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Credit Subsidies in Budgetary Lending */

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I. Introduction

This paper examines the role of interest subsidies in government direct lending, with emphasis on the presentation of a relatively simple technique for measuring the actual financial cost to the government of these subsidies (Section IV). Section III discusses the rationale for credit subsidies and briefly surveys the literature on their probable economic effects. Finally, Section V provides a data checklist for economists who may be interested in calculating credit subsidies in official direct lending for other countries. The Appendices contain calculator programs to use in such an analysis.

Because this area is primarily of empirical rather than theoretical interest, the presumption of the study from the outset has been that its usefulness would be enhanced significantly if it included an application of the method to a specific country's actual lending experience. The Republic of Korea was chosen as the sample country mainly because official lending has been an important aspect of that Government's overall financial policies. The study received the full cooperation and support of the Korean authorities, for which the author is grateful. Since the analysis focuses on the cost side of what is fundamentally an extremely complex cost-benefit problem, while forgoing the more difficult task of quantifying the benefits, the paper should not be interpreted as critical of Korean policies on balance. However, while it is widely recognized that the Korean authorities have pursued successful growth strategies and prudent fiscal policies (fiscal policy has been relatively conservative and was used generally in a countercyclical fashion during the 1970s), they themselves have begun to recognize some of the costs that have resulted from direct central government intervention in the financial intermediation process. Indeed, in the early 1980s, the Korean authorities have already taken some steps toward a more market-determined financial system, which might be considered a natural progression as the economy's structure has become more complex and as successful direct intervention in the resource allocation process has become increasingly difficult. Particularly noteworthy in this regard was the June 1982 decision to eliminate the interest rate differential between policy-directed and other loans in the banking system.

To anticipate the results, using the estimation method derived in the case of the Republic of Korea during the decade of the 1970s, explicit interest subsidies in direct government lending are shown to have been a major determinant of the Korean Government's fiscal position, equal to a minimum of at least half the Central Government's deficit, on average. Moreover, these interest subsidies are found to be growing faster than any other category of expenditure. With more complete loan coverage and inclusion of interest-based tax expenditures, credit subsidies would surely have equalled or exceeded the entire deficit in every year.

II. Overview and Scope of the Study

Because official credit programs generally involve more lenient terms to borrowers than are generally available to them in the market, or in many cases than those at which the government itself borrows, they all contain (1) a pure loan aspect, reflecting the government's role as a financial intermediary, and (2) a distributional aspect, which represents the extent of the interest subsidy. Since interest paid and received both appear above the line in the unified cash budget, the annual cost of these subsidies is reflected in the observed fiscal deficit, but it is nowhere overtly identified. In addition, because these subsidies are spread over the entire lifetime of loans, their true magnitude is easily overlooked or grossly underestimated. 1/

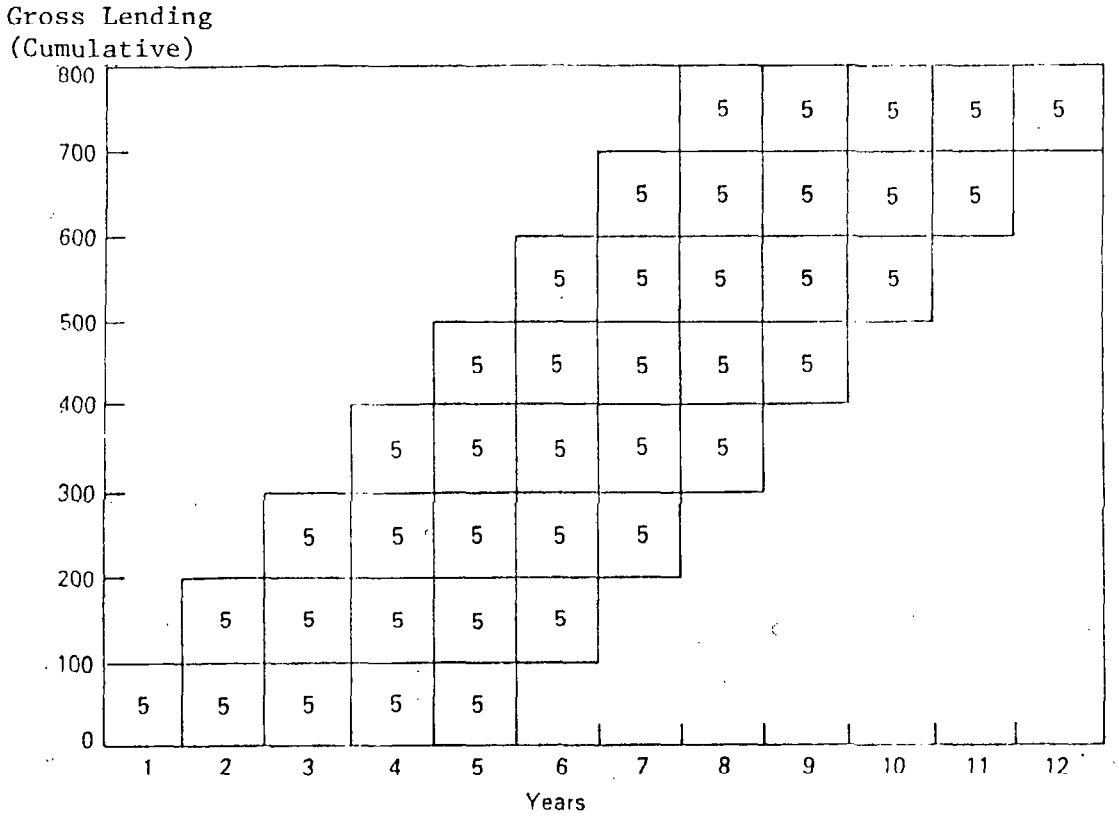
This time dimension of lending is really what distinguishes it from other expenditure items. Since subsidized credit schemes are common in a wide variety of countries, from developing to industrial ones, currently observed fiscal deficits may simply reflect, to a surprisingly large degree, past interest subsidy commitments. Because this process contributes to the creation of long-term structural deficits, the flexibility of fiscal policy may become severely restricted (see Figure 1).

Figure 1 depicts an eight-year government program which annually lends an amount designated as 100 at 5 per cent a year interest. This scheme is financed by government borrowing at 10 per cent a year interest. It is assumed that both the lending and borrowing involve five-year bonds (principal due in one lump sum at maturity, while annual payments of interest only are due prior to maturity); lending occurs on January 1 and repayment on December 31. As can be seen, the annual subsidies grow to an equilibrium level, which remains even after no new net lending occurs and current new loan commitments are being met fully with repayments from past loans (as in years 6-8). The only way these annual subsidies can be stopped is by terminating the program and retiring the debt (years 9-12).

By way of introduction, it may also be of interest to apply to this illustration the method of evaluating the subsidy value developed later in this paper. It should be noted that, in each year in which governmental intermediation is undertaken at these relative terms (years 1-8), the government commits itself to a total interest subsidy of 18.95, which is the present value of the annual subsidy stream discounted at 10 per cent a year, or the government's opportunity cost of funds. Alternatively, the total subsidy being given at the outset of the eight-year program is 111.23. To appreciate the true level of the subsidies being granted, therefore, it is preferable to use these much larger, essentially hidden figures.

1/ See U.S. President's Commission on Budget Concepts (1967), pp. 335-45; and A.S. Carron (1981), p. 269.

Figure 1
THE STRUCTURAL FISCAL BURDEN BUILT INTO
OFFICIAL SUBSIDIZED LENDING PROGRAMS



Annual subsidy	5	10	15	20	25	25	25	25	20	15	10	5
Gross lending	100	100	100	100	100	100	100	100	0	0	0	0
Net lending	100	100	100	100	0	0	0	0	-100	-100	100	-100
Debt outstanding (end period)	100	200	300	400	400	400	400	400	300	200	100	0

Still, the concealed nature of these expenditures does not make them any less subsidies, and, like any outlay, they are always financed by taxes, borrowing, or monetary growth at higher levels than would otherwise have occurred or by other expenditures being lower than they would otherwise have been. However, it may mean that such expenditures are more difficult to control than other expenditures and, by implication, when periods of austerity force budget cuts to be made, they may escape scrutiny because it might be more difficult to defend their retention on allocational or distributional grounds than outlays that are in fact reduced. This is not to argue that all government lending programs should immediately be ended. As Section III explains, there may be circumstances in which the subsidies are appropriate and justifiable. Still, credit subsidies should be required to vie for the limited public resources on an equal basis with other competing claims. This requires, at a minimum, that their true magnitude be known.

Clearly, this is a matter of degree. In many countries, the government intervenes in the financial intermediation process far more pervasively than simply through direct official lending. For example, it may own the banking system, or it may impose deposit and lending rate ceilings throughout the system and differentiate the rates to the relative advantage of certain sectors as a matter of governmental policy. Depending upon how these credit subsidy schemes are financed, they will generate either a larger or smaller supplementary fiscal deficit, which should be added to the conventionally measured one to capture the true aggregate demand impact of fiscal operations. 1/ Because this is a far more intractable issue operationally, it will not be addressed in this study, which is limited to an analysis of direct official lending within the budget.

Similarly, government loan guarantees, which do not affect the cash deficit unless default occurs but which do involve substantial subsidies and governmental intervention in credit markets, are beyond the scope of this study, which again focuses on the likely direct cash cost to the government of credit subsidies. 2/ For other purposes, however (for example, in judging the likely degree of crowding out due to governmental credit activities), the inclusion of loan guarantees as well as gross direct lending is more crucial. Recent reports that the U.S. Government

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1/ The theoretical case for this argument is developed in McKinnon and Mathieson (1981).

2/ In recent years much more work has begun to focus on this important area. For an introduction, see U.S. Congressional Budget Office (1978 and 1979). Methods developed to measure the value of loan guarantees are based on the contingent claims method; see, for example, Jones and Mason, "Valuation of Loan Guarantees" in U.S. Congressional Budget Office (1981 d), pp. 349-77. Other papers in this volume are also of interest.

itself will account for an unprecedented 56 per cent of all funds raised in its national capital markets in 1982 are based on such measures, including all off-budget lending. 1/ In terms of the analysis to be pursued in this paper, such off-budget lending programs certainly should be included in the analysis, with corresponding adjustments made upward in the measured deficit and financing.

Finally, it should be emphasized that the method employed below to separate official lending into its "pure loan" and "cash grant" equivalents is limited to what might be called the expenditure side of the budget. This subsidy mechanism on the outlay side is, in principle at least, completely interchangeable with the operation of so-called tax expenditures on the tax side that result from the tax deductibility of interest income and payments. 2/ However, the two methods are neither equivalent in practice nor in their budgetary treatment. In particular, the relative size of the government sector in the economy would always be smaller if tax expenditures are used. An example may help to clarify the differences; for present purposes, the complications of maturities, discounting, and so on, are dispensed with in the tax expenditure case, since the effect of these is the same from both the tax and expenditure perspectives.

First, let us assume that the government, which pays 7 per cent in its borrowings of similar maturities, makes a direct loan of $100 million to a final borrower at 3 per cent for 15 years, while the best market rate available to this borrower would have been 10 per cent on the same loan. The total amount of the subsidy is 7 per cent annually. This can be further divided into two parts. The explicit portion (4 per cent a year) represents the differential amount the government must actually pay; the implicit portion (3 per cent a year) includes the additional benefit received by the borrower, compared with his opportunity cost. 3/ The focus in this paper is mainly on the explicit part. Assuming a simple annuity structure, the direct cost to the government of this arrangement would involve an interest outlay of just over $39 million in excess of interest income over the period of the loan. Stated in terms of present value of the total debt service (discounted at 7 per cent), such a credit subsidy would be worth about $23.7 million, which is defined as the subsidy (or grant) value of the

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1/ Washington Post, June 5, 1982, p. D9.

2/ This point is made in various places. See, for example, either U.S. Office of Management and Budget (1977), p. 87, or Aragon (1980), p. 374. Also, for an example of how this mechanism works through industrial development bonds or industrial revenue bonds in the United States, see U.S. Office of Management and Budget (1981), pp. 184-86, and U.S. Congressional Budget Office (1981 b).

3/ This distinction is also made in Aragon (1980), p. 373.

loan. 1/ Alternatively stated, at current government interest rates, the loan could be sold by the government to private sector lenders in a secondary market for $76.3 million. Under these conditions, the government is agreeing to an undisclosed subsidy of $23.7 million when it enters into the loan contract. It is committing itself to a deficit in this operation this year, and for the next 14 years. As before, the government does not have to finance the implicit subsidy directly, but it is offset economically by efficiency losses due to the misallocation of resources.

Now, the same subsidy operation could have been financed by forgone tax revenues. That is, the tax system could have been adjusted so that interest income to the lender was tax exempt. Lenders in the 70 per cent tax bracket or above (in the example) would then have found it profitable to lend at 3 per cent tax exempt, even though the borrowers' opportunity cost rate might be 10 per cent. Whether such lending would actually occur depends, of course, on the other alternatives available to the prospective lenders. In any case, the direct cash cost to the budget here is the amount of tax revenue forgone; and, even more so than in the previous case, this is not clear under the usual accounting conventions. It should be noted that, here again, the real economic cost of these programs would usually be greater than the realized financial cost to the government. These additional costs or subsidies are inherently more difficult to measure because they depend on the borrowers' opportunity costs; and, as indicated earlier, because they are financed by resource misallocations and inefficiencies, they are not reflected in the budget deficit.

In actuality, most governments operate both types of interest subsidy schemes simultaneously, so that a comprehensive measure of official interest subsidies should take into account both mechanisms. However, because the purpose of this paper is to focus on the expenditure side--that is, on official lending and its terms--interest subsidies based on tax expenditure have been defined as beyond the scope of this study. Thus, they were not estimated in the case of Korea, even though many kinds of interest income and payments in Korea were tax deductible during the 1970s. 2/

Given the omission of interest rate tax expenditures, the magnitude of the estimated explicit credit subsidies cited in the opening paragraphs

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1/ The subsidy (or grant) element--a concept introduced later--is defined as the subsidy value stated as a percentage of (the present value of) the loan's face value--here equal to 23.7 per cent (see Organization for Economic Cooperation and Development (1980), p. 241).

