structure is a better principle to follow than equity with regard to the total tax structure. If the treatment of single people is thought to be inequitable under the income tax, let that be corrected within the context of the income tax. There seems to be little merit in correcting the discrimination

against single people in the income tax structure by discriminating against married couples in the Ed Op tax structure. Since each tax serves a different purpose, equity should be defined within the context of each tax. And within the context of the Ed Op tax, it is clear that the Report proposal discriminates against working wives.

In addition to problems of equity, the Report proposal also raises serious problems of efficiency, since it fails to ensure that nonworking wives will repay their full obligation to the Ed Op Bank. Table III.1 shows that couples will choose to file individually in virtually all cases. The effective reductions in rates implied by their tax savings, which are given in Table III.2, are usually at least three percentage points. These reductions are particularly serious for women who are not participating in the labor force, since their private costs are reduced to a fraction of their social costs. Consequently, if the Report proposal is adopted, many women would find that their college education was underpriced, leading to excessive investment in women's education.

In addition to the questions of equity and efficiency raised above, the Report proposal creates considerable difficulties for the decision making of the couple and the financing of the Ed Op Bank.

Insofar as couples try to minimize their total discounted tax burden over time, a couple's filing decision becomes extremely complicated. Because of the opting-out possibility, there is no guarantee that the filing procedure that minimizes the couple's tax burden in any one year will be the filing procedure that minimizes their total discounted tax burden. This can occur because the couple's increased income tax payments are not credited to the Ed Op Bank. Consequently, even though filing separately may reduce the total annual tax burden, by reducing the payments credited to the Ed Op Bank, it may extend the re-

TABLE III.2

TREASURY GAIN, BANK LOSS, AND REDUCTION IN ED OP TAX RATES FOR COUPLES
WHO FILE INDIVIDUALLY, 4 PER CENT ED OP TAX PER SPOUSE
When Husband's Share of Family Income Is

Family's Adjusted Gross Income \$	100%			75%			67%		
	Treasury Gain + \$	Bank Loss - \$	Reduction in Ed Op Tax Rate (per- centage points)	Treasury Gain + \$	Bank Loss - \$	Reduction in Ed Op Tax Rate (per- centage points)	Treasury Gain + \$	Bank Loss - \$	Reduction in Ed Op Tax Rate (per- centage points)
500	0	20	4.0	0	20	4.0	0	20	4.0
1,500	0	60	4.0	0	60	4.0	0	60	4.0
2,500	1	100	4.0	0	100	4.0	0	100	4.0
3,500	6	140	3.8	2	140	3.9	1	140	3.9
4,500	15	180	3.7	4	180	3.9	1	180	3.9
5,500	33	220	3.4	7	220	3.9	2	220	3.9
6,500	53	260	3.2	17	260	3.8	6	260	3.9
7,500	69	300	3.1	24	300	3.7	15	300	3.8
8,500	93	340	2.9	19	340	3.7	8	340	3.9
9,500	119	380	2.7	19	380	3.8	3	380	3.9
12,500	239	500	2.1	58	500	3.5	36	500	3.7
17,500	595	700	0.6	152	700	3.1	63	700	3.7
35,000	NS	NS	NS	530	1,400	2.5	248	1,400	3.3
75,000	NS	NS	NS	1,111	3,000	2.5	465	3,000	3.4
300,000	NS	NS	NS	2,302	12,000	3.2	962	12,000	3.7

NS: No switch to single filing.

payment period and consequently increase the couple's lifetime total tax payments. Therefore, short of estimating future income streams and present values, there is no way for a couple to determine its optimal filing strategy. At best, the couple's filing decision becomes extremely difficult and the complexity of filing increases enormously; at worst, many couples find that they end up paying higher taxes than necessary. Since the upper income groups are usually more sophisticated in respect to minimizing their tax burden, this characteristic of the Report's proposal introduces a regressive effect.

Moreover, because couples who file individually reduce their Ed Op tax payments and increase their income tax payments, the Report proposal would create considerable instability in Treasury and Bank revenues. Since it would be difficult to predict which way couples would file, this aspect of the Report proposal would make it difficult to predict revenues of

either the Treasury or the Bank. This would obviously create many difficulties in financing government programs. Moreover, since the Bank loses money on every couple who chooses to file individually, the filing option could create serious problems in financing the Bank. As Tables III.1 and III.2 show, a switch to individual filing would be a common occurrence. Consequently unless some means could be found to transfer the Treasury gains back to the Ed Op Bank, the financial viability of the Bank could be threatened, unless repayment rates were raised.

This problem could be solved by estimating the Ed Op Bank losses and the Treasury gains and then having the Treasury make a payment to the Ed Op Bank equal to the Treasury gain. Although some difficulties would be connected with estimating these magnitudes, such a payment would in principle be possible to estimate and to make. However, it should be clear that such a repay-

ment procedure would undermine the independence of the Ed Op Bank from the Treasury, since the estimated magnitudes could be subject to political pressures when the government was running a deficit.

Instead of having the Treasury estimate its gains and make an annual lump sum payment, each couple who chose to file individually could estimate the additional income tax liabilities incurred by filing individually and pay these liabilities to the Ed Op Bank directly. This would ensure that the Ed Op Bank received all of the Treasury gains directly and thus would avoid the problems associated with estimating an annual payment. Moreover, this approach would also simplify the couple's filing decision, since any income tax payments over and above their joint tax liability would be credited to the Ed Op Bank. This would ensure that the filing procedure that minimized the couple's annual tax burden would also be the filing procedure that minimized their total discounted tax burden.

However, if this procedure is followed, the incremental income tax payments must be allocated very carefully between the accounts of each spouse in the Ed Op Bank. Although a couple's combined effective Ed Op tax payments will always be less if they file individually than if they file jointly, the Ed Op tax payments of any one spouse could be greater under single filing than under joint filing if the incremental income taxes were allocated to the account of each spouse in an arbitrary fashion. This would obviously complicate the opting-out decisions of the couple. To ensure the proper distribution of the additional income tax payments to the Ed Op Bank, the income tax payments should be credited to the low income spouse until his Ed Op tax plus the additional income tax payments under single filing equal his Ed Op tax payments under joint

filing; any additional income tax payments should then be credited to the account of the other spouse. This rule ensures that the opting-out decision of the couple is unaffected by the filing decision and is given formally in Appendix B.

In conclusion, then, the Report proposal suffers from the following drawbacks. 1) Married couples in which the wife works are discriminated against and must incur a higher Ed Op tax burden than two single people with comparable incomes and Ed Op tax obligations. 2) Most couples in which the wife does not work will choose to file individually to reduce their total tax burden. Whether their incremental income tax payments are credited to the Ed Op Bank or not, the Bank will lose money on these couples and find that the woman's effective tax rate is usually reduced by at least two-thirds. Hence the nonworking college-educated woman will be subsidized by the rest of the college-educated population. 3) The filing decision is extremely complicated in view of the opt-out provision. While the filing decision could be simplified by having any incremental income taxes paid directly to the Ed Op Bank, the allocation of these funds between the account of each spouse becomes quite complicated. 4) Finally, tying the Ed Op tax payments to the income tax filing decision reduces the independence of the Ed Op Bank from the Treasury.

In view of these difficulties, we propose that the repayment of couples be determined by the following formula:

$$P^h = r^h Y^h$$

$$P^w = r^w Y^w, \text{ if } W^w \geq \bar{W}$$

$$P^w = r^w Y^w + r^w \left(\frac{\bar{W} - W^w}{\bar{W}} \right) Y^h, \text{ if } W^w < \bar{W},$$

where

P^h : repayment of husband

P^w : repayment of wife

r^h : total repayment rate charged to husband

- r^w : total repayment rate charged to wife
 Y^h : total income of husband
 Y^w : total income of wife
 W^w : wage and salary income of the wife
 \bar{W} : some average of women's wage and salary income.

Under this plan, the husband would pay his Ed Op tax on his own income. If the wife earned more than \bar{W} , she would pay her Ed Op tax on her own income; and if she earned less than \bar{W} , she would pay her Ed Op tax on her own income, while her husband would pay a proportion of her Ed Op tax on his income. For example, if the wife's earnings were one-half of \bar{W} and if she had incurred an Ed Op tax liability of 4 per cent, her husband would have to pay an additional Ed Op tax of 2 per cent on his income.

While this proposal doubtless contains inefficiencies and inequities, they appear to be less than those that would exist under the Report proposal. With regard to questions of equity, this repayment formula attempts to ensure that married women who are fully participating in the labor force are treated identically to men or single women. *Thus, \bar{W} is a proxy for full participation in the labor force.* In this connection, the use of the wife's wage and salary income (W^w) instead of the wife's total income (Y^w) seems desirable since it eliminates the possibility that the couple could reduce their tax burden by having the husband transfer property income to his wife. Only if the wife earns money, is she able to reduce her husband's obligation to pay her educational debt. Thus, this proposal should encourage women to use their education productively.

Obviously, this scheme is sensitive to the choice of \bar{W} . If \bar{W} is set "too low" many women would find that by working part time they could earn an income greater than \bar{W} and be treated identically

to men while not repaying their Ed Op Loan. However, if \bar{W} were set "too high," many fully employed married women would find that they were discriminated against and pay a higher Ed Op tax than a man with an identical income and Ed Op tax liability. If \bar{W} were defined to equal the average of all women's wage and salary income, it would reflect the part-time nature of many women's employment and the lower wages and salaries usually paid to women. As long as a woman works full time, her wage and salary income should be greater than this average and she would not be discriminated against. Similarly, women who are marginally employed should earn less than \bar{W} and consequently repay their loan through their husband's payments on his own income. Thus setting \bar{W} equal to the average of women's wage and salary income would seem to meet considerations of equity and efficiency reasonably well. As an alternative, it might be desirable to set \bar{W} in such a way that the Bank would just break even on its loan to women. This would certainly ensure that women did not underpay and would probably lead to relatively few inequities with respect to fully employed wives.

Table III.3 shows the relationship between the repayment rates under the two proposals. We take this proposal as a norm and estimate the differences in the repayment rates between the Report proposal and this proposal, assuming a repayment-tax rate of 4 per cent and $\bar{W} = \$4,075$, slightly more than the average income of women "with income" in 1965. The payment of couples in which the wife earns nothing would be identical under the Report proposal and this proposal if the couples filed jointly. Since, however, all couples except those in the highest income brackets would choose to file separately, couples in which the wife earns nothing would pay considerably less under the Report proposal than under this proposal. If the Report pro-

posals were accepted, the education of nonworking wives would be subsidized. In general, couples in which the wife earns less than \bar{W} will pay less under the Report proposal than under this proposal, while couples in which the wife earns more than \bar{W} will pay more. Consequently on the grounds of both efficiency and equity, this proposal seems preferable.

TABLE III.3
DIFFERENCES BETWEEN EFFECTIVE ED OP TAX
RATES UNDER REPORT PROPOSAL
AND STUDY PROPOSAL *

Family's Adjusted Gross Income \$	Husband's Share of Family Income		
	100%	75%	67%
500	-4.0	-3.0	-2.6
1,500	-4.0	-2.7	-2.3
2,500	-4.0	-2.5	-2.1
3,500	-3.8	-2.2	-1.8
4,500	-3.7	-2.1	-1.5
5,500	-3.4	-1.7	-1.4
6,500	-3.2	-1.6	-1.1
7,500	-3.1	-1.3	-0.8
8,500	-2.9	-1.1	-0.7
9,500	-2.7	-1.1	-0.4
12,500	-2.1	-0.1	+0.3
17,500	-0.6	+0.2	+0.3
35,000	0.0	+1.5	+0.7
75,000	0.0	+1.5	+0.6
300,000	0.0	+1.8	+1.3

* Assuming Ed Op tax rate of 4 per cent per spouse and $\bar{W} = \$4,075$.

Obviously this proposal is not free of problems. If it is adopted, there will doubtless be cases of discrimination against working wives and cases of underpayment. However, both of these occurrences should be less under this proposal than under the Report proposal. In addition, this proposal encourages women to use their college education productively by reducing their family Ed Op tax obligations in proportion to their earned income; it keeps the income tax and Ed Op tax payments entirely separate and maintains the independence of the Ed Op Bank from the Treasury;

it is easy to calculate; and it does not cause any distortions in the opting-out decision. Consequently, we recommend that this proposal be adopted as a means of coping with the problems associated with women in the Ed Op Bank.

APPENDIX A

DETERMINATION OF ANNUAL TAX LIABILITIES UNDER JOINT AND INDIVIDUAL FILING UNDER THE REPORT PROPOSAL

(I) *Ed Op Tax*

If a couple files individually, their Ed Op tax is given by

$$r^h Y^h + r^w Y^w$$

where

r^h : total Ed Op tax rate on husband

r^w : total Ed Op tax rate on wife

Y^h : adjusted gross income of husband

Y^w : adjusted gross income of wife

If they file jointly, their Ed Op tax will be given by

$$(r^h + r^w)(Y^h + Y^w)$$

Clearly, the Ed Op tax will always be greater if the couple files jointly. The difference in the Ed Op tax liabilities if the couple files individually or jointly is given by

$$r^h Y^w + r^w Y^h$$

(II) *Income Tax*

If a couple files their tax individually, their family tax burden is given by

$$(1) \quad T^* = \sum_{i=1}^p y_i^h t_i^h + \sum_{i=1}^m y_i^w t_i^w$$

where

y_i : the taxable income in class i

t_i : the marginal rate on class i

p : the last class into which husband's taxable income falls

m : the last class into which wife's taxable income falls.

