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Robert L. Slighton, David S. C. Chu and Richard V. L. Cooper

A Report prepared for

AGENCY FOR INTERNATIONAL DEVELOPMENT

Rand
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PREFACE

This report is the summary document of a study carried out by The Rand Corporation under the sponsorship of the Agency for International Development concerning the effects on the U.S. balance of payments of an untying of development assistance. Two additional reports on special aspects of this topic are also being issued: Richard V. L. Cooper, The Additionality Factor in U.S. Development Assistance, R-974-AID; and David S. C. Chu and Robert Shishko, The Respending Effects of Untying Aid, R-975-AID.

The basic objective of this study has been to provide U.S. policymakers with quantitative estimates of the short- and long-run shifts of world trade that would result from untying. It is generally conceded that an elimination of procurement restrictions on foreign development assistance would carry with it substantial advantages in terms of the increased value of aid and reduced administrative friction. It is less clear whether such a policy decision would create significant balance-of-payments difficulties for certain of the donor nations. This has been the chief stumbling block in the now-suspended negotiations among the member countries of the Development Assistance Committee of the Organization for Economic Cooperation and Development, for policymakers have been understandably concerned that they not create a new set of problems in the course of solving old ones.

SUMMARY

Any estimation of the consequences for the U.S. balance of payments of a shift from a tied to an untied development lending program must include information on three sets of parameters. We must know what the pattern of exports procured with untied aid will be; we must know what the effective as opposed to the apparent pattern of exports financed under tied aid has been; and we must know the nature of the relationship between the initial changes in trade flows caused by untying and the changes in trade over time that will be induced by those initial changes.

ESTIMATING THE FUTURE PATTERN OF EXPORTS PROCURED WITH UNTIED AID

The starting point for our analysis of likely future procurement patterns for exports financed through untied aid is the matrix of average shares of "commercial" exports in the period 1966-68 (exports not financed through barter arrangements, tied grants, or tied loans with a relatively high concessional element). This matrix was then adjusted in several different ways to take account of time trends in trade shares, the exchange rate realignments of 1971, and certain differences between the matrix of average shares of commercial exports and the matrix of average shares of exports financed through International Bank for Reconstruction and Development (IBRD) and International Development Association (IDA) loans. The average share concept (adjusted for trends) was chosen over the marginal share concept because of the extreme instability of measures of marginal trade shares. We estimate that the U.S. share of exports procured through untied U.S. aid is likely to be 25-27 percent in the early 1970s if that aid is distributed geographically in the same way that U.S. development loan expenditures were distributed in 1969.

ESTIMATING THE PATTERN OF EXPORTS PROCURED WITH TIED AID

The measure of the effectiveness of tying restrictions is the ratio of the increase in exports from the donor country to the

recipient country that results from a tied aid program to the volume of exports financed by the aid program. We shall call this ratio the additionality factor. It is not, in general, equal to one. In certain areas a significant proportion of the exports financed by tied aid represents exports that would have been purchased in any event. In certain other cases the increase in exports from the United States arising from a tied aid program is greater than the size of the aid program itself. If it is required that U.S. tied aid be used in part to purchase goods that would ordinarily be purchased from another country, the additionality factor is not constrained to be less than or equal to one.

We have estimated this factor for the major recipients of U.S. aid through regression analyses of time series on trade and development assistance. We find, in some sense paradoxically, that the additionality factor is inversely related to the U.S. share of commercial exports to the recipient country. Further, where the U.S. share of commercial exports is small, we find that the additionality factor is often likely to be greater than one. We say "likely to be" rather than "is" because the standard errors of our estimates of additionality in many cases are relatively large (although considerably smaller than the estimates themselves).

The uncertainty as to the size of the additionality factor for U.S. aid is compounded by the fact that there is no direct evidence as to additionality factors for the tied aid of the other Development Assistance Committee of the Organization for Economic Cooperation (DAC) nations except in the case of the United Kingdom. Neither is there direct evidence as to the meaningfulness of the DAC distinction between tied and untied aid. The additionality factor appropriate to officially "untied" aid of the other DAC nations -- the effectiveness of de facto tying restrictions -- is thus not known. As a result we are forced to estimate the balance-of-payments effects of untying with a variety of additionality assumptions. This uncertainty as to the appropriate set of additionality factors is the major source of potential error of estimation of the consequences of untying for the U.S. balance of payments.

ESTIMATES OF THE FIRST-ROUND BALANCE OF PAYMENTS LOSS TO THE UNITED STATES

Although the precise magnitude is highly uncertain, it can easily be predicted that under any set of foreseeable circumstances, untying will result in a substantial balance-of-payments loss to the United States. If this untying is unilateral, the ensuing first-round loss of exports would probably fall in the range of 46-53 percent of the amount of the aid program being untied if AID regulations pertaining to shipping costs were not changed. That is, if a $1 billion U.S. aid program were converted from a tied program to an untied program, the first-round drop in U.S. exports would probably be somewhere between $460 million and $530 million. It is not totally unreasonable that the drop in exports should fall outside this specified range, however. Our "best" estimate is that the first-round balance-of-payments loss resulting from a unilateral untying of U.S. aid would be about 48 percent of the value of the aid program.

If the United States were to agree to a reciprocal untying of aid with all DAC countries, our "best" estimate is that the first-round U.S. balance-of-payments loss would be something like 36 percent of the amount of U.S. aid untied if the DAC distinctions between tied and untied aid are meaningful for the other donors. The assumption here is that the ratio between U.S. aid and the aid of other DAC donors is the same as in 1969. If, as we think more likely, these distinctions are only partly meaningful, and if the untying agreement were to cover de facto as well as official procurement restrictions, the U.S. first-round loss of exports would be equal to roughly 33 percent of the amount of the affected aid program. We would set the range of likely variation for these estimates at 33-41 percent and 30-38 percent respectively.

These losses would increase somewhat if certain DAC member nations refused to participate in the multilateral untying agreement. If it is assumed that it is administratively feasible to prevent such countries from increasing their share of exports financed from aid, the U.S. first-round balance-of-payments loss would increase roughly one-half cent for each dollar of U.S. aid untied if Canada were to abstain.

The refusal of France to participate would add roughly one-and-one-half cents per U.S. aid dollar to the first-round U.S. balance-of-payments cost of untying. If there were no administrative machinery to prevent a nonparticipant from securing its commercial share of the exports financed through untied aid, these added costs would be about one cent and two cents on the U.S. aid dollar respectively.

ESTIMATES OF THE TOTAL BALANCE-OF-PAYMENTS LOSS TO THE UNITED STATES

These estimates of the first-round loss of U.S. exports overestimate the total change in U.S. exports attributable to untying in that they ignore the increases in the demand for U.S. exports that will be induced by the increases in income in those countries enjoying a first-round increase in exports. The method we have chosen for estimating the magnitude of these respending effects is a straightforward adaptation of the generalized model of the multisector multiplier. This model avoids the major pitfalls encountered in previous attempts to solve the respending problem by focusing directly on the behavioral linkage between changes in exports and changes in imports.

Our conclusion is that estimates of the first-round losses of U.S. exports overestimate the total change in U.S. exports deriving from untying by some 7-15 percent. When respending effects are considered, we estimate the (undiscounted) total fall in U.S. exports to be about 43 percent of untied U.S. aid for the case of unilateral untying and 30-32 percent for multilateral untying if the ratio of U.S. aid to the aid of other DAC donors is the same as 1969. These numbers correspond to the 48 percent and the 33-36 percent estimates of first-round losses in exports. The range of likely variation for these estimates of total changes in exports we shall set at 40-49 percent and 27-37 percent respectively.

The figures given above pertain to export changes only. If the total balance-of-payments effect of untying is considered -- and if it is assumed that the United States does not pursue a policy of compensating for the income effects of the first-round drop in exports -- the "cost" of untying is somewhat less. The difference here is, of course, that the first-round fall in exports will induce a subsequent

fall in imports unless the U.S. government follows a compensatory fiscal-monetary policy. If this effect is considered in conjunction with the fact that future values are comparable to present values only if they are discounted, the total balance-of-payments loss to the United States of untying (viewed in terms of present value at the time of discounting) can be estimated as 37 percent of aid untied for the case of unilateral untying and 26-28 percent for the multilateral case. This assumes that the first-round fall in expotts occurs with a lag of one year after the decision to untie and that the appropriate rate of discount is 10 percent (the Eurodollar rate). The absolute range of the likely variation in these estimates remains approximately as before.

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I. INTRODUCTION

In recent years there has been an increasing recognition of the problems created by the attachment of procurement restrictions to foreign development assistance. These restrictions reduce the real value (volume of goods procured) of such assistance and distort investment decisions. They lessen the political benefits that might otherwise derive from an aid program in that they lend support to the contention that the objective of the donor is to promote commercial exports -- and in that they provide a constant source of administrative friction. And they restrict the growth of exports from the less developed countries, thus further constraining their prospects for rapid economic development.

Such were the conclusions of the Pearson report to the World Bank, the Presidential Mission to the Western Hemisphere headed by Nelson Rockefeller, and the executive task force chaired by Rudolf Peterson. In response to the findings of these groups, the development assistance policy of the United States underwent a series of modifications in 1969 and 1970 that permitted a certain degree of relaxation of the procurement restrictions attached to AID loans; and in September 1970 President Nixon proposed that all donor nations agree to a reciprocal untying of their development aid. Negotiations among the member nations of the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) began shortly thereafter and continued until the summer of 1971, when they were suspended pending resolution of the international payments problems that came to a head at that time.

The suspension of these negotiations underscores the concern of U.S. policymakers that an elimination of procurement restrictions on development aid might create a new set of problems in the process of solving an old set. In particular, the shift in the pattern of international trade that would result from untying might create significant balance-of-payment difficulties for the United States. This is the question to be examined in this study. More specifically, we shall

investigate the effect on the U.S. balance of payments of three types of untying decisions: a unilateral elimination of all export-procurement restrictions; a reciprocal untying agreement with all aid donors; and a reciprocal untying agreement with a subset of aid donors.

THE RESEARCH DESIGN

Estimation of the consequences for the U.S. balance of payments of a shift from a tied to an untied development lending program requires development of information on three sets of parameters: What will be the pattern of exports procured with untied aid; what has been the effective as opposed to the apparent pattern of exports financed under tied aid; and what is the relationship between the initial changes in trade flows and the changes in trade over time that will be induced by the initial set of changes? That is, we must know the relationship between the short- and long-run equilibrium trade patterns implied by an untying of aid.

This is a tall order. In the strict sense we can know what the procurement pattern for exports financed by untied aid will be only if we have constructed a complete model of the determinants of international trade by country and by commodity type. Knowledge of what the relationship between the new short- and long-run trade-pattern equilibria will be implies clairvoyance with respect to the future economic policies of every nation. Needless to say, we do not expect to provide strict solutions to either problem.

The design of this report is dictated by these information requirements. Section II is concerned with the estimation of export procurement patterns under the assumption that development lending is untied. These estimates are based on an examination of recent procurement patterns for both "commercial" exports and exports financed by IBRD/IDA lending. The implications for export shares of the December 1971 exchange rate realignment are also investigated.

The "real" as opposed to the apparent procurement patterns of exports financed under tied aid -- the so-called "additionality" problem -- are explored in Section III. Estimates of the additionality factor for the major recipients of U.S. development lending are obtained through regression analysis of time series.

The estimates of future export-procurement patterns and past additionality are combined in Section IV to yield estimates of the short-run changes in the U.S. balance of payments that would be forthcoming given an untying of aid. Given the inherent uncertainty of both sets of parameters, these estimates are derived for a variety of sets of initial assumptions.

Section V examines the extent to which respending effects will tend to reverse over time the short-run changes in the U.S. balance of payments that were estimated in Section IV. The method used here is neither the reserve-accumulation nor "reflection-ratio" approach of previous analysis but an extension of multisector multiplier analysis.

THE QUESTION OF AGGREGATION

Our analysis has been carried out in terms of a model in which the world is defined as the sum of sixteen trading sectors. Eight of these sectors are aid donors: the United States, Canada, the United Kingdom, Germany, France, the Other Common Market countries (Belgium, Italy, and the Netherlands), Japan, and Australia-New Zealand-South Africa. Six are aid recipients: the Caribbean area, Other South America, the Middle East, Africa, South Asia, and the Far East.[1] The sector labeled Other Europe is both an aid giver and an aid receiver, and the Sino-Soviet area is presumed to carry out trading relations with the other fifteen sectors that are invariant with respect to the question of whether development aid is tied or untied.

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[1] We have defined the Caribbean area to include Colombia and Venezuela. The classification Other South America is thus South America less Colombia and Venezuela. The point of this distinction is that the export procurement patterns of these two countries are less homogeneous with respect to the rest of South America than they are to Central America. A second difference is that we have included Greece and Turkey in the Middle East. South Asia includes India, Pakistan, Ceylon, and Afghanistan. The Far East we have defined as those countries constituting the classification "Other Asia" in the International Monetary Fund's Direction of Trade Annuals less Hong Kong and the nations classified as South Asia. Our definition of Africa is identical to the Direction of Trade Annual classification "Other Africa."

Several explanatory comments are in order concerning our decision as to what sort of aggregation procedure to adopt. In the age of computers there is a strong tendency to disaggregate extensively. Indeed, it may be thought unreasonable to carry out analysis of this sort in terms of any other unit than the individual country. We disagree. There are several reasons why some form of aggregation may be desirable -- only one of which is that the tedium of calculation thereby is reduced. One argument for some form of aggregation is the unwieldiness of the presentation of the results of a greatly disaggregated model. Another is that of reduced variance. A fully disaggregated model may appear to be "more accurate," but this apparent advantage may be completely spurious. Although it may seem more reasonable to predict Korean imports from Korean export-procurement patterns than from export patterns relative to some Far East aggregate, this need not be the case. The variance of the parameters estimated for individual countries tends to be quite large relative to those of regional groupings, and if the individual countries of an aggregate are reasonably homogeneous over time with respect to the characteristic in question, it may well be advantageous to estimate the behavior of individual countries from parameters estimated for a regional aggregate.

Such considerations are interesting, but the basic question remains. Are our results affected very much by our aggregation procedure? The difference between the estimates of the effect on the U.S. balance of payments of unilateral untying presented in Section IV (estimates containing seven aid-receiving sectors) and estimates from a model containing 25 aid-receiving sectors is only one-tenth of one percent of the amount of aid untied.[1] In the case of multilateral untying, there may be nontrivial differences for the other DAC countries between the results given by the aggregation scheme used here and the results

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[1]These sectors were Colombia, the Dominican Republic, Regional Organization of Central America and Panama, Other Caribbean, Bolivia, Brazil, Chile, Other South America, Yugoslavia, Greece, Turkey, Other Middle East, Ghana, Nigeria, Morocco, Tunisia, Other Africa, India, Pakistan, Other South Asia, Indonesia, Philippines, Korea, Taiwan, Other Far East.

of a less aggregated model, but the estimates for changes in the U.S. balance of payments do not change significantly. For example, although the various subregions of Africa are not homogeneous with respect to the export shares of European countries, the U.S. export share is uniformly low. Thus while the aggregation procedure used in this study may introduce some bias with respect to changes in the balance of payments of France or Britain, the bias it creates for estimates of changes in U.S. trade is trivial.

II. THE ESTIMATION OF PROCUREMENT SHARES OF EXPORTS FINANCED THROUGH UNTIED AID

The problem to be dealt with in this section is that of predicting what changes would take place in the distribution of exports by country of origin if imports financed through development loan programs could be procured freely. That is, what countries would be supplying those exports that are now being supplied by aid donors under tying arrangements if the loans were to continue but the tying arrangements were to be eliminated?

In the most general case this means coming to grips with the fact that there is no particular procurement pattern that would be common to the unilateral relaxation of tying restrictions of every aid donor. For example, the increase in French exports resulting from the untying of $1 million of (successfully) tied U.S. aid to India is not likely to be the same as that resulting from a reduction of (successfully) tied U.K. aid to India of the same amount. By "successful" tying we mean a tying arrangement that results in an increase in total exports from the donor that is equal to the amount of aid that is tied.

What is conceptually desirable is not necessarily empirically feasible, however. In order to obtain the appropriate set of export-share vectors for each pair of donors and recipients it would be necessary to carry out a line-by-line analyzing of the exports financed through each development assistance program and a detailed projection of the exports likely to be financed by future aid programs. This is simply not feasible.

The procedure we used here is considerably more simplified. First, we shall generally assume to be true what we have pointed out above as being false -- that the same procurement pattern is appropriate to the untied aid of every aid donor.[1] To use the example first given,

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[1] We have relaxed this assumption only in the case of exports arising out of aid to the Caribbean area. European aid programs to that area are to enclaves whose import patterns are radically different from those of the region as a whole. The aggregation bias that would

we shall in fact assume that the increase in French imports resulting from a unilateral untying of $1 million (successfully) tied aid from the United States to India would be the same as that resulting from the same action by the United Kingdom. This is a strong assumption. In the strict sense it would not be warranted even if all successfully tied aid were in the form of generalized balance-of-payments support. It is particularly suspect in the circumstances of this study, for the relative composition of project and program components of the lending programs of various aid donors varies widely. In general, it can be expected that project lending is concentrated in activities for which the donor country has sufficient special competence to give it a relative advantage in an export competition. Even more significant, project lending often follows grant assistance by the same country for project loan development, and the national origin of the technical inputs into project planning plays an extremely important role in determining the national origin of the exports used in the construction of that project. For such reasons this basic assumption is not one that we make cheerfully. We make it because we lack the detailed information necessary to its abandonment. For assessing the consequences of a unilateral abandonment of tying restrictions by the United States, this assumption presents no great problem. It is potentially a significant source of error, however, in assessing the detailed consequences of multilateral untying.[1]

We shall be somewhat bolder in dealing with two further issues -- whether the trade-share pattern appropriate to untied aid is the same

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result from the assumption of a common procurement pattern is thus a potentially important source of error in estimating changes in the U.S. balance of payments. To minimize this bias we have estimated separate procurement vectors for the United States, the United Kingdom, France, and the Netherlands. A similar problem obtains for Africa, but the aggregation biases here are quantitatively important only for estimates of changes in the balance of payments of European donors.