2/ See Korean Ministry of Finance, Korean Taxation, various years, for details.

is surprisingly large. 1/ These results reflect two facts. First, net lending of the consolidated Central Government grew extremely rapidly during the 1970s in Korea; 2/ indeed, it was the fastest growing item in the budget during the period under study, and by 1979 this item was greater than the entire budget of the consolidated Central Government (including net lending) only six years earlier. Secondly, the terms at which the Korean Government lent remained relatively unchanged until the end of the decade, while the terms at which it borrowed were significantly higher initially and widened substantially as time progressed. The mean effective rate of interest on government budgetary lending stayed almost constant during 1971-79 at 5.5 per cent annually and maturity was 22 years; then in 1980 the rate jumped abruptly to 11 per cent annually and the maturity dropped to 19 years. A similar increase in mean lending rates occurred under the other main off-budget lending program that was analyzed, although maturities did not change in the latter case. Meanwhile, the Korean Government's marginal borrowing rates varied between a low of 16.6 per cent annually in 1973 and a high of 28.8 per cent in 1980. All this suggests a rather long recognition and response lag on the part of the authorities to a growing fiscal problem. It is quite possible that both aspects of the policy lag could have been shortened if the subsidies inherent in the Government's borrowing and lending pattern had been calculated as a routine matter. 3/

III. Rationale and Economic Effects

Official credit programs usually are claimed to be necessary to correct market failures in private capital markets. Operationally, these imperfections have been presumed to exist wherever potential borrowers cannot acquire credit at a "reasonable" cost. This may be due to inadequate flows of information, making risk assessment difficult and inaccurate; it may be due to monopolistic elements in the intermediation

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1/ The general description of the results in Section I is based on the detailed presentation later, for example, in Tables 11, 13, and 14. Moreover, it should be recalled that the larger context within which these transfers take place in Korea is one where the Government manages all the interest rates in the wider financial system to achieve its policy objectives. Thus, the rationale for additional intervention in the financial intermediation process, such as is being studied here, is weaker. This makes the results even more surprising.

2/ Official net lending as a percentage of gross domestic product increased more rapidly between 1973 and 1979 in Korea than in any other country cited in Premchand (1982).

3/ So far as the author is aware, the only country in which these kinds of calculations are regularly done (although very roughly) is the United States; see the references from the U.S. Office of Management and Budget, the Credit Budget (available since 1980) and the Special Analyses for various budget years, as well as the U.S. Congressional Budget Office, Analyses of the President's Credit Budgets, various years.

process or to other factors that inhibit the mobility of capital; 1/ it may be due to inherent flaws in specific security instruments; 2/ or it may result from the complete absence of financial institutions, as is sometimes the case in rural areas. Reasons conceptually similar to these market-perfecting explanations but which also can as easily support other budgetary expenditures as credit programs alone, are those relating to exploitation of economic externalities, pursuit of social goals, or alteration of the market-determined distribution of income. The first type of rationale is particularly prevalent in developing countries because it arises naturally in the planning context. Frequently, for example, governments attempt to divert credit into sectors when they are believed to generate more backward and forward linkages in the economy, or where there may be other reasons for the divergence between private and social costs, such as that arising in the field of education and prompting the establishment of official student loan programs. 3/

While any or several of these reasons may legitimately give rise to a specific official credit program, many such schemes still exist after the original conditions that motivated their adoption have long since changed. When such programs operate in areas where there are no longer significant market failures, the official assistance is best understood as a reallocation of credit, usually at subsidized interest rates, to specific activities or borrowers (United States, Congressional Budget Office, 1982). A large part of these flows also may be pure income transfers because the loans would have been made anyway by the private market, but at significantly higher rates of interest. This process undoubtedly results in important sacrifices of economic efficiency, as it siphons credit away from other uses that have stricter risk/return criteria, while delivering it to users selected, at least partially, on the basis of noneconomic criteria.

One of the major recognized economic effects of many official lending programs is, therefore, some sacrifice in the rate of economic growth. As implied earlier, this does not necessarily follow when social and private returns are not equal, because then a well-designed

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1/ For example, in the United States, state chartering of savings and loan associations and banks historically prevented excess loanable funds in surplus regions from flowing to areas of excess demand; see Plantes and Small (1981), pp. 14-15.

2/ Such as originally existed in U.S. residential mortgage instruments, which lacked liquidity and carried onerous terms for borrowers and associated high risks for lenders before the Government created the Federal Housing Administration and Federal National Mortgage Association (a secondary market); see Aragon (1980), p. 359.

3/ For a somewhat different, but related, discussion of the reasons frequently given by the local authorities for direct credit market intervention in developing countries, see Johnson (1975).

official credit program could encourage investments with high social returns, even though private returns were relatively low. However, even if government officials were able to select projects with high social (but low private) returns, it can be argued that interest rate subsidies are inefficient instruments in this context because they also distort factor prices in the process (Fry, 1981, p. 38). If government intervention in credit markets is substantial, these distortions encourage inappropriate capital-intensive production techniques for existing products and movement into new products which are more capital intensive. Thus the economy starts down the wrong technological path, making subsequent reversals of development strategy more difficult. The opposite side of the same issue is, of course, that such "successful" credit programs increase unemployment, frequently in economies with a surplus of labor.

Moreover, relatively cheap loans over significant periods of time can profoundly affect the financial structure of private enterprises in the sectors involved, creating, for example, relatively high ratios of debt to equity. This configuration of the corporate sector's balance sheet can then place severe constraints on the conduct of monetary policy, since an abrupt raising of interest rates can bankrupt the business sector if rates on the outstanding debt are adjustable. 1/

All these effects are evident to some degree in Korea. During the period under study, the amount of direct government participation in the credit markets averaged at least half of all funds raised in the corporate sector (Table 1). 2/ Most of these funds were channeled at subsidized interest rates into the heavy and chemical industries, which are characterized by relatively large, capital-intensive plants and in which excess capacity is now evident. Indeed, it is widely believed currently that overexpansion occurred in these sectors, a result that may not be surprising, given that the real rate of interest on borrowing for these sectors during the period of most rapid growth was strongly negative. 3/ Moreover, the mean debt-equity ratio of the Korean manufacturing and corporate sectors are so high--at 4.6:1 to 4.9:1 during 1980-81--that in terms of international comparisons the only

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1/ This fact has been amply demonstrated in international capital markets with sovereign external debt in recent months.

2/ This is a lower bound because there may be additional loan guarantee programs of which the author is unaware.

3/ During 1976-79, before inflation soared, real effective rates on lending to these sectors were estimated as:

Year	Rate Range
1976	-6.1 to -2.0
1977	-3.1 to 1.9
1978	-4.9 to -0.5
1979	-12.0 to -5.0

Table 1. Korea: Government Participation in Corporate *Credit Markets*, 1971-80

(In billions of won)

	Total Corporate Sector Funds Raised 1/ (1)	Net Government Direct Lending and Loan Guarantees 2/ (2)	Percentage of Government Participation 3/ (3)
1971	337.0	8.2 4/	2.4
1972	254.4	46.1	18.1
1973	385.5	156.5	40.6
1974	865.1	516.4	59.7
1975	1,138.1	257.2	22.6
1976	994.0	708.2	71.2
1977	1,551.6	965.4	62.6
1978	2,768.4	1,069.9	38.6
1979	3,956.0	1,089.1	27.5
1980	4,625.6	1,875.4	40.5

Sources: Bank of Korea, Economic Statistics Yearbook and Monthly Statistical Bulletin; International Monetary Fund, Government Finance Statistics Yearbook, 1982; Korean Exchange Bank, Monthly Review, 1982(3); and World Bank, private communication.

1/ Total funds raised by the corporate sector, including government-invested, public, and private enterprises, on a flow-of-funds basis.

2/ Sum of consolidated central government net lending, net domestic government guaranteed loans to private small and medium industries, and net foreign government guaranteed private debt.

3/ Percentage of government participation represents Column 2 divided by Column 1 times 100.

4/ Omits net foreign government-guaranteed private sector debt.

country to come near these levels is Japan, which is usually regarded as in a class by itself on this index. 1/

While one might legitimately wonder why it is necessary to be concerned about these matters, given the growth performance of Japan and Korea, the argument here relates to the riskiness or vulnerability of the resultant structure--that is, the extremely high debt-equity ratio may not be a problem during periods of rapid inflation and growth, but it may become a severe handicap if growth and inflation slow quickly or the cost of capital rises abruptly (both of which occurred worldwide recently). Moreover, there is the question of what the growth rate might have been without the distortions.

If these results seem somewhat impressionistic, this is because surprisingly little careful empirical work has been done on the real economic effects of direct government lending programs in Korea or anywhere else. Most of what is known is based on the experience of the United States and is well presented in an article by Aragon (1980). 2/

The available evidence does not permit firm conclusions, even for the United States; and, of course, what does seem evident may not be readily transferable to widely different economies that are characterized by significantly smaller and less unfettered capital markets. The major uncertainties regarding the economic effects of official credit programs are summarized by Aragon into two basic questions:

(1) Do official credit activities produce lasting changes in the composition and volume of credit?

(2) Do such alterations produce predictable changes in the allocation of economic resources?

Earlier studies, covering the period 1958-65, concluded that the answer to both questions was yes. However, these studies considered only the primary effects of the credit programs and not the various offsetting financing and portfolio adjustment reactions of private markets. Studies incorporating these effects into their models and carried out during 1973-78 produced conclusions at odds with the earlier work with regard to most aggregate, long-run effects, although the short-run effects were similar. Other studies found that, even when changes were produced in the overall composition of credit, parallel recompositions of real assets sometimes did not follow. For example, one study concluded that mortgage loans finance acquisitions of both financial assets and real assets other than houses.

1/ These figures present the total liabilities-equity ratios computed by the World Bank for the entire corporate sector and manufacturing sector, respectively, for the years indicated. Comparative figures for the United States and Western Europe would be about 1:1 and 2:1, respectively.

2/ Unless otherwise indicated, the remainder of this section comes directly from Aragon's article; the interested reader should refer to it directly for greater depth and thoroughness.

With regard to stabilization issues and the contribution toward full employment, Aragon concluded that the effect of credit programs seems to vary according to the specific goals and assumptions of particular schemes and, for all purposes, the stance of monetary policy. Specialized program objectives, such as income redistribution, often conflict with maximization of economic efficiency and growth, as already suggested. Programs aimed at perfection of capital markets and the provision of high-risk capital, however, have sometimes promoted innovation, investment, and efficiency. New spending was found most likely to occur when credit was extended to marginal or needy borrowers, especially in market-perfecting programs directed at small businesses. However, these were only the initial results. The final impact on overall spending depended mainly on the response of monetary policy, and the income-generating effects of credit programs were found to depend crucially on the level of supportive, or accommodating, monetary expansion.

When the money supply remained relatively fixed, federal credit activities in the United States simply resulted in private displacement of lenders and borrowers--that is, "crowding out" occurred. 1/ This tended to offset any possible expansionary impact. Additional national income resulted only when the money supply was expanded. Since credit programs became increasingly important to certain sectors during times of monetary restraint, the supportive role of the U.S. Federal Reserve System also resulted in a policy dilemma. Moreover, there usually has been an important asymmetry between credit-program crowding out and deficit-financing of the budget crowding out. Budget financing requirements have generally been worst in periods of deep recession, while the financing requirements of credit programs have been heaviest during periods of high economic activity. Therefore, the probability of crowding-out effects would seem to have been substantially greater for credit than for budget financing, although this would not necessarily be the case if large fiscal deficits were accompanied by tight monetary policy.

1/ As Weidenbaum (1976), p. 162, explains: "This . . . occurs for a variety of reasons. The total supply of funds is broadly determined by household and business saving and the ability of banks to increase the money supply . . .. The normal response of financial markets to an increase in the demand for funds by a borrower, such as is represented by a federal credit program, is an increase in interest rates so as to balance out the demand for funds with the supply of savings. But the Federal Government's demand for funds is 'interest-inelastic' . . . and the interest-elasticity of savings is relatively modest. Thus, weak and marginal borrowers will be 'rationed' out of financial markets in the process, while the Treasury and other borrowers pay higher rates of interest."

Whether an expanded level of spending translated into inflated or real economic growth tended to depend on the relative elasticities of sector outputs and the uses for the credit. When resource utilization was high in favored sectors, expanded official credit resulted in price increases and almost no change in real output, even without concurrent monetary expansion. This resulted from the fact that the shift in expenditure composition raised prices in the stimulated sector, but the high prices were not offset by price deflation in the sectors crowded out. For example, increases in mortgage credit resulted in decreases in business credit, with more spending on housing and less on business activities. The increased demand for housing in periods of tightness in the housing market was simply inflationary, as there was no offset in business sector prices. If accompanied by a supportive monetary policy, the official credit activity in the mortgage field tended to be even more inflationary.

Tempering all these results, however, are a number of particular problems that make empirical work on the aggregate economic effects of credit programs extremely difficult and definitive conclusions essentially impossible. First, significant, generic differences in purposes among programs result in different impacts on real and financial variables--e.g., a market-perfecting program should have a different impact than an income-redistributing scheme. Second, credit programs have different growth stages that alter the degree and diffusion of their impact--therefore, the effects may depend partly on how long the program has existed. Third, both the financial and real effects of specific credit market interventions have complicated, lagged patterns, which can be properly evaluated only by using comprehensive econometric models. Since the level of aggregation must be high, only the very largest of such programs can realistically be evaluated at all. Finally, the effects of credit programs depend to a large extent on the overall financial and economic climate and the simultaneous actions of fiscal and monetary policy. However, in spite of these difficulties, there seems to be a growing impression that several undesirable impacts can be associated directly with official credit programs, such as displacement of private lenders and borrowers; encouragement of foreign financing; creation of a policy "wedge" in private decisions; preservation of large, inefficient organizations; creation of inflationary pressures; complications in the coordination of stabilization policy; and the sacrifice of economic efficiency without corresponding increases in the total supply of investible funds, so that the overall rate of economic growth suffers.

IV. Budgetary Credit Subsidies in Korea

No generally accepted, objective method now exists for estimating the subsidy value in official direct lending programs, mainly because of the difficulty of establishing precisely the private rates that would have been paid by borrowers in private markets without government intervention. Moreover, for some programs--for example, those addressing a "total" market failure--there may be no alternative private rate at all. Still, it is the premise of this paper that the concealed subsidies are sometimes so great that an attempt must be made at estimation, even if the resultant measure is not exact. By focusing on the explicit portion of the total subsidy (as defined in Section II), the most intractable of the operational obstacles can be avoided at the final borrower stage. The resultant estimate is, of course, biased downward in terms of the value received by the borrower because it omits the implicit portion of the subsidy. Moreover, in the case of Korea, even the calculated explicit subsidy was consciously underestimated, so that the direction of bias in the answer was known.

1. Measurement of the subsidies

a. Conceptual framework

The method for estimating the value of the interest subsidy is first presented here in the simplest of cases, complications are next introduced, and issues relevant to the operational use of the technique are then discussed.