If the couple files jointly, they can divide their family income, calculate their tax on half the family income and then double this tax liability to obtain their family tax liability. This procedure has the effect of doubling the income classes for married couples. Thus when filing jointly, the couple's income tax liability can be given by

$$(2) \quad T' = \sum_{i=1}^{k-1} 2y_i t_i + t_k y'_k$$

where k is the last class into which one-half of family taxable income falls, and y'_k is the income in that class. Since

$$y'_k = \sum_{i=1}^{k-1} y_i + \sum_{i=k}^n y_i$$

(where n is the last class into which total family income falls) the joint tax liability can also be given by

$$(2a) \quad T' = \sum_{i=1}^{k-1} y_i (2t_i - t_k) + t_k \sum_{i=k}^n y_i$$

The difference D between the couple's tax liability when filing separately and jointly can be given by

$$(3) \quad D = T^s - T' = \sum_{i=1}^{m-1} y_i t_i + \sum_{i=m}^{p-1} y_i t_i + y_m^w t_m + y_p^h t_p - \sum_{i=1}^{k-1} y_i (2t_i - t_k) - t_k \sum_{i=k}^n y_i$$

where

- m : the last income class of the wife's individual taxable income
- p : the last income class of the husband's individual taxable income
- n : the last income class of the couple's combined taxable income
- k : the last income class of one-half of the couple's combined taxable income.

Three situations are possible: (1) the husband and wife receive equal incomes; (2) the husband and wife receive unequal incomes; (3) the husband receives the entire income. The difference in income tax payments when the couple files individually or jointly are given as follows:

Equal incomes.

$$(3a) \quad D_1 = T^s - T' = t_k \left(\sum_{i=1}^{k-1} y_i - \sum_{i=k}^n y_i + 2\hat{y}_k \right)$$

where \hat{y}_k = the actual income in last class of the husband's or the wife's income.

However,

$$2\hat{y}_k = y'_k = - \sum_{i=1}^{k-1} y_i + \sum_{i=k}^n y_i.$$

Therefore, $D_1 = 0$.

Unequal incomes.

$$(3b) \quad D_2 = T^s - T' = t_k \sum_{i=1}^{m-1} y_i + \sum_{i=m}^{k-1} y_i (t_k - t_i) + \sum_{i=k}^{p-1} y_i (t_i - t_k) - t_k \sum_{i=p}^n y_i + y_m^w t_m + y_p^h t_p.$$

Husband receives entire income.

$$(3c) \quad D_3 = T^s - T' = \sum_{i=1}^{k-1} y_i (t_k - t_i) + \sum_{i=k}^n y_i (t_i - t_k).$$

The couple's *annual* tax liability will be less under individual filing if

$$(T^s - T') < (r^h Y^w + r^w Y^h).$$

APPENDIX B

THE FILING DECISION

(I) *The Filing Decision under the Report Proposal*

Since a rational couple will want to minimize its discounted total tax liability in deciding which way to file income tax forms the couple must first make the following three computations:

(1) Solving for N :

$$B^h + B^w = \sum_{i=1}^N (1 + R)^{-i} \times (r^h + r^w) (Y_i^h + Y_i^w)$$

(2) Solving for N^w :

$$B^w = \sum_{i=1}^{N^w} (1 + R)^{-i} r^w Y_i^w$$

(3) Solving for N^h :

$$B^h = \sum_{i=1}^{N^h} (1 + R)^{-i} r^h Y_i^h$$

where

B^h : borrowing of husband

B^w : borrowing of wife

N^h : opt-out year of husband

N^w : opt-out year of wife

N : opt-out year for couple

t : time in years

R : opt-out interest rate

The expression within the summation sign is the present discounted value (PDV) of Ed Op repayment in the year t , discounted at an interest rate of R per cent, which we assume for convenience to be equal to the borrowing and lending rates. We also assume perfect certainty about future incomes.

Solving each equation for the value of N gives that year in which the PDV of the stream of Ed Op payments equals total borrowing. It is in that year that the couple (or individual) will opt out, i.e., in that year they would receive a notice from the IRS saying that a payment of \$0.00 would be sufficient to cancel their debt if they were to convert to an R per cent loan.

Case 1: $N, N^*, N^h < 40$ (assuming this is the length of the repayment period). In this case, since both partners opt out regardless of the way in which they file, they will always file jointly. They do this because in either method of filing, the PDV of their Ed Op payments is the same, but their income tax payments are reduced by filing jointly.

Case 2: $N, N^*, N^h \geq 40$. Here, neither partner opts out in either choice, so a dollar to the IRS is the same as a dollar to the Ed Op Bank (i.e., since they never pay off their loans, they must pay throughout the duration of the repayment period regardless of their filing decision). Therefore, they will choose the pattern of filing that will give them the minimum total payment of Ed Op tax plus income tax in each year.

Case 3: $N < 40, N^h$ and/or $N^* \geq 40$. The couple must minimize the PDV of the stream of total payments (knowing that they can file jointly or separately in each year, that filing jointly accelerates the opting out of each separately, and filing separately decelerates the opting out of the couple). In this case, it is impossible to say anything *a priori* about the pattern of filing because the filing decision in the early years affects the opt-out date and consequently the stream of payments in the later years. Only after making complicated calculations to determine the minimum PDV of their tax payments would the couple know their pattern of filing for the 40-year period, assuming, of course, that they knew their future income stream with certainty.

(II) *The Filing Decision Under the Modified Report Proposal*

Under this proposal any additional income tax payments are credited directly to the Ed Op Bank. Since a couple's income tax payments that are credited to the Treasury will always equal their income tax payments if they filed jointly, the filing decision that minimizes a couple's annual tax liability will also be the filing decision that minimizes their total discounted tax liability. Under joint filing, a couple's Ed Op tax payments are given by $P^t + P'^t = r^t(Y^t + Y'^t) + r'^t(Y^t + Y'^t)$, where r^t and r'^t represent the respective repayment rates of the high and low income spouse and Y^t and Y'^t represent the respective incomes of the high and low income spouse. Under single filing, a couple's tax liability is given by $P^t = r^t Y^t + r'^t Y'^t + (T^t - T'^t)$, where T^t and T'^t represent the income tax burdens under joint and separate filing. Clearly if $(T^t - T'^t) < (r^t Y^t + r'^t Y'^t)$, the couple will choose to file individually. However, to ensure that the opting-out decision remains unaffected, the additional income tax payments must be credited to the accounts of each spouse in such a way that their credited Ed Op tax payments (\tilde{P}^t and \tilde{P}'^t) take on the following values

$$\left. \begin{aligned} \tilde{P}^t &= r^t Y^t \\ \tilde{P}'^t &= r'^t Y'^t + (T^t - T'^t) \\ \tilde{P}^t &= r^t Y^t \\ &+ (T^t - T'^t) - r'^t Y'^t \\ \tilde{P}'^t &= P'^t \end{aligned} \right\} \begin{aligned} &\text{if } (T^t - T'^t) < r^t Y^t, \\ &\text{if } (T^t - T'^t) > r^t Y^t. \end{aligned}$$

(III) *The Study Proposal*

Under the alternate proposal, there is no income tax filing decision. The opt-out calculation becomes straightforward, but is of small interest to the couple since they are automatically notified when the opt-out date has arrived. The calculation is important, however, in estimating repayments to the Ed Op Bank, and this simplification is of great advantage.

The calculation becomes:

(1) Solving for N^h :

$$B^h = \sum_{t=1}^{N^h} (1 + R)^{-t} r^h Y_t^h$$

(2) Solving for N^w :

$$B^w = \sum_{t=1}^{N^w} (1+R)^{-t} \times \left[(r^w Y_{t^w} + r^w) \left(1 - \frac{W_{t^w}}{\bar{W}} Y_{t^w} \right) \right]$$

This gives the year in which each partner will opt out independent of income tax filing decisions.

IV. THE REPAYMENT TAX RATE AND THE RATE OF RETURN

The rate of return to the Ed Op Bank can be thought of as that interest rate at which each cohort of college students pays back its borrowings plus interest charges. If the Bank plans to be exactly self-sustaining, then it is essential for it to know the relationship between the Ed Op tax rate and the rate of return. If, on the other hand, the Bank plans to run a deficit (or accumulate a surplus), then it can calculate the estimated amount of subsidy required (or the amount of surplus to be accumulated) from the estimated difference between the government borrowing rate and the rate of return along with estimated total new borrowings.

To the economist, this rate of return serves as a crude estimate of the marginal private "profitability" of investment in higher education to be expected after the adoption of the Ed Op Bank. After allowance for distortions created by our tax laws and allowance for external effects the rate of return can be compared with those in other sectors of the economy, serving as a guide to public policy.

The question we seek to answer is thus: If the Ed Op Bank allows members of a given college class the option of borrowing \$1000 for a pledge to pay τ per cent of income each year over T years, what is the implied rate of return r ? In Tables IV.1 through IV.6, we present our estimates of the rate of return r under various stipulations on the tax rate τ , the repayment period T , and cut-off

salary for married women \bar{W} .¹ The tax rate is varied from 1 per cent for every \$1000 borrowed ($\tau = 1.00$ per cent) to 1 per cent for every \$5000 borrowed ($\tau = .20$ per cent). The stipulations on cut-off salary for married women are: \bar{W} set equal to mean college-educated female income; \bar{W} set equal to \$5000 (1.045)^{t-1965} on the assumption that salaries grow at the annual rate of 4.5 per cent; \bar{W} set equal to the mean college-educated male income.² Repayment periods T of 30 and 40 years are considered.

TABLE IV.1

RATE OF RETURN r (IN PER CENT) AS A FUNCTION OF THE TAX RATE τ

Repayment period T set at 40 years
Cut-off salary for married women \bar{W} set at mean college-educated female income *
Annual growth rate of incomes assumed to be 4.5 per cent
Opt-out interest rate R set at 6.5 per cent

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed				
	$\tau = .20\%$	$\tau = .25\%$	$\tau = .33\%$	$\tau = .50\%$	$\tau = 1.00\%$
1969	2.9	3.6	4.3	5.1	5.5
1970	3.0	3.7	4.4	5.1	5.5
1971	3.1	3.8	4.4	5.1	5.5
1972	3.2	3.8	4.5	5.2	5.5
1973	3.3	3.9	4.6	5.2	5.6
1974	3.4	4.0	4.6	5.2	5.6
1975	3.5	4.1	4.7	5.3	5.6
1976	3.6	4.1	4.7	5.3	5.6
1977	3.7	4.2	4.8	5.3	5.6
1978	3.7	4.3	4.8	5.3	5.6
1979	3.8	4.3	4.8	5.3	5.6
1980	3.9	4.4	4.8	5.3	5.7
1981	4.0	4.4	4.8	5.3	5.7

* \$4,075 (1.045)^{t-1965}.

¹ See our discussion of the treatment of married women in Section III of this report.

² For 1965, our estimate of mean income of college-educated women "with income" is \$4,075, for college-educated men "with income" it is \$10,192. We derive these estimates from the Census data for 1959, assuming that money incomes grew at the annual rate of 4.0 per cent during the 1959-1965 period. The case of \bar{W} set equal to mean college-educated male income was investigated to test the sensitivity of our results; in practice, such a high value of \bar{W} is not likely to be satisfactory.

TABLE IV.2

RATE OF RETURN r (IN PER CENT) AS A
FUNCTION OF THE TAX RATE τ

Repayment period T set at 30 years
Cut-off salary for married women \bar{W} set at mean
college-educated female income*
Annual growth rate of incomes assumed to be
4.5 per cent
Opt-out interest rate R set at 6.5 per cent

College Class Enter- ing in	Tax Rate τ Per \$1,000 Borrowed				
	$\tau=.20\%$	$\tau=.25\%$	$\tau=.33\%$	$\tau=.50\%$	$\tau=1.00\%$
1969	1.5	2.3	3.3	4.5	5.3
1970	1.6	2.4	3.4	4.6	5.4
1971	1.8	2.6	3.5	4.7	5.4
1972	1.9	2.7	3.6	4.7	5.4
1973	2.0	2.8	3.7	4.8	5.4
1974	2.1	2.9	3.8	4.8	5.4
1975	2.2	3.0	3.9	4.9	5.5
1976	2.4	3.2	4.0	4.9	5.5
1977	2.5	3.3	4.1	5.0	5.5
1978	2.6	3.4	4.2	5.0	5.5
1979	2.7	3.5	4.2	5.0	5.5
1980	2.8	3.6	4.3	5.0	5.6
1981	3.0	3.6	4.4	5.1	5.6

* \$4,075 (1.045) ^{$t-1965$} .