[1]Since the ratio of program to project lending is apparently higher for the United States than for the DAC countries as a whole, the assumption of identical procurement patterns for aid from various donors may yield estimates of the U.S. share of exports financed by foreign aid that are too large. If so, the total U.S. balance-of-payments loss resulting from untying would be underestimated.

as the distribution by country of origin of "commercial" imports -- and whether the pattern of trade observed in the past is appropriate to the future. With respect to the first of these problems the simplest assumption is that the pattern of commercial exports predicts the procurement pattern that is appropriate to assessing the consequences of an untying of aid. This "homogeneity" assumption does not hold strictly and certain modifications are desirable; in particular, some account should be taken of the fact that the distribution by type of the imports financed through assistance programs is not the same as the distribution by type of all imports. The former set of imports will be weighted much more heavily with capital-goods items that can, in general, be supplied only by the industrial nations. This is particularly true of project lending, but it is true to some extent of program lending as well. The experience of the IBRD and IDA with respect to trade-share patterns resulting from project lending provides a benchmark that can be used to adjust the patterns that emerge from analysis of commercial trade. There is thus a sound empirical basis for modifying the homogeneity assumption, but the precise adjustments called for -- particularly in the case of program lending -- necessarily require the application of a certain amount of "Kentucky windage."

Adjustments of past trade patterns to take account of expected future changes also must partake to some extent of an ad hoc character. There are two critical problems here. First, even if we were to possess a model of the determination of export shares that was perfectly splendid in terms of the certainty of estimation of its parameters, we would not in general know the figure values of the independent variables of that model. Second, we do not have such a model.

Our judgment is that the problem addressed in this report does not warrant the expenditure of time and effort required to develop an explicit model of export shares.[1] First, the major sources of

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[1]For a survey of model of the direction of trade see R. Stern and E. Leamer, Quantitative International Economics (Boston: Allyn, 1971).

uncertainty in estimating the balance-of-payments effects of untying aid are uncertainty with respect to additionality (the effectiveness of tying arrangements) and uncertainty with respect to the relevance of commercial trade patterns to the estimation of procurement patterns for untied aid -- not uncertainty with respect to commercial trade patterns. Second, the construction of such a model presents formidable difficulties. The determinants of trade shares for the less-developed regions are exceedingly complex, and many elements important to the causation of changes in trade patterns are not readily susceptible to empirical analysis. Nonquantifiable or hard-to-quantify factors such as institutional relationships (for example, sales networks) deriving from a previous colonial status can be handled only in terms of "dummy" variables, and the extent to which the importance of such determinants is changing through time is virtually impossible to estimate given simultaneous changes in relative prices, exchange rates, product quality, and the emergence of new products.

The remainder of this section reflects the basic problems to which we have alluded. First we examine the evidence from the recent past as to the distribution of commercial exports. We are concerned here both with the sensitivity of trade patterns to the precise definition of what we mean by "commercial" exports and the question of the stability of these patterns over time. Second, we contrast these results with evidence as to the pattern of distribution of exports financed through IBRD and IDA lending. Third, we establish several synthetic sets of estimates of the likely pattern of procurement applicable in the future to untied aid -- estimates that incorporate certain features of both the "commercial" and IBRD/IDA trade matrices and attempt to allow for both recent trends in trade shares and the recent round of exchange-rate readjustments.

THE WORLD PATTERN OF "COMMERCIAL" EXPORTS

Any attempt to derive an estimate of export shares that would be relevant to an untied aid program from past data must distinguish between "commercial" and "non-commercial" commodity flows. This is obvious. What is not obvious is precisely how to make this discrimination.

One definition of "non-commercial" trade embraces all commodity flows whose procurement is effectively specified by the terms of foreign public assistance programs. This is not totally satisfactory. What do we mean by an "assistance program"? What do we mean by "effectively specified"? Should exports financed under credits from the Export-Import Bank or its foreign counterparts be excluded? Further, should exports originating in barter arrangements be considered "commercial" exports?

Our choice is not to try to adopt a particular definition of what should be meant by "non-commercial" imports. Instead we shall offer several measures and examine the differences between them. Certain exclusions seem obviously warranted. "Special category" exports from the United States (1965 definition) -- military exports -- come under this category. So, we think, do exports deriving from the various P.L. 480 programs. Although such exports do undoubtedly represent in some part a substitute for "commercial" exports, the virtually certain continuation of the program argues for the exclusion of this type of commodity trade from our consideration of trade shares. Exports financed through tied foreign development grants or loans should also be excluded insofar as those loans are "effectively tied" -- that is, they result in exports from the donor country that would not have taken place in the absence of the loan. Exports financed under "untied" grants and loans present something of a special problem. A priori, such exports should not be excluded. Nevertheless, a high proportion of formally untied assistance is conveyed in such a manner as to effectively specify that any imports deriving from such assistance will largely come from the donor country. To make no allowance at all for the trade derived from "untied" assistance would be to distort the results somewhat in our opinion.

A final exclusion is exports from the Sino-Soviet bloc. These in large part reflect the existence of bilateral trade agreements. There is no reason to assume that existing Sino-Soviet trade shares provide any basis for estimating the Sino-Soviet share of the imports that would result from an increment of free foreign exchange. Indeed, in the case where this "free foreign exchange" derives from the untying

of a U.S. development loan, the most likely procurement share of the Sino-Soviet bloc is something close to zero.

Although unquestionably exports arising out of "effectively tied" development assistance should not be considered "commercial" exports, the doubly complex problem remains as to what part of the various flows of assistance are "effectively tied." In the case of the United States it is generally agreed that a portion of U.S. exports financed under grant or loan programs represent exports that would have taken place in the absence of those assistance programs. That is, additionality is only partial. In the case of Germany, however, it is generally reckoned that the flow of "effectively tied" exports is substantially larger than the volume of formally tied assistance. This arises because for Germany the ratio of formally tied to formally untied assistance is relatively low (33 percent in 1969). We have already discussed the likelihood that there is a relatively high degree of "additionality" involved in project lending, whether formally tied or untied. In these circumstances we must examine the consequences of various assumptions about both additionality and the flow of assistance to which this additionality is assumed to apply.

One final note should be made with respect to the flow of tied development aid from the United States. The figure that appears most appropriate here is the volume of AID-financed exports from the United States. An alternative figure is AID development loan expenditures, but this total does not allow for exports financed under (tied) supporting assistance grants or (tied) contingency fund expenditures.

The importance of these various adjustments is indicated in Table 1. The U.S. share of total exports according to the International Monetary Fund's Direction of Trade (DOT) is given as a benchmark. We also used four alternative definitions of "commercial" exports. As was expected, the U.S. share of "commercial" exports is generally less than its share of total exports to the various less-developed regions. For South Asia, the difference between "commercial" trade shares and total trade shares is extraordinary. Substantial differences also exist for Africa and the Far East. The question remains, however, as to which definition of commercial trade establishes

Table 1

THE U.S. SHARE OF COMMERCIAL EXPORTS BY REGION FOR ALTERNATIVE DEFINITIONS OF THE TOTAL VOLUME OF COMMERCIAL IMPORTS

U.S. Share of Exports in Period 1966-68 to:	Caribbean Area	Other South America	Other Europe	Africa	Middle East	South Asia	Far East
Definition one: Commercial exports = total DOT exports	.545	.330	.093	.103	.192	.332	.279
Definition two: Commercial exports = total DOT exports less (U.S. special category exports + P.L. 480 exports + Sino-Soviet exports + AID financed exports)	.539	.299	.098	.081	.163	.098	.216
Definition three: Commercial exports = definition two + non-additional (1-α) AID financed exports (α = .6 for Latin America, .9 elsewhere)	.543	.311	.099	.082	.164	.112	.221
Definition four: Commercial exports = definition three less 90 percent of tied development loans and grants (other than technical assistance) by countries other than the U.S.[a]	.552	.313	.099	.085	.167	.124	.229
Definition five: Commercial exports = definition three less 90 percent of total development and other than technical assistance by countries other than the U.S.[b]	.558	.320	.099	.090	.169	.141	.232

Table 1 (continued)

Sources:

Total Trade: International Monetary Fund, Direction of Trade Annual 1964-1968 (Washington).

U.S. Special Category Exports, AID financed exports, P.L. 480 exports: AID, Trade and Payments Division, Office of Policy Development and Analysis.

Development loans and grants for countries other than the United States:

[a]Organization for Economic Cooperation and Development, Terms Matrix 1967 and 1968 (Paris, 1970) and OECD, Analysis of Terms Received by Particular Recipient Countries in 1966 (Paris, 1968).

[b]Table F-2 data of the annual Development Assistance reviews as reported by the Trade and Payments Division, Office of Policy Development and Analysis, AID.

the trade-share pattern most appropriate to analysis of the trade effects of untying aid. Our choice is definition five, which deducts substantial export flows from aid donors other than the United States as well as Sino-Soviet exports and the part of U.S. exports financed by public lending that we deem "additional." The matrix of shares of exports to the less developed regions for all exporting regions given in Table 2 is that specified by this definition.

Whatever definition of "commercial" trade is deemed most appropriate, the problem remains that the share estimates of Table 1 are of average trade shares. Yet if procurement patterns for untied development lending were to follow the pattern of shares of commercial exports, the share concept that would appear most relevant to estimation of the trade effects of an untying of development assistance is the marginal trade share -- the share of changes in trade. Trade patterns are not static, and estimates of the change in U.S. exports resulting from an untying of aid that are based on recent evidence as to average trade shares are likely to be overestimated for regions where the U.S. trade share has been falling.

In the aggregate, however, it is difficult to establish evidence for any trend in the U.S. share of exports to the less developed countries. As shown in Table 3, the ratio of total U.S. exports to the LDCs as a proportion of total exports to LDCs has been declining fairly steadily since 1964, but this has been mainly the result of a falling off of "non-commercial" exports -- military items, P.L. 480 exports, and exports financed either by development assistance or supporting assistance. The evidence of Table 4 is that there is no discernible trend in the U.S. share of "commercial" exports to the less developed world.[1] The U.S. share in 1969-1970 was slightly less than in the period 1966-1968, but the difference is in no sense significant. In

[1]It should be noted that the shares given in Table 4 are based on definition 2 of the volume of total commercial exports. This definition includes exports procured with aid from other DAC countries. As such it undervalues the U.S. commercial share. Further, since DAC aid seems to have been growing more rapidly than U.S. aid in the period since 1962 the extent of this undervaluation has probably increased with time.

Table 2

SHARES OF COMMERCIAL EXPORTS BY REGION OF ORIGIN AND REGION OF IMPORT[a]

Region of Export	Caribbean	Other South America	Other Europe	Africa	Middle East	South Asia	Far East
United States	.558	.320	.099	.090	.169	.141	.232
Canada	.035	.028	.011	.005	.008	.013	.011
Caribbean	.028	.048	.013	.002	.002	.002	.004
Other South America	.019	.132	.022	.004	.012	.004	.002
United Kingdom	.043	.052	.145	.133	.141	.143	.065
Germany	.089	.113	.227	.073	.150	.097	.054
France	.013	.032	.078	.227	.071	.046	.017
Other Common Market	.060	.073	.138	.128	.140	.094	.043
Other Europe	.080	.103	.162	.086	.105	.073	.034
Africa	.000	.007	.030	.012	.023	.022	.014
Middle East	.001	.032	.034	.031	.050	.107	.036
South Asia	.001	.004	.004	.012	.027	.046	.014
Japan	.064	.045	.022	.113	.075	.095	.361
Far East	.004	.006	.007	.026	.012	.072	.065
Australia, New Zealand, South Africa	.005	.006	.008	.059	.015	.046	.048

[a]Commercial exports as given by definition five of Table 1.

Sources:

See Table 1.

Table 3

SHARES OF TOTAL EXPORTS TO LESS DEVELOPED COUNTRIES
BY REGION OF ORIGIN, 1962-1970

Exporting Region	1962	1963	1964	1965	1966	1967	1968	1969	1970
United States	.243	.243	.273	.256	.257	.248	.243	.229	.236
Canada	.014	.016	.017	.016	.017	.018	.017	.016	.021
United Kingdom	.111	.108	.102	.100	.089	.082	.079	.083	.080
Germany	.071	.069	.068	.072	.072	.073	.073	.073	.074
France	.077	.077	.074	.071	.064	.065	.066	.066	.067
Other Common Market	.067	.064	.065	.070	.073	.074	.076	.076	.076
Other Europe	.056	.054	.053	.056	.058	.060	.062	.066	.064
Japan	.077	.084	.089	.103	.104	.113	.125	.139	.140
Australia, New Zealand, South Africa	.023	.024	.023	.025	.029	.035	.031	.032	.033
Less-developed countries	.207	.208	.187	.178	.186	.183	.184	.177	.173
Sino-Soviet	.054	.053	.050	.053	.052	.050	.045	.043	.037

Source:
International Monetary Fund, Direction of Trade Annuals 1960-64, 1964-68, and 1966-70 (Washington).

Table 4

SHARES OF COMMERCIAL EXPORTS TO LESS DEVELOPED COUNTRIES BY REGION OF ORIGIN, 1962-1970[a]

Exporting Region	1962	1963	1964	1965	1966	1967	1968	1969	1970
United States	.185	.173	.210	.201	.205	.194	.198	.192	.202
Canada	.015	.017	.018	.017	.018	.019	.018	.017	.022
United Kingdom	.120	.119	.111	.108	.095	.088	.083	.087	.083
Germany	.076	.075	.074	.078	.077	.078	.077	.077	.078
France	.083	.084	.080	.076	.068	.069	.070	.064	.070
Other Common Market	.072	.070	.071	.075	.077	.079	.081	.080	.079
Other Europe	.060	.059	.057	.060	.063	.065	.066	.069	.067
Japan	.083	.092	.097	.110	.111	.121	.132	.146	.147
Australia, New Zealand, South Africa	.025	.026	.025	.027	.031	.037	.033	.033	.034
Less-developed countries	.223	.227	.203	.191	.199	.196	.195	.185	.180
Sino-Soviet	.058	.058	.054	.057	.056	.054	.047	.045	.038

[a] "Commercial exports" are defined as DOT exports less U.S. Special Category exports, P.L. 480 exports, AID-financed exports, and Sino-Soviet exports.

Sources:

Total exports: see Table 2.

U.S. Special Category exports, P.L. 480 exports, and Aid-financed exports; Trade and Payments Division, Office of Policy Development and Analysis, AID.

the period 1966-70 there were only three instances of changes in export shares that were sufficiently persistent to warrant the term "trend." The Japanese share of commercial exports to LDCs was rising, and the shares of the United Kingdom and the less developed countries were falling.

With respect to the pattern of trade by importing region, the question of trends in the U.S. share is rather more complex. Table 5 summarizes the data that are available to us. The U.S. share of total exports by importing region is given for the periods 1962-65, 1966-68, and 1969-70. The U.S. share of "commercial" exports (definition two) is given for 1962-65 and 1966-68. The only trade relationships for which there is reasonably good evidence of a persistent change through time in the U.S. share of exports are those with the Caribbean region and the Far East. In both cases the U.S. share is declining and the Japanese share is growing. In the case of the Caribbean region the shift away from imports from the United States also involves an increase of imports from these European countries outside the Common Market.

Although there is good evidence that trade share patterns are changing, there is no particularly satisfactory way of making allowance for this fact. The use of marginal trade shares rather than average shares is one possibility, but the marginal trade share parameter is extraordinarily variable. Indeed, as indicated in Table 6, the ratio of the standard deviation to the mean of the annual U.S. marginal trade shares during the period 1962-68 approaches one for every importing region other than the Caribbean. For other exporting regions the relative variance of marginal trade shares is, in general, even greater. Many marginal trade shares are in fact negative. This large variance derives in part from the fact that the increments of commercial exports to certain regions have been relatively small. For regions where the total volume of commercial imports has been more or less stable, the presence of random "noise" guarantees that the marginal trade share parameter estimated from recent data is virtually worthless as an estimate of the pattern of trade resulting from an untied development plan.

Table 5

CHANGES OVER TIME IN THE U.S. SHARE OF EXPORTS
BY IMPORTING REGION

Export Share	Caribbean	Other South America	Other Europe	Africa	Middle East	South Asia	Far East
Average share of total DOT exports in:							
1969-1970	.511	.302	.082	.099	.180	.237	.207
1966-1968	.545	.330	.093	.103	.192	.332	.261
1962-1965	.576	.331	.095	.100	.228	.362	.280
Average share of total DOT exports less U.S. Special Category exports, P.L. 480 exports, AID-financed exports adjusted for additionality, α = .6, .9, and Sino-Soviet exports in:							
1966-1968	.543	.311	.099	.082	.164	.112	.221
1962-1965	.578	.314	.096	.072	.157	.124	.251

Sources: Table 3.

Table 6

THE U.S. SHARE OF INCREASES IN EXPORTS TO THE LESS DEVELOPED REGIONS FOR VARIOUS TIME PERIODS[a]

U.S. Share of Increased Imports in:	Caribbean Area	South America	Africa	Middle East	South Asia	Far East
From 1965 to 1968	.437	.218	.139	.233	.064	.181
From 1962 to 1968	.459	.250	.075	.206	.121	.202
Average for three-year periods 1962-1965, 1963-1966, 1964-1967, and 1966-1968, minimum period share = 0	.423	.281	.113	.196	.113	.182
Average for share of yearly increments in period 1962-1968, minimum share = 0 (standard deviation)	.381 (.184)	.234 (.245)	.146 (.157)	.175 (.141)	.165 (.178)	.170 (.131)

[a]Commercial exports are defined as DOT exports less P.L. 480 exports and AID-financed exports adjusted for additionality (α=.6 for Latin America, .9 elsewhere). Both the regional classifications and the adjustment for P.L. 480 exports used here differ slightly from those used elsewhere in this study.

Source:

International Monetary Fund, Direction of Trade Annuals 1960-64, 1964-68. Agency for International Development, Operations Reports, December 31, 1961, through December 31, 1968.