Let us assume first that a loan of amount A is made at interest rate i; it is disbursed in full immediately and amortized over N years, to be repaid in equal annual installments of principal plus interest. If P is defined as the value of this annuity, then

$$P = A \left[\frac{i}{1 - \frac{1}{(1+i)^N}} \right]$$

If

$$D_N = \left[\frac{1 - \frac{1}{(1+i)^N}}{i} \right]$$

then,

$$P = \frac{A}{D_N}$$

D_N is defined as the discount factor that gives the present value of one unit (if the loan above is for A dollars, then it is one dollar) payable yearly for N years. Alternatively, $1/D_N$ is the annual payment necessary to pay off a loan of one dollar over N years.

Analogously, if the same loan could have been made at market rate i*, then under market conditions the equation would be:

$$P^* = A\left[\frac{i^*}{1-\frac{1}{(1+i^*)^N}}\right] = \frac{A}{D_N^*}$$

Since the presumption is that $i^* > i$, the subsidy element each year is

$$S = P^* - P = A\left[\frac{1}{D_N^*} - \frac{1}{D_N}\right]$$

However, if the alternative loan is made in terms fixed until maturity, then S, which gives the annual subsidy, grossly understates the present value of the total subsidy involved in making the loan at the lower rate because this would accrue every year, for N years. Thus, it is necessary to know the capitalized value of this stream of annual differences in payments, where the discount rate used is based on the market (or "true" opportunity) cost of capital:

$$\Delta = S \cdot D_N^* = A\left[1 - \frac{D_N^*}{D_N}\right]$$

where Δ = the grant or subsidy value in the loan.

The proper interpretation of Δ is that the two situations are identical in the following sense--it is precisely equivalent either (1) to grant the N-year loan at rate i when the opportunity cost rate is i*, or (2) to grant the N-year loan at rate i* and provide a cash grant of Δ. Thus, provision of a "low interest" loan is equivalent to providing a "pure loan" combined with a pure subsidy.

Another form of presentation is a table of cash flows which is set up to obtain the present value of the total debt payments. 1/ This is

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1/ This approach to the problem was inspired by a monograph by Harvey (1981), especially pp. 10-29.

useful because it allows the structure of the loan to be changed easily, and then the new (different) subsidy element can be computed.

Years	Receipts (1)	Annual Payments (2)	Annual Net Receipts (3)	Discount Factor with Market Interest Rate (4)	Net Present Value (5)=(3)x(4)
0	A	-	+A	1	A
1 to N	-	A/D_N	$-A/D_N$	D_N^*	$-A \cdot \frac{D_N^*}{D_N}$
Total (Δ)					$A\left[1 - \frac{D_N^*}{D_N}\right]$

This formula is relatively easy to compute on any simple calculator, particularly one with a y^x function. The program for this problem is presented in Appendix I for use on the Hewlett-Packard 38 programmable financial calculator. It is set up so that the loan terms (face value, loan rate, maturity, market rate) can be easily changed and additional subsidy values and elements (subsidy values as percentages of the face values) can be recalculated, so long as the structure of loans (annuity, no grace period, etc.) remains constant. For example, if A = \$10,000,000, i = 10 per cent per annum, N = 20 years, and i* = 12.5 per cent per annum, then Δ = \$1,494,333.51, which is 14.94 per cent of the loan's face value.

Now, if the above loan is structured so that the payback period is preceded by a grace period (of n years) during which nothing is payable, then the cash flow would appear as:

Years	Receipts (1)	Annual Payments (2)	Annual Net Receipts (3)	Discount Factor with Market Interest Rate 1/ (4)	Net Present Value (5)=(3)x(4)
0	A	-	+A	1	A
1 to n	-	-	-	D_n^*	-
n to n+N	-	A/D_N	$-A/D_N$	$D_{n+N}^* - D_n^*$	$-\frac{A}{D_N}\left[D_{n+N}^* - D_n^*\right]$
Total (Δ)					$A\left[1 - \left(\frac{D_{n+N}^* - D_n^*}{D_N}\right)\right]$

1/ The subtraction of the discount rates may appear confusing in years n to n+N. In the former example, D_N^* was used to obtain the P.D.V. of the stream of net payments for the simple loan. The problem now is just that this stream occurs n years in the future, so it must be discounted again by $\frac{1}{(1+i^*)^n}$:

$$D_{N+n}^* = \frac{1 - \frac{1}{(1+i^*)^{n+N}}}{i^*} \qquad (1)$$

$$D_n^* = \frac{1 - \frac{1}{(1+i^*)^n}}{i} \qquad (2)$$

$$D_{N+n}^* - D_n^* = \frac{\frac{1}{(1+i^*)^n} - \frac{1}{(1+i^*)^{n+N}}}{i^*} \qquad (3)$$

$$D_{N+n}^* - D_n^* = \frac{1}{(1+i^*)^n}\left[\frac{1 - \frac{1}{(1+i^*)^N}}{i^*}\right] \qquad (4)$$

$$D_{N+n}^* - D_n^* = \frac{1}{(1+i^*)^n} D_N \qquad (5)$$

Continuing the previous example, if n = 5 years, the new subsidy value is $5,280,002.44, or 52.8 per cent of the loan's face value. 1/ Thus, the addition of a "pure" grace period can be seen to affect the subsidy calculation dramatically.

Let us consider next a grace period of n years, but with interest only payable during the grace period at rate i_n. In this case, the following tabulation shows the result.

Years	Receipts (1)	Annual Payments (2)	Annual Net Receipts (3)	Discount Factor with Market Interest Rate (4)	Net Present Value (5)=(3)x(4)
0	A	-	+A	1	A
1 to n	-	$i_n \cdot A$	$-i_n \cdot A$	D^*_n	$-A \cdot i_n \cdot D^*_n$
n to n+N	-	A/D_N	$-A/D_N$	$D^*_{N+n} - D^*_n$	$-\frac{A}{D_N}\left[D^*_{n+N} - D^*_n\right]$
Total (Δ)					$A\left[1 - i_n \cdot D^*_n - \left(\frac{D^*_{n+N} - D^*_n}{D_N}\right)\right]$

To continue the example, if $i_n = i_N = 10$ per cent per annum, then the subsidy value would be $1,719,391.02, or 17.19 per cent of the loan's face value. Alternatively, if $i_n < i_N$ (a common situation in Korean lending), say $i_n = 8$ per cent per annum in this example, then Δ becomes $2,431,504.69, or 24.32 per cent of the loan. The program for this type of loan, presented in Appendix II, is the program that was used for analysis of National Investment Fund lending in Korea.

1/ No specific specific example of this program is given in the Appendices because no examples of this type of loan were actually evaluated in the Korean case.

It should be noted that the results in this example conform to an intuitive a priori impression about the relative "softness" of the loan terms: 1/

Loan Structure	Subsidy Value (Δ) (In U.S. dollars)	Subsidy Element (Δ) as Percentage of Face Value
Simple annuity	1,494,333.51	14.94
With grace, where $i_n = i_N$	1,719,391.02	17.19
With grace, where $i_n < i_N$	2,431,504.69	24.32
With grace, where no payments	5,279,959.37	52.80

Finally, let us consider a case in which the loan is set up like a bond--i.e., interest only is payable throughout the life of the loan and the principal is repaid in one lump sum at the maturity date. The program for this formulation that is presented in Appendix III was used to analyze the lending in Korea other than that of the National Investment Fund.

Years	Receipts (1)	Annual Payments (2)	Annual Net Receipts (3)	Discount Factor with Market Interest Rate (4)	Net Present Value (5)=(3)x(4)
0	A	-	+A	1	A
1 to N	-	$i \cdot A$	$-A \cdot i$	D_N^*	$-i \cdot A \cdot D_N^*$
N	-	A	-A	$(1+i^*)^{-N}$	$-A \cdot (1+i^*)^{-N}$
Total (Δ)					$A\left[1 - (1+i^*)^{-N} - i \cdot D_N^*\right]$

1/ It is worthy of note here that the alternative methodology (the effective rate of interest (ERI)) introduced later would give roughly the same ordinal ranking of the alternatives. Thus, the ERI on the last loan is 6.05 per cent per annum, on the third option 9.09 per cent per annum, and on the first two it equals the quoted loan rate of 10 per cent per annum.

Although a fairly simple loan structure has been retained for purposes of exposition, the principles involved remain the same, even if loan structures are different and more complex. Most generally stated, the subsidy value of a loan is the difference between the present value of its disbursements and the present value of its service payments, discounted at the market rate of interest. The grant element is defined as the value of the subsidy or grant as a percentage of the present value of the disbursements. According to these definitions, therefore, a loan made at the market rate of interest carries a subsidy value and grant element of zero, while a pure grant has a subsidy element of 100 per cent. For a "soft" or "concessional" loan, the grant element lies somewhere between these extremes.

The Development Assistance Committee (DAC) of the OECD and the External Debt Division of the World Bank regularly compute the degree of concessionality in their own and other foreign lending by computing the grant element (based on a fixed discount rate of 10 per cent per annum) and simply defining any loan for which this value is greater than 25 per cent as a concessional loan. 1/ Most lending covered is assumed to be structured around equal principal repayments. Examples of these types of loans and the calculator programs for their analysis are provided in Appendices IV and V.

The major difficulty with the DAC and World Bank procedure is that the conventionally used (and never changed) discount rate of 10 per cent per annum is too arbitrary and rigid. Other rates would have been (and will be) more appropriate at various times, depending on the conditions prevailing in world capital markets. For example, over the past few years, the 10 per cent rate clearly has been much too low and has resulted in significant underestimates of concessional lending. Moreover, the massive volume of loans analyzed requires that many simplifying assumptions be made regarding the structuring of loans. However, some limited analysis by the author suggests that grant elements--and particularly, grant equivalents (the subsidy values)--are quite sensitive to the way loans are structured. Therefore, elements of error (of unknown magnitude) are introduced when the analysis is not done on a disaggregated basis in order to retain a high degree of accuracy. Since the emphasis of these organizations is on the grant element, the problem may not be as critical as it is in the present study, where the focus is the value of the subsidy. However, both of these difficulties introduce an element of uncertainty into the published figures and make unambiguous interpretation difficult.

1/ See, for example, Organization for Economic Cooperation and Development (1980), p. 241, and World Bank (1981), pp. vi-vii.

Before turning to a discussion of the problems that arise in putting into operation the methods outlined here, mention should finally be made of the general relationship between the subsidy element of a loan and the interest spread between its quoted rate and the opportunity cost interest rate. The regularity and shape of this connection has important implications for applications of the subsidy estimation technique and for interpretation of the results. Figure 2 shows the subsidy (or grant) element as a function of this spread for a bond, where A=100, i=15, and n=20. From the forgoing discussion, it is clear that this function should cross the zero axis when the opportunity cost rate of interest (i*) is set equal to the effective rate of interest (ERI) on the loan (see Section IV), which in this case also equals the quoted rate. When i* is below the loan's ERI, then clearly profits can be made in the government's borrowing-cum-lending operations. This is indicated in the figure by negative subsidy rates at these levels. 1/ Alternatively, when i* rises above the ERI on lending, then positive subsidy rates are implied; and the higher the i*, the more of the loan which really is a gift. However, note that the relationship is highly nonlinear. Even a relatively small interest spread (5 per cent) gives a reasonably large (25 per cent) subsidy element. Similarly, once a certain spread has been attained (say, 20 per cent, i.e., when i* equals 40 per cent), then the subsidy element is already relatively high (62 per cent) and marginal increases in the spread do not give rise to much additional subsidy flows. In the limit, of course, when i* is infinitely high, the subsidy element approaches its maximum limit of 100 per cent.

Figure 3, which presents the same function for different types of loan structures, shows that this shape is not unique to the bond structure assumed. Specifically, this figure plots the examples given earlier in this section: for A=10,000,000; i=.10; N=20; and i*=.125; A1 plots the simple amortized loan (as in Appendix 1), A3 the bond (as in Appendix III). A4 assumes the same general terms but adds a grace period of 5 years and uses the equal principal payments structure described in Appendix IV. A2.A, A2.B, and A2.C show amortized loans with a grace period (as in Appendix II); they assume the same general terms, but the five-year grace period added is characterized differently: A assumes that full interest (0.10) is paid during the grace period; B assumes that reduced interest (0.08) is paid; and C assumes that nothing is paid.

b. Application

The preceding section glossed over a number of difficulties which need to be addressed when the method is applied. As Section III suggested, it is necessary to know a great deal about specific program

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1/ Of course, the formulas work when i* < ERI on the loan. In applications, all such loans should be included in the analysis, so the government's position on balance can be derived. In Korea many loans analyzed involved negative subsidies at the i* rates used.