TABLE IV.3

RATE OF RETURN r (IN PER CENT) AS A
FUNCTION OF THE TAX RATE τ

Repayment period T set at 40 years
Cut-off salary for married women \bar{W} set at mean
college-educated male income*
Annual growth rate of incomes assumed to be
4.5 per cent
Opt-out interest rate R set at 6.5 per cent

College Class Enter- ing in	Tax Rate τ Per \$1,000 Borrowed				
	$\tau=.20\%$	$\tau=.25\%$	$\tau=.33\%$	$\tau=.50\%$	$\tau=1.00\%$
1969	3.5	4.1	4.8	5.3	5.5
1970	3.6	4.2	4.9	5.4	5.5
1971	3.7	4.3	4.9	5.4	5.5
1972	3.8	4.4	5.0	5.4	5.5
1973	3.9	4.5	5.0	5.4	5.5
1974	4.0	4.5	5.1	5.4	5.5
1975	4.1	4.6	5.1	5.4	5.5
1976	4.1	4.7	5.1	5.4	5.5
1977	4.2	4.7	5.2	5.4	5.5
1978	4.3	4.8	5.2	5.4	5.4
1979	4.4	4.8	5.2	5.4	5.4
1980	4.4	4.9	5.2	5.4	5.4
1981	4.5	4.9	5.3	5.4	5.4

* \$10,092 (1.045) ^{$t-1965$} .

TABLE IV.4

RATE OF RETURN r (IN PER CENT) AS A
FUNCTION OF THE TAX RATE τ

Repayment period T set at 40 years
Cut-off salary for married women \bar{W} set at
\$5,000 (1.045) ^{$t-1965$}
Annual growth rate of incomes assumed to be
4.5 per cent
Opt-out interest rate R set at 6.5 per cent

College Class Enter- ing in	Tax Rate τ Per \$1,000 Borrowed				
	$\tau=.20\%$	$\tau=.25\%$	$\tau=.33\%$	$\tau=.50\%$	$\tau=1.00\%$
1969	3.0	3.7	4.4	5.1	5.5
1970	3.1	3.8	4.5	5.2	5.5
1971	3.2	3.9	4.6	5.2	5.5
1972	3.3	3.9	4.6	5.2	5.5
1973	3.4	4.0	4.7	5.2	5.5
1974	3.5	4.1	4.7	5.3	5.5
1975	3.6	4.2	4.8	5.3	5.5
1976	3.7	4.2	4.8	5.3	5.6
1977	3.8	4.3	4.9	5.3	5.6
1978	3.9	4.4	4.9	5.4	5.6
1979	3.9	4.4	5.0	5.4	5.7
1980	4.0	4.5	5.0	5.4	5.7
1981	4.1	4.6	5.0	5.4	5.7

TABLE IV.5

RATE OF RETURN r (IN PER CENT) AS A
FUNCTION OF THE TAX RATE τ

Repayment period set at 40 years
Cut-off salary for married women \bar{W} set at mean
college-educated female income*
Annual growth rate of incomes assumed to be
4.0 per cent
Opt-out interest rate R set at 6.5 per cent

College Class Enter- ing in	Tax Rate τ Per \$1,000 Borrowed				
	$\tau=.20\%$	$\tau=.25\%$	$\tau=.33\%$	$\tau=.50\%$	$\tau=1.00\%$
1969	2.5	3.1	4.0	4.8	5.4
1970	2.6	3.2	4.0	4.9	5.4
1971	2.7	3.3	4.1	4.9	5.4
1972	2.8	3.4	4.2	5.0	5.4
1973	2.9	3.5	4.2	5.0	5.5
1974	2.9	3.6	4.3	5.0	5.5
1975	3.0	3.6	4.3	5.1	5.5
1976	3.1	3.7	4.4	5.1	5.5
1977	3.2	3.8	4.4	5.1	5.5
1978	3.3	3.9	4.5	5.1	5.6
1979	3.4	3.9	4.6	5.2	5.6
1980	3.4	4.0	4.6	5.2	5.6
1981	3.5	4.1	4.6	5.2	5.6

* 4,075 (1.040) ^{$t-1965$} .

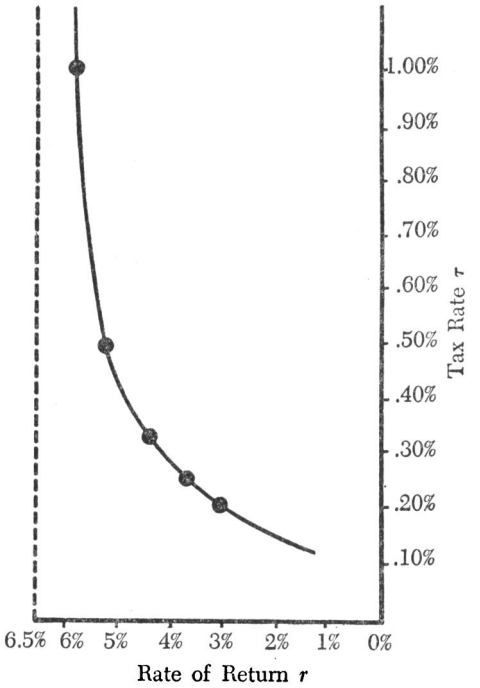
TABLE IV.6
RATE OF RETURN r (IN PER CENT) AS A
FUNCTION OF THE TAX RATE τ
Repayment period T set at 40 years
Cut-off salary for married women \bar{W} set at
\$5,000(1.040) ^{$t-1965$}
Annual growth rate of incomes assumed to be
4.0 per cent
Opt-out interest rate R set at 6.5 per cent

College Class Enter- ing in	Tax Rate τ Per \$1,000 Borrowed				
	$\tau=.20\%$	$\tau=.25\%$	$\tau=.33\%$	$\tau=.50\%$	$\tau=1.00\%$
1969	2.6	3.3	4.1	4.9	5.4
1970	2.7	3.3	4.1	5.0	5.4
1971	2.8	3.4	4.2	5.0	5.4
1972	2.9	3.5	4.3	5.1	5.4
1973	2.9	3.6	4.3	5.1	5.4
1974	3.0	3.7	4.4	5.1	5.4
1975	3.1	3.8	4.5	5.2	5.5
1976	3.2	3.8	4.5	5.2	5.5
1977	3.3	3.9	4.6	5.2	5.5
1978	3.4	4.0	4.6	5.2	5.5
1979	3.5	4.1	4.7	5.3	5.5
1980	3.5	4.1	4.7	5.3	5.5
1981	3.6	4.2	4.7	5.3	5.6

We assume that incomes will grow (in current dollars) at an annual rate of 4.5 per cent. To be conservative, we also consider the case where the annual income growth is only 4.0 per cent. We consider three values of the opt-out interest rate: 6.0 per cent, 6.5 per cent, and 8.0 per cent.

In Figure IV.1, we graph the rate of return r as a function of the tax rate τ . Of course, r is an increasing function of τ . For very small (but positive) values of τ , r is negative. As τ gets very large, r becomes closer and closer to the opt-out interest rate. (That is, r is asymptotic to the opt-out interest rate.) Although r is an increasing function of τ , it increases at a decreasing rate. (r is a concave function of τ .) From Figure IV.1, we conclude that, in a well designed program, the opt-out interest rate R should be set substantially higher than the rate of return r . As r approaches R , the repayment-tax rate τ becomes very large. With τ high, participants in the program will have to make large repayments in

FIGURE IV.1
RATE OF RETURN r AS A FUNCTION OF
TAX RATE τ
Repayment period T set at 40 years
Cut-off salary for married women \bar{W} set equal
to mean college-educated female income
Opt-out interest rate R set at 6.5 per cent
College class entering in 1969 *



* Source: Table IV.1.

the years immediately following college graduation.
For a given tax rate τ , the rate of return r is shown to be generally increasing through time (see Tables IV.1-IV.6). Of all the schemes treated in this section, the one portrayed in Table IV.1 is probably the most attractive. If T is set at 40 years, then college students entering in 1969 should be able to borrow roughly \$3000 for every 1 per cent of future income pledged. The case portrayed in Table IV.3 with \bar{W} set at mean college-educated *male* income is probably least attractive, since it offers by far the least income insurance to working wives. Table IV.3 is presented mostly to evalu-

ate the sensitivity of r to \bar{W} (compare IV.1 and IV.3). We conclude that when r is substantially less than the opt-out interest rate, increasing \bar{W} holding τ fixed will lead to an increase in r . However, when r is within 1.5 percentage points of R , then effect on r of changes in \bar{W} is not substantial. By comparing Tables IV.1 and IV.5, or Tables IV.4 and IV.6, the sensitivity of our income growth rate assumption can be tested.

In Tables IV.7 through IV.15, we estimate the tax rate τ given the rates of return $r = 4.0$ per cent, $r = 4.5$ per cent, and $r = 6.0$ per cent for the various values of the repayment period, cut-off salary for married women, and the opt-out interest rate. Computation of the tax rate τ was by an iterative procedure that allowed for an error of ± 0.01 percentage points in τ . This is the reason that the reported values of τ in Tables IV.7 through IV.15 do not move smoothly through time.

TABLE IV.8

Rate of return set at $r = 4.5$ per cent
Projected salary growth rate assumed to be 4.5 per cent
Opt-out interest rate R set at 6.0 per cent
Cut-off salary for married women \bar{W} set at mean college-educated female income *

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.56%	.42%
1970	.56%	.42%
1971	.54%	.40%
1972	.52%	.38%
1973	.52%	.38%
1974	.49%	.38%
1975	.49%	.38%
1976	.47%	.35%
1977	.47%	.35%
1978	.47%	.33%
1979	.45%	.33%
1980	.45%	.33%
1981	.42%	.33%

* \$4,075 (1.045)^{t-1965}.

TABLE IV.7

Rate of return set at $r = 4.5$ per cent
Projected salary growth rate assumed to be 4.5 per cent
Opt-out interest rate R set at 6.5 per cent
Cut-off salary for married women \bar{W} set at mean college-educated female income *

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.49%	.36%
1970	.49%	.35%
1971	.47%	.34%
1972	.46%	.33%
1973	.45%	.33%
1974	.42%	.32%
1975	.42%	.30%
1976	.41%	.29%
1977	.40%	.29%
1978	.39%	.28%
1979	.38%	.28%
1980	.38%	.27%
1981	.35%	.26%

* \$4,075 (1.045)^{t-1965}.

TABLE IV.9

Rate of return set at $r = 4.0$ per cent
Projected growth rate of incomes assumed to be 4.5 per cent
Opt-out interest rate R set at 6.5 per cent
Cut-off salary for married women \bar{W} set at mean college-educated female income *

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.41%	.29%
1970	.40%	.28%
1971	.39%	.27%
1972	.38%	.27%
1973	.36%	.26%
1974	.35%	.25%
1975	.34%	.25%
1976	.33%	.23%
1977	.32%	.23%
1978	.30%	.22%
1979	.30%	.21%
1980	.29%	.21%
1981	.28%	.20%

* \$4,075 (1.045)^{t-1965}.

TABLE IV.10

Rate of return set at $r = 4.0$ per cent
 Projected growth rate of incomes assumed to be 4.5 per cent
 Opt-out interest rate R set at 6.0 per cent
 Cut-off salary for married women \bar{W} set at mean college-educated female income *

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.45%	.32%
1970	.43%	.30%
1971	.42%	.30%
1972	.41%	.29%
1973	.40%	.28%
1974	.39%	.28%
1975	.38%	.27%
1976	.38%	.26%
1977	.35%	.26%
1978	.35%	.25%
1979	.34%	.25%
1980	.33%	.23%
1981	.33%	.23%

* $\$4,075 (1.045)^{t-1965}$.

TABLE IV.12

Rate of return set at $r = 4.5$ per cent
 Projected growth rate of incomes assumed to be 4.5 per cent
 Out-out interest rate R set at 6.0 per cent
 Cut-off salary for married women \bar{W} set at $\$5,000 (1.045)^{t-1965}$

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.56%	.40%
1970	.54%	.38%
1971	.52%	.38%
1972	.52%	.38%
1973	.49%	.35%
1974	.47%	.35%
1975	.47%	.33%
1976	.45%	.33%
1977	.42%	.32%
1978	.42%	.30%
1979	.42%	.30%
1980	.40%	.30%
1981	.40%	.28%

TABLE IV.11

Rate of return set at $r = 4.5$ per cent
 Projected growth rate of incomes assumed to be 4.5 per cent
 Opt-out interest rate R set at 6.5 per cent
 Cut-off salary for married women \bar{W} set at $\$5,000 (1.045)^{t-1965}$

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.47%	.35%
1970	.47%	.34%
1971	.45%	.33%
1972	.43%	.32%
1973	.42%	.30%
1974	.41%	.30%
1975	.40%	.29%
1976	.39%	.28%
1977	.38%	.27%
1978	.36%	.27%
1979	.35%	.26%
1980	.34%	.25%
1981	.33%	.25%

TABLE IV.13

Rate of return set at $r = 4.0$ per cent
 Projected growth rate of incomes assumed to be 4.5 per cent
 Opt-out interest rate R set at 6.5 per cent
 Cut-off salary for married women \bar{W} set at $\$5,000 (1.045)^{t-1965}$

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.40%	.28%
1970	.39%	.27%
1971	.38%	.27%
1972	.36%	.26%
1973	.35%	.25%
1974	.34%	.24%
1975	.33%	.23%
1976	.32%	.22%
1977	.30%	.22%
1978	.29%	.21%
1979	.29%	.21%
1980	.28%	.20%
1981	.27%	.19%

TABLE IV.14

Rate of return set at $r = 4.0$ per cent
 Projected growth rate of incomes assumed to be
 4.5 per cent
 Opt-out interest rate R set at 6.0 per cent
 Cut-off salary for married women \bar{W} set at
 \$5,000 $(1.045)^{t-1965}$

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.42%	.30%
1970	.42%	.29%
1971	.40%	.28%
1972	.40%	.28%
1973	.38%	.27%
1974	.36%	.26%
1975	.35%	.26%
1976	.35%	.25%
1977	.34%	.23%
1978	.33%	.23%
1979	.32%	.22%
1980	.30%	.22%
1981	.30%	.21%

TABLE IV.15

Rate of return set at $r = 6.0$ per cent
 Projected growth rate of incomes assumed to be
 4.5 per cent
 Opt-out interest rate R set at 8.0 per cent
 Cut-off salary for married women \bar{W} set at mean
 college-educated female income*

College Class Entering in	Tax Rate τ Per \$1,000 Borrowed	
	Repayment Period $T = 30$ Years	Repayment Period $T = 40$ Years
1969	.68%	.52%
1970	.66%	.52%
1971	.63%	.49%
1972	.61%	.47%
1973	.59%	.47%
1974	.59%	.45%
1975	.56%	.45%
1976	.54%	.42%
1977	.54%	.42%
1978	.52%	.40%
1979	.52%	.40%
1980	.49%	.40%
1981	.49%	.38%

* \$4,075 $(1.045)^{t-1965}$.