These difficulties could be overcome in part by lengthening the time period over which the marginal trade share is calculated. A better solution would be to estimate marginal trade shares through estimation of the parameters of the equation

$$X_{ij_t} = a_1 + a_2 \sum_i X_{ij_t} + u_t,$$

where "a_2" is the estimated marginal share of country "i" of total exports to country "j". The problem here again is one of high variance, exacerbated by the fact that we have information on the preferred definitions of commercial trade (definitions 4 and 5) for a very limited period of time. As a result, many marginal-share estimates are negative, and an even larger number are insignificantly different from zero even at very permissive levels of confidence. Given the extreme variability of measures of the marginal-share concept, the stability of U.S. export shares in the aggregate, and the fact that procurement patterns for capital goods appear more stable than the patterns for total commercial exports, we have concluded that average export shares adjusted for time trends provide a better basis for estimating the balance-of-payments effects of untying than do marginal shares.

There is, however, a further problem. The international trade mechanism is to a certain extent a "cybernetic" system. That is, events within the system trigger further events that change the determinants of the way the system works. We have witnessed a striking affirmation of this fact in the recent round of exchange rate readjustments. The market circumstances that obtained during the period on which our "trend" calculations are based no longer hold, and a simple extrapolation of these "trends" is not valid.

The complication that is introduced by this set of changes of relative exchange rates is enormous. First of all, we have absolutely no reasonable basis for estimating the relevant cross-elasticities of demand. That is, we cannot estimate the percentage change in U.S. exports to country "i" resulting from a given percentage change in the price of the currency of country "j", the price of the U.S. dollar

(in terms of the currency of country "i") assumed constant. Second, even if these parameters could be assumed as known, we would have no good basis for estimating the extent to which past "trends" in trade shares reflected dynamic adjustment processes that are still continuing. We are left then with the uneasy conclusion that modification of average share data from the recent past to allow for such changes as can be reasonably expected to have taken place between the base period and the future period of interest is a matter that requires certain inputs of "judgment."

The practice followed here is to adjust average export-share data from the base period 1966-68 in a two-stage process. First, estimates of the time rate of change of average export shares over the period 1962-68 were obtained from regression analysis of each interregional trading relationship. Those estimates that were significantly different from zero at the 5 percent confidence level were used to project average export shares for 1972. The projected 1972 shares were then adjusted to conform to the requirement that they sum to 1.0. Second, these adjusted export-share parameters were further modified to take into account the December 1971 realignment of exchange rates.

The task of predicting the trade consequences of a simultaneous realignment of a large number of exchange rates is one of the most complex problems of applied economics, and we make no pretense of attempting its full solution here.[1] In the absence of information by trading region of the direct and cross-partial elasticities of demand for the exports of each trading region, estimation of the effects of exchange rate alignments on the direction of trade must be an ad hoc process. Two basic procedures can be adopted in this regard. First, a set of elasticities of substitution for each pair of export competitors in each export market and a set of price elasticities of demand for imports for each importing region are assumed. For a given

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[1]For a discussion of this problem see Paul S. Armington, "Adjustment of Trade Balances: Some Experiments with a Model of Trade Among Many Countries," International Monetary Fund Staff Papers, Vol. 1 (1970), pp. 488-523. Also see Rudolf R. Rhomberg, "Possible Approaches to a Model of World Trade and Payments," International Monetary Fund Staff Papers, Vol. 17 (1970), pp. 1-26.

direction-of-trade matrix these assumptions imply a particular set of direct and cross-partial price elasticities of demand for the exports of each exporting region by each importing region.[1] If the set of elasticities of substitution is uniform, the direct price elasticity of demand for the exports of a region "i" by an importing region "j" will vary inversely with the region "i's" share of total exports to region "j." The set of elasticities of substitution can be so scaled as to yield a predetermined value for the direct partial price elasticity of world demand for the exports of region "i." Second, a set of direct and cross-partial price elasticities of demand for exports can be assumed directly. The latter approach is the one adopted here.

We have carried out two sets of adjustments of this sort. The first set assumes that the direct price elasticity of demand for exports tends to vary with the share of exports to the region concerned.[2] When weighted according to the regional share of total U.S. exports in 1968, the assumed set of direct price elasticities yield an aggregate (volume) elasticity of LDC demand for U.S. exports of -1.56, approximately the same as the estimate for the total world (volume) elasticity of demand for U.S. exports obtained by Houthakker.[3] The second set of adjustments presupposes a uniform (volume) price elasticity of demand for U.S. exports across each trading region of -2.0. This yields a value for the (volume) price elasticity of world demand for U.S. exports that is approximately equal to the Houthakker estimate minus its standard error.

Both sets of adjustments were based on the assumption that the value of LDC imports, in terms of the currency of the importing country, is invariant to exchange rate realignment. This supposition was introduced in order to simplify the relationship between price and

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[1] Assuming an infinitely elastic supply of exports over the relevant range.

[2] The volume elasticities assumed were -1.5 for Latin America, the Middle East, and the Far East; and -2.5 for Africa and South Asia.

[3] H. S. Houthakker and S. P. Magee, "Income and Price Elasticities in World Trade," The Review of Economics and Statistics, 51, 1 (1969), pp. 111-125.

share elasticities, for where total imports do not change, share and (value) price elasticities for exports are identical.[1] The percentage change in the U.S. share of commercial exports to a given region is thus equal to the product of the (value) elasticity of that region's demand for U.S. exports and the percentage change in the price of U.S. exports relative to the weighted average price of exports from other regions. The weights in this case are export shares to the region in question, and the changes in export prices are changes in exchange rates. The adjustments of export shares for other countries were carried out in an even more ad hoc fashion than were those for the United States. For both sets of adjustments the (volume) price elasticity of demand for exports was assumed to be -1.0 for all LDCs and -2.0 for Canada. The post-realignment export shares of the developed countries whose currencies were revalued relative to the dollar were obtained as a residual, each country suffering an equi-proportional loss. This method carries with it the implication that there is an inverse relationship between a country's rate of revaluation relative to the dollar and the price elasticity of demand for its exports. The assumption is crude, but given the focus of attention here on changes in U.S. export shares we think it warranted.

These modifications of the recent pattern of "commercial" trade are an important element in the construction of the "synthetic" trade-share matrices that we feel to be the most relevant basis for predicting the trade effects of untying development assistance. They are not the only adjustments that we feel are required, however. A further adjustment of the commercial trade share matrix is required to take account of the fact that the volume of goods financed by development assistance is not homogeneous with respect to type of commodity (and

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[1] For direct price elasticities (as opposed to cross elasticities) the value elasticity is equal to the volume elasticity + 1.0. The assumption that total imports of LDCs will not change as a result of exchange rate changes is not totally unreasonable. The demand for imports of most LDCs is probably constrained by the supply of foreign exchange, and the price elasticity of demand for LDC exports may well be in the neighborhood of -1.0.

hence by region of origin) to the volume of commodities in "commercial" trade. Indeed, for South Asia in particular, the volume of "commercial" trade is so thin relative to the volume of trade originating under some sort of tying arrangement as to make the homogeneity assumption absolutely ludicrous. It is, for example, quite unlikely that 25 percent of the exports now supplied to South Asia by the DAC nations under tied aid agreements would be supplied by the less developed countries of the world if this aid were suddenly to be untied. Yet this is what would be predicted if the redistribution of trade attendant upon multilateral untying were to proceed according to the commercial trade shares for 1966-68 given in Table 2. Some basis for modifying the "homogeneity assumption" is needed. The World Bank experience provides something like that basis.

THE WORLD PATTERN OF EXPORTS FINANCED BY THE WORLD BANK AND THE INTERNATIONAL DEVELOPMENT ASSOCIATION

In the period 1966-70, nearly 2 percent of the exports to the less developed nations of the world were financed either by IBRD or IDA. The great bulk of these exports is accounted for by capital-goods items. The pattern of distribution of these exports by region of origin and region of destination is given in Table 7. Comparison of this matrix with the matrix of "commercial" trade given in Table 2 reveals the following major differences: the less developed countries have a far higher share of commercial exports than of IBRD/IDA exports; the Japanese shares of commercial exports tend to be somewhat greater than their shares of IBRD/IDA exports; and the share of commercial exports held by the United Kingdom and Germany tends to be substantially less than their share of exports financed by the IBRD/IDA.

The difference between the LDC shares of commercial exports and IBRD/IDA exports is shown most clearly in Table 8. For purposes of this table, "commercial" exports were defined as total DOT exports without any exclusion of military items or items financed under some form of development assistance. Even so, the share of the LDCs in IBRD/IDA exports remains substantially less than their share in total trade for each importing region. These data underscore the suspicions

Table 7

SHARE OF EXPORTS FINANCED BY IBRD AND IDA BY REGION OF EXPORT AND REGION OF IMPORT, FY 1965/66-FY 1969/70

Region of Export	Caribbean	Other South America	Other Europe	Africa	Middle East	South Asia	Far East
U.S.	.436	.389	.153	.119	.204	.171	.181
Canada	.017	.032	.001	.008	.002	.031	.004
Caribbean	.011	.002	.000	.000	.000	.004	.000
Other South America	.001	.041	.000	.000	.001	.004	.000
U.K.	.059	.100	.098	.172	.182	.266	.099
Germany	.092	.097	.315	.098	.270	.181	.121
France	.027	.056	.076	.207	.055	.029	.007
Other Common Market	.099	.096	.094	.218	.099	.066	.115
Other Europe	.142	.098	.234	.090	.152	.071	.067
Africa	.000	.005	.000	.002	.000	.022	.000
Middle East	.004	.003	.002	.019	.012	.009	.007
South Asia	.000	.002	.000	.022	.001	.002	.030
Japan	.110	.058	.027	.027	.023	.103	.286
Far East	.000	.003	.000	.005	.000	.025	.076
Australia, New Zealand, So. Africa	.001	.020	.000	.013	.000	.015	.007

Source:

Unpublished data furnished by the IBRD and IDA.

Table 8

COMPARISON OF LDC SHARE OF TOTAL EXPORTS TO LDCs (1966-68)
AND LDC SHARE OF EXPORTS FINANCED BY IBRD AND IDA
(FY 1965/66-FY 1969/70)

Share of IBRD/IDA Exports
(Share of Total Exports)

Region of Export	Region of Import					
	Caribbean	Other South America	Africa	Middle East	South Asia	Far East
Caribbean	.011 (.028)	.002 (.043)	.000 (.002)	.000 (.001)	.004 (.001)	.000 (.003)
Other South America	.001 (.018)	.041 (.118)	.000 (.004)	.001 (.010)	.004 (.002)	.000 (.002)
Africa	.000 (.000)	.005 (.006)	.002 (.010)	.000 (.019)	.022 (.012)	.000 (.011)
Middle East	.004 (.001)	.003 (.029)	.019 (.026)	.012 (.041)	.009 (.059)	.007 (.028)
South Asia	.000 (.001)	.002 (.003)	.022 (.010)	.001 (.022)	.002 (.025)	.030 (.010)
Far East	.000 (.004)	.003 (.005)	.005 (.022)	.000 (.010)	.025 (.040)	.076 (.050)
Total LDC	.016 (.052)	.056 (.204)	.048 (.074)	.014 (.103)	.066 (.139)	.113 (.104)

Source:
Unpublished data furnished by the IBRD and IDA; International Monetary Fund, Direction of Trade Annual, 1964-68.

we voiced earlier concerning the bias in estimating the trade effects of untying assistance that would result from maintaining the "homogeneity" assumption as to exports financed by development assistance and total commercial exports. To utilize the data on LDC shares of IBRD/IDA exports as estimates of the share of the LDCs in the exports financed out of untied development assistance would be to introduce an opposite bias, however. For the case of the United States, at least, a substantial portion of development assistance takes the form of generalized balance-of-payments support. The distributions by type of commodity and region of origin of exports financed in such a manner are most likely intermediate between those characteristic of total commercial exports and IBRD/IDA exports. As such, the estimate of LDC shares most appropriate to an examination of the balance-of-payments effects of untying aid should fall somewhere in between the shares that have been observed for these two export totals.

The differences between shares in commercial exports and IBRD/IDA exports for the various developed countries or regions are illustrated in Table 9. In both cases the data refer to proportions of those exports that originated in the developed regions only. These share differences are considerably less pronounced than in the case of LDCs. Although in the aggregate the shares of IBRD/IDA exports of Japan tend to be less than their shares of commercial imports, and those of the United Kingdom and Germany tend to be more, the same does not hold for all regions. For the United States there is substantial variation between regions as to the relationship between "commercial" shares and IBRD/IDA shares. In the aggregate, they are very similar. The U.S. share of commercial exports (definition two of Table 1) from the developed countries to the less developed countries was .275 in 1966, .259 in 1967, .262 in 1968, .249 in 1969, and .271 in 1970. The respective figures for the U.S. share of exports from DCs to LDCs that were financed by the IBRD or IDA are .271, .283, .263, .212, and .257. Time series for the shares of the various exporting regions in total exports financed by the IBRD are given in Table 10. In general they tend to show the same set of trends with respect to trade shares as do the aggregate data on total commercial trade.

Table 9

COMPARISON OF DEVELOPED COUNTRY (DC) SHARES OF COMMERCIAL EXPORTS BY DCs TO LDCs (1966-68) WITH DC SHARES OF IBRD/IDA EXPORTS BY DCs TO LDCs (FY 1965/66-FY 1969/70)[a]

Region of Export	Share of IBRD/IDA Exports by Developed Countries (Share of commercial exports by developed countries)					
	Region of Import					
	Caribbean	Other South America	Africa	Middle East	South Asia	Far East
U.S.	.443 (.589)	.412 (.415)	.125 (.099)	.207 (.194)	.183 (.189)	.204 (.268)
Canada	.017 (.037)	.034 (.036)	.009 (.006)	.002 (.009)	.033 (.017)	.005 (.013)
U.K.	.060 (.045)	.063 (.067)	.180 (.146)	.184 (.161)	.285 (.191)	.112 (.076)
Germany	.093 (.094)	.102 (.146)	.103 (.080)	.274 (.172)	.194 (.130)	.136 (.062)
France	.027 (.015)	.060 (.042)	.217 (.249)	.056 (.081)	.031 (.061)	.008 (.020)
Other Common Market	.101 (.063)	.101 (.095)	.229 (.140)	.100 (.160)	.071 (.126)	.129 (.050)
Other Europe	.144 (.084)	.104 (.133)	.095 (.094)	.154 (.120)	.076 (.098)	.076 (.039)
Japan	.112 (.068)	.061 (.058)	.029 (.123)	.023 (.086)	.111 (.127)	.322 (.417)
Australia-New Zealand South Africa	.001 (.005)	.021 (.008)	.013 (.065)	.000 (.017)	.016 (.061)	.008 (.055)

[a]Commercial Trade as given by definition five of Table 1.

Source:

Unpublished data by the IBRD and IDA; Table 2.

Table 10

SHARE OF EXPORTS FINANCED BY THE IBRD BY REGION OF EXPORT, FY 1955/56-FY 1969/70

Region of Export	1958/59	1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70
United States	.318	.290	.297	.296	.332	.315	.214	.264	.264	.245	.202	.243
Canada	.020	.009	.023	.015	.011	.017	.012	.016	.025	.023	.011	.007
United Kingdom	.207	.234	.165	.137	.137	.175	.187	.214	.188	.140	.114	.122
Germany	.164	.157	.170	.135	.109	.136	.125	.133	.127	.126	.154	.163
France	.053	.055	.067	.120	.123	.045	.085	.046	.050	.061	.072	.052
Other Common Market	.104	.114	.119	.120	.123	.155	.133	.100	.085	.124	.143	.119
Other Europe	.048	.051	.066	.076	.062	.057	.098	.094	.075	.091	.108	.106
Japan	.056	.030	.039	.061	.050	.036	.096	.098	.114	.113	.146	.125
Other	.030	.060	.054	.040	.053	.064	.050	.035	.072	.077	.050	.063
(LDCs)								(.028)	(.067)	(.071)	(.045)	(.056)
Australia New Zealand South Africa								(.007)	(.005)	(.006)	(.005)	(.007)

Source:
Unpublished data furnished by the IBRD.

There are a number of problems with using IBRD/IDA share data to estimate the balance-of-payments effect of an untying of development assistance. First, the export flows are relatively small, and there is something of a "lumpiness" problem. As a consequence, the variance of the annual average share of a given exporting region in the IBRD/IDA exports to a given import region tends to be relatively large. Second, as discussed above, the exports financed by the IBRD or IDA are not quite homogeneous in terms of distribution by type of good with the exports financed under the various government-to-government assistance programs. And third, the distribution of IBRD/IDA exports by country of origin is not simply a matter of relative price, institutional habit, and the other factors that are most important to the determination of "commercial" exports -- and that would be most important, presumably, to the determination of the pattern of exports financed under untied aid. An important determinant of the IBRD/IDA export pattern for a project is the nationality or distribution of nationalities of the IBRD/IDA team that provided the required technical assistance during the project-planning phase. As a result, the distribution of exports arising from IBRD/IDA lending is to some extent at least a matter of institutional discretion.

In spite of these problems, we feel that predictions of the balance-of-payments consequences of an untying of aid ought to reflect certain of the differences between the IBRD/IDA share matrix (for exports from DCs to LDCs) and the share matrix for commercial exports. On balance, the distribution of goods by type of the exports that are financed by tied development assistance is probably closer to that of IBRD/IDA-financed exports than it is to total commercial exports.

SYNTHETIC TRADE-SHARES MATRICES

The thrust of the previous argument is that neither average nor marginal shares of recent commercial exports nor recent IBRD/IDA exports are a uniquely good basis for estimating the changes in trade patterns that would be brought about by untying development assistance programs. The share matrix of commercial exports overestimates the role of LDCs; the share matrix for IBRD/IDA exports underestimates it.

Neither matrix refers to quite the same set of goods that is currently financed with tied development loans. Further, neither matrix takes account of the dynamics of trade patterns or the recent set of exchange rate readjustments.

The synthetic matrices given in Tables 11 and 12 reflect our attempts to deal with these deficiencies. In both cases the starting point was the average-share matrix for commercial exports (definition 5) for the period 1966-68. Synthetic matrix "A" (Table 11) was constructed in the following manner. First, a share of exports originating in LDCs was hypothesized for each aid-receiving region. These estimates fall in between the relevant proportions given in the matrix of commercial trade for 1966-68 and those of the IBRD/IDA procurement share matrix for FY 1966-FY 1970. Second, the residual was allocated among the various developed countries or regions according to a matrix of average commercial export shares of DCs to LDCs for the period 1966-68 that had previously been modified to take into account significant time trends in export shares and the effects of the December 1971 exchange rate realignments. The basis for adjusting for the effects of exchange rate changes was the first of the two sets of exchange rate adjustments described earlier. This set of modifications presupposes an aggregate (volume) price elasticity of the demand for U.S. exports by all LDCs of -1.56, the elasticities varying between regions. Third, that part of the share matrix covering exports from the developed countries was modified slightly to reflect differences between the IBRD/IDA matrix for DC exports and the commercial-export matrix for DC exports.