FIGURE 2

SUBSIDY ELEMENT AND INTEREST SPREAD

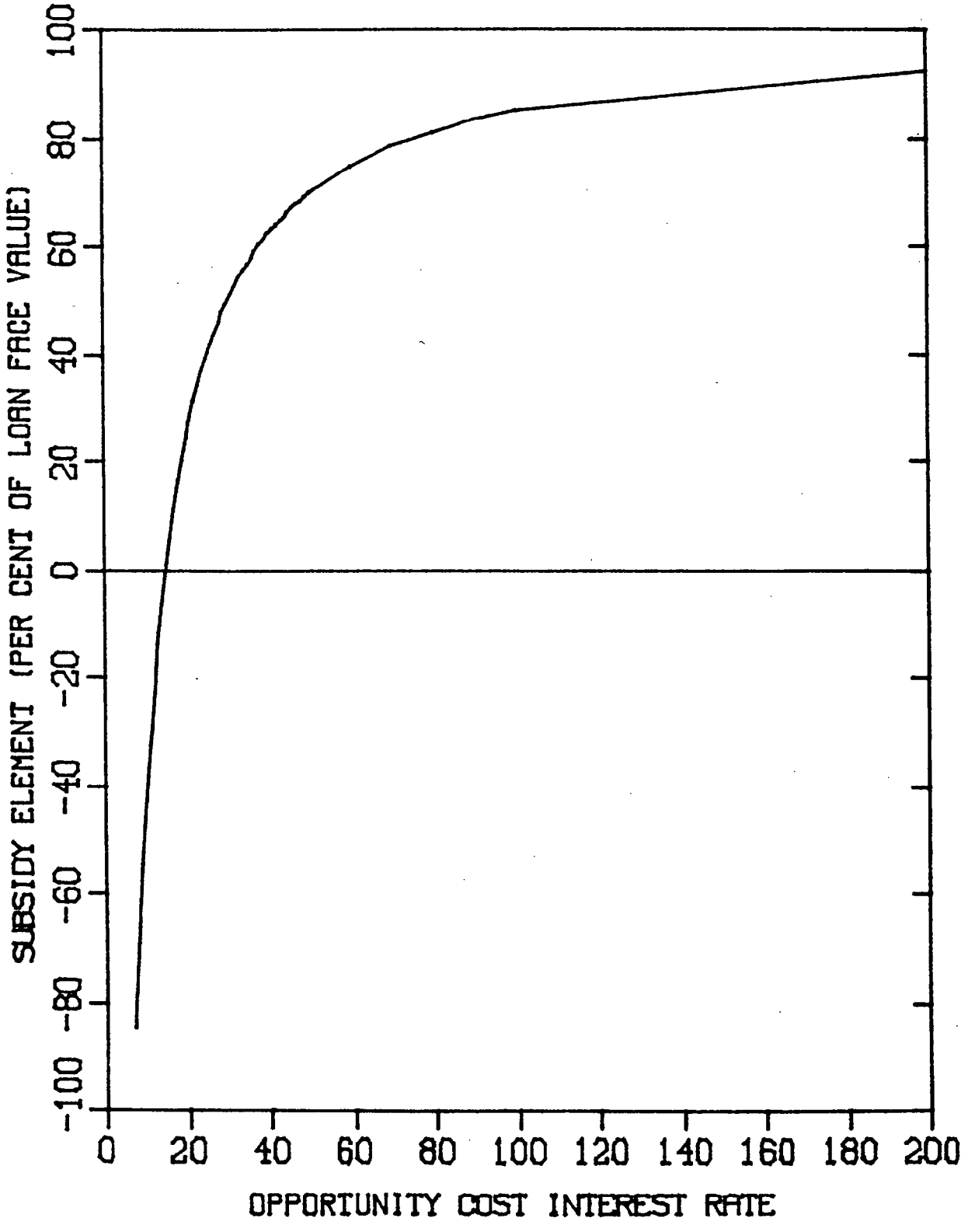
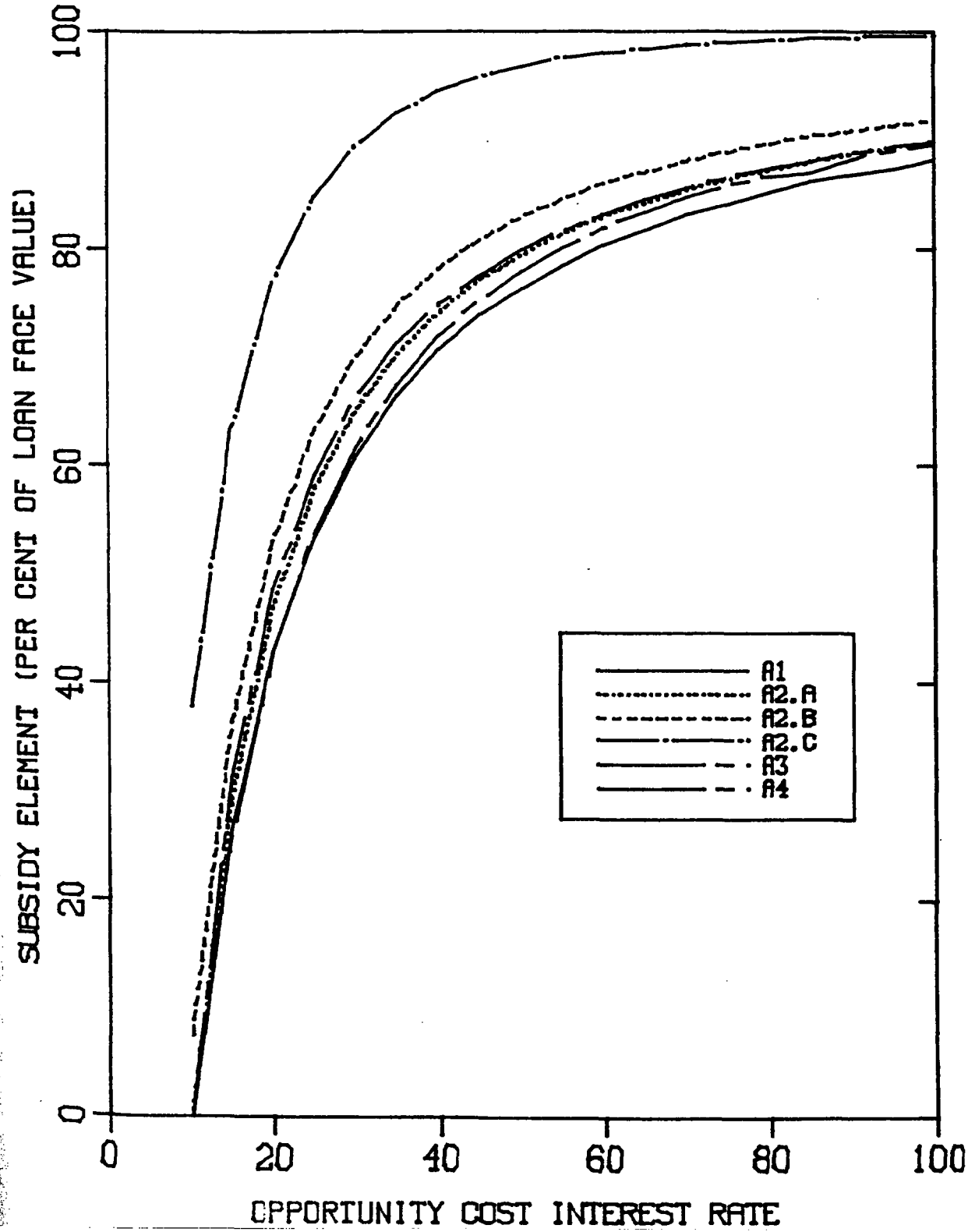


FIGURE 3

SUBSIDY ELEMENT AND INTEREST SPREAD COMPARATIVE PATTERNS



borrowers to estimate properly the income transfers, the impacts on credit allocation, and the total interest subsidies involved. For example, official lending operations conducted with a relatively fixed supply of total credit result in income transfers to inframarginal borrowers of the difference between the interest expense they would have incurred on private credit and that paid to the government, while the amount transferred to submarginal borrowers is only the remaining income yielded by their projects after repayment of their government loans. Moreover, loans to this latter group create a real transfer of credit, while lending to the former involves no reallocation of credit at all, unless these borrowers choose to incur more indebtedness than they otherwise would have in private markets. Therefore, precise quantification of the economic role of official lending operations requires reliable information about the credit status of the borrowers, the alternative interest rates they would have paid, the interest rate elasticity of their demands for credit, and the profitability of their officially funded projects. 1/

Of course, most of these data do not exist, and their estimation over a wide spectrum of groups at the microlevel is entirely impractical within the framework of most Fund missions to member countries. Furthermore, even if available, their usefulness would be limited by the factors brought out in the preceding discussion (e.g., different stages and lag patterns among programs, etc.). Thus, it seems inevitable that if any useful descriptive figures are to be generated at the aggregate level while minimizing the data requirements and assuring some simplicity in the analysis, then a less ambitious goal than estimating the total subsidies must be accepted. In these circumstances, it makes sense to focus on the explicit subsidy transfer alone and forgo the desirable aim of measuring the larger flows and real impacts.

This emphasis solves some, but not all, of the difficult operational problems. If the method is applied directly to government lending, taking the A, i, N, n, etc., elements from observable official loans and using the government's marginal borrowing rate for i*, then the major assumption required is that the borrowers are inframarginal relative to the government's borrowing rate. This seems plausible for the case under study and would also seem to be true for most capital-scarce countries. In Korea, credit demand has usually far outstripped the available supply, and government credit rationing has always been common. Moreover, the bulk of Korean lending that was analyzed went to borrowers in shipbuilding and other heavy industries,

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1/ Break (1982), pp. 288-89. This means a meticulous study will probably be program-specific. For an excellent example of such an analysis, see von Furstenberg (1976).

chemicals, and exports. 1/ It seems reasonable to presume that most of these borrowers would have been in the credit market in any case and surely would have paid the equivalent of the Korean Government's borrowing rate, which incorporates a minimal risk premium and is far below the generally recognized rates of return to capital in these sectors.

Figure 4 helps to set the context of this discussion, depicting the explicit subsidy measure as well as the inframarginality assumption. If dD and SS are the market demand and supply schedules, then G would be the free market solution without government intervention; OC of credit would be extended at rate i_{FM}. If the government decides to make D'D of credit available and selects recipients at random from among all those who demand credit at the government's subsidized lending rate (i_L^G), then the fraction $D'D/i_L^G D$ of all those demanding credit at any rate of no less than i_L^G receive official subsidized loans, with the remaining demand satisfied in the unassisted private market along D'd. However, D'd determines only the residual quantity of credit supplied in the market. To fix the rate that unassisted borrowers must pay to private lenders, the total demand for credit must be obtained by adding back in the quantity channeled to the subsidized borrower, D'D. The intersection of this combined schedule (d'D) with the original supply schedule determines the rate for unsubsidized borrowers (i_{FM}'), who demand OA of credit, out of a total of OE, where AE equals D'D. In the Korean case, i_{FM}' is not directly observable, but it would be some weighted average of rates on the unorganized money market and rates from the banking system that were under direct government control during the period under study. The value of the total interest subsidy (explicit plus implicit) is represented by the area IGDD'.

If i_B^G represents the government's marginal borrowing rate, then YBDD' represents the value of explicit credit subsidies received by government loan recipients. In the actual measurements undertaken, the present value of this area has been approximated by the present value of the slightly different area ACDD' (equals TAD'X) on the assumption that all borrowers are inframarginal to the government's borrowing rate i_B^G (i.e., all lie on dD above B).

In terms of practical application, therefore, selection of the government's marginal borrowing terms remains as the final major operational issue, and this process is far from trivial because the results

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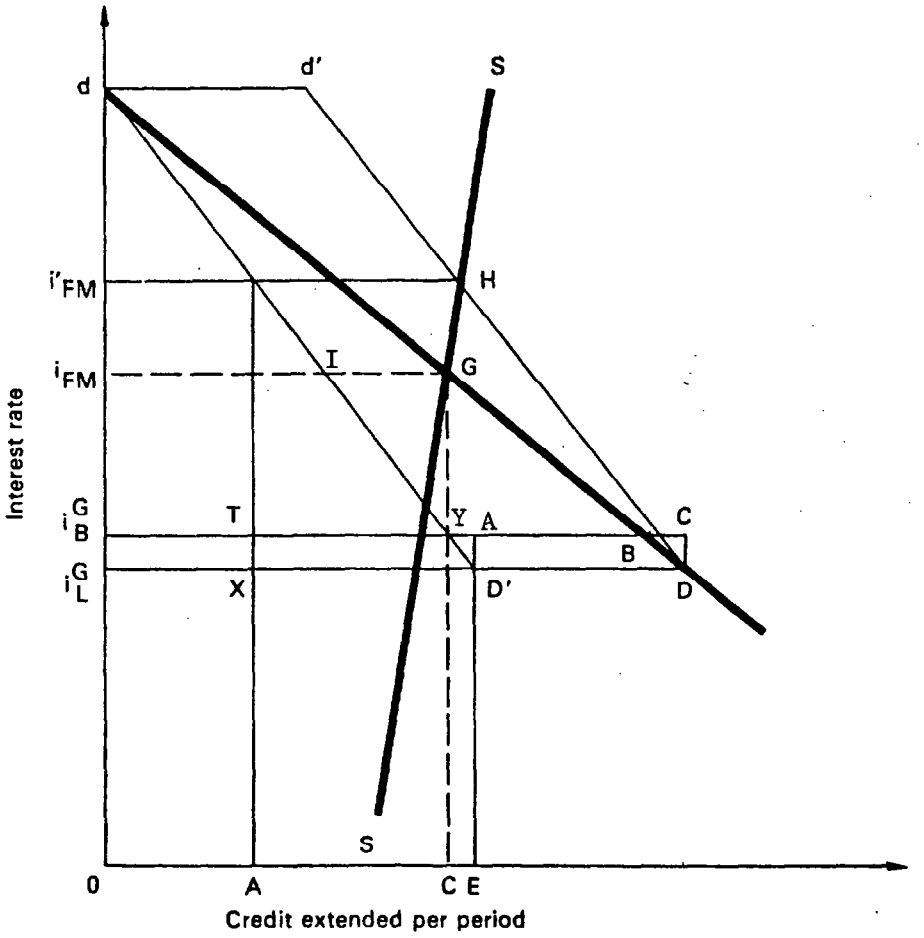
1/ The Korean authorities provided data indicating that of W 1,876.9 billion in National Investment Fund loans made during 1974-80, the distribution was as follows: heavy and chemical industries (61.0 per cent), electric power industry (24.6 per cent), exports on a deferred payment basis (7.1 per cent), projects to increase food production (5.7 per cent), others (1.6 per cent). These loans accounted for about three fourths of the total loans analyzed in this study.

FIGURE 4

THE EXPLICIT SUBSIDY MEASURE



Source: Adapted from von Furstenberg (1976), Figure 1.

are very sensitive to variation in the i*'s. 1/ The major alternatives available are those on official external and internal borrowing. In general, the internal rate should be preferred because it entails the same currency in which the lending occurs, thus minimizing errors that might be introduced through incorrect estimates of exchange risk. 2/ In Korea the basic rates used were the average yields on government and public bonds (Table 2). Given the institutional context, these seemed the best reflection of the Korean Government's true marginal borrowing costs. 3/ Moreover, when the exchange rate was allowed to adjust, this rate was broadly in line with external rates. 4/ As direct application of the formula for capitalized value clearly also holds N constant, ideally the maturity of this borrowing should be equal to that of the

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1/ One should not infer from the whole line of reasoning in this section that a government should simply charge its own borrowing rate on its lending. Clearly, a misallocation of resources in the economy would still result, and the implicit credit subsidies would not be removed. As Break (1965), pp. 36-39, has shown, if this were done, the resultant government lending programs would be overexpanded and social welfare would be reduced.

2/ This statement is based on the presumption that for instruments that are identical except for their currency of denomination, the only reason for an interest rate differential between them should be expected changes in the exchange rate between the two. This is known as the Fisher hypothesis. While there may be other reasons for departures from Fisher parity (e.g., transactions costs, differential taxation, political risk), the major determinant is assumed to be exchange risk (see Blejer (1982), p. 271).

3/ The major results presented in the next section rely on these rates. It should be noted that the maturity structure of this borrowing is also similar to the bulk of the National Investment Fund lending analyzed (see Table 9), although somewhat shorter than that on the "pure government lending" (Table 8). However, to check the sensitivity of the results, an alternative method was devised that relied mainly on the (lower) rates paid on a set of National Investment Fund bonds sold to "captive" buyers through forced sales (Table 3). This method and the comparative results are discussed below.