In the four appendices to this section, we explain the bases of our calculations in detail. For purposes of these calculations, borrowers from the Ed Op Bank are divided into categories relevant to their income and repayment patterns. The five categories used are: (D) decile income; (E) educational level attained; (A) age; (M) marital status; and (S) sex.³

It is readily apparent that the last four categories affect incomes and thus repayments. The decile income breakdown is included to increase the accuracy of the opt-out calculation. Those who opt-out will be individuals with above-average incomes. Accordingly, if the opt-out calculation had been based on income patterns by EAMS, the numbers opting out would have been underestimated. This inaccuracy is reduced by breaking down the income distribution within each EAMS category into ten groups.

Once borrowers are broken down into groups by DEAMS, it is necessary to know the numbers in each DEAMS category for each of the years for which calculations are made. Appendices A and B explain how these numbers are estimated; Appendix C describes the method of projection of DEAMS income data; and Appendix D presents the basis for the computation of the rate of return.

APPENDIX A

ENROLLMENT PROJECTIONS

1. Projections of enrollment are used in estimating both borrowing from and repayments to the Bank. Since it is assumed that only full-time undergraduates are allowed to borrow, full-time undergraduate enrollment is projected to 1984; an attempt is made to take account of the likely effects of the existence of the Ed Op Bank on enrollment. Graduate as well as undergraduate enroll-

³ Leading to the acronym DEAMS. Naturally these are not the only characteristics which affect incomes. Race was initially included in the income data, but this category could not be used since no enrollment data by race were available.

ment data, and estimates of degrees earned, are needed on the repayments side because the level of educational attainment affects earnings.

2. Definitions:

- a) Opening fall enrollment—enrollment as of October in the category being discussed.
- b) Degree-credit enrollment—number enrolled in a program leading to a degree.
- c) Control of institution—public or private.
- d) Level of institution—2-year or 4-year postsecondary institution.
- e) Undergraduate enrollment—all students, full-time and part-time, resident (living on or near campus) or extension (attending an extension campus of the school), enrolled in degree-credit courses leading to a bachelor's degree in 4-year and 2-year institutions.
- f) Graduate enrollment—all students, full-time or part-time, resident or extension, enrolled in degree-credit courses leading to a degree higher than a bachelor's but not a first-professional degree.
- g) First-professional students—all students, full-time or part-time, resident or extension, enrolled in degree-credit courses leading to a first-professional degree, i.e., first degrees in law, dentistry, medicine, veterinary medicine, theology, library science, social work, and public administration. These are all usually thought of as advanced degrees.

3. Full-time undergraduate enrollment

(a) The data and methods we use to project enrollment are taken from *Projections of Educational Statistics to 1975-76*, a publication of the Office of Education. This is the only available source of well-documented projections. Separate projections are made of total enrollment and graduate enrollment. The difference is the sum of undergraduate and first-professional enrollments.¹

¹ Unaccountably, the Office of Education includes both these categories in its "undergraduate" data. The categories were reported separately in 1963, so that an approximate adjustment

Enrollment rates by sex, control and level of institution are calculated by dividing total enrollment in these categories by the population aged 18-21. Projections of these enrollment rates are then made and applied to projected population to give projected enrollment. (See *Projections*, especially Tables A and B in the Appendix.) When necessary, we extend these projections beyond 1975-76 using these enrollment rates applied to Census Bureau population projections.² The equation used for projecting enrollment rates has a linear time trend. There is, therefore, good reason to conclude that for purposes of long-term projections, these estimates are upward biased.

In data for 1963³ the Office of Education separates first-professional enrollment from undergraduate enrollment. In that year, first-professional enrollment was 12.3 per cent of undergraduate plus first-professional for men and 2.8 per cent for women. In the absence of other data, we assume that these percentages would persist to 1984, and apply them to our projected enrollment figures. The estimated first-professional enrollment is subtracted from undergraduate enrollment and added to graduate enrollment.

(b) We assume for purposes of this study that only full-time students will be allowed to borrow. We again follow the *Projections* and assume that the ratio of full-time enrollment to total enrollment will remain at the 1961-62 level in each sex, level, and control grouping. This gives us our final projections of full-time undergraduate enrollment to

could be made (see below). Until 1961 the Office of Education's data on "bachelor's degrees earned" also included first professional degrees. The *Projections* continues to use these arbitrary definitions.

² The population data we use are from unpublished series from the Office of Education. These series are consistent with Series C advance projection data in U.S. Department of Commerce, Bureau of the Census, "Current Population Reports: Projection of the Population of the United States, by Age, Sex, and Color to 1990, with Extensions of Total Population to 2015," Series P-25, No. 359, February 20, 1967.

³ U.S. Office of Education, "Resident and Extension Enrollment in Institutions of Higher Education, Fall 1963," OE-54000-63, U.S. Government Printing Office, Washington, 1965, especially Table 3.

1984, assuming for the moment that there is no increase in enrollment due to the implementation of the Ed Op Bank.

(c) In addition, two alternative sets of projections are made on the basis of assumptions of increased full-time enrollment due to implementation of the program. The first assumes that full-time enrollment will increase by 1 per cent in each of the first five years and then remain at a level 5 per cent higher than our unadjusted projections. The second set of projections assumes that the increase due to implementation of the Bank will be 2 per cent per year to a level of 10 per cent.

4. Projections for repayments

The problem to be attacked here is that of breaking down each cohort into educational attainment levels to be applied with the incomes data in the calculation of rates of return and size of repayments. Several items of information are needed to make these calculations: first, the number of students in each freshman class; second, the number of these freshmen who will earn bachelor's degrees; and third, the number of these freshmen who will go on to graduate study.

(a) *First-time enrollment.* Projections of first-time enrollment appear in the *Projections*. The procedure is the same as that used to project total enrollment except that the population used is that averaging age 18. Again, we extend these projections to 1984.

(b) *Projections of degrees.* Degrees are projected on the assumption that all bachelor's degrees are earned at age 22, all master's degrees at age 24, and all doctorates at age 27. Thus, degrees are projected on a trend basis, projecting degrees as a percentage of population (by sex) averaging 18 years of age, four, six, or nine years earlier, for bachelors, masters, and doctorates, respectively.

Again, we want to separate first-professional figures from bachelor's degrees. After 1960, the Office of Education began to publish these figures separately.⁴ In projecting first-professional degrees, we use the average ratio of first-professional degrees to total first-professional plus bachelor's degrees in the three years for which data are available.

(c) *Cohort breakdown.* Past evidence

shows that 60 per cent of all freshmen receive degrees within ten years of first enrollment.⁵ We assume that all 60 per cent graduate in four years and that 40 per cent never graduate. Thus, 40 per cent of each cohort falls into the 1-3 years of college category. On balance, this assumption may be responsible for a small upward bias in our estimates of rates of return.

To split the 60 per cent who graduate into those who stop after four years and those who go on to graduate work, we calculate entering graduate students in each year. This is assumed to be the change in graduate enrollment from the previous year to this current year adjusted for the number of degrees awarded. Unfortunately, the data proved to be inadequate to account properly for those who leave graduate school without a degree. This leads to an upward bias in estimating the fraction of bachelors who will attend graduate school. On the other hand, the data is inadequate to account properly for those students who obtain two or more advanced degrees. This leads to a downward bias in estimating the fraction of bachelors who will attend graduate school.

APPENDIX B

CREATION OF THE NUMBERS MATRIX

In Appendix A, we described the method of projecting the number of males and females of each cohort in each of the three education classes. In addition, we need to know (1) the number in the various classes who marry and (2) the number who survive through time.

1. *Marriage.* Two major assumptions underlie our treatment of married people (for expositional purposes, we concentrate on married women since under our proposal the Ed Op Bank treats married men in the same way as single men). First, we assume that people marry at the mean age of first marriage and stay married throughout the repayment period unless the woman dies. Second, we assume that women marry men of the same or higher educational attainment. Men are assumed to marry at age 26 and women at age 25, these being the mean ages at first marriage for people with one or

⁴ U.S. Office of Education, *Degrees Earned*, 1961, 62, 63.

⁵ Iffert, Robert E., *Retention and Withdrawal of College Students*, Office of Education, Bulletin 1958, No. 1.

more years of college.⁶ Assuming that repayment begins at age 22, survival rates for men and women are applied to find the number still living at ages 26 and 25 (this is discussed in more detail below).

Marriage rates are based on "Marriage, Spouse Present" data from the Bureau of the Census.⁷ Data are given by sex, education level, and age. For each sex and education level, two histograms were constructed of per cent married over time, one from age 22 (beginning of the repayment period) to age 52 (for a 30-year program) and the other from 22 to 62. For each histogram one "average" marriage rate P_A was determined by solving $\sum p_i l_i = T p_A$, where p_i is the frequency of "married, spouse present" in the i th age class, l_i is the length of i th age class, and $T = \sum l_i$ is the length of the repayment period. Thus p_A depends on T . For simplicity, we combined the frequency derived for $T = 30$ years and $T = 40$ years to obtain single average used for all our calculations. The next table indicates that our results should not be greatly affected by this averaging procedure.

CALCULATED PERCENTAGES OF MEN AND WOMEN MARRIED BY YEARS OF COLLEGE EDUCATION ATTAINED

Length of Program T	E					
	Men			Women		
	1-3	4	More Than 4	1-3	4	More Than 4
40	84%	86%	83%	77%	74%	56%
30	84%	85%	83%	81%	79%	62%
Average	84%	85%	83%	79%	76%	59%

We assume further that all women with five or more years of higher education are married to men of the same educational level and that all women with four years of college are married to men with at least four years of higher education. There is a sufficient number of college men to ensure that, under our assumptions, all college women marry college men.

⁶ U.S. Bureau of the Census, PC(2)-4D, *Age at First Marriage*, 1960, Table 9.

⁷ U.S. Bureau of the Census, *Educational Attainment*, 1960, pp. 71-72.

Only the median income of women in each age-education class is used. In the mating process, the women in each education class are evenly distributed over the income deciles of the education class of the men they married. For example, then, we might have two-thirds of the men in each decile of the highest education class married to women with five or more years of education and one-third married to women with four years, each earning the median income of her education class. The rest of the women graduates will marry over the deciles of males with four years of college education and all the women with 1-3 years of college will be similarly married.⁸

This process gives us the following information: the numbers of single and married women in each education class at age 25, each identified by the median income of the wife's education class and one of ten decile incomes of the husband's education class.

2. *Survival Rates.* The estimates of the number of people surviving at any age are based on 5-year survival rates projected to the year 2010.⁹ For ages 22-27, the rate for 1975-80 is used, for ages 27-32, the 1980-85 rate, and so on until ages 52-57 where the 2005-2010 rate is used. For all successive 5-year periods, 2005-2010 rates are used.

The 5-year rate is applied to the number surviving to the initial year of the age range to find the number remaining at the end of the period. The number not surviving in five years is divided by 5 and that amount is subtracted each of the five years to find the number in each group in each year. This procedure is applied to men to age 26 to find the number married and then in each year until age 64. The same procedure is applied

⁸ Our marriage assumption exaggerates the relationship between husband's and wife's educational attainments, leading to an upward bias in estimating the inequality of family income distribution. On the other hand, we assume that within education classes there is no relationship between husband's and wife's income. This second assumption leads to a downward bias in estimating the inequality of family income distribution.

⁹ U.S. Bureau of the Census, *Current Population Reports*, Series P-25, No. 286, "Population Estimates, Projections of the Population of the United States by Age and Sex, 1964 to 1985, with Extensions to 2010," p. 64.

to women until age 25, and then to married and single women separately until age 64. Sex and age specific survival rates are assumed to be the same in each DEA class.

Combining the calculations discussed in the two subsections above yields a matrix of the number of people from a given cohort in each DEAMS category. The number matrices are calculated for each cohort from the college class entering in 1969 to 1981.