Synthetic matrix "B" (Table 12) was constructed in a slightly simpler manner. The adjustments to account both for the excess share of LDCs in the 1966-68 commercial-export matrix and for time trends are identical to those carried out in constructing synthetic matrix "A." A different set of assumptions was utilized, however, in modifying the pattern of DC exports to LDCs to take into account the realignment of exchange rates. A (volume) price elasticity of demand for U.S. exports of -2.0 was assumed for all regions. The second difference between the two synthetic matrices is that matrix "B" has not

Table 11

SYNTHETIC MATRIX "A" OF SHARES OF EXPORTS TO LDCs BY REGION OF EXPORT AND IMPORT: AVERAGE COMMERCIAL EXPORT SHARES FOR 1966-68 ADJUSTED FOR 1962-68 TRENDS, EXCESS LDC SHARES, COMMODITY HETEROGENEITY, AND EXCHANGE RATE REALIGNMENT[a]

Region of Export	Region of Import: Caribbean	Other South America	Other Europe	Africa	Middle East	South Asia	Far East
United States	.520	.395	.140	.115	.200	.171	.225
Canada	.035	.035	.010	.006	.011	.020	.012
Caribbean	.016	.013	.000	.000	.000	.000	.000
Other South America	.009	.069	.000	.000	.000	.000	.000
United Kingdom	.045	.060	.100	.116	.130	.156	.046
Germany	.085	.125	.290	.096	.170	.125	.075
France	.020	.040	.080	.186	.080	.070	.019
Other Common Market	.065	.085	.095	.150	.145	.120	.054
Other Europe	.110	.115	.220	.098	.120	.095	.039
Africa	.000	.000	.005	.015	.000	.010	.000
Middle East	.000	.000	.010	.015	.010	.020	.000
South Asia	.000	.000	.007	.015	.010	.005	.005
Japan	.090	.055	.025	.125	.096	.120	.431
Far East	.002	.003	.010	.016	.011	.038	.050
Australia, New Zealand, South Africa	.003	.005	.008	.047	.017	.050	.044

[a]Share elasticity = .5 for Latin America, Middle East, and Far East;
= 1.5 for Africa, South Asia.

Table 12

SYNTHETIC MATRIX "B" OF SHARES OF EXPORTS TO LDCs BY REGION OF EXPORT AND IMPORT: AVERAGE COMMERCIAL EXPORT SHARES FOR 1966-68 ADJUSTED FOR 1962-68 TRENDS, EXCESS LDC SHARES, AND EXCHANGE RATE REALIGNMENT (SHARE ELASTICITY = 1.0)

Region of Export	Region of Import						
	Caribbean	Other South America	Other Europe	Africa	Middle East	South Asia	Far East
United States	.588	.417	.118	.103	.207	.164	.251
Canada	.037	.035	.013	.005	.010	.017	.013
Caribbean	.016	.013	.000	.000	.000	.000	.000
Other South America	.009	.069	.000	.000	.000	.000	.000
United Kingdom	.037	.057	.154	.109	.124	.141	.043
Germany	.076	.123	.240	.085	.162	.116	.053
France	.011	.035	.083	.183	.086	.078	.018
Other Common Market	.052	.080	.147	.152	.150	.130	.041
Other Europe	.090	.112	.172	.101	.114	.098	.032
Africa	.000	.000	.005	.015	.000	.010	.000
Middle East	.000	.000	.010	.015	.010	.020	.000
South Asia	.000	.000	.010	.015	.010	.005	.005
Japan	.077	.049	.024	.134	.099	.121	.440
Far East	.002	.003	.016	.016	.011	.038	.050
Australia New Zealand South Africa	.005	.007	.008	.067	.017	.062	.054

been modified to take account of differences between the matrix of commercial exports from DCs to LDCs and the matrix of IBRD/IDA procurement from DCs. Matrix "B" is influenced by the IBRD/IDA data only through the adjustment made to reduce the share of LDCs in total procurement.

The complexities of the various adjustments carried out in constructing these synthetic estimates of procurement patterns make it easy to lose track of one essential assumption: that the determinants of procurement from untied aid would be much the same as the determinants of commercial exports. We think this assumption is reasonable. If it were not, the analysis of this section would be simply a futile exercise in numerology. With this caveat we think that these synthetic estimates of procurement patterns provide a reasonable basis for predicting the effects on the U.S. balance of payments of an untying of development lending. We think that matrix "A" is to be preferred to matrix "B." The assumptions as to the elasticity of demand for U.S. exports that are imbedded in the latter matrix are excessively optimistic, in our opinion.

III. ESTIMATING THE ADDITIONALITY FACTOR FOR TIED DEVELOPMENT ASSISTANCE[1]

If the increase in exports resulting from tied aid were exactly equal in value to that aid, the only parameter needed for estimation of the short-run balance-of-payments effects of untying would be the procurement-share matrix discussed in the preceding section. Matters are not quite so simple, however, for tied aid is often not "effectively" tied. That is, the ratio of the increase in exports from a donor country "i" to a recipient country "j" that results from a tied aid program A_{ij} to that flow of aid is not, in general, equal to one. This ratio we shall define as the additionality factor, α_{ij}, where

$$\alpha_{ij} = (X_{ij}-X^{*}_{ij})/A_{ij}. \tag{3.1}$$

X_{ij} is the observed flow of exports from "i" to "j," and X^{*}_{ij} is the (unobserved) value for what the flow of exports from "i" to "j" would have been had A_{ij} been equal to zero.

We may appear to be belaboring the obvious here, but there is, in fact, a certain amount of confusion over what is meant by the terms "effectively" tied and "additionality," and we believe this confusion has led to a tendency to underestimate the flow of exports resulting from a tied aid program. For example, additionality is commonly spoken of as the proportion of commodities financed by an aid program (financed through the letter of credit established for disbursements under that program) that would not have been purchased in the absence of that loan. Or, as an equivalent alternative, additionality is (commonly) defined as the 1 minus the proportion of goods financed through the relevant letter of credit that would have been exported by the donor in any event. This concept of additionality may seem straightforward, but it is not in fact the same as the (correct)

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[1]For a fuller discussion of additionality see Richard Cooper, The Additionality Factor in Tied U.S. Development Assistance, R-974-PR, The Rand Corporation, Santa Monica, April 1972.

definition given in equation (3.1). The commonly held concept of additionality is rooted in an examination of the list of exports that in an accounting sense were "caused" by aid. Yet in a wide variety of circumstances there will be an additional flow of exports from the United States to the recipient country that, although not directly financed by aid (not financed through the letter of credit established for disbursements of that aid), are just as effectively "caused" by that aid as those exports considered "additional" in the ordinary sense.

The additionality factor cannot be estimated by simply enumerating the U.S. exports financed directly by aid that are judged as likely to have been purchased in the absence of aid. The effectiveness of tying depends upon a complex set of determinants of which the most important are the propensity of the recipient country to import various types of commodities out of incremental foreign exchange, the degree of competitiveness of U.S. exports relative to exports from the rest of the world, and the administrative practices of USAID with respect to the restrictiveness of the list of commodities authorized to be financed through U.S. assistance.

The following simplified model will illustrate certain of the key interrelationships among these variables. Consider the case of three trading sectors -- the United States, the aid recipient (LDC), and the rest of the world (row) -- and two sets of commodities -- type 1 goods (g_1) that the United States sells at price p_1, and type 2 goods (g_2) that the rest of the world sells at price p_2 and that the United States sells at price $(1+\rho)p_2$, $\rho > 0$. The relative preferences of the aid recipient for g_1 and g_2 are defined by the elasticity of substitution τ. In the simplest case where $\tau = -1$, the ratio of the value of LDC imports of type 1 goods to the value of total imports and the ratio of the value of LDC imports of type 1 goods to the value of type 2 goods are constants. In the absence of aid, LDC imports from the United States will thus be

$$X_{us}^{*} = p_1 g_1^{*} = \sigma M^{*}, \tag{3.2}$$

σ being the U.S. share of commercial exports to the LDC, and LDC imports from the rest of the world will be

$$X^*_{row} = p_2 g^*_2 = (1-\sigma)M^*, \tag{3.3}$$

where M^* is the total value of LDC imports without development aid. If aid of amount A is tied, but there is no agreement that the LDC must purchase type 2 goods from the United States, U.S. exports to the LDC will be

$$X_{us} = p_1 g_1 = \sigma M = \sigma(M^* + A), \tag{3.4}$$

if it is assumed that all aid is used for additional imports. In this case the additionality factor is σ, for

$$\Delta X_{us} = \sigma A. \tag{3.5}$$

If, on the other hand, aid is tied and a certain proportion "γ" of that aid must be used to purchase type 2 goods from the United States,

$$X_{us} = p_1 g_1 + (1+\rho) p_2 g_2^{us} = \sigma(M^*+A) + \gamma A, \tag{3.6}$$

and the additionality factor shifts to $(\sigma + \gamma)$, since

$$\Delta X_{us} = (\sigma+\gamma)A. \tag{3.7}$$

Note that there is no restriction implied in equation (3.7) that $\alpha \leq 1$. If $\gamma=1$, $\alpha=1+\sigma$. Yet if additionality is defined in terms of the proportion of exports "financed" by A that would have been purchased in the absence of aid, the maximum value that it could assume is 1.0.

Equation (3.7) holds only for the special case where the elasticity of substitution $\tau = -1$. If $\tau=0$, the case of fixed proportions,

$$\Delta X_{us} = [\sigma(1-\gamma\beta) + \gamma]\, A, \tag{3.8}$$

where $\beta = (1-1/1+\rho)$.[1] The additionality factor α thus is $[\sigma(1-\gamma\beta)+\gamma]$, less than $(\sigma+\gamma)$, the additionality factor for the case $\tau = -1$.

For most manufactured goods, however, we suspect that the elasticity of substitution is less than -1 (an absolute value greater than 1). In this case the ratio of the value of imports of g_1 to total imports will increase somewhat if it is required that some portion of the loan be used to purchase g_2 from the United States at the higher price $(1+\rho)p_2$. The increase in U.S. exports will thus be

$$\Delta X_{us} = [\sigma + \sigma(\rho,\gamma,\tau) + \gamma]A, \tag{3.9}$$

where the substitution effects are given by the function $\sigma(\rho,\gamma,\tau)$. This function is specified > 0 where σ, ρ, and $\gamma > 0$, and $\tau < -1$. The additionality factor will be $[\sigma + \sigma(\rho,\gamma,\tau)+\gamma] > (\sigma + \gamma)$.

Equation (3.9) should be compared with the commonly held definition of additionality $\alpha = \gamma + \min(\sigma,1-\gamma)$. The latter differs (improperly) from equation (3.1) in all cases where $\tau \neq -1$. Even in the unlikely case $\tau = -1$, the ordinary basis for estimating additionality will yield incorrect results if $(\sigma+\gamma) > 1$.

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[1] For the derivation of (3.8) consider the following argument. Where $\tau=0$, $g_2^* = \theta g_1^*$, and $p_1 g_1^*/M^* = p_1/(p_1+p_2\theta) = \sigma$. If there is a requirement that the proportion γ of A be spent on imports of g_2 from the United States, $g_2^{row} + g_2^{us} = g_2^{row} + \gamma A/(1+\rho)p_2 = \theta g_1$. Thus $M^* + A = p_1 g_1 + p_2\, \theta g_1 + \gamma\beta A$, where $\beta = 1 - 1/(1+\rho)$. From this we see that $p_1 g_1 = [p_1/(p_1 + p_2\theta)][M^* + (1-\gamma\beta)A] = \sigma M^* + \sigma(1-\gamma\beta)A$. Since $(1+\rho)p_2 g_2^{us} = \gamma A$ by assumption, $\Delta X_{us} = [\sigma(1-\gamma\beta) +\gamma]A$.

Except in certain special cases, therefore, a proper estimate of additionality cannot be obtained through examination of the list of commodities financed by aid. A direct examination is required of variation in U.S. exports as a function of variation of total exports and variation of aid. Adapting equation (3.9) to the most general case, we may write

$$X_{us} = \sigma M^{*} + [\sigma + \sigma(\rho,\gamma,\tau) + \gamma]A, \tag{3.10}$$

where $\sigma(\rho,\gamma,\tau) \gtrless 0$, or, in terms of observables,

$$X_{us} = \sigma(M-A) + [\sigma + \sigma(\rho,\gamma,\tau) + \gamma]A. \tag{3.11}$$

Since equation (3.11) is not meant to be deterministic, it should be rewritten as

$$X_{us} = \sigma(M-A) + [\sigma + \sigma(\rho,\gamma,\tau) + \gamma]A + u, \tag{3.12}$$

as an estimating equation, where "u" is a random disturbance term. Given the ordinary assumptions about the distribution of "u," least squares estimates of the coefficients of equation (3.12) will yield consistent and unbiased estimates of the additionality factor "α."

It should be noted that while there are only two explanatory variables in equation (3.12), there are three unknown parameters, σ, γ, and $\sigma(\rho,\gamma,\tau)$. Therefore while σ can be identified, γ and $\sigma(\sigma,\gamma,\tau)$ cannot. This is not a problem. The objective is to achieve estimates of "α," not γ or $\sigma(\sigma,\gamma,\tau)$, and the coefficient of regression on A is the desired estimate. That is, rather than equation (3.12) we are in fact concerned with the equation

$$X_{us} = \sigma M + (\alpha-\sigma)A + u. \tag{3.13}$$

In this sense we can obtain our objective without fully understanding the parameters that determine the value of the additionality factor. For example, we are in some sense quite indifferent whether the

marginal propensity to purchase U.S. goods is affected by the tying procedure (whether $\sigma(\rho,\gamma,\tau) \neq 0$). What is important is that we be able to estimate "α."

There is something of a problem, however, if the entire proceeds of a loan are not in fact used to purchase additional imports. In such circumstances the estimate of additionality obtained from equation (3.13) will be biased upward. If the fraction $(1-\lambda)$ of the loan A is used to accumulate reserves, the estimate of "α" obtained from (3.13) will be too large by the factor $(1-\lambda)\sigma$. We feel that this is unlikely to prove a significant problem, however. Of much greater concern to us is the possibility that the independent variables of equation (3.13) are correlated with unincluded variables that are important to the determination of U.S. exports. An example of such a variable is direct U.S. investment.

An additional problem with equation (3.13) is the possibility of a time trend in the U.S. share of commercial exports. In such circumstances a better estimate of additionality would be obtained from an estimating equation either of form

$$X_t = (\sigma_o + \beta t)(M_t - A_t) + \alpha A_t + u_t, \tag{3.14}$$

or

$$X_t = (\sigma_o + \beta t)(M_t - A_t) + (\alpha_o + \beta t)A_t + u_t. \tag{3.15}$$

Equation (3.14) presupposes an additionality factor that is stable over time in spite of changes in the U.S. share of commercial exports. Equation (3.15) presupposes that USAID administrators maintain a constant proportion of type 2 goods (goods normally supplied by other countries) in the U.S. exports financed by tied aid. That is, γ is stable over time.

The parameters of equations (3.13), (3.14), and (3.15) were estimated for the major recipients of U.S. development aid by ordinary least squares (OLS) regressions of the dependent variable X_t on the independent variables M_t and A_t for data from the period 1958-68. These results are given in Tables 13 and 14. Both X_t and A_t are defined <u>net</u> of special category (military) exports and P.L. 480

exports from the United States. M_t is defined net of the sum of these items and Sino-Soviet exports.

The coefficients of determination (R^2) for estimates of equation (3.13) are generally quite high, the equations for Turkey, Ghana, and Indonesia being the worst performers. In each of these three cases the time-trend coefficients of equations (3.14) and (3.15) are significant and the R^2 improves considerably. The only other country for which the trend coefficient is significant is Brazil, and this result would not hold if the regressions excluded 1958 data.

The estimates of commercial export shares (σ) for these equations have very low standard errors for the most part, but the estimates of the additionality factor (α) are much less precise. Given this caveat, the estimates of α conform very well to a priori expectations. The higher the commercial export share the lower additionality, since "switching" is relatively difficult either to detect or to prevent in such circumstances. Where the commercial export share is small, additionality is estimated to be in excess of 1.0 in a number of cases. This conforms to our hypothesis that α will approximate $(\gamma+\sigma)$ rather than $[\gamma + \min(\sigma,1-\gamma)]$.

Only one of the estimates of additionality of Tables 13 and 14 is inexplicable -- that for Chile. In spite of a very good fit for the basic estimating equation, the estimate of α is significantly less than the estimate of σ. We can only presume that the coefficients of our estimator reflect the influences of unincluded variables.

For three out of the four cases where the trend coefficient in equations (3.14) and (3.15) is significant at the 5 percent confidence level, the estimate of additionality adjusted for trend is greater than the unadjusted estimate (Table 13). Ghana is the variant case. The trend coefficient for Colombia is significant at the 10 percent level, and the effect of the trend adjustment is to yield a (higher) additionality estimate that is considerably more consistent with our a priori expectations.