4/ The average annual exchange rate of the Korean won for the U.S. dollar was fixed at 484:1 from 1975 through 1979. During this period, a substantial amount of pressure accumulated for a won depreciation. A major change came in 1980, when the average rate moved to 608:1. This 26 per cent change more than accounts for the difference in 1980 between the average domestic government bond yields (28.8 per cent) and the rate on new commitments for external public and publicly guaranteed private debt of similar maturity published in the World Bank's World Debt Tables (14 per cent). (The corresponding rate for external public debt alone was 16.2 per cent.) Similarly, the Eurodollar rate plus the Korean spread was 15.2 per cent.

Table 2. Korea: Average Yields on Government and Public Bonds, 1971-80

(Annual percentage rate)

Year	Average Yields on Government Bonds 1/
1971	26.0
1972	19.0
1973	16.6
1974	21.0
1975	21.1
1976	21.6
1977	20.7
1978	21.6
1979	25.2
1980	28.8

Source: Bank of Korea, Economic Statistics Yearbook, various years.

1/ Computed averages weighted by amounts of issues. Coverage varies slightly by year, but generally includes reimbursement bonds for requisitioned properties, grain bonds, foreign exchange finance bonds, industrial finance bonds, national housing bonds, highway construction bonds, and Treasury bills. The figures quoted represent nominal interest rates; because many of these bonds pay the interest in advance, the effective rates are higher (perhaps 2-4 per cent per annum), but there is no accurate way of computing these on the basis of the information available. Maturities vary between three and five years.

Korean Government's lending. As a practical matter, the selection of instruments with the appropriate maturity is not as difficult, nor as important (because the present value of subsidies accruing several years in the future is diminished through the discounting process) as is the choice of the interest rate.

c. Complications

In applications other than Korea's lending, economists may have to use an external borrowing rate because a domestic counterpart is unavailable. In such cases the exchange risk problem must be addressed, as previously mentioned. Moreover, even though governments still issue a large amount of fixed-term foreign bonds, 1/ this market may be effectively closed to some countries. They may have access only to floating rates, or to adjustable rate markets (e.g., the Eurodollar market). In this case there are three alternatives available, none of which is entirely satisfactory. First, the observed rate could be used, assuming that it would not change, at least on average, over the period of analysis. Second, forecasts could be made of expected changes in the rate, perhaps by using different values to determine a range of subsidy values. Finally, if there seemed to be too much uncertainty in either of the former strategies, it might be preferable to forgo estimation of the capitalized value of the subsidy stream and simply do the analysis on an annual basis. Computationally, this is much easier and involves only the calculation of the service payments on outstanding loan balances at the mean lending rate and again at the mean borrowing rate, and then the subtraction of one from the other. The difference is the subsidy value for that particular period. 2/

It is well known that unanticipated inflation can result in a shift in real income from lenders to borrowers as the real value of debt contracted in fixed nominal terms is eroded. However, if the government is both borrowing and lending at fixed rates over similar periods (as was the case for Korea during the period of analysis), then, as a first approximation, it can be assumed that there are no net inflationary effects on the subsidy calculations because what is lost on the lending side is gained on the borrowing side. Similarly, if it is assumed that nominal interest rates are adjusted to incorporate fully actual inflationary developments under flexible rate loans, then more rapid rates of amortization will be implied than would have occurred under comparable

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1/ The share of adjustable rate notes in total bonds floated is small and has not grown noticeably in recent years, although maturities have shortened somewhat (see Williams, Johnson, et al. (1982), pp. 49 and 55).

2/ For an application of this approach, see U.S. Congressional Budget Office (1981 c), pp. 35-6.

fixed rate loans. 1/ But, again, if the government is both borrowing and lending in this way, then the net effect on the subsidy transfer should largely net out. Only if there is some mixed combination of structures would there seem to be a significant impact on the real value of the subsidy transferred through the government. The more common configuration surely would be the case of foreign borrowing at variable rates, but domestic lending on fixed terms. Here an increase would be expected in the real value of the subsidy transferred through the government due to inflation, and calculations based solely on nominal values would, therefore, underestimate the real transfer. Since the capitalized value of the subsidy stream is being computed, attempts to correct for these effects would have to include inflation forecasts over the relevant time horizon.

d. Korean data and assumptions

Because official Korean publications nowhere provide a cross tabulation of any government lending by both interest rate and maturity, a special request was made to the Ministry of Finance to provide such information on as much lending as feasible. The data supplied cover only the direct lending of central government ministries and administrative bodies (hereafter called government budgetary lending) and lending through the largest of the extrabudgetary funds, the National Investment Fund (NIF). As Table 3 shows, the loans included, therefore, accounted for about 55 per cent of central government lending between 1974, when the NIF was formed, and 1980.

The NIF was established to increase the flow of domestic savings toward sectors the Korean Government wished to encourage. The major sources of NIF loanable funds consist of the proceeds from sales of NIF bonds and contributions made by deposit money banks (except Fisheries Cooperatives), members of the National Savings Association, moneys in trust, insurance premiums from nonlife insurance companies, and various public funds managed by the central and local governments or other public sector entities. The contributions are deposits to the NIF or compulsory purchases of NIF bonds. 2/ The NIF makes both fixed investment and working capital loans, mainly to the heavy, chemical, and electric power industries (see footnote 1, page 22). The deposit money

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1/ See "Inflation and Debt Service," Appendix II, pp. 42-5 in Nowzad, Williams, et al. (1981).

2/ Deposit money banks are required to deposit with the NIF 13 per cent of the net increase in their gross amounts of time and savings deposits (5 per cent for the National Agricultural Cooperatives Foundation); nonlife insurance companies, 50 per cent of the amount remaining after deducting insurance money paid out and business expenses from their gross premium amount and other income; national savings associations, the full amount of their savings; life insurance companies, 50 per cent of their

Table 3. Korea: Loans Analyzed as Percentage of Consolidated Central Government Lending, 1972-80

(In billions of won)

Year 1/	Consolidated Central Government Gross Lending (1)	New Loans Issued—Government Budget (2)	New Loans Issued—National Investment Fund (3)	Study's Coverage as Percentage of Consolidated Central Government Gross Lending (4)
1972	106.2	34.4	—	32.4
1973	103.1	29.4	—	28.5
1974	203.4	32.0	62.7	46.6
1975	312.0	53.8	119.1	55.4
1976	366.4	43.6	178.1	58.8
1977	582.9	90.8	219.0	53.1
1978	813.8	106.9	402.1	62.5
1979	981.9	145.9	457.4	61.4
1980	1,413.5	179.3	438.4	43.7

Sources: Column 1: Ministry of Finance, A Summary of Government Finance in Korea, 1980; Columns 2 and 3: the Korean authorities.

1/ Year 1971 is deleted because gross consolidated central government lending is unavailable for that year.

banks, the Korea Development Bank, and the Export-Import Bank perform intermediary functions for these loans. The operational funding structure of the NIF involves negative margins between its lending and borrowing rates, so that losses result, which are fully offset by direct transfers from the government budget. These subsidies began at W 2.2 billion in 1974 and increased rapidly and steadily during the period under study, reaching W 40.0 billion in 1980.

Since the NIF has required budgetary grants in every year since its inception, the basic subsidy results were computed by using the average yields on government bonds as the discount rate, or "ultimate" marginal borrowing rate (i*) (Table 2), on all the lending analyzed, as discussed earlier. On the basis of these results, various comparisons of relative levels and growth rates with expenditures, taxes, and so on are made. However, to check the order of magnitude of the subsidies estimated in this way, an alternative method was employed that retained the same i* for government budgetary lending, but used the rate on NIF bonds for NIF lending (Table 4), and then added to the sum of the separately estimated subsidies the level of direct budgetary grants to the NIF. The comparative results, presented in Table 5, show that the second method gives rise to a similar level of total subsidies, just 12 per cent lower over the 1971-80 period.

Since only a simple adjustment was necessary in the calculations to compute an estimate of the implicit credit subsidies at the same time that the explicit calculations were being done, this was thought to be worthwhile, even though these results are not emphasized because of the admittedly less reliable estimate of i*. As indicated in Table 6, the alternative rates for borrowers were taken as the mean of the likely upper and lower bounds for this variable. The lower limit was set at the Korean Government's marginal borrowing rate, as it can safely be assumed that the firms receiving the loans could not have acquired funds at a lower cost than the sovereign state. Similarly, the upper bound was estimated by the prevailing rate in the so-called unorganized money

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2/ (Cont'd from p. 26) gross insurance premium receipts through the National Savings Association; Public Officials Pension Fund, 90 per cent of funds excluding normal payment reserves; for each of National Welfare Pension Fund, Military Pension Fund, Industrial Accident Compensation Insurance Fund, Korea Development Institute, Family Planning Research Center Fund, Teachers' Pension Fund, and Export Insurance Fund--their entire funds except normal payment reserves. As of December 31, 1980, of the total funds mobilized (W 1,616.2 billion), 62.1 per cent came from deposit money bank time and savings deposits, 19.1 per cent came from public funds, 9.7 per cent came from national savings associations, 6.5 per cent came from nonlife insurance companies, and 2.6 per cent came from elsewhere (e.g., postal savings, etc.).

Table 4. Korea: Interest Rates Paid on National Investment Fund Bonds Issued, 1974-80

(Annual percentage rate)

Year	Interest Rate 1/
1974	15.0
1975	15.0
1976	15.3
1977	15.7
1978	16.8
1979	18.6
1980	22.8

Source: Data provided by the Korean authorities.

1/ Weighted averages by amounts issued. The bonds usually mature in five years and carry a yield based on the one-year deposit rate of the deposit money banks.

Table 5. Korea: Alternative Method for Estimation of Explicit Credit Subsidies, 1971-80

(In billions of won)

Year	Computed Credit Subsidies on: Pure government lending 1/	National Investment Fund lending 2/	Direct Budgetary Grants to National Investment Fund 3/	Total
1971	30.9	--	--	30.9
1972	21.9	--	--	21.9
1973	18.0	--	--	18.0
1974	22.6	17.8	2.2	42.6
1975	38.8	22.0	5.3	66.1
1976	32.5	33.8	10.5	76.8
1977	63.3	38.6	15.6	117.5
1978	72.1	83.1	18.2	173.4
1979	116.8	93.8	43.1	253.7
1980	107.5	95.2	40.0	242.7
Total	524.4	384.3	134.9	1,043.6

Source: Data provided by the Korean authorities.

Note: Components may not add to totals because of rounding.

1/ Using the average yield on government bonds (Table 2) as the opportunity cost rate.

2/ Using the weighted average yield on National Investment Fund bonds (Table 3), which is based on the one-year time deposit rate in the deposit money banks.

3/ These grants are necessary to compensate the deposit money banks and other financial institutions for the so-called reverse margin inherent in National Investment Fund operations; this can be seen by comparing the deposit rates (paid) and lending rates (earned) on these funds:

	Deposit Rates	Lending Rates
	(Annual percentage rate)	
1974	15.0	6.0-11.0
1975	15.0	6.0-11.0
1976	15.0-16.2	6.0-12.5
1977	14.4-16.2	6.0-12.5
1978	14.4-18.6	6.0-14.5
1979	18.6	6.0-14.5
1980	19.5-24.0	6.0-20.5

Table 6. Korea: Estimated Alternative Borrower Interest Rates, 1971-80

Year	Alternative Borrower Rates
1971	41.9
1972	32.9
1973	27.8
1974	35.0
1975	35.6
1976	35.3
1977	33.1
1978	34.4
1979	38.5
1980	46.4

Sources: Based on average yields on government and public bonds shown in Table 2, and unorganized money market loan rate reported by the Bank of Korea, Survey of Business Financing and Unorganized Money Markets, quarterly report, various issues (see also Table 7 below).

market, or "curb" market (Table 7). 1/ The curb market has been a very important source of capital for the business sector during the period of analysis, primarily because of the Korean Government's interest rate policy and credit allocation scheme. Government regulations have set such low ceilings on nominal interest rates throughout the financial system that real rates have been near zero or negative, while real returns to capital have frequently exceeded 25 per cent. Thus, there has been excess demand for credit, and borrowers turned down by the government-owned banks have had to borrow in the curb market at very high rates. 2/

Although essentially a marginal market, the curb market handles transactions equivalent to one fourth of the narrowly defined money supply, and at least 26 per cent of Korean firms are regularly dependent on this market for capital, while many more come to the curb only intermittently. In a rare survey done on these questions (by Sogang University of Seoul), it was found that 75 per cent of all firms responding had some debts outstanding at the unorganized money market, while 10 per cent had more than 50 per cent of their debts in that market. 3/

A summary of the total lending analyzed and its terms, plus a very rough sectoral breakdown for each, is presented in Tables 8, 9, and 10. 4/

e. Results

Before discussing the results briefly, it is worth noting once again that they are actually conservative underestimates of the true credit subsidies in Korean direct government lending over the period. The underestimation results primarily from the restricted coverage of the analysis (Table 3) and the fact that the marginal borrowing rate of the Korean Government (i*) that was used understates the true rate by 2-4 per cent per annum (see note to Table 2). Moreover, in addition to reduced interest rates, there are general factors that make official credit assistance more favorable than its private counterpart that have not been taken into account at all in this analysis. For example, governments accept higher loan-to-value ratios, riskier projects, and frequently the fees or premiums charged are inadequate to cover costs of administration, or they may simply be waived. 5/

1/ *It could be argued that some weighted average of these two rates* would be preferable to the method used--i.e., that too much weight is given here to the unorganized money market rate. However, empirically, the results really are not very sensitive to this level of fine tuning. As the discussion of Figure 2 has indicated, once a certain level of i* has been reached, marginal increases mean less and less in terms of the subsidy transferred. This will be verified in the results from Korea.

2/ Healy (1981), p. 17.

3/ See van Wijnbergen (1981), p. 43, and Hoon (1982), pp. 49-50.

4/ The sectoral breakdown clearly is inadequate, but this is all the information available.

5/ U.S. Office of Management and Budget (1981), p. 188.

Table 7. Korea: Interest Rates in the Unorganized Money (Curb) Markets, 1971-80

(Annual percentage rate)

Year	Unorganized Money Market Loan Rate
1971	57.7
1972	46.8
1973	39.0
1974	49.0
1975	50.1
1976	48.9
1977	45.5
1978	47.2
1979	51.7
1980	63.9

Sources: Bank of Korea, Survey of Business Financing and Unorganized Money Markets, quarterly report, various issues; and the Korean authorities.