APPENDIX C

INCOME DATA

1. *Data sources.* The calculations are based on data from the 1960 Census which give income distribution by age group, education and sex.¹⁰ There are three educational levels: 1-3 years of college, 4 years, 5 or more years; and age classes are: 18-19, 20-21, 22-24, 25-29, 30-34, and thereafter by ten year intervals.

The method by which income projections for men in a given educational category are made will be described immediately below; later the modifications required to obtain separate estimates for married and unmarried women will be outlined.

2. *Frequency distribution of male incomes.* The Census income distribution includes all men in any given EA category "with income" in 1959, but excludes those with zero income. To obtain the basic frequency distribution of incomes used in the calculations, a cell of zero income was added to the Census data. The number of men in this cell is equal to the total number of men in that EA category in the entire population¹¹ minus the number in that group reported as being "with income."

3. *Decile incomes.* In calculating decile incomes, it is assumed that the distribution of incomes in all but the last two Census income classes is uniform. The last two classes are \$10,000-\$14,999 and \$15,000 and over. The income distribution within these two classes is assumed to be Paretian. The Paretian distribution is:

$$\begin{aligned} f(x) &= \frac{aB^a}{x^{a+1}} & x \geq B \\ f(x) &= 0 & x < B \end{aligned}$$

¹⁰ U.S. Bureau of the Census, 1960 Census of Population, "Educational Attainment," pp. 88-89, 112-113.

¹¹ *Ibid.*, pp. 54-57.

where a and B are parameters, x is the level

of income, and $\int_{x_1}^{x_2} f(y)dy$ is the frequency

of the income class (x_1 to x_2). The frequencies in the last two income classes are used to solve for the two parameters, a and B .

It is assumed that mean income in any decile is the median income in that decile; accordingly we estimated income for the 5th, 15th, . . . , 95th percentiles of the reconstructed income distribution.

4. *Incomes by age.* At this stage we have income by age group, educational class and decile for men in 1959. The next step is to obtain incomes for men of each age. The median age of men in each Census age class was computed from Census data by one-year age class for the whole population.¹² It is assumed that the median age of men in any given DEA class in the incomes data is the same as the median age of men in that age class in the entire population; and that the median income for that DEA class is earned by an individual of median age.

This yields a series of estimates of income by age in each DE class. Linear interpolation is used to obtain income for each age, and thus DEA income data, for 1959.

5. *Income growth.* Our final goal is income data by DEA category for the years 1973-2015. A significant assumption now made is that no man moves from his decile position in the income distribution. Any individual who is in a given decile of the income distribution in his first year out of college remains in that decile for the rest of his life.

To obtain the income of any DEA group after 1959 it is assumed that incomes for each group grew at the historical growth rate of 4 per cent up to 1965, and will grow thereafter at 4.5 per cent. This is composed of a 2.6 per cent per capita growth of real income¹³ and 1.9 per cent inflation. The latter is higher than average peacetime rates, but more consistent with an assumed unem-

¹² Bureau of the Census, 1960 Census, Vol. I, Characteristics of the Population, Part I, United States Summary, p. I-354.

¹³ Based on the projections of the National Planning Association, "National Economic Projections to 1976/77," p. 35.

ployment rate of 4.0 per cent. The assumption of a uniform 4 per cent growth rate after 1959 is also used, to test the sensitivity of the results to the assumed rate of growth.

The calculations and assumptions described in subsections 2-5 of this appendix enable us to calculate income for any male DEA category for any year after 1959.

6. *Married women.* The Census does not present separate income data for married and single women. It does present the frequency distribution of income of all women, and it is possible to calculate the number of all women in any EA class with zero income in the same way as this calculation is made for men.

The basic assumption used in calculating separate DEA incomes for married and unmarried women is that there is no difference between the incomes of married and unmarried women in any EA class who receive positive incomes, but that more married than single women have zero income.

The first step is to calculate the numbers with zero income. We know the totals of single and married women in each EA group,¹⁴ and participation rates in the labor force by marital status, age and education are available.¹⁵ It is assumed that the number of women with zero income by marital status is proportional to the rate of nonparticipation in the labor force by marital status.

Specifically, the following estimates are used:

$$\hat{n}_i = \frac{n_i(1-p_i)}{n_i(1-p_i)} \hat{n}_i = \frac{\bar{n}_i}{n_i} \hat{n}_i$$

where

n is the number in a class
 \hat{n} is the number with zero income
 \bar{n} is the number not in the labor force
 p is the labor force participation rate
 $i = m, s$ indicates married or single, and the subscript t indicates over-all rates or numbers.¹⁶

¹⁴ Appendix B, subsection 1 above.

¹⁵ "Educational Attainment," *op. cit.*, pp. 71-74. These data are not precisely by marital status; the categories are "Married, Spouse Present" and "Other."

¹⁶ Using this calculation, the percentage of single women "with income" varies between 85 and 95 per cent; for married women the range is 40-75 per cent.

Given the numbers of single and married women in each EA category without income, the numbers with income by marital status can be calculated. It is assumed that the relative frequencies of those with incomes do not vary by marital status. Thus if we know that X per cent of all women with income fall within a given income class, then we assume that X per cent of marrieds with income and X per cent of unmarries with income fall within that class. This makes it possible to obtain income distribution data for women by marital status in each EA class.

Income data by education and age classes for married and unmarried women are then calculated using a similar set of procedures to that for men described in subsections 3-5 above.

APPENDIX D

RATE-OF-RETURN CALCULATIONS

Calculation of the rate of return for each cohort depends on a number of parameters:

- (1) Stipulated tax rate τ ,
- (2) Stipulated length of repayment period T ,
- (3) Stipulated cut-off salary \bar{W} for calculating repayments of married women,
- (4) Assumption about growth rate of salaries,
- (5) Stipulated opt-out interest rate R .

The terms of the loan seem to be attractive to members of all DEAMS groups attending college, so we base our calculations on the assumption that borrowing is evenly distributed over all income, marital status, and sex (DMS) classes. Further, it is assumed that those with 1-3 years of college borrow one-half of the amount borrowed by those who graduate. The absolute amount borrowed by participants in the Ed Op Bank is not needed for calculating the rate of return.

We assume that borrowers either pay their Ed Op taxes for the full T years of the obligation or opt-out at the date when under the opt-out provision they no longer have an obligation to the Bank. This assumption follows from the fact that even at the 6.0 per cent or 6.5 per cent opt-out rate of interest a program like this with free insurance features, etc. will probably offer the most attractive borrowing rate available to indi-

viduals.¹⁷ We further assume that a college graduate borrows an equal amount from the Bank during each of his four undergraduate years. Since college costs are rising through time, this assumption will lead to a small downward bias in the rate of return. If R is the opt-out rate, then the opt-out year is found by solving for the smallest positive integer N such that

$$250[(1+R)^4 + (1+R)^3 + (1+R)^2 + (1+R)] \leq \tau \sum_{t=1}^N (1+R)^{-t} Y_t,$$

where for males, Y_t is income in year t . For females:

$$Y_t = \begin{cases} Y_t^f + \left(1 - \frac{Y_t^f}{\bar{W}}\right) Y_t^m, & Y_t^f \leq \bar{W} \\ Y_t^f, & Y_t^f > \bar{W} \end{cases}$$

where

Y_t^f is female's income in year t ;

Y_t^m is husband's income in year t .

Note: \bar{W} grows at the same rate as incomes. Using Y_t^f as a proxy for W_t^f probably introduces an upward bias in calculating r .

The left-hand side of this inequality as-

sumes that \$1,000 is borrowed, \$250 in each year. This is compounded at the rate R from the time when the student starts paying, age 22. If $N \leq T$, we assume that the borrower opts-out in year N . If $N > T$, the borrower ceases paying his Ed Op tax in year T .

We assume that all those in the education class "1-3 years of higher education" borrowed from the Ed Op Bank for two years. Again, solving for the smallest positive integer N such that

$$250[(1+R)^4 + (1+R)^3] \leq 1/2 \tau \sum_{t=1}^N (1-R)^{-t} Y_t.$$

This assumes "drop-outs" and junior college students borrow half the amount and borrow it in the first two years of school. τ remains tax rate per thousand.

Having calculated the opt-out year for every DEMS (Decile income, Educational attainment, Marital status, Sex) category, the rate of return is calculated. Let n_i^t be the number of persons in the i th DEMS cell in year t ; let P_i^t be the payment of each person in the i th cell in year t ,

$$P_i^t = \begin{cases} \tau Y_i^t, & t < N_i \text{ and } t \leq T \\ (1+R)^{N_i} \left[250 \{ (1+R)^4 + (1+R)^3 + (1+R)^2 + (1+R) \} - \sum_{t=1}^{N_i-1} P_i^t (1+R)^{-t} \right], & \text{for } t = N_i \leq T \\ 0, & t > N_i \text{ or } t > T \end{cases}$$

where N_i is the opt-out year for the i th cell.

Then we solve for the rate of return r :

$$250 \left[\sum_{G,D} n_i^1 (1+r)^4 + \sum_{G,D} n_i^1 (1+r)^3 + \sum_G n_i^1 (1+r)^2 + \sum_G n_i^1 (1+r) \right] = \sum_{t=1}^T (1+r)^{-t} \left[\sum_G n_i^t P_i^t + \frac{1}{2} \sum_D n_i^t P_i^t \right]$$

where G = all cells with four or more years of education,

D = all cells with 1-3 years of education,

t runs from the graduation year ($t = 1$, at age 22). On the left-hand side of the above equation t is set equal to 1 assuming that mortality rates in ages 18-22 are negligible.

V. FISCAL IMPACT OF THE ED-OP BANK

Even though the Educational Opportunity Bank may require no direct ap-

¹⁷ This hypothesis is probably not as realistic for our 8.0 per cent opt-out rate. Thus, calculations based upon the 8.0 per cent opt-out rate overstate the rate of return, because of the adverse selection of participants.

propriations from the Congress, its operations, especially in its early years while repayments are small, will have an impact on our fiscal and monetary policy decisions which is similar to an increase in government spending. This is because in any year the Nation has only a limited amount of capital and land and labor to

produce goods and services that satisfy our demand for output, including education, government programs, and business investment. Those who borrow from the Bank will use up some of those resources purchasing education, housing and food. Unless they or someone else automatically reduce other expenditures to offset these purchases as a result of the Bank's operations, the government will have to restrain demand to avoid inflation by raising taxes, foregoing a tax cut, reducing its own expenditures, or allowing interest rates to rise (as they will tend to do anyway because of the Bank's borrowing in capital markets) to cut down business investment. In order to get an unambiguous measure of the fiscal impact of the program, we study the situation where the government offsets any rise in interest rates through monetary policy, and does not reduce its own spending, so that the whole burden of restraining demand is thrown on taxes. The size of the tax cut that would be possible if the Bank were not in operation and monetary and expenditure policy were as we have assumed, we will call the *fiscal impact* of the program. In reality, a very different mix of fiscal and monetary tools may be used to restrain demand. We study this case only as an analytical convenience.

In measuring this fiscal impact it is important to be very careful to note all the changes in spending patterns that will result from the Bank's operations. It is easiest to do this by dividing the total loans from the Bank into categories, and examining the impact of each of these in turn.

1) There will be some people going to college who, if the Bank loans were not available, would be working. As jobholders, these people contribute to capacity by working, as well as drawing on output by spending their earnings. But they spend less than they produce since part of what they earn is taxed away and part is saved. When they leave the labor force to go to college, their spend-

ing will decline only a little, if at all. Other spending must therefore be reduced by the full amount they would be earning if expenditure is to remain inside the bounds of capacity. From our projections of earnings and spending we estimate that people would earn about 140 per cent of what they will spend on college, so this is the amount by which other aggregate spending must be reduced to make room for the Bank-financing of college for people who would not otherwise have gone to college at all, or are extending a two year program to four years because of the availability of Bank loans.

2) The largest volume of expenditures financed by the Bank will be likely to replace expenditures that would have been made anyway out of family savings or income. This is the classic situation of a family depriving itself of some luxury or (perhaps) necessity, or depleting its wealth, to send children through college. If such a family decides to switch to Bank financing, what will it do with the money it would have spent? If it saves it in bank accounts, bonds, stocks, or real estate, there will be no addition to demand. If it spends it on a new car, a swimming pool, or a vacation there will be an increment to demand. We estimate, conservatively for our purpose, that such a family will spend all of the funds that it would commit to its children's education in the absence of the Ed Op Bank loans.

This is probably an upper limit on the marginal propensity to consume out of these funds, and so may overestimate the fiscal impact slightly. Just how people will look on this "windfall" is not easy to determine. In general, individuals spend about 90 per cent of their disposable income, with richer people spending less than poorer people. But the institution of the Bank may remove one of the chief motives families have for saving and lead some families to dissave when it is introduced. To allow for these possible shifts,

which will increase demand, the 90 per cent figure is raised to the 100 per cent figure given above.

This net increase in consumption expenditures will add more than its own value to total demand because the first-round recipients of the extra expenditure will spend a fraction of it, and so on. It is commonly estimated that a dollar increase in autonomous consumption demand finally results in a \$2.25 increase in total demand. The amount by which other expenditures must be curtailed to make room for this component of Ed Op generated financing is, then equal to 225 per cent of the extra expenditure.