Since the standard errors for the additionality estimates of Tables 13 and 14 are relatively large, no single estimate of the additionality factor in U.S. tied aid can be argued as providing a truly

Table 13

ESTIMATES OF THE ADDITIONALITY FACTOR FOR U.S. DEVELOPMENT ASSISTANCE TO MAJOR RECIPIENT COUNTRIES

(standard errors given in parentheses)

Aid Recipient	Additionality Factor (α) (equation 3.13)	Commerical Export Share (σ)	Coefficient of Determination of Estimating Equation (R^2)
Colombia	.317 (.143)	.502 (.013)	.911
Dominican Republic	.582 (.077)	.552 (.016)	.957
Brazil: (1958-68)	.764 (.199)	.310 (.013)	.899
(1959-68)	.949 (.114)	.293 (.008)	.973
Bolivia	.416 (.355)	.390 (.037)	.844
Chile	.049 (.077)	.397 (.008)	.977
Turkey	.877 (.260)	.142 (.037)	.610
Greece	.971 (.454)	.096 (.006)	.885
Ghana	1.325 (.293)	.068 (.011)	.610
Tunisia	1.177 (.197)	.049 (.010)	.827
India	1.026 (.118)	.111 (.015)	.891
Pakistan	.906 (.085)	.110 (.019)	.961
Korea	1.106 (.108)	.203 (.015)	.951
Indonesia	.850 (.624)	.105 (.011)	.576
China (Taiwan)	.935 (.187)	.268 (.013)	.959

Table 14

ESTIMATES OF THE ADDITIONALITY FACTOR FOR U.S. DEVELOPMENT ASSISTANCE TO MAJOR RECIPIENT COUNTRIES ADJUSTED FOR TIME TRENDS

Aid Recipients	Equation 3.14		Equation 3.15	
	Additionality Factor (α) (standard error in parentheses)	Coefficient of Determination of Estimating Equation (R^2)	Additionality Factor Estimated for 1968 (α_t)	Coefficient of Determination of Estimating Equation (R^2)
Colombia	.768 (.328)	.931	.683	.926
Dominican Republic	.623 (.084)	.963	.608	.962
Brazil	1.124 (.261)	.930	1.094	.928
Bolivia	.428 (.362)	.856	.412	.857
Chile	.047 (.082)	.977	.049	.977
Turkey	1.120 (.234)	.772	1.080	.773
Greece	not estimated		1.159	.900
Ghana	.619 (.222)	.895	.638	.898
Tunisia	.843 (.477)	.839	.860	.839
India	.832 (.178)	.912	.878	.909
Pakistan	.889 (.095)	.962	.897	.962
Korea	1.018 (.338)	.952	1.126	.951
Indonesia	1.444 (.574)	.745	1.431	.744
China (Taiwan)	.698 (.244)	.967	.695	.966

satisfactory basis for estimating the effect of untying on the U.S. balance of payments. Speaking very broadly, it would appear that a reasonable range of estimates for additionality of U.S. aid to Latin America is .55 to .75. For U.S. aid to the rest of the world the corresponding range is .85 to 1.0.

The preceding discussion has been confined to the estimation of additionality factors for the United States. Since data on official development lending by other DAC countries are not available before 1966, OLS estimates of the parameters of equation (3.13) for other DAC countries would not be meaningful. In these circumstances we are forced to introduce the additionality factors for countries other than the United States as out-and-out assumptions.

There is only one exception to this state of affairs. The Economic Planning Staff of the Ministry of Overseas Development has estimated that some 62 percent of all fully tied British capital aid was disbursed to finance British exports that would have been purchased in any event. It was further reckoned that this percentage was higher for India and Pakistan than for other aid recipients. When account was taken of the probable British share of exports financed out of the free foreign exchange created by this "switching," an additionality factor of approximately .5 was arrived at.[1] This value was based on an examination of disbursement data, however, and it thus may be underestimated.

With the exception of the United Kingdom it seems generally accepted that the additionality factors associated with the tied development lending of other DAC countries is relatively high. Whether there is any evidential basis for this assertion we simply do not know. What seems even more uncertain is the additionality factor to be associated with untied development assistance. If the DAC distinction between tied and untied aid were meaningful, the additionality factor for untied aid should be the same as the procurement-share estimate based on commercial trade patterns. It is our understanding,

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[1]Bryan Hopkin and Associates, "Aid and the Balance of Payments," Economic Journal, 80 (March 1970), pp. 5-7.

however, that the DAC distinctions between tied and untied development lending are "official but not authoritative," by which we interpret that various "untied" assistance programs are subject to de facto tying restrictions. We shall thus base our estimates of the balance-of-payments effects of untying on two alternative sets of assumptions as to the additionality factors for the other DAC donors. The range of our assumptions as to additionality factors for the tied aid of other DAC donors is .50-.75 for the United Kingdom and .90-1.00 for other donors. For untied aid the range of our assumptions for all DAC donors is .20-.50.

IV. THE SHORT-RUN BALANCE-OF-PAYMENTS EFFECTS OF UNTYING AID

The effect on a country's balance of payments of a given change in the procurement restrictions associated with development assistance is a complex function of trade shares, the effectiveness of tying arrangements, the proportion of the development assistance used for commodity procurement as opposed to transport costs, the size of the aid programs affected, and the list of countries eligible for export procurement under the new set of restrictions. From the point of view of a policymaker the latter two variables are the most interesting, for they are subject to his direct manipulation. Accordingly, we will organize the discussion of this section to reflect three basic policy situations: first, an aid donor unties unilaterally with no restriction on export procurement; second, all aid donors untie with no restrictions on procurement; and, third, a subset of aid donors untie with joint reciprocity with respect to procurement restrictions -- only donors not participating in the untying agreement being ineligible sources for procurement of goods to be financed by the aid programs of the participant countries.

UNILATERAL UNTYING

In a situation in which all aid donors have tied assistance programs, the volume of exports from any given country that is financed by these programs is equal to that part of its own aid flow that is not shifted to procurement from other countries -- the aid program of the country in question multiplied by its "additionality" factor -- plus its share in that part of the aid programs of other countries that has been switched to procurement from sources other than the donor. This is perhaps best noted symbolically. Let

A_{ij} = the flow of aid from country "i" to country "j,"

α_{ij} = the proportion of A_{ij} that results in additional exports from country "i" to "j."

σ^k_{ij} = the share of country "i" in the supply of exports to country "j" that is financed by untied aid from country "k" to country "j,"

θ^k_{ij} = the share of country "i" in supplying the shipping and insurance services generated by the assistance program of country "k" to country "j," and

λ_{ij} = the ratio of exports f.o.b. to imports c.i.f. for the aid program of country "i" to country "j."

Then, when all aid programs are tied, the flow of exports of goods and services that is financed by these programs is

$$X^o_{kj} = \alpha_{kj}(1-\lambda_{ij})A_{kj} + \sum_{i\neq k} \frac{\sigma^i_{kj}(1-\alpha_{ij})(1-\lambda_{ij})}{(1-\sigma^i_{ij})} A_{ij} + \sum_i \theta^i_{ij}\lambda_{ij}A_{ij}, \quad (4.1)$$

and the total flow of goods and services from "k" to all countries arising out of tied assistance programs is

$$X^o_k = \sum_j X^o_{kj}. \quad (4.2)$$

If country "a" determines to untie its development assistance programs unilaterally, exacting no compensatory action from the other aid donors, its flow of exports of goods and services to country "j" that is financed by aid programs will shift to

$$X^{U\cdot a}_{aj} = \sigma^a_{aj}(1-\lambda_{aj})A_{aj} + \sum_{i\neq a} \frac{\sigma^i_{aj}(1-\alpha_{ij})(1-\lambda_{ij})}{(1-\sigma^i_{ij})} A_{ij} + \sum_i \theta^i_{ij}\lambda_{ij}A_{ij}, \quad (4.3)$$

and its total flow of aid-financed exports will shift to

$$X_a^{U\cdot a} = \sum_j X_{aj}^{U\cdot a}. \tag{4.4}$$

This unilateral action by country "a" will shift the flow of aid-financed exports from country "k" to country "j" to

$$X_{kj}^{U\cdot a} = \alpha_{kj}(1-\lambda_{kj})A_{kj} + \sigma_{kj}^{a}(1-\lambda_{aj})A_{kj}$$

$$+ \sum_{i\neq a,k} \frac{\sigma_{kj}^{i}(1-\alpha_{ij})(1-\lambda_{ij})}{(1-\sigma_{ij}^{i})} A_{ij} + \sum_i \theta_{kj}^{i}\lambda_{ij}A_{ij}, \tag{4.5}$$

and its total flow of aid-financed exports to

$$X_k^{U\cdot a} = \sum_j A_{kj}^{U\cdot a}. \tag{4.6}$$

The balance-of-payments effect of this unilateral untying action by country "a" for any country "k" (including "a") is thus

$$B_k^{U\cdot a} = X_k^{U\cdot a} - X_k^{o} = \text{equation (4.4) or (4.6) less equation (4.2)}$$

$$= \sum_j (\sigma_{aj}^{a} - \alpha_{aj})(1-\lambda_{aj})A_{aj}, \quad k=a, \tag{4.7/1}$$

$$= \sum_j \left[\sigma_{kj}^{a}(1-\lambda_{aj})\right] \left[1 - \frac{(1-\alpha_{aj})}{(1-\sigma_{aj}^{a})}\right] A_{aj}, \quad k\neq a. \tag{4.7/2}$$

We have estimated equations (4.7/1) and (4.7/2) for the assumption that the U.S. aid program drops all procurement restrictions on exports but retains the existing requirements with respect to the U.S. share of shipping costs. The results for the U.S. balance of payments for various assumptions as to export shares and additionality are given in Table 15. In each case it is posited that the geographical distribution of assistance is the same as it was in CY 1969 and that 10 percent of aid flows are used to purchase transport and insurance services. In order to make the results independent of the size of aid flows, we expressed them as the change in the U.S. balance of payments as a percentage of the total U.S. aid program.

The results are straightforward. The greater the additionality factor assumed (the less the balance-of-payments loss caused by the existing tied aid program), the greater the balance-of-payments loss of a unilateral untying action to the untying country. Additionality assumption (5) of Table 15 assumes that no procurement switching is taking place at the present time -- that, in the absence of the U.S. assistance program, U.S. exports to the LDCs would have been less than they are now by precisely the amount of exports currently funded under the U.S. assistance program. This improbable assumption was introduced chiefly to provide benchmark estimates. Although it is possible to make a reasonable case for additionality assumption (1), we feel that assumptions (2), (3), and (4) provide a better basis for calculation.

The various export-share assumptions all derive from the alternative share matrices considered in Section II. Share assumption (2) of Table 15 corresponds to the matrix of average commercial export shares (definition five) for 1966-68. Share assumptions (3) and (4) posit synthetic export-shore matrices obtained by various adjustments to the average commercial export-share matrix for 1966-68 to take into account such factors as time trends and exchange-rate realignment. Share assumption (3) thus corresponds to Table 11; share assumption (4) corresponds to Table 12. Our personal judgment is that share assumption (3) is a better basis for estimation than assumption (4). This is particularly likely to be true for the period 1962-63, for the

Table 15

THE EFFECTS ON THE U.S. BALANCE OF PAYMENTS OF A UNILATERAL UNTYING OF THE U.S. DEVELOPMENT LOAN PROGRAM

(net losses as a percentage of the U.S. development loan program)

Export Share Assumptions	Additionality Assumptions				
	(1)	(2)	(3)	(4)	(5)
(1)	-40.0	-46.5	-49.0	-59.5	-67.3
(2)	-40.8	-47.3	-49.8	-60.4	-68.1
(3)	-38.5	-45.0	-47.5	-58.1	-66.6
(4)	-37.4	-43.8	-46.4	-56.9	-64.6

Additionality assumptions:

(1) α_{ij} = .5 for Latin America, .8 for rest of world.

(2) α_{ij} = .55 for Latin America, .9 for India, .85 for rest of world.

(3) α_{ij} = .6 for Latin America, .9 for rest of world

(4) α_{ij} = .75 for Latin America, 1.0 for rest of world

(5) α_{ij} = 1.0 for all countries

Export share assumptions:

(1) σ^i_{ij} = U.S. share of 1965-1970 IBRD/IDA exports (Table 7).

(2) σ^i_{ij} = U.S. share of 1966-1968 commercial exports (Table 2).

(3) σ^i_{ij} = synthetic export matrix A (Table 11).

(4) σ^i_{ij} = synthetic export matrix B (Table 12).

elasticities used to derive the synthetic matrices of Tables 11 and 12 are medium-run to long-run values. Our best guess as to the short-run or "first-round" balance-of-payments loss resulting from a unilateral untying of the U.S. assistance program in the early 1970s is thus about 48 percent of the total aid program if there is no change in shipping restrictions.[1] This would be reduced somewhat if the share of aid received by the countries of South Asia were to fall.

One feature of Table 15 deserves singling out. The range of high to low estimates for various additionality assumptions (for a given share assumption) is greater than the range of high to low estimates for various export share assumptions (for a given additionality assumption). This is true even if the results for additionality assumption (5) are excluded. This reflects what we feel to be an appropriate representation of the relative degree of uncertainty involved in estimating these two sets of parameters. If either commercial trade shares or shares of IBRD/IDA exports are a reasonable starting point in estimating the pattern of exports that would hold in the absence of tying restrictions, the range of variation in the balance-of-payments calculations for what we believe to be "reasonable" adjustments to either basis is relatively small. If neither matrix is a reasonable starting point, we know of no way short of line-by-line review of existing (and probable future) procurement records for estimating the balance-of-payments effects of a change in procurement practices. The additionality parameters are somewhat less certain, however. Although we think that additionality assumption (3) is probably the best basis for this type of balance-of-payments estimate, we do not feel that the results of our analysis of additionality parameters are such as to justify the rejection of assumptions (1), (2), and (4) as "unreasonable."

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[1] Assuming export share assumption (3) and additionality assumption (3).

MULTILATERAL UNTYING

If all aid-giving countries were to eliminate tying restrictions other than those relating to shipping, the flow of aid-financed exports from country "k" to country "j" would shift from X^o_{kj} (equation (4.1)) to

$$X^M_{kj} = \sum_i \sigma^i_{kj}(1-\lambda_{ij})A_{ij} + \sum_i \theta^i_{kj}\lambda_{ij}A_{ij}, \qquad (4.8)$$

and the total flow of aid-financed exports from country "k" would shift from X^o_k (equation (4.2)) to

$$X^M_k = \sum_j X^M_{kj}, \text{ for all k.} \qquad (4.9)$$

This implies a change in the balance of payments of country "k" of

$$B^M_k = X^M_k - X^o_k$$

$$= \sum_j \left[(\sigma^k_{kj}-\alpha_{kj})(1-\lambda_{kj})A_{kj} + \sum_{i\neq k} \left[\sigma^i_{kj}(1-\lambda_{ij})\right] \left[1- \frac{(1-\alpha_{ij})}{(1-\sigma^i_{ij})}\right] A_{ij} \right]. \qquad (4.10)$$

We have estimated equation (4.10) for various combinations of assumptions as to export shares, additionality, and tied aid flows. These estimates are presented in Tables 16, 17, 18, and 19. Tables 16 and 17 express the resultant changes in the U.S. balance of payments in terms of percentages of the U.S. development loan program. Table 16 presents the relative balance-of-payments implications for a wide range of export-share and additionality assumptions for two different assumptions as to the ratio of U.S. aid eligible for untying to the eligible aid for the other DAC nations. Table 17 gives the implications of a broader set of assumptions as to the relative amounts

Table 16

THE EFFECTS ON THE U.S. BALANCE OF PAYMENTS OF A MULTILATERAL UNTYING OF THE DEVELOPMENT LOAN PROGRAMS OF ALL DAC COUNTRIES: PART I
(changes in U.S. exports as a percentage of U.S. development loans)

A. Assuming the ratio of U.S. aid eligible for untying to rest-of-world eligible aid is 1.09, the ratio of U.S. tied development loans to rest-of-world tied development loans in 1969.

Export Share Assumption	Additionality Assumption								
	(1)	(2)	(3)	(4)	(5)	(6)[a]	(7)[a]	(8)[a]	(9)[a]
(1)	-26.7	-34.2	-36.0	-45.1	-52.0				
(2)	-29.5	-36.7	-38.7	-47.6	-54.9				
(3)	-25.8	-33.1	-35.1	-43.7	-50.9				
(4)	-24.6	-31.8	-33.8	-42.4	-49.6				

B. Assuming the ratio of U.S. aid eligible for untying to rest-of-world eligible aid is .71, the ratio of total U.S. development loans to total rest-of-world development loans in 1969.

Export Share Assumption	Additionality Assumption								
	(1)	(2)[a]	(3)	(4)[a]	(5)	(6)	(7)	(8)	(9)
(1)	-19.1		-28.7		-43.3	-32.4	-27.3	-45.5	-40.4
(2)	-23.1		-32.4		-47.5	-34.7	-30.4	-47.8	-43.5
(3)	-18.2		-27.7		-42.2	-30.9	-25.8	-44.0	-38.9
(4)	-17.0		-26.5		-40.9	-29.7	-24.5	-42.8	-37.6

[a]No estimate made.

Additionality Assumptions:

(1) U.S.: α_{ij} = .5 for Latin America, .8 for rest of world;
U.K.: α_{ij} = .8 for South Asia, .9 for rest of world;
Other donors: α_{ij} = .9

(2) U.S.: α_{ij} = .55 for Latin America, .9 for South Asia, .85 for rest of world;
U.K.: α_{ij} = .5; Other donors: α_{ij} = .9.

(3) U.S.: α_{ij} = .6 for Latin America, .9 for rest of world;
U.K.: α_{ij} = .6 for South Asia, .9 for rest of world;
Other donors: α_{ij} = .9.

(4) U.S.: α_{ij} = .75 for Latin America, 1.0 for rest of world;
U.K.: α_{ij} = .75; Other donors: α_{ij} = 1.0.

(5) All donors: α_{ij} = 1.0.

(6) U.S.: α_{ij} = .55 for Latin America, .9 for South Asia, .85 for rest of world:
U.K.: α_{ij} = .4; Germany: α_{ij} .4; France: α_{ij} = .85;
Other donors: α_{ij} = .9.

Notes to Table 16 (continued)

(7) U.S.: α_{ij} = .55 for Latin America, .9 for South Asia, .85 for rest of world;
U.K.: α_{ij} = .6; Germany: α_{ij} = .7; France: α_{ij} = .95;
Other donors: α_{ij} = 1.0.

(8) U.S.: α_{ij} = .75 for Latin America, 1.0 for rest of world;
U.K.: α_{ij} = .4; Germany: α_{ij} = .4; France: α_{ij} = .85;
Other donors: α_{ij} = .9.

(9) U.S.: α_{ij} = .75 for Latin America, 1.0 for rest of world;
U.K.: α_{ij} = .6; Germany: α_{ij} = .7; France: α_{ij} = .95;
Other donors: α_{ij} = 1.0.

Export Share Assumptions: Same as Table 15.