Table 8. Korea: Sectoral Distribution of Lending Analyzed, 1971-80

Year	Agriculture	Exports and Shipbuilding	Other	Total
		(In billions of won)		
1971	15.68	1.05	25.03	41.76
1972	12.05	1.05	21.32	34.42
1973	8.13	0.09	21.21	29.43
1974	15.65	2.00	77.09	94.74
1975	23.77	4.00	145.13	172.90
1976	32.08	10.00	173.41	215.48
1977	37.54	18.42	253.84	309.80
1978	59.45	20.09	429.42	508.96
1979	94.29	38.46	470.59	603.34
1980	90.30	54.58	472.84	617.73
Total	388.94	149.74	2,089.88	2,628.56
		(In per cent)		
1971	37.5	2.5	59.9	100.0
1972	35.0	3.1	61.9	100.0
1973	27.6	0.3	72.1	100.0
1974	16.5	2.1	81.4	100.0
1975	13.7	2.3	83.9	100.0
1976	14.9	4.6	80.5	100.0
1977	12.1	5.9	81.9	100.0
1978	11.7	3.9	84.4	100.0
1979	15.6	6.4	78.0	100.0
1980	14.6	8.8	76.5	100.0
Total	14.8	5.7	79.5	100.0

Source: Calculated from data provided by the Korean authorities.

Table 9. Korea: Average Loan Terms of Government Budgetary Lending, By Sector, 1971-80

Year	Agriculture	Exports and Shipbuilding	Other	Total
		Interest Rates 1/ (Annual percentage rate)		
1971	3.66	6.00 2/	6.37	5.34
1972	4.65	6.00 2/	6.57	5.88
1973	4.76	6.00 2/	5.88	5.57
1974	4.52	6.00 2/	6.14	5.80
1975	3.39	7.00 3/	5.80	5.34
1976	3.09	—	6.14	5.25
1977	3.94	—	6.38	5.64
1978	3.50	—	8.15	6.22
1979	1.96	—	7.25	4.55
1980	8.12	—	12.80	11.01
		Maturities 1/ (Years)		
1971	18.3	20.0 2/	18.3	18.3
1972	23.5	20.0 2/	19.2	20.7
1973	17.6	20.0 2/	23.5	21.8
1974	26.3	10.0 3/	24.2	23.7
1975	27.1	10.0 3/	21.2	22.1
1976	29.8	—	24.9	26.3
1977	20.6	—	22.4	21.9
1978	18.8	—	21.1	20.1
1979	19.8	—	21.7	20.7
1980	18.8	—	19.1	19.0

Source: Calculated from data provided by the Korean authorities.

1/ All figures are weighted averages, where the weights equal the face values of loans.
2/ Shipbuilding.
3/ Exports.

Table 10. Korea: Average Loan Terms of National Investment Fund Lending, By Sector, 1974-80

Year	Agriculture		Exports and Shipbuilding		Other		Total	
	Grace period	Payback period	Grace period	Payback period	Grace period	Payback period	Grace period	Payback period
			Interest Rates 1/ (Annual percentage rate)					
1974	7.5	7.5	—	--	7.5	7.5	7.5	7.5
1975	7.5	7.5	6.0 2/	6.0 2/	10.5	10.5	10.1	10.1
1976	7.5	7.5	6.0 2/	6.0 2/	10.5	10.5	9.9	9.9
1977	8.5	9.5	8.0 3/	8.2 3/	11.1	11.9	10.7	11.5
1978	8.5	9.5	8.0 3/	8.2 3/	11.1	12.0	10.8	11.7
1979	10.5	11.5	10.0 3/	10.0 3/	12.9	13.5	12.6	13.1
1980	14.5	15.5	14.0 3/	14.0 3/	16.2	17.1	15.8	16.6
			Maturities 1/ (Years)					
1974	3.0	5.0	—	--	3.0	5.0	3.0	5.0
1975	3.0	5.0	1.0 2/	3.0 2/	3.0	5.0	3.0	4.9
1976	3.0	5.0	1.0 2/	3.0 2/	3.0	5.0	2.9	4.9
1977	3.0	5.0	3.0 3/	7.5 3/	2.7	5.5	2.7	5.6
1978	3.0	5.0	3.0 3/	7.5 3/	2.9	5.2	2.9	5.3
1979	3.0	5.0	3.0 3/	7.5 3/	2.9	5.2	2.9	5.4
1980	3.0	5.0	3.0 3/	7.5 3/	3.0	5.2	3.0	5.5

Source: Calculated from data provided by the Korean authorities.

1/ All figures are weighted averages, where the weights equal the face values of loans.
2/ Exports.
3/ Shipbuilding.

The estimated annual credit subsidies for 1971-80 are presented in Table 11. 1/ The sectoral distribution of explicit subsidies is shown in Table 12, while the levels and rates of growth of the explicit subsidies are compared with (or scaled by) other relevant variables in Tables 13 and 14. The most obvious point to note first is that, despite the substantial underestimation, these subsidies are large. They equalled about half of the central government deficit, on average, between 1974 and 1980, or roughly 5 per cent of either total taxes or expenditures. Over the same period, they averaged 60 per cent of official fixed capital formation, 31 per cent of total educational expenditures, four times the amount spent on health, 44 per cent of corporate tax revenues, or 31 per cent of customs duties. Moreover, it is interesting to note that explicit credit subsidies were growing at a faster rate over the period than any other major category of expenditure except interest payments.

Because the sectoral breakdown provided by the Korean authorities was not very useful, not much can be said about the beneficiaries of these transfers. However, it is interesting to note that a simple distribution of lending is inadequate to show the allocation of the subsidies. The latter depends entirely on the terms at which the credit is made available. Thus, a comparison of Tables 8 and 12 shows that, whereas the agricultural sector received only 14.8 per cent of the lending analyzed, it received 22.3 per cent of the subsidies.

Perhaps most important of all from the standpoint of applying this methodology elsewhere is the comparison made in Table 15. This table reports the results of calculating the explicit subsidies two different ways: first, on the basis of individual loans, which involved hundreds of calculations; and second, on the basis of annual aggregations of loans, where their weighted average terms were used in the subsidy formulas. This latter method involved only nine calculations, which took about five minutes on a hand calculator, using one of the programs described in the Appendices. The comparative results over the 1971-80 period differ by only 2.6 per cent.

2. Explicit credit subsidies in the fiscal accounts

Since each year's gross lending (and therefore net lending) have now been disaggregated into "pure lending" and "credit subsidies," the fiscal accounts should be revised to reflect this. Tables 16 and 17 present this revision. Since the analysis has relied on estimates (e.g., of i*) that could be wrong, these numbers do not have the same reliability as the rest of those in the cash budget. For this reason,

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1/ It should be noted that the marginal difference between the explicit and implicit subsidies seems smaller than might have been expected. This is a result of the phenomenon shown in Figure 2.

Table 11. Korea: Estimated Credit Subsidies, 1971-80 1/

(In billions of won)

Year	Explicit Subsidy	Implicit Subsidy	Total
1971	30.9	4.5	35.4
1972	21.9	5.5	27.4
1973	18.0	4.8	22.8
1974	50.0	17.3	67.3
1975	80.8	35.2	116.0
1976	95.0	42.7	137.7
1977	133.0	60.8	193.8
1978	208.3	104.0	312.3
1979	285.9	104.7	390.6
1980	262.3	132.0	394.3
Total	1,186.1	511.5	1,697.6

Source: Calculated from data provided by the Korean authorities.

1/ These interest subsidies were calculated from the loans described in Table 3. Between 1972 and 1980, these loans averaged 49.2 per cent of consolidated central government lending. The method employed is described in the text. The explicit subsidies use the average yield on government bonds (Table 2) as an opportunity cost rate, while the implicit subsidies are based on the mean of the government bond and curb market rates (Table 6).

Table 12. Korea: Sectoral Distribution of Estimated Explicit Credit Subsidies, 1971-80

Year	Agriculture	Exports and Shipbuilding	Other	Total
		(In billions of won)		
1971	12.51	0.80	17.62	30.93
1972	8.38	0.70	12.84	21.91
1973	5.07	0.05	12.86	17.99
1974	9.05	1.22	39.71	49.98
1975	14.54	1.50	64.80	80.85
1976	19.37	3.18	72.41	94.96
1977	24.49	8.37	100.14	133.01
1978	40.71	9.46	158.09	208.27
1979	74.92	18.57	192.43	285.92
1980	55.39	23.60	183.31	262.30
Total	264.43	67.45	854.22	1,186.11
		(In per cent)		
1971	40.4	2.6	57.0	100.0
1972	38.2	3.2	58.6	100.0
1973	28.2	0.3	71.5	100.0
1974	18.1	2.4	79.5	100.0
1975	18.0	1.9	80.2	100.0
1976	20.4	3.4	76.3	100.0
1977	18.4	6.3	75.3	100.0
1978	19.5	4.5	75.9	100.0
1979	26.2	6.5	67.3	100.0
1980	21.1	9.0	69.9	100.0
Total	22.3	5.7	72.0	100.0

Source: Calculated from data provided by the Korean authorities.

Table 13. Korea: Relative Size of Estimated Explicit Credit Subsidies to Consolidated Central Government Accounts and GNP, 1974-80

Year	Explicit Credit Subsidies as Percentage of:											
			Expenditure							Tax revenue		
	Gross national product	Central government deficit	Fixed capital formation	Capital transfers 1/	Current subsidies transfers 1/	Education	Health	Roads	Net lending	Individual income tax	Corporate profits tax	Customs duty
1974	0.7	30.4	61.4	86.5	31.2	32.3	438.4	157.2	36.3	52.8	45.3	39.7
1975	0.8	40.1	57.3	49.7	47.3	36.0	493.0	158.8	49.1	58.7	60.1	40.2
1976	0.7	49.4	53.1	35.1	47.4	27.2	369.5	206.0	42.2	26.1	39.8	27.6
1977	0.8	42.1	56.1	118.9	51.6	28.3	275.4	157.6	28.3	33.0	40.1	28.0
1978	0.9	69.4	65.2	141.9	68.3	34.4	346.0	241.6	33.3	38.8	41.3	26.9
1979	1.0	52.5	71.7	216.1	32.4	33.1	507.0	319.8	37.3	40.4	42.5	31.3
1980	0.8	30.9	51.5	196.5	38.9	23.4	326.2	195.5	23.4	34.2	35.6	25.9
Memorandum items:												
Mean	0.8	45.0	59.5	120.7	45.3	30.7	393.6	205.2	35.7	40.6	43.5	31.4
Standard deviation	0.1	13.6	7.1	69.3	12.8	4.5	87.7	59.6	8.5	11.5	7.9	6.1

Source: Calculated from International Monetary Fund, Government Finance Statistics Yearbook, 1982; and Table 10.

1/ Less transfers to other levels of national government and abroad.

Table 14. Korea: Relative Growth Rates of Credit Subsidies and Other Categories of Expenditure, 1974-79

(Annual percentage rate)

Category	Growth Rate	Explicit Credit Subsidy Growth Rate as Percentage of Item's Growth Rate
Credit subsidies	42.1	99
Explicit	41.7	100
Implicit	43.3	96
Economic classification		
Total expenditure net lending	37.9	110
Total expenditure	37.4	113
Current expenditure	38.0	110
Goods and services	35.5	117
Wages and salaries	39.0	107
Interest payments	56.1	74
Subsidies and other current transfers 1/	39.0	107
Capital expenditure 2/	34.4	121
Acquisition of fixed capital assets	37.4	111
Capital tansfers 1/	27.1	154
Net lending	41.0	102
Functional classification		
General public services	32.8	128
Defense	37.8	111
Education	41.0	103
Health	37.7	112
Social services and welfare	36.1	117
Housing and community amenities	13.4	314
Other community and social services	25.5	165
Economic services	37.0	114
Other 3/	41.2	102

Source: Calculated from International Monetary Fund, Government Finance Statistics, 1982.

1/ Deleting those to other levels of national government and abroad.

2/ Purchases of stocks, land, and intangible assets are deleted either because they were insignificant or grew so erratically that the calculated growth rates are difficult to interpret.

3/ A large proportion of this item represents interest payments in extrabudgetary accounts.

Table 15. Korea: Comparison of Calculated Explicit Credit Subsidy Values on Individual Loan and Aggregated Bases, 1971-80 1/

Year	Aggregated Loan Values (In thousands of won) (1)	Mean Interest Rate 2/ (Annual percentage rate) (2)	Mean Maturity 2/ (Years) (3)	Number of "Loans" 3/ (4)	Subsidy Values (Individual Basis) (In billions of won) (5)	Subsidy Values (Aggregated Basis) (In billions of won) (6)	Percentage Change 4/ (7)
1971	41,762,100	5.34	18.34	30	30.93	32.71	5.75
1972	34,420,728	5.88	20.71	26	21.91	23.12	5.52
1973	29,425,034	5.57	21.83	19	17.99	18.87	4.89
1974	32,025,465	5.80	23.71	9	22.62	22.93	1.37
1975	53,761,760	5.34	22.14	13	38.81	39.58	1.98
1976	43,612,998	5.25	26.29	6	32.49	32.82	1.02
1977	90,759,886	5.64	21.87	14	63.30	64.95	2.61
1978	106,877,096	6.22	20.10	17	72.10	74.61	3.48
1979	145,895,288	4.55	20.70	14	116.77	118.41	1.40
1980	179,313,184	11.01	18.96	16	107.49	109.85	2.20
Total					524.41	537.85	2.56

Source: Calculated from data provided by the Korean authorities.

1/ Includes government budgetary lending only, excludes National Investment Fund lending. Since explicit subsidies are calculated, the discount rate is that in Table 2.

2/ Weighted mean, where weights equal face values on individual loans.

3/ These may not be "loans" per se, but aggregations by interest rate-maturity combinations.

4/ Column 6 over Column 5.