3) One effect of the Ed Op Bank may be to reduce the amount of private scholarship aid from colleges and foundations. It seems likely that these institutions will reallocate these funds toward current purchases of goods and services rather than saving them by adding to their endowments. This will be another autonomous addition to demand, and will generate 225 per cent of itself as an addition to total demand.

4) Some part of the Ed Op loans may replace federal scholarships or private loans. This part we assume will generate no increase in total demand directly. From the point of view of the Federal government, its own use of funds should be included in its tax calculations anyway. The decrease in demand for loans from the private capital market may have a small effect on total spending by lowering interest rates, but this will not be large.

Finally, repayments will act on the other side, by decreasing the demand for goods and the pressure on resources. If we assume that repayments will have the same effects on expenditures as ordinary taxes, every dollar of repayments will decrease total demand by about \$1.75.

The total increase in aggregate demand attributable to the program is calculated from the following formula:

Total increase in excess demand =

- 1) 140 per cent of net increase in expenditures on education
- + 2) 225 per cent of displaced family support
- + 3) 225 per cent of decrease in private scholarships
- 4) 175 per cent of repayments.

A tax increase lowers aggregate demand both directly and through the multiplier effect described above. The usual estimate is that every dollar of extra taxes decreases total demand by \$1.75, which we used in calculating the effect of repayments. If we divide the total increase in demand by this figure we get the fiscal impact of the program:

Fiscal impact = (approximately)

- 1) 130 per cent of displaced family support
- 2) repayments
- + 3) 125 per cent of decrease in private scholarships
- + 4) 80 per cent of net increase in expenditures on education.

We have tabulated in the following section the yearly fiscal impact of the Ed Op Bank on different assumptions about the size of loans. The projection that seems to us most likely to be near the truth gives a fiscal impact of \$2.1 billion in 1969, reaching a peak of \$15.2 billion in 1977 and declining to \$9.5 billion by 1984 as a consequence of increased repayments. In this section, we have ignored the effect due to the nation's increased productive capacity resulting from a more highly educated labor force. Therefore, our calculations of fiscal impact of the Bank are more overstated for the later years of Bank operation.

The fiscal impact of the Ed Op Grant program discussed in Section VII is easier to calculate, since no repayments are involved, and it is unlikely that poorer families will reduce their saving. If the Ed Op Grant goes to a person who would otherwise be working, the fiscal impact

will be 80 per cent of the value of the grant (see category 4 above). If the Grant goes to someone who would not be in the labor force anyway, it is only safe to assume that the 130 per cent figure of category 1 would apply. The fiscal impact of the grants will be very similar to that of the loans in the early years, but as repayments begin it is obvious that the loans will start to pay part of their own way, while the grants will continue as direct subsidies.

VI. THE SIZE OF THE PROGRAM:
NEW LOANS, OUTSTANDING LOANS,
AND FISCAL IMPACT

The projected size of the program depends on:

1) Estimates of the number of borrowers (based on the projections of total enrollments described in Section IV) and an estimate of the proportion of students using loans.

2) An estimate of the average loan authorization which will be the sum of projected tuition and fees and projected subsistence costs.

3) An estimate of repayments, which will depend on the rate of return the Bank demands on its operations, since that determines the tax rate per thousand dollars borrowed for each cohort.

4) An estimate of the proportion of loans going to students who would not otherwise have gone to college, since this proportion has an effect on fiscal impact.

There is no reliable guide to the number of borrowers. We feel that the loans will be attractive because of their insurance feature and the guaranteed ceiling on interest rates. In Table VI.1 we assume that eventually 80 per cent of all students will borrow the full cost of their education from the Bank, but that this level will be reached gradually and linearly over the first five years. (That is, 16 per cent in the first year, 32 per cent in the second year, and so on.)

There are somewhat better projections

available for tuition and fees at private and public universities. For private institutions we have extended the U.S. Office of Education's *Projections of Educational Statistics to 1975-76 to 1984-85*. This same source projects tuition at public universities, but we think it likely that these projections underestimate the probable real increases in tuition and fees at public institutions. To correct for this we assume in Table VI.1 that after the initiation of the Ed Op Bank in 1969 the public universities will begin to raise tuition by the same amount per year as the private institutions, but will maintain the absolute difference between their charges and private tuition. For a more thorough discussion of tuition projections, see the Appendix to this section.

To tuition charges we add subsistence costs. These have been estimated for 1965 by a method described in the Appendix and projected to 1984 by multi-

TABLE VI.1 *
(Billions of Dollars)

Year	New Loans	Repayments	Out-standing Loans	Fiscal Impact †
1969	1.620	0.000	1.620	2.106
1970	3.435	0.000	5.054	4.465
1971	5.510	0.008	10.556	7.154
1972	7.886	0.045	18.397	10.206
1973	10.557	0.177	28.777	13.546
1974	11.245	0.415	39.606	14.202
1975	11.950	0.797	50.759	14.738
1976	12.630	1.326	62.063	15.093
1977	13.290	2.042	73.311	15.234
1978	13.968	2.936	84.344	15.223
1979	14.664	4.058	94.950	15.005
1980	15.301	5.405	104.845	14.485
1981	15.892	6.876	113.862	13.783
1982	16.382	8.626	121.617	12.670
1983	16.605	10.715	127.507	10.871
1984	16.796	12.331	131.972	9.503

* $T = 40$, $r = 4.5$ per cent, $R = 6.5$ per cent, $\bar{W} = \$4,075 (1.045)^{T-1965}$,
Participation rate gradually increasing to 80 per cent.

† Assumed to be equal to 130 per cent of displaced family support plus 80 per cent of net increase in expenditures on education minus repayments. See Section V of this report. Changes in scholarship support are ignored for purposes of calculations presented in this section.

plying by our assumed rate of inflation of 1.9 per cent per year. The basic figure for 1965 is \$1490, which rises to \$1606 by 1969 and to \$2130 by 1984.

Repayments in Table VI.1 are calculated on the premise that the tax rate will be set to realize a 4.5 per cent return on the Bank's loans to each cohort, with an opt-out rate of 6.5 per cent. The cut-off income \bar{W} above which married women repay on the basis of their own income rather than family income is set equal to mean college-educated female income; the repayment period T is set at 40 years.

It is important to see how sensitive these estimates are to our assumptions. Obviously a change in the number of enrolled students who use loans will change these estimates by the same proportion. If only 40 per cent of those eligible eventually become borrowers, all the estimates would be just halved. If 100 per cent became borrowers, all the estimates of Table VI.1 would be increased by 25 per cent.

TABLE VI.2*
(Billions of Dollars)

Year	New Loans	Repayments	Out-standing Loans	Fiscal Impact
1969	1.625	0.000	1.625	2.093
1970	3.467	0.000	5.092	4.444
1971	5.606	0.008	10.690	7.153
1972	8.103	0.045	18.748	10.271
1973	10.953	0.178	29.522	13.736
1974	11.744	0.421	40.845	14.430
1975	12.525	0.813	52.557	14.982
1976	13.261	1.361	64.458	15.334
1977	13.954	2.109	76.303	15.449
1978	14.667	3.043	87.927	15.402
1979	15.397	4.216	99.108	15.137
1980	16.066	5.627	109.546	14.556
1981	16.687	7.168	119.066	13.784
1982	17.201	9.000	127.266	12.586
1983	17.435	11.190	133.511	10.680
1984	17.635	12.882	138.264	9.228

* $T = 40$, $r = 4.5$ per cent, $R = 6.5$ per cent, $\bar{W} = \$4,075 (1.045)^{t-1965}$,
Participation rate gradually increasing to 80 per cent,
Induced enrollment increase gradually approaching 5 per cent.

Table VI.2 shows the effect of an induced 5 per cent increase in enrollments on the size of the program. Again, 80 per cent of the enrollers are assumed to borrow, but all of the added students are assumed to be among this 80 per cent. This merely changes the fiscal impact from \$9.5 billion in 1984 to \$9.2 billion.

TABLE VI.3*
DRAMATIC INCREASE IN PUBLIC TUITION
(Billions of Dollars)

Year	New Loans	Repayments	Out-standing Loans	Fiscal Impact
1969	2.152	0.000	2.152	2.797
1970	4.610	0.001	6.761	5.992
1971	7.469	0.011	14.219	9.698
1972	10.760	0.061	24.918	13.927
1973	14.453	0.239	39.132	18.550
1974	15.443	0.562	54.013	19.513
1975	16.464	1.082	69.395	20.321
1976	17.458	1.806	85.047	20.889
1977	18.427	2.789	100.686	21.166
1978	19.426	4.019	116.092	21.234
1979	20.456	5.567	130.982	21.026
1980	21.407	7.432	144.957	20.397
1981	22.298	9.475	157.780	19.512
1982	23.050	11.911	168.919	18.054
1983	23.432	14.826	177.525	15.635
1984	23.765	17.091	184.199	13.804

* $T = 40$, $r = 4.5$ per cent, $R = 6.5$ per cent, $\bar{W} = \$4,075 (1.045)^{t-1965}$,
Participation rate gradually increasing to 80 per cent,
Public tuition initially increased to projected private rate until projected public tuition is equal to projected public instructional costs. See public tuition scheme (3) in Table VI.A-2 in the Appendix to this section.

Table VI.3 shows the effect of a dramatic initial increase in public tuition to the levels of private tuition but not exceeding projected public instructional cost per student. This naturally increases the size of the program. If the public institutions follow this policy, outstanding loans would be \$184.2 billion by 1984. In 1969, fiscal impact would be \$2.8 billion, rising to a peak of \$21.2 billion in 1978, and falling to \$13.8 billion in 1984.

If the Bank operates with more of a subsidy element, and lowers tax rates

TABLE VI.4*
(Billions of Dollars)

Year	New Loans	Repay-ments	Out-standing Loans	Fiscal Impact
1969	1.620	0.000	1.620	2.106
1970	3.435	0.000	5.054	4.465
1971	5.510	0.006	10.558	7.156
1972	7.886	0.035	18.408	10.216
1973	10.557	0.142	28.824	13.582
1974	11.245	0.332	39.736	14.286
1975	11.950	0.635	51.051	14.899
1976	12.630	1.067	62.614	15.351
1977	13.290	1.633	74.270	15.643
1978	13.968	2.333	85.906	15.825
1979	14.664	3.235	97.335	15.828
1980	15.301	4.312	108.323	15.578
1981	15.892	5.466	118.749	15.193
1982	16.382	6.853	128.277	14.442
1983	16.605	8.480	136.402	13.105
1984	16.796	10.297	142.900	11.537

* $T = 40$, $r = 4.0$ per cent, $R = 6.5$ per cent, $\bar{W} = \$4,075 (1.045)^{t-1965}$,
Participation rate gradually increasing to 80 per cent.

TABLE VI.5*
(Billions of Dollars)

Year	New Loans	Repay-ments	Out-standing Loans	Fiscal Impact
1969	1.620	0.000	1.620	2.106
1970	3.435	0.001	5.054	4.464
1971	5.510	0.011	10.552	7.151
1972	7.886	0.063	18.376	10.189
1973	10.557	0.249	28.683	13.474
1974	11.245	0.597	39.331	14.021
1975	11.950	1.149	50.132	14.386
1976	12.630	1.906	60.856	14.513
1977	13.290	2.930	71.215	14.246
1978	13.968	4.195	80.989	13.964
1979	14.664	5.823	89.830	13.240
1980	15.301	7.762	97.368	12.128
1981	15.892	9.878	103.382	10.781
1982	16.382	12.049	107.715	9.247
1983	16.605	14.015	110.305	7.571
1984	16.796	16.301	110.799	5.533

* $T = 40$, $r = 6.0$ per cent, $R = 8.0$ per cent, $\bar{W} = \$4,075 (1.040)^{t-1965}$,
Participation rates gradually increasing to 80 per cent.

until it realizes 4 per cent (instead of 4.5 per cent) on its loans, repayments would decline and fiscal impact increase, as we show in Table VI.4. If the Bank realizes

a rate of return $r = 6.0$ per cent and raises the opt-out interest rate to 8.0 per cent, then the size of the program is as shown in Table VI.5. For this high rate-of-return scheme, fiscal impact reaches a peak of \$14.5 billion in 1976, while falling to only \$5.5 billion by 1984.

APPENDIX

The new loans estimates are arrived at by multiplying the enrollment projections derived in Section IV by the proportion of students using the program and then multiplying this product by the sum of subsistence and tuition charges, weighted by the proportions attending public and private institutions. We have performed calculations on the basis of two separate projections of participation.

Participations:

1) 80 per cent participation is reached gradually and linearly in five years. That is to say, 16 per cent in 1969-70, 32 per cent in 1970-71, 48 per cent in 1971-72, 64 per cent in 1972-73, and 80 per cent from 1973-74 on. Calculations based on this assumption appear in Table VI.1.

2) 100 per cent is reached gradually and linearly in five years. Calculations based on this assumption appear in Table VI.A-1.

Our main source for tuition data is: U.S. Office of Education: *Supplement to Projections of Educational Statistics to 1975-76, Basic Student Charges*. These projections are made separately for undergraduate level in private institutions of higher learning and for resident (of state) undergraduate students in public institutions of higher learning. These projections are regressions of per student average charges in fixed 1965-66 dollars against time, fitted to data from 1961-62, 1962-63, 1963-64, 1964-65. The two regression lines are:

- 1) Private charges = $1,335 + 50.5(t-1969)$;
- 2) Public charges = $278 + 6.0(t-1969)$.