Table 17

THE EFFECTS ON THE U.S. BALANCE OF PAYMENTS OF A MULTILATERAL UNTYING OF THE DEVELOPMENT LOAN PROGRAMS OF ALL DAC COUNTRIES: PART II
(changes in U.S. exports as a percentage of U.S. development loans)

Additionality Assumption	Ratio of U.S. Aid Eligible for Untying to Eligible Aid from Rest of World					
	(a) 1.094	(b) 0.967	(c) 0.806	(d) 0.710	(e) 0.683	(f) 0.615
(1)	*	*	*	*	*	*
(2)	-33.1	-31.2	-28.4	*	*	*
(3)	-35.1	-33.0	-30.1	-27.7	-26.9	-24.6
(4)	-43.7	-41.4	-38.1	*	*	*
(5)	*	*	*	*	*	*
(6)	*	*	*	-30.9	-30.4	-28.7
(7)	*	*	*	-25.8	-25.1	-22.9
(8)	*	*	*	-44.0	-43.5	-41.8
(9)	*	*	*	-38.9	-38.2	-36.0

*Signifies not estimated.

Export share assumptions:

All estimates based on export share assumption (3), Table 11.

Additionality assumptions:

See Table 16.

Ratio assumptions:

(a) 1.094 = U.S. tied development loans in 1969/rest-of-world tied development loans in 1969;

(b) 0.967 = \$750 x 10^6/rest-of-world tied development loans in 1969;

(c) 0.806 = \$750 x 10^6/1.2 x rest-of-world tied development loans in 1969;

(d) 0.710 = U.S. total development loans in 1969/rest-of-world total development loans in 1969;

(e) 0.683 = \$1000 x 10^6/1.2 x rest-of-world total development loans in 1969;

(f) 0.615 = \$750 x 10^6/rest-of-world total development loans in 1969.

Table 18

THE DISTRIBUTION BY EXPORTING REGION OF THE SHORT-RUN BALANCE-OF-PAYMENTS EFFECTS OF A MULTILATERAL UNTYING OF THE DEVELOPMENT LOAN PROGRAMS OF ALL DAC COUNTRIES
(millions of dollars)

Export Region	Assumption Set			
	(a)	(b)	(c)	(d)
United States	-281.0	-371.3	-223.7	-381.2
Canada	-28.3	-27.3	-27.9	-21.6
Caribbean	1.5	3.2	2.1	3.2
Other South America	4.8	8.8	6.4	9.1
United Kingdom	71.0	64.6	50.9	86.0
Germany	34.1	55.4	-30.3	63.7
France	-58.8	-62.3	-64.5	-50.9
Other Common Market	72.5	93.8	64.6	65.1
Other Europe	67.7	91.3	47.2	51.9
Africa	7.3	8.5	9.9	9.0
Middle East	12.6	14.8	16.8	15.4
South Asia	7.1	8.4	10.0	8.7
Japan	20.3	32.0	47.1	57.9
Far East	29.2	34.7	37.9	34.9
Australia, New Zealand, South Africa	40.0	47.5	53.3	48.8

Assumption sets:

(a) Export share assumption (3), Table 11;
Additionality assumption (2), Table 16;
U.S. aid eligible for untying = 1969 U.S. tied development loans;
Other DAC country aid eligible for untying = 1969 other DAC country tied development loans.

(b) Same as set (a) except that additionality assumption (4) (see Table 16) replaces additionality assumption (1).

(c) Export share assumption (3), Table 11;
Additionality assumption (7), Table 16;
U.S. aid eligible for untying = 1969 U.S. development loans;
Other DAC country aid eligible for untying = 1969 other DAC country total development loans.

(d) Same as set (c) except that additionality assumption (8) (see Table 16) replaces additionality assumption (7).

Table 19

THE DISTRIBUTION BY AID-RECEIVING REGION OF THE SHORT-RUN EFFECTS ON THE U.S. BALANCE OF PAYMENTS OF A MULTILATERAL UNTYING OF THE DEVELOPMENT LOANS OF ALL DAC COUNTRIES
(millions of dollars)

Aid-Receiving Region	Assumption Set			
	(a)	(b)	(c)	(d)
Caribbean	5.6	-14.7	12.0	-15.9
Other South America	-12.3	-39.7	-4.7	-40.1
Other Europe	3.3	3.8	4.9	3.9
Africa	-22.5	-27.5	-11.1	-25.6
Middle East	-32.8	-41.1	-23.7	-42.6
South Asia	-218.9	-247.0	-207.7	-252.3
Far East	-3.4	-5.1	6.6	-8.6

Assumption sets: See Table 18.

of aid eligible for untying from the United States and other countries, but a narrower set of assumptions as to export shares and additionality. Table 18 gives dollar estimates of the short-run or "first-round" balance-of-payments changes for each exporting region. Table 19 presents the distribution of the dollar amounts of the short-run changes in the U.S. balance of payments by aid-receiving region.

Certain assumptions are common to each set of estimates. First, the ratio of exports f.o.b. to imports c.i.f. was assumed to be .9 for all trading relationships. That is, $\lambda_{ij} = .9$ for all i,j. Second, except in the case of exports to the Caribbean region, the share of a given country in the exports to an aid-receiving region that are financed by an untied aid program is assumed to be the same for every program. That is, the U.S. share of exports to India financed by untied German aid is assumed to be the same as the U.S. share of exports to India financed by untied aid from the United Kingdom. In terms of the notation used here, $\sigma^m_{kj} = \sigma^n_{kj}$ for all k,m,n, and all j except the Caribbean region. For the Caribbean region we estimated separate export-share vectors for the untied aid coming from France, the United Kingdom, the Netherlands, and the United States. The aid vector relevant to U.S. aid was used to estimate the balance-of-payments effects of untying the Caribbean aid programs of the remaining DAC donors. Third, for all development loan categories, the geographical distribution of aid by region of donor and region of recipient is assumed to be directly proportional to that distribution observed in 1969.

The various estimates of Tables 16 and 17 are not equally probable. Export-share assumption (2), the matrix of average commercial-export shares for 1966-68, is difficult to defend. So is export-share assumption (1), the matrix of average shares of IBRD/IDA exports for 1965-70. We regard export-share assumption (3), the synthetic share matrix presented as Table 11, as the "best" basis for estimation. With respect to additionality assumptions matters are somewhat less certain. Additionality assumptions (1) and (5) of Table 16 generate extreme results that we have introduced chiefly as benchmarks. With respect to the choice among the remaining assumptions, matters are somewhat difficult.

If the multilateral untying agreement were to apply only to formally tied development loans, the most defensible basis for estimation would be additionality assumption (3), although assumptions (2) and (4) are not unreasonable.

Certain countries maintain development loan programs that are untied de jure but tied de facto, and a multilateral untying agreement would almost certainly involve the elimination of these informal tying arrangements. In other words, the official DAC data are not authoritative with respect to the tied-untied distinction.[1] For this reason we have calculated the balance-of-payments effects of a multilateral untying of development loan assistance with respect to measures of both total development loans and tied development loans. Yet unless it can be assumed that additionality is the same for tied and untied aid flows, the same set of additionality parameters cannot be used to estimate both the effects of eliminating all tying restrictions and those of eliminating only de jure restrictions. Accordingly, we have developed four sets of additionality factors -- assumptions (6), (7), (8), and (9) of Table 16 -- to be used for estimates of the effect of eliminating all procurement restrictions. Thus, for any given share assumption, the difference between the calculations jointly defined (for example) by additionality assumption (2) and aid assumption (a) of Table 17 and those defined by additionality assumption (6) and aid assumption (d) is a measure of the marginal effect of eliminating de facto tying restrictions. Additionality assumptions (4) and (9) and aid assumptions (b) and (f) are pairs of assumptions that also specify such a measurement.

The most striking feature of the various estimates of equation (4.10) is their sensitivity to the U.S. share of the development lending eligible to be untied. Table 17 shows that where the ratio of U.S. aid to the aid of other DAC nations is 1.094 (the ratio of tied U.S. development loans to tied development loans from other DAC

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[1] This is probably an understatement. Some knowledgeable observers feel that the DAC distinctions between tied and untied loans refer solely to the nature of the project being financed and are irrelevant with respect to the freedom to procure exports.

countries in 1969), the U.S. balance-of-payments loss according to additionality assumption (3) is 35.1 percent of the value of the U.S. loan program. This reduces to 30.1 percent if the ratio of U.S. aid to be untied to the aid of other DAC nations that are eligible for untying falls to .615, the ratio that would obtain if the volume of U.S. aid were $750 million and the volume of other DAC aid were equal to the total volume of development lending by other DAC countries in 1969. These losses should be compared with the 47.5 percent loss that would follow a unilateral untying of U.S. development loans (for the same set of assumptions with respect to export shares and additionality).

Table 16 underscores the potential importance to the United States of securing the elimination of de facto as well as formal tying restrictions as part of any multilateral untying agreement. If the official distinctions between tied and untied lending are irrelevant -- if all DAC development loans are in fact now tied -- the consequences for the U.S. balance of payments of a multilateral agreement to eliminate all tying restrictions are best described by estimates of the sort given in Part B of Table 16. If these official distinctions are meaningful -- if so-called untied aid is in fact truly untied -- the estimates of Part A of Table 16 would be the relevant set. Comparison of column (2) of Part A with column (6) of Part B [or column (4) of Part A with column (9) of Part B] gives our estimate of the marginal advantage to the United States of negotiating the removal of de facto tying restrictions.

The estimates of the balance-of-payments effect of a multilateral untying agreement are thus considerably more uncertain than the estimates in the case of unilateral untying. This is essentially a matter of the added uncertainty as to the additionality parameters for aid donors other than the United States, for the question of whether the appropriate basis for calculation is total development loans or tied development loans is essentially the question of what is the appropriate set of additionality parameters for those countries whose aid programs consist of a mix of formally tied and formally untied (read partly tied) assistance. We know of no way short of an intensive review of the informal tying arrangements of the other DAC donors of

reducing this uncertainty. Such an investigation is beyond the scope of this study.

The range between the high and low estimates for various assumptions as to export shares -- the other assumptions fixed -- is somewhat greater for the situation of multilateral untying than for unilateral untying. If share assumption (2) is eliminated, however, the range of variation of the estimates diminishes considerably. This assumption corresponds to the matrix of average commercial export shares for the period 1966-68 (Table 2). We have already indicated that we feel that estimates of U.S. balance-of-payments losses derived from this assumption are biased upward.

For each set of assumptions three nations suffer consistent balance-of-payments losses as a result of a multilateral untying of development loans -- the United States, Canada, and France. The less developed countries, the Common Market nations other than France and Germany, and the remaining nations of continental Europe enjoy consistent balance-of-payments gains. The United Kingdom and Japan both enjoy improvements in their balance of payments, but the extent of this improvement depends on what is assumed about the importance of informal untying arrangements and the extent to which they are eliminated as part of the multilateral untying agreement. Since virtually all of Japanese aid is formally tied, the improvement in the Japanese balance of payments attendant upon multilateral untying would be substantially greater if informal untying arrangements were important and, if important, they were eliminated. The case of Germany is somewhat complicated. About two-thirds of German development lending is formally untied, but there is considerable suspicion that de facto tying arrangements in fact insure a relatively high additionality factor. If this is true, and if these arrangements are abandoned as part of the untying agreement, Germany will suffer substantial balance-of-payments losses as a result of multilateral untying. The estimates implied by assumption (c) indicate such a result. If, as in assumption (d), a relatively low allowance for de facto tying is specified, Germany will enjoy substantial balance-of-payments gains even if the basis for calculation is total aid rather than tied aid.

It is important to keep in mind that each of these estimates is highly dependent upon what is assumed about the distribution between aid recipients of the aid that is to be untied. Table 17 shows that the United States would sustain a balance-of-payments loss equal to 41.8 percent of its development loan program as a result of multilateral untying if ratio assumption (f), export-share assumption (3), and additionality assumption (8) were to obtain. But this calculation is based on the assumption that the geographical distribution of the U.S. aid eligible for untying is the same as the distribution of U.S. development lending in 1969. This distribution is approximately as follows: Caribbean, 15 percent; other South America, 19 percent; Africa, 7 percent; Europe and Middle East, 9 percent; South Asia, 43 percent; and the Far East, 7 percent. Note the relative importance of aid to India and Pakistan. Yet the circumstances of additionality and U.S. export shares to South Asia are such that an untying of aid to that region implies a particularly large relative balance-of-payments loss. As a result, the great bulk of the estimated balance-of-payments losses for the United States attendant upon an untying of aid would result from a reduction of exports to South Asia. This is shown vividly in Table 19. Thus if it is assumed that the proportion of U.S. aid going to South Asia is reduced -- for example, if it is assumed that the distribution of U.S. development assistance is 17 percent to the Caribbean, 21 percent to South America, 11 percent to Africa, 13 percent to Europe and the Middle East, 27 percent to South Asia, and 11 percent to the Far East -- the U.S. balance-of-payments loss would be less. For the same set of assumptions that yielded an estimated loss of 41.8 percent of the aid program eligible for untying, this revised distribution of U.S. aid implies a 36.0 percent balance-of-payments loss.

RECIPROCAL UNTYING BY A SUBSET OF DONOR COUNTRIES

The balance-of-payments consequences of a reciprocal untying of aid by a subset of the donor nations are more difficult to estimate than those of a full multilateral agreement. The chief problem here is specifying the joint additionality parameter for the subset of

countries agreeing to reciprocal untying. That is, what proportion of the exports financed by the loan programs of this subset of donors will in fact be procured from ("switched" to) donor countries not participating in the untying agreement? This question seems particularly troublesome because the administrative machinery required to prevent "switching" in circumstances of reciprocal untying would be extremely cumbersome. We have thus decided to treat the problem parametrically. In one set of circumstances we shall assume that joint additionality for the subset of reciprocally untying nations is such that the flow of aid-financed exports from donor nations that are not participants in the untying agreement is the same after the agreement as before. A donor nation that refuses to participate neither gains nor loses by its decision. We shall identify this as case 1. We shall also consider a case 2 in which we assume that no machinery to prevent export "switching" to non-participant donors is in fact set up. A country not participating in the untying agreement is thus assumed to be able to secure its normal "commercial" share of all exports financed by the development assistance of those nations that have agreed to reciprocal untying.

In case 1, if all countries other than country "n" participate in an untying agreement, the aid-financed exports of country "n" are

$$X_n^{M-n(1)} = X_n^o, \tag{4.11}$$

and the balance-of-payments effects for country "n" of this agreement are thus

$$B_n^{M-n(1)} = X_n^{M-n(1)} - X_n^o = 0. \tag{4.12}$$

In the same set of circumstances, the exports of a country "k" (that is participating in the untying agreement) shift from X_k^o (equation (4.2)) to

$$X_k^{M-n(1)} = \sum_j \left[\sum_{i \neq n} \left[\frac{\sigma_{kj}^i (1-\lambda_{ij})}{(1-\sigma_{nj}^i)} \right] \left[1 - \frac{\sigma_{nj}^i (1-\alpha_{ij})}{(1-\sigma_{ij}^i)} \right] A_{ij} \right.$$

$$\left. + \left[\frac{\sigma_{kj}^n (1-\alpha_{nj})(1-\lambda_{nj})}{(1-\sigma_{nj}^n)} \right] A_{nj} + \sum_i \theta_{kj}^i \lambda_{ij} A_{ij} \right], \quad k \neq n. \tag{4.13}$$

Participation in a reciprocal untying agreement in case 1 situations thus results in a change of country "k's" balance of payments of

$$B_k^{M-n(1)} = X_k^{M-n(1)} - X_k^o$$

$$= \sum_j \left\{ \left[\frac{\sigma_{kj}^k}{(1-\sigma_{nj}^k)} - \alpha_{kj} \right] (1-\lambda_{kj}) A_{kj} \right.$$

$$+ \sum_{k \neq k,n} \sigma_{kj}^i (1-\lambda_{ij}) \left[\left[\frac{1}{(1-\sigma_{nj}^i)} \right] \left[1 - \frac{\sigma_{nj}^i (1-\alpha_{ij})}{(1-\sigma_{ij}^i)} \right] \right.$$

$$\left. \left. - \left[\frac{(1-\alpha_{ij})}{(1-\sigma_{ij}^i)} \right] \right] A_{ij} \right\}. \tag{4.14}$$

In case 2, if all countries other than country "n" participate in a reciprocal tying agreement the volume of aid-financed exports from country "n" shifts from X_n^o to

$$X_n^{M-n(2)} = \sum_j \left[\alpha_{nj} (1-\lambda_{nj}) A_{nj} + \sum_{i \neq n} \sigma_{nj}^i (1-\lambda_{ij}) A_{ij} \right.$$

$$\left. + \sum_i \theta_{nj}^i \lambda_{ij} A_{ij} \right]. \tag{4.15}$$

The effects of such a reciprocal untying arrangement on country "n's" balance of payments is thus

$$B_n^{M-n(2)} = X_n^{M-n(2)} - X_n^o$$

$$= \sum_j \sum_{k \neq n} \left[\sigma_{nj}^i (1-\lambda_{ij}) \right] \left[1 - \frac{(1-\alpha_{ij})}{(1-\sigma_{ij}^i)} \right] A_{ij}. \qquad (4.16)$$

Given the same case 2 circumstances, the volume of aid-financed exports of a country "k" that is a participant in a reciprocal untying agreement shifts from X_k^o to

$$X_k^{M-n(2)} = \sum_j \left[\sum_{i \neq n} \sigma_{kj}^i (1-\lambda_{ij}) A_{ij} + \sigma_{kj}^n \frac{(1-\alpha_{ij})}{(1-\sigma_{nj}^n)} (1-\lambda_{nj}) A_{nj} + \sum_i \theta_{kj}^i \lambda_{ij} A_{ij} \right], \qquad (4.17)$$

and its balance of payments changes by the amount

$$B_k^{M-n(2)} = X_k^{M-n(2)} - X_k^o$$

$$= \sum_j \left[(\sigma_{kj}^k - \alpha_{kj})(1-\lambda_{kj}) A_{kj} + \sum_{i \neq k,n} \sigma_{kj}^i (1-\lambda_{ij}) \left[1 - \frac{(1-\alpha_{ij})}{(1-\sigma_{ij}^i)} \right] A_{ij} \right]. \qquad (4.18)$$

Estimates of equations (4.14) and (4.18) for the United States for various assumptions as to additionality and the subset of DAC nations participating in a reciprocal untying agreement are presented in Tables 20 and 21. Both tables are based on export-share assumption

Table 20

A COMPARISON OF THE EFFECTS ON THE U.S. BALANCE OF PAYMENTS OF RECIPROCAL UNTYING OF DEVELOPMENT LENDING BY A SUBSET OF DAC DONORS: PART I
(changes in U.S. exports as a percentage of U.S. development loans)

Type of Untying Agreement	Additionality Assumptions					
	(2)		(3)		(4)	
Multilateral Untying	-33.1		-35.1		-43.7	
Reciprocal Untying by All DAC Countries Other than:	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
Canada	-33.7	-34.1	-35.7	-36.1	-44.2	-44.9
France	-34.3	-35.7	-36.4	-37.6	-45.1	-46.9
Japan	-33.1	-36.6	-35.0	-38.5	-43.3	-47.9
United Kingdom	-30.4	-34.2	-34.6	-36.9	-42.2	-45.6
Germany	-32.2	-35.1	-34.1	-37.0	-42.0	-46.0
Canada and France	-35.1	-36.8	-37.1	-38.6	-45.7	-48.1

All estimates are based on export-share assumption (3) and the assumption that development loans eligible for untying are the same as tied development loans in 1969. Definition of additionality assumptions are given in Table 16.