Table 16. Korea: Economic Classification of Consolidated Central Government Expenditure, 1975-80

(In billions of won)

	1975	1976	1977	1978	1979	1980
Current expenditure	1,257.6	1,789.3	2,361.6	3,196.6	4,472.4	5,640.9
Goods and services	689.7	1,008.2	1,341.8	1,894.7	2,130.7	2,963.2
Interest payments	48.5	94.4	132.2	190.2	285.2	433.5
Subsidies and other current transfers	519.4	686.7	887.6	1,111.7	2,056.5	2,244.2
Capital expenditure	343.1	504.4	442.7	585.3	751.6	920.9
Acquisition of new and existing fixed assets	141.1	178.7	237.2	319.6	398.9	509.8
Purchase of land and intangible assets	0.8	8.0	30.6	36.1	67.3	56.7
Capital transfers	201.2	317.7	173.5	225.2	273.5	321.9
Net lending	164.6	225.2	470.1	626.1	766.0	1,120.0
Total expenditures and net lending	1,765.3	2,518.9	3,274.4	4,408.0	5,990.0	7,682.0
Memorandum items:						
Subsidies and transfers 1/	333.3	471.2	369.8	452.0	1,013.5	858.6
Estimated:						
Credit subsidies 2/	116.0	137.7	193.8	312.3	390.6	394.3
Explicit	80.8	95.0	133.0	208.3	285.9	262.3
Implicit	35.2	42.7	60.8	104.0	104.7	132.0
Pure net lending 3/	83.8	130.2	337.1	417.8	480.1	857.7
Adjusted subsidies and transfers 3/	414.1	566.2	502.8	660.3	1,299.4	1,120.9

Source: International Monetary Fund, Government Finance Statistics Yearbook, 1982.

Note: Components may not add to totals because of rounding and because small categories (e.g., stock purchases) have been omitted.

1/ Deleting those to other levels of national government and abroad.
2/ See Table 11 and footnote.
3/ The estimated explicit credit subsidies were deleted from net lending above and added to subsidies and transfers above after having deleted those to provincial and local governments and abroad.

Table 17. Korea: Economic Classification of Consolidated Central Government Expenditure, 1975-80

(Percentage of total)

	1975	1976	1977	1978	1979	1980
Current expenditure	71.2	71.0	72.1	72.5	74.7	73.4
Goods and services	(39.1)	(40.0)	(41.0)	(43.0)	(35.6)	(38.6)
Interest payments	(2.8)	(3.8)	(4.0)	(4.3)	(4.8)	(5.6)
Subsidies and other current transfers	(29.4)	(27.3)	(27.1)	(25.2)	(34.3)	(29.2)
Capital expenditure	19.4	20.0	13.5	13.3	12.5	12.0
Acquisition of new and existing fixed assets	(8.0)	(7.1)	(7.2)	(7.3)	(6.7)	(6.6)
Purchase of land and intangible assets	(0.1)	(0.3)	(0.9)	(0.8)	(1.1)	(0.7)
Capital transfers	(11.4)	(12.6)	(5.3)	(5.1)	(4.6)	(4.2)
Net lending	9.3	8.9	14.4	14.2	12.8	14.6
Total expenditure and net lending	100.0	100.0	100.0	100.0	100.0	100.0
Memorandum items:						
Subsidies and transfers 1/	18.9	18.7	11.3	10.3	16.9	11.2
Estimated:						
Credit subsidies	6.6	5.5	5.9	7.1	6.5	5.1
Explicit	4.6	3.8	4.1	4.7	4.8	3.4
Implicit	2.0	1.7	1.9	2.4	1.7	1.7
Pure net lending	4.7	5.1	10.3	9.5	8.0	11.2
Adjusted subsidies and transfers	23.5	22.5	15.4	15.0	21.7	14.6

Source: Table 16.

1/ Deleting those to other levels of national government and abroad.

and because only the cash-based budget is consistent with other financial statistical data (flow of funds, etc.), the accounts themselves have not been directly adjusted. Instead, the credit subsidies are listed as memorandum items, and corresponding alterations are made in net lending and subsidies and transfers. 1/ Figures for the adjusted memorandum items, however, give a more accurate picture of the actual level of governmental "lending" and transfer payments made in every year.

3. Effective rates of interest

The most crucial operational issue in the forgoing analysis is selection of the correct opportunity cost interest rate, i*. In some cases, the correct choice of the discount rate may be so difficult that it cannot be done with any confidence. Or it might be that all rates are floating and an annual type of analysis must be used. In these instances, an alternative approach that does not involve a discount rate is the use of the effective rate of interest (ERI). It bears the same relationship to the former analysis as the calculation of the internal rate of return does to the net present value in project analysis. The analogy results because a loan is just like a "backward project" in the sense that the benefits of the "project" (loan disbursements) come initially, while the costs (debt service payments) are spread over the lifetime of the loan.

The ERI is defined as that rate of interest which, if used as a discount rate, would reduce the net present value of the loan to zero. Thus, the ERI is the same as the rate of interest on any loan on which interest must be paid on outstanding balances at all times (and on which there are no other costs payable) (Harvey, 1981, p. 17). Therefore, there usually is no need to calculate the ERI because it is the same as the quoted rate on the loan. However, when loans include special arrangements, such as grace periods during which payments are reduced below interest at the quoted rate, then the ERI diverges from this quoted rate and thus must be calculated directly.

Calculation of the ERI involves solving the following familiar equation for r:

$$\sum_{t=0}^{n} = \frac{LD_t - DSP_t}{(1+r)^t} = 0$$

1/ Break (1982), p. 288, comes to a similar conclusion regarding the integration of lending activities into the budget figures.

where LD = loan disbursements

DSP = debt service payments

t = time period

n = maturity

Fortunately, the functional equivalent of this equation has been preprogrammed into most financial calculators. Appendix VI demonstrates how to calculate the ERI on a loan with a grace period by using the program in that Appendix.

Estimation of credit subsidies using ERIs is done in the same way as was described above for annual subsidies. First, the ERIs in both government borrowing and lending are calculated, then the cost of servicing the outstanding balance of loans is calculated for each. The difference between the borrowing and lending cost is the subsidy. Table 18 presents calculated ERIs on the Korean Government lending that was analyzed previously. This is done separately for both direct budgetary lending and National Investment Fund lending. These can be compared directly with the average yields on government bonds (Table 2) and on National Investment Fund bonds (Table 4), which represent the ERIs on borrowing. Since the outstanding balances by program were not available for Korea, the final step in this approach was not completed. However, it is clear there is a substantial gap between the borrowing and lending ERIs in every year. Also, it should be noted that the lending ERIs changed very little through 1979, then jumped dramatically in 1980. It would be interesting to know whether similar calculations were done by the Korean authorities in 1979.

V. Implications and a Data Checklist

Explicit interest subsidies in direct government lending have been shown to be a major determinant of the Korean Government's fiscal position throughout the 1970s, equal to a minimum of at least half of the Central Government's deficit, on average. Moreover, it was found that interest subsidies are growing faster than any other category of expenditure. With more complete loan coverage and an inclusion of interest-based tax expenditures, interest subsidies would surely equal or exceed the entire deficit in every year.

One of the central reasons for these trends may be the concealed nature of the subsidies. Without undertaking the calculations recommended in this paper, the authorities could not have appreciated the full extent of subsidy commitments embodied in each year's new lending. Furthermore, given the Fund's classification system for its data on government finance statistics, it is even difficult to determine the

Table 18. Korea: Estimated Effective Rates of Interest on Official Lending, 1971-80 1/

Year	Government Budgetary Lending			National Investment Fund		
	ERI (Annual percentage rate)	Maturity (Years)	Total lent (In billions of won)	ERI 2/ (Annual percentage rate)	Maturity (Years)	Total lent (In billions of won)
1971	5.34	18.34	41.8	--	--	--
1972	5.88	20.71	34.4	--	--	--
1973	5.57	21.83	29.4	--	--	--
1974	5.80	23.71	32.0	7.50	8.00	62.7
1975	5.34	22.14	53.7	10.06	7.90	119.1
1976	5.25	26.29	43.6	9.90	7.76	171.9
1977	5.64	21.87	90.8	11.05	8.35	219.0
1978	6.22	20.10	106.9	11.19	8.28	402.1
1979	4.55	20.70	145.9	12.81	8.34	457.0
1980	11.01	18.96	179.3	16.13	8.52	438.4

Source: Calculated from data provided by the Korean authorities.

1/ ERIs and maturities calculated as weighted means from individual loans, using loan amounts as weights.

2/ Figures in 1975 and 1979 are exact. During other years, rates were changed over the course of the year, within a reasonably small range, but available data does not allow identification of specific amounts lent at various rates. Consequently, for the calculations it was assumed that all loans were made at the lowest rate, an assumption that is consistent with the analysis presented and discussed elsewhere in the text.

amount of annual interest subsidies without attempting to estimate the benefit stream's present value. Another cause is the recent trend in international interest rates. Because of high interest rates throughout the world, and domestically in Korea, some programs may now carry subsidies much more substantial than were ever intended. This process not only contributes to the misallocation of investment resources, thereby depressing the rate of economic growth, but it also generates additional derivative distortions--for example, the proper assessment of "profitability" in enterprises built on subsidized credit.

The implications of the analysis are twofold. First, rational decision making and expenditure control require that the value of these credit subsidies be estimated as a routine matter. Moreover, implicit in this suggestion is the belief that, once exposed, many of these programs could not be defended on the grounds of distribution or resource allocation. Hence, major budgetary cuts and less private sector crowding out should both follow. Second, the analysis demonstrates that the time dimension of lending really distinguishes it from other expenditure items in the budget. Even relatively small interest spreads between borrowing and lending rates lead quickly to large subsidy elements in longer-term loans. Since such subsidized credit schemes are common in a wide variety of countries from developing to industrial ones, currently observed fiscal deficits may simply reflect, to a surprisingly large degree, past interest subsidy commitments. Finally, because this whole process contributes to the creation of long-term structural deficits, the flexibility of fiscal policy in the short run may therefore become severely restricted.

The data required for this type of analysis are not extensive, and they should be reasonably easy for government authorities to provide. Most government loan programs have fixed terms (maturities, interest rates, grace periods) that do not change much over time. Since the grant element (the subsidy value as a proportion of the present value of loan disbursements) is constant for fixed terms, a quick method is simply to estimate this element from the structure and then multiply that percentage by the total funds lent in a program to obtain the total subsidy value.

Checklist

If a list of requests were to be drawn up for the necessary data to estimate the explicit interest subsidies contained in one year's direct government lending and effective rates of interest on borrowing and lending (say, to add to a questionnaire for a Fund mission), it would include at least the items listed below; if additional information is desired, such as the sectoral distribution of lending, this could be added. Item 5 would replace items 3 and 4 in the quick method.

1. For official government foreign borrowing and bond issuance, complete details on the following items are included:

a. Outstanding balances of debt at the beginning and end of year

b. Amounts of new loans, plus currencies of denomination (classified simultaneously by items c-f)

c. Disbursement schedules

d. Repayment schedules, including:

i. Characterization of any grace periods--whether interest is payable, at what rate, and frequency

ii. Loan structure--how repayments of principal and interest are determined, whether they are amortized

e. Maturity

f. Interest rate(s)

2. For official domestic borrowing and bond issuance, item 1 is included for all such transactions.

3. For all official direct government lending programs (separate budget and off-budget programs), the following are included:

a. Amount of lending, classified simultaneously by interest rate and maturity:

Gross New Lending During (Year),
By Interest Rate and Maturity

(Currency units)

Maturity

Interest rate			
		Amount	

where

- interest rate divisions should be no more than 0.25 per cent per annum;

- maturities should be in terms of years; and

- maturities should be defined as exclusive of grace periods. 1/

Separate tables should be prepared whenever the structure of the loans differ--e.g., it is desirable to aggregate all programs with common grace periods and repayment structures. Thus, for example, separate tables are required for amortized loans and equal principal repayment loans.

b. For each table prepared in item 3a, item 1, all parts should be included.

4. For each table in item 3a, the outstanding balance of debt at the beginning and end of the year should be given.

5. If it is impossible to include figures for items 3 and 4, then the following should be provided for all direct government lending (separating budget and off-budget lending):

a. Outstanding balances of debt at the beginning and end of year

b. Amounts of new loans (gross)

c. The mean interest rate at which new funds are lent (where the mean is the weighted average, using the face values of individual loans as weights)

d. The mean maturity (exclusive of grace period) over which new funds are lent (where the mean is the weighted average, using the face values of individual loans as weights)

e. The most common loan structure of the lending including:

i. Full characterization of grace periods, including length and debt service provisions on both principal and interest;

ii. Determination of principal and interest payments during the payback period--e.g., amortization methods.

1/ Any grace periods associated with loans should be explicitly identified and fully characterized in terms of interest/prinncipal due, frequency of payment, and duration.

Program 1/ for Calculating Subsidy Values on Simple Amortized Loans Without Grace Periods

I. Method of Calculation

The formula being calculated is based on loan repayments in the form of an annuity:

$$SV = A \left(1 - \frac{D_N^*}{D_N}\right)$$

where

SV = subsidy value

A = amount of loan (any denomination)

i = interest rate on loan (per cent per year)

N = maturity of loan (years)

i* = opportunity cost (alternative) interest rate

D_N = discount factor that gives present value of \$1 payable yearly for N years, therefore

$$D_N = \frac{1 - (1 + i)^{-N}}{i}$$

D_N^* = analogous to D_N for i*.

II. The Program

The program calculates the appropriate subsidy value, pauses for 10 seconds to allow it to be written down, then proceeds to compute the subsidy, or grant, element, i.e., the value of the subsidy as a proportion of the face value of the loan. When only this program is in the HP-38 calculator, its memory allocation should read: P-50 r-14.

1/ The Hewlett-Packard 38 (HP-38) program is presented here.

APPENDIX I

Program Step Number	Key Stroke
01	1
02	ENTER
03	RCL 4
04	+
05	RCL 3
06	y^x
07	1
08	$x \gtrless y$
09	÷
10	1
11	$x \gtrless y$
12	-
13	RCL 4
14	÷
15	STO 5
16	1
17	ENTER
18	RCL 2
19	+
20	RCL 3
21	y^x
22	1
23	$x \gtrless y$
24	÷
25	1
26	$x \gtrless y$
27	-
28	RCL 2
29	÷
30	RCL 5
31	$x \gtrless y$
32	÷
33	1
34	$x \gtrless y$
35	-

Program Step Number	Key Stroke
36	RCL 1
37	x
38	PSE
39	PSE
40	PSE
41	PSE
42	PSE
43	PSE
44	PSE
45	PSE
46	PSE
47	PSE
48	RCL 1
49	$x \gtrless y$
50	%T

III. Example

When it is found necessary, the program calls up the loan parameters that are stored in the calculator's first four memories. Therefore, the first step in using the program involves storing the following data:

A is stored in register 1

i is stored in register 2

N is stored in register 3

i* is stored in register 4

Example: If A = 3,160,000 (STO 1)

i = 0.075 (STO 2)

N = 20 (STO 3)

i* = 0.083 (STO 4)

Then keystroke R/S gives:

1st: 183,414.60 (absolute value of the subsidy)

(ten-second pause)

2nd: 5.80 (subsidy element of the loan).