The Private Projections

The trends projections show that tuition will cover 75-80 per cent of the educational expenditures by 1975-76, and more in subsequent years. For this reason we have used the trends projections alone for private institutions of higher learning, but we have ad-

justed the regression line for 1.9 per cent assumed inflation. The formula is:

$$\text{Average private tuition charge} \\ = [1,335 + 50.5(t-1969)]1.019^{(t-1965)}$$

Public Tuition Projections

Our first problem is to adjust the regression line to reflect nonresident of state students' charges as well as the resident of state students' charges.

In 1963-64 institutional median tuition and required fees were \$191 for residents and \$449 for nonresidents (see U.S. Office of Education: *Higher Education Basic Student Charges 1963-64*). In the same year non-resident enrollment was about 10 per cent (see U.S. Office of Education: *Resident and Migration of College Students*, Fall 1963 State and Regional Data). Now if average per student data were related to each other as institutional medians are, the over-all average should have been 15 per cent higher than the residents' average. Adjustment for this factor has been made by raising the intercept of the regression line in the year 1965 by 15 per cent, leaving the slope unchanged.

To allow for possible changes in public tuition policies we have made three projections for public tuition charges:

Public Projection (1) is the regression line (1) adjusted to reflect nonresidents as well as residents. The formula is:

$$\text{Public (1)} = [292 + 6(t-1965)]1.019^{(t-1965)}$$

This projection is used for Tables VI.1, VI.2, VI.4, VI.5, and VI.A-1.

Public Projection (2) is the above adjusted regression up to 1969-70, but from then on we assume a higher slope, equal to the slope in the private tuition line. The formula is:

$$\text{Public (2)} = [332 + 50.5(t-1969)]1.019^{(t-1965)}$$

This projection is used in Table VI.A-4.

Public Projection (3): To get a maximum for public tuition, we take the public charges to be equal to the private projection. But after the early 1970's this projection gives figures higher than the projected educational expenditure per student in public institutions of higher learning. For our maximum we project public charges as being equal to private charges from 1969-1972, and from then on as equal to projected per-student

costs in public universities, as estimated by the regression:

$$\text{Average cost per student} \\ = 1094 + 22.1(t-1954).$$

This projection is used in Table VI.3.

These three different projections of public tuition give three different estimates for the size of the program, which we call Public

TABLE VI.A-1*
(Billions of Dollars)

Year	New Loans	Repay-ments	Out-standing Loans	Fiscal Impact
1969	2.025	0.000	2.025	2.632
1970	4.294	0.000	6.318	5.581
1971	6.887	0.010	13.195	8.943
1972	9.858	0.057	22.996	12.758
1973	13.196	0.221	35.971	16.933
1974	14.056	0.519	49.508	17.753
1975	14.937	0.996	63.449	18.422
1976	15.787	1.657	77.579	18.866
1977	16.612	2.553	91.639	19.043
1978	17.461	3.670	105.430	19.029
1979	18.330	5.072	118.688	18.757
1980	19.126	6.757	131.057	18.106
1981	19.865	8.595	142.327	17.229
1982	20.477	10.782	152.022	15.838
1983	20.756	13.394	159.384	13.589
1984	20.995	15.414	164.965	11.879

* $T = 40$, $r = 4.5$ per cent, $R = 6.5$ per cent, $\bar{W} = \$4,075 (1.045)^{t-1965}$,
Participation rates gradually increasing to 100 per cent.

TABLE VI.A-2
(Dollars)

Year	Private Tuition	Public Tuition		
		(1)	(2)	(3)
1969	1460.	340.	357.	1460.
1970	1544.	353.	420.	1544.
1971	1630.	367.	484.	1630.
1972	1718.	381.	551.	1701.
1973	1810.	395.	620.	1759.
1974	1904.	409.	692.	1819.
1975	2001.	425.	766.	1880.
1976	2101.	440.	843.	1943.
1977	2204.	456.	922.	2008.
1978	2311.	472.	1004.	2074.
1979	2420.	489.	1089.	2142.
1980	2533.	506.	1177.	2212.
1981	2650.	524.	1267.	2284.
1982	2770.	542.	1361.	2358.
1983	2893.	561.	1457.	2434.
1984	3020.	580.	1557.	2512.

Tuition 1, Public Tuition 2, and Public Tuition 3. These three projections for public tuition and our private tuition estimates are shown in Table VI.A-2.

Our projection of subsistence costs is based on: Ernest V. Hollis and Associates; *Costs of Attending College* (U.S. Office of Education

TABLE VI.A-3
PROJECTION OF AVERAGE ANNUAL
SUBSISTENCE COST

Year	Projected Cost (in Dollars)
1969	1606.
1970	1637.
1971	1668.
1972	1699.
1973	1732.
1974	1765.
1975	1798.
1976	1832.
1977	1867.
1978	1903.
1979	1939.
1980	1976.
1981	2013.
1982	2051.
1983	2090.
1984	2130.

TABLE VI.A-4*
PUBLIC TUITION PROJECTION (2)
(Billions of Dollars)

Year	New Loans	Repay- ments	Out- standing Loans	Fiscal Impact
1969	1.628	0.000	1.628	2.116
1970	3.500	0.000	5.128	4.550
1971	5.692	0.008	10.812	7.391
1972	8.257	0.046	19.023	10.687
1973	11.200	0.182	30.041	14.378
1974	12.086	0.431	41.696	15.280
1975	13.009	0.832	53.872	16.079
1976	13.923	1.395	66.400	16.704
1977	14.833	2.166	79.067	17.116
1978	15.780	3.137	91.710	17.377
1979	16.765	4.367	104.108	17.427
1980	17.700	5.861	115.947	17.149
1981	18.597	7.513	127.031	16.662
1982	19.387	9.494	136.924	15.709
1983	19.872	11.882	144.914	13.952
1984	20.321	13.757	151.478	12.660

* $T = 40$, $r = 4.5$ per cent, $R = 6.5$ per cent, $\bar{W} = \$4,075 (1.045)^{T-1965}$.

Participation rate gradually increasing to 80 per cent.

Bulletin, 1957, No. 9). We take their total capital and current expenditure figures for 1952-53 (not including meals and rent at parents' home), subtract tuition, take a simple average between public and private institutions of higher learning, project up to 1965 by cost-of-living index adjustment, and from then on by assumed inflation of 1.9 per cent annual rate. The figure for 1965 is \$1490. This subsistence cost estimate is shown in Table VI.A-3.

VII. EDUCATIONAL OPPORTUNITY GRANTS FOR HIGHER EDUCATION

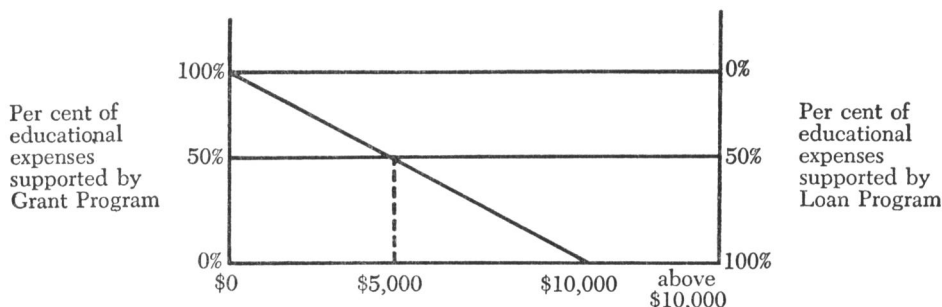
The Program

As a variant of the Ed Op Bank, it has been proposed that students be given a grant to cover the expenses of tuition, fees, room and board, and other subsistence costs for the first two years of college, with the proportion of the expenses to be paid by the grant depending directly upon the size of family income.¹ For example, if a limit of \$10,000 were set on the family income of grant recipients, a student whose family income was \$10,000 or greater would receive no grant; a student whose family income was \$5,000 would receive half of his educational expenses as a grant; a student whose family income was \$2,500 would receive three-quarters of his educational expenses as a grant.

The possible complementarity of the grant and the loan programs is illustrated in Figure VII.1, below, where the maximum family income is assumed to be \$10,000 and where all educational expenses are included in the grant so that the grant and the loan programs are commensurate. Since there is a positive relationship between parents' income and the

¹ Such a grant program was proposed by Jerrold R. Zacharias at a Washington, D.C. press conference held on September 7, 1967. Zacharias proposed that Ed Op Grants be considered as a possible program that would complement the goals and activities of an Ed Op Bank. A similar grant program for higher education has been proposed by the New York State Board of Regents.

FIGURE VII.1



student's expected lifetime income, the existence of the loan program is likely to enable the Ed Op Bank to have a lower repayment tax rate while "breaking even" at the same interest rate.

The Costs

The costs of such a program do not seem excessive, particularly if the program is limited to tuition and fees. A grant program of this nature would cost the Treasury approximately \$600 million if instituted in 1968 for the coming year. In spite of the sizeable projected increases in tuition costs and students, by 1975 the costs of such a program should have risen to only \$950 million because of the secular growth in income. Thus a grant program for tuition and fees would probably cost the Treasury no more than \$1 billion annually.

If the program were expanded to include room and board expenses, costs would probably double, since the costs of a room and board program lie between \$800 and \$900 million annually. If the program were further expanded to include some subsistence costs, the annual program costs would probably increase by another \$400 to \$500 million. Finally, increasing the maximum family income to \$12,500 should increase these estimated costs by 30 per cent; increasing the maximum family income to \$15,000 should increase these costs by 50 per cent.

The relative constancy of the annual costs of the grant program may appear surprising and reflects the influence of

the fixed maximum family income. As incomes rise over time, an increasing proportion of families become ineligible for an Ed Op Grant based on a fixed maximum family income. Thus over time, the grant program affects fewer and fewer families. For example, in 1967 approximately 30 per cent of all students would be eligible to receive at least 50 per cent of their educational expenses as a grant if the maximum family income were set at \$10,000. By 1975 this proportion is projected to fall to approximately 20 per cent. Similarly, in 1967 approximately 30 per cent of all families would be ineligible to receive any grants. By 1975 this proportion is projected to rise to 45 per cent. As an alternative to the fixed maximum income, the government could specify an increasing maximum that would ensure an approximately constant distribution of grant funds (i.e., if the bottom 15 per cent of all families could receive at least 75 per cent of their educational expenses as a grant in 1967, in 1975 the bottom 15 per cent of all families could still receive at least 75 per cent of their educational expenses as a grant, even though their absolute income levels would have risen substantially). If this variant of the grant program were adopted, the costs of the grant program in 1975 would be increased by approximately 50 per cent.

To summarize briefly, a modest program, based on a maximum family income of \$10,000 and providing grants for tuition alone, should cost the Treasury no more than \$1 billion annually. How-

ever, a generous program, based on a maximum family income of \$15,000 and providing grants for all expenses, could cost the Treasury as much as \$3 billion annually. Finally, if an increasing income maximum were adopted to maintain a constant distribution of grants, the annual costs of the modest program would probably rise to \$1.5 billion by 1975, while the annual costs of the generous program would probably rise to \$4.5 billion by 1975.

Some Difficulties

An Ed Op Grant program is attractive because it makes higher education more available to students of low income families than the Ed Op Bank program. Effectively, it acts to reduce the repayment rate on any Ed Op loans taken out in the first two years of college, and thus further subsidizes the education of students from low income families. Insofar as income redistribution of this sort is thought to be desirable, the Ed Op Grants appear to provide a reasonable means of redistribution. Essentially, they make a student's repayment rate depend not only on his own future income, but upon his family's present income. However, the grant program presents certain difficulties, which must be considered and evaluated before the program can be recommended.

1. A general subsidy to higher education can be defended on the grounds that the social benefits of higher education are greater than the private benefits. The private market mechanism fails to allocate sufficient resources to higher education and too few people pursue post-secondary education. By making low interest contingent loans, the Ed Op Bank is clearly providing a subsidy to higher education and thus channeling additional resources into it. However, in adding a grant program to the Ed Op Bank, questions of economic efficiency and income redistribution become blurred. Low income students receive a greater subsidy and thus should be rela-

tively more attracted to higher education. Unless their social productivity is greater than that of their higher income contemporaries, however, it is possible that such a grant program could encourage excessive investment in higher education on the part of these students. Thus it may be better to keep the questions of efficiency and redistribution separate and to provide direct payments to low income families and let them decide how best to use it.

2. The large number of married students could create considerable difficulties for the grant program unless family income is defined very carefully. Under usual IRS definitions, family income should refer to the income accruing to the family unit, consisting of the head of the household and his wife. As long as the college-age children receive one-half of their support from the family, they remain legal dependents and can be considered part of the family unit. However, under usual IRS procedures, their income is not included in family income, although it seems clear that the total income of the family unit should be used in the grant program's means test. However, once a student marries, he is not usually considered to be part of his parents' family unit. This immediately poses problems. If the married student and spouse is considered to be the appropriate family unit, its income should be quite low. The grant program would have to subsidize not only the disadvantaged students, but also student marriages, regardless of their parents' income. Obviously if this definition of family income were used the grant program would mushroom, reducing the viability of the bank. As an alternative, family income could be taken to be total family income, consisting of the income of the married students and both of their parents. This, however, could create obvious difficulties if one set of parents was well-off relative to the other, and would effectively place the burden of higher

education of both spouses on the wealthier set of parents. Only if each spouse were still considered to remain part of the family unit of his or her respective parents would the grant payments remain the same before and after marriage. This would appear to bring up some tricky legal problems and certainly goes against the usual notions of dependence.