Table 21

A COMPARISON OF THE EFFECTS ON THE U.S. BALANCE OF PAYMENTS OF RECIPROCAL UNTYING OF DEVELOPMENT LENDING BY A SUBSET OF DAC DONORS: PART II
(changes in U.S. exports as a percentage of U.S. development loans)

Type of Untying Agreement	Additionality Assumptions					
	(3)		(7)		(8)	
Multilateral Untying	-27.7		-25.8		-44.0	
Reciprocal Untying by All DAC Countries Other than:	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
Canada	-28.1	-28.7	-26.4	-28.0	-44.3	-45.0
France	-28.8	-30.6	-27.2	-29.2	-44.9	-46.8
Japan	-26.3	-31.1	-25.1	-29.9	-42.6	-47.4
United Kingdom	-28.3	-30.9	-24.9	-28.3	-42.0	-45.5
Germany	-30.5	-33.6	-26.6	-30.2	-42.0	-46.0
Canada and France	-29.4	-31.6	-27.9	-30.4	-45.4	-47.9

All estimates are based on export-share assumption (3) and the assumption that development loans eligible for untying are the same as total development loans in 1969. Additionality assumptions are given in Table 16.

(3). Table 20 assumes that the set of development-loan programs eligible for untying is proportional to the relevant set of tied development loan programs in 1969. Table 21 assumes that the set of development loans eligible for untying is proportional to the relevant set of total development loans in 1969. The estimates of Table 21 are thus to be preferred if it is felt both that the official DAC distinction between tied and untied loans is essentially arbitrary and that an untying agreement would eliminate de facto as well as formal tying arrangements. The estimates of Table 20 are preferred if it is felt that de facto tying of formally untied development lending is relatively insignificant.

The most striking fact to emerge from examination of Tables 20 and 21 is the importance to the U.S. balance of payments of creating some sort of administrative capability to insure that non-participant donors are excluded as a procurement source for goods financed through untied aid. The case 2 estimates of the U.S. balance-of-payments loss are substantially larger than the case 1 estimates and are often significantly greater than the estimated balance-of-payments loss in the case of full multilateral untying. If it is assumed that de facto tying is either unimportant or not susceptible to elimination through an untying agreement, Japan is the country whose nonparticipation would result in the greatest incremental U.S. balance-of-payments loss in case 2 situations. If de facto tying is assumed to be both important and negotiable, the nonparticipation of either Germany or Japan would be most costly to the U.S. balance of payments in such circumstances.

If an effective machinery can be created to prevent "switching" of procurement to the nonparticipant donors in amounts beyond that now taking place, the cost to the United States of something less than full DAC participation in a reciprocal untying agreement is considerably less. In all cases there would be modest balance-of-payments costs to the United States if either Canada or France were to abstain from the untying agreement. For all sets of assumptions examined in Tables 20 and 21 save one, the U.S. balance of payments would improve in case 1 situations if Japan did not join in a reciprocal untying

arrangement. The participation of Germany and the United Kingdom would increase the U.S. balance-of-payments loss, given the assumptions of Table 20. Under the assumptions of Table 21, the effect is variable. The greater the effectiveness of de facto tying the more likely that British or German participation would decrease the U.S. balance-of-payments loss.

V. LONG-RUN ADJUSTMENTS TO THE SHORT-RUN BALANCE-OF-PAYMENTS EFFECTS OF UNTYING AID

The total effect of untying aid on the balance of payments of the countries involved consists of two parts: the initial changes in exports, and the subsequent changes in exports and imports that are induced by the initial changes. The latter set of changes we will call the "respending effects," and their estimation is the subject of this section.[1]

It is clear that respending effects can partly reverse the initial effects of untying on the U.S. balance of payments. What is uncertain is the possible extent of this reversal. Previous attempts to estimate the magnitude of respending effects have been based either on models of reserve accumulation or models embodying the "reflection ratio" approach.[2] Unfortunately, both approaches contain serious flaws.

The reserve accumulation model is based on the presumption that governments wish to hold foreign exchange in proportion to their nation's trade volume. As foreign exchange accumulates from exports, a certain proportion is allocated to a reserve fund and the residual is sold to importers. The reserve accumulation proportion may vary from zero (in the case of an LDC with excess demand for foreign exchange) to one (in the case of a developed country whose import demand is assumed independent of its exports). The basic problem is that this approach applies only to a very special set of circumstances -- that of complete exchange control in which the demand for imports

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[1] For a more complete discussion see Chu and Shishko, The Respending Effects of Untied Aid.

[2] For examples of the reserve accumulation model see Whitney Hicks, "Estimating the Foreign Exchange Costs of Untied Aid," Southern Economic Journal, 30, October 1963, pp. 168-174; or Walter S. Salant et al., The United States Balance of Payments in 1968, The Brookings Institution, Washington, D. C., 1963, Chapter 6 and Appendix. For an example of the reflection ratio approach see Rolf Piekarz and Lois E. Stekler, "Induced Changes in Trade and Payments," Review of Economics and Statistics, 49, November 1967, pp. 517-526.

exceeds the supply of foreign exchange allocated for imports and in which no capital export is permitted. Yet the primary problem in estimating respending effects is estimating the behavior of developed countries where such assumptions are simply unfounded.

The "reflection ratio" approach assumes that the demand for imports is a direct function of exports, the ratio of changes in imports to changes in exports being the reflection ratio. The behavioral foundations of this linkage are sought in the relationships between exports and income and income and imports. Unfortunately, the reflection ratio measures rather more than just these relationships, for imports respond to a variety of stimuli including fiscal-monetary policy, changes in investment, and changes in relative prices. Thus it is not uncommon to find short-run reflection ratios well in excess of 1.0. Yet if this were to be presumed to be a true measure of the behavioral relationship between autonomous changes in exports and induced changes in imports, the marginal propensity to consume would also have to be presumed greater than 1.0.[1] This is clearly unacceptable.

The model developed here avoids such difficulties by focusing directly on the behavioral linkage between changes in exports and changes in imports. Generically, it is a straightforward adaptation of the generalized model of the multisector multiplier.[2]

ESTIMATION OF RESPENDING EFFECTS THROUGH A MULTISECTOR MULTIPLIER MODEL

Final changes in income in any country can be decomposed into three parts: autonomous changes in income, self-induced changes in income, and changes in income that result from changes in exports.

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[1] The national income identity $Y = C + X - M$ yields the expression $M = \gamma + \frac{\delta}{1-\beta+\delta}(\alpha-\gamma) + \frac{\delta}{1-\beta+\delta}X$ where it is assumed $C = \alpha+\beta Y$ and $M = \gamma+\delta Y$. This defines the reflection ratio "r" $= \frac{\delta}{1-\beta+\delta}$.

[2] John S. Chipman, "The Multi-Sector Multiplier," Econometrica, 18, October 1950, pp. 355-374.

Assuming that both imports and spending on domestic goods are linear functions of income, and that all goods in all countries are in perfectly elastic supply, then the final change in income for country "i" can be written

$$dY_i = dN_i + m_{1i}dY_1 + m_{2i}dY_2 + \ldots + m_{ii}dY_i + \ldots m_{ni}dY_n, \qquad (5.1)$$

where:

dY_i = the total change in income in country "i,"

dN_i = the autonomous change in income in country "i,"

m_{ji} = the marginal propensity of country "j" to import from country "i," and

m_{ii} = the marginal propensity to spend on domestic goods in country "i".

Since there are "n" equations of the type (5.1) it will be convenient to shift to matrix notation. Let

$$|m| = \begin{bmatrix} m_{11} \cdots m_{1n} \\ \vdots \quad\quad \vdots \\ m_{n1} \cdots m_{nn} \end{bmatrix},$$

$$|dY| = \begin{bmatrix} dY_1 \\ \vdots \\ dY_n \end{bmatrix},$$

$$|dN| = \begin{bmatrix} dN_1 \\ \vdots \\ dN_n \end{bmatrix}, \text{ and}$$

$|I|$ = the identity matrix of same order as $|m|$.

Then

$$|I-m||dY| = |dN|, \text{ and} \qquad (5.2)$$

$$|dY| = |1-m|^{-1}|dN|. \tag{5.3}$$

In the context of the respending question, $|dN|$ is the vector of first-round changes in exports resulting from untying. Given these changes and solving (5.3) for $|dY|$, the subsequent change in the balance of payments of country "i" can be computed as

$$dS_i = \sum_{j \neq i} m_{ji} dY_j - dY_i \sum_{j \neq i} m_{ij}. \tag{5.4}$$

The model can easily be modified to reflect the assumption that the imports of country "i" are foreign exchange constrained (given by the supply of foreign exchange rather than income). Define the final foreign exchange available to country "i" as

$$dF_i = dN_i + \sum_{j \neq 1} m_{ji} dY_j, \tag{5.5}$$

and define the marginal propensity of country "i" to import from country "j" out of dF_i as f_{ij}. Then

$$|dY^*| = |I-m^*|^{-1} |dN|, \tag{5.6}$$

where

$$|dY^*| = \begin{bmatrix} dY_1 \\ \cdot \\ \cdot \\ \cdot \\ dY_{i-1} \\ dF_i \\ dY_{i+1} \\ \cdot \\ \cdot \\ \cdot \\ dY_n \end{bmatrix}, \text{ and}$$

$$|m^*| = \begin{bmatrix} m_{.11} & \cdots & m_{.1n} \\ \vdots & & \vdots \\ f_{.i1} & & f_{.in} \\ \vdots & & \vdots \\ m_{n1} & \cdots & m_{nn} \end{bmatrix}.$$

The subsequent change in the balance of payments is thus

$$dS_j = \sum_{k \neq i,j} m_{kj} dY_k + f_{ij} dF_i - dY_j \sum_{k \neq i} m_{jk} \text{ for country "j" and} \quad (5.7)$$

$$dS_i = \sum_{k \neq i} m_{ki} dY_k - dF_i \sum_{k \neq i} f_{ik} = -dN_i \text{ for country "i."} \quad (5.8)$$

It is also a simple matter to adjust the model for the assumption that the government of country "i" seeks to neutralize the income effects of untying by pursuing compensatory fiscal-monetary policies. In the case where the objective is to compensate for the initial autonomous change in exports, simply set $dN_i = 0$. Should that country seek to insulate itself completely from the income effects of untying, set $dY_i = 0$.

Given $|dN|$ as the vector of short-run or first-round changes in exports resulting from untying (the estimates of Section IV), estimation of equations (5.4) and (5.7) requires estimation of $|m|$, the matrix of marginal propensities to spend on goods from a given region. We have estimated m_{ii}, the marginal propensity to spend on domestic goods, as the marginal propensity to consume.[1] These propensities were obtained by constructing regional totals for Gross National Product (Y) and Consumption (C) for the period 1958-68 and estimating the equation

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[1] For a discussion of the biases introduced by this procedure see Chu and Shishko, The Respending Effects of Untying Aid.

$$C_{i_t} = c_{i_o} + m_{ii} Y_{i_t}. \tag{5.9}$$

The marginal propensities to import were estimated from the equation

$$M_{ij_t} = m_{ij_o} + m_{ij} Y_{i_t} \tag{5.10}$$

for three definitions of trade. Two of these correspond to definitions (3) and (4) of Table 1. The third, what we shall label definition (1a), is defined as total interregional trade less special-category (military) exports from the United States and Sino-Soviet exports. The matrices differ from each other because they are based on different time periods as well as different trade definitions.[1] A fourth set of marginal import propensities was obtained by partitioning the aggregate marginal propensity given by trade definition (3) according to average export shares (σ_{ij}) for the period 1966-68.

SUMMARY OF RESULTS FOR THE STATIC CASE

Estimates of equation (5.4) or (5.7) for the United States are given in Table 22. The results are expressed as ratios of dS_i to dN_i, the ratio of subsequent changes in the balance of payments to initial changes. Eight different initial change vectors are examined for various $|m|$, alternative assumptions as to the constraint on LDC imports, and various assumptions as to the tendency of first-round losers to compensate for the income effects of the first-round export changes. Table 23 specifies the assumptions lying behind the first-round export vectors used in deriving Table 22. There are four differentiating characteristics for these vectors: (1) whether untying is unilateral or multilateral -- and, if multilateral, whether all nations participate; (2) the additionality factors assumed; (3) the volume of aid eligible to be untied; and (4) the distribution of aid between recipient regions. Each of these vectors is based on export-share assumption (3), Table 11.

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[1] Trade definition (1a) is defined for the period 1958-68, definition (3) is defined for 1962-68, and definition (4) is defined for 1965-68.

Table 22

THE RATIO OF RESPENDING EFFECTS TO FIRST-ROUND EFFECTS OF UNTYING OF U.S. AID FOR VARIOUS INITIAL ASSUMPTIONS

Part A. Assuming no first-round losers compensate for the income effects of the initial change in exports; LDC imports given by LDC income.

Matrix of Spending Propensities, $\|m\|$, specified by:	Vector of First-Round Export Changes							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trade Definition (1a)	-.149	-.151	-.165	-.153	-.154	-.148	-.181	-.152
Trade Definition (3)	-.153	-.155	-.163	-.158	-.153	-.153	-.160	-.162
Trade Definition (3) ($\Sigma_j m_{ij}$ partitioned according to 1966-68 average export shares)	-.153	-.156	-.157	-.160	-.150	-.156	-.143	-.165
Trade Definition (4)	-.147	-.151	-.144	-.153	-.137	-.149	-.111	-.167

Part B. Assuming $\|m\|$ is specified by trade definition (3), $\Sigma_j m_{ij}$ partitioned according to 1966-68 average export shares for each "i."

Assumptions	Vector of First-Round Export Changes							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. U.S. compensates for first-round income effects; LDC imports given by Y	-.058	-.062	-.062	-.065	-.055	-.062	-.048	-.070
2. All first-round losers compensate for first-round income effects; LDC imports given by Y	-.098	-.091	-.121	-.088	-.102	-.079	-.217	-.070
3. U.S. compensates for first-round income effects; LDC imports given by X.	-.088	-.092	-.105	-.095	-.092	-.090	-.129	-.086
4. All first-round losers compensate for first-round income effects; LDC imports given by X	-.130	-.124	-.167	-.120	-.143	-.108	-.312	-.086

Table 23

EXPLANATION OF THE ASSUMPTIONS BEHIND THE FIRST-ROUND VECTORS OF EXPORT CHANGES USED IN DERIVING TABLES 22 AND 24

Vector Characteristic	First-Round Vector of Export Changes							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Extent of untying	Multilateral	Multilateral	Multilateral	Multilateral	Multilateral without France (case 1)	Multilateral without France (case 1)	Multilateral	Unilateral
Additionality factors	Assumption (2) (Table 16) U.S.: $\alpha_{ij} = .55-.9$ U.K.: $\alpha_{ij} = .5$ Other donors: $\alpha_{ij} = .9$	Assumption (4) (Table 16) U.S.: $\alpha_{ij} = .75-1.0$ U.K.: $\alpha_{ij} = .75$ Other donors: $\alpha_{ij} = 1.0$	Assumption (7) (Table 16) U.S.: $\alpha_{ij} = .55-.9$ U.K.: $\alpha_{ij} = .6$ Germany: $\alpha_{ij} = .7$ France: $\alpha_{ij} = .45$ Other donors: $\alpha_{ij} = 1.0$	Assumption (8) (Table 16) U.S.: $\alpha_{ij} = .75-1.0$ U.K., Germany: $\alpha_{ij} = .4$ France: $\alpha_{ij} = .85$ Other donors: $\alpha_{ij} = .9$	Assumption (7) (Table 16)	Assumption (8) (Table 16)	Assumption (7) (Table 16)	Assumption (2) (Table 16)
Volume of aid eligible for untying	1969 tied DAC aid	1969 tied DAC aid	1969 total DAC aid	1969 total DAC aid	1969 total DAC aid	1969 total DAC aid	U.S.: $750 x 10^6 Other donors: total 1969 aid	1969 tied DAC aid
Geographical distribution of aid	As in 1969	As in 1969	As in 1969	As in 1969	As in 1969	As in 1969	Weighted as for a reduction of U.S. aid to S. Asia	As in 1969
Export share assumption	Table 11	Table 11	Table 11	Table 11	Table 11	Table 11	Table 11	Table 11

The evidence of Part A of Table 22 is that the subsequent gain in the U.S. balance of payments from respending is likely to be about 14-17 percent of the initial loss resulting from untying. For this base case the ratio of dS_i to dN_i is remarkably invariant for most $|dN_i|$ to the period or trade definition for which the spending-propensity matrix $|m|$ is estimated. These estimates are based on the assumption that the United States does not pursue a fiscal-monetary policy that compensates for the income effects of the first-round change in exports, however. Thus a substantial part of the subsequent improvement in the U.S. balance of payments results from a fall in U.S. imports -- a fall that is induced by the decline in income resulting from the first-round drop in exports. If these effects are excluded -- if it assumed that the U.S. government compensates for the income effects of the first-round change in exports -- the subsequent balance-of-payments gains from respending are only about 5-7 percent of the initial loss. These estimates are given in Part B of Table 22. In both cases it is assumed that the availability of foreign exchange is not the effective constraint on LDC imports.