Program 1/ for Calculating Subsidy Values on Amortized Loans with Grace Periods

I. Method of Calculation

Subsidy elements and values are calculated by this program on loans with grace periods at the beginning (before the period over which the amortization takes place) and during which time interest is paid on the entire outstanding principal, but at an interest rate that may be lower than that applying on the "standard" loan:

$$SV = A\left[1 - i_n \cdot D_n^* - \left(\frac{D_{n+N}^* - D_n^*}{D_N}\right)\right]$$

where i_n = interest rate during the grace period

D_n = discount factor for the grace period, n years, using i_n

D_n^* = analogous to D_n, but using i* over n years

D_{n+N}^* = analogous to D_n^*, but using i* over n+N years

Other variables defined as before.

II. The Program

When only this program is in the HP-38, its memory allocation should read: P-71 r-11.

Program Step Number	Key Stroke
01	1
02	ENTER
03	RCL 5
04	+
05	RCL 1
06	RCL 2
07	+
08	CHS
09	y^x
10	1
11	$x \gtrless y$
12	-
13	RCL 5

1/ The Hewlett-Packard 38 (HP-38) program is presented here. See the text and Appendix I for notation and general interpretation.

APPENDIX II

Program Step Number	Key Stroke
14	÷
15	STO 6
16	1
17	ENTER
18	RCL 5
19	+
20	RCL 1
21	CHS
22	y^x
23	1
24	$x \gtrless y$
25	-
26	RCL 5
27	÷
28	STO 7
29	RCL 6
30	$x \gtrless y$
31	-
32	STO 6
33	1
34	ENTER
35	RCL 4
36	+
37	RCL 2
38	CHS
39	y^x
40	1
41	$x \gtrless y$
42	-
43	RCL 4
44	÷
45	RCL 6
46	$x \gtrless y$
47	÷
48	STO 6
49	RCL 7
50	RCL 3
51	x
52	1

Program Step Number	Key Stroke
53	$x \gtrless y$
54	-
55	RCL 6
56	-
57	RCL 0
58	x
59	PSE
60	PSE
61	PSE
62	PSE
63	PSE
64	PSE
65	PSE
66	PSE
67	PSE
68	PSE
69	RCL 0
70	$x \gtrless y$
71	%T

III. Example

If: A = 14,945,987 (STO 0)

n = 3 (STO 1)

N = 5 (STO 2)

i_n = 0.085 (STO 3)

i_N = 0.095 (STO 4)

$i_n^* = i_N^*$ = 0.216 (STO 5)

Then R/S gives: 6,082,801.44 (subsidy value)

(ten-second pause)

40.70 (subsidy element).

APPENDIX III

Program 1/ for Calculating Subsidy Values on Bond-Like Loans

I. Method of Calculation

The program calculates the subsidy element and value of loans for which the principal is repaid in one lump sum at the maturity date, with only annual interest payments being paid in the interim:

$$SV = A\,[1 - (1 + i^*)^{-N} - i \cdot D_N^*]$$

II. The Program

When only this program is in the HP-38, its memory allocation should read: P-36 r-16.

Program Step Number	Key Stroke
01	1
02	ENTER
03	RCL 3
04	+
05	RCL 2
06	CHS
07	y^x
08	STO 4
09	RCL 1
10	x
11	RCL 1
12	-
13	RCL 3
14	÷
15	1
16	$x \gtrless y$
17	+
18	RCL 4
19	-
20	RCL 0
21	x
22	PSE
23	PSE

1/ The Hewlett-Packard 38 (HP-38) program is presented here. See the text and Appendix I for notation and general interpretation.

Program Step Number	Key Stroke
24	PSE
25	PSE
26	PSE
27	PSE
28	PSE
29	PSE
30	PSE
31	PSE
32	RCL 0
33	$x \gtrless y$
34	%T

III. Example

If: A = 2,413,627 (STO 0)

i = 0.02 (STO 1)

N = 5 (STO 2)

i* = 0.26 (STO 3)

Then R/S gives: 1,526,418.72 (subsidy value)

(ten-second pause)

63.24 (subsidy element).

Program 1/ for Calculating Subsidy Values on Equal Principal Repayment Loans with Full Disbursement Initially and Grace Periods During Which Interest Only is Payable

I. Method of Calculation

Frequently, loans are not amortized but are simply repaid in equal principal payments over some period, while interest is always payable on the outstanding balance due. This period of repayment may be preceded by a grace period during which only the interest is due, perhaps quarterly or semiannually rather than yearly. Many international loans with fixed terms are structured in this way. The program provided in this Appendix is used to calculate the grant and concessionary elements of international credits by both the Development Assistance Committee (DAC) of the OECD (see, for example, its 1980 Review: Development Cooperation) and the External Debt Division of the World Bank (see, for example, its World Debt Tables, published periodically).

The formula used is based on the fact that the present value of the service payments of an equal principal payments loan is the sum of three present value factors: (1) the interest paid during the grace period, (2) the principal payments, and (3) the interest paid after the grace period. Simplification of these elements leads to:

$$SE = 100 \left(1 - \frac{\frac{i}{f}}{d}\right) \left[1 - \frac{(1+d)^{-fn} - (1+d)^{-fn}}{d(fN-fn)}\right]$$

where SE = subsidy element as percentage of face value of the loan
i = annual rate of interest on the loan
f = number of payments per year
d = discount rate per payment period, e.g., $d = (1.1)^{1/f-1}$ for an annual discount rate (i*) of 10 per cent
n = grace period
N = maturity

II. The Program

When only this program is in the HP-38, its memory allocation should read: P-85 r-09.

1/ The example in this Appendix was provided by David McMurray, External Debt Division, the World Bank. It is usable on a Hewlett-Packard 38 (HP-38) calculator.

Program Step No.	Keystroke	Program Step No.	Keystroke	Program Step. No.	Keystroke
01	STO4	29	RCL7	57	÷
02	R↓	30	x	58	RCL6
03	STO3	31	CHS	59	÷
04	R↓	32	y^x	60	1
05	STO2	33	RCL5	61	-
06	R↓	34	RCL3	62	CHS
07	STO1	35	RCL1	63	x
08	RCL0	36	x	64	1
09	1	37	CHS	65	0
10	0	38	y^x	66	0
11	0	39	-	67	x
12	÷	40	RCL1	68	PSE
13	1	41	RCL7	69	PSE
14	+	42	-	70	PSE
15	RCL3	43	RCL3	71	PSE
16	1/x	44	x	72	PSE
17	y^x	45	RCL6	73	PSE
18	STO5	46	x	74	PSE
19	1	47	÷	75	PSE
20	-	48	1	76	PSE
21	STO6	49	-	77	PSE
22	RCL2	50	CHS	78	1
23	RCL3	51	RCL4	79	0
24	1/x	52	1	80	0
25	-	53	0	81	÷
26	STO7	54	0	82	RCL8
27	RCL5	55	÷	83	x
28	RCL3	56	RCL3		

III. Example

This program operates somewhat differently from those in Appendices I-III. It first calculates the grant element from the terms of the loan, and then applies this subsidy rate to the face value of the loan in order to compute the value of the subsidy. Moreover, interest rates are entered as integers, rather than as decimals; the maturity (i.e., the commitment date to the final payment date) is defined inclusive of the grace period; the grace period (i.e., the commitment date to the date of first principal repayment) is identified as that period during which interest only is paid (at the same rate, in this program); and the program allows for more than one payment per year.

As a practical matter, the loan parameters are stored in a slightly different way; for example, let us assume that $10,000,000 is lent on IDA credit terms, and the discount rate (i* = 10) used is that employed

by the DAC of the OECD and the External Debt Division of the World Bank for determining the concessionary element (over 25 per cent grant element) of international credits.

If i* = 10 (STO 0)
A = 10,000,000 (STO 8)
N = 50 years (ENTER)
n = 10 years (ENTER)
f = 2 = frequency of payments per year (ENTER)
i = .75 (3/4 of 1 per cent) = loan interest rate (leave in x)

Then R/S gives: 1st: 83.07 (subsidy element)

(ten-second pause)

2nd: 8,307,380.51 (value of subsidy).

Example of Calculation of Subsidy Values on Equal Principal Repayment Loans with Grace Periods During Which Interest Only is Payable and Loan Disbursements are Spread over Time

The example in this Appendix illustrates the calculation of the subsidy value (grant equivalent) when the loan is structured in a slightly different way. Of particular note is the fact that the present value of disbursements must be calculated if 100 per cent of the loan is not disbursed at the outset. This example was provided by the World Bank and again uses the Bank's conventional 10 per cent discount rate. 1/

Let us consider a loan of $100 with a maturity of 12 years, a grace period of 4 years, and an interest rate of 5 per cent, repayable in equal annual installments of principal. In this example, the loan is assumed to be disbursed over 3 years; it is also assumed that disbursements are made at the beginning of the year and that repayments are made at the end of the year.

1/ The example is taken from David McMurray, "Evaluating Alternative Financing Packages," Draft World Bank External Debt Division Working Paper No. 1982-3 (June 1982), pp. 2-4.

APPENDIX V

Example of Calculation of Grant Element

(In U.S. dollars)

Year	Outstanding at Beginning of Year	Disbursements	Interest	Principal	Total Debt Service	Present Value of: 1/ Disbursements	Present Value of: 1/ Debt service
1	25.00	25.00	1.25	—	1.25	25.00	1.14
2	75.00	50.00	3.75	—	3.75	45.45	3.10
3	100.00	25.00	5.00	—	5.00	20.66	3.76
4	100.00	—	5.00	—	5.00	—	3.42
5	100.00	—	5.00	12.50	17.50	—	10.87
6	87.50	—	4.38	12.50	16.88	—	9.53
7	75.00	—	3.75	12.50	16.25	—	8.34
8	62.50	—	3.13	12.50	15.63	—	7.29
9	50.00	—	2.50	12.50	15.00	—	6.36
10	37.50	—	1.88	12.50	14.38	—	5.54
11	25.00	—	1.25	12.50	13.75	—	4.82
12	12.50	—	0.63	12.50	13.13	—	4.18
		100.00	37.52	100.00	137.52	91.11	68.35

On the basis of the figures in this table, the grant equivalent and grant element are calculated as follows:

$$\text{Grant equivalent} = \$91.11 - \$68.35$$

$$= \$22.76$$

$$\text{Grant element} = \frac{\$22.76}{\$91.11} \times \frac{100}{1}$$

$$= 25.0 \text{ per cent}$$

1/ Discounted at the conventional 10 per cent per annum. The discounting factor is given by the expression

$$\frac{1}{(1+r)^n}$$

where r is the discount rate and n is the number of years. In the above example, the discount factor at the end of the second year is given by

$$\frac{1}{(1.1)^2} = 0.8264.$$

By discounting the disbursements and service payments of this loan at the conventional discount rate of 10 per cent, their present values are $91.11 and $68.35, respectively; the grant equivalent and grant element are therefore $22.76 and 25.0 per cent, respectively. This means that, from the borrower's point of view, a "soft" loan of $100, disbursed over three years, has the same present value as the combination of a "hard" loan of $68.35 and a grant of $22.76 that disburse fully in the year of their commitment. Both alternatives provide the borrower with $91.11 in present value terms.

Calculation of Effective Rates of Interest 1/

When loans involve grace periods during which the payments due are any amount less than the interest due on the outstanding principal at the rate quoted during the payback period, then the effective rate of interest on the loan is less than the quoted rate. Examples of each major type of loan will be calculated for demonstration purposes; notation follows that of other Appendices.

1. Amortized loans--annuities

Let $A = \$10,000,000$

$N = 8$ years

$n = 4$ years

$i_N = 15$ per cent

$i_n = 7.5$ per cent

A loan with a face value of $10 million is lent for a total of 12 years at a rate of 15 per cent, although during the initial four-year grace period no principal is due and reduced interest at half the regular rate only is payable.

To calculate the effective rate of interest (ERI), it is simplest to set up the cash flow pattern; since negative figures are outflows below, this is done below from the lender's point of view.

Year	Cash Flow	Payments		Remaining Loan Balance
		Interest	Principal	
0	-10,000,000.00	--	--	--
1	750,000.00	750,000.00	--	10,000,000.00
2	750,000.00	750,000.00	--	10,000,000.00
3	750,000.00	750,000.00	--	10,000,000.00
4	750,000.00	750,000.00	--	10,000,000.00
5	2,228,500.90	1,500,000.00	728,500.90	9,271,499.10
6	2,228,500.90	1,390,724.87	837,776.03	8,433,723.07
7	2,228,500.90	1,265,058.46	963,442.44	7,470,280.63
8	2,228,500.90	1,120,542.10	1,107,958.80	6,362,321.83
9	2,228,500.90	954,348.27	1,274,152.63	5,088,169.20
10	2,228,500.90	763,225.38	1,465,275.52	3,622,893.68
11	2,228.500.90	543,434.05	1,685,066.85	1,937,826.83
12	2,228,500.90	290,674.02	1,937,826.88	0.00

1/ Based on Hewlett-Packard 38 (HP-38) calculator.

The cash flows are easily computed by using the financial keys. To complete the calculations, recall that the ERI is logically identical to the internal rate of return. So, using the cash flows from the first column above, the ERI is found to be 10.8 per cent. (Checking the answer, net present value = -0.003, or approximately zero, as it should be.)

2. Equal annual principal repayments loan

Let us assume that the above loan is not amortized, but paid back in equal principal installments during years 5-12. Also, interest is paid annually on the outstanding balance, but at the different interest rates during the grace and payback periods.

Year	Cash Flow	Payments		Remaining Loan Balance
		Interest	Principal	
0	-10,000,000.00	--	--	--
1	750,000.00	750,000.00	—	10,000,000.00
2	750,000.00	750,000.00	--	10,000,000.00
3	750,000.00	750,000.00	—	10,000,000.00
4	750,000.00	750,000.00	--	10,000,000.00
5	2,750,000.00	1,500,000.00	1,250,000.00	8,750,000.00
6	2,562,500.00	1,312,500.00	1,250,000.00	7,500.000.00
7	2,375.000.00	1,125,000.00	1,250,000.00	6,250,000.00
8	2,187,500.00	937,500.00	1,250,000.00	5,000,000.00
9	2,000,000.00	750,000.00	1,250,000.00	3,750,000.00
10	1,812,500.00	562,500.00	1,250,000.00	2,500,000.00
11	1,625,000.00	375,000.00	1,250,000.00	1,250,000.00
12	1,437,500.00	187,500.00	1,250,000.00	0

Here, the ERI = 10.59 per cent.

(Checking the answer, net present value = -0.0002.)

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