3. The grant program also creates considerable problems of incentives. For example, consider a man who earns \$5,000, with three children in the first two years of college, each with total educational expenses of \$4,000. Under the grant provisions, the family unit would receive a grant equal to \$6,000. Suppose, however, that each student works in the summer and earns \$1,000. Then family income rises to \$8,000; the grant is reduced to \$2,400. Thus an increase of income of \$3,000 has led to a reduction in grant money of \$3,600, representing a marginal rate of tax of 120 per cent. Clearly, the grant program creates considerable disincentives for either the parents or the children to perform any additional work. Consequently, the grant program would appear to undermine other efforts to increase the incomes of low-income families with college-age children.

4. Furthermore, family income may not be a good indication of ability to pay. Consider, for example, the man earning \$10,000 with three college-age children and the man earning \$7,500 with one college-age child. It seems reasonable to think that the first family has a smaller ability to finance higher education than the latter. Yet under the grant plan, the first family would receive no grant, while the second would receive one. Perhaps a per student means test would be preferable to a family means test.

5. Finally, the grant program seems to undermine one of the goals of the Ed Op Bank to make students responsible for their own education. By relating the size of the needed loan to the size of the family income, the student's independ-

ence is somewhat reduced. Thus the two programs do not appear to be entirely consistent.

At this point it is difficult to say if these problems create insurmountable difficulties for the grant program. However, they must be carefully evaluated before the program is recommended. But the problems of income definition and incentives may be sufficiently great to bring the desirability of such a plan into question.

APPENDIX

ILLUSTRATION OF THE PROCEDURE FOR DETERMINING THE COST TO THE TREASURY OF A GRANT FOR THE FIRST TWO YEARS OF COLLEGE

Two Major Components:

- I. Number of students by distribution of family income, 1967-1975
 - II. Cost per student, 1967-1975
- I. Number of students by distribution of family income, 1967-1975.
 1. Distribution of personal income for 1967-1975 was estimated by assuming the same average rate of change in each of five income classes as existed in the 1960-1965 period.
 2. The distribution of family income for each of four classes of high school graduates categorized by college plans and actual attendance in 1960 was taken from *Factors Related to College Attendance of Farm and Non-Farm High School Graduates: 1960*, Census Series—ERS (P-27), No. 32, p. 15.
 3. It was assumed that the relationship between the distribution of family income in each of the four plans and attendance categories and the distribution of personal income would be the same over the 1967-1975 period as it was in 1960. Given this assumption, the distribution of family income of each of the plans-attendance groups was established for 1967-1975.
 4. The number of high school graduates for 1966-1974 was taken from *Projections of Educational Statistics to 1975-1976* (1966 edition), U.S. Department of Health, Education, and

- Welfare, p. 25. The high school graduates were divided into plans-attendance groups in the same proportions as existed in 1960 (*Factors Related to College Attendance*, p. 15).
5. The following assumptions were made with respect to the effect of the program on each of the four plans-attendance categories if the program were instituted in 1967.
 - A. All planners-attenders and non-planners-attenders would attend.
 - B. Of planners-nonattenders all would attend *except*
 - a. Those not admitted
 - b. Those drafted into military service
 - c. Two-thirds of those who were married
 - d. Two-thirds of those "needed at home"
 - e. One-third of those who took jobs
 - f. Two-thirds of those who gave "other" as their reason for not attending.
 - C. Of the nonplanners-nonattenders all would attend *except*
 - a. Two-thirds of those with "no desire"
 - b. Assumptions *a* through *f* under B.
 6. On the basis of these assumptions and the percentage distributions of reasons given for not attending as appearing in *Education Status, College Plans, and Occupational Status of Farm and Non-Farm Youths: October, 1959*. Census Series—E.R.S. (P-27), No. 30, Table 13, p. 25, estimates were made of the number of college freshmen in each of the plans-attendance groups for 1967-1975.
 7. The following assumptions were made with respect to the relationship of first and second year students.
 - A. Twenty per cent dropout by the end of the first year. (See Robert E. Iffert, *Retention and Withdrawal of College Students*. Washington: Department of Health, Education and Welfare, 1958.)
 - B. Of these it was assumed that one-third leave for financial reasons (i.e., these would remain under the grant proposal).
 - C. Of the remaining 14 per cent, one-half would plan to return and one-half of these would actually do so. It was further assumed that 25 per cent of those returning would do so after one year, 50 per cent after two years and the remaining 25 per cent after three years.
 - D. Finally it was assumed that second-year students would be divided among plans-attendance groups in the same proportions as first-year students.
 8. Thus, estimates of the total number of first- and second-year students in each plans-attendance category for 1967-1975 were made. These were divided between public and private colleges in the proportions appearing in *Projections*, p. 5.
 9. For each plans-attendance group the percentage of students in each income class was multiplied by the percentage of total number of students which were in that group. These percentages were summed over plans-attendance groups for each income class. These percentages were then applied to the total number of students (public and private separately) to determine the distribution of students by family income for public and for private institutions.
- II. Cost per student to the Treasury.
1. Costs of tuition-fees and room-board were taken from supplement to *Projections*, and inflated into current dollars by assuming a rate of growth of the CPI of 1.90 per cent per year.
 2. Costs of tuition-fees for public institutions were adjusted upwards to account for the effect of the program by assuming that
 - A. In 1970 the tuition charges of public institutions would begin to rise as rapidly as those of private institutions.
 - B. In the years 1968/69 and 1969/70 the trend of public tuition charges would rise somewhat to approach the 1970 rate of increase.

3. It was assumed that if the program were instituted the Treasury would pay the following proportions of education costs of the five income classes:

Under \$4,000—80%
 \$ 4,000— 5,999—50%
 6,000— 7,499—32.5%

7,500— 9,999—12.5%
 10,000 and over—0%

In general the median of each class was used and the formula $(1 - Y_i/Y_{max})$ was applied to determine the above percentages where Y_i = the particular class median and Y_{max} = \$10,000.

TABLE VII.A-1

ANNUAL COSTS OF AN ED OP GRANT PROGRAM
 BASED ON MAXIMUM FAMILY INCOME OF \$10,000

	1967	1968	1969	1970	1971	1972	1973	1974	1975
Total 1st and 2nd year students (1,000's)									
Private	1,174.7	1,172.6	1,191.4	1,221.5	1,251.2	1,271.5	1,284.6	1,302.6	1,314.7
Public	2,341.3	2,402.3	2,497.1	2,607.4	2,721.1	2,817.0	2,913.5	3,010.4	3,096.9
Distribution of Family Income (percentage)									
Less than \$4,000 ...	16.8	16.1	15.7	14.8	14.0	13.2	12.8	11.9	11.1
\$ 4,000—\$5,999 ...	15.3	14.4	13.7	12.8	11.9	11.5	10.6	9.6	9.7
\$ 6,000—\$7,499 ...	13.5	12.5	11.6	10.6	10.0	9.2	8.6	8.6	7.5
\$ 7,500—\$9,999 ...	21.8	22.5	22.9	23.6	24.2	24.6	25.3	25.6	25.7
\$10,000 and over ...	32.6	34.4	36.1	38.2	39.8	41.5	42.7	44.3	45.9
Costs (\$/student)									
Tuition									
Public	257	279	319	379	440	504	570	638	710
Private	1,214	1,309	1,406	1,488	1,570	1,654	1,742	1,832	1,927
Room and Board									
Public	733	768	796	824	852	881	910	941	971
Private	846	878	911	939	968	998	1,021	1,059	1,092
Costs to Treasury (millions of dollars)									
Tuition									
Public	174.9	186.8	211.1	252.7	292.8	329.2	373.0	408.0	443.1
Private	412.7	529.6	444.5	465.1	480.3	487.5	503.0	506.6	510.4
Total	587.6	616.4	655.6	717.8	773.1	816.7	876.0	914.6	953.5
Room and Board									
Public	496.6	513.9	527.4	549.9	566.8	575.2	596.8	597.7	606.4
Private	287.6	286.7	288.0	293.7	296.3	294.3	296.9	292.9	286.0
Total	784.2	800.6	815.4	843.6	863.1	869.7	890.6	872.4	

VIII. SUGGESTIONS FOR FURTHER RESEARCH

While this study has, we hope, contributed to our understanding of the economics of the Ed Op Bank, there remain a number of problems of varying degrees of importance that may well merit further investigation.

1. Our analysis has focused on the proposal in terms of its effects on students and on society as a whole. We have considered the problem from the point of view of student support, student incentives, and returns to students, rather than from the point of view of effect on universities and of university behavior. This

leaves a number of questions unanswered.

Chief among these are questions relating to the future of tuition charges and other means of support in private and public universities. While we have tried to make alternative assumptions sufficiently wide-ranging so as to ensure realism for our results, we have been unable to study in any detail the likely effect of the Ed Op Bank on the financing of institutions of higher learning. Aside from the effect of this on our calculations (which, as indicated, we have tried to take into account), there are other prob-

lems raised which ought to be studied.

2. For example, we have argued that the Ed Op Bank will contribute to the efficient allocation of resources by improving the performance of the existing imperfect capital market. Whether this will in fact lead to a more sensible use of resources, however, will depend in part on whether tuition charges to students will actually reflect the costs of the resources involved in their education. At present that is clearly not the case in public institutions and it is at least questionable whether it is in private ones where research and education are jointly produced. Were tuition charges to remain below cost, then the removal of the imperfection in the capital market might simply remove a barrier to an over-use of an inefficiently priced resource.

Indeed, it may be the case that rather than too few resources, too *many* resources already are being devoted to higher education. This is suggested by comparison of crude estimates of the return to physical capital and to education. While such comparisons are not without difficulties they suggest strongly that this problem should be carefully studied.

3. Next, the possible effects of the program on the relative positions of public and private institutions ought to be studied. The Panel on Educational Innovation suggests (page 6 of their report) that the Ed Op Bank will tend to help private institutions overcome the increasing problems which they now face in view of the fact that they are not subsidized as are public institutions. It is not at all clear whether this will happen. If state legislatures, for example, do not (1) decrease their support of public institutions by the amount of increased tuition payments received from students borrowing under the Ed Op Bank, or if (2) they do not raise tuition to fully cover costs, then it is possible that public institutions will be strengthened relative to private institutions by the adoption of

the Ed Op Program. This might lead to a situation in which public institutions became very advantageously placed relative to private ones and were thus able to attract faculty and students away from private institutions. Whether this will in fact happen depends on the behavior of state governments and of those organizations financing private institutions. This behavior has not been studied in the present report.

4. Our analysis of the costs and benefits of the Ed Op Bank has been largely qualitative. We have given quantitative attention in detail only to the magnitude of the program, its costs to the federal government, and its impact on national fiscal and monetary policy. Discussion of benefits to society has not involved the calculation of actual magnitudes. This is clearly an important area for further research. Such research should cover such questions as: a) How large a misallocation of resources due to present underpricing of education and scholarship grants to students together with imperfections in the capital market would in fact be corrected by the Ed Op Bank? b) What would be the *quantitative gain* to society from the insurance features of the Ed Op Bank program? c) What would the quantitative effects be on self-selection of students if the opt-out rate were raised? This would be especially important if it seems desirable that the Ed Op Bank should earn a higher rate of return than contemplated in our calculations. d) Perhaps most important of all, how many students are there who would go to college were the Ed Op Bank in operation but cannot now do so because of lack of funds? The answer to the last question (and therefore to the others) may turn on whether in fact financing is an effective barrier to higher education. If it is the case that substantial numbers of students from poor families would not go to college even if financing were available, then the immediate impact of the Ed Op Bank in

producing more educated people may be very small. On the other hand, it may be the case that family and class attitudes opposed or indifferent to higher education would be gradually changed as financing became generally available and college attendance a more usual affair. This should clearly be studied.

5. In addition there are some less broad (and easier to answer) though still important questions which might be investigated. Among these are: (a) The economics of Ed Op Banks for professional and graduate schools. (b) The question of what charges should be made to older people who do not enter college immediately after high school. Should they be charged the same rate on their income for borrowing from the Ed Op Bank or should they be charged a higher rate? If so, what rate? Will the institution of the Ed Op Bank program induce

many such people to enter college? (c) What would be the effects of a modification in the program in which loans made to seniors were taxed for repayment purposes differently from loans made to freshmen? Seniors have a higher probability of receiving their degree successfully than do freshmen and thus have higher expected lifetime earnings. Further, they are closer to the beginning of repayment than are freshmen. So it may be sensible to tax them differently. (d) Finally, it may be desirable not to have Ed Op Bank repayments a simple percentage of income but to incorporate some progressive features in them. For example, repayments might be made only as a percentage of income over some stated exemption level. If it is thought to be desirable to do this, its effect on the calculations presented in this report should be examined.