A result more "favorable" to the United States is posited if we assume that the other countries that sustain first-round losses in exports from untying also pursue fiscal-monetary policies that compensate for the income effects of those losses. Such policies would prevent the drop in imports by these countries from the United States that would otherwise be induced by the income effects of the first-round change in exports. If the combined first-round export losses of other countries is relatively large, as in vector 7, the United States gains from subsequent respending in this case may even exceed those of the base case.

The gains to the U.S. balance of payments resulting from respending will also increase if we assume that LDC imports are determined by foreign exchange availability rather than income. The extent of this improvement is indicated by the difference between the results for assumptions (1) and (3) -- or (2) and (4) -- of Part B of Table 22.

The differences between the results for different vectors of first-round export changes chiefly reflect differences in the changes

in French and German exports. The results vary in an important way only if it is assumed that first-round losers pursue a policy of compensating for the income effects of their first-round export losses. Vectors 3 and 7 yield particularly large respending gains to the United States in this case since they posit that both France and Germany will sustain large first-round losses in exports.

The relatively large difference between the results for vector 7 and the other vectors reflects the fact that the ratio of U.S. first-round losses to the sum of first-round losses for other DAC countries is relatively low. This results from three assumptions. First, the U.S. aid program eligible for untying is reduced in size relative to that of the other DAC nations. Second, the share of U.S. aid to South Asia is reduced. Third, the additionality parameters are such that Germany as well as France and Canada will sustain first-round export losses. The assumption that a smaller proportion of U.S. aid will go to South Asia also has the implication that the first-round increases in LDC exports will be relatively large. This of course implies that the difference between the results for vector 7 and those of the other vectors will be relatively large if it is assumed that the effective constraint on LDC imports is foreign exchange.

THE TIME PROFILE OF THE ADJUSTMENT PROCESS TO THE INITIAL CHANGES IN EXPORTS

Since the respending effect dS_i given by equations (5.4) or (5.7) is the sum of an infinite series of future balance-of-payments changes, it is not directly comparable to the first-round or short-run change in exports dA_i unless the appropriate discount rate is zero. That is, if the first-round export changes take place with a time lag "j," the present value of the complete set of balance-of-payments changes caused by an untying of aid at t_0 is

$$V_i^* = dN_{i_t}(1+r)^{-j} + \sum_{t=j+1}^{\infty} dS_{i_t}(1+r)^{-t} = dN_i + dS_i \text{ if } r=0. \qquad (5.11)$$

To estimate dS_{i_t} for all t it is necessary to specify the time relations between the variables of equation (5.1). The simplest of such models is given by equations of the type

$$dY_{i_t} = dN_{i_t} + m_{1i}dY_{1_{t-1}} + \ldots + m_{ni}dY_{n_{t-1}}, \tag{5.12}$$

but this specification is purely arbitrary. Since the data requirements for estimation of a dynamic multisector multiplier model exceed data availability, we chose to estimate a static model and estimate the time profile of S_{i_t} through a simpler simulation.

The particular model chosen for this simulation is a two-country model with one-period lags specified for each consumption and import demand function. That is,

$$C_{i_t} = c_{i_o} + m_{ii}Y_{i_{t-1}}, \text{ and}$$

$$M_{i_t} = m_{i_o} + m_{ij}Y_{i_{t-1}}.$$

An initial equilibrium is defined and then disturbed by an autonomous increase in U.S. imports of (M_{1_t}) of amount δ. The model is then solved for M_{1_t} ($=X_{2_t}$) and M_{2_t} ($=X_{1_t}$) for t = 1 ... j. Where

δ = 1000,

m_{11} = .577 (the U.S. marginal propensity to consume),

m_{12} = .0415 (the U.S. marginal propensity to import),

m_{22} = .745 (the marginal propensity to consume for South America), and

m_{21} = .0984 (the marginal propensity to import for South America),

the time profile of change in X_1 (U.S. exports) is

t	1	2	3	4	5	6	7
dX_{1_t}	0	98.4	59.6	36.7	23.1	14.7	9.5

Given an arbitrary cutoff at t = 7, the present value of the stream of changes in X_1 is

$$dX_1^* = \sum_{t=1}^{7} dX_{1_t} (1+\rho)^{-\lambda t}, \text{ where} \tag{5.13}$$

ρ is the appropriate discount rate and λ is the length (in years) of the time lag in the model. Where λ is 0.5 years, the ratio of discounted to undiscounted export changes is

$$\theta' = dX_1^*/dX_1 = \sum_{t=1}^{7} dX_{1_t} (1+\rho)^{-\lambda t} \Big/ \sum_{t=1}^{\infty} dX_{1_t} \tag{5.14}$$

= .93 where ρ = 0, .90 where ρ = .02, and .80 where ρ = .10. Where λ is one year, θ' = .87 for ρ = .02 and .69 for ρ = .10.

These results enable us to make a rough adjustment of the estimates of Table 22 to take account of the fact that respending effects are flows over time. The parameter θ' given by equation (5.14) is an approximation of the parameter

$$\theta_i = dS_i^*/dS_i = \sum_{t=1}^{\infty} dS_{i_t} (1+\rho)^{-\lambda t} \Big/ \sum_{t=1}^{\infty} dS_{i_t}. \tag{5.15}$$

Thus $\theta' dS_i \cong dS_i^*$, and

$$V_i^* \cong dN_i [1 + (\theta' dS_i)/(dN_i)] \; (1+\rho)^{-j}, \tag{5.16}$$

where as before "j" is the time lag between the decision to untie and the first-round change in exports.

The notion of a "present value" of a balance-of-payments "gain" or "loss" is conceptually somewhat troublesome since the terms gain and loss imply a rather mercantilistic view of the international payments mechanism. Nevertheless, there is a real resource cost that can be associated with a U.S. balance-of-payments "loss" to the extent that the accumulations of dollars held abroad are used to purchase nonmonetary debt instruments in the United States. As such, the appropriate rate of discount of the balance-of-payment "gains" resulting from respending effects appears to be something akin to the

"Eurodollar" rate. We shall take this to be 10 percent. Assuming that time lags λ and j are .5 and 1.0 years respectively, the present value of the total U.S. balance of payments "loss" resulting from untying is

$$V_i^* \cong dN_i(1 + .8dS_i/dN_i)/1.1, \tag{5.17}$$

where dN_i is the first-round export effect estimated in Section IV and the ratio dS_i/dN_i is given by Table 22. Estimates of V_i^* expressed as a ratio of the U.S. aid program being untied for the various sets of assumptions considered in Tables 22 and 23 are given in Table 24. The relative relationships between the various V_i^* for multilateral untying are essentially the same as those between the various dN_i except for the case of vector (7).

Table 24

THE RATIO OF THE PRESENT VALUE OF THE TOTAL CHANGE IN THE U.S. BALANCE OF PAYMENTS RESULTING FROM UNTYING TO THE VALUE OF THE UNTIED AID[a]

Respending Assumptions Specified by Trade Definition (3) (modified) and:	First-round Assumptions Specified by Export-change Vector Number:[b]							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No compensation for first-round income effects; LDC imports determined by Y	-.264	-.348	-.205	-.349	-.218	-.357	-.120	-.355
U.S. compensates for first-round income effects; LDC imports determined by Y	-.287	-.378	-.223	-.379	-.237	-.388	-.130	-.386
All first-round losers compensate for first-round income effects; LDC imports determined by Y	-.277	-.369	-.212	-.372	-.227	-.383	-.112	-.386
U.S. compensates for first-round income effects; LDC imports foreign exchange constrained	-.280	-.368	-.215	-.370	-.229	-.379	-.121	-.381
All first-round losers compensate for first-round income effects; LDC imports foreign exchange constrained	-.270	-.358	-.203	-.362	-.219	-.373	-.101	-.381

[a] λ =.5 year; j = 1 year; ρ = 10 percent.

[b] Assumptions for the various first-round export-change vectors given in Table 23.

VI. IMPLICATIONS FOR POLICYMAKING

Given the inherent uncertainty as to many key variables, we felt that we had no choice but to carry out this study with a plethora of caveats and a multiplicity of alternative assumptions. We are well aware that this style of analysis is both confusing and exasperating. This final section is designed to make amends for our transgressions. That is, we shall attempt to satisfy the reader who demands, "Never mind the refinements, just tell me what you think untying will do to the U.S. balance of payments."

Under any set of foreseeable circumstances untying will result in a substantial balance-of-payments loss to the United States. If this untying is unilateral, our best estimate is that the additional first-round loss of exports will be equal to about 48 percent of the amount of the aid program untied.[1] We would be surprised if the loss were to fall outside the range 46-53 percent. If the United States were to agree to a reciprocal untying of aid with all DAC nations, the U.S. balance-of-payments loss would be something like 36 percent of the amount of aid untied if the DAC distinctions between tied and untied aid are meaningful for other donors and if the ratio between U.S. aid and the aid of other donors were the same as in 1969. If, as we think more likely, these distinctions are only partly meaningful, and if the tying agreement were to cover de facto as well as official procurement restrictions, the U.S. balance-of-payments loss would be about 33 percent. Reasonable ranges of variation for these estimates are 33-42 percent and 30-40 percent respectively. The difference of roughly three cents on the untied U.S. aid dollar between these two estimates of the first-round decrease in U.S. exports resulting from untying represents our "best" estimate of the potential advantage to the United States of negotiating the removal of all restrictions on

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[1] Assuming that disbursements for shipping and insurance are 10 percent of total disbursements and that the tying agreement does not affect the U.S. share in the provision of such services.

procurement as opposed to de jure restrictions only. The range of likely variation here appears to be on the order of $.02-.04.

The marginal effect on the U.S. balance of payments of untying in a multilateral context is, of course, strongly dependent upon the relative amounts of aid to be untied by the United States and the other DAC member nations. The estimate that multilateral elimination of all tying restrictions on development lending would result in an increase in the U.S. balance-of-payments deficit of an amount equal to 33 percent of the U.S. development loan program is based on the assumption that the loan flows involved are the same as those for 1969. If the ratio of the aid of other DAC countries to U.S. aid were assumed to be twice that observed in 1969, our "best" estimate of the additional loss to the U.S. balance of payments resulting from multilateral untying is some 18 percent of U.S. development loan expenditures.

Each of the above estimates assumes that the ratio of tied U.S. development lending to total U.S. development lending in the period prior to the decision to untie would be the same as in 1969. This assumption will not hold exactly, however, since various changes in procurement policy have in fact taken place since then. All U.S. development loans now permit export procurement from LDCs, and so-called "local currency" loans are now fully untied. As a result, our estimates of the future marginal cost of complete untying are somewhat exaggerated. How much so is not clear, for these changes in procurement policy have taken place too recently for their full effects to have yet been fully felt. As a rough order of magnitude we would guess that our estimates of the marginal cost of complete (unilateral or multilateral) untying will turn out to be 5-10 percent too large (relatively, not absolutely) when full allowance is made for the amount of untying already implied in existing procurement regulations.

These incremental costs of untying are in addition to the balance-of-payments costs associated with tied development lending. Rough estimates of the total effect of development lending on the U.S. balance of payments are presented in Table 25. Two sets of additionality assumptions and two assumptions as to the ratio of U.S. aid to the aid of other DAC nations are examined. The estimates of Table 25

Table 25

EFFECT OF PROCUREMENT POLICY ON THE U.S. BALANCE-OF-PAYMENTS LOSS DERIVING FROM U.S. DEVELOPMENT LENDING[a]
(percentage of the U.S. development loan program)

	U.S. aid = $866.1 x 10^6 Other DAC aid = $1220.5 x 10^6[b]		U.S. aid = $433.1 x 10^6 Other DAC aid = $1220.5 x 10^6[b]	
	Additionality Assumption (6)[c]	Additionality Assumption (9)[c]	Additionality Assumption (6)	Additionality Assumption (9)
U.S. development loans	-100.0	-100.0	-100.0	-100.0
Exports procured from tied U.S. development loans	(69.2)	(82.3)	(69.2)	(82.3)
Shipping procured from U.S. development loans	(5.0)	(5.0)	(5.0)	(5.0)
First-round balance-of-payments effect with tied loans (undiscounted)	-25.8	-12.7	-25.8	-12.7
Marginal effect of unilateral untying	(-45.0)	(-58.1)	(-45.0)	(58.1)
First-round balance-of-payments effect with unilateral untying (undiscounted)	-70.8	-70.8	-70.8	-70.8
Marginal effect of multilateral untying	(-30.9)	(-38.9)	(-16.8)	(-19.7)
First-round balance-of-payments effect with multilateral untying (undiscounted)	-56.7	-51.6	-42.6	-32.4
Respending effects (undiscounted):				
Tied loans	(3.6)	(1.8)	(3.6)	(1.8)
Unilaterally untied loans	(11.7)	(11.7)	(11.7)	(11.7)
Multilaterally untied loans	(8.9)	(8.2)	(6.3)	(4.9)
Total (discounted) balance-of-payments effects:				
Tied loans	-20.8	-10.3	-20.8	-10.3
Unilaterally untied loans	-53.8	-55.8	-55.8	-55.8
Multilaterally untied loans	-45.1	-40.9	-34.2	-25.9

Notes to Table 25:

[a]Ignoring payments of interest or principal and assuming that the volume of development assistance by other DAC nations is independent of U.S. development lending.

[b]Distributed as in 1969.

[c]For definition of additionality assumptions see Table 16. All estimates based on export-procurement share assumption (3), Table 11.

are in some sense the maximum possible estimates of the balance-of-payments costs of development lending. They include no allowance for payment of interest or principal; they assume that the amount of development lending by the other DAC nations is independent of the amount of U.S. aid; and they assume that the trading relationships established as a result of development assistance programs have no impact on the volume of "commercial" exports. A careful determination of the total balance-of-payments costs of development lending would have to make allowance for each of the above factors. We have not done so here because the cost concept relevant to consideration of changes in procurement policy is that of marginal or incremental cost.

The major reason for our uncertainty as to the first-round marginal effects of untying is uncertainty as to the additionality factors applicable to current U.S. aid and the aid of other donors. We do not see any feasible way of achieving a major reduction in the uncertainty attached to the additionality factors for U.S. aid. A policymaker intimately informed on the details of French, German, or Japanese aid programs may be able to use his expertise to narrow somewhat the range of additionality factors that we have applied to the aid of those countries. The most valuable bit of information of this type would be evidence as to the additionality inherent in "untied" German aid.

We feel that uncertainty as to the likely share of exports to be procured under untied aid is a considerably less important source of error of prediction than uncertainty as to additionality. Although it is quite possible that the geographical pattern of exports financed through untied aid would not closely resemble the pattern of commercial exports, the great similarity between that pattern and the pattern of exports financed by IBRD/IDA lending gives us reasonable confidence that shares of commercial exports are a reasonable basis for further analysis. There is, of course, a large degree of uncertainty as to the likely effects of the December 1971 exchange rate realignment on the world pattern of trade, but we would be quite surprised if our adjustments for this factor turned out to be so misguided that the error from this source in our estimate of the balance-of-payments cost of untying was more than plus or minus one cent on the aid dollar.

In contrast, the magnitude of (unsurprising) error deriving from misspecification of additionality factors is perhaps plus or minus four cents on the dollar.

The U.S. balance-of-payments losses resulting from untying would increase somewhat if certain DAC member nations refused to participate in the multilateral untying agreement. If it is assumed that it is administratively feasible to prevent such countries from increasing their share of exports financed from aid -- if the refusal to participate implies neither gain nor loss to the country making that decision -- the U.S. balance-of-payments loss on the first round would increase roughly one-half cent on the (U.S.) aid dollar if Canada were to abstain. If France were to abstain the added U.S. first-round balance-of-payments loss would be about one-and-one-half cents on the U.S. aid dollar being untied. If there were no administrative machinery to prevent a non-participant from securing its commercial share of the exports financed through untied aid, the increase in the U.S. balance-of-payments loss would be about one cent on the U.S. aid dollar if Canada were to abstain and about two cents on the U.S. aid dollar if France were to refuse to participate.

The only countries that would be virtually certain to sustain a balance-of-payments loss if they were to agree to a multilateral untying of development assistance are the United States, Canada, and France. Under certain circumstances Germany would sustain a first-round drop in exports. The U.S. loss of $.36 per dollar of untied aid in the case of full multilateral untying compares with a loss of $.50 per dollar of untied aid for Canada and a loss of $.25 per dollar of untied (French) aid for the case of France. The maximum German balance-of-payments loss would be equivalent to $.10 per dollar of untied German aid. These first-round decreases of exports amount to 0.2 percent of total exports (3.4 percent of exports to LDCs) in the case of Canada, 0.4 (1.8) percent in the case of France, and, in the least favorable set of circumstances, 0.1 (0.9) percent for Germany. The first-round drop in U.S. exports would be about 0.8 percent of total (1969) exports and 2.8 percent of (1969) exports to LDCs.

These estimates of first-round or short-run losses of exports overestimate the total change in U.S. exports by 7-15 percent. When respending effects are considered, we estimate the (undiscounted) total drop in U.S. exports to be about $.43 per U.S. aid dollar for the case of unilateral untying and $.30-.32 for multilateral untying. These correspond to first-round losses of $.48 and $.33-.36 per aid dollar respectively. When all losses are discounted at the Eurodollar rate, the present value (at time of untying) of the future drop in exports is about $.40 per dollar of untied aid for the unilateral case and $.28-.30 for multilateral untying.[1]

The estimates above pertain to changes in exports only. If the total balance-of-payments effect of untying is considered -- and if it is assumed that the United States does not pursue a policy of compensating for the income effects of the first-round drop in exports -- the present value of U.S. balance-of-payments losses should be about $.37 per dollar of aid untied if untying is unilateral and $.26-.28 per aid dollar in the multilateral case. The difference here is, of course, that the first-round fall in exports will induce a subsequent fall in imports unless the U.S. government follows a compensatory fiscal-monetary policy.

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[1]We are assuming here that the first-round drop in exports occurs with a lag of one year after the decision to untie. The reason for this lag is the so-called "pipeline" effect. Our calculations further assume a discount rate of 10 percent and a multiplier period of six months.